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GREAT TELESCOPES.

Only eighty miles to the moon, or, rather, the human eye, to all intents and purposes, is brought within the above distance to our attendant satellite, through the annihilation of 160,000 miles of space by the immense refracting telescope represented in our illustration. Its magnifying power, in other words, is 3,000 times, and as the eye naturally receives a beam of light one fifth of an inch in diameter, this instrument, gathering from the surface of its twenty-five inch object glass, will have an illuminating power 15,625 times greater. That is, it will convey that number of times more light into the eye.

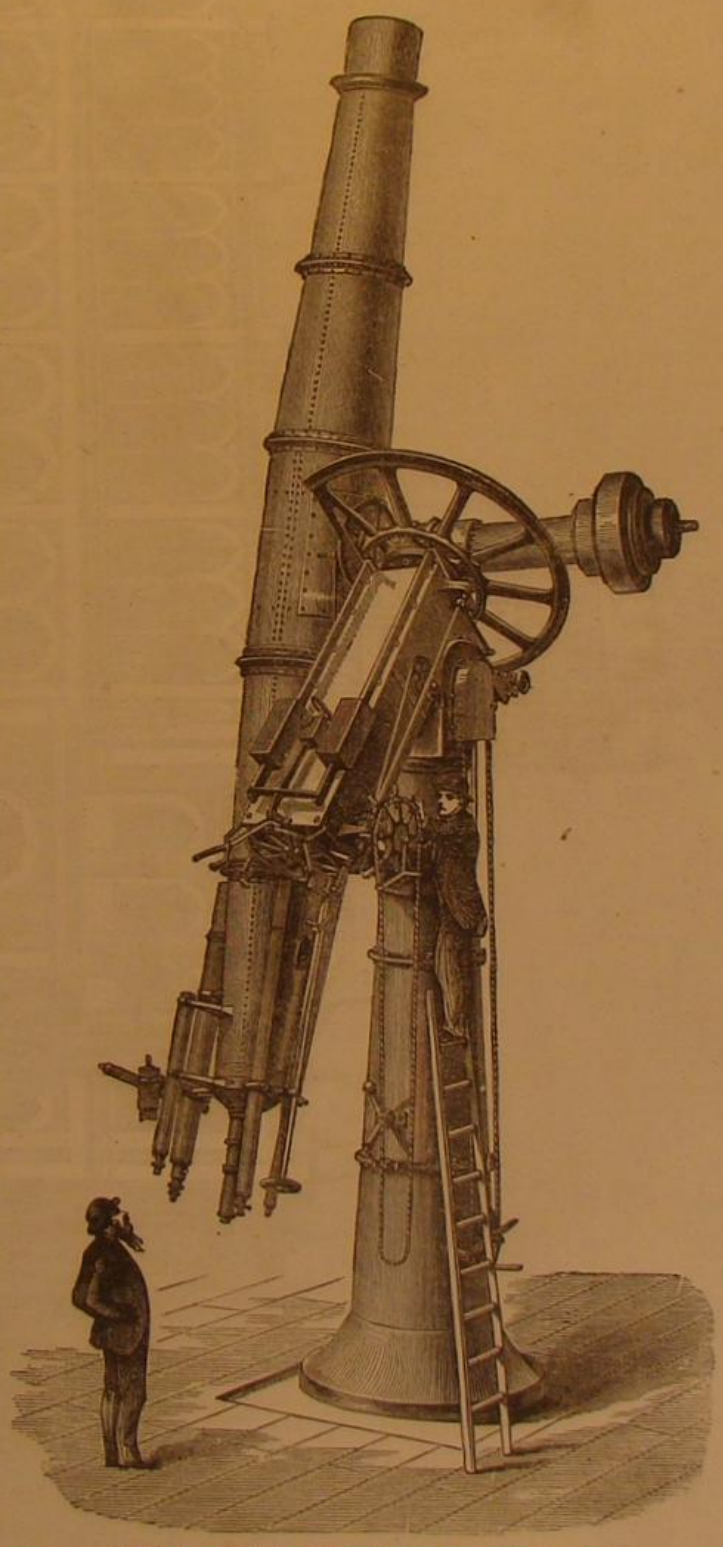
The object glass, now the largest in the world, was recently made in England. It is by far the most difficult part of the apparatus to construct, for it must be without blemish, *striæ* or wavy lines, of absolutely uniform density, and perfectly pellucid. To produce so large a lens, the labor is immense, for, with the increase of power, every defect is proportionately magnified. Even after the glass is cast, its grinding to exact curves and the application of the polish is a scarcely less formidable work.

The tube of this telescope is of steel, of strength sufficient to prevent the possibility of flexure under the great weight which it has to carry. A zinc tube within serves to cut off any currents of warm air which would disturb the cone of light. The instrument is mounted on a pillar, twenty-nine feet high, on which it is adjusted with the nicest precision. Suitable clockwork serves to carry it around in following any heavenly body which is under observation. The entire instrument weighs nine tuns.

The next largest telescope is located in the observatory in Chicago. It was made by Mr. Alvan Clark, and its object glass is eighteen and a half inches in diameter. The two next in size, having objectives three inches smaller, are of German manufacture and are located at Cambridge, Mass., and Pulkowa, Russia.

Though the instrument we illustrate is now the largest in existence, it will not long remain so. The Messrs. Clark, of Cambridgeport, Mass., have, for some time past, been engaged in grinding a twenty-seven inch lens for our Government, which, when complete, is to cost $50,000. The telescope in which it will be placed will, in all probability, be located on some elevated position, or in the astronomical station to be established by the United States Coast Survey Bureau, on the Sierra Nevada mountains. It will be situated at a hight of from seven to ten thousand feet above the sea level, in an atmosphere of great purity and comparatively free from clouds. This great instrument will doubtless allow of observations which will add greatly to our knowledge of physical astronomy.

Perhaps it may be the fortune of our readers at some future period to learn of the construction of the million dollar telescope, to be built under government auspices, the erection of which we recently advocated in these columns In such a case, instead of being eighty miles from the moon, as we now virtually are, we should reduce that distance to four or five miles. The magnitude of the results which could thus be obtained can hardly be conceived; but the question of the existence of human or other beings in the moon, which, from the times of that veracious scientist, Baron Munchausen, to the present day, has disturbed the mental equilibrium of sensational would-be astronomers, might at least be definitely settled through the convincing agency of direct optical proof.



THE LARGEST REFRACTING TELESCOPE.

Novel Fire Alarm.

Mr. N. M. Booth, Secretary and Superintendent of the Ohio River Telegraph Company, at Evansville, Ind., has lately put a novel fire telegraph and steam signal apparatus into operation in that city.

The telegraph is so arranged that, when the circuit is closed, it pulls the support from under a lever. The lever, being an extension of the handle to a cock, falls and swings back and forth, letting on the steam and cutting it off as it continues to swing. When oscillation ceases, the whistle gives a prolonged scream until the lever is replaced ready for another alarm. This line is only a part of Major Booth's invention, being intended as a signal to the engineers to put on extra water pressure in the water pipes when a fire occurs. On a recent trial a police officer turned the alarm key, when instantly the steam whistle tooted out five or six puffs and then settled down to a long shriek.

Names of Oil Wells.

We have frequently been amused as well as interested at the odd names given to oil wells in the oil regions, says the *National Oil Journal*. From 200 to 300 new wells are completed each month, and to each must be given a name by which it may known by the producers and pipe companies, and we do not wonder that owners should find a dearth of names or resort to those that seem odd. Should the same name be used more than once, much confusion and annoyance would be the result, and many times mistakes would be made that it would be next to impossible ever to correct. We find one man, who evidently thinks much of the game of cards, who has named his wells "High," "Low," "Jack," "Game," "Seven Up," etc. Another man thinks more of such things as "Race Course," while "Reliable" and "Prosperity" and "Calamity" figure very conspicuously with "Faith," "Hope," and "Charity." Not far away, and beneath the "Maple Shade," another, with "Wild Cat," "Black Sheep," and "Devil's Ridge," closely fills up the background, and we might go on indefinitely, but we forbear. "What's in a name," if the well pays?

Air and Steam Engines.

It is well known that the injection of a certain small quantity of air amongst the steam that is to supply a steam engine has been found to produce improved economy of heat to a certain extent. There are obvious causes for this fact connected with the more efficient communication of heat from the fuel to the water and steam. For example the air may be previously passed through tubes which expose a large surface to the fire in addition to that which the steam boiler alone presents, or the air may be itself part of the products of combustion, being freed from dust by suitable processes.

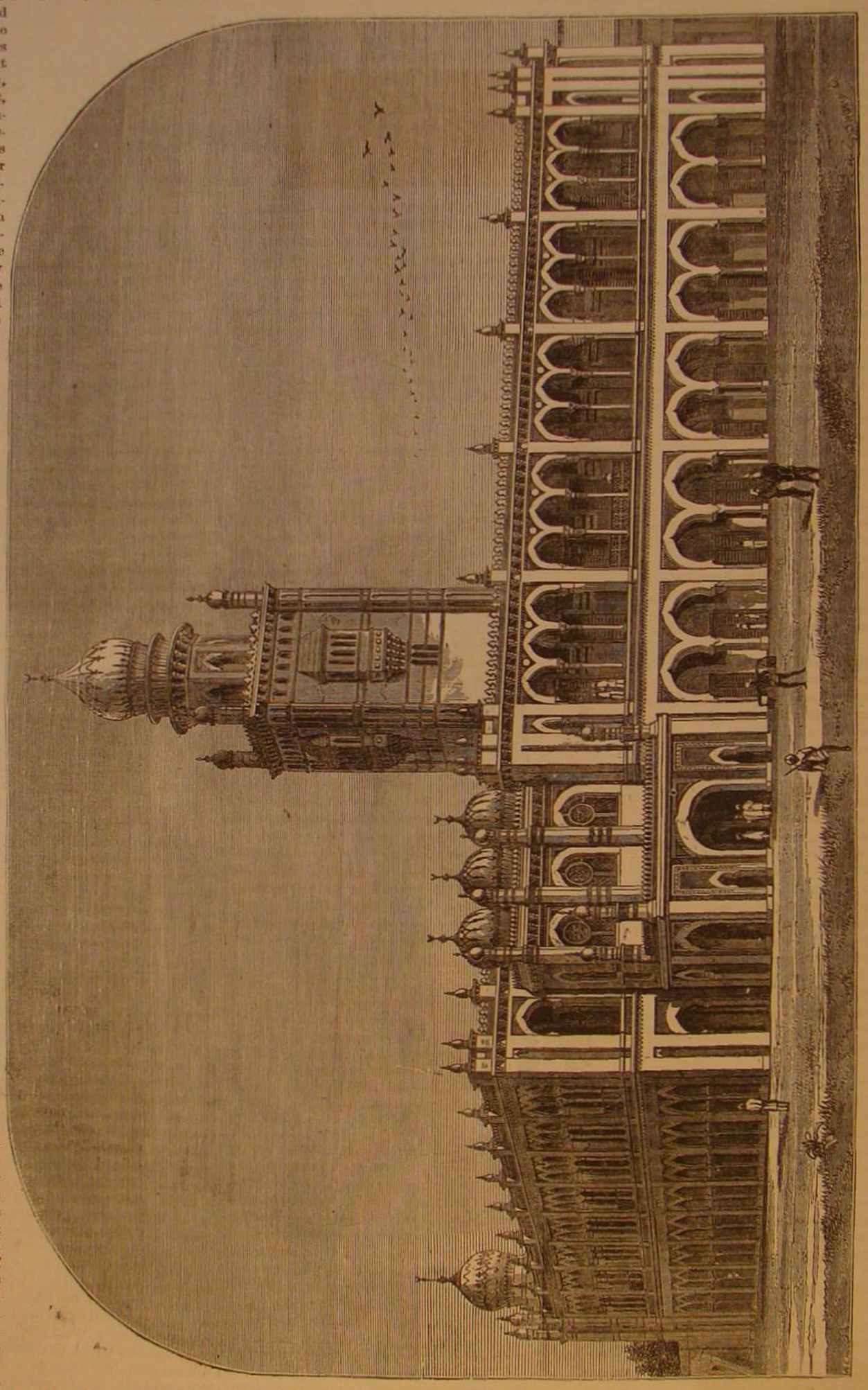
The following remarks are intended to show that according to the principles of thermodynamics the air has a tendency, independently of the communication of heat from the fuel, to increase the efficiency of the steam in transforming heat into motive energy, and to show that it is worth while to test how far this beneficial action can be carried in practice, by the aid of experiments in which a larger proportion of air shall be employed than has hitherto been tried. It is well known that the efficiency of any heat engine is limited by the temperatures between which it works; the greatest possible efficiency, that is, ratio of work done to heat expended between given limits of temperature, being expressed by dividing the range of temperature by the absolute temperature at the higher limit.

In order that this theoretical duty may be realized, it is essential that all heat whatsoever received by the working substance should be received at the highest limit of temperature, and all heat rejected by the same substance given out at the lowest limit; for example, if the air is heated at five atmospheres and cooled at one atmosphere, of absolute pressure, the upper and lower limits of absolute temperature bear to each other the proportion of 1·58 to 1, and the theoretical efficiency is about 0·37. In a steam engine working between the same limits of pressure, the theoretical limits of temperature on Fahrenheit's ordinary scale would be about 296° and 212°, corresponding on the absolute scale to 757° and 673° Fahrenheit, and the theoretical efficiency would be equal to 84÷757=·124. It is easy to see in a general way that in an engine in which the fluid employed consists of air and steam mixed, the efficiency will be something intermediate between the quantities above set down, being less than that in which air alone is employed. The most efficient engine of all, theoretically, would be one in which nothing but dry air was employed. Here we are met by the fact that great practical difficulty has been found to attend the employment of dry air, in particular that it has been found almost impossible to prevent the heating vessel from becoming overheated, and consequently burned. On the other hand, an engine worked with steam alone is liable to fall considerably below the calculated theoretical efficiency. There is a certain proportion of air to steam which enables all the heat required for raising the temperature to be produced by the compression of the air, being the surplus over and above that which is required in order to raise the temperature of the air itself, and thus the efficiency of the engine is prevented from falling materially below the calculated theoretical efficiency for steam. In the examples already given, the compression of dry air to five atmospheres would produce a rise of 390° Fahr., while the actual rise required is only 84° Fahr., and without going into a minute calculation of the surplus heat produced by the compression of the air, it may be mentioned as the result of such a calculation that the surplus heat so produced amounts to about three fourths of the whole heat due to the compression, and that by introducing a mass of air at each stroke, equal to about one and one third the mass of feed water employed, the whole heat, necessary for raising by 84° Fahr. the temperature of the air and water, may be obtained by compression of the air alone, to the great benefit of the efficiency of the steam.

The above example appears to be sufficient to show that it is worth while, in what have lately been called aëro-steam engines, to carry experiment further than has hitherto been done in the direction of the introduction of large quantities of compressed air.

NEW BUILDINGS IN MADRAS FOR THE REVENUE BOARD OFFICES..

The Revenue Board Buildings in Madras, India, of which we append an illustration, stands adjacent to the old palace of the Nawabs of the Carnatic. The latter structure, which is now used as a college, is constructed in the mixed Hindoo-Mahomedan style so common in the south of India, and the general effect of the exterior (which is colored dark red and white) is more pleasing than that of many buildings subsequently erected by Anglo-Indians. The Government found it necessary to make extensive alterations and additions, and, by the desire of the Governor General, Lord Napier, these works have been carried out so as to assimilate the Revenue Board buildings with the older adjacent structure. Mr. Chisholm, the Government architect, while keeping to the general lines of the old structure, has taken his details and many forms from purer types of the style, and superior materials have enabled him to adopt a much lighter form of construction. When the offices have been completed, the outlay will scarcely be felt, as the amount of rent now paid by Government for private offices represents capital equal to the expenditure involved.



THE REVENUE BOARD BUILDINGS IN MADRAS, INDIA.

The material is the fine chunam of that coast, a well known and beautiful building stone.

The building finds favor in the locality; both Europeans and natives seem to take a general interest in its progress, and Lord Napier, in a lecture delivered there some time back, makes the following allusion to it:

"The Government has endeavored, with the advice of an accomplished architect, to exhibit in the improvements at the Revenue Board an example of the adoption of the Mussulman style to contemporaneous use. Mr. Chisholm would be the first to disclaim and condemn the material which has been forced upon him by necessities to which we are still subjected, but his design will be a practical demonstration of the views which I have here advocated. He has paid the first tribute to the genius of the past; he has set the first example of a revival in native art which I hope will not remain unappreciated and unfruitful."

The Practical Man.

The practical man derides those who bring forward new inventions, and calls them schemers. No doubt, whatever they do scheme—and well it is for the country that there are men who do so—it also may be true that the majority of the schemes prove abortive; but it must be recollected that the whole progress of art and manufacture has depended and will depend upon successful discoveries which, in their inception, were and will be schemes just as much as were those discoveries that have been and will be unfruitful; but the successful discoveries, because they are successful, are taken out of the category of schemes when years of untiring application on the part of the inventors have, so to speak, thrust them down the throat of the unwilling practical man. Take the instance of Mr. Bessemer, who was beset for years by difficulties of detail in his great scheme of improvement in the manufacture of steel. As long as he was beset the practical men chorused: "He is a schemer; he is one of the schemers; it is a scheme." Supposing that these practical difficulties had beaten Mr. Bessemer, and they had not been overcome to this day? The practical man would have derided him still as a schemer, although the theory and groundwork of his invention would have been as true under these circumstances as it now is. Fortunately for the world, and happily for him, he was able to overcome these most vexatious hindrances and make his invention that which it is. No one now dares to apply the term "schemer" to Mr. Bessemer, or "scheme" to his invention, but it is as true now that he is a schemer and his invention a scheme, as it would have been had he failed up to the present to conquer the minor difficulties. It is a species of profanation to suggest, but it as true, that Watt, Stephenson, Faraday, and almost every other name among the honored dead to whose inventive genius we owe the development that has taken place within the last century in all the luxuries, the comforts, even the bare necessities of our daily existence, would, in their day and while struggling for success, have been spoken of as schemers, even in respect of those very inventions of which we are enjoying the fruits.—*Popular Science Monthly.*

THE American cotton crop of 1872 will considerably exceed that of last year. The acreage this year is 8,656,504, an increase of 945,305 acres over last year. The average yield per acre last year was 0·385 of a bale, making the total yield 2,974,351 bales. At this rate the crop will be 3,290,000 bales.

The Teeth--Treatment of Exposed Pulp.

While we are not always and under all circumstances in favor of capping exposed pulps, says Dr. G. W. Klump, in *Dental Cosmos*, we believe that, when it is desirable, a large majority of teeth so conditioned may be treated and restored to health.

Our first effort is to remove all decay and foreign matter from over and around the pulp without injuring the pulp itself; next prepare a piece of punk of suitable size, moistened with carbolic acid, tincture of aconite, or any good anodyne, and after drying out the cavity carefully, place the punk over the exposed pulp and seal it up with cotton and sandarac, being cautious not to use too much cotton so as to cause a pressure on the pulp when the cotton swells. We let this remain in the tooth one, two, or three days, as the case may be, with special directions to the patient to come in, without regard to the appointment, at the first approach of pain. We regard this last injunction as highly necessary in the proper treatment of an inflamed pulp. If we can, by this means, keep an exposed pulp ten days or even a week without giving any pain, we consider the case one favorable for capping with oxychloride.

We now remove any decay that may yet remain along the edges of the cavity, and insert, for a few moments only, a pledget of cotton with carbolic acid. We then prepare another pledget of cotton moistened with glycerole of thymol, and after removing the former pledget, place this in the cavity and again seal up, say from five to ten minutes. In the meantime we take as much of the oxychloride and liquid as we expect to use, placing them on a glass slide near each other. We select an excavator of proper shape and size, and roll some cotton around it tightly, forming a kind of cotton probe. Having a bottle of collodion on hand, we now, by any means preferable, protect the cavity from the fluids of the mouth, remove the cotton with the thymol, dry out the cavity, and, with cotton saturated with collodion, give the entire cavity a coating. We now mix oxychloride to proper consistency, and introduce to the orifice of the cavity with spatula or flat burnishers, and with the cotton probe press to its proper place; keep it dry ten or fifteen minutes, then give it a coating with sandarac or wax, or, what is better, seal up with cotton and sandarac, and let it so remain ten days or two weeks. If the tooth during this time remains perfectly comfortable, it may now be filled over the capping with the permanent filling.

The above has, for some time, been our usual mode of practice. The almost unbearable pain which so frequently followed the capping, and which was such a serious cause of anxiety to both patient and operator, is by this means either entirely removed or so slight that it forms no important objection to capping, and, as we would naturally infer, is much less liable to produce destruction of the pulp than when such severe pain follows the operation. We have capped very many in this way, and they have, with few exceptions, proved successful in every respect.

PROFESSOR TYNDALL ON LIGHT.

The eminent English scientist and investigator, Professor John Tyndall, has for the first time appeared before a New York audience, and in two masterly discourses has opened a series of lectures on the subject of "Light." Familiar as we are with the admirable works of this learned author, we naturally expected an able and entertaining disquisition on the prolific subject he had selected; but we confess we were unprepared for so excellent, clear and scholarly an elucidation of the most elementary principles of physics. He fairly placed light in a new light, and by his simple explanation of theory and splendid execution of experiments illuminated with the brilliancy of his genius even the dazzling rays from which he drew such treasures of learning and thought.

It is a matter of regret to us that the pressure upon our columns and the rapid sequence of Professor Tyndall's lectures prevent our giving them *verbatim;* but the most interesting and striking portions will be carefully selected and presented as fully as our space will admit. An allusion to the favor with which his books were received in this country, and the circumstances which brought about his visit to the United States, constituted the introductory remarks of the opening discourse. After briefly glancing at the birth of science and in a few words tracing its progress to the time of Newton, the lecturer entered upon his subject proper at its very beginning: The ancients, he said, satisfied themselves that light moved in straight lines; they also knew that these lines, or rays of light, were reflected from polished surfaces and that the angle of incidence was equal to the angle of reflection. This knowledge constitutes our starting point. To the source of light to be employed during the experiments attention was asked, and after alluding to the generation of heat and light by combustion, Professor Tyndall brought together coke points, which being attached to the poles of a small voltaic battery, glowed with a white heat. Whence comes this heat? Suppose, in the first instance, when the thick wire was employed, that we had permitted the action to continue till one hundred grains of zinc were consumed, the amount of heat generated in the battery would be capable of accurate numerical expression. Let the action now continue with this thin wire glowing until one hundred grains of zinc are consumed. Would the amount of heat generated in the battery be the same as before? No, it would be less by the precise amount generated in the thin wire outside the battery. In fact, by adding the internal heat to the external, we obtain for the combustion of one hundred grains of zinc a total which never varies. Here, continued the speaker, we have an illustration of the constant law that in physical nature we have incessant substitution, but never creation.

Professor Tyndall then added some further remarks regarding the electric light, saying that it would constitute the mode of illumination for experimental purposes, and noting the fact that, during the intense glow of the carbon, the eye failed to see the coke points whence the light issued. This, he stated, is due to the spherical aberration of the organ, or in other words, that the circumferential and central rays have not the same focus. To illustrate by means of a lens, the carbon points in the lantern were projected on the screen. The image was faint and nearly obliterated by a halo of light by which it was surrounded. A similar effect is produced in the eye, the blur of light upon the retina being sufficient to destroy the definition of the retinal image of the carbons.

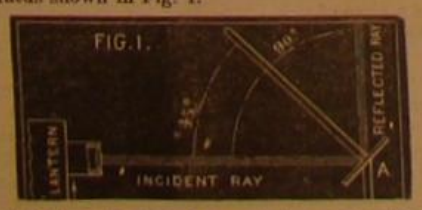
The theoretical defects of the eye were alluded to—its opacity, want of symmetry, lack of achromatism and absolute blindness in part—which, said the speaker, caused an eminent German philosopher to say that, if any optician sent him an instrument so full of faults, he would return it with the severest censure. Referring to the

PROPAGATION OF LIGHT,

its rectilineal nature may be shown by the simple experiment of allowing the rays to pass through a minute orifice into a darkened chamber, where external objects will be projected reversed upon a screen. Every straight ray proceeding from the object stamps its color upon the screen, and the sum of all the rays form an image of the object, which is seen inverted because the rays cross each other in the aperture. To explain this fact, the lecturer made a small perforation in a sheet of tinfoil stretched before the light in his lantern. A single reversed, though blurred, image of the carbon points appeared on the screen. A second aperture produced another image, several orifices a number of images, until if the foil be removed altogether all these bright figures run together and combine to form the circle of clear light.

ILLUSTRATION OF A LAW OF LIGHT.

The law that the angle of incidence is equal to the angle of reflection was experimentally illustrated by the simple apparatus shown in Fig. 1.

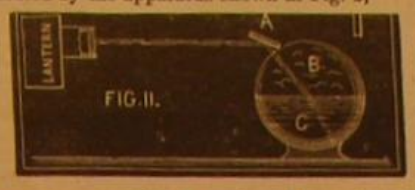


A straight lath is placed as an index perpendicular to a small mirror, A, capable of rotation. The beam of light from the lantern is received upon the glass and reflected back along its line of incidence. The index being turned the mirror turns with it, and at each side of the former the incident and the reflected beams are seen tracking themselves through the dust of the room. This device enables us also to illustrate the law that, when a mirror rotates, the angular velocity of the beam reflecting from it is twice that of a reflecting mirror. That is, referring to our engraving, that while the mirror B passes from the perpendicular to its represented position of an angle of 45°, the beams diverge to a right angle or 90°. This is shown by mere inspection from the position of the index.

Passing to the subject of

REFRACTION,

Professor Tyndall gave a short historical sketch, of the course of inquiry into the phenomenon from the year 1,100, by Alhazen, an Arabian philosopher, to the first discovery of the principle by Willebord Snell in 1621. The bending of the ray in passing from a thin to a dense medium was admirably illustrated by the apparatus shown in Fig. 2,



the lecturer observing that he preferred to produce direct optical proof rather than ask the audience to believe facts from chalk lines on the black-board. A circular vessel with its two sides of clear glass is partially filled with colored or turbid water; A is a movable inclined mirror which may be placed at any point on the periphery of the circle, so as to reflect a beam of light from the lantern either perpendicularly to the surface of the water or obliquely, as represented. Striking the liquid perpendicularly to its surface, the course of the ray is shown in a bright vertical line in the water, so that it is unrefracted. Meanwhile the beam passes unseen through the air above the water. Laughingly observing that he was not addicted to the small vice of smoking, Professor Tyndall lit a cigar and puffed the smoke into the space B, when the track of the ray became clearly apparent. Moving the mirror A to the position shown in the cut, the beam was caused to strike the liquid obliquely, when refraction was clearly produced as represented. Snell's discovery that the quotient (the index of refraction), obtained by dividing the sine of the angle of incidence by the sine of the angle of refraction, was always a constant quantity for the same medium, whatever the obliquity of the rays may be, was then graphically described and referred to as one of the cornerstones of optical science. This was applied by Descartes to the

EXPLANATION OF THE RAINBOW.

The bow is seen when the back is turned toward the sun. Draw a straight line through the spectator's eye and the sun; the bow is always seen at the same angular distance from this line. This was the great difficulty. Why should the bow be always, and at all parts, forty-one degrees distant from this line? Taking a pen and calculating the track of every ray through a rain drop, Descartes found that at one particular angle the rays emerged from the drop almost parallel to each other, being thus enabled to preserve their intensity through long atmospheric distance; at all other angles the rays quitted the drop divergent, and through this divergence became practically lost to the eye. The particular angle here referred to was the foregoing angle of forty-one degrees, which observation had proved to be invariably that of the rainbow.

Newton's experiment with the prism was then described, and served to introduce the subject of the

PHENOMENA OF COLOR.

Various well known experiments were made in the analysis and synthesis of light, proving that the colors of a spectrum may be squeezed or blended together by the aid of a lens; that an image of the carbon points, whence the light issues, may be built up from the colors of the spectrum, and that, in virtue of the persistence of luminous impressions upon the retina, the prismatic colors may be mixed together in the eye itself, the impression of whiteness being the result.

DISPERSION

is the drawing out of a white line into a spectrum. Newton supposed that refraction and dispersion were inseparable, but Dollond showed that, by combining two different kinds of glass colors could be extinguished still leaving a residue of refraction, and he employed this residue in the construction of achromatic lenses. This point was illustrated by throwing a beam through a prism of water and marking with a pointer the position of the spectrum on the screen; then, by adding a prism of glass, a white image was produced, which, compared with the point noted, was still considerably refracted. The refraction and dispersion of bisulphide of carbon, as compared with water, was alluded to in order to show the great extent and richness of color of the spectra of the former substance.

WHAT IS COLOR?

Natural bodies have showered upon them, in the white light of the sun, the sum total of all possible colors, and their action is limited to the sifting and appropriating from this total the colors which really belong to them and rejecting those which do not. The portion rejected gives them their hue. But what is black? Throwing a brilliant spectrum upon the screen, the lecturer placed a piece of black ribbon in succession in the different colors. It quenched all, and consequently blackness is the result of the absorption of the constituents of solar light. Taking a second piece of ribbon he held it in the red portion of the spectrum; it appeared as black as the first piece. He then moved it along until it reached the green, when it appeared of a vivid shade of that color. Therefore the ribbon absorbs all the red and yellow light and offers mere darkness to the eye; while it rejects the green and blue shades, appearing of its proper hue. The same was similarly shown with a red ribbon, which absorbed the green color and rejected the red. Why is it that on looking at objects through a red glass, all are tinged with that hue? This was answered by passing the dispersed rays through such a colored glass, when the spectrum showed nothing but the red, all other tints being quenched. A blue glass allowed blue, indigo, violet and green rays to pass, and a yellow glass permitted only the transmission of green, yellow, orange and red. A very beautiful experiment was made with a solution of permanganate of potash, which is a very exquisite purple and unlike the pure tone of that tint in the spectrum. Passing the light through the prism of that liquid, it was found that not only the purple but the red rays were allowed to pass, so that by the mixture of these colors the unusually beautiful shade was obtained.

BLUE AND YELLOW DO NOT MAKE GREEN

but white, as they are complementary colors. Why is it then that by mixing chrome yellow and Prussian blue we obtain a green pigment? It was shown in the course of the above experiments that a blue glass permits not only the blue of the spectrum to pass through it but a portion of the adjacent green. A yellow glass though cutting off the blue, also allows the passage of the green. This may be expressed as follows, representing the colors by their initials, those absorbed being in italics, thus: Blue glass, *R, O, Y,* G, B, I, V. yellow glass, R, O, Y, G, *B, I, V.* Now combine both glasses; together they destroy every color but the green which as experiment proved, appeared singly on the screen. Consequently the blue and yellow powders when mixed together absorb all other colors and appear to the eye as of the only color to which both are transparent. The blending of blue and yellow light to make white will be explained in a subsequent lecture. In conclusion, said Professor Tyndall, we may profitably glance back on the web of relations which these experiments reveal to us. We have, in the first place, in solar light an agent of exceeding complexity, composed of innumerable constituents, refrangible in different degrees. We find, secondly, the atoms and molecules of bodies gifted with the power of sifting solar light in the most various ways, and producing by this sifting the colors observed in nature and art. To do this they must possess a molecular structure commensurate in complexity with that of light itself. Thirdly, we have the human eye and brain so organized as to be able to take in and distinguish the multitude of impressions thus generated.

FRESH GRAPES IN WINTER.



Parties still having grapes on their vines at the end of October or the beginning of November can keep them fresh and juicy by observing the following method: When the first frost comes on, cut the grapes with a considerable stem, having one or two knots below and one above the grape (see engraving). The upper end of the stem is to be covered with beeswax to prevent the escape of the circulating juices. After the grape is thus prepared, remove all bad berries from the bunch, and place the stem in a bottle of water, having a layer of charcoal at the bottom, which tends to keep the water clean; then close the bottle with a cork letting the stem pass through the center, and cover the top with beeswax. Grapes prepared in this manner will be sure to keep fresh and juicy all winter. DAHEIM.

A Composite Counterfeit $500 Note.

The ingenuity of counterfeiters is well illustrated by th following recent development at Washington:

There was received, a few days ago, at the Treasury of t United States, a note purporting to be a United States leg tender note of the denomination of $500. It is composed of parts of different genuine notes of various denominations. The center is a part of a one hundred, with the "one" taken out in the center and upper border, and a "five" neatly inserted. The left hand lower end contains a portrait of Andrew Jackson taken from a five dollar note, and the right hand lower end, a vignette from a ten. The scroll work, containing the figures 500, has been taken from a national bank note. The back of the note is from a ten dollar United States note, the "ten" having been cut out and replaced by the "ovals" from the back of a five. Although this note is not calculated to deceive bankers and brokers, it would be readily taken by those who are not accustomed to handling much money, as the engraving is all genuine. Fortunately its general appearance has no resemblance to the note of the denomination of which it purports to be a genuine issue.

THE Boston *Globe* says: "Our friend Potts read somewhere that electric sparks could be evolved from a cat by taking it into a dark room and rubbing its back. He made the experiment, and was surprised to hear a loud yell, and to feel something clawing across his face. Then he missed the cat. Mr. Potts is now uncertain whether he was struck by lightning evolved from the cat's back, or whether she became unduly excited as he stroked her, and stroked back again; but he is certain that, when he undertakes to procure electricity again from a cat, he will first soothe her with a shot gun."

Correspondence.

[For the SCIENTIFIC AMERICAN.]

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the items of meteorological observations, for nearly all relating to meteors, and for some of the computations, in the following notes, I am indebted to students.

The places of the planets are given approximately only, the aim being to furnish to everyday readers such information as will enable them to recognize the principal planets.

M. M.

Meteors.

The evening of November 27 was marked by an unusual number of meteors. The period which includes the last week of November and the first of December is known to be one in which meteors are frequently seen, but there was no reason to locate the maximum of this period on any particular evening. At 5h. 15 m., before the daylight was over and when the sky was so much overcast by thin clouds that very few stars could be seen, a brilliant meteor, starting from the zenith, passed toward the west leaving a bright yellow train.

At 5h. 40 m. another, so brilliant that it attracted the attention of a student who was not near a window, passed from a point near the pole star to the horizon. Before 6 P. M. so many had been seen that, as soon as it could be arranged, a systematic look-out was instituted. Two students began at 6h. 20 m. to keep a record. They were aided, after half an hour, by three others, and the count was kept up until 8h. 45 m., when it became cloudy.

From 6h. 20m. to 7 P. M., more than 200 were seen. The frequency diminished after 7 P. M., but, in the 2h. 20m. during which the watch was kept up, 795 were recorded. It is not an easy task to trace the course of meteors in the few seconds of their apparition, but an effort was made to determine the radiant point. The constellations *Cassiopeia* and *Perseus* were named by the observers, but the greater number must have radiated from the latter.

More than ordinary interest is felt in the meteors of this period because they are supposed to be connected with Biela's comet.

The evenings of December 7, 10, and 11 have also been reported to me (by students) as the dates of remarkably bright meteors.

Positions of Planets for January, 1873.

Mercury.

Mercury rises on the 1st at 5h. 45m., comes to meridian, or souths, at 10h. 27m. in the forenoon, and sets at near 3 P. M. It is at its greatest elongation on the 5th. January 31, Mercury rises at 6h. 40m., comes to meridian about half past eleven and sets at near 4 P. M.

Venus.

January 1, Venus rises a few minutes before 10 A. M., comes to meridian, or souths, at 2h. 55m., and sets near 8 P. M.

January 31, Venus is nearly in the celestial equator; it rises at nine in the morning, comes to meridian a little after 3 P. M., and sets at 9 in the evening.

Mars.

Mars is still very small, but its ruddy light makes it easily known. When it souths on the 1st, it is 4° above *Spica*, the star being east of the planet. Mars rises on the 1st about 1 A. M. On the 31st it rises soon after midnight, comes to meridian at 5h. 26m., and sets at about 11 A. M.

Jupiter.

Jupiter rises before 9 P. M. on the 1st, souths at 3h. 30m. A. M., and sets about 10 A. M.

On the 30th Jupiter rises at 6h. 24m., comes to meridian at 1h. 22m. on the morning of the 31st, and sets about 8 A. M.

All through the month Jupiter increases in apparent size, and its position becomes more and more favorable for observers. On the 31st, at 1h. 22m., it has, in the latitude of Vassar College, an altitude of more than 61°.

The Nautical Almanac gives the time of the eclipses of the satellites, and according to that, the 3rd satellite, which is the largest, passes into the shadow of Jupiter, or is eclipsed, on the 1st at 6h. 42m. 7·5s. (Washington time) and reappears at 10h. 15m. 38·5s. A glass of very small magnifying power will show this phenomenon at places above whose horizon Jupiter has risen.

On the 1st, Jupiter is east of the bright star *Regulus*, in *Leo*, and they will have nearly the same altitude when on the meridian. On the 31st they will be nearer together in right ascension, and further apart in declination.

Saturn.

Saturn has been apparently very near to Venus, during the first half of December, especially on the 4th. It sets on the first at half past five, having passed meridian 10 minutes before one.

On the 31st, Saturn rises before the sun and sets before 4 P. M., coming to meridian before the sun.

Uranus.

January 1. Uranus comes to meridian at 1h. 45m. A. M., sets about 9 A. M., and rises at about 6½ P. M. It is among the small stars of *Cancer*.

January 31. It comes to meridian at 11h. 38m., having risen 20 minutes after 4 P. M.

Neptune.

This planet, unlike the others, requires a large telescope. It souths on the 1st at 9h. 42m. at an altitude of (in this latitude) of 55° 50′.

On the 31st, it rises in the morning, comes to meridian before 5 P. M., and sets at about 11 P. M.

Meteorology.

OBSERVATORY, VASSAR COLLEGE.

THERMOMETER AND BAROMETER FROM NOVEMBER 15 TO NOVEMBER 30.

Highest thermometer at the time of recording was at 2 P. M., November 25.....51°
Lowest thermometer 7 A. M., November 30.....12°
Highest barometer 9 P. M., " 17.....30·58"
Lowest " 7 A. M., " 30.....29·55"

The highest wind was from the southwest, on November 30 at 2 P. M. There was no rain.

DECEMBER 1 TO DECEMBER 15.

Highest thermometer at the time of recording was at 2 P. M., December 27.
Lowest thermometer 9 P. M., December 12.....7°
Highest barometer 9 P. M., " 11.....30·37
Lowest " 2 P. M., " 9.....29·63

The highest wind was from the northwest December 10, at 2 P. M. Fall of rain very slight.

The Unknown Planet Actually Seen.

To the Editor of the Scientific American:

In your issue of December 14, I see a statement, which I saw before in *Nature*, that Mr. J. R. Hind, the astronomer, was demonstrating that there was a probability that a planet is situated between Mercury and the sun. As I do not know Professor Hind's address, nor the facts upon which he bases his opinion, I address you in hopes that the statement I make will, by this means, fall under his eye. I do not know whether it will add to his store of knowledge, but it is a fact vital to his theory. In the latter half of September, 1859—I cannot now fix the exact date, though it may have been about the 20th—I saw the planet pass over the disk of the sun. I first saw it about 9 o'clock, my attention being called to it by some boys who were looking at the sun through smoked glass. It was then on the eastern limb, and its apparent diameter was about 2¼ inches. It took it about two hours to pass over the sun. As it is impossible for any of the known interior planets to pass over the sun in the month of September, it must have been an unknown planet. I communicated this fact to the naval professors in 1869, requesting that search be made for this interior planet at the eclipse of that year, but nothing was ascertained.

Hoping that this fact may be of service to Professor Hind, I make this statement through your valuable paper.

St. Louis, Mo. JOHN H. TICE.

Sulphite of Lime in Cider.

To the Editor of the Scientific American:

I wish to give my experience in the use of sulphite of lime in cider:

One writer thinks it may be injurious to the health; if he will study the chemical effects of its use, he will see that it has no disposition to appropriate the oxygen already combined, but prevents further combination, its own appetite for oxygen being stronger than that of the cider. There is, possibly, an electrical action besides, as the sulphite does not chemically combine with the cider; being insoluble, or very slightly soluble, it sinks to the bottom as so much sand.

What the effect would be on the blood I do not know; but I should think, as the blood was vitalized in the lungs, if it should come in contact with sulphite in the stomach, no harm would be done, especially as a very doubtful quantity is ever taken into the stomach.

The greatest danger would arise from an impure article; if the lime used was impure, especially if magnesia was present, it would have the effect of Epsom salts, as I have known in several instances. If the sulphite is not neutral, it will spoil the cider. It had better be acid than the opposite, as free lime kills the life of the cider. This can be ascertained from the taste; if it has a caustic taste, discard it. It should have very little flavor, and nothing that is in the least unpleasant; it ought to taste very much like wheat flour.

During the years 1861, '62, and '63, I made large quantities of it; I had a boy to help me, and in the season for it, about two months each year, there were few days in which he did not eat enough for a common forty gallon cask, and many days much more. I never knew of its doing him any harm, unless, perhaps, it stopped his working as much as he could without it.

WM. A. BARNES.

Bridgeport, Conn.

REMARKS BY THE EDITOR:—The use of sulphites to prevent the fermentation of liquors was early suggested by Liebig, and has long been practiced in Europe and this country. At first the sulphite of soda was employed, but so much alkali in the wines was found to be deleterious, and recourse was had to sulphite of lime. This latter salt, when pure and neutral, contains, in 100 parts, 41 parts of sulphurous acid. The sulphurous acid absorbs the oxygen and thus stops fermentation. Sulphate of lime, or gypsum, is formed, which settles in an insoluble paste to the bottom and thus imparts no taste to the liquid. There is very little cider in the market which has not been kept sweet by the use of sulphite of lime; and as this salt has long been recommended, there appears to be no objection to its use.

DOCTOR PITHA, of Vienna, it is stated, has just received a fee of 100,000 florins ($50,000) on the recovery of the young Baron Todesco, the only son of a millionaire. The case entailed an attendance of about two months, and the patient remained entirely unconscious during 23 days. Professor Pitha's assistant also received a large sum of money.

Rocky Mountain Geological Explorations.

In October last a party, under the lead of Professor O. C. Marsh, of Yale College, started from New Haven for the purpose of procuring fossils in the almost unknown region near the Rocky Mountains. Several expeditions have been made in former years by Professor Marsh and scientific students, and they have resulted in some important discoveries of fossil remains, which have shed a good deal of light upon the ancient animal inhabitation of the continent, as well as given some important hints as to its geological formation.

The October party went out with the intention of continuing these researches. They have lately arrived home in good health, satisfied with the successful results of the expedition.

At Fort Wallace they were joined by a military escort consisting of Lieutenant Pope and eight soldiers, army wagons, and mules for riding. The whole party had a competent guide, Edward S. Lane. They started from Fort Wallace and proceeded down the Smoky Hill Fork, and in this neighborhood camped out for twenty-five days. In this region there were immense quantities of buffaloes, and the party shot while camping, about fifty of them. One herd was seen which it was estimated numbered about fifteen thousand. There were also great quantities of deer and antelope. The time of the party was spent mainly in discovering fossils, and quite a lot of valuable saurians, pterodactyls and birds were found. Of the first two classes, there was an especially good collection obtained, and there were also some valuable bird fossils found. The largest bird fossil, Professor Marsh said, stood fully six feet high. A large number of fossil fish were found, not valuable enough to pick up.

The daily life of the party was something as follows: They usually arose at from seven to eight o'clock, and, after looking after their mules, prepared breakfast, which consisted generally of buffalo meat, sometimes deer and prairie hens. They were obliged to depend upon the government for such supplies as tea, coffee, flour, etc., obtaining them at wholesale government price. After breakfast the party generally started for the cañons and spent the rest of the day in diligent search for fossils, not returning to the camp till supper time. On the prairie they were thoroughly armed, each one carrying a rifle, revolver, knife and cartridge belt. The evening was generally spent in arranging the collection of fossils found during the day, under Professor Marsh's direction The party slept at night in the regular Sibley tent, heated with the Sibley stove. At Cheyenne they found the thermometer standing at fifteen degrees below zero, and very naturally did not care to do much outdoor work in such an atmosphere. Water was all frozen up, and the most bitter winter weather was experienced. From Cheyenne they took a southeasterly direction to Crow Creek in Colorado. Here they camped seven days and explored the country toward the Rocky Mountains. At this point Pike's Peak was in sight. The explorations were not very successful, except near the camp where they found one or two cañons full of bones. There were found some rhinoceros' teeth, as well as bones of various rodents, and fossil turtles in plenty.

Snow Plowing.

A correspondent, W. W. of Evanstown, Wyoming Territory, states that a plow 32 feet long, 11 feet wide, and 12 feet high, *plus* 58 feet for trucks and platform, is well proportioned; and a weight of 50 tuns is enough. But, he says, "the first side drift it strikes, it will throw something (I think it will be the rail). The rail we use here is 4 inches high plus 3½ inches wide, and some of the old pine ties are two feet apart and spiked with a smooth spike. I have shoveled snow in the same drift as John Chinaman. He told me: 'Irishman all same as Hong Kong man, no count to keep track clear of snow when it drifts 40 knots an hour, snow plow and locomotive on *larbert* side' (topsy turvy)." "I see," continues W. W., "no better method for clearing away snow than the one the aboriginal American used before the pale face borrowed his corn."

BE CHEERFUL.—"Be cheerful," says the man who is easy in his circumstances, missing no loved face at the table, nor by the hearth. But does he ever consider how hard it may be to be cheerful when the heart aches, and the cupboard is empty, and there are little fresh graves in the churchyard, and friends are few and indifferent, and even God, for the time being, seems to have forgotten us, so desolate is our lot? How difficult for one man to understand another in such different circumstances! How easy to say "Be cheerful!" How hard he would find it to practice, were he stripped of all life's brightness!

A NEW GALVANIC BATTERY.—Gaiffe's new galvanic battery consists of a vessel in which are contained a plate of lead and a plate of zinc. The lead reaches to the bottom, while the zinc is but half as long. The bottom of the vessel is covered with a layer of red oxide of lead, and the exciting fluid is water containing 10 per cent of sal ammoniac. The electro-motive power of this battery is estimated at one third of that of a Bunsen cell. Its internal resistance is very slight and it is said to be very constant. It has the merit of cheapness.

A PECULIAR LOCOMOTIVE.—A new locomotive, named the Anthracite, which has been placed on the Albany and Susquehanna Railroad, has six driving wheels and carries its water above the boiler. A tender is thus dispensed with. The firing apparatus is stated to be so arranged that the fires last all day without replenishing, and the furnaces only require damping once a week.

EARLY TRACES OF MEN.

When quarrymen uncovered slabs of Connecticut sand stone, bearing impressions exactly like bird tracks, geologists reasonably inferred that, at the time the rock was forming and was as yet but wet sand, there existed gigantic birds or bird-like animals, which strode along these ancient sea shores much as beach birds do along the shores of to-day. The fact that traces of birds had never been found before in strata so ancient, much less the popular theory that birds were of later creation, did not invalidate the inference; one positive fact, as is well known, outvalues any amount of negative assertion, and the old theory had to give way.

When workmen, digging a canal near Stockholm, came upon a buried hearth with charcoal on it, exactly like those which uncivilized people now make and use, the natural inference was that some one of more than brute intelligence had lived there before the overlying earth was deposited. Had the hearth been slightly buried, say six feet below the surface, there would have been no question of its artificial origin; it would have been accounted the work of man as surely as if a human skeleton had been found lying beside it. Should the inference be considered less legitimate because there happened to be sixty feet of earth above the hearth? True, that accumulation of erratic blocks and sand and sea shells gave unmistakable evidence of great geological changes since the hearth was last used—glacial action, submergence of the land and its subsequent elevation,—all involving long periods of time; but that told not so much against the testimony of the hearth as against the belief that man was of more recent creation.

Now that such witnesses have been multiplied to an almost infinite number, forming a continuous chain from the earliest historic times far back into the tertiary period, the evidence is overwhelming; the "alleged" antiquity of man, as it is styled by those who have never investigated the matter, passes from the domain of hypothesis into the region of demonstrated fact. The vista of human antiquity opened up by these surprising discoveries is indeed vast, so vast that even those who have most patiently followed them and assisted in their development are overwhelmed with the thought of it. No wonder, then, that those to whom it comes as a sudden revelation should flatly refuse to admit its reality. As Mr. Evans remarks in the closing paragraph of his magnificent work on the ancient stone implements, weapons and ornaments of Great Britain, "it is impossible not to sympathize with those who, from sheer inability to carry their vision so far back into the dim past, and from unconsciousness of the cogency of other (than the fossils described in the work above mentioned) and distinct evidence as to the remoteness of the origin of the human race, are unwilling to believe in so vast an antiquity for man as must of necessity be conceded by those who . . . have fully and fairly weighed the facts which modern discoveries have unrolled before their eyes." Yet while we sympathize with the natural incredulity of those who lack the basis of intelligent judgment, we need not imitate their unreasoning assurance in contradicting the deductions of science while refusing to examine either the ground of their own convictions or the evidence of the different convictions of others.

The geological proofs of the antiquity of man, to which Mr. Evans alludes, are of threefold character:

1. The association of human bones with the bones of extinct animals, under conditions which prove them to be of equal age.

2. The signs of human action on the bones of extinct animals: the breaking of them to extract the marrow, after the manner of existing savages; the shaping and polishing of them for use and ornament; and more instructive still, the tracing on them of the outlines of mammoths and other animals now extinct or driven by change of climate to distant parts of the earth.

3. The discovery of wrought stone implements, weapons and ornaments under undisturbed strata demonstrably belonging to periods reaching as far back as the pliocene period, if not farther.

Detailed descriptions of these evidences, which are as marvelous in number as in variety and interest, may be found in the elaborate works of Lyell, Lubbock, Wilson, Evans and other English scholars, as well as in numerous French and German writings; or the evidences themselves may be studied *in situ*, and in numerous rich collections of archæogeological specimens, by any one disposed to do so. The purposes of this article admit but the briefest mention of a few of the most ancient of these traces of early man.

First, for our own country. Perhaps the oldest skull yet discovered is the one found in the pliocene strata of Cable Mountain, California. Having no companion in its almost incredible antiquity, it was natural at the time of its discovery for men to ridicule the age accorded it, and to take refuge in the assertion that it never came from the place alleged, or, if it did, it must have come there by irregular means. But when many corroborating evidences of human existence during the pliocene period are found, as they have been, in the same strata under conditions which satisfy careful geologists that the strata had not previously been disturbed, the astonishing character of the testimony is not sufficient ground for flatly rejecting it. More recently, similar fossil evidences of perhaps a still earlier presence of man on our Pacific coast have been discovered. At a meeting of the San Francisco Academy of Science, in May last, Dr. Blake presented the Society with a number of perforated implements of serpentine, which had been taken from stratified rock near the summit of the coast range, 1700 feet above the sea. They were found, embedded in argillaceous shales, in digging away the side of a hill for the foundation of a house, and, says Dr. Blake, were "evidently fashioned by the hand of man or some animal capable of using its anterior extremities so as to fashion objects to meet its wants, and apparently possessed of sufficient intelligence to use lines or nets for catching fish; as it would seem that these instruments must have been used as sinkers." Dr. Blake pronounces the rock in which these interesting specimens of primitive manufacture were discovered, to be of an age not later than the pliocene period; while Professor Whitney, the State Geologist, is of opinion that it is still more ancient. Anyhow, man appears to have antedated the upheaval of the coast range and the attendant geological changes; a remoteness in time which makes the fossil skeleton found at Natchez and New Orleans, and the human fragments under the Florida canals, seem comparatively modern. Yet at that distant period man had existed long enough to overspread a considerable portion of the earth, if not the whole of it, since traces of such primeval men have been found wherever they have been diligently sought for.

Scarcely a decade has passed since geologists began to admit the possibility of finding traces of men in glacial or preglacial strata; yet already human bones or unquestionable evidences of human handiwork have been found in the deposits of those early times, in connection with the remains of supposed prehuman animals, in England, Scandinavia, Belgium, France, Spain, Italy, Germany, India, Australia, and South America, as well as in our own country; and the more carefully the search has been conducted, the farther back the history of man has been pushed into the distant past. Every inch of the ground has been fought over, the firm conviction of the early investigators that man could not be so old a creature causing them to receive every discovery with downright disfavor. Such an upturning of all the recognized foundations of history seemed of necessity to involve some hidden error. But it did not. The facts are so numerous and intelligible that the most skeptical enquirers have been convinced, and now not a few of them hold high rank among the authorities of the young science of archæogeology. Among these is the venerable Sir Charles Lyell, whose caution is not less remarkable than his courage. After studying some of the earlier discoveries of human fossils, he admitted their preglacial origin and thought we might expect to find the remains of man in the pliocene strata. Writing after the discovery of such pliocene remains, Sir John Lubbock set the time of the first beginning of the human race as far back as the miocene, or middle tertiary period; while Alfred Wallace carries the date still farther back, into the eocene period; this, however, on theoretical grounds, since the traces of men earlier than the pliocene period are few and somewhat questionable. In what is said to be miocene strata near Pontlevoy, France, a M. Bourgeois has found numerous wrought flints in a stratum containing the remains of a long extinct animal allied to the rhinoceros, and beneath a bed which contains the mastodon, the dinotherium and the rhinoceros. Similar evidences of man's presence and skill have been found in the miocene beds of Aurillac, with the remains of animals long since extinct; and at Pouancé, another observer, M. Delaunay, has discovered a bone of a herbivorous cetacean of the miocene period, which bears the marks of cutting instruments, such as must have been made when the bone was in a green condition. Doubtless these faint foreshadowings of man's presence in the middle tertiary will be strengthened by future discoveries, as the first evidence of his existence in the later tertiary and quarternary periods have been.

The time required for all the geological changes which have taken place since man demonstrably entered upon the struggle for existence is simply inconceivable. The glacial limit lately set to his history has been overpassed, and his dominion extended perhaps farther beyond it than it is back of the present. "We of the present generation," says Sir Charles Lyell, "when called upon to make grants of thousands of centuries in order to explain the events of what is called the *modern* period, shrink naturally at first from making what seems so lavish an expenditure of past time." Yet, however much the imagination may take alarm at the immensity of such periods, the sternest reason declares them to be necessary unless we stand ready to deny the orderly sequence of events. The same sort of evidence which proves the existence of man on earth six thousand years ago proves his presence here as many thousand centuries.

BESSEMER'S ANTI-SEA-SICK SHIP.

The channel which separates England from France has, from time immemorial, been a bugbear to the traveling public of both countries. Innumerable are the books that have been written depicting the miseries of the passage from Dover to Calais, and equally multifarious are the proposals and plans published, having for their object to connect the two shores, and so not only abolish the wretched steamers now in use, but save the traveler from the discomforts of sea sickness and exposure to the weather. As near as we are able to discover, no less than thirty schemes have been advanced, including submarine tunnels, tubes laid on the bed of the channel, submerged roadways, embankments from coast to coast, steam packets of especial construction with improved harborage, and, lastly, a vast bridge which should span the twenty-two miles of dreaded water. All these ideas, involving as they do, not only a consummate engineering skill, but the expenditure of at the least of a hundred million dollars, are but dim visions of the future. At present Mr. Henry Bessemer, well known for his invaluable improvements in the manufacture of steel, steps forward with a saloon vessel, constructed on a principle which has already been applied to furniture, berths, and even state rooms. In short, Mr. Bessemer proposes to suspend an entire saloon, after the fashion of a lamp or compass, in gimballs. As there is in every vessel, when pitching or rolling, a neutral axis, on a point coincident with this axis Mr. Bessemer intends to hang his apartment.

The first point to overcome was the mobility of the load. A passenger could not be expected to sit perfectly still in a fixed position during the voyage, while, on the other hand, were he to move or promenade, the equilibrium of the apparatus would be lost. The inventor, finding, therefore, that he could not prevent motion by his means of suspension, concluded he could arrest it the moment it began. To this end he designed a saloon—the description of which we find in the London *Times*—70 feet in length, 30 feet in width, and 20 feet in hight, carrying on the top a promenade deck at a hight of seven feet above the ordinary deck of the vessel. The points of suspension of this saloon will be in a line with the keel of the vessel and coincident with the neutral axis of the ship when rolling. The saloon will be well lighted and ventilated, and will be fitted at each end with rooms for passengers. The governing power consists of a set of powerful hydraulic apparatus connected on the under side of the flooring, and so arranged that, as the vessel rolls to either side, the pressure or resistance afforded by the water is instantly brought into play and utilized in checking the motion. The device is controlled by a pair of very sensitive equilibrium valves actuated by a hand lever. At this lever stands a steersman who, with a curved spirit level before him, watches the slightest indication of the rolling of the vessel, and in an instant suppresses the tendency of the saloon to follow the motion of the ship.

The difficulty of pitching is overcome by increasing the length of the vessel so as to insure longitudinal stability. The principle of the saloon is, in fact, carried out in a vessel designed by Mr. E. J. Reed, for the channel passage. She will be 350 feet long, with 65 feet beam over her paddle boxes, and 7 feet 6 inches draft of water. The saloon will be placed amidships, in the position generally occupied by the engines. The latter will be of 750 horse power, nominal, and are expected to drive the vessel twenty knots per hour. The ship will be double-ended so as to enable them to enter and quit existing harbors, and at each extremity will be provided a very low free board, so that she may cut the waves instead of rising to them.

In order to demonstrate the feasibility of his scheme, Mr. Bessemer has constructed a large working model on the grounds of his residence. The arrangement consists of a wenty foot length of the hull of a vessel of twenty foot beam sunk in a brick pit and carried on a longitudinal axis. In the ship is a saloon suspended as above described, and connected with it is a curved spirit level, with a graduated scale and pointer, the latter of which the steersman always keeps at the zero point. An oscillatory motion is given to the hull by a small engine connected to it with suitable gearing. This motion amounts to 14° each way, representing a total roll of 28° with ten oscillations per minute, but notwithstanding this the cabin does not indicate a deviation of more than from 1° to 1½° from the horizontal. Mr. Bessemer considers his idea but the germ of what may be thought out, and frankly admits that some other brain than his own may push on the work he has initiated.

We hardly think the plan will prove successful, and are convinced that Mr. Bessemer will find the short chopping sea of the channel, seemingly striking a vessel on all sides at once, far different from the regular oscillations produced in his model. Moreover, unless there is some mistake in the figures as we extract them from the *Times*, it seems impossible that a vessel 350 feet long should not pitch in a very decided manner. We have crossed the channel repeatedly in a ship 320 feet long, and in rough weather have experienced pitching by no means light. Again, if simple pitching and rolling were a vessel's only motion, the apparatus might answer, but such is not the case, unless, perhaps, in the long heavy and regular swells of the Atlantic. A chopping sea, which is, *par excellence*, that found in the channel in rough weather, produces a spiral, so to speak, movement of the ship, calculated to vanquish the strongest stomach, while the sometimes unaccountable angles taken by the decks cannot, we believe, be avoided by any device based on Mr Bessemer's principle.

THE London journals state that that interesting young stranger, the hippopotamus recently born in the Zoölogical Gardens, is being brought up entirely by hand. Like children generally, he is giving considerable trouble to his keepers. As an instance of his juvenile precocity, it is mentioned that he can already remain under water twice as long as his mother.

IT has been decided to pierce the tunnel of St. Gothard, in Switzerland, by means of lithofracteur; 25 tuns of this explosive body have just been purchased by the engineers in charge of the work. Some idea of the extent of the undertaking and the exceptional hardness of the rock to be traversed may be formed from the fact that at least 1,500 tuns of lithofracteur will be the total amount required.

A YOUNG Briton lately won a bet on spiders, in the following ingenious manner: He wagered that a spider which he would produce would cross a plate quicker than a spider to be produced by a friend. Each spider was to have its own plate. His opponent's spider, however, on being started, would not stir, whilst its rival ran with immense speed. The bet was consequently lost; and the loser soon found out the reason why; his friend had a hot plate.

PRIME'S WASH BOILER.

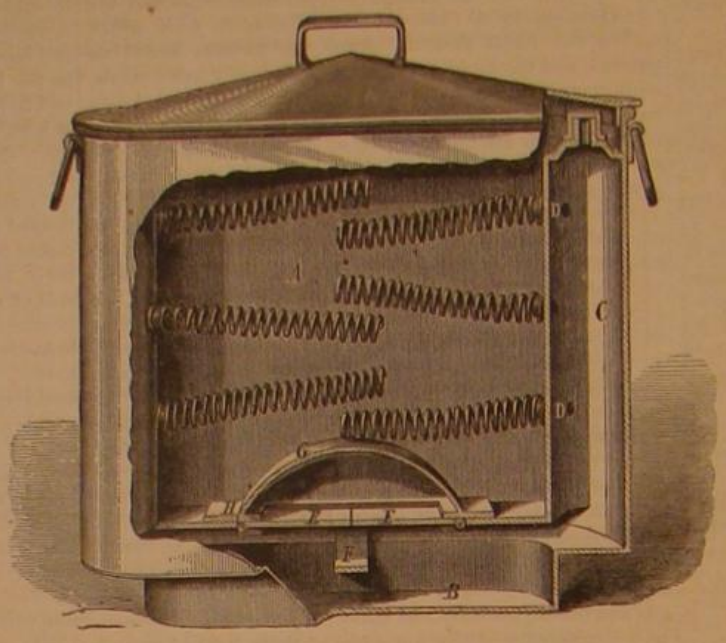
The inventor of this device proposes to furnish an improved and more effective circulation of the steam and water among the clothes by means of appliances which prevent the contents of the boiler from packing around, and so closing the orifices in its sides. The illustration shows parts of the apparatus broken away, with sectional views of other portions, and affords a clear idea of the interior arrangements.

A is the wash boiler, which may be of any suitable design. B is the receptacle beneath for the soap and water. C C are chambers or channels closed at the top and connecting with the interior of the apparatus by means of the orifices, D. The spiral springs shown are so arranged as to fit over the ends of short tubes around the perforations, within the boiler, and to extend through and among the clothes. E E are wing valves opening downwards as far as the guard, F, and protected from being choked, by the clothes above, by the guard, G. These valves are hinged to a plate, H, which may be readily removed for cleaning the heating chamber.

By means of the spiral springs, channels are afforded which admit of a free escape and circulation of the steam and water passing from the heating chamber, B, through the conductors, C, The springs may be either used separately, being placed in and removed from the boiler with the garments or they may be attached to nozzles, as shown, or directly to the walls.

The various portions of this device are easily accessible for cleansing or repairs, and the apparatus is claimed by its inventor to thoroughly meet all practical requirements.

Patented through the Scientific American Patent Agency, Nov. 12, 1872. For further information regarding agencies, sale of machines and territory, address Geo. M. Prime, Eldorado, Ark.



PRIME'S WASH BOILER.

Litmus Paper.

When the physician and pharmacist buy litmus paper, says Dr. Squibb, they generally make the same mistake that the photographer does, and demand that it shall be deep in color, that the blue shall be very blue, and the red very red. This is wrong in principle and in practice, particularly for physicians' uses, where slight traces of alkalinity or acidity are often important, and the palest instead of the deepest paper should always be selected. To prepare good litmus paper, the following formula may be useful: Take of good litmus, in fine powder, 1 part; water, 4 parts; alcohol, 1 part, all by weight.

Put these ingredients into a bottle, and shake the mixture occasionally during 24 hours; allow the sediment to settle out completely, and decant as much as possible of the clear liquid into another vessel; then put the same quantity of water and alcohol upon the sediment, shake again and, when again well settled, pour off the clear liquid for use in diluting the first portion of liquid, or for dissolving a fresh portion of litmus. Separate about one fourth part of the first clear liquid, and add to the remainder dilute sulphuric acid until it becomes of a purple tint, or gives a purplish blue color to a slip of white paper; then add about one half of the separated fourth part of the solution, and if this should entirely restore the original pure blue color, again add diluted acid until a purplish tint is again obtained; then add the remaining eighth part of the original solution to restore the pure blue color, or, which is more delicate as a test for acidity, a very faintly purple blue color; then dilute this solution either with water, or with the second liquid from the litmus sediment, until a slip of neutral white paper dipped into it has a pale blue or pale purplish blue color. Here it is necessary to remember that this paper when dry is many shades paler than when wet, and the dilution should be made accordingly. The solution making red litmus paper will not bear the same amount of dilution as that for the blue, and must be made of the proper purplish red color by the addition of dilute acid before dilution. The solutions so made will keep almost indefinitely, and may be passed on from one process to the next. The paper should be made from pure rag stock—not from bleached wood nor straw—should be quite white, and above all, must be quite neutral, and show no red spots or blotches when moistened with the blue solution. French or German filtering paper commonly answers well if of good quality. This is cut into convenient size, the larger the better, because there is less waste, and held by two corners, which corners are to be kept dry; it is to be skillfully laid on the surface of the solution, first one side and then the other, then drained, and hung over clean glass tubes to dry. The vessel to hold the solution for dipping should be larger than the sheet of paper, and shallow.

The sheets when dry are laid together, and the edges trimmed off all round. They are then cut into sheets 3 to 4 inches wide and 12 to 18 inches long, according to the size of the paper used What is sold as "a sheet of litmus paper" should never be less than 4 inches by 12, or 3 by 18. Such a sheet cut lengthwise through the middle gives a strip which, when cut crosswise into strips a quarter or three eighths of an inch wide, is of a convenient size and form for use. The sheets, one paler and one deeper of the same color, if desired, should be rolled up together in a tight roll, slipped into a test tube and corked. In corked test tubes they keep unchanged for an indefinite time, while the test tubes when empty and corks are always worth their cost to those who use litmus paper.

In this form of sheets, however, the paper is not so convenient for the physician as when cut into strips 1 to 2 inches long and a quarter of an inch wide; and the writer finds that about 100 of such strips, put up in a wide mouth tube vial, corked and properly labeled, is a most convenient and popular form for physicians' use. One such vial of each color put up together forms a pair which no physician should be without. And most physicians will buy them if they can get them. These convenient little strips may be shaken out of the vial as wanted for use, but as the fingers, should, by rights, never touch any other strip than the one taken, it is best to take them from the vial by a pair of forceps from the physician's pocket case.

BROWN'S IMPROVED BEEHIVE.

As the embodiment of a long experience in apiculture, the accompanying invention will doubtless prove a valuable acquisition to all engaged in that industry. The inventor has aimed to so construct a hive as to prevent the diseases to which bees are subject in changeable climates, and in winter to keep their dwellings sufficiently warm, so that the young insects may not be destroyed by the cold. Free ventilation in the breeding chamber is provided, and the hive generally is constructed in close imitation of the abode of the bees in their natural state.

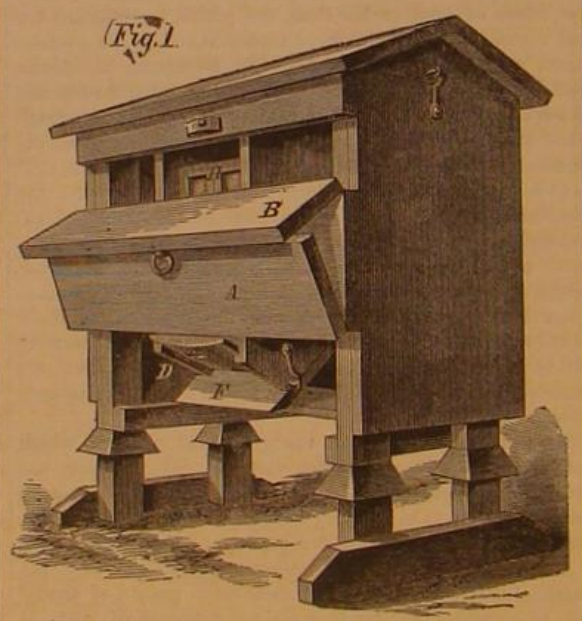


Fig. 1

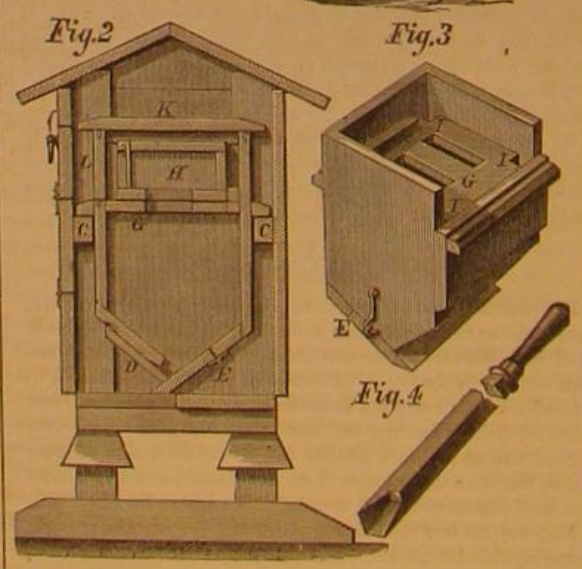


Fig. 2

Fig. 3

Fig. 4

Fig. 1 represents a perspective view of the house and hive; Fig. 2 a sectional plan, and Fig. 3 shows the interior of the chamber for holding the honey boxes. The house, Fig. 1, is constructed with a movable roof or lid, and with two shutters, A, which can be raised and folded back, designed to be closed in winter and opened in summer, and B, by which access may be had to the honey receptacles. Between the floor and the shutter there is about one quarter of an inch of space left in order to insure a supply of fresh air. The floor is movable. Fastened longitudinally in the interior are cleats, C C, Fig. 2, which support the hive in place. The legs are provided with inverted cups or flares to prevent the ascent of mice, etc.

The hive proper is arranged with perpendicular sides. The bottom consists of two inclined portions, D and E; D, the front, has a sliding cover whereby the size of the bee aperture may be regulated, and is provided with a small notch at F for ventilation when closed. The rear portion, E, is hinged to the hive, its forward inclined part constituting a lighting board for the bees. G, Figs. 2 and 3, is the diaphragm dividing the breeding from the honey chamber. It is pierced, as shown more clearly in Fig. 3, with two rectangular orifices in the center, which communicate with similar holes in the bottom of the honey boxes, H. The inventor has found, through long experience in the management of bees, that the eggs of the bee moth are always deposited around the corners of the hive. In order to remove these nuisances, and so to protect the bees from their ravages, he provides the four corner orifices, I I, in the diaphragm, G, which, whenever necessary, he scrapes with the instrument shown in Fig. 4, thus detaching the cocoons; after which, by means of a small swab, he covers such portions with a strong solution of brine, also applying the same liquid to the bottom of the hive. This operation requires but a few minutes, and may be accomplished without moving the hive or disturbing the bees. The corner orifices, when not thus used, are covered with wire gauze. The upper part of the hive is closed with a movable lid, K, and front, L, which should not be left in position except when feeding a late swarm that have not secured sufficient honey for their maintenance.

Fig. 1 represents the device arranged for summer use, that is, with doors open and lid of hive removed. In winter time these portions are all closed, and the two inch space between the hive and walls of the house is packed with straw so as to secure warmth.

The inventor claims that the apparatus, with proper management, will prevent the vitality of the eggs being destroyed by cold, obviate the foul brood caused by chill and dampness (leaving a black and decomposed mass liable to kill the entire colony), and lead to early swarms and an abundance of honey. The device is simple and durable, and is well worthy the attention of bee keepers throughout the country.

Patented September 10, 1872. For further particulars regarding sale of entire right, etc., address the inventor, Mr. Peter Brown, Taylorville, Ill.

Telegraphic Experiment.

Mr. Highton describes in the *Chemical News* the following experiment: On November 4, the cable from Dover to Boulogne was broken by a ship's anchor, about 5 miles from Dover. By the kind permission and co-operation of Mr. Bourdeaux, the engineer of the Submarine Telegraph company I placed my instrument (shown lately to the Society of Arts) between the end of the broken cable at Dover and the water pipes of the town. To our surprise we could distinctly read every message to and from Ostend, Calais, and Dover, on the Dover and Ostend and Dover and Calais cables. The explanation was as follows: Part of the electrical current which went to earth at the Dover water pipes went on to a second earth formed by the end of the broken cable, and in its passage made signals on the instrument. Thus the enormous fault formed by the Dover water pipes was not sufficient to prevent a perceptible current of electricity passing on to the broken end of the Dover and Boulogne cable.

We also asked the French operator at Boulogne to send a current through the broken cable, and got a feeble result; but as we were not able, without special authorization from the French Government, to get him to put on such batteries and instruments at Boulogne as were necessary, and the remaining cables were fully occupied with messages, we did not follow out this portion of the experiment.

ATMOSPHERIC SUBMARINE POSTAL COMMUNICATION BETWEEN FRANCE AND ENGLAND.—E. Martin describes a modified plan, which consists in the use of a narrow tube through which simply microscopic photograms containing the dispatches, produced upon collodion, are to be transmitted. It appears that this method of operating was first used during the late siege of Paris, and has now been improved upon. The execution of these microscopic photograms can be conducted by day or at night by the aid of the electric light. The tube through which these light pellicules are to be transmitted need only be some few centimeters in diameter. The motion is imparted by compressed air.

AMERICAN IRON.—The Philadelphia *North American* says: "Certainly, if a country so limited in extent as Great Britain should dominate the iron trade of the world, as she has long done, we can, with our immense wealth of iron and coal, and our fast accumulating capital, do that much. Twenty years hence, if we are true to ourselves in the meantime, the American iron product will reach eight or ten millions per year, and we may even be able by that time to export a tun of iron for every bale of cotton. The era of cotton and wheat in American commerce has been a great one. But the era of iron now dawning upon us is destined to be far greater."

Scientific American.

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OUR NAVY.

The Secretary of the Navy has, each year since the commencement of the first term of President Grant, earnestly endeavored to impress upon Congress and upon the country the vital necessity of preserving the efficiency of our diminutive navy. Congress has, at last, taken up the matter and is considering the advisability of authorizing the construction of a number of new vessels of war.

There can be no doubt, in the mind of any thoughtful citizen, that the United States requires a navy, and that it will require one so long as we have commercial relations with foreign countries, so long as we are liable to become involved in war with other maritime nations, and so long as a large share of the great work of exploring distant parts of the globe can be best and most economically performed under the auspices of our navy department.

How large and of what character, this navy of ours should be, is not so easily decided. We must, certainly, have a number of cruising vessels to do the work which falls to our navy in time of peace, and this work may be done by ships of comparatively light armament, of full sail power, and of good speed under steam: by such vessels, it can be done efficiently.

We believe that there is not a vessel in our navy which possesses all of the requisites of such a class of ships. The "Wampanoag" class had the speed, the sail power, and the necessary armament, but were originally defective in their machinery, and are now generally worthless in consequence of the decay and weakness of their hulls. It is to make good our deficiency here, we presume, that the Secretary of the Navy proposes building ten new vessels. They are evidently urgently needed, and it is to be hoped that they will be built and built quickly. In justice to the Department, to Congress, and to the people who pay for them, it is to be hoped that they will, when completed, embody the very latest and best modern practice. They should have iron hulls; economical, simple, light and durable machinery, and an armament that shall not be rendered inefficient by deference to the hobbies of any enthusiastic inventor or of any single man. The plans should be invariably endorsed by properly constituted boards, who should be authorized and required, also, to consult experts, of generally recognized standing, in relation to all plans. Such a course would protect the navy department from malicious or ignorant misrepresentation and abuse.

We learn from the annual reports of the secretaries of our navy, commencing as far back as the administration of Gideon Welles, that our iron-clad navy, originally created under the pressing exigencies of civil war, and, as a matter of course, to some extent defective in design and hurriedly constructed, has become as worthless as the first class of ships. The Dictator is the most formidable of our iron-clads; but even the Dictator is of slow speed as compared with more recently built foreign vessels, has far less invulnerable armor, and is equally inefficient in her armament. Once the most powerful and formidable of iron-clads, she is, to-day, comparatively weak. This vessel, and others of our iron-clads, should not be allowed to become utterly worthless for want of proper care; but we question seriously the policy of building a new iron-clad fleet to compete with that of England, of Prussia, or even of Spain. We are by no means certain that the day of iron-clads has not already passed, and that the perfection of our various systems of using torpedoes for both attack and defence may not have already rendered us independent of such terribly expensive engines of war.

A new fleet of effective iron-clads, if built, should consist of not less than twenty vessels, each capable of meeting successfully the strongest foreign-built iron-clads, and would cost thirty millions of dollars.

Such a fleet might defend our shores and might successfully contend with all existing iron-clads, but it could not prevent the destruction of our limited commerce by fleets of fast, lightly-armed cruisers, and it could not enter or seriously threaten an enemy's port well defended by a system of torpedoes.

Abroad, the unarmored, lightly armed and fast vessels, which it is now proposed to build, could best destroy an enemy's commerce, and would easily avoid heavily armed cruising iron-clads, since the latter must always, of necessity, be defective, either in speed or endurance, or both.

At home, we are already safe against attack, thanks to the intelligence and energy of the torpedo corps of both army and navy.

The exigencies of our late civil war gave rise to these now well organized and effective organizations.

It would be impolitic to make public the results of their unremitting and very fruitful labors. The only suggestion that need be made is that, to still further increase their efficiency, the best talent of the naval engineer corps should be better utilized in this now vitally important work than it has yet been.

In brief, we may state that, in the event of our becoming involved in war with the most formidable of foreign powers, our harbors would be at once rendered inaccessible to the most formidable fighting machines yet put afloat, and this, too, at comparatively slight expense. Were all the fleets of the world to attack New York harbor, not one vessel would be likely to pass the Narrows. A fleet lying off the coast would be unsafe during the day and could be scattered or destroyed during a single night.

A worthy successor of Farragut would find means of destroying easily the most powerful of an enemy's fleet with the resources which are now made available by our torpedo corps.

We have fixed torpedoes that may be made to explode when struck by an enemy's ship, others that may be exploded from secure stations far away at any instant desired, others that may be rendered harmless when our vessels are passing among them and which may be then made to destroy any pursuing vessel that may attempt to pass them: and we have torpedo vessels that can be sent out without a single human being on board to attack a fleet anchored off the shore, and, directed from the shore, they will approach and explode a charge of powder under any vessel that it may be desired that they should destroy.

We may rely upon our torpedo corps, with confidence, to defend our shores and harbors against the world.

Let us have our cruisers, therefore; but let us hesitate before commencing to build iron-clads. We may find that the expenditure of many millions, in attempting to rival other nations, may be saved us by the comparatively inexpensive operations of well organized torpedo corps, and by the application of the wonderful ingenuity of our inventors to the perfection of floating and sub-aqueous torpedoes and torpedo ships.

The inventive minds of some of our readers will find here an interesting field in which to labor, and they may accomplish results of value to the nation while attacking a problem which, nearly a century ago, gave Hopkinson the text for his humorous poem, "The Battle of the Kegs," and with which Bushnell and Fulton made creditable progress at a very early period in the history of our country.

THE MOSCOW EXPOSITION.

The great Russian Exposition at Moscow was recently closed, and, according to a correspondent of the *Engineer*, the United States were extensively represented in the mechanical department; not, however, by goods sent directly from this country, but by machinery made in Austria, Prussia, Belgium, Russia and other countries, copied from American patterns, the products of American genius, protection for which by patents in the countries specified is practically denied to our citizens. At this exposition, the show of American sewing machines supplied from Germany was quite large. The correspondent says:—"If that benefactor of mankind, the ingenious Howe himself, could have appeared in the flesh and visited the Exposition, I think he would have been highly gratified, for the pet offspring of his genius, in some form or other, is continually to be met with, it being more difficult to say where it is not than where it is."

The entire motive power of the exhibition seems to have been furnished by the American Corliss steam engines, examples of which were supplied by several German manufacturers. Indeed, so many of these engines were to be seen in the exhibition that the correspondent is led to ask: "I wonder if the inventor reaps any advantage from this patent in Germany?"

This is only one of hundreds of examples of the way in which the Germans, especially the Prussians and Austrians, appropriate the best improvements of English and American inventors.

Our Commissioner, General Van Buren, in his endeavor to procure a large appropriation from Congress to be wasted in Vienna, is endeavoring to satisfy the members that unless the money is granted the United States will not be duly represented at the coming Vienna show. But Congress need not give itself any apprehension on that score. The ingenuity of America will be well represented in all the mechanical departments, by the pirating manufacturers of Austria and Germany. No nation in the world will have its mechanical ideas so largely represented at Vienna as the United States; but our countrymen will not specially profit thereby

But to return to the Moscow affair:

Among harvesters, the Johnson American Self-raking Reaper is specially mentioned. As to steam fire engines, the first prize has been, as stated to have been, awarded to an American machine.

The display of war material was quite large, some very ancient and curious pieces, of Russian origin, being exhibited. Among these were queer shaped revolving mitrailleurs, having from twenty-four to forty-four barrels, five feet long and three quarter inch bore. These were made in the time of Peter the Great, but were discarded by him as impracticable. A brass rifled cannon was shown, which was cast in 1615—a hundred and fifty years nearly before the idea of rifling guns was known in England. A rifled arquebuse made in 1661, several breech-loaders, and a revolving gun of the seventeenth century were also on exhibition.

A SLIPPED ECCENTRIC AND WHAT CAME OF IT.

A correspondent in Connecticut, who writes to announce the sending of an excellent list of subscribers to the SCIENTIFIC AMERICAN, shows how our paper has practically benefitted him and his employers as follows:

"I have taken the SCIENTIFIC AMERICAN for nine years. When I first commenced to run a steam saw mill, I worked by the day as sawyer. One day the eccentric slipped on the shaft, and the engine, of course, stopped. The proprietor being away, we were in a bad fix. The fireman did not know how to set it again, and, practically, I knew nothing about it myself; but I recollected reading in your paper the rule for such an engine (a common slide valve one). So I tried my hand and succeeded, the engine doing better work, with less fuel, making a gain of three cords of slabs in ten days."

To the practical workman the regular reading of the SCIENTIFIC AMERICAN is unquestionably of great value. It insensibly educates the mind of the reader and, if he is a workman, renders him more intelligent, more skillful and more useful to his employer. It is the custom in some establishments for employers to present their workmen on the return of each new year with a year's subscription to the SCIENTIFIC AMERICAN. Proprietors find themselves abundantly repaid in the greater industry and superior work which their men give back in return for such attentions. Those who have not already done so should remember that now is the time to register subscriptions to our paper. This is the first number for 1873.

Send in the names as fast as possible.

PROFESSOR TYNDALL AS A MONEY MAKER.

During the evening of Professor Tyndall's first lecture in this city, while he was busy in exhibiting the wonderful qualities of light at the Cooper Institute, a thief struck a light in the Professor's room at the Brevoort Hotel and carried off $200 in gold from the Tyndall trunk. But that, after all, is a small item when we consider that the Professor is bagging about ten thousand dollars a week from his lectures, one of which he gives every other night.

If other scientific lecturers would bestow as much personal attention upon the preparation of their public appearances as does Professor Tyndall, it is probable that the demand for their services might be increased. There is never any hitch or break in the experiments, illustrations or speaking of Dr. Tyndall. The day preceding each lecture is devoted to a careful rehearsal of the experiments that are to be produced, and his assistants are drilled in the manipulation of the apparatus by their leader with the same care that the leader of an orchestra bestows in the rehearsal of his music.

Work and watchfulness are the keys to Professor Tyndall's experimental success as a lecturer.

THE VIENNA SHOW IN CONGRESS.

After a somewhat lengthy debate, a bill appropriating the sum of $100,000 to defray the expenses of American representation in the Vienna Exhibition has passed the House of Representatives and has been forwarded to the Senate for its concurrence. In addition, two naval vessels have been designated for transport duty, to carry pianos, sewing machines, buggies and other goods of exhibitors to Trieste, Austria. Space forbids our entering into any *resumé* of the discussion in the House. The bill was introduced by Mr. Banks of Massachusetts, and the opposition was led by Mr. Shellabarger, of Ohio. The latter gentleman made an able argument against the grant of the appropriation until the Austrian patent laws should be so modified as to protect American inventors; but the bill passed without this proviso, so that it now remains for the Senate to determine whether we shall allow this golden opportunity of testifying to the world our condemnation of these unjust and oppressive regulations to escape.

The amendment offered by Mr. Shellabarger, although it is a step in the right direction, hardly, in our opinion, covers the entire requirements of the situation. What we need and insist upon is not a protection merely for the limited duration of the show, but a permanent guarantee, ratified in solemn treaty obligation that the rights of our citizens in Austria, in respect to their inventions, shall be upheld the same as are the rights of Austrians in this country.

We earnestly trust that an amendment framed in this view will be introduced and favorably considered in the Senate. It is but a simple act of justice, it works no hardship to any one, and secures to us advantages that are inestimable. We have repeatedly shown that, in other continental countries, patent laws exist as oppressive as those of Austria. The latter nation is deeply anxious to procure a full representation of American genius, and, were such an amendment enacted, there is little doubt but that the objectionable features

in the Austrian statutes would be repealed. This done, we should have gained an entering wedge toward ameliorating the similar laws of other countries, and eventually we should succeed in obtaining for our countrymen as full privileges in Europe as in the United States.

Our representatives, in advocating the appropriation, seem to look no further than the so-called protective certificate to be granted to exhibitors. It should be distinctly understood that the certificate simply purports to afford protection for a year; that is, it saves the inventor from the loss of his right to a patent during the period of the Exhibition. There is nothing to prevent an Austrian from gaining all possible knowledge regarding an idea, completing every preparation, and at the end of the specified time putting all he has thus acquired into practical execution. We have shown that nothing can be accomplished by bringing infringement suits, and that to this piracy there is no check. The certificate therefore merely permits the inventor to delay his application for a patent one year, and leaves him precisely where he would be in the beginning, did it not exist. He must accordingly then manufacture within the succeeding twelve months precisely in correspondence to his drawings, etc., and comply with sundry other similar regulations, or his patent, if he gets one, is null. On the other hand, an Austrian coming to the United States with a new invention may, by our law, make, sell and exhibit it all over the country for two years, and at the end thereof obtain a patent for seventeen years giving him complete and exclusive property in his device. He is not compelled to work his invention within any specified period, but is at liberty to do precisely as he pleases with his patent, which remains good for the term granted.

It is but little appreciated in this country to what an immense extent American inventions are manufactured abroad, and what vast benefits the people of Europe reap from our ideas. The continent is full of devices of American origin, and every new improvement of value is immediately adopted there, pirated and manufactured to the exclusion of the American inventor. The scientific publications of the continent are full of extracts from American patents, which they issue, with engravings, of all our latest and best improvements, which are promptly put in use. Of the dozen or more steam engine exhibitors from Austria, Prussia, Russia, Belgium, and other countries in the late Moscow Exhibition, nearly every one displayed Corliss engines of their own manufacture, made after the patterns used in Providence, R. I.; the entire steam power of the exhibition was supplied by these engines. In Russia, Prussia, Belgium, and Austria, the McCormick reaper, Howe sewing machines, Burleigh rock drill, Blake stone breaker, Gatling guns, Hotchkiss' projectiles, Colt's revolvers, Hoe's and Bullock's steam presses, Danks' puddlers, Westinghouse's railway brakes and hundreds of other American designs are well known, and many of them used; and without doubt large numbers of our best inventions of the most recent dates will be found among the entries of foreign manufacturing houses in this Vienna show.

We should have been glad had the motion in the House to strike out the appropriation altogether prevailed. Not that we do not appreciate the value of the Exposition, or fail to believe that, in the words of a contemporary, we "ought to join in all peaceful measures which belong to international courtesy and promote mutual goodwill," but simply to publish to the world that the United States failed to take part in the Austrian Exposition, because Austria has refused to do justice to American inventors. This it is yet in our power to do, and the amendment that we advocate should be so worded as to deny the payment of the appropriation until the Secretary of State receive official notification of the alteration of Austrian laws.

Our leading position among industrial nations, our world-wide renown as a people of transcendent inventive genius and our unexampled progress in civilization during the past century are due in great part to the stimulation and encouragement which our laws give to the inventor, teaching him to study new arts and processes, to develope new ideas and in the end to turn the results of his thought and labor into substantial profit. Is it not evident that the stimulus, thus afforded, would be infinitely increased could we make a world, instead of a country, the market for our productions? Can it be controverted that the direct advantages to our people would be invaluable, did they possess an exclusive and guaranteed property in their own original ideas in foreign countries? Or is not the fact plainly manifest that, were such rights secured to the United States and other people forced to come hither for the most useful improvements in science and art, we should place all other nations under contribution? In view of such benefits, the acquirement of which is so easily begun, it seems impossible that our legislators will neglect so plain a duty as to secure for the country the advantage which is now within their grasp.

SUNDAY RAILWAY TRAINS.

A few weeks ago we published a paragraph, copied from a reliable source, to the effect that the Brotherhood of Locomotive Engineers, in their recent St. Louis convention, had passed a resolution having in view the entire stoppage of railway trains on Sunday. We commented on such action as unwise, showing that while we were as decidedly in favor of the general rest from labor, on the part of engineers, of one day in seven, as anybody could be, still we considered it to be a matter of public necessity that certain trains should be run on the Sabbath.

The New York *Daily Witness*, in commenting upon our remarks, says:

"Is it not strange that the SCIENTIFIC AMERICAN should be in antagonism to this Brotherhood of Locomotive Engineers, which recently passed resolutions in St. Louis in opposition to the running of Sunday railroad trains? The SCIENTIFIC AMERICAN believes in running them for mails, passengers, and freight as a necessity. The Brotherhood believes in no such necessity; but that the running on Sunday is a breach of the divine command and an infraction of public morals. We are glad that the Brotherhood are not afraid to speak their minds in favor of all classes connected with railroads having the rest of the Sabbath. Right is might and must prevail."

The *Witness*, if it wishes to give reliable testimony upon this subject, should inform itself better before attempting to speak. The SCIENTIFIC AMERICAN did not urge the running of freight trains on Sunday, but spoke of the necessity of running a limited number of trains for the transit of the mails and the carriage of such passengers as from necessity had occasion to travel on that day. The SCIENTIFIC AMERICAN further alleged that it was no more sinful to travel in case of necessity on a railroad, which was a public road, on Sunday and in a railway car, than to ride on an errand of necessity in an ordinary buggy on a common road on the Sabbath.

The *Witness* is also mistaken as to the objects of the Brotherhood. We have received a letter from Mr. Charles Wilson, G. C. E., of the Brotherhood, from which it appears that the engineers do not seek to stop all trains on Sunday, but only the unnecessary trains. He states that on some roads more traffic is run on Sunday than on any other day of the week, and it is to prevent this and cause the Sunday trains to be restricted to such as are actually necessary that the Brotherhood have resolved.

In this laudable endeavor the Brotherhood well know that they may count upon the aid of the SCIENTIFIC AMERICAN, and to this end we will thank them to give us the names of the roads and their controlling officers who impose in the manner stated by Mr. Wilson upon their engineers.

Inasmuch as the Brotherhood do believe with us, as represented by Mr. Wilson, that the running of certain trains on Sunday is necessary, the *Witness'* fervid puff of the piety of the Brotherhood, as relates to the breach of the Divine command and the infraction of public morals, is entirely wasted.

THE NEW YEAR.

The present number of the SCIENTIFIC AMERICAN is the first for the new year of 1873, and we would remind those of our readers who have not already done so that their subscriptions should be at once renewed. This will prevent interruption in the regular coming of their papers, and save them the risk of losing any numbers. One of our subscribers says that he regards the loss of a single number of the SCIENTIFIC AMERICAN like time lost in the prime of life. Send in your subscriptions as fast as possible. Terms, $3 a year. One copy of the SCIENTIFIC AMERICAN for one year and one copy of SCIENCE RECORD for 1873 will be sent for $4.50.

Some idea of the interesting and valuable character of the SCIENCE RECORD may be gleaned by reference to the general statement of contents published in our advertising columns. It will be noticed that every department of science is to be represented. Among the biographical illustrations several fine steel plate engravings are given, among which are portraits of Professor Henry, of the Smithsonian Institute; Professor Pierce, of the Coast Survey; Professor Dana, of Yale; portraits of Professor Morse, as he appeared in the prime of life, soon after the completion of the first telegraph line, of Professor Tyndall, who is now lecturing here, and other distinguished men of science.

RAPID TRANSIT IN NEW YORK.

The New York *Times* does not look with favor upon the proposition to use steam upon the street cars, in lieu of horses, for the reason that there would be increased liability to accident without any gain in speed. Our cotemporary thinks that the only way to realize fast traveling in the city is by means of tracks removed from the surface. The two ends of the metropolis are now twelve miles apart, and the people suffer great inconvenience for a lack of quick means of communication. The discussion of the various plans by which this may be best effected is a matter of interest, not only to New Yorkers, but to the people of all large cities. Nothing so stimulates business, gives value to property, and promotes the comfort of city life, as prompt and safe modes of local conveyance.

It is only by an elevated or an underground railway that rapid transit can be realized in New York. The relative cost of these roads is about the same, namely, from one million to one million five hundred thousand dollars per mile. The elevated road is inevitably an obstruction, in whatever street it is built, for it is simply an immense bridge, which no one wants before his doors. On the other hand the underground railway is entirely out of sight, does not interfere with the streets, and disturbs no one. In London a shopkeeper in one of the main streets was asked by an American where the underground railroad passed. He said he did not exactly know, but he believed it was on the next street back, a block distant from his premises. But the truth was, the railway in question passed directly in front of the man's door, forty feet below the surface of the ground; and the shopkeeper, who had moved in subsequent to the building of the road, was not aware of the fact, although three hundred trains a day were regularly passing. It has been affirmed by experienced engineers in this city that a single omnibus, clattering over the Broadway pavement, shakes the adjoining buildings and makes more noise on each trip than would all the trains of an underground railway during an entire day, if built on that street. Well made cars slide along very smoothly over a properly constructed track.

One and a half millions of dollars a mile is an immense cost for a city railway, and to insure its pecuniary success the first essential is to locate its route where its cars and accommodations will be constantly under the public eye, readily accessible to the largest portion of the population. Such was the testimony of the eminent engineer, Mr. John Fowler, before the Parliamentary Committee in respect to the London underground railways. It is evident that the route under Broadway in this city is the natural and proper line for such a road.

A variety of charters have been granted for steam roads in this city; but their routes are faulty, and none have been built, save the post railway on Greenwich street, which is far away from Broadway, and has proved a bad bargain to its original stockholders. They have not only lost their charter, but every cent of their original investments, amounting, it is said, to over one million of dollars in cash.

Another grand scheme was the Viaduct or elevated railway, the charter for which was granted to the notorious Sweeny & Co. The routes proposed were on side streets, east and west of Broadway. Although five millions of dollars were to be taken from the city treasury to help the scheme, still such was its enormously expensive character, so defective the route, and so greatly was it disapproved by the public, that it was impossible for the corporation to procure subscriptions enough to start the thing.

Three other charters were granted last year, one to Mr. Vanderbilt for an underground road on Fourth avenue, east of Broadway, another to Mr. Gilbert for an elevated railway to run on a side street either east or west of Broadway, according as certain commissioners may determine; and another to Mr. Swain for a double road, with both elevated and underground tracks, to run on the side streets west of Broadway. There seems to be no great obstacle to the procuring charters for New York railways. The grand difficulty is to secure the right route.

Of the various plans for fast railways in this city, that of the Beach Pneumatic Transit Company, for an atmospheric railway under Broadway, has been the most carefully examined and the most widely approved by the public. It has been shown that, for a cost of about one million dollars per mile, a double track railway can be built from the City Hall to Harlem which, with certain lateral branches, will give to our citizens the luxury of rapid transit all through the county. At the inception of this enterprise, the trustees of the corporation caused the most careful investigations to be made in respect to route and the method of building, and the unanimous conclusion was that the Broadway route was not only the most economical for construction, but afforded promise of accommodating a larger number of people than any other line that could be selected.

Great pains were taken to accumulate reliable evidence. Nearly all on the leading architects in New York were consulted in the matter, especially those who had had occasion to erect important buildings on the above thoroughfare. With an almost unanimous voice they joined in certifying that the railway could be built and operated on Broadway on the plan proposed by the company, without any molestation of or injurious effect upon adjoining buildings. The advice of the most eminent and experienced civil engineers was also taken, among whom were A. W. Craven, Esq., C. E., George S. Greene, Esq., C. E., Major General J. F. Barnard, U. S. Engineers, General Charles K. Graham, C. E., all of whom, after personal examination, certified in the most unqualified terms that the work proposed by the company could be executed and the railway worked without injury to adjacent property.

The advice of prominent English engineers was also taken upon the subject, among whom were Mr. F. E. Cooper, of the London Underground Railway, and Charles Douglas Fox, Esq., C. E., the well known railway constructor and engineer of London; all of whom fully coincided with our own engineers and architects. Mr. Fox did not merely write upon the subject, but had come to this country and made a personal examination of the route.

To illustrate the matter still further, and remove every lingering prejudice against the work that might exist in the minds of property owners, the company determined to construct a short working section of railway under Broadway. This they were enabled to do under the provisions of their original charter, which gives them the right to place pneumatic tubes under the streets for carrying freight and parcels. The company accordingly secured premises in the lower part of the large marble building at the corner of Broadway and Warren street, and, having constructed a novel boring machine, set it to work to excavate a railway tunnel down Broadway, below the foundations of the buildings, under the water pipes, sewers and gas pipes, without disturbing the surface of the street, and with all the omnibuses, trucks, and the enormous traffic of the street going on directly over the heads of their workmen. So carefully, expeditiously, and successfully was this work executed that the entire section of the tunnel, which is between nine and ten feet in diameter, from Warren street down Broadway to Murray street, was almost completed and the track laid before the newspaper reporters or the public were informed that anything of the kind was in progress. The work was then finished up, a large blowing engine put in, a handsome passenger car placed on the track, and the railroad set in operation. All this was done at an outlay of about a quarter of a million dollars. The admirable working of this short railway has been before described in our columns. It will

be sufficient to say that, by means of the blowing machine, a current of air is impelled through the tunnel, and that it drives against one end of the car, carrying it along, just as the wind acting upon the sail of a vessel gives it motion. The car, on reaching the lower end of the tunnel, actuates a telegraph signal, the air current is reversed, and the car is driven back. Thus back and forth, indefinitely, the car is moved by atmospheric pressure, while the constant driving of the air current through the tunnel maintains a pure atmosphere and perfect ventilation. The car carries twenty-two passengers, moves with but little noise, and there is no gas, smoke, dust, or cinders to interfere with one's comfort. Many thousands of our citizens have enjoyed the ride under Broadway in the pneumatic car, and this method of traveling is not only well known here, but is highly appreciated. The works of the Transit Company on Broadway form one of the most interesting attractions in New York. For city purposes, this system of car propulsion is admirable. The expense of its maintenance is estimated to be somewhat higher than the locomotive; but the pneumatic plan is so decidedly superior, in point of comfort and health to passengers, that the trustees had no hesitation in giving it preference. Its adoption was also recommended by the London engineers, where, as our readers will remember, there is a smaller pneumatic railway of between two and three miles in length, which has been worked successfully for several years past. Several miles of other small pneumatic tubes are also now in use in London for the transmission of telegraph messages between important points.

After the Transit Company had, at the great expense mentioned, completed their working section of road under Broadway, they applied to the State legislature for an amendment to their charter, authorizing them to carry passengers and proceed with the work. The members of the legislature visited the city, inspected the works, rode in the car and became thoroughly satisfied of the excellence of the plans. Both branches of the legislature, by very large majorities, passed the bill, and it was sent to the Governor, Hoffman, for approval. The notorious Sweeny & Co. were then in the zenith of their power, and the Governor was the pliant tool of their wishes. At their solicitation, he vetoed the bill and then promptly gave his approval to the abortion known as the Viaduct bill, of which the public disapproved, and in which Peter B. Sweeny and his immediate confederates figured as chief incorporators. Last year the legislature again passed the Beach Transit bill by increased majorities in both houses, but Governor Hoffman repeated his veto. A new governor, General John A. Dix, a man of much higher capacity, takes his seat in the gubernatorial chair on the 1st of January, and the many friends of this excellent enterprise believe that he will be glad to give it his approval.

In brief, then, the actual condition of the rapid transit business in New York is this: The only plan and route that fully meets the wants of the people that has been thoroughly examined, approved and endorsed by property owners along the route on which it passes and by the general voice of the public, is that of the Beach Pneumatic Transit Company.

At a heavy expense this Company has already begun the work, and stands ready to prosecute it with the greatest vigor as soon as the necessary authority of law is granted. No good reason exists why that authority should be withheld. It is a shame that the Company should be delayed and hindered in carrying forward this important enterprise in which so many of our leading citizens are interested, and by which the public convenience will be so greatly promoted. The Company will urge their petition before the new legislature, and, it is to be hoped, will this time succeed.

To Mail Subscribers.

The regular receipt of the SCIENTIFIC AMERICAN by mail is sufficient evidence to old subscribers that the time for which they prepaid has not expired.

To new subscribers, the regular receipt of the paper is an acknowledgment that their money has been received at the office of publication. It is a rule of the publishers to discontinue the paper when the time is up for which it is prepaid.

WORK has been commenced on a new railway tunnel through the rocks of Jersey Hights, at Weehauken, N. J., on the Hudson River, opposite New York. The tunnel is to be fifty feet wide, about a mile in length, and will have four railway tracks.

A CORRESPONDENT, writing for some missing back numbers, says that the loss of any copies of the SCIENTIFIC AMERICAN is like lost time in the prime of life.

SCIENCE differs from learning in being prophetic; whereas learning is a mere matter of the memory.

PATENT OFFICE DECISIONS.

Patent Wrench.

THE COLLINS COMPANY, ASSIGNEES.—APPEAL FOR THE REISSUE OF PATENT OF JORDAN & SMITH, FOR WRENCHES, OCTOBER 19, 1865.

LEGGETT, *Commissioner:*

It is admitted that the device differs from the references cited, and the applicant maintains that the words "substantially as described" sufficiently indicate the difference and define and limit the invention intended to be secured by this claim. The real issue in this case is whether the claim presented is met by the references cited. Otherwise an appeal to the Board would not have been in order. I think that as drawn it is met. It should be limited by including the nut, or otherwise, to clearly distinguish the invention from the references, and then the words "substantially as described" may or may not be used; but, as they serve to well round a claim, I would rather favor their employment than otherwise.

The decision of the Board is affirmed.

Improvement in Cutter Bars for Mowers and Reapers.

APPEAL OF H. MEWES.

LEGGETT, *Commissioner:*

This case had several examinations by the Principal Examiner, and was by him rejected. The applicant made numerous amendments. The final amendment embraced two claims, the latter of which is entirely inconsistent with the description of the invention in the body of the specifications. This fact was recognized by the Principal Examiner, and also by the Board of Appeals. The Examiner permitted the appeal to be taken, and the Board of Appeals heard the same and permitted the appeal to be taken to the Commissioner in person without first requiring that either the claim or the specifications be so amended as to make them consistent with each other.

The Commissioner will not examine the case in its present condition upon its merits, but returns the same to the Principal Examiner to have the preliminary questions settled.

Improved Spectacles.

APPEAL OF JULIUS KING.

LEGGETT, *Commissioner:*

Applicant proposes to improve ordinary steel spectacle frames by making the bridge or nose piece of solid silver instead of steel or steel silver-plated, as they have heretofore been made. The advantage alleged is that while oxidation is prevented, as in plated bridges, the solid silver bridge can be united to the steel rims by the autogenous process of soldering, which is said to be employed at a lower temperature than a steel bridge can, and thereby the danger of burning the steel and rendering it brittle at the point of union is obviated and a better frame is produced.

The decision of the Examiner, which is affirmed by the Board, proceeds upon a denial of the allegation that a more ready and safe application of the soldering process is practicable where a silver bridge is used than where the spectacle frame is made wholly of steel, and upon the assertion that no invention is exhibited.

I am satisfied, however, that it is true a silver bridge can be united to the rims at a lower degree of temperature than a steel one, and that thereby the danger of burning the rim and rendering it brittle is obviated. If the common method of soldering by the use of an alloy were employed, as seems to have been represented to the Examiner and Board, this would not be the case, but to secure a silver bridge no solder is required, as the silver itself (which is not perfectly pure) is a solder, and it can be united to the rims by such a degree of heat as will fuse it. That there is invention exhibited—not in any single step or feature taken alone, but in what is claimed (namely, the novel combination of the parts presented)—cannot be successfully denied, in view of the improved result obtained.

The decision of the Board is therefore overruled.

Trade Mark.

APPEAL OF BYRON GRAHAM FOR THE REGISTRATION OF A TRADE MARK FOR HARVESTERS.

"Manny," as applied to harvesters is a generic and descriptive name, and is common property as such. The word "New" as a qualifier of "Manny" is held to be equivalent to *improved*, and as such is descriptive.

Such a mark (The New Manny) cannot distinguish a machine from those of other manufacturers of "Manny" machines with improvements.

THACHER, *Acting Commissioner:*

As the only essential portion of the proposed trade mark is descriptive and not distinguishing, I am of the opinion that registration should be denied.

Saw Mill Carriage.

L. C. PATTEE.—INTERFERENCE APPEAL.

A rehearing in a case of interference will only be granted on such a showing of merits as would entitle a mover to a new trial in a suit at law.

THACHER, *Acting Commissioner:*

I have no doubt, after an examination of authorities, that in a parallel case a new trial would be unhesitatingly refused before the courts, and it must be here.

The motion is denied.

DECISIONS OF THE COURTS.

United States Circuit Court, District of Massachusetts.

PARTON *vs.* PRANG.

Copyright.

A suit in equity brought by Arthur Parton, artist, against Louis Prang, publisher, to restrain the defendant from the publication and sale of the chromo entitled "Close of Day," a reproduction by the process of chromo-lithography of a painting designed and executed by complainant in oils. Although the complainant had sold the original painting, which ultimately had been purchased by defendant, no special conditions being annexed to the sale, it was contended in behalf of the complainant that such sale of the picture did not convey the right of reproducing or publishing the same.

The opinion of the Court was delivered by Mr. Justice Clifford, in which a very able review of the general scope of the copyright law is given, and the distinctions pointed out between a copyright on a literary production and a copyright on a painting.

Assignments of a manuscript are required to be in writing by the copyright act; but enough has been remarked to show that a picture, under that act, might be transferred by an oral contract, and it is well settled law that even copyright is an incident to the ownership of a manuscript, and that it passes at common law with the transfer of a work of art. *Turner vs. Robinson*, 10 Irish Ch., N. S., 142. *Power vs. Walker*, 3 M. and S. 9. Hence the remark of the Court in *Turner vs. Robinson* that it was a strange proposition that the transfer of property should destroy and extinguish that which principally constitutes the value of the thing transferred, meaning not that the right to publish did not pass by the sale, but that the exclusive right of publication which attached to the manuscript was not lost by the transfer. Such a transfer of the manuscript or picture is not a publication of the same unless it was so intended by the parties; but if the sale was an absolute and unconditional one and the article was absolutely and unconditionally delivered to the purchaser, the whole property in the manuscript or picture passes to the purchaser, including the right of publication, unless the same is protected by copyright, in which case the rule is different. (*Baker vs. Taylor*, 2 Blatch., 82; *Ryan vs. Goodwin*, 3 Sum., 518; *Wood vs. Zimmer*, Holt, N. P., 60; *Pennock vs. Dialogue*, 2 Pet., 14.)

Unfairness is not pretended in this case, and inasmuch as the sale and delivery were in their terms absolute and unconditional, and without any reservation, restriction, or qualification of any kind, the court is of the opinion that complainant is not entitled to relief.

T. W. Clark, for complainant.

S. E. Bowman and *H. W. Chaplin*, for defendant.

Supreme Court of the United States.

Steam Engine Patent.

JAMES REES, Plaintiff in Error, *vs.* WILLIAM L. GOULD.

In error to the Circuit Court of the United States for the Western District of Pennsylvania.—December term, 1871.

Mr. Justice Clifford delivered the opinion of the Court.

Letters patent were granted to William L. Gould, on the 24th of January, 1860, for a new and useful improvement in steam engines, described in specification as "a new and useful mode of operating and handling" such machines, which consists, as the patent states, in so arranging and constructing the cranks or arms of the lifters and cam rods of puppet valve engines that they may be operated and handled with ease and speed, by means of levers and connecting rods, the whole being arranged and constructed in the manner described in the specification.

Process was issued, and being served, the defendant appeared and plead as follows: 1. That he was not guilty. 2. That the plaintiff was not the original and first inventor of the improvement described in the letters patent, and tendered an issue to the country, which was joined by the plaintiff.

The defendant requested the presiding justice to instruct the jury that when a combination of mechanical devices is claimed, the patent is not infringed by the use of a combination differing substantially in any of its parts, and that the omission of one essential feature or element of the combination as claimed avoids the infringement, repeating that request in respect to each of the three claims of the patent; and the bill of exceptions shows that the presiding justice refused to give the instruction as to any one of the three claims, and that he instructed the jury in respect to the second claim that the use of the combination is an infringement, and that the omission of one of the elements and the substitution of another mechanical device to perform the same function will not avoid the infringement, adding, what undoubtedly is correct, that the elements of the machine may be old and the invention consist in a new combination of old elements whereby a new and useful result is obtained.

Just exception cannot be taken to the last paragraph of the instruction, but the preceding clause, which asserts that the omission, of one of the elements and the substitution of another mechanical device to perform the same function, will not avoid the infringement, cannot be sustained, as the principle as there stated, without any qualification, is not correct, and when given, as the instruction was, without any explanation it was well calculated to mislead the jury.

Where the defendant in constructing his machine omits entirely one of the ingredients of the plaintiff's combination without substituting any other, he does not infringe, and if he substitutes another in the place of the one omitted, which is new or which performs a substantially different function, or if it is old but was not known at the date of the plaintiff's invention as a proper substitute for the omitted ingredient, then he does not infringe.

Tested by these principles, as the instruction in question must be, it is plainly erroneous, as it warranted the jury in finding for the plaintiff, whether the ingredient substituted for the one omitted was new or old, or whether the one substituted was or was not well known at the date of the plaintiff's patent as a proper substitute for the omitted ingredient.

Judgment reversed and a new venire ordered.

Facts for the Ladies.—Miss Ellen Corbett, Brooklyn, N. Y., has used her Wheeler & Wilson Lock-Stitch Machine since 1858, doing the entire sewing for thirteen adults; it is as easily used as a hand needle. A No. 2 needle did all the sewing for 10 years; it has paid for itself many times over, and they would not go back to hand-sewing for ten times its cost. See the new Improvements and Woods' Lock-Stitch Ripper.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notice exceed Four Lines, One Dollar and a Half per Line will be charged.

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Gear Wheels for Models. Illustrated Price List free. Also Materials of all kinds. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Millstone Dresser, J. B. Harris Patent, but little used, in perfect order, for $45. Shoemaker & Carter, Rush, Susq. Co., Pa.

Lyman's Gear Chart, 50c. E. Lyman, C. E., New Haven, Conn.

Spur and Bevel Wheels and Spindles, of great durability, cast to order by Pittsburgh Steel Casting Co. All work warranted.

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To Inventors—Wanted, by a responsible Philadelphia firm, the right to manufacture, on royalty or otherwise, some useful invention in Iron. Address, giving description of article, Artisan, West Philadelphia P. O., Pa.

Wanted—A situation as an apprentice in a machine shop. Address H. J. Scott, Fletcher, Vt.

For the best Presses and Dies and all Fruit Can Tools, apply to Bliss & Williams, 118 to 120 Plymouth St., Brooklyn.

Wanted to purchase six large Windmills. Parties who are in a position to make estimates for same, will please address W. R. Grace & Co., 47 Exchange Place, P. O. Box 5283.

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

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

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

First Class Steam and Vacuum Gauges, Engine Registers, Davis' Recording Gauges. New York Steam Gauge Co., 46 Cortlandt St., N. Y.

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

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 26 and Nov. 29, 1869. 64 Nassau St., New York.

For Steel and Iron Set Screws, send to Reynolds & Co. for Price List, New Haven, Ct.

Four Brick Machines, Combined with Steam Power (Winn's patent), makes 40 M. per day, for sale at a bargain. Address the manufacturers, John Cooper and Co., Mount Vernon, Ohio.

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

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

T. R. Bailey & Vail, Lockport, N. Y., Manf. Gauge Lathes.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1859.

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Boynton's Lightning Saws. The genuine $500 challenge Will cut five times as fast as an ax. A six foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

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

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

Notes & Queries

[We herewith present a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.]

1.—How can I do silver plating on carriage work with foil?—T. R.

2.—How is canvas prepared for painting pictures on?—J. C. J.

3.—Will some one tell me how horn is cleared or made transparent?—A. J.

4.—Will some one please inform me how shot guns are loaded so as to throw the shot closely?—A. J.

5.—Is there anything that will remove the taste of kerosene from a cask?—Z.

6.—Can you inform me how to take the oil out of cotton waste in the quickest and cheapest manner?—J. C. W.

7.—Can you give a recipe for making paste to stick to bright tin without first roughing the tin; a paste that will not peel off?—B W. & Co.

8.—What is the best size to use for gilding the engraved lines on ornamental walnut work, and also for gilding on pine board?—W. H. C.

9.—What is the best and cheapest process for gilding picture frames, and how can I obtain the high polish or gloss on certain parts of the gilt surface?—H. R.

10.—What is the best means of cutting brass stencil plates with acid, and what is the proper material with which to cover the portions of the plate that are to be protected?—J. J. C.

11.—Is it possible to take ink stains from dressed stone? One of the finest buildings in our city has been defaced by the use of writing fluid and some kind of syringe, in the hand of some spiteful unknown.—W. D. G.

12.—How is the pearl work put on the many sided part of ornamental handles of boxes, and on heads of canes, whips, etc.? From what is the material obtained, and in what part of the world is it produced, and what is the process?—C. D.

13.—Will some one tell me how thin, crooked ornamental patterns are made, such as stove patterns, column capitals, etc.? And how are small castings made to have the appearance of bronze or copper, by a cheap process?—G. W.

14.—I have a lead cistern which leaks; the plumber says it is caused by the action of the water on the lead. It is supplied from a well, and the water is not very hard. Do you know of any cement or paint which will stop the leaks and prevent any further corrosion?—B. F.

15.—Does wood, after it has been thoroughly kiln dried and treated with a non-absorbent of moisture, shrink and swell with variations in temperature, as iron, brass, zinc, and pipe metal do, and to what extent, taking iron as the unit? What is the best non-absorbent to use to give a hard and glossy finish? Would liquid glass answer the purpose?—A. A. D.

16.—I am building a cedar skiff and am desirous of making it as light as possible. Is there any preparation that I can use in the place of paint and oil that will be as good and weigh less?—J. H. R.

17.—What can I use for a light in a dark lantern for night hunting that will enable me to see farther than ordinary kerosene or signal oils?—J. H. R.

18.—Can there be telescopic sights adjusted to a rifle barrel that would be of use in night hunting, at a moderate cost?—J. H. R.

19.—I want a substance like glue, mucilage, or varnish with which I can give oak wood one or two coats, to keep it from burning, or else make it burn very slowly. I want to mix up liquid iron with it. I don't mind if the wood burns, so that it burns slowly.—W. H. P.

20.—How can I make a fireboard for a grate front? I have finished one, but it is wrinkled and full of folds. How can I stretch the cloth on the frame, and how can I paste the paper on the cloth so that it will be stretched smooth?—C. R.

21.—Will some one give a rule for laying out for dovetailing on a bevel, say for a hopper for a grist mill, or the corners of a carriage seat? I find very few mechanics who understand it.—T.

22.—I have a steam engine, cylinder of 1¼ inches diameter, 3 inches stroke, which I wish to use for running a sewing machine, and perhaps some other small affairs about the house. How can I build a boiler for it that will be cheap and safe, and will run it at 150 revolutions a minute with 25 pounds pressure? Can I make one to go on a cooking stove, or would it be better to set a boiler into a common cylinder stove, or to make a boiler and furnace separate from any stove? What thickness of iron and how large should be the safety valve, and what should be the length of arm and the amount of the weight?—J. E. S.

ANSWERS TO CORRESPONDENTS

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·50 a line, under the head of "Business and Personal."

ALL references to back numbers must be by volume and page.

J. B., of N. Y.—Your windmill can, we think, be patented.

What is properly the damper in a stove? Is the movable plate next the pipe called the damper, or is the sliding plate in the front which shuts off the air properly the damper? I contend the plate which turns the fire under the oven is not the damper proper, but the regulator, and the valve in front is the damper. The dictionaries are not explicit enough to satisfy the understandings of different persons. Answer: We generally designate the movable plate or dish within or near the smoke flue as the damper, and the valve in front as the draft regulator. The plate that sends the fire around the oven might be called the oven damper or the oven regulator. It makes little difference what name you give to mechanical parts provided people understand what you mean when you speak.

Have any experiments been made with a sheet iron cylinder, filled with hydrogen or coal gas for the purpose of making an electro-magnetic helix out of it? If not, would you please to give me your opinion, whether such a helix would heat the gas, and cause it to explode, if there were a battery of 36 cells attached to it, or whether it would have no effect on the enclosed gas? The knowledge of whether it would have any effect on the gas would be a step forward to an important invention. —D. M. B. Answer: Experiments have been made. A sheet iron cylinder will not act as a helix with such a battery. The gas would not be perceptibly affected, and would not explode if it were heated. It requires to be mixed with oxygen in proportion approaching 2 volumes of hydrogen to one of oxygen to make it explosive.

Is metallic antimony a good conductor of electricity for a positive metal in a galvanic battery, and what is its conductivity relative to silver or copper? What number of copper wire would it take for an electro-magnet 3 inches long with a core of ¼ inch or 1 inch diameter?—C. B. Answer: Owing to the action of the acids, antimony would be a very poor material to use in a galvanic battery. In a thermo or dry battery it may be used to advantage. It is a much poorer conductor than silver or copper. As to magnet, make your core a little longer, say 6 inches, for the diameter you mention, and use No. 20 cotton or silk covered copper wire.

M. M. S. asks: Suppose 130 is the larger, and 28 the smaller gear on a lathe, can a screw be cut coarser than said gears will cut on same lathe without larger or smaller gears? Is so, how can it be done? Answer: There can no coarser thread be cut with those gears, except by the use of intermediates on a stud.

It is argued that a person travelling, either eastward or westward, around the world—say at the equator—would find on arriving at his starting point that he had either gained or lost one day of the week. Is this so?—J. R. T., Jr. Answer: Yes. Make a calculation on a terrestrial globe, and you will see for yourself.

S. H. G. says: In the schedule of charges adopted by the Institute of Architects, June 4th, 1866, I find the following: "Drawings as instruments of service are the property of the architect." I wish to know how the architect can recover plans after such service. Answer: In the same manner in which a person may recover any other property of his, which may be improperly detained by another,—by due course of law.

I have in my possession a stone, something similar, I presume, to diamond. Enclosed is a small piece, which I hope you will give a thorough examination. It has been tested by several in this place and they report it a valuable stone of some kind, but do not know for certain whether it is a diamond or not.—J. M. McN. Answer: The fragment sent is from a pure, limpid rock crystal; this it is, and nothing more. Of no value.

E. B. M., of Tenn.—The crystals are sulphuret of iron or pyrites, and are valueless.

J. H., of N. J.—The specimen you send is shell marl, that is, a mixture of clay and lime containing small bivalve shells.

J. A. B.—The mineral you send is chalcedonic quartz, of no special value.

W. S. H. says: How can I arrange the exhaust pipe to my engine, so as to get the greatest degree of heat in the water in the tank? And if I use a coil or worm, do I lose any power from back pressure? Also, what would cause blisters on the bottom of the boiler? And would they be considered dangerous with plenty of water in the boiler? Answer: To get most thorough utilization of the heat of your exhaust steam, lead it into a receiver near the lowest point and carry off such as remains uncondensed by a pipe from the top. Sprinkle your feed or other water to be heated, by a rose fixed in the upper portion of the receiver. The feed will thus be heated to the boiling point if properly arranged. Place your pump so low, or the receiver so high, that there will be a good head of water above it, or you will find pumping hot water a difficult matter. If you must draw and force your feed water with a single pump, you will be compelled to use a worm heater. If well proportioned, it ought to do good work without seriously increasing back pressure. Give it plenty of surface, and do not make the pipe too small. Large blisters are always dangerous.

S. W. H. says: Your decision between R. and W., page 394, in the matter of a balance wheel keyed on diagonally to the shaft, as shown in the figure, seems to me unsound. You admit that it will always tend to turn itself until its axis coincides with that of the shaft, and say, "this effort will be a constant one, tending to bend the shaft, but does not necessarily produce unsteadiness in the shaft." Now unless the shaft be infinitely inflexible (which was not in the proposition) it must yield to the unlimited effort to bend it; and if the shaft does yield it becomes crooked, and if crooked a greater weight will be thrown on one side of its axis than the other. In which case I think you will hardly maintain that its steadiness would not be affected under high motion. If machinists may key on their balance wheels at 45 degrees to thin axes and furnish shafts crooked to any degree without affecting the steadiness of the motion, I think that somebody deserves a patent for the discovery. Answer: If our correspondent will try the experiment, even with the extreme case supposed by him, he will find our decision confirmed, provided that his bearings are not left loose, if he experiments with a horizontal shaft. With a vertical shaft, he may even leave his bearings quite loose and still obtain steady motion, unless the driving force act as does gravity in the first example. Cam shafts often illustrate this case, and our correspondent will readily be able to confirm what has been stated. We shall be glad to publish the result of his experiments should he take sufficient interest in the subject to make them.

H. B., page 373, Vol. XXVII., wants the working part of a rammer or scraper, to work in the ground among gravel. Chilled cast iron will suit his purpose better than steel, as it is harder than most merchantable steel can be made, and far cheaper. It can be had in almost any car wheel foundery where No. 3 cold blast charcoal iron is used. Let H. B. support the working edge if possible with fine cast iron, which need not be chilled. If he wants holes in the chilled part, they should be round or oval, not square, as a square corner affords a fine starting point for a fracture. Those holes should be cored. It is very hard to drill chilled cast iron unless provided with suitable tools.—P. McC., of N. J.

J. W. B., page 362, Vol. XXVII., wishes to know how to make good cider. Take good sound apples (the sweeter the apples, the richer the cider; although apples slightly tart make cider of the best flavor) late in the fall, the later the better, before freezing. Early apples and wind falls may do for vinegar, but will not make cider that will keep any length of time. Fill the barrel full, put in the cellar, take out the plug and let the cider ferment for about ten days, keeping the barrel full with cider made at the same time. In this way most of the pomace is thrown out. This, however, is not very essential. After the cider has worked about ten days, take a long slim bag that, when filled, will go in at the bung hole, put in about one pound of English mustard for every 30 gallons, and drop into the cider, then cork the barrel air tight and let it stand about three weeks, then draw off into another barrel. Or put back in same barrel after thoroughly cleansing it; see that the barrel is full, then cork tight. Cider treated in this way will remain unchanged until warm spring weather, when it may be bottled for summer use. Cider will gradually get hard if the barrel is daily drawn from; in that case bottle when the flavor just suits. Sulphite of lime kills the life of cider and renders it as flavorless and worthless as dish water.—E. H. R.

To W. S. H., page 362, Vol. XXVII.—I have seen as smoky days in July as ever I saw in the fall, and several in succession. The leaf burning theory will hardly do for July.—E. H. R.

To tin brass pins, etc., the goods are to be cleaned free from oil; then an earthen pot is to be prepared. First a thin sheet of block tin is to be put at the bottom, then a steam pipe is to be introduced nearly down to the same; next put a layer of the goods, then a sheet of tin as before, next more goods, and so till it is filled. Then fill up with water till all are covered, throw in some cream of tartar and turn on the steam just enough to keep boiling. After whitening, rinse in clear water, and pass through saw dust. In a small way, I have whitened ordinary tinner's ware by covering with tin foil, and boiling over the fire, filling up the water as it evaporated.—W. A. B.

COMMUNICATIONS RECEIVED.

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

On Bursting Strains of Boilers. By T. W. B. and E. E.
On a Geometrical Problem. By H. B.
On Vulcanized Rubber and Rubber Belts. By A. E. V. E
On Certain Remarkable Effects of the Solar Rays. By G. R.
On Perpetual Motion. By W. J. A.
On the use of Belts for Machinery. By W. G. B.
On the Action of a Balance Wheel placed out of right Angle on its Shaft.—By H. C. K.
On Scientific and Mechanical Possibilities. By J. E. E.
On Steam Pressure. By F. G. W.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

SPRING BED BOTTOM.—Henry E. Maker, South Framingham, Mass.—The object of this invention is to furnish a spring bottom for beds; and it consists in slats resting upon pins which pass loosely through holes in cross bars. The ends of the pins rest upon wires which connect pairs of springs. The slats are placed longitudinally or at right angles with the cross bars on the tops of the pins, and are in themselves elastic, so that they give or conform to the tension of the springs and weight on the bed.

SPRING BED BOTTOM.—John Ralston, Mansfield, Ohio.—This invention has for its object to furnish an improved spring bed bottom, and it consists in two sets of slats, upper and lower, held apart by cross bars having between them spiral springs. Said cross bars as well as the slats are elastic and give further spring to the bed.

GARBAGE BOX.—Moritz Bacharach, of New York city.—This invention relates to a new garbage box, which is to be placed upon the sidewalks near the gutters of streets in cities and towns, and within which, to some extent, the moisture contained in the offal will be separated from the solid matter and ejected into the gutters. The invention consists in making the garbage box with an opening in the top and with a perforated false bottom, and in arranging on its side a door above the false bottom and an opening beneath the same.

FEED WATER APPARATUS FOR STEAM BOILERS.—John W. Youman, Mobile, Ala.—This invention relates to a new and improved mode of introducing feed water into steam boilers. The feed water pipe passes through the rear head and extends forward to near the front head of the boiler, and returns back to and through the rear head. This pipe is located at or near the water line, and near the shell of the boiler. The feed water, in passing through and before it reaches the return portion of the pipe, which is perforated, will become heated to near or quite the boiling point, and the sediment contained therein will be deposited in the pipe, and may be blown off from time to time through a small blow off pipe extending through the rear boiler head. This perforated tube may be larger in diameter than the other part, and may be arranged in the boiler so as to be just submerged. In this position it will serve as a surface blow off by shutting off the feed water.

FENCE.—Edward M. Crandal, Marshalltown, Iowa.—The invention consists in an arrangement of rails, posts, and braces to form a cheap, strong, and durable, yet easily transported, fence. The corner post consists of four uprights, connected together by transverse bars, extending outward laterally in different directions so as to support the braces. The uprights are also connected together by rails, upon which the rails of the fence rest, the ends of the rails being notched and held down by wires. The uprights of the post are placed at a sufficient distance apart to admit the rails and allow the fence to be extended at right angles in either direction. The other posts are made in a similar manner, but with two uprights, with braces extending in each direction to keep the fence upright, except that, at proper intervals—say once in four or five rods,—braces, which support the fence longitudinally, are added. The fence may be made with any desired number of rails, and each one may be removed separately, so that a gateway may be made between any two posts for the passage of teams, stock, or for other purposes.

BED, SOFA, AND LOUNGE BOTTOM.—Royal Jennings, Racine, Wis., assignor to himself and Wallace H. Jennings, of same place.—This invention relates to a new construction of bed, sofa, and lounge bottom, which is very light, graceful and elastic, and at the same time durable and cheap to make. The invention consists in the arrangement of wire springs, clasps, and a wire or cord bottom. The spiral springs are of suitable number, each having its two ends formed into hooks. The outer ends of these springs are, by the hooks thereon, fastened to screws or pins that project from the upper faces of the end rails. When all the springs have thus been placed, a wire or string is fastened with one end to a pin of an end rail, then carried loosely along the outer sides of pins that project from the side rails, laid around a pin on the opposite rail, carried back to the first end rail, and hooked to the first spring thereon, and so brought back and forth and hooked to the several springs, and finally fastened with its other end substantially as with the first. All the while the string or cord is left quite slack. Subsequently it is drawn tight by small clasps that are hooked over adjoining lengths of the wire at proper intervals.

SLOP PAIL.—John S. Jennings, Brooklyn, N. Y.—This invention consists of a detachable seat for slop pails, also a cover therefor, detachably connected with it, the seat being detachably connected to facilitate the cleaning of the pails, which can be done much more readily and thoroughly when the seat is detached than when not so, as they have been heretofore made.

FEEDING CANALS.—James G. Brewer, Lone Tree, Nebraska.—This invention consists in an improved mode of conducting water from rivers which flow over shifting sands or quicksands into canals or races to enable the water to be used as a motive power. The inventor drives piles into the bottom of the river, or into the sand near the river, so close together as to exclude both sand and water, or at least the sand, and inclosing a larger or smaller space, according as more or less water is required. The piles form a close curb all around the inclosed area except an opening for the canal or race. The water rises through the sand in the curb, which forms the beginning of the canal, and flows through the said canal or race to the place where it is to be used. Should the sand rise with the water, the sand may be kept back by wire screens, which, in this case, will not choke, as the water rising through the clean sand is free from sediment. This invention enables the water of the Platte, Arkansas, and other similar rivers, to be used for water power, which heretofore has been impossible.

MITTENS.—John L. Whitten, Essex Junction, Vt.—This invention relates to the construction of mittens made, either in whole or in part, of leather, and consists in the mode of cutting the leather, and in the patterns for the parts of the said mittens.

MEDICAL COMPOUND.—Herman Themel, Esconawba, Mich.—This invention relates to a new medical compound, which is intended for use against stomach diseases in cases of cholera, etc. It is composed of the following ingredients: bog bean, wormwood, juniper berry, valerian, gentian, potash: the remainder, alcohol or alcoholic liquor—such as whisky.

FENCE.—Harrison McMullin, Batesville, Ark.—This invention has for its object to furnish an improved fence. It consists of a number of planks resting above each other and supported by blocks of stone or wood. The low wall thus made is surmounted by crossed stakes and a rider.

CAR COUPLINGS.—David Walter, Evansport, Ohio.—This invention consists in a gravitating self-coupling hook, which is raised by the link when it enters the buffer, and engages said link automatically, which said hook is provided with a rolling or oscillating guard, which falls between the link and the point of the hook whenever the end of the link is thrown upward more than is usual in the ordinary working conditions—as, for instance, when a car jumps the track and effects the uncoupling, so that the cars remaining on the track will not be forced off by one already off.

GRANARY.—Charles T. Moorman, Jr., Jamestown, O.—This invention has for its object to furnish an improved granary, which shall be so constructed that rats and other vermin cannot get into it, which shall be firm and solid, will not "creel" with weight, will protect the grain better and may be readily moved without injury to the building. The entire granary is supported upon posts which are set at an angle of about forty degrees, and are arranged in pairs, the upper ends of the posts of each pair being firmly secured to each other. Hanging posts are inclined at an angle of about thirty degrees in the opposite direction from the above mentioned posts. By other and suitable construction the granary is fully protected from rats and other vermin, as the inclination of the exposed parts affords them no chance to stand or sit and gnaw.

EARTH AUGER.—Isaac N. Pyle, Cameron, Mo.—The invention consists of an earth borer in which two jaws are affixed to the lower ends of upright arched plates, which are, respectively, attached to the pendent arms of a shank. This shank is double, its upper or stem parts being held together by means of straps placed around them. A wedge can, from below, be forced in between the parts of the shank to spread the jaws and plates to a suitable extent. The plates are slotted, and are secured to the pendent parts of the shank. Two other curved plates are placed between the plates and have jaws flexibly attached to their lower ends, and are only used in sand. The jaws serve as valves to let the sand in and prevent its escape, thus constituting a trap in which the sand bored out will be collected convenient for removal.

BAKE PAN.—Richard D. McDonald, Jersey City, N. J.—This invention relates to apparatus to be placed in ovens for baking bread or roasting meats, and all similar purposes; and it consists in the mode of connecting the parts together, or more definitely in a beveled flange around the edge of the upper part of the pan. The angle of this flange, from a vertical line, is designed to be about the same as that of the sides and ends of the lower part of the pan, and is designed to form, with the lower part, a tight joint, so as to confine the gases or steam generated in the pan from the article being roasted or baked.

BURIAL CASE.—Collins C. W. Morgan, of Holly Springs, Miss.—This invention relates to connecting the two parts of a burial casket—made of terra cotta or other suitable material—by means of clips or clasps, and to constructing said clips or clasps with handles, thereby dispensing with the necessity of the handles ordinarily provided for coffins.

SUBSOIL PLOW.—Christian Myers and William Gunsmow, of Marysville, Cal.—The invention consists in the mode of adjusting the subsoil plow, whereby it can be shifted independently and also arranging it with the common plow in such a manner as to avoid the necessity of the off horse walking over the loosened bottom of the furrow or in a very deep furrow, as in subsoiling in the common way. It also avoids the trampling or packing of the loosened earth in the bottom of the furrow, common to the ordinary way.

BRACELET.—William Edge, of Newark, N. J.—This invention has for its object to improve the construction of chain work bracelets, so as to better adapt them for keeping their form when worn, while at the same time making them more beautiful and elegant in appearance. It consists in a bracelet formed by turning the edges of a piece of chain work down over the edges of a metallic plate.

DRAWERS.—John jBellamy, of New York city.—This invention consists of drawers for men's wear, in which the parts forming the legs are cut by novel patterns, the outlines of which are of such form that with inflexible material the legs may fit the wearer tightly and not draw or bind across the knees, as drawers of inflexible goods now are apt to do unless made uncomfortably large.

FEATHER RENOVATOR.—Theodore J. Adams, of Ansonia, Conn.—This invention has for its object to furnish an improved apparatus for renovating feathers, moss, hair, etc. In using the machine, the substance to be renovated is placed in an inner cylinder through a door, which is then tightly closed, and steam is admitted through a hollow gudgeon which enters the inner cylinder through the perforations of the wall and a pipe, which insures the substance being thoroughly acted upon, the steam entering the substance both from the outside and center. When the substance has been sufficiently steamed the steam is shut off and the door opened, allowing the moisture to escape, the heat communicated by the steam being sufficient to evaporate all the moisture and thoroughly dry the substance.

LETTER BOX.—Anna T. Sinclaire, of New York city.—This invention has for its object to construct a letter and newspaper drop box, whose contents will be protected by a false bottom whenever the lid is opened, so that the fraudulent removal of letters or papers is effectually prevented. The invention consists in forming the said false bottom of two hinged plates that are arranged within the box and connected with the lid, or secured in such manner as to overlap each other when the lid is opened, and drop apart when the same is closed.

HAND VISE.—Thomas Overton, of Corpus Christi, Texas.—The object of this invention is to furnish an implement or tool for the use of mechanics, which can not only be used as a hand vise for holding small articles, but which can be attached to bits or augers for gaging the depth of the hole bored, and also counterslnking such hole for screws. A slot is provided in the screw head, for convenience in setting saws.

FOLDING BOX BED.—Alfred G. Bayles, of New York city.—This invention has for its object to furnish an improved folding box bed, which, when folded, will occupy but little space, while at the same time furnishing a convenient receptacle for clothing and various other articles, and which, when opened out, will furnish a complete bed. The box or body of the bed is made in two parts which are hinged to each other at one side, and may be opened out. The spaces on which the two parts of the mattress rest are made of such a depth that the edges of said parts may project sufficiently above the mattress to give space for the bed clothes, so that when the bed is made up and the edges of the bed clothes tucked in around the edges of the mattress, the box may be opened and closed without disturbing the make up of the bed. The adjacent edges of the two parts of the box, upon its hinged side, are cut away so that they may not inconvenience the sleeper, the mattress, when the bed is opened out, bulging over said recessed edges so as to be continuous. The edges of the part opposite the hinges may be provided with a board, which, when the box is opened, serves as a foot board to the bed. The bolster, when arranged for use, is placed upon a partition, the ends of which rest upon inclined cleats attached to the box, and the inner edge of which is hinged to the edge of the horizontal partition. The part of the box beneath the partitions is divided into three spaces adapted to hold clothing and other purposes.

MACHINE FOR CUTTING NAIL PLATES.—Thomas Searle, Pottstown, Pa.—The invention consists in constructing and combining a feed table, feed rolls and clamp rolls with sheet cutters, so that a pair of tongs may pass freely and conveniently nearly up to the cutters, and thereby cause nearly the whole sheet of metal to be utilized. Secondly, it consists in bringing the frame that holds the feeding mechanism so that it may be turned back from the cutters and allow easy access to them. Thirdly, it consists in causing the feed rolls to rotate a little after the sheet has reached one or both of the gages so as to insure that any slight disarrangement which may have taken place will be remedied and the sheet presented to the knives always at exactly the same angle.

IMPROVEMENT IN THE ART OF DENTISTRY.—Robert Arthur, M. D., Baltimore, Md.—The invention consists in a method of separating or spacing teeth by means of a thin abrading disk, which is rotated between them, and which completes the operation in greatly less time, with much less pain and annoyance to the patient, and in a far more workmanlike manner.

RAILWAY SNOW PLOW.—Jerome B. Hulbert and James Anderson, of Hermon, N. Y.—The invention consists, first, in making the lower part of the sides of a snow plow vertical, and the upper part of said sides backwardly sloping, so as to cause the snow to rise as it is pushed laterally after passing the point, and the less compacted upper portion thereof to be turned over one side of the track. Secondly, it consists in hinging the sides of a snow plow so as to adapt it to light or heavy snows. Thirdly, it consists in the mode of combining an open front plow and screw with elevations, drive mechanism, and air forcing apparatus for compressing, elevating and discharging snow.

COMBINED CHAIR AND BED.—Jonathan H. Green, of Louisville, Ky.—This invention consists in a chair composed of a supporting frame having legs, a seat frame hinged to said frame, and a back frame having arms attached thereto, and hinged to said seat frame so that the parts of chair may be unfolded to make a bed.

STEAM BOILER AND FURNACE.—George W. Lascell, Syracuse, N. Y., assignor to himself and Hugh Robinson, Jersey City, N. J.—This invention has for its object to furnish an improved boiler and furnace for generating steam and for heating and evaporating purposes, which shall be so constructed as to consume the smoke and combustible gases that may be developed in the combustion of the fuel, and which shall, at the same time, be simple in construction and of greater steam generating, heating, or evaporating power than boilers and furnaces constructed in the ordinary manner. The tops of the fire chambers are left open, and the air to support the combustion passes in through the said open tops and passes down through the dead coal to the live coal in the lower part of said chambers, where the combustion takes place. The smoke and gaseous products of combustion pass through openings or flues in the side of the lower part of the boiler, where they mix with air entering through perforations in the bottom of said boiler and are consumed. The perforations in the bottom of said boiler are regulated by means of a damper. The walls of the boiler are made double to form a water space. The water spaces between the double walls of the fire chambers are connected by pipes, into one of which the water is introduced from the pump or reservoir. The other end of the pipe, that is broken to connect with the pump or reservoir, is connected with the space between the double walls of the boiler, so that the water, before passing into the boiler, circulates around all the fire chambers. The spaces between the double walls upon the opposite sides of each fire chamber are connected by pipes which are coiled or zigzagged across the inner ends of said chambers so as to be exposed to the heated products of combustion as they pass from said chambers into the interior of the boiler. The water space between the double walls of the boiler is made wider at the lower than at the upper part to form a contracted well or chamber, into which the smoke and other combustible gaseous products of combustion from the fire chambers are introduced, and in which they are burned by the aid of the air introduced through the openings in the bottom of the boiler, which openings are regulated by the damper to introduce exactly the amount of air required to effect their thorough combustion. The lower part of a water pipe is coiled to form a dome-shaped partition at the top of the contracted part or combustion well, in which the gases are consumed, which dome-shaped coil, in a measure, checks the ascent of the smoke and gases and secures their perfect combustion. This pipe may pass up into and be combined with the dome or steam chest. The steam is conducted away through the pipe. The incombustible products of combustion pass up, through short pipes inserted in the double walled top of the boiler, into the space between the said top and the bottom of the dome, whence they pass into the space inclosed by the jacket, which incloses the dome and projects down along the sides of the boiler. The lower end of the jacket is left open, and is surrounded by another jacket which incloses the lower part of the boiler and the lower part of the first jacket, and extends up so as to overlap the lower part of the dome. The bottom and the top of the second jacket are closed, and the incombustible products of combustion escape from its upper part into the flue.

CAR COUPLING.—C. S. Flower, of Kickapoo City, Kansas, and C. F. Graves, Hickory, Iowa.—This invention has for its object to furnish an improved car coupling, which shall be so constructed that it will uncouple automatically should one or more cars get off the track, turn over, or drop down below the level of the other cars. Upon the forward end of the draw bar is formed the bumper head, which is attached to the car in the ordinary manner. The forward part of the bar or head becomes gradually wider, and upon the upper side of its forward end is formed a strong upwardly projecting flange, for the lower end of the coupling pin to rest against to sustain the draft, and which is made in the arc of a circle. A block, made of cast iron, is pivoted, toward its rear end, to the bar. Its forward end does not extend quite to the flange; to its side edges are bolted bars or plates made of wrought iron, and the forward ends of which extend forward to the flange, and are notched upon their lower edges to fit upon said flange. To and between the forward ends of the bars is swiveled a short bar through which the coupling pin passes. By this construction should one or more of the cars get off the track or turn over, the block will swing around upon its pivoting bolt, and as soon as the end of the coupling pin has slipped from the end of the flange, the swiveled bar will turn, allowing the coupling link to slip from the coupling pin. By suitable construction, when the cars are in proper position upon the track, a spring holds the block down upon the draw bar; but should one or more of the cars drop below the level of the other cars, the forward end of the block will be raised, compressing the spring and raising the lower end of the coupling pin above the flange, allowing the swiveled bar to turn and the coupling link to slip from the coupling pin.

BRICK MACHINE.—Henry B. Ramsey, Rockville, Ind., assignor to A. K. Stark, of same place.—This invention relates to the class of brick machines adapted for a simultaneous and continuous working and discharge of the clay. The lower end of a vertical shaft revolves in the center of the bottom of a tank attached to the frame. The upper part of the shaft revolves in bearings attached to the upper part of the frame, and to its upper end is attached the sweep or lever by means of which the power is applied. To the shaft within the tank, and at different hights, are attached radial knives or arms by which the clay is worked into proper condition for entering the molds. The lowest knife revolves near the bottom of the tank and is so formed as to force the clay through an opening in the forward part of the said bottom, made of the size of a brick. An adjustable frame is secured to the frame below the tank to support the molds. The molds are inserted beneath the middle part of the tank from one side. To a shaft pivoted to the lower part of the frame work are attached arms which project upward and press against the rear side of the mold last inserted and push it forward beneath the openings into position to receive the clay. By suitable mechanism the molds may be moved forward twice at each revolution of the shaft. The rock shaft is drawn back to its place, when the arm is released, by a coiled or equivalent spring, and it may be operated by hand to move the first mold forward beneath the openings before the machine is started. As the filled molds move out upon the frame, they are removed by the off-bearers.

CORN HARVESTER.—Jacob Bowers, Iola, Kansas.—This invention has for its object to furnish an improved machine for cutting and shocking corn. The wheels are securely attached to the axle, so as to carry the said axle with them in their revolution. The forward part of the platform is pivoted at its rear end to the frame, so that the forward end of the said part may be raised and lowered to cut the corn higher or lower, as may be desired. The forward end of the pivoted part of the platform by suitable means is held in any position into which it may be adjusted. To the forward end of the pivoted part of the platform are attached two stationary knives, the inner edges of the forward parts of which incline from each other, to serve as guides to bring the stalks into proper position to be cut by a vibrating cutter, which is pivoted to the platform. The forward part of the side edges of the cutter are made inclined or curved, to adapt it to serve as guides to conduct the stalks into proper position to be cut, and the rear part of the side edges concaved to give them a better hold upon the stalks while cutting them. The cutter is vibrated by the advance of the machine. To the platform are attached two upright frames, between which the corn stalks, after being cut, are carried back to the rear part of the platform. To the top bars of the upright frames are attached springs which are designed to keep the corn stalks from falling forward while being carried rearward. Proper means are provided to serve as a reel to sweep the top parts of the corn stalks into the space between the upright frames and hold them in, or nearly in, a horizontal position. A further combination of ingenious devices removes the corn shock from the platform and sets it on the ground.

TERRA COTTA GRAVE COVER.—Collins C. W. Morgan, Holly Springs, Miss.—This invention consists of a terra cotta cover for graves, being in the form of an inverted hollow cover adapted to inclose the mound, with a base resting on the ground around it, the base being a large projecting flange with a groove descending from the head to the foot, and forming a water course for conducting the water shed from the cover into a gutter at the foot to prevent it from washing the earth away around its base.

WASHING MACHINE.—John Turner, Oakdale Station, Pa.—This invention has for its object to furnish an improved washing machine, and it consists in the two closely slotted self-adjusting racks and the vibrating lever presser, slotted at right angles with the racks. The clothes to be washed are divided, and part is placed upon each side of the presser. As the presser is moved in either direction, the clothes in front of said presser are forced against the rack, the pivots of which enable the said racks to adjust themselves so that the clothes may be pressed evenly. As the presser retires, the clothes fall back into the water to be again saturated.

WHEEL FOR VEHICLE.—Walter D. Howell, Newburgh, N. Y.—The main body of the hub is cast with a closed outer end and with a solid ring flange for the outer edges of the inner ends of the spokes to rest against. At the inner side of the flange is formed a ring groove to receive the inner ends of the spokes, the shoulder at the inner side of said groove being made low. The inner ends of the spokes are made widest at their extreme ends, and a ring plate is made, somewhat dishing so as to press against the edges of the said spokes. Upon the outer side of the plate is formed a circular bead, said spokes. Upon the outer side of the plate is formed a circular bead, which fits into a circular groove in the side of the nut, so as when the nut is screwed up to hold the segmental plate securely in place. Putty, with iron filings mixed into it, may be placed between the plate and the edges of the spokes to give the said plate a firmer hold upon the said spokes. Upon the inner surface of the hub is formed an offset or shoulder, and in the inner surface of the inner end of the hub is cut a screw thread into which screws a tubular nut, and when the hub and nut are screwed together it will be impossible for the wheel to work itself loose or off. By this construction a chamber is left between the end of the halved nut and the shoulder, which is designed to be filled with sponge, and thus to serve as an oil reservoir, into which oil may be poured.

[OFFICIAL.]

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For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 3, 1872, AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
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APPLICATION FOR EXTENSION.

Application has been duly filed and is now pending for the extension of the following Letters Patent. Hearing upon the applications appointed for the day hereinafter named.

23,263.—BOTTLE STOPPER FASTENING.—H. W. Putnam February 26, 1873.

EXTENSIONS GRANTED.

22,165.—PUMP.—A. Cooley.
22,364.—CAR SEAT AND SLEEPING COUCH.—P. B. Green.
22,222.—HORSE RAKE.—C. Garver.
22,219.—MACHINE FOR MAKING NUTS.—J. B. Savage.
22,311.—LAMP SHADE SUPPORTER.—W. F. Shaw.

DESIGN PATENTED.

6,881.—NEWEL POST.—R. Lowry, Nashville, Tenn.

TRADEMARKS REGISTERED.

1,075.—MOWER, ETC.—Adriance, Platt & Co., Poughkeepsie, N.Y., and N.Y. city.
1,076.—ISINGLASS.—Cape Ann Isinglass and Glue Company, Rockport, Mass.
1,077.—CONFECTIONERY.—H. Chaurant & Co., New Orleans, La.
1,078.—SUGAR CURED HAMS.—J. Gruhs & Co., Cincinnati, O.
1,079.—DRESS TRIMMINGS.—W. I. Peake, New York city.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

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

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

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

How Can I Best Secure My Invention?

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

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

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

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

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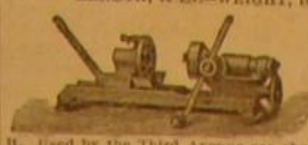
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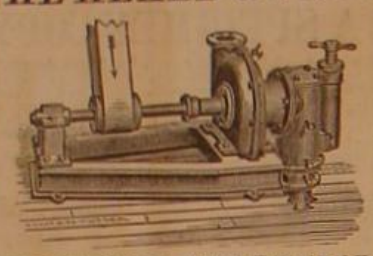
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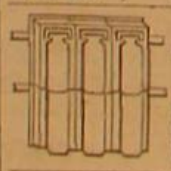
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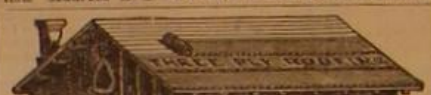
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Vol. XXVIII.—No. 2. [NEW SERIES.] NEW YORK, JANUARY 11, 1873. $3 per Annum, IN ADVANCE.

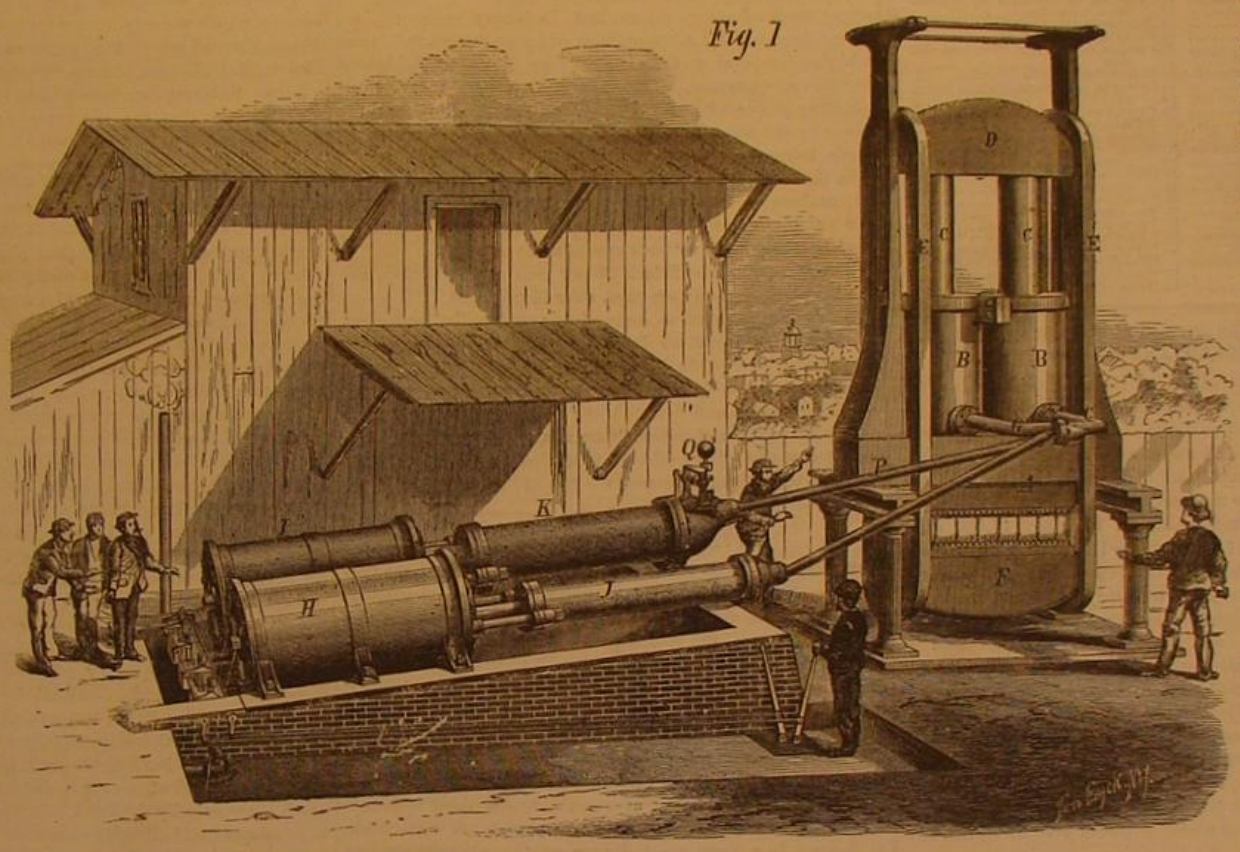
DIRECT ACTING STEAM AND HYDROSTATIC PRESS.

A valuable and ingenious application of steam to the hydrostatic press is illustrated in the accompanying engravings. The power is transmitted to the oil, water, or other liquid in the press from the pistons of two steam cylinders, which act upon the platen alternately, one imparting the initial and the other the finishing pressure. The latter is operated by live steam from the boiler, and the former is actuated by the exhaust. The steam is thus used twice over on the compound principle, thus effecting no inconsiderable saving of fuel.

Our large engraving, Fig. 1, represents the entire apparatus set up and in action. Fig. 2 shows the steam cylinders in plan, broken to exhibit the attachment, and Fig. 3 a section of the check valve. A, Fig. 1, is the hydrostatic press, adapted for pressing cotton or other substances. B B are hollow cylinders inclosing the solid rams, C C, which, communicating with the crosshead, D, raise the links, E E, and consequently the platen, F; G G are branched pipes through which the liquid enters the cylinders, B B. H and I, Figs. 1 and 2, are the steam cylinders, equal in size. J and K are chambers in which work the solid plungers which, at the same time, are the piston rods of the cylinders, H and I. The plunger in J, it will be noticed, is much smaller in diameter than that in the chamber, K.

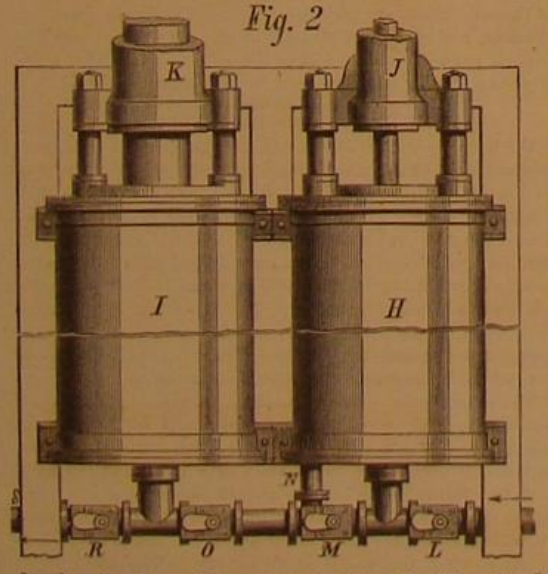
Previous to the pressing operation, live steam is admitted (in the direction of the arrow, on the right of Fig. 2) which, the valve, L, being open, enters the cylinder, H, and forces the piston ahead against the pressure of the liquid which is contained in the press cylinders, B B, the

Fig. 1



TAYLOR'S DIRECT ACTING STEAM AND HYDROSTATIC PRESS.

Fig. 2



chamber, J, and one of the connecting pipes, P. The valve, L, is then closed, steam pressure is thus cut off, and the piston, acted upon by the liquid pressure, returns to the rear of the cylinder, forcing out the steam contained therein. Meanwhile the valve, M, is opened, and the steam, having no other exit, passes through the same and into the pipe connecting the valve chambers of the two cylinders. As the inlet valve, O, of the second cylinder is closed, the steam enters the pipe, N, and is thereby reconducted into the cylinder, H, the said pipe passing along the outside of the cylinder to its front end, when it communicates therewith, and the steam fills the whole space in front of the piston. The object of the proceeding is to thoroughly warm the cylinder, H, so that it may less condense the live steam that is subsequently admitted into it.

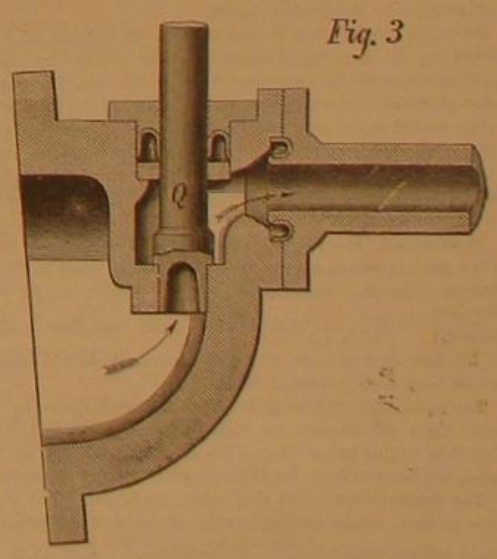
In commencing the pressing, the valve, O, is first opened. The steam, which we have above alluded to as having entered in front of the piston in the cylinder, H, now returns through the pipe, N, and becomes the motive steam in the cylinder, I, continuing to flow from one cylinder to the other, until the pressure on the two pistons is equalized. The valve, O, then closes by its own weight, and any steam which may remain in front of the piston, in cylinder H, may be allowed to escape through a pipe (not shown) in connection with the exhaust, S. The steam, entering through O, pushes forward the piston in cylinder, I, and the ram in chamber, K, thus displacing the fluid, forcing it underneath the rams, C C, and thereby lifting the platen, F. As soon as the motion of the piston stops, either by its reaching the end of its cylinder, or being arrested by the opposition of the liquid, a check valve, Q, at the front end of chamber, K, which has been opened by the passage of the fluid as it is forced through, closes automatically by its own weight, thus preventing a return of the current. The arrangement of this valve with the forward portion of its containing chamber is clearly shown in section in Fig. 3.

The valve, L, is next opened, and live steam admitted to the piston, in cylinder H, which, by means of the ram in J, drives a second current through its connecting pipe of the pair, P, under the rams, C C, and so completes the pressure of the material between the platens. The bale being properly tied, the valve, L, is closed, and the valve, M, opened. The weight of the platen acting on the liquid forces the piston in cylinder, H, back, the steam in the rear of the latter once more passes by the tube, N, to the front, and the operation, as already explained, is repeated. The various valves alluded to are governed by convenient and suitable mechanism, which need not here be described, and are controlled by the hand levers, as shown in the large illustration. The initial pressure upon the platen not requiring so great an application of power as the finishing pressure, it is evident that, by the increased diameter of the ram, K, and the reduced action of the exhaust steam, a quicker though less effective force is obtained. But the ram, J, being of smaller sectional area, and receiving also the full force of the live steam, is, as may be mathematically shown, necessarily capable of exerting an enormous pressure. Moreover, this ram is constructed less in diameter than the press rams, C C, in order that the pressure upon the latter may be in proportion as their diameters are the greater. It is evident, therefore, that this portion of the invention is excellently devised for imparting the concluding powerful impulse to the platen.

The inventor informs us that two of these presses are in operation in Charleston, S. C. One having two rams, each 16 inches in diameter and 44 inches travel, steam cylinders of 48 inches, and stroke 7 feet, with 86 pounds of steam, gives a pressure of 1,200,000 pounds, on the material in the press, or 14,117 pounds for every pound of steam. The other, with 22 inch rams, 56 inch cylinders, and 8 foot stroke, with 80 pounds of steam, affords 2,138,640 pounds pressure, or 26,733 pounds per pound of steam. The operation of these machines is stated to be in every way satisfactory.

Patented February 28, 1871. Reissued through the Scientific American Patent Agency, April 2, 1872. For further information, address the patentees, Messrs. John F. Taylor & Co., Phœnix Iron Works, Charleston, S. C.

Fig. 3



Disinfection of Air of Sick Rooms.

The three best agents for accomplishing the disinfection of air after smallpox or other contagious diseases, are sulphurous acid, iodine, and carbolic acid. The best method of employing sulphurous acid is to scatter a little flowers of sulphur upon a heated shovel and carry it about in the room or rooms which are to be disinfected.

Iodine may be used by simply placing a little in an open glass or earthen vessel, and it vaporizes readily at the ordinary temperature of a house. Carbolic acid may be employed by sprinkling a weak solution of it on the floor of the room, or cloths wetted in such solution may be hung about the rooms. A simple apparatus for using this acid is to have a broad band of cotton passing over two wooden rollers over a dish filled with a solution of the acid. As the upper half of the band dries, give the rollers a turn, and the lower half of the band, wet with the solution, takes its place uppermost.

A PHILADELPHIA manufacturer is preparing a plan for a column 1,000 feet high, to be constructed entirely of iron, in open work, from the summit of which the grounds of the Centennial Exposition are to be illuminated by means of a Drummond light. If adopted, it will be the loftiest monument in the world.

A CORRESPONDENT tells us that corn is now selling at Topeka, Kansas, for from 14 to 18 cents a bushel. The price is usually 40 to 50 cents per bushel.

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Scientific American.

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NEW YORK, SATURDAY, JANUARY 11, 1873.

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LOSSES OF POWER IN THE STEAM ENGINE. WHERE IT MAY BE IMPROVED AND TO WHAT EXTENT.

The mechanical equivalent of heat, as we have had frequent occasion to state, is reckoned at 772 foot pounds per thermal unit—that unit being the quantity of heat necessary to raise one pound of water one degree in temperature The fact is so very important that we shall be excused, however frequently we may present it.

A pound of pure carbon yields, in burning, 14,500 units of heat, equivalent to $14,500 \times 772 = 11,194,000$ foot pounds of energy. A pound of good coal containing 91 per cent carbon, as shown in the report of the committee of the American Institute testing steam boilers in 1872, produces about 13,200 units of heat, and its mechanical equivalent is $13,200 \times 772 = 10,190,400$ foot-pounds of work.

The very best classes of modern steam engines very seldom consume less than two pounds of coal per horse power per hour, and it is a good engine that works regularly on three pounds. A horse power raises 1,980,000 pounds one foot high per hour. Consequently, a pound of coal, in our very best engines, developes but $\frac{1,980,000}{2} = 990,000$ foot pounds instead of the 10,190,400 which it would give us were there no loss of power.

The first-class steam engine, therefore, yields less than 10 per cent of the work stored up in good fuel, and the average engine probably utilizes less than 4 per cent.

A part of this loss is unavoidable, being due to natural conditions beyond the control of human power, while another portion is, to a considerable extent, controllable by the engineer, or by the engine driver.

Scientific research has shown that the proportion of heat, stored up in any fluid, which may be utilized by perfect mechanism, must be represented by a fraction, the numerator of which is the range of temperature of the fluid while doing useful work, and the denominator of which is the temperature of the fluid when entering the machine, measured from the "absolute zero"—the point at which heat motion is supposed to cease entirely—461° Fahr. below the zero of the common scale.

Thus, steam, at a temperature of 320° Fahr., being taken into a perfect steam engine, and doing work there until it is thrown into the condenser at 100° Fahr., would yield $\frac{320-100}{320+461} = 0.28+$, or rather more than one fourth of the 10,190,400 foot pounds of work which it should have received from each pound of fuel.

The ratio, $\frac{3,000,000}{10,190,400} = 0.34 = \frac{1}{3}$, of the work done by our best class of engines, to this possible performance of a perfect engine using 75 pounds of steam, shows us how much we have to hope for in improving the steam engine.

The proportion of work that a non-condensing, but otherwise perfect, engine, using steam of 75 pounds pressure, could utilize, would be $\frac{320-212}{320+461} = 0.14 = \frac{1}{7}$; and, while the perfect condensing engine would consume two thirds of a pound of good coal per hour, the perfect non-condensing engine would use $1\frac{1}{2}$ pounds per hour for each horse power developed, the steam being taken into the engine and exhausted at the temperature assumed above. Also, were it possible to work steam down to the absolute zero of temperature, the perfect engine would require but 0·19 pounds of similar fuel.

We may therefore state, with a close approximation to exactness, that, of all the heat derived from the fuel, about seven tenths is lost through the existence of natural conditions over which man can probably never expect to obtain control, two tenths are lost through imperfections in our apparatus, and only one tenth is utilized in even good engines.

We have intended to include boiler and engine when writing of the steam engine above. In this combination, a waste of probably one third at least of the heat derived from the fuel takes place in the boiler and steam pipes, on the average, in the best of practice, and we are therefore only able to anticipate a possible saving of $0{\cdot}2 \times 0{\cdot}75 = 0{\cdot}15$, about one sixth of the fuel, now expended in our best class of engines, by improvements in the machine itself. This is a most important fact to ingenious and enthusiastic but uninformed inventors.

The best steam engine, apart from its boiler, therefore, has 0·85, about five sixths, of the efficiency of a perfect engine, and the remaining sixth is lost through waste of heat by radiation and conduction externally, by condensation within the cylinder, and by friction and other useless work done within itself. It is to improvement in these points that inventors must turn their attention if they would improve upon the best modern practice by changes in the construction of the steam engine.

To attain further economy, after having perfected the machine in these particulars, they must contrive to use a fluid which they may work through a wider range of temperature, as has been attempted in air engines by raising the upper limit of temperature, and in binary vapor engines by reaching toward a lower limit, or by working a fluid from a higher temperature than is now done down to the lowest possible temperature. The upper limit is fixed by the heat-resisting power of our materials of construction, and the lower by the mean temperature of objects on the surface of earth, being much lower at some seasons than at others.

In the boiler, the endeavor must be to take up all the heat of combustion, sending the gases into the chimney at as low a temperature as possible, and securing, in the furnace, perfect combustion without excess of air supply.

The best engines still lack 15 per cent of perfection, and the best boilers, as an average, over 30 per cent.

This is not as much as some of our readers had supposed. We know of instances in which they are wasting time, money and energy, in the confident anticipation of making one pound of coal do the work that now requires ten, and we have endeavored here to show them what is the amount of actual waste and where it occurs, in order that they may detect the fallacy which has misled them, as well as in order to instruct and interest the general reader.

GOVERNMENT TELEGRAPHY.

We have observed the progress of the efforts that are now being made in Congress to place the institution of telegraphy, like that of the mails, in the hands of the general government. In theory, the idea is pleasing and on the whole popular. Sooner or later, doubtless it will be done. But if any one expects that messages will be transmitted any cheaper, quicker, or better than at present, we think they will be disappointed. Then, in the matter of damages suffered, individuals will have no remedy against the government, whereas, with the telegraph in private hands, the courts hold the companies to the strictest accountability for their blunders or neglect. The interests of the companies are thus made to depend in a very great degree on the promptness and accuracy with which they transact their business. But in government hands, no such incentives will exist. The courts could not then punish the stockholders, and the telegraph, like all other government machines, would be conducted in a slow and comparatively careless manner.

Then as to cost, under the existing *régime* those who use the telegraph pay the expenses. But when we place the lines in the hands of the government, the people at large will be taxed to pay for the purchase and make good the inevitable annual deficiency. In England and other parts of Europe, the telegraph is operated by the governments, and the statistics show that messages are not so promptly delivered, and cost quite as much or more than in this country under the present arrangements, and that the receipts fail to meet the expenses. Our Postmaster General, Mr. Creswell, has become quite a strenuous advocate for the postal telegraph, and in an official report made upon the subject he presents a variety of information; but unfortunately it is full of inaccuracies which impair its value, and will be apt to perplex those who attempt to deduce practical instruction therefrom. For example, he estimates that for about twelve millions of dollars the government could build telegraph lines equal in extent to all now in use in this country, or one hundred and seventy-five thousand miles in total length. Singularly enough, this estimate is adopted on the evidence of Mr. Chester, who put up the fire telegraph in this city, six hundred and twenty-six miles in length, and charged the authorities eight hundred and fifty thousand dollars therefor. At the rate of Mr. Chester's price for New York city, the cost to the government for the postal telegraph would be over two hundred millions of dollars.

We earnestly hope that Congress will move deliberately in this matter. Our present telegraph system works exceedingly well; indeed, no other country is better supplied. Let well enough alone is a safe rule. But if we must have a change, Congress ought first to procure, for the information of its own members and the people, the most full and accurate estimates of the cost, and the advantages, if any, which would be likely to ensue. We think that a special Congressional committee might be appointed, charged with the duty of collecting and arranging the real facts in the matter. Such an investigation, honestly conducted, would be approved by the public.

THE NEW YORK INDUSTRIAL EXHIBITION.

Quite a number of wealthy citizens of New Yorkcity have, for some time past, been considering a plan of establishing a permanent industrial exhibition building in some convenient locality in the metropolis. At a recent meeting a committee was appointed to examine into the subject, from the lately published report of which we glean the following particulars regarding the scheme: The Industrial Exhibition Company is a regularly organized corporation under the State laws. It has contracted to purchase a piece of land lying between 98th and 102d streets, and Third and Fourth avenues, in this city, consisting of eight blocks of ground, for the sum of $1,700,000. $200,000 of this has been paid. The estimated cost of a suitable building and ground improvements is seven million dollars. A proposition has been made by a New England firm to construct a dome over the court, which dome shall be the largest and most magnificent in the world. The estimated cost of this structure is $3,000,000, but all the builders ask in payment is a perpetual lease of it above the spring of the arch. Finally the hope is expressed that Congress will favor the idea of the World's Fair being opened in this building in 1876. It is not proposed to interfere with Philadelphia's "Centennial," but, as the committee state, "we, New Yorkers, cannot but feel that we may celebrate in our own way so important an occasion."

The report was adopted, and committees were appointed, among which we may notice the names of Messrs. Samuel Sloan, Richard Schell, Paul Spofford, Wm. B. Astor, Wm. M. Evarts, R. H. Pruyn, Francis Skiddy, E. L. Tiffany, and many others. Subscription papers have been prepared and freely circulated, so that the enterprise thus fairly launched bids fair to be rapidly pushed forward to a successful completion.

CORN AS FUEL.

A curious state of affairs exists in the West. Farmers are not only burning corn for fuel at the present time, but laying in supplies to serve for that purpose during the coming winter. It is asserted that corn gives a better heat for cooking purposes than any wood excepting hickory, while, for economy of consumption, it is cheaper. Hard wood on the spot costs $7.50 per cord, corn, $5.60. As compared with coal, it is estimated that three tuns of corn will give heat equal to one tun of coal, while in economy of use, it is equal to one and a half tuns of the latter.

That this is an unpleasant commentary upon our facilities for transportation cannot be denied. The cost of food here in the East is notoriously large, and it is equally true that living expenses have in but a small degree decreased since the darkest period of the war. Yet, such are the rates of freight or the fewness of carrying lines that it seems a better paying operation to burn food than to send it to Eastern markets for sale.

A cotemporary aptly suggests that evidence is here afforded of the gradual diminution of our forests, a serious fact to which we have frequently adverted. There are strong efforts being made by the National Bureau of Agriculture, as well as by State societies, to protect the growing timber, and suggestions from these sources should be heeded and acted upon. If, as the burning of grain implies, the woodland in the neighborhood of the corn-producing districts in the West has become so sadly depleted, it is time that protective means were adopted and effective measures inaugurated which will at least supply the deficit to future inhabitants of the country. Corn may make excellent fuel for future generations, but it will scarcely answer as a material from which houses or furniture can be constructed.

Another idea worthy of consideration is that of raising a cheap variety of maize which will yield a maximum of woody or combustible fiber with a very light consequent exhaustion of the soil. There are varieties which will thrive in northerly climates, and can be cultivated at the rate of seventy-five bushels per acre. It is swift of growth, as it contains more oily than starchy qualities, and is well adapted for fuel.

THE HENDERSON IRON PROCESS.

We have heretofore chronicled the progress of this new improvement in the manufacture of iron, and are happy to be able to say that the recent tests to which it has been subjected, which have been many and thorough, have fully confirmed the great value and importance of the invention. It promises to revolutionize the art of manufacturing iron; greatly economizing in the labor and vastly improving the quality of the metal produced. The invention is by James Henderson, of New York, who for the past year has been engaged in England, in developing the merits of the discovery where it has attracted the greatest attention.

The Henderson process consists in the application of fluorine, in the form of fluor spar, and of oxygen in the form of oxide of iron to the molten cast iron. The ingredients mentioned are thrown into the puddling furnace and the cast iron is then poured in upon the mixture, which remains at the bottom. The iron is then allowed to boil for about half an hour, then rabbled for ten minutes, when the metal is balled up. The time occupied is an hour for each charge. The fluorine and oxygen remove the phosphorus and other impurities within a few minutes. The discovery is applicable to the production of wrought iron and steel of the best qualities. From cinder pig and the common brands of cast iron, a wrought iron having very great toughness is produced. Mr. Kirkaldy certifies that steel made from the Henderson wrought iron derived from common Scotch pig, gave a tensile strength equal to steel made from the best Swedish iron, and, in the form of tools, stood the wear equally well The analyses of Dr. Noad show that the Henderson process removes every impurity from the iron. The *Mechanics' Magazine* states that,

by the Henderson process, iron in England can be made equal in purity to the best Swedish, and substituted for the Swedish in making the highest classes of steel.

FRICTION OF JOURNALS.

A correspondent writing from Columbus, Ohio, asks whether the friction of a large journal is greater than that of a small one, the length and character of bearing being the same in both cases, and the number of revolutions the same, the only difference being in the diameter of the journal.

The friction on any surface, whether plane or cylindrical, is proportional to the weight resting upon it and is not at all affected by the area of the rubbing surface, provided the pressure is not so great, on the one hand, as to change the character of those surfaces, nor so light, on the other hand, as to make the resistance principally that of viscosity of the lubricant rather than that of true friction. In the former case, the friction may increase immensely in consequence of the cutting of the surfaces; and, in the latter, the increase of frictional resistance will be approximately proportional to the increase of area.

The work done in any given time, that is, the power wasted in turning any journal on its bearings, is, where the frictional resistance is the same, proportional to the speed of the rubbing surfaces, since it is measured by the product of the resistance into the distance through which that resistance is overcome. Therefore, it follows that a very large journal absorbs a larger proportion of the driving power of a machine than does one of small diameter, and in designing machinery we should make journals of as small diameter as possible without danger of breaking the shaft, or of causing abrasion of the rubbing surfaces.

Again, the tendency of a journal to heat is the greater the greater the pressure per square inch of longitudinal section of the journal, and it is increased by increasing the speed of the rubbing surfaces. Therefore, to make journals safe against heating, make them of as small diameter as safety permits; and having thus reduced their absorption of power to the lowest limit, secure bearing surface by giving them ample length. If they are, however, made so long that the shaft can spring in the journal, heating may occur from that cause; in line shafting, this will, of course, not happen. The best practice gives line shafting for mills a length of journal equal to four times the diameter of the shaft.

There are rules, known to engineers, for properly designing journals, which are based on the principles above stated. The earliest of which we have knowledge is that of Professor R. H. Thurston, which was based upon observation of the action of crank shafts of naval steamers in 1862. A somewhat similar rule, based on locomotive practice, was published by Professor W. J. M. Rankine in 1865. The first is expressed as follows:

$l = \frac{PV}{60000\,d}$, and $\frac{P}{ld} = \frac{90000}{V} = p$. The second is, $\frac{4480}{V \text{ plus } 20} = p$, and, when reduced to the same form as that of Professor Thurston, becomes $l = \frac{P(V \text{ plus } 20)}{4480\,d}$.

Here l—length of journal in inches; P—total pressure on journal; p—pressure per square inch of longitudinal section; V—velocity of rubbing, in feet per minute; d—diameter of journal in inches.

In no case in general practice should the pressure, on even the slowest moving journals, be allowed to exceed 1,000 pounds per square inch of longitudinal section with steel journals or about 600 on iron, running in well worn boxes in each case.

Special care should always be taken to provide for effective lubrication.

PATENT BUSINESS IN CONGRESS.

The Congressional bureau for patent business is now in full blast, and the reports of a single day's proceedings, connected with such matters, occupies an entire page of one of our largest newspapers. It appears from these proceedings that every man who has been dilatory in applying to the Commissioner for an extension of his patent, as the law requires, may readily get a special law passed for his relief by applying to the Committee on Patents of the House of Representatives. Mr. Meyers, from that Committee, stated the other day to the House that in all such cases the Committee unanimously recommended that the petitioner should be relieved, and that Congress had never refused relief. Such being the feeling of Congress, it seems to us that members might save themselves the loss of much valuable time by passing a general law authorizing the Commissioner to hear dilatory petitions.

In the following cases, wherein the parties failed to put in their petitions for extensions within the time specified by law, Congress has, by special enactment in each case, authorized the Commissioner to hear and decide as to the propriety of extensions, namely:

Patent of Joseph Fox, for an Improvement in machinery for making Crackers. Patented February 1, 1859.

Patented by Thomas Warker, for an Improvement in apparatus for Generating Acid Gas. Patented April 27, 1858.

Patent of James C. Cooke, for an Improvement in Manufacturing Webbing. Patented January 4, 1858.

Patent of Nicholas G. Norcross, for an Improvement in Planing Machines. Patented June 22, 1852. In this case it was shown that the patentee was deceased and that his son, Frederick W. Norcross, who now applies for the extension, was, at the time of the expiration, in the service of his country as a lieutenant and had distinguished himself for gallantry and bravery. In consequence of his occupation in the service he was unable to apply for the extension within the time required by the law, and now comes before Congress, asking that the Commissioner of Patents may be authorized to hear and act upon his petition, the same as though there had been no legal lapse.

The bills for the extension of the following important patent monopolies were then discussed:

WOODBURY'S HORSE POWER PATENT.

Application of Daniel Woodbury for a revival of his Horse Power Patent. Originally granted in 1846. Expired in 1860, at which time the applicant made strenuous efforts to get the patent extended by the Commissioner of Patents, who, for good and sufficient reasons, refused an extension. Three years ago Woodbury applied to Congress for an extension, but the bill failed to pass. He now appears again, his patent having rested among the dead for twelve years. The Committee made a long report on the subject adverse to the revival of the monopoly, and so the patent sleeps.

MARCHER'S COMPOSITION PATENT.

Rebecca A. Marcher. Being an application for a second extension of the patent of her late husband, Robert Marcher, originally granted October, 1851, for a machine for applying semi-liquid composition to picture frames, producing ornamental work thereon, etc. Extended seven years by the Commissioner of Patents, which extension expires October 21, 1872. This is an important patent and is in very extensive use. The Committee, in consideration of the fact that the petitioner was a widow in indigent circumstances, with three minor children to provide for, recommended a further extension for seven years from October 21, 1872, and the bill was passed.

THE HAYDEN BRASS KETTLE PATENT.

The great Hayden Brass Kettle case was then considered. This was the patent granted to Hiram W. Hayden, December 16, 1851, for machinery for making kettles and analogous articles. Extended for seven years by the Commissioner of Patents, which extension expired December 16, 1872. The patentee asks Congress to give him another extension of seven years.

It was shown that this patent formed one of the largest patent monopolies ever granted. For the last twenty years it has been held by the Waterbury Brass Company, who are understood to have grown immensely wealthy from the profits on the patent. The patent covers, broadly, the right to make kettles and other articles by what is known as the spinning process. It was shown that the Waterbury Company had driven out of market all other kinds of kettles and possessed the exclusive monopoly of the business.

It was shown in behalf of the inventor that, even if his assignees had grown wealthy, that he himself had not received any adequate remuneration; but he probably would be able to compensate himself if the further extension now asked were granted.

Mr. Kellogg, speaking in behalf of the applicant, made the following interesting remarks:

"This is an invention which completely revolutionized the manufacture of brass kettles; it created a new art. Instead of being an invention to be sneered at as worth but little, it is one of the most wonderful inventions ever made in the process of working metals. It consists in what is called spinning metal. A flat disk of brass is taken, and by means of machinery the metal is spun, so that the particles are changed, while still maintaining their adherence and force. Before this invention, kettles were pounded or battered or stamped by hand—a process so laborious that no man even in those days could work at this occupation more than eight hours a day; and even then the kettles were so made that they would be thinnest at the bottom and the edges, where the fire came; so that two kettles made in this way would not last any longer than one made by this new process by spinning. By this process of spinning metal this inventor, Mr. Hayden, produced kettles of double thickness at the places where the fire comes; and according to all the evidence before the committee, one of these kettles will outlast two of the old kind. In proof of this I may mention that, when this invention had come into use, kettles manufactured by the old process were driven entirely out of the market. The evidence also shows that at least a million and a half of dollars have been saved by this invention on the single article of kettles.

"This article of manufacture is comparatively less used in this country than formerly. This inventor not only introduced a new art, but he opened up a new branch of commerce with some of the European nations and Africa. A great part of the kettles manufactured under his invention have been exported. Thus this invention is helping every day to keep the balance of trade in our favor.

"I am aware that he has received a little more than $1,500 a year from the invention; but it is an invention which took him years to perfect. He was a poor mechanic at the outset, and this paltry sum is a small compensation for so valuable an invention."

The House divided, 60 ayes, 64 noes, so the bill was defeated, and the Brass Kettle Monopoly comes to an end.

ART TREASURES FROM CYPRUS---ENGLISH CRITICISM ON THEIR DESTINATION.

There are two journals published in London which may be considered the organs of that exclusive class of British society who, whether from choice or from indolence to obtain the commonest information, possess and cultivate the most profound ignorance, not to say stupidity, regarding everything in anywise pertaining to the United States. We allude to the *Saturday Review*, which, in classical English and faultless rhetoric, gravely puts forward the most extravagant absurdities, and the *Pall Mall Gazette*, which, if we remember rightly, especially distinguished itself during our late war by systematically publishing false reports of every Federal victory, and, with other rebel-sympathizing papers, revelled in predictions of grass growing in the thoroughfares of New York, and the untamed buffalo roaming over the ruins of the national Capitol. Both of these journals are the legitimate objects of the editorial scissoring of the balance of the London press, and, following the general example, the *Building News*, with a strange lack of discrimination, has culled from the valuable pages of the *Pall Mall Gazette* an article entitled "Art Treasures from Cyprus," which is a scholarly description of the collection of Greek and Phœnician antiquities, made by our late consul, General Di Cesnola, among the ancient ruins of that island. These relics were exposed for sale for some time in Europe, but met with no purchaser, owing to the high price set upon them. Recently, however, and in a late number of our journal, we adverted to the fact that they were bought by the management of the Metropolitan Museum of Art, and in proper time will be permanently located in that institution in New York city.

Now, if some obscure German principality had taxed its few inhabitants to the full extent of their incomes to purchase these works of art, and had entombed them in the dingy recesses of some out-of-the-way university where no one could possibly be benefited by them, save a few fossil professors, all might have been well. But unfortunately they are to go to America—and worst of all to New York—and there "waste their sweetness on the desert air" of barbaric and benighted Yankees. No wonder, then, that the learned pundit of the *Pall Mall Gazette*, whose whole æsthetic nature has been thus ruthlessly harrowed up, bewails their loss in the following manner: "And where are these materials going to for their final lodgment? Where, indeed? To New York, U. S. America. That seems a strange destination for a collection of antiquities which is not one representative of beautiful and popular forms of Greek or Greco-Roman work . . . and invaluable as the supplement of existing museums in centers of organized scholarship and research. The shipment of these things to New York means simply, for the present at any rate, mystification to the New York gaper, and sea sickness for the European archæologist. For the most intelligent New Yorker can get but moderate advantage out of the antiquities of this collection taken apart from their historical place in relation to antiquities of other schools and another aspect; and specimens of these last he does not possess and has little chance of coming by."

The first response to the foregoing remarks is the question which naturally occurs: "Why were not these inestimable treasures bought during the long period they were offered abroad?" But this aside, we perhaps may venture humbly to suggest to the above erudite authority that the American public, and especially the citizens of New York, are educated to a far higher standard of art criticism, and can appreciate the value of such relics in a degree somewhat superior to the cockney visitors, who would flatten their noses in something more than mere "mystification" against the glass cases of the South Kensington Museum, in London, did the collection find its way to that celebrated edifice. And further, we may add for the information of our cotemporary, that our metropolis contains gentlemen who are as familiar as the writer of the above with the galleries and museums of Europe, and consequently as thoroughly able to reap the advantages of comparison and kindred knowledge as any foreign "sea sick" archæologist that may deign to visit our shores.

It is about time that America and the Americans were better understood by the English public, who still persistently cling to the extravagant representations of the country supplied by Dickens and Mrs. Trollope. The public of New York, Boston, and, indeed, every other of our cities, appreciate scientific and artistic subjects with a zest unknown to the people of Europe. The English journals well know that Professor Tyndall, for example, justly celebrated as he is, could not command $1,000 a night for a course of lectures in any city in the United Kingdom, and that no foreign operatic manager would listen to such prices, demanded and received among us by such musicians as Rubinstein, Lucca, or Nilsson. Our native artists, painters, and sculptors find in their own country patrons, in private citizens, who supplement their efforts with a munificence unheard of abroad; while, on the other hand, it is but recently that the European papers were regretting the fact that many of the finest gems of ancient art were crossing the Atlantic simply through the lavish expenditure of American connoisseurs. The fact of our being destitute of the great museums and galleries, such as are found in the cities of foreign countries, requires no other explanation than the youth of the nation. The need for such valuable aids, in the education of popular taste, is fully appreciated, and throughout the different States wealthy and public spirited citizens are laboring to found repositories of the choicest specimens afforded by science and art.

Such slurs upon the American public and upon our distinguished scholars, as are cast by the *Pall Mall Gazette*, will fail to influence the liberal-minded or progressive in any part of the world, while they serve to fully exhibit the narrowness, intolerance, and ignorance of the mind by which they were conceived.

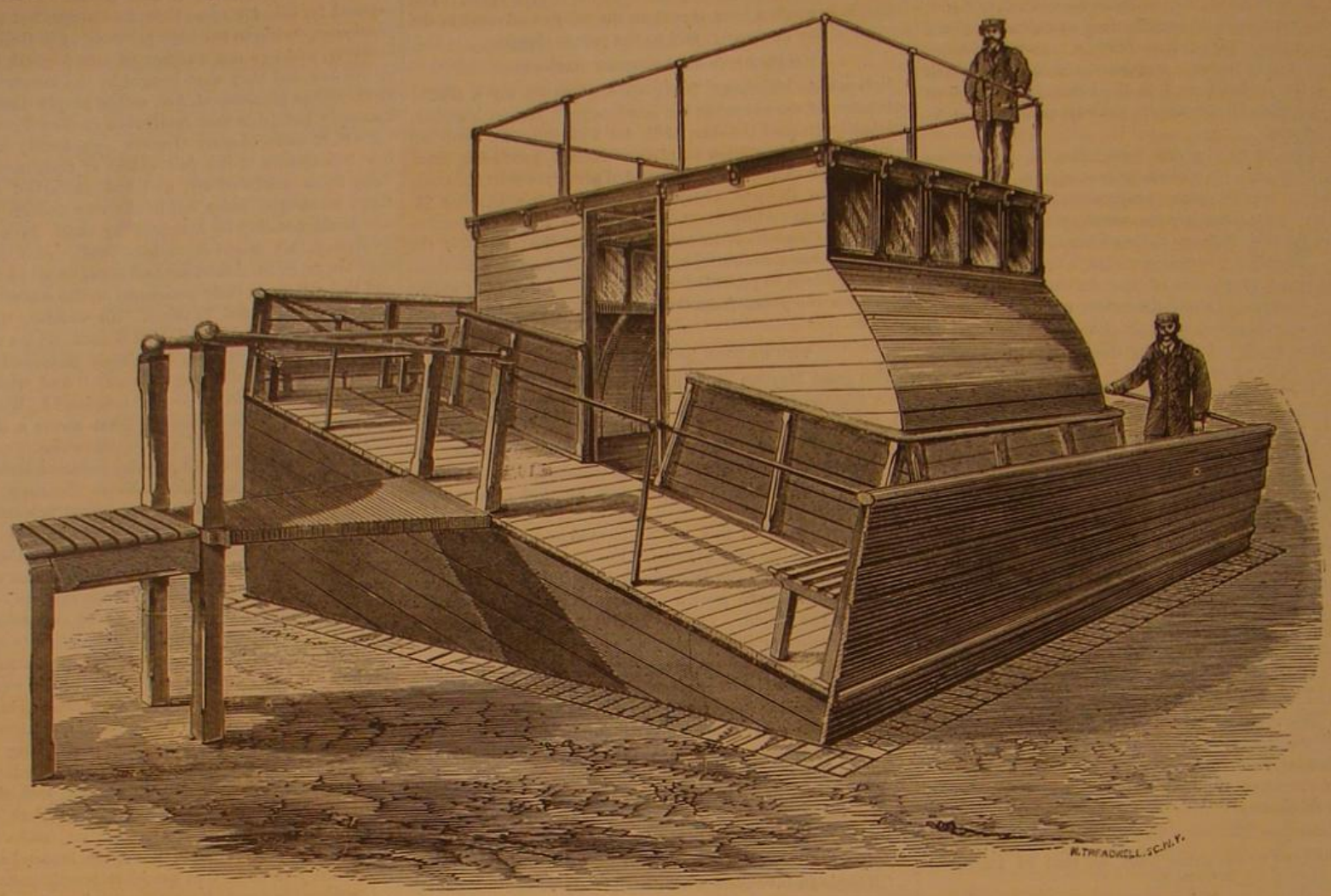
THE description of a device for opening window blinds from within the casement, recently sent to us by a correspondent, occupies sixteen foolscap pages and the drawings sixteen additional pages, or thirty-two pages in all. It is well written and clearly described, every part of the device being illustrated in every possible position, the whole forming a curious example of exactness and prolixity. Most persons could have sketched and described the thing with sufficient clearness in the space of a single page.

THE ANTI-SEA-SICK SHIP.

We last week gave a description of the proposed anti-sea-sick steamer of Mr. Henry Bessemer, and the experimental apparatus lately erected by him on the grounds of his residence at Denmark Hill, England. We give herewith an illustration of this apparatus from *Engineering*. Our cotemporary states that the prospectus for a proposed company, entitled "The Bessemer Saloon Steamboat Company," has appeared, capital $1,000,000. The proposition is to build a large vessel to run across the English Channel, between England and France. Mr. Bessemer is to have for his patent 20 per cent upon the charges made to passengers who use the swinging saloon, and 10 per cent upon all sales of rights to other constructors. The arrangement consists of a twenty foot length of the hull of a vessel of twenty foot beam sunk in a brick pit and carried on a longitudinal axis. In the ship is a saloon suspended as above described, and connected with it is a curved spirit level, with a graduated scale and pointer, the latter of which the steersman always keeps at the zero point. An oscillatory motion is given to the hull by a small engine connected to it with suitable gearing. This motion amounts to 14° each way, representing a total roll of 28°, with ten oscillations per minute, but notwithstanding this the cabin does not indicate a deviation of more than from 1° to 1¼° from the horizontal. Mr. Bessemer considers his idea but the germ of what may be thought out, and frankly admits that some other brain than his own may push on the work he has initiated.

The difficulty of pitching is overcome by increasing the length of the vessel so as to insure longitudinal stability. The principle of the saloon is, in fact, carried out in a vessel designed by Mr. E. J. Reed, for the channel passage. She will be 350 feet long, with 65 feet beam over her paddle boxes, and 7 feet 6 inches draft of water. The saloon will be placed amidships, in the position generally occupied by the engines. The latter will be of 750 horse power, nominal, and are expected to drive the vessel twenty knots per hour. The ship will be double-ended so as to enable her to enter and quit existing harbors, and at each extremity will be provided with a very low free board, so that she may cut the waves instead of rising to them.

In the SCIENTIFIC AMERICAN for May 21, 1870, our readers will find an engraving of Lorenzo D. Newell's swinging saloon, which antedates Mr. Bessemer's device, and in some respects may be considered preferable.



SALOON OF BESSEMER'S ANTI-SEA-SICK SHIP.

NEW THEORY OF THE AURORA.

The *English Mechanic* publishes the views of Dr. Wolfert, a German observer, on the nature and origin of the aurora borealis, which, it will be noticed, are based on speculations which do not connect the phenomenon with a magnetic or electric source. Dr. Wolfert says: "The sun's rays, falling on the earth, are variously reflected according as they fall vertically or at an angle more or less obtuse. The earth being conceived as a large mirror, many of the obliquely incident rays will be reflected to a part of the celestial vault on the night side of the earth." The zodiacal light he ascribes to the irregular reflection of sunlight from water, and similarly the vast fields of ice in the polar regions, he considers, may be regarded as an imperfect mirror irregularly reflecting the incident light. The rays which fall most obliquely are the most abundantly reflected; and as the quantity of reflected light increases with the angle of incidence, adds the author, we may see how the reflected sunlight illuminates in the highest degree the night skies of the region nearest the pole; further, the great similarity of the incipient light of the aurora to moonlight is thus explained, the latter being also sunlight reflected.

The rays falling on the ice at an angle of 40° are, however, dispersed as well as reflected. It is commonly said that the point of origin of the aurora is indicated by the direction of the magnetic needle. More correctly, according to Dr. Wolfert, a line drawn from the sun at right angles to the horizon and prolonged would be the middle line of the phenomenon. On this supposition an advance of the central part of the aurora to the north is explained.

The grounds on which Dr. Wolfert rejects the ordinary hypothesis of the aurora may here be briefly stated. The strongest reason given for supposing a magnetic origin of the aurora is that the phenomenon seems to originate in the quarter to which the needle points. It is replied that in expeditions to Boothia Felix and Melville Island, the needle has in these places taken a vertical position and even at times pointed southward, while the aurora appeared in the north as usual. If the aurora consisted of a streaming of electricity from the magnetic pole, it would be difficult to explain how an observer at the pole always sees the light beyond the horizon as at other places. When lightning strikes a ship, the compasses become irrecoverably useless. But ships have ventured in the midst of these (supposed) currents from the pole, and their compasses have been but temporarily disordered. Neither man nor beast suffer from such currents nor do sensitive electrometers show any change in atmospheric electricity when the phenomenon occurs.

It is said that the needle shows irregularities before the aurora. But this is by no means a constant occurrence. The polar light and the electric (disturbing) currents may have a common cause. Heat also diminishes the attractive force of magnets, and this might account for the variation of the needle. If the phenomena were electric it would be difficult to account for their punctual regularity of appearance and disappearance in northern regions. This is explained, however, when we connect them with the sun.

In recent times, it has been supposed that the sun spots are in some way connected with the aurora. The recurring frequency of the latter every ten or eleven years is found to coincide with the periodic maxima of the former. Dr. Wolfert suggests the following as a possible explanation: If it be true that the spots diminish the solar radiation, the cold winters that recur in these periods may be thus caused. Now cold winters imply an extension of the polar ice southwards, and therewith an enlargement of the reflecting surface in the same direction.

An Iron Boomerang.

A locomotive lately exploded at Lafayette, Ind., and the *Journal* of that city says that a large piece of iron, weighing about a hundred pounds, in the shape of the segment of a circle, was projected from the wreck, and struck the wall of Levering and Abernathy's saw mill about three feet from the ground, going through that and a partition within, lodging against the inside north wall, and playing sad havoc with the contents of the office through which it passed. The distance from where the locomotive stood was three hundred feet. The course taken by the mass of iron was most peculiar—first upward in a curve, going in a south-westerly direction until it had passed over the saw mill, then suddenly changing when near the ground to directly north, and going in a direct line through the walls. The erratic movements of the mass of iron can only be accounted for by its peculiar shape, being not unlike the boomerang of the Australian aborigines.

Petroleum Wells in Ecuador.

The English *Oil Trade Review* publishes the report of the Government Engineer of the Republic of Ecuador, in which we find it stated that petroleum has been found in that country in large quantities. On a surface of about four square leagues from the sulphurous springs of San Vicente to the sea shore, wells have been sunk and the bituminous matter obtained in a liquid state. At the upper part of many of the wells, it is found in hard compact masses. The crude petroleum is of a dark brownish color, which gets darker with the greater consistence of the oil.

The manner of working the wells is exceedingly primitive as the inhabitants have neither the knowledge nor the implements required. Pits from ten to twelve feet deep are dug in the sand till clay is reached, and when the oil, which oozes from all sides, has filled them it is dipped out. Near the wells are rude furnaces built with sun-dried clay on which are open iron boilers. The bituminous matter is thrown into these vessels and cooked until all the volatile products disappear and leave a thick pitch.

"To Whom it may Concern."

Mr. D. D. T. Moore, publisher of the *Rural New Yorker*, closes his volume for 1872 with the following sensible announcement:

"The editor and founder of this journal hereby announces his retirement, as speedily as possible, from all business enterprises, offices, etc., not connected with its management. Having during the past twenty years permanently invested, for the ostensible benefit of individuals and the public, through the persuasion of friends, various small and large amounts—and meantime held sundry time-absorbing and otherwise expensive offices of trust and honor (but not one sinecure), our ambition is amply satisfied, and the decision now made and recorded "means business." Therefore all persons wanting to borrow money, place us in office, or make us rich by the use of "only a trifle" of our currency, time or influence, are advised that we are "not at home" to or persuadable by any such applicants. In fact we cheerfully forego all such chances for fame and fabulous wealth as seductive speculators and systematic swindlers have aforetime beguiled us with, and notify each and all of like proclivities that we shall in future not only believe in but be guided by the wise proverb which saith "all labor is profitable, but the talk of the lips tendeth only to penury." And, moreover, all who have designs upon us will find said proverb posted, in plain print, upon the walls of our office and sanctum."

THE big pig of Connecticut for 1872, killed in December, weighed 720 lbs. dressed. Stratford enjoys the honor. Piggy was fed on pork rinds during his youth; but for the last four months the diet was corn meal.

PROFESSOR TYNDALL ON LIGHT--SECOND LECTURE.

THE PROCESSES OF SCIENTIFIC THOUGHT.

What is this thing which, under the name of "light," we have been generating, reflecting, refracting and analyzing? The question cannot be considered, much less answered, without transporting oneself to a world which underlies the sensible one and out of which, in accordance with rigid law, all optical phenomena spring. To realize this sub-sensible world, the mind must possess a certain pictorial power; it must visualize the invisible. The imagination must be exercised, and the magic of its art consists, not in creating things anew, but in so changing the relations of sensible things as to render them fit for the requirements of the intellect in the sub-sensible world. As an illustration of this subject, the case of Newton may be cited. Before he began to deal with light, he was intimately acquainted with the laws of elastic collision. With this previous knowledge, the material for theoretic images, he had only to change the magnitude of conceptions already in his mind to arrive at the emission theory of light. He supposed light to consist of elastic particles of inconceivable minuteness shot out with inconceivable rapidity from luminous bodies, and that such particles, impinging upon smooth surfaces, were reflected in accordance with the law of elastic collision. Dropping vertically downward toward the earth's surface, the motion of a body is accelerated as it approaches the earth. The particles of light Newton believed were acted upon in a similar manner, and he supposed that, on approaching a surface obliquely, they were drawn down upon it exactly as a projectile is drawn by gravity to the surface of the earth. This deflection, according to Newton, was refraction, and he imagined that differences in color were produced by particles of different magnitudes impinging upon the retina.

The verifications of physical theory occur in the world fo sense. Laying the theoretic conception at the root of matters, we determine by rigid deduction what are the phenomena which must of necessity grow out of this root: If the phenomena thus deduced agree with those of the actual world, it is a presumption in favor of the theory. If, as new classes of phenomena arise, they also are found to harmonize with theoretic deduction, the presumption becomes still stronger. If, finally, the theory confers prophetic vision upon the investigator, enabling him to predict the existence of phenomena which have never yet been seen, and if those predictions be found on trial to be rigidly correct, the persuasion of the truth of the theory becomes overpowering.

After alluding to the supporters of Newton's theory, among whom were Laplace, Malus, Biot and Brewster, the lecturer proceeded to explain the

UNDULATORY THEORY OF LIGHT AND ITS ORIGIN.

The conception of an ether was advocated by Huyghens and the mathematician Euler, but it was reserved for Thomas Young to discover the resemblances which exist between the phenomena of light and those of wave motion. Professor Tyndall paid an earnest tribute to the genius of this philosopher, placing him on a level but little below that of Newton, and then proceeded to describe the general theory of wave motion:

The propagation of a wave is the propagation of a form, and not the transference of the substance which constitutes the wave.

The length of the wave is the distance from crest to crest, while the distance through which the individual particles oscillate is called the amplitude of the oscillation. You will notice that in this description the particles of water are made to vibrate across the line of propagation. Picture two series of waves intersecting each other and proceeding from two centres of disturbance. The motion of every particle of water is the algebraic sum of all the motions imparted to it. If crest coincide with crest, the wave is lifted to a double hight; if furrow coincide with crest, the motions are in opposition and their sum is zero.

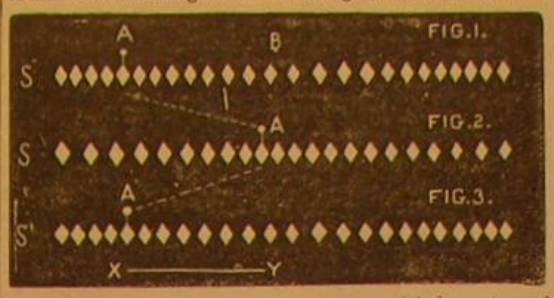
THE ANALOGY BETWEEN SOUND AND LIGHT.

Young's fundamental discovery was the principle of interference applied to light. We can imagine the air of a room to be traversed by a series of sound waves, and that a second series be propagated, so related to the first that condensation coincides with condensation and rarefaction with rarefaction. The consequence would be a louder sound than would be produced by either set of waves singly. But we can also imagine a state of things where the condensations of the one system fall upon the rarefactions of the other, when the two systems neutralize each other, and thus by adding sound to sound we produce silence. Now, in a similar manner, by adding light and light together, we may obtain darkness. There is, however, a fundamental

DIFFERENCE BETWEEN LIGHT AND SOUND WAVES.

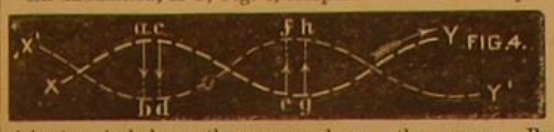
Could we see the air through which sound waves are passing, we would observe every individual particle of air oscillating to and fro in the direction of propagation. Could we see the ether, we would also find every individual particle making a small excursion to and fro; but here the motion above referred to would be across the line of propagation. The vibrations of air are longitudinal, those of ether, transversal.

To illustrate this point, Professor Tyndall threw on the screen a line of light dots as at Fig. 1, representing air particles in a wave of sound. At A is a condensation, at B a rarefaction. These were drawn upon a blackened glass disk and placed in the lantern. When the disk was rotated, the dots that were closed at A separated, and those that were separated, as at B, closed, the motion being kept up along the whole line. From Fig. 1, combined with Figs. 2 and 3, the motion of a particle of air acted upon by sound may be determined. Let A be such a particle in Fig. 1, in the midst of the condensed portion of the wave. In Fig. 2 the wave of condensation has become one of rarefaction, and the particle A has travelled along half a wave length, or to the center of



the rarefied wave. In Fig. 3 this same particle has returned to its former position. It has consequently made an excursion to and fro over the length, X Y, oscillating, in other words, throughout this distance.

An undulation, X Y, Fig. 4, composed of a series of par-



ticles in spiral shape, then appeared upon the screen. By rotating a disk similar to the one above described, these waves alternately appeared as in X Y and X' Y'. Now, bearing in mind the example of a wave in water, we may understand how an undulation may progress while the particles of fluid simply oscillate up and down. Let us consider *a c* as two particles on the crest of the undulations X Y, and *e g* as other particles in a furrow. Imagine these waves to roll on in the direction of the large arrow until a furrow is substituted for a crest and *vice versâ*, or until the medium takes up the undulation X' Y'. Then the particles *a* and *c* will have descended to *b d* and the particles *e g* ascended to *f h*. Consequently the particles will not advance longitudinally (as we explained those in Figs. 1, 2 and 3 did on the line X Y), but will simply rise and fall on the vertical lines *ab*, *cd*, *fe*, etc.

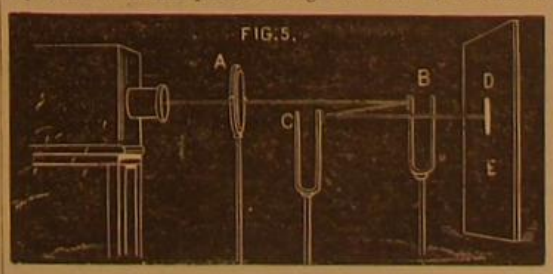
INTERFERENCE.

The most familiar illustration of the interference of sound waves is furnished by beats in music, which are produced by two musical sounds slightly of tune. Professor Tyndall here brought forward two large tuning forks tuned in unison, and swept a bow across each. A loud musical note filled the air. He then attached a cent to one of the forks, which somewhat retarded its vibrations. He explained that if, for instance, the difference between the forks now were such that while one fork made 100 vibrations the other made 101, it would result that at every hundredth vibration the wave would combine to form the highest wave, that is, the loudest sound, and half way between these the crest of one wave would meet the furrow of the other, making the least wave and the lowest sound. This effect of increasing and decreasing sound was very plainly audible. The speaker then put another cent on the loaded fork and the differences of sound succeeded each other with greater rapidity.

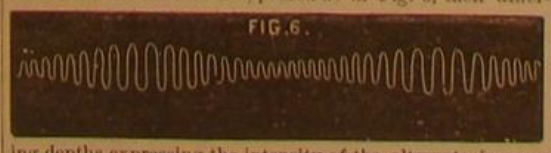
To show these facts optically, the light was reflected from a small mirror on the prong of a tuning fork to the screen, appearing as a small luminous circle. By vibrating the fork the circle lengthened out into a line, by reflecting which from a looking glass and sweeping the same rapidly about, a luminous scroll appeared, showing by the depth of its sinuosities the amplitude of the vibrations.

OPTICAL DEMONSTRATION OF INTERFERENCE.

Fig. 5 shows the apparatus used for this purpose. The ray from the lantern passes through the lens A, is reflected



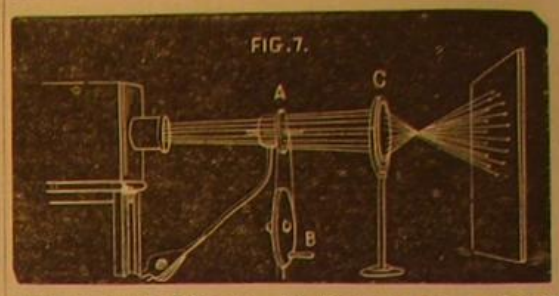
from a small mirror on tuning fork B, thence to another mirror on fork C, and thence to the screen. When the forks vibrated in unison a luminous band, D E, appeared. When one, as the lecturer expressed it, was "jockeyed" with the weight of a cent, the band alternately shortened and lengthened. By reflecting this from a looking glass, as before, the sinuosities on the screen appeared as in Fig. 6, their differ-



ing depths expressing the intensity of the alternate increase and diminution of the sound.

PITCH.

The pitch of a sound is wholly determined by the rapidity of the vibration, as the intensity is by the amplitude. To show the rise of pitch by the rapidity of the impulses, Professor Tyndall explained a form of siren shown in Fig. 7. At A is a perforated disk rotated by the wheel B over a cylinder. In the end of the latter against which the disk revolves are orifices similar to those of the disk, so that coincidences occur. Air is forced into the cylinder from the bellows. When the apertures in the disk coincide with those in the cylinder, a puff escapes; and when these puffs succeed each other so as to form a musical sound, the more rapid the rotation of the disk is, the quicker are the impulses and the



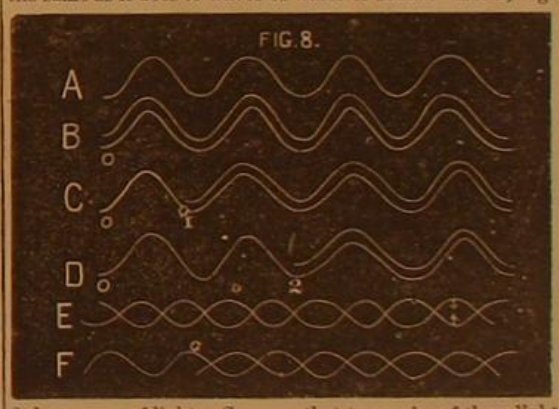
higher the pitch of the note. By this means any number of vibrations due to a sound may be determined. Passing the light through the cylinder and lens, the perforations appeared on the screen as shown. Then by forcing in air and rapidly revolving the disk, producing a dismal species of caterwaul, the lecturer reflected the luminous dots on the screen from a hand mirror. On vibrating the latter the most curious undulatory sinuosities appeared—circles interwoven with each other wonderfully intricately, besides other singular combinations of form.

PITCH IS THE ANALOGUE OF COLOR.

The waves of light have been measured, and it has been found that the more refrangible the light, the shorter are its producing waves. The shortest are those of the extreme violet, the longest, those of the extreme red. The length of a wave of the latter is such that it would require 36,918 placed end to end to cover one inch; of the former, 64,631 would be needed to occupy a similar space. The number of shocks on the retina corresponding to red is four hundred and fifty-one millions of millions, to violet, seven hundred and eighty-nine millions of millions. All space is filled with matter oscillating at such rates, and in ether, just as in water, the motion of every particle is the algebraic sum of all the separate motions imparted to it.

WHAT IS DARKNESS?

The principle of interference applies to the waves of light the same as it does to waves of water or sound. Let A, Fig.



8, be a wave of light. Suppose that two series of these light waves start from a common origin, B. Then their parts correspond and the systems blend together in double amplitude. Suppose they start as at C, one wave a whole wave length ahead of the other; again they coincide and we have increased luminous effect. At D the second wave starts two wave lengths ahead; the result is still the same. But if one system start half a wave length in advance as at E, one and a half as at F, or an odd number of half way lengths, then the crests of one system fall upon the sinuses of the other. Opposite forces, indicated by the little arrows in E, are brought into play. Stillness of the ether is the result of their joint action. This quietude is darkness and corresponds with a dead level in the case of water.

CONDITIONS FOR THE GENESIS OF COLOR.

If we have in interference an agency by which light may be self extinguished, we have in it the conditions for the production of color. Whence, then, are derived the colors of the soap bubble? Imagine a beam of white light impinging on a bubble. When it reaches the first surface of the film, a known fraction of the light is reflected back. But a large portion of the beam enters the film, reaches the second surface and is again in part reflected. The waves from the second surface thus turn back and hotly pursue the waves from the first surface. And, if the thickness of the film be such as to cause the necessary retardation, the two systems of waves interfere with each other, producing augmented or diminished light, quadrupling it, or totally extinguishing it, as the case may be. But, inasmuch as the waves of light are of different lengths, it is plain that, to produce self-extinction in the case of the longer waves, a greater thickness of film is necessary than in the case of the shorter ones. When, therefore, the red is quenched, the blue and green are not quenched; hence the production of color in the case of thin plates.

Various beautiful experiments illustrating this theory were then made. The colors of a thin layer of oil on the surface of water were projected upon the screen. Also, the hues derived from a thin film of air, compressed between two pieces of glass; and lastly, reflected light was thrown through a soap bubble, covering the screen with the most gorgeous prismatic tints.

NEWTON'S RINGS

were then carefully explained, and on curved flat surfaces being pressed together, the curves were beautifully apparent when thrown by the lantern upon the screen. The interference of the waves caused by the varying thickness of the film of air was described and the colors produced pointed out. Then tinted glasses were interposed, and by the monochromatic light the number of rings was greatly increased, so that the whole light circle given by the instrument seemed to be covered with a ripple of alternate light and darkness.

Professor Tyndall then entered upon a lengthy explanation of Newton's method of accounting for the above phenomena in connection with the emission theory. The reference to

OTHER COLORS DUE TO INTERFERENCE

concluded the lecture.

Fine scratches drawn upon glass or polished metal reflect the waves of light from their sides; and some, being reflected from opposite sides of the same furrow, interfere with each other and quench each other. But the obliquity of reflection which extinguishes the shorter waves does not extinguish the longer ones, hence the phenomena of color. These are called the colors of striated surfaces. They are well illustrated by mother-of-pearl. This shell is composed of exceedingly thin layers, which, when cut across by the polishing of the shell, expose their edges and furnish the necessary small and regular grooves. The most conclusive proof that the colors are due to the mechanical state of the surface is to be found in the fact that, by stamping the shell carefully upon black sealing wax, we transfer the grooves, and produce upon the wax the colors.

Correspondence.

Certain Properties of the Solar Rays.

To the Editor of the Scientific American:

I thank you for giving insertion in the SCIENTIFIC AMERICAN (November 16) to my paper on the solar rays, and also for recently calling attention to the importance of the inquiry. Having myself often derived pleasure and instruction from your editorial articles on the higher branches of physics, I may be permitted to express my sense of the great value, as well as of the enlightened spirit pervading its columns, of the influential organ of scientific information over which you preside.

With respect to the repetition of my experiments, you will, I am sure, agree with me as to the indispensable necessity, in any such steps, of reproducing carefully and fully the essential conditions present when the original observation was made. It would hence obviously be quite useless to attempt to obtain here, in the midst of a freezing December, illustrations of solar power equal to those witnessed last July and August, when the thermometer at noon was seldom under 90°, and when people were every day prostrated by heat in the streets of New York.

My latest experiments, those with albumen, were performed at the end of September, when the sun's power had considerably declined, and within a month I placed at the disposal of a scientific journal, circulating throughout the civilized world, a simple statement of the chief facts noticed, and of the conditions under which the observations were made, authenticating this statement by attaching to it my name and professional status in England. I really do not see that I could have done more.

In taking this course, I expected and hoped that my experiments would speedily be repeated and verified. For among the numerous readers of the SCIENTIFIC AMERICAN, many doubtless reside in tropical districts, where conditions similar to those existing here last midsummer continue throughout the greater part of the year. The experiments are so simple (merely requiring an ordinary lens such as those used for examining photographs) that any person can repeat them. If any of your readers, thus favorably circumstanced, should be willing to perform this service in the cause of science, it would be a satisfaction to me to know the results, positive or negative, the actual conditions present as to season, place, temperature, clearness of atmosphere, etc., being detailed; or, if more agreeable, these communications can be addressed to you editorially.

If, in experimenting, any more minute directions should be required, I shall be glad to give any information in my power in reply to letters addressed to me, post office box No. 2,622, New York.

It will be observed that the experiments arrange themselves into three groups, namely: 1. Those on living animal tissues under water. 2. Those with albumen. 3. Those on the penetration by the sun's rays of certain opaque and other media. And, as a general rule, the solar power required to produce satisfactory results in each group follows the same order.

In reference to my mode of experimenting, I may observe that an eminent telegraphic engineer in India has successfully employed the nerves of the finger and tongue to detect the escape of electricity from badly insulated wires, and has found this plan preferable in practice to any artificial test. Neither should it be forgotten that an apparently trivial physiological observation was the seed from which sprung the science of galvanism with all its ubiquitous and magnificent associations.

Nor are my experiments on the penetrating power of the sun's rays at all inconsistent with the facts observed by various eminent philosophers, or with the legitimate inferences from these facts. Thus Melloni found that the penetrating power of rays of heat, emanating from various artificially heated bodies, as tested by different media, was directly proportioned to the actual temperature of the body from which those rays proceeded. What then can be more natural than that the concentrated rays of by far the hottest body known to us—the sun—should possess an extraordinary power of penetrating even many opaque media? The truth is that the facts of nature are always in harmony with each other. It is only man's reasonings and speculations on these facts that are liable to change and error.

In one respect you have slightly misunderstood the purport of my paper. I "claim" nothing but to have performed certain experiments, under certain specified conditions and with certain uniform results. I merely alluded to one or two possible explanations of the phenomena described, but expressly reserved any definite conclusions until more facts bearing upon the question should be accumulated, either by myself or others. And in the concluding sentence I referred pointedly to the obscurity still surrounding the subject, and to the necessity for its further systematic investigation.

In employing this guarded language I had in view chiefly the physiological relations of the solar forces, a field of research yet almost untrodden, but of the highest importance both to science and to humanity. For while every practical physician and every student of hygiene feels compelled to recognize the great influence which the solar emanations exercise upon the human body in health and disease, how little do we know of the rationale or conditions of their action! It has often seemed to me remarkable that, notwithstanding our boasted modern progress, the ancients actually knew more or at least made more practical use in the arts and in medicine of the heating and stimulating effects of the sun's rays than we do.

The whole subject demands extensive experimental examination, for the range of the inquiry is immense. Each sunbeam may indeed be regarded as a little world, peopled by a host of active forces, so intimately commingled and united that the utmost ingenuity of man has not yet succeeded in thoroughly unraveling and clearly individualizing a single thread of that mystic cord.

What do we know positively of the nature of light or heat or actinism, or of their relations to each other and to electricity and to the vital forces?

In conclusion, I need scarcely say that it will be very gratifying to me if the rude, desultory observations, commenced amid the fogs of the east coast of England, should obtain even a partial fruition under the more potent sun and brighter skies of America.

New York city. GEORGE ROBINSON, M. D.

Are not the Elements Molecules?

To the Editor of the Scientific American:

One of the tenets of the modern atomic theory, namely, that no compound can exist where the valences of its component elements are not all satisfied, is universally acceded to by writers on chemistry; but in the very face of this statement, they nearly all rush into what appears to the writer to be a rank absurdity and inconsistency, and perhaps on the very next page they will assert that certain elements, for instance tin, antimony, platinum, etc., are endowed with the extraordinary faculty of behaving as dyads, triads, tetrads, or pentads, indifferently, according to circumstances. A convenient and full explanation occurs to me, by which this apparent inconsistency may be accounted for. *Imprimis:* To me it appears just as irrational to assert that an element can exist where its valences are not all satisfied as that a compound can. What then becomes of the other two valences of the tetrad tin, in the case of stannous chloride, $Sn\,Cl^2$? or of the other two, in the case of antimonious chloride, $Sb\,Cl^3$? My answer to these queries is, not that the valences have vanished, but that they are fully active in satisfying those of another similar molecule, or, in other words, the respective formulæ for the above salts are $\left|\begin{matrix}Sn^{IV}\ Cl^2\\ Sn^{IV}\ Cl^2\end{matrix}\right.$ and $\left|\begin{matrix}Sb^{V}\ Cl^3\\ Sb^{V}\ Cl^3\end{matrix}\right.$.

And now for the deduction from the following facts: If antimony be dissolved in HCl, the trichloride, $SbCl^3$, is only obtained, and in the case of tin, the bichloride, $SnCl^2$, whereas, by projecting powdered Sb into chlorine gas, the pentachloride, or, of tin, the tetrachloride, is obtained. My deduction is that tin, antimony, or any other element, as a single atom, cannot exist, but that every atom, in the uncombined state, is bound by all its valences to one of its own number. Antimony, then, is $\left|\begin{matrix}Sb^{V},\\ Sb^{V}\end{matrix}\right.$ and when acted on by HCl, where the negative affinity of the Cl is in a measure masked by the H, it is only capable of separating three of the Sb valences, and $\left|\begin{matrix}Sb\ Cl^3\\ Sb\ Cl^3\end{matrix}\right.$ results. Project antimony, on the other hand, into Cl gas, and now the powerful negative affinity of the Cl, not being diluted by the H, is capable of cutting apart all five of the antimony valences, and $Sb\,Cl^5$ is obtained. The same is true of tin, and, in fact, instances might be added *ad infinitum*; but is not the above sufficient? My conclusion, then, is, that the elements are constant in their saturating power, and under all circumstances are endowed with the maximum number of valences which they show under any circumstances. R. D. W.

Well Equipped Railroads.

To the Editor of the Scientific American:

The instances of great railroad corporations being completely equipped with all the latest improvements, to render their patrons and employees secure and add to their comfort, are so rare that I request a small space of your valuable, most widely circulated, and carefully read paper to give publicity and due credit to a great line of travel to the far west, embraced in three roads, the Chicago, Burlington and Quincy, Hannibal and St. Joseph, and Kansas Pacific. These have tried all the real improvements offered and have adopted the best, consequently the air brakes, jointed rails, self-couplings for cars, a complete arrangement for heating and ventilating; smooth, well ballasted road bed, and efficient system of signals are adopted by them; these, with a well paid and consequently a good class of conductors, engineers and brakemen, who, feeling that the spirits administering these lines mean to excel, are to a corresponding degree inspired to exert greater care and attention to their duties, render these roads great public benefactors.

By publishing this, you may wake up some of the managers of the dormant roads, who can never see the benefit derived from making improvements. JOHN WHITEFORD.

Detroit, Mich.

Lieutenant Wheeler's Expedition.

To the Editor of the Scientific American:

I was a member of a party which, for the purposes of exploration, was fitted out last July at Camp Douglas, Utah, and left on the 28th of that month for Eastern Nevada and Northern Arizona. The expedition was divided into two main bodies, one intending to take a line south as far as Beaver, the other to go to Nevada, and thence to Beaver, and to explore all the country between the first party and the Nevada State line. From Beaver, we divided ourselves into four sections, and continued south. The country was found to be very rich with silver, coal, and iron, and may be described as a good field for the geologist and the artist. The scenery is beautiful, and there is every variety of stone, limestone, sandstone, and granite being very plentiful. There are diamonds as good as in Arizona to be found in Utah, within 100 miles of Salt Lake city. The great drawback to the locality is poor water and no rain in summer. There is now being constructed, southward from Salt Lake city, a railroad of which about 35 miles is complete. It will run to or near St. George, which is a lively Mormon settlement. Here cotton, castor beans, peaches, grapes, and all fruits needing a warm climate, grow in abundance. Cotton and woolen mills are scattered through the country. The whole of the party will have arrived back in Camp Douglas, by December 20, except one man who was drowned.

Utah Territory. A. F. M.

Explosions produced by High Notes.

A large portion of the explosives known to chemists contain more or less nitrogen. The simplest, and one of the most unstable, of these is the compound of iodine with nitrogen. The iodide of nitrogen, as it is called, is very easily prepared by dissolving finely powdered iodine in concentrated ammonia and filtering. The filter paper is removed from the funnel while wet, and is torn in small strips, which are spread around to dry. Although entirely harmless while moist, as soon as it is dry the compound explodes by the slightest touch with a loud report. What seems most remarkable is that it may be exploded by certain high notes and sharp sounds.

The following interesting experiments with this substance were recently made by Champion and Pellet: Two long glass tubes 13 millimeters in diameter and 2·4 meters in total length were joined by a strip of paper, and pieces of paper with 0·03 grammes iodide of nitrogen placed in each end. Upon detonating one of these with a hot wire, the other also exploded. That the explosion was not occasioned by the pressure of the air was proved by placing a small light pendulum in the tube, and this pendulum was not swayed by the explosion any more than it would be by blowing into the tube with the mouth. Small quantities of the iodide of nitrogen were fastened on the deep strings of a contra-bass, bass viol and violin, and the string caused to vibrate. The deep tones produced no explosion, but a loud one instantly followed when the vibrations exceeded 60 in number. The very high notes produced by touching the strings between the bridge and the tail piece also exploded the iodide.

Experiments tried with Chinese tamtams gave the same results; the bass instrument failed to explode it, but the more rapidly vibrating one, which gave a higher note, always caused the explosion. Two parabolic concave mirrors, 20 inches in diameter, were stationed 8½ feet apart, and paper containing a few grammes of iodide of nitrogen placed in the focus of one mirror and half way between the mirrors. In the focus of the other mirror a drop of nitro-glycerin was exploded, which caused the explosion of the iodide in the focus of the first mirror but not of that half way between the mirrors. Although other explosives fired off in the focus of the second mirror will produce a like effect, yet this is not due, as might be claimed, to the heat, since 0·03 grammes of nitro-glycerin, which produces no more heat than 0·9 grammes of gunpowder, will produce an explosion requiring 8 to 10 grammes of powder. The mirrors were then obscured with smoke, when 10 grammes of powder were unable to explode the iodide, but, even under these conditions, 0·03 grammes of nitro-glycerin sufficed to accomplish the result.

A MAN out West wants a patent on an invention calculated to prevent the bungling method of executing criminals, that has now grown so common. In case the vertebræ of the condemned are not scientifically dislocated at the first fall, the rope instantly lowers the victim safely to the ground, lassoes the sheriff and his assistants, jerks them fifty feet into the air and drops them on the nearest picket fence. This device is known as the "Automatic Avenger."

Printing Presses.

Probably the machine which attracted the most attention at the London International Exhibition, last year, was the Walter press, used for printing the *Times*, representing, as it does, what may be termed a revolution in newspaper printing, and being also exhibited for the first time to the public. It is constructed on a principle which it is now seen is the only road to progress in the designing of fast printing machines—namely, a continuous roll of paper continually being brought between the impression cylinders. Hoe's machine, which was a great improvement in this direction, is completely eclipsed by the Walter, which saves an enormous quantity of labor, and delivers the papers, printed on both sides, at the rate of about 12,000 an hour. The American Hoe 10 feeder, by an arrangement of flyers, dispensed with takers off, but required ten persons to lay on the sheets. The Walter, on the contrary, requires neither layers on nor takers off, but, as a matter of fact, two persons attend the sheets as they are laid down by the machine, in order to avoid any hitch in the process or any delay to the progress of the work. [The Walter machine is a modification of the new American machine known as the Bullock press, largely used in the United States.] In the Hoe, at each of the places for delivery of the printed sheets, a frame work of laths was provided, which, actuated by cams, moved through the space of a quarter of a circle. When this flyer stood at right angles to the delivery board, it was in a position to receive the sheet from the tapes which brought it from the printing cylinder. Having obtained its burden, it commenced the descent, deposited the sheet on the heap, and returned for another. This operation was, or rather is, for the machine is still used by some morning papers and *Lloyd's*, performed with such regularity that takers off were dispensed with, all that was required being the removal of the heap when a certain number of papers had been deposited on it. The Walter, on the other hand, while preserving this feature in a modified form, dispenses with layers on. The paper is supplied in an immense roll, containing generally some 6,000 sheets, and is mounted at one end of the machine. The end is passed through an arrangement of four rollers covered with blanket, one of which dips into a trough of water, so that the paper is equally damped, while the pressure exerted by the others—the grip being necessary to insure the advance of the web and the unrolling of the cylinder of paper—also secures the requisite uniformity of dampness in the substance of the paper. The paper thus damped passes to the printing cylinders, four in number, placed one above another, the upper and lower of which carry the stereotype plates, and the two inner being the impression cylinders proper, pressing the sheet between their blanket covered surfaces and the face of the type. From the printing cylinders the paper, now printed on both sides, passes to the dividing rollers, where the web is cut up into newspapers. These rollers consist of two blank cylinders, the circumferences of which are equal to the breadth of the open sheet of the *Times*. Between these the printed web of paper is passed on its way from the printing cylinders to the tapes by which it is to be distributed. In one of these blank cylinders is a deep fluting parallel to the axis; this is a sheath into which the edge of the knife enters. In the other cylinder is a projecting knife having on each side of its entire length a copper guard held in projection by springs. If pressure is exerted on these copper guards, they are depressed and the knife exposed. When the pressure is removed, the springs recover their position. When the guard approaches the deep fluted roller, it is depressed, and between it and the upper roller the web of paper is held for a very small fraction of a second. With a rapidity too great for the powers of vision the knife acts, the other side of the cut being held by the other spring. But the separation is not yet complete. The knife is not one continuous blade, but is formed of long angular projections; these perforate the paper so that the sheets are nearly, but not quite, separated, a narrow strip being also left unperforated at each margin to preserve the integrity of the sheet till the web has entered between the endless tapes. These tapes pass over two rollers, the sheet being gripped between, and as they are revolving at a higher velocity than the web is traveling, the sheet is separated and conveyed to the distributing frame slightly in advance of the succeeding sheet. This frame consists of a flyer, working backwards and forwards between uprights. The sheets pass over a roller at the top of these uprights, and are laid down by the flyer alternately on either side, the distance traveled over by the frame, or flyer, being sufficient to deposit the newspaper in a place of safety, and to afford time for the next paper to advance so far that it is deposited on the other side by the return motion of the flyer.

Metallic Manganese.

Although manganese is one of the most abundant metals, possessing great hardness, and, from its close resemblance in many respects to iron, we might expect to find it of great use in the arts, its reduction from its ores has been so difficult and expensive that metallic manganese is to-day a curiosity found only in the college collections and metallurgical museums. Mr. Hugo Tamm has recently succeeded in inventing a flux, or rather two fluxes, which seem to solve the problem and promise to give us cast manganese in large quantities at reasonable prices.

A white flux is first made from: Pulverized glass (free from lead), 63·0 parts; quick lime, 18·5 parts; fluor spar, 18·5 parts.

Of this white flux he takes 34 parts and mixes it with 5·5 parts lampblack or soot and 60·5 parts good pyrolusite or black oxide of manganese. When fused in a suitably protected crucible, he obtains 17·5 parts of crude manganese and a beautiful olive green slag, which is pulverized and used for reducing more of the ore, under the name of green flux.

A crucible which will withstand a white heat for hours is then lined with a mixture of 3 parts graphite and 1 part fire clay stirred up with water to a thick dough. This lining protects the crucible from the action of the flux, which at that high temperature would destroy even a graphite crucible.

When about to begin the operation of reducing the ore, 91 parts of good soot or lampblack are intimately mixed with 1,000 parts of pyrolusite, after which 635 parts of the green flux above mentioned is slightly mixed with it, and enough of any sort of oil added to moisten the mass. The charge is next pressed into the crucible and covered with a thick, round, wooden cover, which is, of course, charred in the fusion, and thus protects the contents. Over this is placed a cover of graphite or clay, an opening only being left for the escape of the gases generated during fusion.

The crucible and contents are first heated gradually as long as gases are given off, then the heat is rapidly increased by a blast up to a white heat and kept there several hours, the time depending on the size of the charge. When the reduction is completed, the heat is lessened and the crucible allowed to cool before the contents are removed. The olive green slag is ground up and used again, mixed with about one tenth its weight of white flux.

The manganese obtained in this way contains about 3 per cent of impurities, principally iron, aluminum, silicon and carbon. The contaminations being similar to those in cast iron, Mr. Tamm proposes to call it "cast manganese." It may be refined according to Berthier's method, by fusing in a fire clay crucible with one eighth its weight of carbonate of manganese, a wooden cover being used to prevent oxidation.

The value of Mr. Tamm's discovery becomes evident when we compare the simplicity and cheapness of his process with those previously employed. Brunner obtained it by reducing the chloride or fluoride with sodium, after the method of Deville in preparing aluminum. It had also been obtained in small quantities by repeated fusions of the protoxide with charcoal and oil. The happy thought of adding to this some ground glass and fluor spar renders a single fusion sufficient to reduce a native ore, instead of requiring several fusions and much trouble in preparing a protoxide from the carbonate.

Metallic manganese has somewhat the appearance of cast iron. It is hard enough to scratch steel and cuts glass like a diamond. It has the effect of rendering steel itself harder and better. In the Bessemer process, manganese is introduced into the converter in the form of spiegeleisen. This property of its hardness will, no doubt, render it very valuable in the preparation of alloys. In its pure state, we cannot expect to use it extensively, owing to its oxidizing so readily that specimens of it require to be kept in closely stopped bottles or under naphtha. It decomposes water like sodium, but less rapidly, and does not reduce metallic salts like the last named metal.

It is only fusible in the strongest heat of the blast furnace, and this refractory property is communicated to its alloys. When heated, it shows a play of colors at different temperatures, like steel, and is covered with a brown film of oxide. It is about as heavy as iron, for which it would be mistaken by the careless observer, but the difference would be easily detected on applying a magnet, by which it is but slightly attracted, if at all. The truth is we know very little about the properties of manganese, as it has never been prepared pure in large quantity. Manganese and copper afford an alloy very similar to German silver.

How a Yankee Boy made a Meteor.

The Springfield *Republican* tells rather a flighty story of a well kept secret, which suggests that some of the modern meteors, which are constantly being discovered, may be accounted for in similar manner. The story goes that a boy, well back in 1811, made a kite and attached a lantern to it, in which he put a candle and arranged it so that, when the candle had burned out, it would explode some powder which was in the bottom of the lantern. He kept the secret entirely to himself, and waited for a suitable night in which to raise his kite. The boy got his kite into the air without being discovered, for it was so dark that nothing but the colored lantern was visible. It went dancing about in the air wildly, attracting much notice, and was looked upon by ignorant people as some supernatural omen. The evil spirit, as many supposed it, went hobbling around for about twenty minutes, and then exploded, blowing the lantern to pieces. Next morning all was wonder and excitement, and the lad, who had carefully taken in his kite and hidden it after the explosion without being found out, had his own fun out of the matter. The people of Brattleboro' never had any explanation of the mystery until nearly sixty years afterward, when the boy who had become quite an old gentleman published the story in a Brattleboro' newspaper.

The Manufacture of Carbon.

About a year ago Mr. Haworth, a gentleman from Boston having heard of the burning well at Cumberland, Md., tested the quality of the gas, and was satisfied that he could put into operation a scheme or plan of his own for the manufacture of carbon from the gas. Accordingly, the well was leased or purchased by Mr. Haworth and others, known as Lamb and Co., and a patent obtained for the manufacture of carbon, according to the plan of Mr. Haworth. A building was constructed and the manufacture of carbon commenced about six months ago. There are now in operation six hundred and sixty burners, each burner consuming eight cubic feet per hour. The gas is allowed to burn against soapstone plates, on which the carbon is deposited in the form of soot. By a very neat mechanical arrangement, the soot is scraped off and deposited in large tin boxes about three feet long, and a foot and a half wide, and a foot and a half deep; scrapers are passed along the soapstone plates every twenty minutes, and the boxes are filled on their fourth passage. A large building is now in course of construction, twice the size of the present one, and will have in use thirteen hundred and twenty eight-feet gas burners. The present consumption of gas amounts to about one twelfth of the whole quantity escaping from the well. When the new building is completed and the burners put in operation, the total consumption of gas, by the burners of both buildings, will be one fourth of the whole.

The carbon is used for the manufacture of ink, and these works, we believe, are the only ones of the kind in the world.

Patents in Germany.

Although the various states of Germany are united in one confederation for certain purposes, such as defence, commerce, etc., in relation to patents they are separate, and each State has its own patent laws. Some twenty patents are required to cover all the German states. The project of establishing a general patent law has been under consideration for some years, and there is now every probability of an early reform; however, there is considerable diversity of opinion on the subject. Some chambers of commerce, notably that of Leipsic, are in favor of the total abolition of patents: but the majority of competent authorities appear to favor the scheme of proposals put forward by the Association of German Engineers, of which the following are the details:

1. The patent system of Germany shall be unified and centralized:

2. A patent shall confer upon the inventor or his assigns the exclusive right and title in his discovery:

3. There shall be no preliminary examination:

4. As regards the novelty and priority of the invention, an inquiry shall be instituted only when exceptions have been taken and objections made within a definite period; the invention shall be made known immediately upon the application for a patent, subject and entitled, however, to provisional protection:

5. A commission composed of judges and experts shall be summoned to take cognizance of the objections, and to hear all persons interested:

6. There shall be an appeal to a superior court:

7. The following shall not be fit subjects for, or capable of, being patented, namely:

a. Purely scientific principles, without any definition or description of the mode of application;

b. Things prejudicial to public order, and contrary to law and propriety:

8. The duration of the patent is fixed at 15 years:

9 The patentee shall not be obliged to develope and carry out his invention:

10. The patent, though gratuitous for a certain number of years, is thereafter subject to a progressive tax:

11. The patent shall become void at the end of 15 years, or in default of due payment of the imposts:

12. Foreigners shall be fully entitled to obtain patents in the Empire:

13. The State may appropriate any patent, duly indemnifying the patentee:

14. Every patentee may work and develope the object of his patent throughout Germany in whatever way he may think fit.

These are liberal propositions, and, if a corresponding law is enacted, it will greatly add to the prosperity of Germany.

A Conflict with a Wheelbarrow.

The following must have emanated from a person who had experience in tumbling over a wheelbarrow (and who has not?) to have enabled him to so graphically describe the sensation:

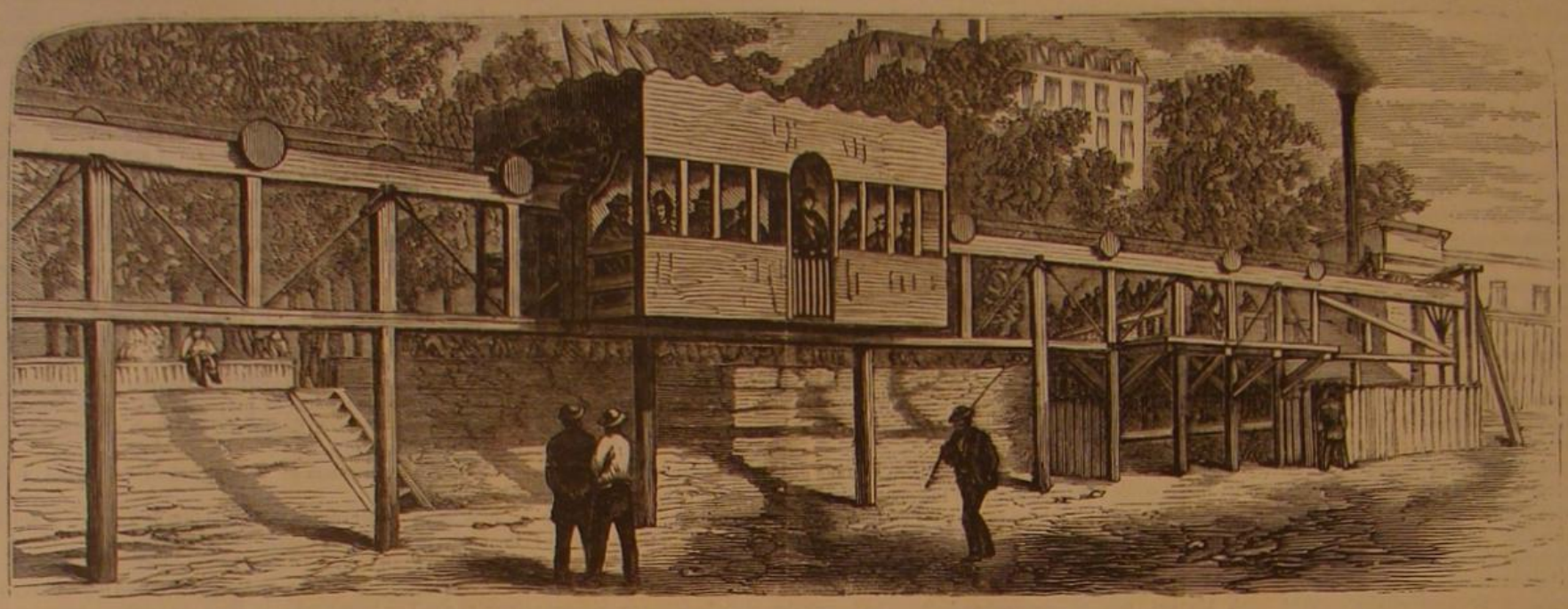
If you have occasion to use a wheelbarrow, leave it, when you are through with it, in front of the house with the handles toward the door. A wheelbarrow is the most complicated thing to fall over, on the face of the earth. A man will fall over one when he would never think of falling over anything else. He never knows when he has got through failing over it, either, for it will tangle his legs and arms, turn over with him and rear up in front of him, and, just as he pauses in his profanity to congratulate himself, it takes a new turn and scoops more skin off him, and he commences to evolute anew, and bump himself on fresh places. A man never ceases to fall over a wheelbarrow until it turns completely on its back, or brings up against something it cannot upset. It is the most inoffensive looking object there is, but it is more dangerous than a locomotive, and no man is secure with one unless he has a tight hold of its handles, and is sitting down on something. A wheelbarrow has its uses, without doubt, but in its leisure moments it is the great blighting curse on true dignity.

As the buckwheat season is upon us, the following substitute for greasing the griddle is recommended: Take a turnip, cut in half, rub the griddle with the inner side, and, it is said that, the cakes will come off nice and smoothly, and the housekeeper will be rid of the disagreeable odor of burning fat.

THERE will be an Exhibition of Science and Art in Bombay, in February, 1873.

THE LYONS EXPOSITION ELEVATED RAILWAY.

During the recent Exposition in the Park of the Golden Head, in Lyons, France, the curiously constructed elevated railway, shown in our illustration, was built to convey visitors from the Bridge of Morand to the gate of the Park. The mode of propulsion, it will be noticed, is very nearly the same as that first introduced in the Greenwich street railway, in this city. It consists simply of endless wire rope passing over drums at either extremity of the route, and actuated by powerful engines. The car is supported on trucks running on the single upper track, and of course can be readily disconnected from or attached to the constantly moving rope whenever it is required to arrest or resume its motion.



THE LYONS EXPOSITION ELEVATED RAILWAY.

This form of railroad, we learn, worked with satisfactory esults over the short distance it was required to traverse. Its safety is plainly apparent, the entire weight of car and load being entirely beneath the wheels, so that no accident can happen except by the track giving way. The single upper rail is strongly made of wood, bolted together with heavy bolts and stays; the lower rail, acting as a guide for the car, is similarly built, and also serves as a brace for the upright pillars. The car was constructed to accommodate from sixteen to twenty people, and made in two sections, the openings being, as shown, in the sides.

IMPROVED BLAST FURNACE.

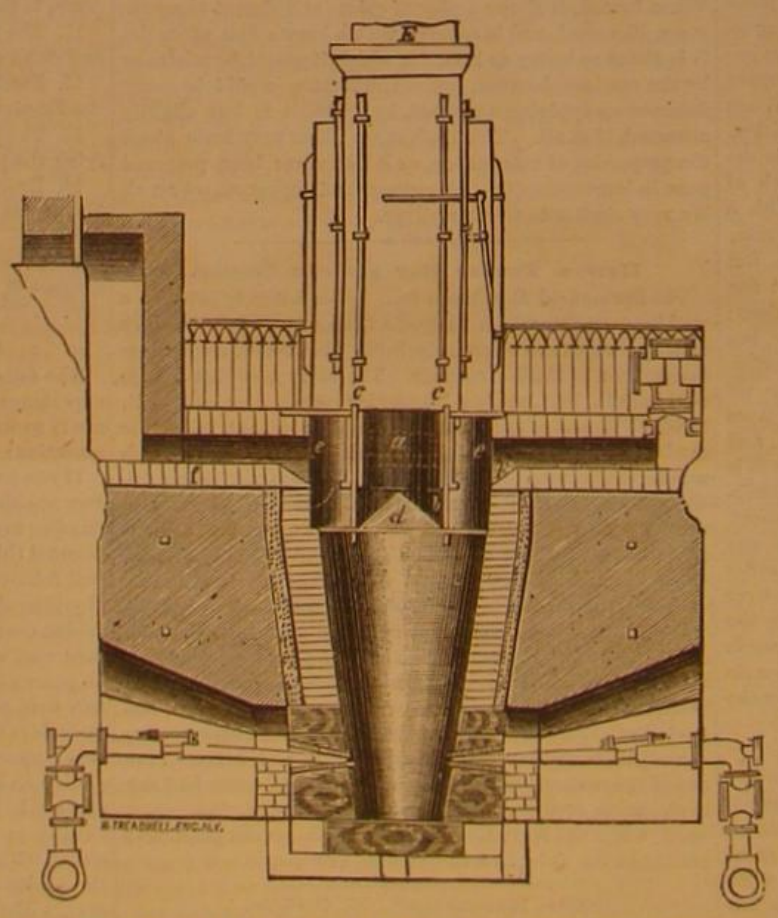
The utilization of brown coal or lignite, unmixed with other fuel, for the blast furnace, has thus far been an unsolved problem, it having been used at most in the quantity of one fourth or one fifth of the charge, the remainder being charcoal or coke. When used in larger quantity, it did not produce a sufficiently high temperature, and since it crumbles readily into fragments, its application for the production of iron has thus far been only a limited one. Turner, we believe, first pointed out the necessity of smelting under a high pressure, with hot blast and a larger addition of lime. Mr. A. Eilers, of this city, in a paper read before the American Institute of Mining Engineers, "On the Metallurgical Value of the Lignites," expressed substantially the same ideas. "To burn that material in the blast furnace," he said, "cylinder blasts are required, and perhaps it would also be necessary to close the top of the furnaces, in order to smelt under a high pressure, which may be regulated by the damper in the flue. The extraordinary results thus obtained, in producing high temperatures, by Bessemer are too new to require recalling. Nothing of this kind has, however, yet been tried in the West, but I hope that, during the present year, this subject will be thoroughly investigated."

The subject under consideration is evidently one of immense importance to the great West and Southwest. It is well known that those districts which abound in valuable iron ores are essentially barren, containing but little wood except cotton woods and willows; moreover they are devoid of either anthracite or bituminous coal. Yet there occur vast beds of lignites or brown coal. This coal is mostly of a black color and a resinous luster, and is streaked with brown, but is devoid of any wood structure. According to Professor Newberry, these lignites underlie not less than 50,000 miles in the Great Basin and along both flanks of the Rocky Mountains. At present a great deal of this fuel is being used on the locomotives of the Union Pacific and Central Railway companies, where no high temperature is required; but the use in blast furnaces, for the reasons referred to, is now virtually given up. If a method was discovered, or a furnace invented, by which this fuel could be directly used, namely, without the employment of costly gas generators, it would be of the utmost importance, for the railroad companies could then produce their own rails, and the various industries of those regions, depending on the use of iron, would receive a fresh impulse.

We herewith present an illustration of a blast furnace, invented by Mr. Khern, of Austria, which is said to fulfil all requirements. It is not stated where it is in operation, but should it prove successful, it cannot fail to be of great service to the manufacturer.

The following is a translation from a late number of the *Illustrirte Gewerbezeitung*, relating to this furnace: "Assuming that, in the higher zones above the belly, no alteration of the ores takes place, but that reduction and carbonization only commence in the latter, Mr. Khern accomplishes the preparation of the materials outside of the furnace, and this does away with two thirds of its whole hight. The same is only seventeen feet high, or as high as the belly, the ascending gases being used in this particular apparatus to char the lignites, to roast the ores, and to heat the blast. *a* is a cylinder for the reception of the ore and the prepared fuel; *b* is another cylinder which, when lifted by means of the rods, *c*, attached to levers, allows the charge to drop over the cone, *d*, into the furnace. *e* is a reservoir for the gases; these pass through *f* to the ovens for carbonizing, to the roasting furnaces and the apparatus for heating the blast, to be conveyed to the stack, E. The ovens for carbonizing are built in such a manner that the gases, issuing from the furnace, pass through two channels divided by a partition, above which there are, in two rows, eighteen or twenty boxes, made of cast iron, of a capacity of one tun each. They are provided with covers, and serve for the reception of the fuel. The bottoms, as well as the sides, are exposed to the gases, and pipes convey the generated tar vapors into condensers. Such a blast furnace, with the other furnaces mentioned, is said to cost $46,500, gold, and it is stated that 100 pounds of white pig iron may be produced by it for $1·07, gold, which would make $23·96 for the long tun of 2,240 pounds.

In conclusion, we would remark that Mr. Brunner finds the hight of the furnace too low for the complete reduction and carbonization of the ore, but states that coked lignite was used in Austria in the quantity of one third of the charge of charcoal with complete success.



KHERN'S BLAST FURNACE FOR THE USE OF LIGNITE.

The Marinoni Press.

At the London Internation Exhibition was exhibited a six feeder Marinoni, printing the *Echo*, which is an improvement on Hoe's, and prints both sides of the paper at the rate of about 10,000 sheets per hour, or 20,000 copies of the newspaper, as the *Echo* is worked in duplicate. In its general features, it is similar to Hoe's, but the impression cylinders are, of course, doubled to obtain the printing on both sides of the sheet. The arrangement of flyers for taking off of course dispenses with labor, but six men are necessary to lay on the sheets. Each sheet represents, as we have said, two papers, which are divided by a rotating circular knife in the middle line of the machine, cutting the paper in the direction of its travel. Both this machine and the "Walter" exhibit a very great advance in fast working printing machines, but while the principle of the former has probably been brought as near to perfection as possible, the application of that of the latter is only in its infancy as regards the production of vast numbers of newspapers in an incredibly short space of time.

Twenty Dollar Tea.

The greatest dainty that the palate of a Chinese craves is *fan chow*, the flower of tea. A San Francisco *Chronicle* man had the opportunity, a few days ago, to sip the imperial tea bloom, the priceless beverage of celestial extravagance. Learning that the enterprising firm of Castle Brothers, 213 and 215 Front street, had samples of a very rare tea, he visited the counting room of that firm, was shown the samples, and directed to Tuck Chong & Co., Chinese wholesale merchants, at 739 Sacramento street, for information. Tuck Chong, an urbane Chinese, received the reporter kindly, listened to his request to be shown the imperial leaf, and brought in the priceless luxury in a small and highly ornamental box of sandal wood. The slide lid was pulled out, and six alternate layers of perfumed rice paper and silk were carefully lifted.

Beneath all this covering was a gilded square piece of sandal wood. This also was lifted, and the tea blossom was displayed. Rolled in balls, twisted into tiny, flame-shaped rolls an inch long, twisted very small, tied in little bunches, like cigarettes, at one end and whipped into shreds at the other, was the tea flower, packed in loose petals of its own kind, to preserve its fragrance.

"This," said Tuck Chong, "is a tea that only mandarins of highest rank ever get a chance to drink in China. It is grown on the plantation of a very rich mandarin, in the province of Foo Chow, and can only be gotten from him or his agent in Pekin. There was once a law forbidding its export, but even an American can now buy and drink it. It costs $10·50 in China. My brother brought back a few pounds on his last visit to China. I have none for sale, but it could not be sold in San Francisco for less than $20 a pound."

FLEXIBLE STONE.—We are indebted to Mr. Samuel J. Blume, of Nazareth, Pa., for a specimen of itacolumite, or flexible stone, a curious mineral, of which he is in possession of several samples obtained by him in Stokes Co., N. C. In Brazil and the Ural mountains, diamonds have been found in the itacolumite rocks; but, in general, the diamonds are obtained from the soil in the vicinity of the above rocks.

A SPRING of naphtha has been discovered at Caserta, Naples.

THE GREAT LAXEY WATER WHEEL.

Probably the largest water wheel in the world is that represented in our illustration. It is located at Laxey, Isle of Man, in which village are extensive mines which have now been worked for several centuries, and which are noted for their richness in copper, lead, and silver ores. The deepest workings extend 1,380 feet below the surface, and are drained chiefly by the powerful pumps operated by this immense motor.

The wheel was erected by Mr. Casement, a Manx engineer. It is known as the "Lady Isabella," after the wife of a former governor of the island, and was started September 27, 1854. It is of about 200 horse power, and can pump 250 gallons of water per minute from a depth of 400 yards. Its diameter is 72 feet 6 inches; circumference 217 feet 6 inches. Its breadth is 6 feet, and it has a crank stroke of 10 feet. The water for driving it is brought from a reservoir on a neighboring hill. The wheel and its fittings are, as represented in our engraving, supported on an elegant structure of iron and masonry formed in open galleries.

The only water wheel approaching the one above described in magnitude, in the United States, of which we are at present aware, is that which supplies power to the Burden Iron Works, in Troy, N. Y. This is an overshot wheel, 50 feet in diameter and 22 feet in breadth.



THE GREAT LAXEY WATER WHEEL.

A Suggestion for Electro-platers.

We would throw out a suggestion, says the *Building News*, which has occurred to us in connection with electro gilding, namely, we cannot see why a pattern or ornament (similar in character to the old style called damascening) could not be either printed or penciled upon the articles to be plated, with a varnish or medium which would prevent the deposit of the electro silver or gold upon the parts which it covers, and which would be easily removed after the article has been electro gilt. If this could be done a wide field would be opened up for its application, as, for instance, supposing an article was first plated with silver, and then a damascene pattern was put on the silver in the manner above described, and then the parts left uncovered were plated with gold, we should have a work of art of a very high class, at a comparatively low cost, the pattern being gold upon silver, or *vice versâ*. As to the practicability of the operation, we have no manner of doubt whatever, and, therefore, commend the hint to those whom it may concern.

Envelope Making.

At the recent International Exhibition in London, a series of machines were exhibited by Messrs. Dickenson, manufacturing envelopes from the roll of paper to the finished article, gummed and counted into packets. In this series the web, as the roll of paper is called, is drawn along by suitable rollers and cut into sheets, one of the chief features of the machine being the method of varying the rate of advance of the web, or, in other words, the size of the sheets. On the roll shaft and that of the knife are deeply flanged pulleys, the rings of which are in segments; the radial arms carrying these segments are operated on by wedges attached to a collar which can be slid along the shaft, so that, when the wedges are brought into play, and to just the extent to which they are advanced or withdrawn, the pulley is increased or decreased in diameter. The circumferential proportions of these pulleys are preserved by an ingenious piece of mechanism, so that the driving belt in connection with them is always at the same tension. When the sheets are cut to size they are passed through milling rolls, where they are glazed, and are then piled to about an inch in thickness under a shaping press consisting of a series of punches, which cut the heaps into the shape of an opened envelope. The operations of gumming and folding are accomplished by ingenious mechanism which could not be explained without elaborate drawings. Several machines were exhibited for effecting these operations, one of which lifts each envelope from the heap by a pneumatic plunger, and hands it over to the gumming mechanism. The lip of the envelope is sometimes embossed by the cutters at the same operation as the cutting, but special embossing is performed by a separate machine, as are also the black borders and the folding. As may be supposed, these machines, from their complicated construction, are expensive, but they are models of mechanical ingenuity. Bookfolding and newspaper folding machines were also exhibited, but these do not afford so remarkable a saving of labor and time as to insure their general adoption.

To the New York and New Haven and Hartford Railroad Company is accredited the following brilliant plan for keeping switchmen awake: It is proposed to have the lever of the switch in a sentry box, so arranged that when the switch is open the door is shut and locked, and can only be opened by closing the switch. If a train comes along while the switch is open, it is sure to smash the sentry box first, and the switchman can only save his life by attending to his business. He is not likely to sleep much when trains are due on his track.

TURNING THE TABLES.—An Irish gentleman, of a mechanical turn, took off his gas meter to repair it himself, and put it on again upside down, so that at the end of the quarter it was proved that the gas company owed him £3 7s. 6d.!

PITTSBURGH has eleven blast furnaces in operation. At present prices of iron the proprietors of these furnaces must be a cheerful class of persons.

Continuous Expansion Engines.

At a recent meeting of the London Association of Foremen Engineers, Mr. Nicholson referred to the continuous expansion engine, made by Mr. John Stewart, Blackwall Iron Works, which, he stated, is the only engine on the compound principle now in the market as a competitor to the Woolf machine. The steam is worked in a different channel from any other engine. It is cut off at about half stroke on the small piston. At the time the small piston passes the cellular ports in the sides of the small cylinder, the two pistons begin to share the steam between them. At the same time they begin to expand the steam, when the small piston has finished its up or down stroke. The large piston continues to expand the steam until nearly at the end of its stroke, which causes it to be, as its name indicates, really a continuous expansion engine. The steam is a less time exposed to the atmosphere than in the ordinary compound engine; it gives out a steady motion, and each cylinder can be worked separately at pleasure, which is a great consideration in case of a break down.

This engine is applicable to all purposes, and more particularly where a steady motion is required, such as flour or cotton mills. It is nearly as economical when working non-condensing—commonly called high pressure—as the ordinary condensing engine, and is well adapted for American rivers. The steam could always be worked to within one pound of the atmosphere, and no more noise would be heard than from a condensing engine.

The difference between the continuous expansion engine and the ordinary compound engine is that, in the latter the steam has to expand in the first cylinder until nearly the end of the stroke: then the steam passes to the second cylinder. If cut off at half stroke, the steam would then be half of the boiler pressure, before it entered into the apertures prepared to receive the steam previous to acting on the second piston. In the continuous expansion engine (the steam going through a different channel, and as soon as the piston passes the cellular ports in the side of the first cylinder, the two pistons sharing the steam between them), it is therefore absolutely necessary to proportion the engine with minimum ports and not to throttle, in order to get the maximum power. That is the reason why the hollow valve or traveling steam chest is introduced between the two cylinders, to receive the steam from the first and pass it to the second. The steam does not enter the chest; it passes through the hollow valve, which is nothing more than the continuing of the steam ports from the one cylinder to the other. Both pistons are running in the same direction, and the pressure of the steam on the large piston is just in proportion to the space that is filled; the smaller the spaces, the greater the pressure, that is, minimum spaces and maximum power. In the compound or, rather, Woolf system of working, the greater the pressure on the large piston, the greater the resistance on the small piston. Not so in the continuous expansion engine. Instead of a resistance, there is a great assistance by a vacuum being formed in the first cylinder as well as the second. Very long stroked engines, working from 12 to 14 strokes per minute, would not give such good results by being connected to the condenser; but engines running from 60 to 100 strokes do not allow time enough for the cooling to take place in the cylinder; therefore the continuous expansion engine will give out considerably more power with the same area than any other compound engine yet discovered.

A CORRESPONDENT, J. W., of Ill., in writing on the criminal negligence of large corporations, states that the superintendent of a railroad in his State has been heard to say, when applied to for employment: "Wait a while; there will be a vacancy soon. We kill or cripple a man every day."

THE PROGRESS OF CHEMISTRY IN 1872.

The year that has just closed has not introduced to us any startling discovery, or produced an invention which is likely to work a revolution in any art; but it has added its fair share to the general stock of knowledge, and its contributions may be said to compare favorably with those of times past. It may be well to review some of the most conspicuous chemical events of the old year, in order to make a fair beginning on the new. The continuous and economical manufacture of chlorine gas, directly from hydrochloric acid without the intervention of manganese dioxide, as proposed by Deacon, has been improved and perfected during the year, and may be set down as one of the most important contributions to chemical technology of recent times. A heated mixture of atmospheric air and hydrochloric acid gas is made to pass through tubes filled with fragments of brick saturated with a solution of sulphate of copper, or is driven through a reverberatory furnace, the floor of which is covered with bricks filled with a copper salt, and at a temperature of 370° to 400° C. The hydrochloric acid is thus decomposed and chlorine gas is liberated. If the heat be increased to 425° C. considerable chloride of copper is volatilized and there is a considerable loss of the reducing material. The importance of an invention of this character can readily be appreciated by all who are familiar with the enormous consumption of chlorine in England and this country. Hydrochloric acid may be said to be an incidental product in England, and it has therefore long been employed in the production of chlorine by the manganese process. To enable the manufacturer of bleaching powders to dispense with manganese and substitute a continuous copper method constitutes the chief merit of Deacon's invention.

The artificial production of alizarine from coal tar, which merely dawned upon us a year or two since, has, during the past year, been brought up to the standard of a commercial success. The reasoning by which the inventors of artificial alizarine arrived at their results is one of the best illustrations of the value of applying real scientific training to the solution of technical problems. Two chemical manufacturers in Germany, Messrs. Graebe and Liebermann, in their study of a class of bodies called *quinones*, came to the conclusion that alizarine was one of them, and to prove this, they passed the vapor of natural alizarine obtained from madder over heated zinc dust, and obtained a product which proved to be in every way identical with anthracene. Having made anthracene from alizarine, the next step was to reverse the process and produce alizarine from anthracene; this they were finally enabled to do in a circuitous manner, but sufficiently economically for commercial purposes. Artificial alizarine is now largely made and employed as a substitute for the natural Turkey red of the madder root. Attention has consequently been called to anthracene, which, occurring in small quantities among the products of coal tar distillation, has not been hitherto much studied or appreciated. The demand for it as a source of color has invited the study and invention of chemists, and during the past year, Messrs. Fenner and Versmann have discovered more economical methods of preparing it from pitch as well as tar, and there is every indication that they may be able to separate it commercially from the native asphaltum of Trinidad. Thus anthracene, which few persons have ever seen or heard of, bids fair to become an article of large manufacture for use in the production of colors. There are so many articles of value which are now made from coal tar that it is safe to predict that, if it were not incidentally produced in the manufacture of illuminating gas, we should soon have works started to give us the tar required in numerous industries. It is not many years since the tar of the New York gas houses was allowed to run away into the North river. It would certainly be curious to see works created to manufacture it, while the gas was allowed to escape into the air. Such a reversing of the ancient order of things is not impossible, however improbable it may seem. At the present time, there are fifty-six distinct products resulting from the distillation of coal. Only a few of these are of direct practical value, a majority of them being less known than was anthracene a year ago. Every year witnesses the picking up and utilizing of one or more of these compounds; and if chemists did not continually add to the number, we might hope before many years have passed to get through the entire list.

There is another product of Nature which has received great attention during the past year, and that is cellulose. The chemical properties of cellulose have long been understood, and its use in many arts dates back to remote antiquity; but nevertheless it has been subjected to close scrutiny in late years, and its applications have been proportionately extended. We have paper, gun cotton and clothing made from cellulose; and during the past year, we find it taking the place of parchment and membrane for many purposes; and, as a good solvent has been found for it, it is made into strong bands to be employed as substitutes for leather, and is applied to the manufacture of roofing, gas pipes, water conductors, safety fuses, hats and boots; and the best photographic collodion is now made from precipitated cellulose. These are only the beginning of the purposes to which it is safe to predict that cellulose will some day be applied.

The chemistry of fermentation has been the subject of considerable controversy during the year, and Pasteur, the champion of the germ theory, has invented a new process for brewing beer, which is attracting much notice in this country and Europe. We gave a full description of it a short time since. According to Pasteur's process, the fermentation is accomplished with the exclusion of the air, and thus the deterioration due to the absorption of oxygen is avoided. It remains to be seen whether the French "revenge beer" will eventually drive the German lager from the market.

In the economical use of furnace slags, there has been much improvement during the year. The unsightly accumulations about blast furnaces bid fair to disappear; and by degrees, we shall see the slags worked up very much as the waste tar has been, after many years of study. The slags are useful for glass, for cements, for fluxes, for artificial stone, for alum, for fillings, and for the production of chemical salts. Many German furnaces now sell them for a moderate sum, which will doubtless be increased as new uses are discovered. The progress in this direction during the past year is one of the most satisfactory we have to record.

The interest attached to nickel plating has in no way flagged; but, on the contrary, the processes have been greatly improved and the application of the art has been extended in all directions. One of the most important improvements has been that of nickel plating for facing type. The hardness of nickel makes it very desirable for this purpose.

In the direction of tanning, we have recorded a few inventions; and the attention of chemists to the best methods for obtaining concentrated extracts of tannic acid is meeting with encouragement.

The general topic of disinfectants and antiseptics has been discussed and experimented upon, but not much valuable information has been added to our previous store of knowledge. The distinction between a disinfectant and an antiseptic is now better understood, and as the paths of investigation are cleared of rubbish, we may anticipate important discoveries in this line in the future.

The cheap production of hydrogen was announced by Du Motay, and the oxyhydrogen illumination of the same inventor still struggles on without finding acceptance among gas men. The ozone generators which are in the market do not offer this modified oxygen cheap enough to admit of its use as a bleaching agent. But ozone is still claiming a large share of attention. Houzeau quite recently invented an ozonizer, described in these columns last summer, similar to the one exhibited at the last fair of the American Institute. Now comes M. Boillot with a new and improved form of ozonizer constructed as follows: A tube 13 inches long and ½ an inch in diameter is covered externally, for 11 inches, with powdered coke attached with gelatin. Another tube 11 inches long and ¼ inch in diameter was similarly covered with carbon and placed within it, and both enclosed in an outer tube of glass. A current of oxygen was passed between the cylinders, one tube was connected with one pole of an induction machine and the other with the other pole, and a silent discharge kept up for several hours. A large quantity of ozone was thus obtained. P. Thénard publishes a method of measuring the ozone produced by determining the amount of arsenious acid that it is able to convert into arsenic acid. This test might, perhaps, be used in comparing the results produced by various forms of ozone generators. The peroxide of hydrogen, which is also a powerful oxidizer and is likely to be of great use if any easy and cheap method of preparation can be discovered, does not convert arsenious into arsenic acid, and hence there is a readily noticed distinction between them.

H. Struve has noticed that, when freshly precipitated carbonate of barium is exposed to a low red heat, a small quantity of peroxide of barium is formed, which, on being treated with water and carbonic acid, forms peroxide of hydrogen.

In the manufacture of aniline dyes, we are glad to notice that, although it is still impossible to produce aniline red on a large scale without arsenic, this disadvantage is partially overcome by preparing some of the colors directly, which can be accomplished without arsenic, instead of making them from the aniline red which seems necessarily to contain arsenic. W. F. Gintle has found cheap aniline dyes adulterated with sugar, which he detects with a lens, the color and shape of the crystal being sufficient to distinguish them.

Under the general head of sugars, we find Casamajor recommending the use of subacetate of lead in place of bone black for obtaining colorless solutions to be used for polarimetric analysis. The manufacture of starch sugar, free from gum, for the preparation of spirit coloring, is accomplished in the usual manner, boiling with sulphuric acid; but the boiling is continued 5 to 8 hours after the liquid has ceased to show starch reactions with iodine, or till a portion of the liquid remains clear when mixed with one sixth volume of 96 per cent alcohol. For beer and liquors not stronger than 30 to 50 per cent, commercial starch sugar will answer. It is first heated until it begins to burn, and one fiftieth its weight of carbonate of ammonia stirred in.

Bone black ignited in a current of hydrogen possesses equal decolorizing power with the ordinary charcoal, so that this power cannot be due to condensed oxygen in the pores.

Another new anæsthetic has been discovered, to which Romensky gives the name of trichlor-hydrin, $C_3H_5Cl_3$. It occupies an intermediate place between chloroform and chloral, as it can be either inhaled or given by the stomach. Its action when inhaled is slower than that of chloroform, and given in the stomach, it produces gastro-intestinal irritation.

Carefully conducted experiments with *phénol* (carbolic acid) continue to sustain its well merited rank of queen of the disinfectants. Its physiological actions were found to be similar to those of strychnin.

The crude ammonia salts resulting from the purification of coal gas are frequently found to contain sulphocyanates which render them unfit for manure. In some cases, the amount of sulphocyanate of ammonia present was sufficient to destrop the crops where it was applied.

M. Gorceix has directed his attention to the gases given off by Vesuvius and other volcanoes. Analyses show that the composition varies daily, most of it being carbonic acid mixed with a little sulphuretted hydrogen.

The phosphorus in iron ores, which is highly injurious, may not only be removed so as to render the iron fit to smelt for pig iron, but can itself be utilized, according to Jacobi, by treating the ore with a solution of sulphurous acid. The insoluble basic phosphates are converted into soluble acid phosphates, which are precipitated by lime, and used for fertilizing or other purposes.

The experiments of Weiske-Proskau and Wildt have contradicted the former supposition that considerable quantities of earthy phosphates mixed with the food were deposited in the bones.

Transparent stereoscopic pictures can now be made on well sized albuminized paper, sensitized as usual, but laid for exposure with the side not made sensitive and not albuminized on the negative. Print rather strongly and tone as usual, the tone being judged of by the transparency.

Several new methods for concentrating sulphuric acid have been proposed. Carlier recommends passing steam of three atmospheres pressure through leaden worms lying at the bottom of wooden tubes lined with lead inside, and filled with acid of sp. gr. 1·5 which, as soon as its gravity has risen to 1·7, is transferred into another wooden tank of the same kind.

We have thus given a few of the topics of interest that have attracted more than usual notice during the year, and the reader will see that our statement made at the outset, that, while no startling discovery has been made, the progress in past discoveries has been important and useful, is justified.

A GIGANTIC FIRE ENGINE.

The city of New York, occupying as it does the narrow tongue of land washed on one side by the Hudson and on the other by the East river, may be said to stand in the very midst of water; but, strange to say, this most abundant supply is rarely made use of for the extinguishment of fires. We fill our fire engines with water brought in pipes from a lake distant some forty miles from the city—a source which is always liable to be cut off or diminished at the moment of greatest necessity.

The idea of employing stationary engines located near the rivers, for the purpose of sending strong streams of salt water through the city, for use in the event of fire, has been frequently suggested by prominent engineers, but has never been carried out. We are pleased to notice, however, that an experimental beginning is about to be made, the success of which may have an important influence in the improvement of our fire department.

Messrs. A. S. Cameron & Co., the well known steam pump builders, in East 23d street, this city, have lately obtained permission from the municipal authorities to lay a six inch water pipe from their factory to the river, for the purpose of drawing salt water, for use in case of fire. They are placing a large Special steam pump in their works, fitted with discharge pipes, and have so arranged them as to command not only their own building, but also those adjacent, including the Corporation yard. The pump is intended exclusively for fire purposes, and will be of the capacity of about three first class city fire engines. This great pump will be supplied with water from the river as stated.

The work is being done entirely at the expense of Messrs. Cameron, and it will furnish an example of the availability and advantage of salt water for protection against fire in this city. The extensive business of Messrs. Cameron requires them to have a pressure of steam, and watchmen on hand at all times, so that the great pump can be put in operation at a moment's notice.

Steam versus Fire.

The following facts, clipped from the *Boston Advertiser*, are from the report made to an insurance company over twenty years ago, on the application of steam to the extinguishment of fires. Steam possesses decided advantages over water, as it is not so liable to injure goods or furniture, while it can penetrate to places which a stream could not be made to reach.

The experiments were made in a large mill, through which suitable pipes and connections had been laid, communicating with the different rooms. A box of waste cotton was ignited in the second story, making a fierce blaze. Steam was turned on, filling first the upper stories and finally reaching and completely extinguishing the blaze. After trying this experiment with dry cotton several times, lamps were lighted and placed in various positions on the stairs and floor, with the wicks very high, producing strong flames. It was remarked that each lamp, as the steam reached it, was immediately put out.

Steam, it was shown, can be let into any and every part of the mill in much less time than water could be under the best arranged water mills. In case of fire, the steam is attached to or upon every surface in all positions, and will follow fire into every recess, hole, or crack. It will, in fact, precede the flames, and, covering everything in its course with water, prevent their spread.

THE new scheme for a network of tramways, proposed by an American company for the city of Berlin and its environs, has been sanctioned by the Minister of Public Works, by a concession. It comprises an encircling line round the ancient *enceinte* of the town, with various suburban routes branching out therefrom, to the number of nine. But, singularly enough, not one of these lines is prolonged into the center of the city; and it is considered that, short of their extension to a common center in the heart of the city, the full benefit of the system can hardly be realized.

SCIENTIFIC AND PRACTICAL INFORMATION.

UTILIZATION OF FATTY MATTER FROM THE WASHING WATERS OF CLOTH FACTORIES.

For spinning every 100 lbs. of washed wool, 12 or 14 lbs. of oil (mostly olive oil) are required; and extensive cloth manufactories use for fulling 50 or 75 tuns of soap, each, yearly. There are, annually, 25,000 tuns of washed wool spun in Austria, and almost 3,500 tuns of oil are consumed; the oil is valued at two millions and a half florins. This quantity which, until lately, has been entirely wasted, is again separated by fulling with soap. A writer describes a process in operation in Brünn, near Vienna, for saving this waste. It has been in operation for four years, and consists of the following manipulations: The soap water is collected in a reservoir from which it is pumped into a wooden tub. Sulphuric acid of 66° B., diluted with three times its volume of water, is then added under constant stirring, until the soap is perfectly decomposed. The fatty acids rise to the surface and, when cool, are collected, put into bags, and are subjected to high pressure in order to separate the water as much as possible. After a few hours the bags are emptied, and the mass, which in the meanwhile has become consistent, is formed into cakes, to be molten at a temperature of from 350° to 400° Fah. and pressed again. The thus-gained product is mostly used for the manufacture of soap, and it is estimated that the value of the material thus reclaimed amounts in Austria alone to 350,000 florins.

CHEMISTRY IN THE WORKSHOP.

H. W. Behse has just published a book, entitled "*Die Chemie in der Werkstatt*" (Chemistry in the Workshop) which we should like to see translated. A review says: "Chemistry, more than any other science, is called upon to shed light upon the darkness yet prevailing in many technical manipulations, in order that the manufacturer, guided by theoretical knowledge, may not only operate with more certainty, but may also obviate failures with more reliance. The author has solved this problem in the most meritorious manner."

REFINING GOLD BY CHLORINE GAS.

The application of chlorine to the refining of gold, as some of our readers may be aware, consists in passing a current of chlorine through the molten metal covered with borax. In a few minutes the silver present is converted into chloride, which floats on the surface, while the chlorides of lead, copper, antimony, and arsenic escape. The fineness of the gold produced in this way varies from 991 to 997 in 1,000 parts; the few remaining thousandth parts of the product are silver, a quantity which is less than that resulting from any of the previously known processes. E. Dumas informs us that in the Mint in London as much as 750,000 kilogrammes of gold have been refined and toughened by the process, one kilogramme being 2·2046 lbs. avoirdupois. The apparatus is in use for only three days per month, and the cost of the chlorine gas is only from four to five francs for refining 5,000 kilogrammes of the gold. In order to refine 40 kilogrammes, a current of the gas for five minutes' time is sufficient. The silver is found in the borax covering the gold.

NEW PROCESS FOR EXTRACTING GOLD AND SILVER FROM COPPER PYRITES.

This method, invented by F. Claudet, is based upon the insolubility of the iodides of gold and silver. After the pyrites have been desulphurized by the addition of salt, they are placed in a barrel with a false bottom and lixiviated with acidulated water. The wash water consists of sulphate of soda, chloride of copper, and some chloride of silver. From this liquor the copper may be precipitated in a metallic state by means of sheet iron or iron scraps; but if the noble metals are to be separated, the waters from the three first extractions are collected, and the requisite quantity of iodide of potassium in solution is added to them. After having been left undisturbed for twenty-four hours, the clear liquor is drawn off, the vessel is then filled again, and iodide of potassium is added (in short, the operation is repeated) until a sufficiently large quantity of precipitate has collected. This contains sulphate of lead and copper salts, besides the iodides of gold and silver. The salts of copper are washed out, whereupon the residue is mixed with zinc, in a finely divided form, which combines with the iodine. Hence the result is a mixture of gold, silver, lead, and some oxide of zinc, from which it is easy to separate the noble metals. Claudet produced in 1871, by this process, from 16,300 tuns of desulphurized pyrites, 333·242 kilogrammes silver, and 8·172 kilogrammes gold, at a net profit of $16,160.

DYEING SHODDY WOOL BROWN.

The advantage of the process here described consists in that the operation can be carried out in one vat. One hundred lbs. wool are left for half an hour in a boiling bath containing 30 lbs. yellow wood, 3 lbs. alum, 2 lbs. crystals of tartar, and 1 lb. sulphate of copper. After that time, one pound chromate of potash and three quarters of a pound of a solution of rosain in hydrochloric acid are added to the bath, which is now kept gently boiling. By the addition of turmeric, various shades may be obtained. Logwood will darken them, 6 lbs. of logwood and 10 lbs. of turmeric being recommended for 100 lbs. wool. The term rosain applies to a waste product obtained in the manufacture of aniline red.

DYEING SHODDY BLUE.

In this method, half woolen threads are destroyed by muriatic acid; the acid is then neutralized by chalk, and the fabric is well washed and dyed. One hundred pounds require one pound of chromate of potash, one pound sulphate of copper, five pounds alum, one pound crystals of tartar, and one pound oil of vitriol, which are dissolved in the vat, the goods being left in the boiling liquor for half an hour. The goods are then boiled in a fresh bath containing 25 lbs. logwood, to which half a pound of "shoddy" carmine and a quarter of a pound of rosain are added, the liquor being left boiling for another half hour. The so-called shoddy carmine is prepared by dissolving in hot water twelve pounds alum, nine pounds indigo carmine, and three pounds of soluble aniline blue, and stirring until cool. This carmine is very suitable for dyeing ordinary wool.

DETERMINATION OF IRON IN BLAST FURNACE SLAGS.

This method is recommended as being free from the objections belonging to the generally known systems of analysis. The finely pulverized slag is mixed in a platinum crucible with three or four times its quantity of fluoride of ammonium. The crucible is first heated in the water bath under gradual addition of sulphuric acid; and when the boiling has ceased, it is heated in the sand bath until the acid commences to evaporate. Upon cooling, water is added; the insoluble residue is put on a filter and washed out, until the washing water ceases to indicate iron. It is now heated in a balloon with some zinc, so that the peroxide may be reduced to protoxide; and when this is the case, the iron is determined by volumetric analysis in the generally known manner.

RECENT PATENT DECISIONS

Locking Nuts.

APPEAL OF PETER CAMPBELL.

LEGGETT, *Commissioner:*

Applicant fully sets forth his alleged invention in his claim, which is—

A nut lock composed of a portion of the metal of the nut, projecting into a recess in one of the threads of the bolt, said recess being formed and the metal forced into it at one operation.

It is obvious, upon mere inspection of this claim, that it does not cover a patentable invention. Applicant cannot make such a nut lock as he describes so as to be ready for use or sale in the market. His invention, then, is not a device or article that he can offer to the public as complete for their use. It is only a process that he presents, which every man must apply himself to secure the result contemplated. In other words—every man must make his own fastening, upon the plan proposed, every time he wishes to employ it. The process merely is all there is in the case, and that, as shown by the reference cited—patent of A. D. Smith, No. 78,899—is old. There is nothing new or patentable in this application in view of the reference, and the decision of the Board is, therefore, affirmed.

Ladies' Hoopskirts.

APPLICATION OF SAMUEL PEREEDY FOR EXTENSION OF PATENT NO. 22,197, GRANTED NOVEMBER 30, 1858. DECIDED NOVEMBER 27, 1872.

Extension refused where only five per cent of the net profits to arise from the extended term were to go to the inventor, and ninety-five per cent to assignees.

United States Circuit Court---Southern District of New York.

Machines for Pegging Shoes.

GALLAHUE *et al.* vs. BUTTERFIELD.

Before WOODRUFF, Circuit Judge.

A suit in equity, brought by Alpheus C. Gallahue and Eli Bennet against William Butterfield, for the infringement of certain letters patent on shoe pegging machines, granted the complainant, Gallahue, on the following dates, respectively, namely, August 16, 1853, and reissued July 6, 1869; March 29, 1859, and reissued June 22, 1869; and August 26, 1862.

Patent sustained. Decree for plaintiffs granted.

Keller & Blake, for complainants.

G. L. Roberts, for defendant.

United States Circuit Court--District of Massachusetts.

SMITH vs. NICHOLS.

WM. SMITH'S PATENT FOR IMPROVEMENT IN CORDED ELASTIC FABRICS—INVENTION DISTINGUISHED FROM MERE SKILL IN CONSTRUCTION.

A suit in equity under the patent involved in the various cases, Smith vs. Elliott, same vs. Warren *et al.*, etc., tried heretofore, the claim of the patent in the present case, however, being modified by a disclaimer filed in May, 1872.

The case was heard by Mr. Justice Clifford, of the Supreme Court, and his honor Judge Lowell.

Upon the whole we feel constrained to agree with the opinion of the learned circuit judge of the second circuit, that the old webbing was a fabric of like kind with the complainant's, and that the improvement, important though it is, must be held to be due to the skill and sagacity with which the mode of operation, by which that webbing was made, has been adapted and applied by the plaintiff, by the use of better materials and a more careful weaving, but not by the exercise of the invention requisite to enable him to claim the product as a fabric before unknown.

Bill of complaint dismissed.

T. A. Jenckes, for complainant.

B. Dean and *B. R. Curtis*, for defendant.

The Hop Preserving Patent Case.

To the Editor of the Scientific American:

In your issue of 7th December, I find *in extenso* the decision of the Acting Commissioner in the matter of the interference between the application of Benjamin Bates and the patent of Seeger & Boyd.

Decisions of the Commissioner have not unfrequently contained extra judicial opinions derogatory to the validity of existing patents. Whatever of evil there may be in this practice is vastly augmented by the greatly increased publicity now given by the publication of these decisions in the *Patent Office Gazette*, the SCIENTIFIC AMERICAN, and other journals. Extra judicial opinions are objectionable at any time, and in this case the strength of expression amounts to a grievance. On behalf of my clients, and all other honest patentees, I enter my protest.

The patent, being already granted, is beyond the jurisdiction of the Commissioner. He can say nothing to impair its validity; but his words may encourage infringement and incite litigation. A patent receives validity only through the signature of the Commissioner; its issue is his act; and for him to assert that a patent is illegal and fraudulent is to stultify his own record. A patent granted is property. To stigmatize as fraudulent that in which a citizen has a vested interest, proclaims to the country that the right in that property may be set at nought with impunity; but the Commissioner has no power to protect such persons as may, ignorantly relying upon official expressions of the Commissioner's opinions, infringe that patent.

In the present instance, the Commissioner characterizes as fraudulent, and unworthy to be called invention, a matter which had twice been passed upon by the Examiner, and had passed the Examiner of Interferences and the Board of Examiners in Chief, without any challenge of this sort. In matters of issue, on appeal to the Commissioner, the law makes his judgment of superior force; but in matters of pure and gratuitous opinion, destitute of legal force, such expressions, when officially made, are, to say the least, not in good taste.

Misconception of Seeger and Boyd's patent has led the Commissioner into this error of judgment; but it is none the less objectionable on that account. A patent is not invalid because no special skill is required to work it, or because a child can exercise it, or because there is no evidence of inventive genius. Simplicity is generally regarded as a merit rather than a demerit. A patent is not granted for inventive genius, as many have found out,—or for special skill, or for what requires bodily strength; but for some new or improved art or thing wherefrom the public may derive benefit.

That the thing claimed by Seeger & Boyd is both new and valuable as an acquisition to trade, is not questioned by the Commissioner; he should have, therefore, confined his decision to the question of priority, which was the only issue before him.

R. D. O. SMITH.

Washington, D. C., Dec. 3, 1872.

NEW BOOKS AND PUBLICATIONS.

GEMS OF GOLDSMITH. With Notes, Illustrations, and a Sketch of the Author's Life. New York: Samuel R. Wells, 389 Broadway.

An admirably printed edition of "The Traveller," "The Deserted Village," and "The Hermit," with excellent engravings. It will make a most acceptable present for the season, and deserves commendation as a beautiful production of three masterpieces of one of the purest and most elegant of English writers. We should like to see a complete edition of the works of the talented but erratic Goldsmith, published in a style similar to this little book.

Facts for the Ladies.—Mrs. W. Weber, New York, has operated on a Wheeler & Wilson Lock-Stitch Machine twelve years, earning from $2.50 to $3.00 per day, in private families; can stitch a dozen linen shirt bosoms and five dozen pairs of cuffs in an hour. See the new Improvements and Woods' Lock-Stitch Ripper.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From October 22 to December 5, 1872, inclusive.

COUPLING CARS.—J. C. Morton, Boston, Mass.
CUTTING GLASS, ETC.—C. W. Lewis, New York city.
CUTTING HARD SUBSTANCES.—B. C. Tilghman, Philadelphia, Pa.
GORING FOR BOOTS, ETC.—C. Winslow, Boston, Mass.
GRAIN SEPARATOR.—A. Hunter, E. H. Osborn, Quincy, Ill.
GRINDING MACHINERY, ETC.—A. Assman, Linden, N. J.
LEVER AND SCREW PRESS.—G. B. Boomer, Syracuse, N. Y.
MAKING HARROWS.—W. Barr, Jersey city, N. J.
MAKING BRICKS.—I. Gregg, Philadelphia, Pa.
MAKING GAS, ETC.—T. A. Howland, C. G. McKnight, Providence, R. I.
MAKING IRON TUBES, ETC.—E. Wheeler, Philadelphia, Pa.
MAKING STEEL.—T. Brooks, Minerva, Ohio.
MALLEABLE CAST IRON, ETC.—J. M. Roberts, Burlington, N. J.
MOTOR FOR SEWING MACHINES, ETC.—G. W. Manson, New York city.
PISTON PACKING.—J. C. Furness, Boston, Mass.
PRINTING MACHINE.—E. L. Ford (of Brooklyn, N. Y.), London, England.
PRINTING, PRESSING, ETC., MACHINE.—E. L. Ford, New York city.
PRINTING TELEGRAPH.—E. Gray, E. M. Barton, Chicago, Ill.
PUMPING ENGINE.—E. Cope, J. R. Maxwell, Cincinnati, Ohio.
RAIL JOINT.—J. McL. Staughton, Riverton, Ky.
RAISING SUNKEN VESSELS.—H. F. Knapp, New York city.
ROCK DRILL.—A. C. Rand, J. B. Waring, New York city.
SEWING MACHINE, ETC.—J. L. & D. H. Coles, New York city.
SEWING MACHINE.—R. Whitehill, New York city.
SHEET METAL CANS.—G. H. Chinnock, Brooklyn, N. Y.
SHOE PEGS.—J. H. Oliver, M.D., Baltimore, Md.
SHUTTLE SPOOL.—T. H. Dodge, Worcester, Mass.
SPINDLE BOLSTER.—C. F. Wilson, J. E. Folk, Brooklyn, N. Y.
SPINNING MACHINERY.—E. Freeman, Norton, Mass.
STEAM PUMP.—W. C. Selden, Brooklyn, N. Y.
STENCH TRAP, ETC.—N. Thompson, Brooklyn, N. Y.
TELEGRAPH.—S. F. Van Choate (of Boston, Mass.), London, England.
UTILIZING HYDROCARBONS, ETC.—P. F. Goodrich, San Francisco, Cal.
VENTILATOR.—S. C. Maine, Boston, Mass.
WATERING LOCOMOTIVES.—W. E. Prall, Washington, D. C.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

WASHING MACHINE.—George Washington Mollineaux, Marble Hill, Mo.—The invention consists of a pair of horizontally reciprocating washing or rubbing boards, suspended adjustably from slides upon the cover, with their rubbing surfaces on the under side, to work on the top of the clothes, which rest on a stationary ribbed board, and the sides of the tub are provided with vertical ribs for acting upon the clothes. The rubbing boards are suspended from a vertically adjustable cross head, mounted on rods rising up from the slides, and held down upon the clothes with the required pressure by friction pawls on the cross head, held on the rods by springs. The slides are worked by a lever pivoted to the top of the tub between them, so as to work them simultaneously in opposite directions. The top of the tub is hinged at one end, and held fast at the other end by a yoke, which is readily disengaged to allow the top to be lifted. The slides and rubbers swing out of the tub when the cover is raised, to facilitate the adjustment of the clothes.

WASHING MACHINE.—Ira B. Stillman, Almond, N. Y.—This invention relates to that class of washing machines in which the washing is performed by passing the clothes between a set of rollers held to their work by spring power; and it consists in the construction of the pressure spring, whereby a greater range of elasticity is effected than has been gained by springs heretofore used, and in the manner of adjusting the said spring to the different degrees of pressure required. It also consists in a device whereby the machine may be readily and securely attached to and conveniently detached from the tub or other vessel in connection with which it may be desired to be used.

BLOTTING, RULING AND CUTTING IMPLEMENT.—Hugh S. Ball, Spartanburg, S. C.—This invention has for its object to furnish an improved ruler, blotter and paper cutter combined, which shall be so constructed that it may be used with as much facility as a ruler, blotter, and paper cutter as if it were constructed especially for each of said uses. It consists in a plate of light sheet metal, of suitable length and breadth, the sides of which are bent downward so as to hold in a semi-cylindrical form a sheet of india rubber which is covered with blotting paper. A narrow strip of metal soldered to the sides of the device serves as a paper cutter. When the blotting paper becomes soiled it may be easily replaced.

WASH BOILER.—Wellington H. Lines, Cannonsville, N. Y.—This boiler is designed to cleanse the clothes by means of boiling water elevated by means of steam pressure and discharged upon the top of the clothes. The operation is as follows: Water or suds sufficient in quantity to fill a lower compartment is introduced into the boiler, which passes down through a valve tube. The clothes are then put in. When heat is applied to the bottom of the boiler and steam generated, the ball valve will be forced up and will close the top of the tube, and the water will rise in the outside tubes and be discharged on top of the clothes. This water will pass down through the clothes, and will accumulate on the bottom till it will in a few seconds overcome, by its weight, the pressure of steam on the valve. The latter will consequently fall, and the water will return to the lower compartment. When the steam accumulates the valve will be again forced up and close the top of the tube, and thus intermitting action will be repeated every few seconds. No water is allowed to pass upward except through the outside tubes. This action is kept up as long as may be required to thoroughly cleanse the clothes.

WATER ENGINE.—James H. Connell, Elizabeth, N. J.—This invention consists of an arrangement of the piston rod for filling up the space in the cylinder to economize water. It also consists in an arrangement of the piston and piston rod packing to simplify the cost of construction and utilize the water pressure for packing. It also consists of a combination of a valve and pipe connection with the valve chest, whereby the flow of water may be directed through it while the crank is passing the dead centers, so that the shocks common to the ordinary engines by the sudden stoppage of the water column will be avoided; and it also consists of the combination of an air chamber with the valve chest of a water engine, also with an escape valve for neutralizing these shocks more completely than can be done with either alone.

ROTARY ENGINE.—Truckson S. La France, Elmira, N. Y.—The invention relates to the packing pieces which are affixed to the ends of cogs in rotary engines, and consists in a peculiar construction and application thereof. By making the piece wider at the bottom than at the top, the inventor obtains extra surface, against which the stream may act, thus insuring a positive movement. The piece being beveled is loose, movable, and cannot stick fast when the expansion takes place. While the cog wheel is running in hot steam the packing piece is pushed down into the groove, and when the wheel is contracted by cooling, the springs push the pieces out against the case. Thus it is tight under all circumstances. This cannot be accomplished with a straight packing piece.

REFRIGERATOR.—J. Hyde Fisher, Chicago, Ill.—This inventor relates to a new and useful improvement in refrigerators, having particular reference to a refrigerator for which letters patent of the United States were granted the inventor, dated August 1, 1865, and reissued the 31st day of January, 1871, which present invention consists mainly in an air space beneath the ice chamber, in the double bottom, between the ice chamber and the refrigerating or provision chambers, the lower portion of the bottom being of wood and the upper portion being metal. The air space being separated from the ice by only the metallic portion of the double bottom, the air therein partakes of the temperature of the ice, and assists in keeping up the circulation.

CASE FOR WRITING MATERIALS.—George B. Chase, Austinburg, Ohio.—This invention relates to a new case or box for the reception of pen, ink, paper, etc., and consists in providing a groove under the bottom of the narrow box for the insertion, transversely, of the cover, so that the cover will, when the box is opened, aid in supporting the box in an upright position.

RAILROAD RAIL JOINT.—Thomas Slaughter, Lawrence, Mass.—This invention is designed to fasten the fish plates and rails of railway joints together and to serve as a substitute for bolts and nuts. Holes are cut through the plates, flared large at the openings. In these are inserted gibs and, within or between the gibs, wedges are driven so as to bend the gibs against the tapering wall of the hole. The tapering ends of the gibs are bent around the keys to prevent their working out.

CONNECTING ROD.—Samuel N. Wate, Jr. Danville, Pa., assignor to himself and P. J. Adams, of same place.—This invention has for its object to improve the construction of the connecting rod described in letters patent No. 128,831, granted to the inventor and P. J. Adams, July 9, 1872, so as to make it simpler in construction and neater in appearance. A long strap passes around one end and along the side edges of the body of the rod. A short strap passes around the other end of the rod, and its ends overlap the ends of the long strap. A bolt or bar passes through slots in the end parts of the long strap through holes in the end parts of the short strap, and rests in a slot or notch in the end edge of the main body of the rod, and is secured in place by nuts. Bolts, one or more of which may be used, pass through holes in the strap and through slots in the rod, so that the said rod and strap may be moved upon each other in opposite directions and still be secured by said bolts. A small block is interposed between the overlapped ends of the straps and the end of the rod, and against which the inner brass at that end of the rod rests. A set screw passes through a screw hole in the center of the bolt in line with the length of the rod, the middle part of the end of the rod being cut away to receive it and allow it to be operated. By movement of this set screw, in combination with other mechanism, the straps are drawn toward each other, drawing the outer brasses inward just so much as the inner brasses moved outward, thus taking up the wear while keeping the pins at exactly the same distance apart.

PAPER FOLDING MACHINE.—Alyah Washburn, Medina, Ohio.—This invention consists of a series of light folding frames hinged on the top of a table, and provided with operating gear actuated by a cam shaft, which said frames are arranged in such order and sizes relatively to each other that a printed sheet delivered on the table over all the folding frames by the depositors of a printing press will be folded in the order of folding it by hand, and thrown off the machine by another frame similar to the folding frames. The said machine is operated by the printing press from which it receives the sheets as they are printed.

PLATE AND SHEET GUIDE FOR ROLLING MILLS.—James Moore, Belleville, N. J.—The object of this invention is to attach to rolling mills a device whereby the curling of the plates or sheets when they emerge from between the rollers will be prevented. At present it frequently and almost invariably happens that the plates or sheets curl up as they emerge from between the rollers which makes it more difficult to subsequently handle them and often threatens the destruction of the entire machinery, or injury thereto. In order to counteract this tendency of the plates to curl, a pendent lever is applied to the machine, with a foot at its lower end that reaches to the plate and holds its end down, following the motion of the plate as the same passes out of the rolling mill.

COAL CHUTE.—Cornelius W. Williams, Port Jervis, N. Y.—The pocket of the chute, in this invention, is to be elevated sufficiently for spouting from it into a wagon. The lower portion of the spout is hinged so as to fold up out of the way, so that a wagon can be drawn close alongside without being obstructed. A cross bar is suspended in front of the lower end of the spout for the coal to strike against, and be thereby turned directly downward to prevent it from shooting over the side of the wagon. A series of grate bars is arranged at the bottom of the spout to screen the coal as it flows from the pocket to the wagon.

RAILROAD FROG.—James Brahn, Jersey city, N. J.—The invention consists, first, in slotted iron blocks with wood filling between point and wings or between the wings. This construction greatly facilitates the putting together of the frog, as the blocks can be driven in till they fit, and then holes to receive the bolts can be bored through the wooden blocks through the holes in the wings and point. The wooded blocks alone bear the strain, and thus allow the point and wings to be drawn together more firmly and held more securely. The wood, by its spring, takes up the wear, and serves as a cushion to prevent jar and noise from the wheels. The wooden parts of the blocks thus do the work, while the iron parts strengthen the wood, and protect and preserve it from decay and from losing its elasticity. Second, each fish plate is made in two parts, which can slide upon each other. The inner part has two round holes formed in the end that is bolted to the end of the frog, and two short slots in the ends that are to be bolted to the end of the rail. The outer part of each fish plate has one round hole formed in its outer end to receive the outer bolt, and three slots to receive the other bolts. This construction enables the fish plates to be readily adjusted and secured to the ends of the rails of any road, and so long as one of the bolts remains tight the rail cannot move. The tread of the wheels, especially the drive wheels of the engine, is made considerably wider than the head of the rails, and by use becomes hollowed along the flange, so that the outer edge of the wheel, when running upon or leaving the point of a frog, will strike the other rail of said point and chip it out and injure it. To remedy this a solid iron block is placed between the rails of the point at the place where the outer edge of the wheels strikes or leaves the rail of the point, so that the outer part of the tread will be held up level with the top of the rail when passing upon or leaving it.

BLACKBOARD.—Frank G. Johnson, New York city.—This invention relates to a new and useful improvement in blackboards for schools and for all the purposes for which the ordinary blackboard is used: and it consists in a series of slates or tablets and in a grooved frame or case, in which grooves the tablets slide. When five (more or less) tablets are combined in the case they require no more wall space than a single one. A problem may be demonstrated on the outside of the first tablet; and it may be turned over and the other side used: or it may be drawn out so as to expose another tablet and laid away, or drawn in either direction so as to expose the next tablet or a part of it, and still remain in the case: and so of all the tablets. The case is designed to hang upon the wall.

COFFEE POT.—Martin Hofman, San Francisco, Cal.—This invention has for its object to furnish an improved coffee pot, extracting the strength so thoroughly from the ground coffee that a much smaller quantity will be required than when an ordinary coffee pot is used. The upper part of the body of the coffee pot is made cylindrical in form, and the lower part is bulged or swelled. The bottom of the pot is concave so as to more thoroughly concentrate the heat. A funnel rests upon the bottom of the body and its tube enters the tube of another funnel which is placed at the lower edge of the cylindrical part of the body and connected with and supported from the first named funnel. The steeper is fitted into the mouth of the cylindrical part of the body, and its bottom is finely perforated or made of fine wire gauze. In the center of the perforated bottom of the cup or steeper is formed a hole, in which is secured a tube through which the tube of the upper funnel passes, and which is made a little larger than said funnel tube, so that steam may pass up between them. A perforated plate with a hole through its center is designed to be placed upon the coffee in the cup and hold it down evenly and smoothly, so that the water may act upon and leach the coffee evenly. In using the coffee pot, the ground coffee is placed in the cup and the plate placed upon it; then, as the water becomes heated, it is forced up through the tubes, flows upon the plate, and percolates through the coffee, wholly removing its strength in a very short time, the plate and cup catching any fine coffee that may pass through the bottom of the cup, so that the coffee will always pour out clear.

LEVER FOR LATCHES.—Charles C. Lewis, Gainesville, Ala.—This invention relates to an attachment to door knobs, whereby the latch mechanism is brought within reach of small children, who can thus open the doors. The invention consists in a knob lever constructed with jaws and held by a key, and in providing a knob lever with spring and cord, and arranging it horizontally in a stop box.

TURBINE WATER WHEEL.—Thomas J. Alcott, Mount Holly, N. J.—This invention consists in the construction of an inside cylinder, with chutes and vertically adjustable guides, combined with an outside case. The object is to prevent the wear of the cylinder, to cause less friction, and make a perfect watertight joint. The inside adjustable cylinder has chutes or openings corresponding with the chutes or openings of the outer stationary case, the outer case being made of one solid casting with the lower half or curb smaller in circumference than the upper part. The upper part has twelve (more or less) openings, and between each opening and on the inside of the outer cylindrical case there are recesses for the purpose of passing off any sand or gritty substances that might collect between the cylinders, and causing less friction. On each side of each recess there are brass or Babbitt metal bearings to prevent the wear of the cylinder, making as perfect watertight joint. The inner cylinder is adjusted horizontally back and forward, so as to graduate the flow of the water passing through the openings of the outside cylindrical case, thus diminishing the size of the openings or closing them perfectly whenever required, and the inner cylinder is also adjusted vertically by the tightening or loosening of the nuts of the bolts or guides that pass through the top of the case and the cross arms of the top of the inner cylinder, the arms being below the cover of the case; and the center circular plate works backward and forward against and around the lower part of the dome of the top. For further particulars see advertisement on another page.

CRADLE, CRIB, AND STANDING STOOL COMBINED.—Calvin E. Nurse, Chesterfield Factory, N. H. assignor to William W. Hopkins, of same place.—This invention has for its object to furnish an improved combined cradle, crib, and standing stool, which shall be so constructed that it may be conveniently adjusted for use in either capacity, and which may be compactly folded for storage or transportation.

BEE HIVE.—William R. Clark, Piqua, Ohio.—The object of this invention is to provide convenient, safe, and efficient means for wintering honey bees. Through the cap, which is made to fit the top of the hive above the honey frame and is filled with straw, is formed a channel or passage way which is in communication with the alighting board in front. The filling is kept in place by two or more cross pieces, and is lined with woolen cloth or other material. The bottom or platform of the cap is composed of slats and clamps, and rests upon the top of the body of the hive, and is nearly covered inside with woolen cloth, which may be saturated with brine or other solution. The bees have free access to the passage way or channel, and from thence to the alighting board, and are thus allowed to feed in winter from one comb to another. The end clamps are grooved to the ends of the slats, where they are fastened in any suitable manner. The alighting board is attached to the clamp and may be removed therewith at any time. A ventilator and a shutter, one or both, may be closed down over the bee orifice of the alighting board, as may be desired. The filling absorbs the moisture, and, together with the lining, the natural heat of the bees is retained. The bees have free access from the honey frames of the hive to the channel in the cap, and from thence on to the alighting board. The honey frames are confined to the frame by a strap or metallic hook. The shutter may be elevated more or less, leaving the ventilator closing the entrance, thus enabling the ventilating air current to be controlled, while the escape of the bees is prevented. A small current is maintained through the entrance, and up through the filling and openings in the top, thus carrying off the moisture and relieving the brood chamber of foul air or odors.

LAMP CHANDELIER.—Randolph S. Mains, New York city.—The chandelier is so suspended that it may be raised or lowered, as may be required, and may be made and used either with or without a shade. With the common kerosene lamp in this chandelier, all the advantages of the expensive extension gas chandelier are secured with this additional advantage—the light may be readily removed and utilized away from the chandelier.

TREATING PETROLEUM.—Emil Schalk, New York city.—This invention consists of a continuous process of treating the distillate, by which much time and labor will be saved. Instead of having a tank and filling it with oil, and then adding the sulphuric acid, the oil and the acid, in the right proportion, are allowed to run in a continuous flow into a horizontal agitator, where it is agitated for a certain time, allowing the product to run out at the other end into a series of small tanks, filling one after the other and allowing the first to be emptied before the last is filled. From each tank the distillate is run into another horizontal agitator, where the washing is carried on in the same continuous way as when treated with acid, and in like manner it is again discharged into tanks, and from there into a third agitator to be treated with alkalies, and then washed again.

RAILROAD SWITCH LOCK.—James L. Anderson, Bucyrus, Ohio.—This invention relates to a new means for locking the switch levers on railroads, automatically and effectively. The invention consists in providing the switch lever with an up and down adjustable transverse bolt, which will drop into notches of the arcs between which the lever can be moved. The invention also consists in combining with the aforementioned key a projecting ear on the lever, a vertical drop bolt for locking into it, and an ordinary key for raising the drop bolt and liberating the lever when desired.

DUMPING WAGON.—Charles G. Taft, Triangle, N. Y.—The object of this invention is to furnish a wagon for transporting and unloading stone and similar material. The sides of the body are rigidly attached to the bolster and to the rear axle, so that they are immovable. The end boards are rigidly attached to the bottom. An iron rod, secured at the ends, passes through the two end boards, and rests upon the inside of the bottom in the middle of the wagon. The bottom and ends being thus supported by this rod, are allowed to turn thereon in either direction. On each side of the wagon box, and working in a slot in the side board, is a cam lever, so arranged that the cams come just above the bottom when the levers are turned up to the side boards. When one of the cams is turned out, the bottom will turn and dump the load; but when both cams are turned in, the bottom is secured in a horizontal position, and may be loaded with stone or other material, and in this condition the load may be moved or transported, and then dumped on either side, as may be desired.

ORE JIGGER.—Johann Friedrich Utsch, Iserlohn, Germany.—The object of this invention is to produce an automatic discharge for jig machines whereby the several grades of ores will be discharged according to their specific gravity without reference to size. The invention consists in the application to the jig sieve of two, three, or more discharge pipes, whose upper ends project at various distances above the sieves, so that during operation the heavier parts of the ore will be discharged through the pipe projecting least, while the lighter grades, forming higher strata on the sieve, will be discharged through the pipes projecting higher.

AUTOMATIC CAR BRAKE.—John E. Worthman, Mobile, Ala.—The invention has in view to connect all the brakes of a train with a mechanism on the tender, or on the truck of any car. It consists in the mode of tripping the spring rack, which locks the brakes, so that the latter will be at once allowed to assume a position out of contact with the wheels. It also consists in a novel mode of automatically ungearing a drum winding pinion from an endless screw which rotates it, so that the brake lever will be locked at a given point and the brakes operated with a given pressure. It also consists in a novel mode of regulating the time when the ungearing of said pinion from said endless screw shall take place, so that greater or less force may be applied. It also consists in the general method of operating all the brakes of a train of cars simultaneously and with a uniform force in going down an incline, the acquired momentum produces an immense strain upon the costly engine and racks, and greatly lessens its durability, because the brakes are applied at different times by the several brakesmen. This is avoided entirely by using simultaneous brakes.

PLOW.—Henry C. Godfrey, Elizabeth City, N. C.—The invention relates to that class of plows which are employed in the cultivation of cotton, especially in its early growth. The invention consists in a scraper formed of two parts, one of which serves to run an inch (or a fraction thereof) beneath the surface of the soil and thus to cut up the weeds, while the other serves as a cutter, but mainly as a guard, to prevent the loose soil from falling over on the plants. Secondly, The invention consists in the arrangement of a small turn plow on the side, to the rear of the front, and above the bottom of the landside of a larger plow, so as to follow the scraper and throw clean soil to the stems of the young cotton plants. Thirdly, The invention consists, finally, in the mode of attaching the small plow to the landside of the larger one.

BLOW-OFF FOR STEAM BOILERS.—Buckingham C. Nye, Pomeroy, Ohio.—The invention relates to that part of a boiler which is immediately above the fire, which is accustomed to become covered with scale and sediment, and which is thereby rendered liable to rapid oxidation, to diminution in strength, and to the production of explosions. The invention consists in two horizontal tubes having each a continuous slot on the bottom, and emptying into a central vertical discharge tube which is open at the bottom, to produce an upwardly perpendicular current directly therethrough.

WAGON BRAKE.—George W. Jackman, Bath, N. H.—The invention consists in forming an automatic brake of a bar pivoted near to the end of a tongue and jointed to a brace hinged to the axle, whereby the holding back of the animals applies the brake. It also consists in a peculiar mode of curving the bar, and jointing it to the brace so as to give relief to strain upon the necks of the animals.

VERTICAL BOILER.—Philip Estes, Leavenworth, Kansas.—The invention relates to a vertical boiler, more especially designed for heating hot houses or other buildings with hot water. It consists, first, in constructing the boiler and furnace in three easily detachable sections, whereby the commonest mechanic can take it apart, clean, and again put it together. It consists, secondly, in providing the crown sheet with cups and circulating tubes that hang down in the fire chamber, to facilitate the heating operation.

MACHINE FOR CUTTING FABRIC INTO PIECES FOR BAGS.—William J. Cussen, Richmond, Va.—The invention consists in a spring clamp swiveled to the side of a table, holding together the fractional parts of a previously cut piece while others are being unfolded, and turning to one side when its function has been performed.

DOFFER STRIPPER.—A. M. Comstock, Holden, Mass.—The stripper is provided with teeth beveled on one side, and is arranged so as to support the stock or roving between the card cylinder and condensing rolls, and deliver it to the latter in a peculiarly effective manner. It is especially adapted for use when short stock is being worked up.

CULTIVATOR.—William D. Smith, Homerville, Ga.—This invention has for its object to furnish an improved cultivator, so constructed as to stir up the soil to any desired depth without turning up the fertilizer to the surface and to avoid having its gases evaporated by the rays of the sun. The bar or beam to which the plows are attached is made in zigzag form, to form shoulders or offsets for the attachment of the plows. The rear part of the draft bar or beam is bent or curved upward, and has a hole formed in its upper end to receive the round that connects the handles and holds them in their proper relative positions. The ends of the zigzag bar or beam are supported by the brace rods, the rear ends of which are secured to the ends of the said bar or beam, and their forward ends are secured to the forward part of the draft bar or beam. The plows are made long and narrow, are curved or bent downward and forward, and are twisted so that their forward sides may be slightly inclined to allow the soil to slide off the said plows as they are drawn forward, thus enabling them to stir up the soil thoroughly and move it toward or from the plants as may be desired. The zigzag bar or beam may be made of any desired length, and may have any desired number of shoulders or offsets for the attachment of plows.

BILLIARD TABLE.—William H. Griffith, New York city.—This invention relates to a new manner of bracing and sustaining the top of a billiard table. Such top is now usually made of slate or other mineral substance in three or more slabs, which are placed side by side upon the supporting frame, and is liable to sag in the middle, especially on tables having but four legs, and also to open the joints between the several slabs or pieces of slate. Either of these occurrences would virtually destroy the billiard table. The invention consists in the arrangement of metallic bars, which connect with the end slabs and press under a middle bridge of the billiard table, serving to draw the slabs firmly together, and also to hold the middle of the table up, and thus keep the top level. This invention is the conception of an extensive billiard table manufacturer, and is intended to greatly improve the strength of the table.

SASH HOLDER.—William Branch and Mark J. Liddell, Laingsburg, Mich.—The object of this invention is to furnish convenient and efficient means for holding window sashes in any desired position when raised, and for fastening them securely down when closed: and it consists in a weighted lever with a double cam attached thereto, one of which cams being arranged to hold the sash up and the other to hold it down.

BARBER'S CHAIR.—Francis J. Coates, Cincinnati, O.—This invention has for its object to furnish an improved barber's chair; and it consists in the arrangement of devices so that by operating a foot lever the seat may be reversed when it has become warm from use, or set at different angles when desired, and so that the pivoted back will adjust itself to the angle or position of the seat and the back of the sitter.

SHOEMAKER'S TOOL.—Joseph F. Ober, Mount Desert, Me.—This invention has for its object to furnish an improved combination tool, designed more especially for shoemaker's use. In using the tool the upper is grasped with the pinchers and drawn into place. The tool is then reversed while being raised, and with a blow, as if with a hammer, the awl is driven into place. A peg is then taken from the mouth and inserted in the hole and driven into place by a blow with the hammer, the tool being reversed in the hand while being raised to give the blow. In this way the shoe may be lasted without laying down the tool, except at the toe, when it is laid down to shave off the folds of the upper to make it lie smooth.

SUCKER ROD ELEVATOR.—Lewis K. Stitts and Solomon R. Dresser, Parker's Landing, Pa.—This invention relates to the pumping machinery of oil and salt wells; and consists in a device for elevating the sucker or pump rod. The elevator consists of a box or frame made in two parts, one part opens as a gate to allow the sucker rod to be slipped in or out. Pivots or journals are formed on or pass through the two parts of the box or frame. Bails are attached to the pivots and a stop plate is fixed on the outside of each of the two parts of the box or frame. In sending the elevator to the swivelman up in the derrick, both bails are put on to a hook of the sucker rod line, leaving the gate of the elevator open, so that the swivelman has nothing to do but to slip the elevator under the shoulders of the sucker rod and shut the elevator gate.

CAR COUPLING.—Erwin C. Hubbard, Green Bay, Wis.—This invention has for its object to furnish an improved car coupling, which will couple itself as the cars are run together. In the forward end of the bumper head is formed a mouth or recess to receive the coupling link. The coupling hook is a bar having a hook formed upon each end. The bar is placed in a slot in the upper side of the bumper head, the forward hook of said bar projecting downward into the mouth or throat of the bumper head, and its rear hooks projecting downward into a slot or recess in the middle part of the bumper head so as to sustain the draft strain by resting against the solid part of the bumper head between the said hooks. The hook bar is held down into its place by a spring laid in a groove formed to receive it in the upper side of the bumpers, which is kept from moving longitudinally, and which enters a recess in the said bumper head. The spring is held down in its place by the edge of the rear end of a shield, which is made hollow and open at its front end, and serves as a guard to prevent the hook from being pressed down or jammed, so that it cannot be raised by the entering link, and as a guide to prevent the bumper head from lifting.

LOCK FOR UMBRELLAS, ETC.—Sigourney Wales, New York city.—This invention relates to a new device for locking the wire springs which support the sliding tubes or sleeves, on which umbrella sticks are held in position, referring more particularly to the lower spring by which the umbrella is held closed. The invention consists in the combination, with the said wire spring, which is of ordinary construction, of a sliding slotted tube within the umbrella stick, and of a spring connected with said tube, and of a key for setting said tube so that the umbrella cannot be opened without said key.

SEWING MACHINE TABLE ATTACHMENT.—John C. Egley, Philadelphia, Penn.—This invention relates to the application of a hinged extension leaf containing two drawers to the table of a sewing machine, one of the drawers containing a pivoted self-balancing trough or vessel, which will always be right side up, whether the leaf attachment is swung up or down: while the other drawer has two slide covers, of which the one on top is or should be used in the corresponding position of the leaf.

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Notes & Queries

1.—Will some one give me a good and simple recipe for making tracing paper and cloth?—T. W. M.

2.—How can I make a varnish that will be transparent, and so hard that it will not scratch? It is to be used on paper and cardboard.—T. C. T.

3.—Can there be an ink manufactured of any particular color that will not be visible to the naked eye on a particular colored paper, and yet be discernible through some particular colored glass?—H. K. J.

4.—What chemicals are used in boiling water to kill moss and at the same time to dye it black? The moss grows here on the trees, and is used for filling mattresses.—G. G. L.

5.—Please give me a recipe for making "Alaska scenery," namely, white formations (in water), which, in size and form, have a resemblance to mountains, etc. I have seen them in druggists' windows in different parts of the city. Can the "Alaska scenery" be colored red, yellow, blue, and green?—G. W. H.

6.—The preparation and dressing of furs seem to be held a secret from the general public and an entire monopoly, from the Hudson Bay Company's trade to that of manufacturing the furs into garments. Can any one furnish particulars of the best and simplest methods of such preparation, and also any improved scientific methods adopted by those who so far monopolize the trade? What is the most elaborate work on fur dressing?—H. I. R.

7.—I can tin wrought and malleable cast iron by first placing the iron in a pickle of oil of vitriol, then I wash it off and dip it into muriatic acid, and then into molten tin. I always have good success with malleable cast and wrought iron, but cannot make the metal adhere to ordinary cast iron. Will you please inform me what different process I need to use for the latter?—C. H. B.

Answers to Correspondents

L. A. B.—See our editorial article, "Losses of Power in the Steam Engine." You are nearly right in your estimate of average leverage of cranks; the figure is 0·7854. There is no loss of power arising out of the employment of the crank.

S. L. P., of N. J., says there is a question between himself and friend in respect to two examples of masonry, one of which is built on straight lines and the other in form of an arch, the longitudinal space covered by the walls being exactly the same. One claims that the quantity of masonry in each example is the same, the other, that the arch contains the greater quantity. Answer: The arch, supposing it to be in the form of a half circle, contains fifty per cent more masonry than the straight wall.

A. P. M. says: Is the friction greater on journals three feet in diameter or journals one inch in diameter? The length and quality of the bearings, the weight upon the journals, and the number of revolutions are the same in both cases. For answer, see editorial remarks, on another page, entitled "Friction of Journals."

C. W. S. asks: At what speed or how many feet per minute a circular saw should run, for sawing pine plates one half inch thick, and brass bolts or bars of three inches diameter? Answer: About 1,000 revolutions per minute for a six inch saw will do.

W. H. L. says: What is the difference of cost in running a car by horse and steam power? Answer: The estimated prime cost and running expenses for a first class two horse street car in this city, interest, wear and tear, driver, conductor, stabling and all the expenses included, is $6,150 per annum. The same estimate for the running of each dummy or steam street car is $7,138, showing an economy of almost $1,000 a year in favor of steam.

B. says: The SCIENTIFIC AMERICAN in an article headed "Scientific and Mechanical Possibilities" says on page 329, volume XXVII.: "Heat increases about one degree for every fifty feet that we penetrate the earth." A California paper of November 8 has the following: "The greatest blow ever given to the hot liquid theory of the interior of the earth was that demonstrated by the artesian well at St. Louis, which developed a temperature at the depth of 3,300 feet which was too cold to be determined by any instrument of science at the time in use for such a purpose." Will you please to explain whether the above article is erroneous? Answer: The statement which you quote from the California paper of Nov. 8, is absolutely false, and is either the result of some most remarkable misunderstanding, or is one of those unpardonable misstatements which are sometimes purposely introduced by dishonorable persons into newspapers, and which have done a vast amount of mischief by misleading the public. Experiments give varying results. Some indicate an increase of 1° Fahr. for each 50 feet of descent, while others show an increase of 1° Fahr. for each 100 feet. All concur, however, in exhibiting an increase of temperature as the earth's crust is penetrated. Estimates of the thickness of the earth's crust have been frequently made. It is not more than a few hundred miles, and may be less than one hundred. Below it, the temperature must be uniform, or nearly so, since there, all ordinary earthly matter and common metals are liquid. "It is not impossible, nor is it improbable, that there may be a central solid mass of alloyed metals whose melting point is too high to allow even a temperature higher than that of a blast furnace to fuse it."*

**Professor Thurston.*

M. H. W., of N. Y., H. C. K., of Mass., and others, write us in reference to our reply to the question of R. and W. about the fly wheel. The subject seems to be one in which many of our readers are interested, and we will endeavor, in an early issue, to state the principles involved. In such manner that all may understand the difference between a "standing" and a "running" balance and between the case which we specified and those presented by our correspondents. We will here simply remind them that we stated that "if the wheel is accurately balanced, and is perfectly symmetrical, it does not necessarily produce unsteadiness *in the shaft*." H. C. K. has experimented with molding machines, grindstones and planing machines and has been annoyed by unsteadiness of movement simply because, although, in good standing balance, there was a loss of gravity. His method of securing a running balance is a method of securing symmetry. By symmetry is meant such an arrangement of heavy material that each particle is balanced by another, equally heavy and equally distant from the center of motion. In such a case only can we get a perfect standing and a perfect running balance at the same time. A standing balance, otherwise, will not be a running balance, nor is a running balance necessarily a standing balance.

P. R. S. says: I think of putting in a 10 horse power steam engine. I will have to dig 20 feet and get very hard water, or put in a cistern and use water from roof. Can you tell me how much water I would have to use per hour in my boiler to get 10 horse power, and how will it work to run the escape pipe down into the water in the cistern? Would it not condense it so that there would be but little loss? Answer: A moderately good boiler driving an ordinarily good 10 horse power engine would require about a hundred gallons of water per hour. A bad boiler and inefficient machine might use nearly double that quantity, while the best boilers and very best known portable engines may be expected to run regularly at 10 horse power on fifty gallons per hour. Your arrangement of exhaust would not be satisfactory. It would only heat the surface, and if carried down under water would subject you to serious loss by back pressure.

E. T. Q., of N. H., says: I observe in your paper for Dec. 21, 1872, a reply to R. and W., in which you affirm that a balance wheel perfectly symmetrical and accurately balanced, keyed firmly upon a shaft in any position, "does not necessarily produce unsteadiness in the shaft." I am unable to understand how your reply can be correct, unless you have some unusual meaning for the expression "unsteadiness in the shaft." Will you explain more fully, and will you also state whether a shaft carrying a perfectly symmetrical and accurately balanced wheel, keyed firmly at an angle of 45° to the shaft, will saw rapidly without jumping from its bearings if not held down? Answer: Already answered elsewhere. We were probably not sufficiently precise in our language. The shaft would leave its bearings if unconfined, and driven at sufficiently high speed. It would not necessarily give trouble in all cases.

E. B. M. says: I notice that some of your correspondents recommend tan bark to clear a boiler of scale. Will it be injurious to our boiler to use water strongly impregnated with old sour liquor from the vats of a tan yard, the liquor being conducted directly from the vats, after being exhausted of its strength in tanning skins, to the feed water of the boiler? Answer: Water strongly impregnated with old sour liquor from a tannery would, in time, corrode your boiler and might do serious injury. If you cannot elsewhere obtain pure water, try it cautiously. Vegetable acids attack iron as do mineral acids, although you may find the solution so weak as not to have any appreciable effect in a long time.

W. E. H. says: Given two boilers, each 3 feet diameter, cylindrical, one 6 feet and the other 12 feet in length, all other things equal, is there any difference in the pressure per square inch required to produce rupture? Or in other words, does the length have any thing to do with the bursting strain? Answer: The length of a steam boiler has no effect either to increase or diminish its resistance to bursting pressure.

One of your correspondents, Le R. F. G., of Mass., maintains, or strives to maintain, that the part of a moving locomotive wheel in contact with the rail does not, "for the time being," move forward. I am inclined to the opinion that, for the following reasons, no part of such wheel is devoid of a forward movement; that if we closely watch a wheel while turning forward, it "seems" as though no part was stationary even for an instant. 2d, If the top part of a wheel has a forward movement dependent upon the progress of the wheel upon the rail, and independent of its motion upon the axle, it "seems" to me that every other part of the wheel must have a forward movement also, because no part of the wheel has a backward movement, and all parts are so connected with the top as that if one moves the other must. If a locomotive wheel, four feet in diameter, with No. 1 marked on its highest part, and No. 2 on the part in contact with the rail, revolves one quarter round, it will bring No. 1 two feet in advance of the axle; and as the axle has moved forward nearly three feet, or one quarter of the wheel's circumference on the rail, No. 1 will be near five feet in advance of the position it first occupied. And as the movement of the wheel one quarter round places No. 3 two feet behind the axle, which has moved near three feet forward, it places No. 2 near one foot in advance of the place it started from. And as the descending movement of No. 1 is equal to the ascending movement of No. 2, it results that No. 1 has moved more than three times faster than No. 2. If we take two wheels an inch in diameter, with a mark on the circumference of each, and hold one stationary in one hand while we take hold of an axle passing through the center of the other, we will find, on putting the marked places together and revolving the one on the axle around the other that the one revolving turns once, and only once, around on its axle.—S. S. G.

To J. E. S., query 1, page 378.—After more than twenty years experience in the use of rubber belts I find iron hooks to be the most convenient and most durable splice. Cut the two ends of the belt perfectly square, and punch the holes for the hooks on an exact line. For heavy belts use two rows of hooks. In this way each hook will have the same strain. Do not depend on your eye for punching the holes on a line, but first mark a line with a square and then punch the holes, not too large for the hook. Now about dissolving rubber in spirits of niter. There is no such thing as dissolved rubber in the true sense of the word. With essential oils it can be expanded, and it has the appearance of being dissolved, but such solution will not saturate. Shellac gum copal, pitch and resin may be dissolved and mixed so that fibrous materials may be saturated with them, but rubber separates from its so called solvents, or rather the solvent evaporates and leaves the rubber in a thin film on the surface over which it is spread. Neither will fire melt it, for at melting heat rubber will decompose, making a tremendous smoke and leaving very little residuum. Rubber is a unique substance. About vulcanized rubber, there are many mistaken notions abroad. The process of vulcanization is simply submitting the rubber to heat (steam or hot air) in such a manner that the heat can be regulated and controlled as to time and degree. I have heard vulcanization compared with the burning of bricks, but there is no similarity in the processes, for the bricks are brought in contact with the fire. Rubber treated in that way would decompose.—A. E. W. E., of Mass.

By my query, page 340, Volume XXVII., I wished to find out if J. W., or any one else, knows any practicable way to shift a belt from a loose pulley at the drives end, provided, of course, that the belt is not in motion. There are plenty of mechanics who are ready to adopt any evident improvement when putting up machinery. I think some of them could be fooled several dollars worth with such advice as J. W.'s, page 292 J. E. S., page 378, intimates that it is not good practice to make the loose pulley much smaller than the tight one. His experience must differ very much from mine, though in my other article my language implied more than I meant when I said a difference of an inch is no hindrance to the shifting of the belt. The plan recommended by Mr. Coleman Sellers of making the hub of the loose pulley longer than the face is a good one, and in addition the face should be made very high in the middle, so that, if the hub wears so as to allow the pulley to tip to one side, the belt will keep as near as possible on the middle of it. When a loose pulley tips, so that the shifter has to be depended on to keep the belt from running off, the friction on the shifter wears the belt very fast. When the driven pulley is placed over the driver, a properly made tightener is in most cases preferable to a loose pulley. Some light machines, as a saw table, with the driving shaft directly below, can be set on guides and the tension of the belt made by moving the machine. This plan works exceedingly well. The tension of the belt can be, as it can also with the tightener, regulated to a nicety, which is very desirable as it saves unnecessary straining of the belt and saves much time in lacing it, and the belt is not wearing while the machine stands still.—W. G. B., of Mich.

To J. E. S. query 1, page 378.—For lacing rubber belts use calf skin, tanned as for boots. Cut lengthwise the skin, and take out the stretch with water instead of oil. My experience is that one such lacing will outlast two of the oil tanned, and will not spoil your belt.—H. D. L.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 10, 1872,

AND EACH BEARING THAT DATE.

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Rivet, J. E. Wootten..... 133,737
Roll for lumber, feed, W. P. Hale..... 133,775
Roll for grinding surfaces, O. I. Foster..... 133,843
Rubber nuts to bolts, applying, J. Minetree..... 133 716
Ruler and blotter, combined, J. E. Eaton..... 133,899
Sash, sheet metal window, H. & G. Zielecke..... 133,740
Saw, A. P. Sproul..... 133,810
Saw, C. N. Brown..... 133,828
Saw gumming machine, Case & Meredith..... 133,830
Saw setting device, C. T. Shoemaker..... 133,727
Scraper, T. Ripley..... 133,890
Scraper, earth, Bowen & Hanna..... 133,825
Screw fan, reversible, W. H. Goyne..... 133,772
Sewing machine, R. Chandler..... 133,757
Sewing machine, O. Venner..... 133,814
Sewing machine cover, G. Gardener..... 133,846
Sewing machine guide, A. Douglas, (reissue)..... 5,180
Sewing machine power, Cleveland & Todd..... 133,760
Sewing machine attachment, E. Stewart..... 133,901
Sewing machine feed, J. L. & D. H. Coles, (reissue) 5,177
Sewing machine slide, E. P. West..... 133,733
Shingle machine, R. Smith..... 133,730
Shoes, goring, Gardiner & Goodwin..... 133,701
Shutter fastening, F. Doepke..... 133,838
Soda water apparatus, W. Gee..... 133,848
Soles, trimming, etc., S. H. Hodges, (reissue)..... 5,183
Spark arrester, Kearney & Tronson, (reissue)..... 5,184
Spinning frame, H. McE. Ward..... 133,816
Staff, miller's red, G. H. Carpenter..... 133,696
Stair rod, F. Miles..... 133,876
Steam generator, D. Renshaw..... 133,723
Steam generator, E. Bayard..... 133,743
Stone, artificial, M. T. Hagen..... 133,774
Stone, artificial, E. L. Ransome..... 133,807, 133,808
Sugar, compacting, A. F. W. Partz..... 133,884
Telegraph, electric, M. G. Farma, (reissue)..... 5,181
Tenoning machine, E. W. Roff..... 133,724
Textile material, cutting, A. Warth, (reissue)..... 5,186
Thill coupling, S. Keller..... 133,782
Tire, steel, J. J. Young..... 133,739
Tobacco hanger, J. Carrier..... 133,755
Transplanting machine, J. M. Gilbert..... 133,849
Trap, faucet, C. W. Curtis..... 133,763
Trap, insect, J. Dildine..... 133,836
Truck, freight elevating, W. F. Morrow..... 133,777
Type writing material, T. A. Edison..... 133,841
Umbrella stand, E. Snedeker..... 133,809
Vehicle wheel hub, W. A. Lewis..... 133,867
Vehicles, lubricating axle for, L. H. Fisher..... 133,769
Vehicles, axle box for, J. and W. Shackelton..... 133,895
Vehicles, detaching horses from, S. Beck..... 133,822
Vessels, raising sunken, H. F. Knapp..... 133,863
Washing machine, G. L. Witsil..... 133,736

APPLICATIONS FOR EXTENSIONS.

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

23,132.—RULING MACHINE.—J. B. Blair. Feb. 19, 1873.
23,246.—MEAT MINCER.—A. W. Hale. Feb. 26, 1873.
23,309.—ENVELOPES.—S. E. Pettee. March 5, 1873.
23,216.—ENLARGING PHOTOGRAPHS.—D. Shive. Mar. 5, 1873.
23,220.—SKIMMER FOR BOILERS.—A. M. Sprague. Mar. 5, 1873.
26,361.—PEGGING MACHINE.—A. C. Gallahue. Mar. 12, 1873.
24,098.—SEWING MACHINE.—P. S. Carhart. May 7, 1873.

EXTENSIONS GRANTED.

22,879.—BORING MACHINE.—G. F. Rice.
22,881.—BRUSH.—R. Shaler.
22,540.—PEGGING JACK.—T. D. Bailey.

DESIGNS PATENTED.

6,282.—WATCH CASE.—J. C. Dueber, Cincinnati, Ohio.
6,283.—CRIB CHAIR.—J. C. Hall, Cincinnati, Ohio.
6,284.—COOKING STOVE.—L. W. Harwood, Troy, N. Y.
6,285.—MATCH STAND.—C. H. Leggett, Elizabeth, N. J.

TRADE MARKS REGISTERED.

1,080.—LINIMENT.—S. H. Kennedy & Co., Johnstown, N.Y.
1,081.—SEWING MACHINE.—Florence S. M. Co., Mass.

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors.

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

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

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

To Make an Application for a Patent.

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

Caveats.

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

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

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

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

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

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

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

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

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

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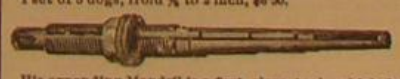
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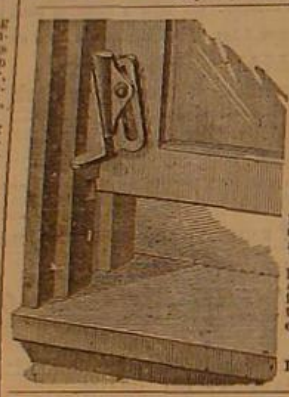
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IMPROVED BRICK MACHINE.

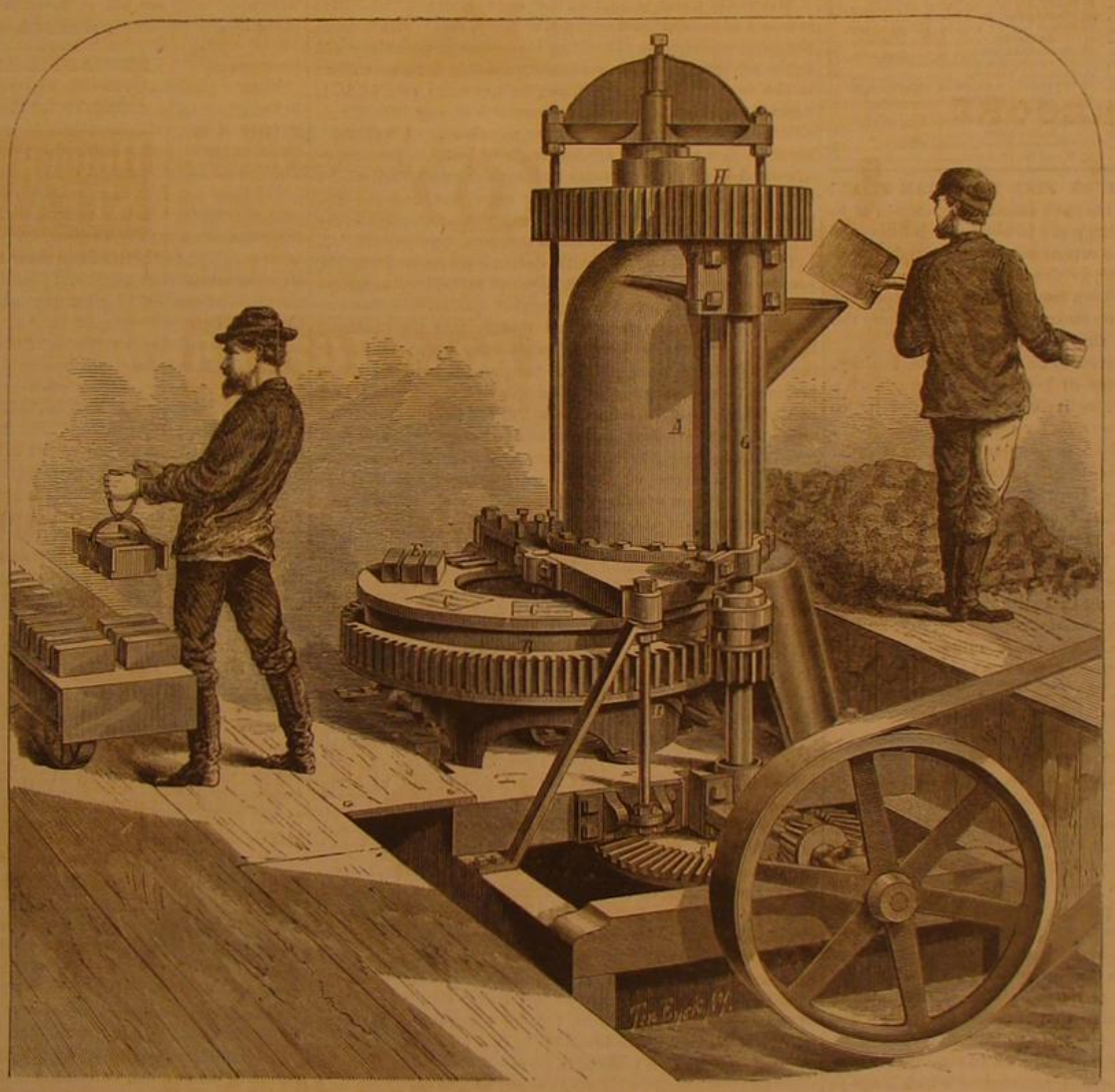
We illustrate this week a recently devised apparatus, known as the "Great American" brick machine, in using which, to quote the words of the inventor, "the brick maker has the satisfaction of knowing that, in five minutes from the time the clay is taken from its original bed, it has been thoroughly tempered into a uniform homogeneous mass, pressed into the nicest shaped brick, and placed into the hack, where no more handling is required until the brick are dry enough to enter the kiln." How these excellent results are obtained, the reader will find in the following description:

A, in our engraving, is the pug mill; B is the mold wheel containing twenty-four permanent metal molds, C C C, arranged in groups of three; under the latter is a movable bottom or follower, not shown, provided with a roller and traveling on a circular track, D, which raises or depresses the follower at proper points in the revolution of the mold wheel. Motion is communicated by the main pulley in the foreground by bevel gearing to the upright shaft, G, on the lower part of which a horizontal pinion actuates the mold wheel, B; while near its upper end is suitable gearing, H, which rotates the beaters within the pug mill.

The clay is brought directly from its bed, and not moistened unless it is too dry in which case a little water is added. The figure on the right is represented as shoveling the crude material into the receiver of the pug mill, within which it is thoroughly ground, tempered, and reduced to a homogeneous mass of about the consistency of thick putty. Thence it is forced into one of the groups of molds, C, which is carried under it by the revolution of the mold wheel, B, a polished metal surface giving the proper smoothness and finish to the top edges of the brick. The follower under the mold wheel then travels up an incline, raising a group of bricks, E, from the molds, all the angles and faces being preserved smooth, sharp, and perfect. As each set of bricks rises from the mold, it is lifted off by the clamp represented in the hands of the figure on the left, and placed upon a double decked truck that is capable of holding one hundred bricks. When filled, the truck is wheeled away and its contents piled in hacks eight or ten bricks high. Each revolution of the mold wheel, therefore, turns out twenty-four bricks, and it is claimed that the machine can produce sixty-five per minute, or thirty-nine thousand in a working day of ten hours.

There is no doubt but that this apparatus is compact, of great simplicity, and economical, in that it produces brick without skilled labor. That it is a decided improvement over the old-fashioned methods of grinding up clay with a superabundance of water, molding in sanded wooden molds, and allowing the moisture to evaporate by spreading the brick in a sanded yard, is also evident. It is neither a "soft mud" nor a "dry clay" machine, but aims at a medium between the two extremes. To continue the list of advantages which the inventor claims, the clay is tempered in the machine itself, so that no separate process is necessary; no molding sand is required, the polished steel molds answering every requirement; no handling or washing of molds, nor edging or spatting of bricks is needed; the bricks are taken directly from the machine to the hack, where they remain while drying, protected from rain and frost. A smaller yard will give the same drying capacity, the hacks being only six feet apart; and, lastly, the bricks can be manufactured at a much reduced cost.

The inventor points to the severe test which his bricks withstood during the Chicago fire, when 50 per cent came out perfect. As an item of interest, we note that the patentee affirms that he has made five hundred millions of bricks since 1865, in Chicago and other points, and that the company working this invention has turned out eight millions during the past season.



THE GREAT AMERICAN BRICK MACHINE.

For further information, address the Great American Brick Machine Company, E. R. Gard, President, No. 53 South Jefferson street, Chicago, Ill.

Ozokerit Candles.

So much money has been expended in advertising ozokerit that in England the public generally look upon the candles purporting to be made from it as, in fact, nothing more or less than the adamantine candles long furnished to the trade. The suspicion is, however, entirely unfounded, as the candles are really made of purified ozokerit, which is paraffin of the best quality. Ozokerit, or native paraffin, also called earth wax, was found embedded in sandstone near Slanik in Moldavia, in the neighborhood of coal and rock salt deposits. It was afterwards discovered in the Carpathians, from which latter source the English manufacturers obtain their principal supply. The crude mineral has a brown, green or yellow color, is translucent at the corners and exhibits a resinous fracture. It is naturally brittle, but can be kneaded like wax. When exposed to the air it becomes black and waxy, and when rubbed is negatively electrified and yields an aromatic hydrocarbon odor. The low melting point of 60° C, renders the admixture of certain other less fusible substances necessary in the manufacture of candles. The illuminating power of candles made from ozokerit has been expressed by the following comparison instituted by Dr. Letheby: To afford a given amount of light, must be taken of ozokerit candles, 754; paraffin candles, 891; wax candles, 1,150. The candles can be colored with mauve and magenta, and they then present a fine appearance.

English Prizes for Economical Stoves.

A friend of Sir W. Bodkin's has presented the sum of $2,500 to the Society of Arts, London, to be awarded in prizes or "otherwise" for the invention of improved stoves for securing economy in the use of coal for domestic heating or cooking purposes. The Council have accordingly announced five prizes, each of which will consist of the Gold Medal of the Society and $250, to be awarded as follows, provided the competing articles satisfy the judges. The announcement is as follows: The Society's Gold Medal and $250:

1. For a new and improved system of grate suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, answer best for warming and ventilating a room.

2. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, best answer for cooking food, combined with warming and ventilating the room.

3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room.

4. For the best new and improved system of apparatus which shall, by means of gas, be best adapted for cooking, combined with warming and ventilating the room.

5. For any new and improved system or arrangement, not included in the foregoing, which shall efficiently and economically meet domestic requirements.

The Council reserve to themselves the right of withholding all or any of the above prizes, as the judges appointed by them may determine.

The competing articles must be delivered not later than the 1st of December, 1873, with a view to their being tested, and they will be subsequently shown in the London International Exhibition of 1874. Further particulars as to place of delivery and other arrangements will be published as soon as they are finally settled.

One moiety of the sum presented to the Society is thus disposed of, but what arrangements are in view for disposing of the other are not at present made public.

Mechanical Engineering in Cornell University.

It may be a word of encouragement to young mechanics in the shops to know that the Board of Managers of Cornell University have selected, for the head of its mechanical engineering department, Mr. John Edson Sweet, of Syracuse, N. Y., a young man who, with but a common school education, has risen from striker at the forge, through the machine shop and drawing room, to be an instructor of engineering in this celebrated school. He has contributed, during the past year, a series of articles to *Engineering*, on "Mechanical Refinements."

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CAN BUILDINGS BE SET ON FIRE BY STEAM PIPES?

The recent destructive fires have raised the question as to the safety of the use of steam pipes in heating buildings; and as in some instances the true cause has been enveloped in mystery (which is quite natural, as fire destroys all evidences) the Fire Marshal of New York has found it most expedient to throw the blame simply on steam, in those cases where the buildings were warmed by that agent.

As steam may be considered to be the most safe, healthy, and economical of all modes of heating buildings, such a suspicion is to be deplored, as it is apt to raise a prejudice against it; hot air furnaces may be considered dangerous, as proved by the well established evidences of the fire records, but not so with the steam heating. In fact, there is not any well authenticated case on record wherein pipes, through which steam passes, have actually set fire to woodwork, and no one experimentor has yet succeeded in igniting wood with such pipes. We maintain that any man of science who has studied the subject of steam, or any practical engineer of common sense, knows that all that steam can do, even when superheated, is to make the woodwork hot and dry, and to predispose it to catch fire. The spark must be supplied from another source; the steam tubes can never attain, outside the heating apparatus, the high temperature of 900° or 1,000° Fah. required for the red heat which is necessary to set woodwork on fire.

In this city many of the steam heating apparatuses are worked on a pressure not above 10 lbs. per square inch, in excess of atmospheric pressure, which gives a heat of 241° F. for the water in the boiler, and a somewhat less heat, of course, for the steam which circulates through the pipes. In the majority of buildings heated by steam, a common boiler is used, from which steam pipes are carried through the premises, and an ordinary pressure for such boilers is 40 lbs. per inch, which gives a heat of 289° F. At a pressure of 120° lbs. above the atmospheric pressure, we have a heat of 355°. It will thus be seen that at pressures, far above any that are used for heating purposes, the heat circulated in the steam pipes is much below that required for the ignition of wood.

That steam pipes predispose woodwork to combustion, and even may assist the spontaneous combustion which is apt to commence in rags soaked with any animal or vegetable oil, cannot be denied; but then any heating apparatus will do the same, and steam is in this respect not so dangerous as a draft of hot air proceeding from a furnace, in which a leak may carry a spark upward, while a leak from a steam tube is utterly harmless. In regard to spontaneous combustion, any danger of that, from oil, may be avoided by using for lubrication the heavy lubricating petroleum. This material is not apt to oxidation or spontaneous heating, as one of our esteemed correspondents discovered and published in our paper several years ago; which valuable property is now also being publicly recognized in Europe.

THE AUSTRIAN SHOW BEFORE THE SENATE.

It is probably needless to state, that the bill granting $100,000 as an appropriation for American representation at the Vienna Exposition having passed the House, the supporters of the scheme will concentrate every effort to induce the Senate to increase that sum, in order to allow of a raid upon the Treasury proportionate to the extravagant figures heretofore fixed upon by the United States Commissioner. The Senate undertakes the consideration of the measure with a full knowledge of the objections which ever since its reception have been strenuously urged, and with the advantage of the previous discussion on the merits and demerits of the bill.

We have traversed the whole ground so fully and so minutely that there is little, in addition to that which we have already presented, left for us to say. We would urge upon the Senate the simple fact that for this appropriation there is no necessity; because, first, as has already been stated by a representative, our citizens should know that for individual success they must depend upon individual enterprise, individual merit and individual energy, and that they are not to be nursed by the Government so that the few may be enriched at the cost of the great body of the people. Second, because we are sure of an adequate representation in any event. This is but a natural conclusion drawn from the precedent of previous European industrial expositions, in which nearly every large manufactory on the Continent exhibited devices of American origin. Corliss Steam Engines, McCormick Reapers, Amoskeag Steam Fire Engines, Howe, Singer, and Wheeler & Wilson Sewing Machines, Gwynne's Rotary Pumps, Burleigh Rock Drills, Blake's Stone Crushers, Blanchard's Lathes (in every country where they make gunstocks, lasts, spokes for wheels, or irregular forms of any kind), Whitney's Cotton Gins, Gatling's Mitrailleurs, Remington Rifles, Hotchkiss Projectiles, Tilghman Engraving, Root Blowers, Colt's Revolvers, Clothes Washers and Boilers, Silver's Marine Governors, Henderson's Process for Iron, Danks' Rotary Puddling Process, Hayden's Invention for Hollow Ware, Hyatt's Pavements, Print Writing Machines, American Pianos, and Hoe and Bullock Printing Presses are but a portion of the large number of our inventions in constant use abroad which it is safe to say will be found in the coming show.

We would remind Congress that our Centennial Exhibition is now a suppliant for a national subsidy, and that although the same objection to extending Government pecuniary aid to the advertising of private business holds here as well as in the case of the foreign show, still, of the two, if it is deemed expedient to grant such assistance, our own Exposition certainly merits the preference. We need not dwell upon the fact that there are hundreds of matters productive of more benefit to the country at large—the reduction of the national debt, the renewing of our commerce, and the improvement of the navy are but examples—to which every spare dollar in the Treasury could be advantageously applied.

The Centennial has met with decided disfavor from the people, as shown by the withholding of individual subscriptions. Such an expression of popular opinion has but one unmistakable interpretation, and that is that the public, if they refuse to countenance an exhibition, which will draw the industries of other countries to our own borders, which presents no obstacles to the safe display of the world's best products, which at the same time will afford an opportunity for aggrandizing ourselves by the exhibit of our wonderful progress during the past century, they look with still less approbation upon a plan which presents not only an equal but a larger number of disadvantages, with a far less proportionate amount of benefits to be gained.

We trust that, so far from increasing this appropriation, a plan which we understand is to be advocated, the Senate will either strike it out altogether or, if it must be passed, curtail its figures. In reference to the latter event, it may be well to remember that the Chairman of Foreign Affairs in the House, during the recent debate, made the following assertions: "The Secretary of State has sent to the Austrian Government the project of a law that will entirely protect the inventors of this country. That has been received by the Government of Austria, and the Secretary of State expects that it will be approved by that Government. No expenditure will be made under this appropriation except with the approval of and by the direction of the Secretary of State." A strong intimation was added to the effect that, until this law was passed, no disbursements would be made. We would call attention to the fact that it is now several months, according to the showing of the United States Commissioner, since this "project" was forwarded to Austria, and that ample time has elapsed to have some action taken. The feeling in this country is well known to that government, and has been commented upon in the Vienna journals. It is therefore advisable, in view of the rapidly approaching time of opening of the Exposition, April next, that an amendment embodying the above proviso be inserted, in case an appropriation is granted, merely as a protective measure.

COLLAPSING BOILER FLUES.

A correspondent, O. L. M., writes from Niles, Trumbull county, Ohio, to inform us of an accident which affords another illustration of the criminally careless or ignorant engineering which annually destroys so many lives, and which, we regret to be compelled to confess, finds a larger number of victims in the United States than in any other country on the globe. The fact is due probably more to the proverbial recklessness of our people than to any other defect in our national character. So far as it is a consequence of ignorance, we may hope that the pages of the SCIENTIFIC AMERICAN and its engineering contemporaries may be found to furnish a valuable preventive; experience only can teach our reckless people prudence, or even that a good business policy dictates greater caution in proportioning and working steam boilers.

In the case mentioned, the steam boilers of a blast furnace are forty-eight inches in diameter, thirty feet long, and have each two flues seventeen inches in diameter, and three sixteenths inch thick.

The usual pressure carried is forty-five pounds per square inch. Recently, while the engine was standing, the steam pressure rising to fifty-five pounds, one flue was collapsed its entire length. Our correspondent desires to know "what was the cause of the accident." The boiler was well supplied with water, and everything apparently all right.

The cause was, undoubtedly, simply weakness in the flues. They were, probably, a little out of shape when put in, had become somewhat weakened by use, and finally collapsed when the pressure was a little higher than usual. If these flues had been *perfectly round*, they would have had a collapsing pressure, when new, of about $606{,}000 \times (\frac{3}{16})^2 \div 30 \times 17 = 55{\cdot}5$ lbs., as determined by the rule which Fairbairn deduced from his experiments on the strength of flues.

The laps of the girth seams would strengthen the flues to a slight extent, and, in this case, about an equally slight weakening had taken place by loss of shape and by use, so that the collapse finally occurred at just the pressure indicated.

These flues should have been made at least one quarter inch thick, or should have been strengthened by properly fitted rings of angle iron at intervals of seven and a half feet. A good engineer, designing such boilers with a view to making good work and sustaining his reputation rather than deferring to a penny-wise, pound-foolish spirit of economy, would have made them of 5-16, or even 3-8 inch boiler plate. Although our law dictates that boilers should have, when new, a strength only about four times greater than their working pressure, good engineers are inclined to make the "factor of safety" six or more in every part.

The other flues of these boilers should be looked after at once, or they may produce a more serious disaster. It would also be well for those whose lives and property are jeopardized, to ascertain how it happened that, where steam was nominally carried at forty-five pounds, the pressure could by any possibility rise to fifty-five.

PROSPECTS FOR 1873.

We are gratified to be able to state that the subscriptions to the SCIENTIFIC AMERICAN for the new year of 1873 are pouring in from all directions, and there is every prospect that our regular edition for the year will reach the round number of *Fifty thousand copies per week.*

We hope our friends who have not yet renewed and all who are engaged in the formation of clubs will send along their names as rapidly as possible. To prevent the loss of back numbers to those whose remittances are a little tardy, we electrotype each issue and preserve the plates, whereby we shall be enabled to print new editions of any numbers that may be required.

The terms of the SCIENTIFIC AMERICAN are $3 a year· $1.50 for six months.

DU MOTAY'S PROCESS FOR OXYHYDRIC ILLUMINATIO

Our excellent cotemporary, *Les Mondes*, a Parisian scientific weekly, translates our recent article upon oxyhydric illumination, from which, to use its own words, it derives "affliction and consolation at the same time." Speaking of M. Tessié du Motay's system, it says: "Misunderstood in France, the inventor and the invention are received and applauded abroad—in England, Germany, Belgium, and America. The glory of the one and the benefits derived from the other will be the consequence of this unfortunate importation."

Our cotemporary strongly dissents from the adverse report of M. Le Blanc, and adds that proof of the value of the process are pouring in from all sides. The best, it continues, is the demonstration recently made that, by the inventions of M. du Motay, the cost price of about 35 cubic feet of hydrogen is reduced to two cents, and that of a smaller quantity of oxygen to the price of about 13¼ lbs. of coal or other fuel. The lowest quotation of coal, as now selling in Paris, given by the commercial journals, is $10 per tun; so that 2¼ lbs. of fuel costs about one cent; consequently oxyhydrogen gas is worth, per thousand cubic feet, a fraction over $1.14. In this city and the environs, ordinary street gas varies from $2.80 to $3.50 per thousand feet.

The economy of the process is obvious from the fact of fuel in this country being much cheaper. Ten dollars per tun is far above our market rates. Taking into consideration the mechanical nature of Du Motay's process, and even allowing for the increased expense of labor in this country, we should judge, from the above, that this improved and excellent mode of illumination might be supplied at a cost not exceeding one half, or, at most, two thirds that of the inferior gas now in use.

OXIDIZING AGENTS.

We are frequently asked by correspondents to name some of the leading agents employed by chemists, to produce what is called oxidation. The operation is an important one in the arts, as upon it depends the success of bleaching, disinfection, and similar processes. We will mention some of the methods now preferred by chemists for the purposes indicated.

Ozone, if it could be cheaply made, would be almost invaluable, but the cost of production stands in the way of its common use. The permanganate of soda or potash is a chemical compound that cannot be excelled in its oxidizing properties, and its use has gone on steadily increasing for years. In England, under the name of Condy's fluid, it is a common article about the household, and for hospitals and bleacheries it is coming into vogue. A little more knowledge of its value would soon lead to its production on a large scale.

Bleaching powders have long been known and used as oxidizers, and, as they can be had in any quantity, are likely to continue to be employed.

Chromic acid, whether in saturated or dilute solutions, has the power of converting carbonic oxide into carbonic acid, readily and completely under ordinary temperatures. Ammonia gas is powerfully oxidized by it, and it readily destroys organic matter. The chlorates and nitrates can also be mentioned in this connection.

PROPERTIES AND USES OF KIESERITE.

Kieserite is a mineral composed of sulphate of magnesia and water, which occurs to the extent of 12 per cent in the salt deposits of Stassfurt, Germany. It differs from Epsom salts by its difficult solubility in water and smaller percentage of water of crystallization.

The first attempts to economize kieserite were made in 1864, when it was proposed to employ it in the preparation of sulphate of potash. Since that time the applications have greatly increased, and it has now become an important article of commerce. The largest quantity of the raw material is sent to England, where it takes the place of the sulphate of magnesia, formerly manufactured from dolomite, or Grecian magnesite, in cotton printing. Another portion of kieserite is converted into Glauber salts which, on account of its freedom from iron, is highly prized by gas manufacturers.

Manufacturers of *blanc fize* employ kieserite instead of sulphuric acid to precipitate the sulphate of barium from chloride of barium, and in all similar cases where it is proposed to prepare a difficultly soluble sulphate, the kieserite can be advantageously used. Kieserite is recommended as a substitute for gypsum in agriculture, as a top dressing for clover, and is largely employed in England for this purpose. It is proposed to use kieserite in the manufacture of alum. There is a mineral called bauxite which chiefly consists of the hydrated oxide of aluminum; this is easily dissolved in hydrochloric acid. Cheap potash salts and the calculated quantity of kieserite are added, alum crystalizes out of the solution, and chloride of magnesium remains in the mother liquor.

The uses indicated above are wholly inadequate to consume the enormous quantities now obtained from the Stassfurt mines. Millions of pounds of kieserite are annually brought to the surface, and it is becoming a serious question to know what to do with it. If it could be used as a substitute for gypsum in building materials and cements, its cheapness would at once commend it to notice. Experiments looking to this application have been tried.

Two equivalents of kieserite and one equivalent of caustic lime were stirred to a paste in water. The mass hardened, but remained granular and brittle. On calcining it, however, again pulverizing and moistening with water, it set to a solid marble-like mass, which could be applied to many useful purposes. It is proposed to employ this material for ornamental decorations in the interior of houses and in general for the manufacture of cements and as a substitute for plaster of Paris.

Kieserite appears likely to prove a valuable accession to our supply of useful minerals, to be ranked by the side of kainite, a potash mineral also found at Stassfurth and now largely imported into the United States.

BALANCING MACHINERY.

In designing and constructing machinery, it frequently becomes necessary to make provision for balancing the weights carried by rotating shafts, and for neutralizing the effects of forces developed by the motion of either rotating or reciprocating parts. Mechanics are in the habit of distinguishing between a "standing" and a "running balance." When a heavy piece is carried upon an axis, in such a manner that it is not balanced on that axis, it exerts an effort to turn itself about the shaft until it comes to rest with its center of gravity in the lowest possible position. This effort is measured by what is called a *moment*. A moment is the product of any force into its lever arm, the latter quantity being the shortest distance from the line of direction of the force to the axis about which it tends to produce motion. In the case of a crank on its shaft, the force is the weight of the crank acting vertically downward through its center of gravity, and the lever arm is the distance from the center line of the shaft to the vertical, through the center of gravity of the crank. The moment would have a maximum value when the crank lies horizontally, and would be one thousand foot pounds were its weight five hundred pounds and its center of gravity two feet from the center of the shaft, or were the weight seven hundred and fifty pounds and this distance sixteen inches, or again, if the weight were two hundred and fifty pounds and the lever arm four feet. If opposite this crank another heavy piece is placed, of such weight and at such a distance that its moment, tending to produce rotation in one direction, is equal to that of the crank tending to turn the shaft the other way, the latter will be balanced. This will be shown by the fact that the shaft, if unacted upon by any other forces than the weights of the crank and its counterbalance, will remain in any position in which it may be placed. In this case we have an illustration of the "standing balance." Should it have happened that the counterbalance, although exerting an equal moment, was not of equal weight with the piece which it was intended to balance, it would be found that, upon setting it in motion at a sufficiently high rate of speed, the shaft would shake in its bearings; or if they were set up tight, the whole machine and even its foundation might shake in consequence of the unsteadiness of the rotating parts.

It would thus become evident that a standing balance and a running balance are not secured by similar conditions. In fact, we have to deal with quite different forces. In the first case we have to equilibrate the force of gravity; in the second, we have to neutralize the effects of the force of inertia as developed by bodies in motion. The force of gravity has an effect simply proportioned to the weight of the piece, while inertia produces an effort proportional to the weight of the mass and, also, to the square of the velocity with which it moves. When a piece swings about a center, as in the case of the crank just considered, or of a stone in a sling, the force with which it tends to break its connection with the center, its centrifugal force, is due to a constant tendency to move in a straight line, and is a consequence of its inertia. The intensity of this force is measured by the product of the weight of the body into the square of its velocity per second, divided by sixteen and one twelfth times the diameter in feet of the circle in which it moves. Algebraically expressed, this force is $F = \frac{WV^2}{16\frac{1}{12}D}$

We may assume, without great error, that this force acts at the center of gravity of the piece. Then our crank, weighing 500 pounds, would have a centrifugal force, at 50 revolutions per minute, of $\frac{500 \times (2 \times 3{\cdot}1416 \times \frac{5}{6})^2}{16\frac{1}{12} \times 4} = 213$ pounds. At 100 revolutions per minute, this would become four times as great, or 852 pounds, and at 150 revolutions the force would become 1917 pounds. Such forces as are thus developed at high speeds frequently have very serious effects, and it sometimes becomes absolutely necessary to secure a good running balance by neutralizing them. Were it attempted to effect a balance by a piece placed opposite, at a double distance, but of half the weight, the counterbalance would have a double centrifugal force, and hence, although a standing balance would be obtained, it would not give a running balance. To secure the latter, it would be necessary to reduce the weight of the counterbalance one half, and this, in turn, would destroy the standing balance.

En resumé, the condition of a standing balance is that the moments of the weights carried by the axis shall neutralize each other. The condition of a running balance is that each piece shall have a counterbalance of equal *vis viva*. By *vis viva* is meant the quantity obtained by multiplying the weight of a moving body by the square of its velocity.

The condition of a combined standing and running balance is that each rotating mass shall have a counterbalance of equal moment and of equal *vis viva*. This is complied with when the counterbalance is of equal weight, and equally distant from the axis with the piece which it balances. If there are several masses revolving on the same shaft, it may happen that, although no two have the same *vis viva*, the sum of the excesses may equal the sum of the defects, and an equilibrium may still occur. In most instances where the balance is secured in such arrangements by trial, this latter case is exemplified.

In high speed engines, and notably in locomotives, it becomes necessary to balance the reciprocating parts. In this case the same principles apply as in procuring a running balance of rotating parts, and the problem is solved by securing equal and opposite *vis viva*.

We will continue this article in a subsequent number of the SCIENTIFIC AMERICAN.

THE SEWING MACHINE MONOPOLY.

An extended article on the application of A. B. Wilson, for another extension of his sewing machine patent, is in type, but is necessarily crowded out this week for want of space.

Sewing machine manufacturers and patentees who are not members of the gigantic sewing machine monopoly should bestir themselves at once if they would avert another seven years' servitude to this oppressive combination. Action should be taken immediately, and every honorable means be adopted to prevent Congress from passing the bill, should the Committee on Patents be wheedled into recommending it. An inexpensive and practical mode of enlightening the people throughout the country in regard to this scheme, which pecuniarily effects every user of sewing machines, will be to send circulars to every postmaster, merchant and manufacturer in the United States explaining how excessive has been the profit exacted from every seamstress and family now using sewing machines, and the heavy tax which every new purchaser will have to pay in consequence of the existence of the sewing machine monopoly, and which another extension of the Wilson patent would further perpetuate. With this circular (requesting the obtaining of as large a list as possible in the shortest time) should be sent a blank petition for the signature of persons opposed to the extension, with a request to forward to the member of Congress from the District where the names are obtained, as soon as a number of signatures are registered.

TO INTENDING EXHIBITORS AT THE VIENNA SHOW.

Mr. Van Buren, the United States Commissioner, in a recent card reminds intending exhibitors that they should hurry up or it will be too late to send their goods. He expects that Congress will pay for freighting the articles over to Austria. But exhibitors may expect to pay pretty freely to have their merchandise looked after and displayed on arrival. This was the case at the Paris Exposition, and the Austrian charges will be much higher. The late war has greatly increased the prices of living in Vienna. The great show will be a money harvest for the people of that city.

PRACTICAL ADVICE TO EXHIBITORS IN AUSTRIA.

The worthlessness of the pretended protection offered by the Austrian government to exhibitors, at the coming Vienna show, is set forth in the accompanying letter from Mr. Hotchkiss. This gentleman is an American patentee who, in the course of regular proceedings under the Austrian patent laws, has become practically acquainted with their working, and his views may be relied upon. We advise intending exhibitors to profit by his advice.

To the Editor of the Scientific American:

I am very much gratified to see the articles in your valuable paper concerning Austrian and other European patent laws, and the gross injustice now practiced under them. There are two or three important points which I have not touched upon in connection with the working of patents in Austria, and in connection with the Exposition certificates proposed.

I would advise inventors designing to exhibit at Vienna not to avail themselves of the proposed exposition protection, but to apply for their patents before the exposition of their goods takes place, for the reason that an Austrian may take a patent for the same thing, during the existence of the Exposition protection, and claim that he was the original inventor, thus creating a dispute between the holder of the patent and the holder of the certificate of protection.

In taking patents the inventor should be particular about his drawings and specifications, and not describe more than one mode of accomplishing his object, for the Austrian patent office demands, if an inventor describes two, or three, or more different ways in which his invention can be made, that, in working his patent within the first year, he shall work it in all the different modes described in his patent, no matter how indifferent some of the modifications may be.

Under the present working of the patent office, where an invention has several modes or modifications described, they allow you to prove the general principle working, and then afterwards demand of you to prove that you have worked some one of the modifications; and if you fail to prove that you have worked any one of them, no matter how trivial or insignificant a matter it may be, the patent becomes void.

Inventors must not expect to have any favors or liberality shown them under the Austrian patent laws.

I hope that you will give publicity to these suggestions and facts, for the benefit of those who propose to be exhibitors at Vienna.

B. B. HOTCHKISS.

Paris, December 20, 1872.

AN INTERNATIONAL SHOW IN SPAIN.

A grand international exhibition is to be held in Spain in 1875; and if the policy of paying out the money of the United States to assist foreign shows is to be continued, of which the Austrian exhibit is an example, we hope that poor Spain will not be forgotten. She really needs help.

If the public funds *must* be used for such wrongful purposes, we suggest that a fair division be made, and we hope that some of the Senators will introduce an amendment to the bill of Commissioner Van Buren, which calls for one hundred thousand dollars for Austria, so as to give half of the amount for the Spanish show. Fifty thousand dollars is quite enough to support our Commissioner for six months in Vienna.

Louis de Coudres.]

Died, in Brooklyn, N. Y., on the 16th ult., Mr. Louis De Coudres, in the 83d year of his age.

Mr. De Coudres was one of the very few yet living who had a hand in fabricating the machinery of the first steamboats. At the early age of thirteen, he was taken by James P. Allaire as his first apprentice, Mr. Allaire at this time carrying on a small brass and bell foundry. It was at this establishment that the brass castings were made for Mr. McQueen, who had machine works and did the work for Robert Fulton in applying his steam engine to the first paddle wheel steamboat, the North River, of Clermont. Several years later, Mr. Allaire started his steam engine works, in Cherry street, which became the leading establishment of the city and famous over the entire country for the number and character of the engines it supplied to the first steamboats which plowed the waters of this continent. Mr. De Coudres continued with Mr. Allaire more than half a century, some of the time as superintendent of the iron foundery and all of the time in charge of the brass casting department, in which art his reputation was pre-eminent. This branch of the Allaire works possessed for many years almost a monopoly of the trade of bell casting. The first great fire alarm bells, put up in the City Hall park, were cast here by Mr. De Coudres. He was in his 83d year, and was probably the oldest brass founder in this country.

THE Citizens Association of Des Moines, Iowa, invites men of capital to come there to build new factories and to enlarge the factories already established. Those for agricultural implements and farm machinery are greatly needed. Starch factories, cotton mills, factories for boots and shoes, hats and caps, canning fruit, and sewing machines, are also required; copper and brass founders, glass works, cooperage, furniture, chairs, baskets, brushes, etc., are all here offered manufacturing inducements. A vinegar factory, possibly a tannery, and many other establishments, and indeed every department of productive industry, must contribute to the great demand of this new and extensive business field.

A TRANSANDINE RAILWAY.—A transandine survey, made jointly by the Argentine and the Chilian Governments, leaves little doubt of the possibility of railway communication between the Atlantic and Pacific. The length of such a communication would be about 1,200 miles, of which nearly 400 miles are actually made.

IMMUTABILITY OF SPECIES.—Cats and dogs embalmed in Egypt four thousand years ago are precisely like those of today, said the late Sir David Brewster. What have the revolutionists to say to that fact? Four thousand years are nothing, so gradually are organic changes brought about—would probably be the Darwinian answer.

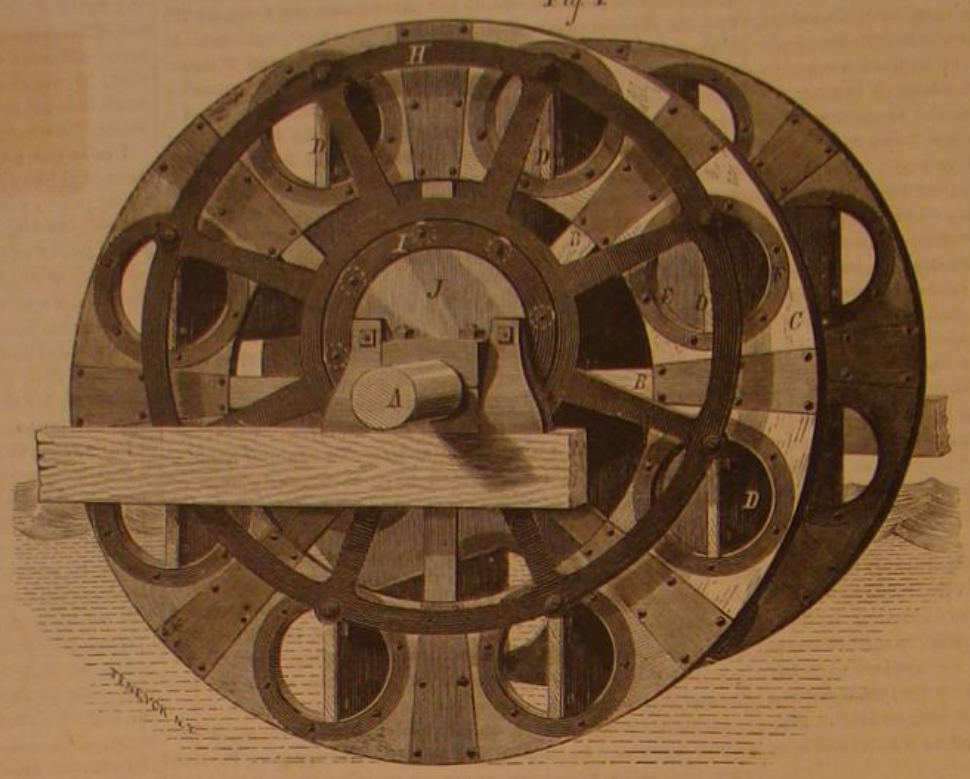
"I HAVE been a constant reader of the SCIENTIFIC AMERICAN for many years," says a renewing subscriber, "and would not be without it for many times its cost. It has been the key to unlock many problems which have agitated my mind."

IMPROVED FEATHERING PADDLE WHEEL.

The invention illustrated in the accompanying engraving is a feathering paddle wheel, or, in other words, a wheel in which the paddles are so arranged as to remain during their motion in a vertical or very nearly vertical position. They are thus prevented from lifting up bodies of water or from striking the water without acting fully and fairly to propel or otherwise give a useful effect.

Fig. 1 gives a general perspective view of the device, and Fig. 2 shows the manner of supporting the paddles in the wheel rim. A is the axle held in suitable bearings upon the frame. B B are the wheel arms connected with the axle and supporting the rims, C. D, the paddles, are secured by bolts passing through flanges of the semicircular cast iron segment, E, Fig. 2. The latter form, when combined, a narrow cylinder which turns in the wheel rim, C, and is guided by the flanges, F, secured thereto. By means of the journals shown, the segments are connected to the eccentric ring, H, which forms a united body with radial arms and an inner ring. J is a center bearing permanently attached and supported by braces to the wheel frame, having on its outer circumference a number of friction rollers, so that the inner eccentric ring rotates freely around it.

Fig. 1

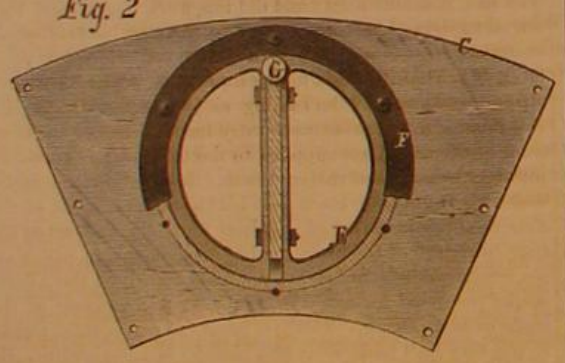


EMERSON'S FEATHERING PADDLE WHEEL.

It is evident from the foregoing construction that, as the wheel is revolved by the shaft, the rim, C, and the paddles, D, are rotated about the axis of said shaft. But the paddles, being connected with the eccentric ring, H, will be moved relatively to the wheel rim, C, in accordance with the eccentricity of the ring as it revolves about the bearing, *a*. The result of the combined motions is that the paddles and segments, E, are so turned in the wheel rim as to preserve a vertical position during a full revolution thereof. The segments, E, rotating in their housings, are always firmly guided and supported on all points of the circumference, thus resisting strains and contusions, whether arising from currents of water, ice, drift wood, or other obstacles.

The journals by which the eccentric ring is connected being situated at the upper edges of the segments, the feathering movement of the paddles is in the direction of the water pressure, as produced by the current made by the wheel, so that to obtain such movement but little power is required. It is further claimed that, by the arrangement of the roller center, I, the power required in actuating the eccentric ring is reduced to a minimum.

Fig. 2



This invention is notably simple in form, in that it avoids the use of projecting cranks for feathering, while its general construction is such as to afford every requisite of strength and durability. It may be readily adapted to any form of wheel now in use. The inventor informs us that a similar wheel was placed upon the steam canal boat Port Byron, recently illustrated in our columns, which vessel has made a remarkably quick passage from Buffalo to New York.

Patented Sept. 28, 1869. For further information address the inventor, Mr. Primus Emerson, Carondelet, Mo.

Experiments with Disinfectants.

As the result of a series of experiments with disinfectants, Herr Eckstein, of Vienna, strongly recommends chloride of lime as the cheapest and best. Bleaching powders rapidly decompose all hydrogen compounds, such as ammonia, sulphuretted hydrogen, sulphide of ammonium, phosphoretted hydrogen; and these are the gases which occasion miasma. It acts rapidly by liberating oxygen, and its chlorine violently decomposes organic matter. At the same time bleaching powders are a cheap commercial article, and hence always accessible. In order to avoid the inconvenience often resulting from the liberated chlorine, the ingenious device has been tried of enclosing the bleaching powders in a bag made of parchment paper. This bag remains quietly where it is placed, and by the principle of endosmose and exosmose, the full effect of the liberated chlorine is attained without any inconvenience to the occupants of the house.

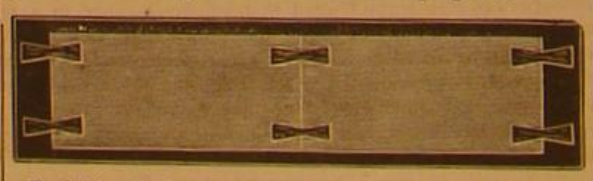
Herr Eckstein made comparative experiments with different disinfectants, for two years, with the following results:

1. Two pounds of sulphate of iron dissolved in water and poured into a saucer at first liberated sulphuretted hydrogen, and after twelve hours no longer produced any effect.
2. A solution of sulphate of copper behaved in the same way.
3. Two pounds of crystals of green vitriol retained its action for two days.
4. A mixture of sulphates of iron and copper and carbolic acid lasted two days.
5. Sulphurous acid was suffocating, and ceased to act in one day.
6. Carbolic acid produced a worse smell in the house than the bad gases of the sewer.
7. Two pounds of sulphate of iron in a parchment bag retained its valuable property longer than when exposed free.
8. Two pounds chloride of lime in a parchment bag continued to purify the air for nine days.
9. Permanganate of soda was successful as long as it lasted, but is too expensive.

Enclosing chloride of lime in a parchment bag, and suspending it in an out-house or leaving it in a sewer, is recommended, by the experimentor, as the best disinfectant to be obtained in the market.

Wooden Ties in Stone Edifices.

All the great temples of Egypt which have withstood the destructive tendencies of time and the assaults of man for four thousand years are of hewn sandstone, with a very few exceptions of about the color and character of the brown stone houses of New York. But the only wood in or about them is ties, holding the end of one stone to another on its upper surface. When two blocks were laid in place, then, it appears that an excavation about an inch deep was made thus, this being a representation of two hewn blocks, into which the hour-glass-shaped tie was driven:



It is therefore very difficult to force any stone from its position. The ties appear to have been the tamarask, or shittim wood, of which the ark was constructed, a sacred tree in ancient Egypt, and now very rarely found in the valley of the Nile. Those dovetail ties are just as sound now as on the day of their insertion. Although fuel is extremely scarce in that country, those bits of wood are not large enough to make it an object with Arabs to heave off layer after layer of heavy stone for so small a prize. Had they been of bronze, half the old temples would have been destroyed ages ago, so precious would they have been for various purposes.

Probably all those monster edifices were raised, course after course, secured in that manner, carefully adjusted by being admirably jointed above and below, but left rough inside and out. When carried to the proposed elevation, then, supported on moveable stays, the workmen dressed both surfaces from top to bottom, leaving figures in relief or the deeply cut symbolic characters which so puzzle archæologists in these latter days.

If our stone buildings were reared in the same manner, of blocks the thickness of the walls, they would certainly be more substantial than those slightly built houses which have their weakness concealed by a casing of thin sheets of brown stone. A difference of climate necessarily modifies architecture, but it is undeniably true that the architects of a remote antiquity, whose structures are monuments of their practical wisdom, were men of genius and extraordinary attainments in a department of art and science combined, not to be undervalued in these times of haste which end in waste.

The Importance of Drawing.

The Select Committee of the House of Commons on Scientific Instruction recommend, in their report, that instruction in drawing should be given in elementary schools. The disregard of such elementary instruction, as a branch of general education, is surprising. Drawing is a universal language; it is easier of acquirement than writing. By the use of a ruler, pencil, and compasses, a child may become self-educated, and acquire a handicraft of essential service in after life.

The exclusion of drawing and geometry from the subjects of examination by the Council of this Society on the recent revision of the subjects of local examination, is greatly to be deplored. Encouragement in this acquirement might thus be given to those who can never attain mediocrity either in reading, writing, or arithmetic; and who can tell what may be the aid to development thereby afforded to the natural born talent of an artist?

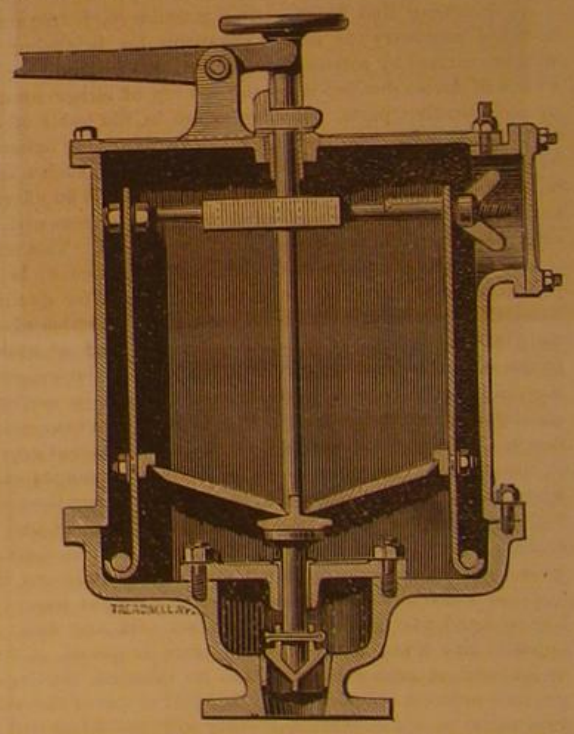
I look upon linear drawing and geometry, says Mr. Buckmaster, as the very foundation of instruction, and as affording, at a more advanced stage, the means of separating and classifying minds into orders or classes, so as to utilize each to the utmost, according to the powers with which it is endowed.

The neglect of drawing, at the earliest stage of the use of a pencil by a child, may be regarded as a great defect in our system of teaching, which our educational authorities have done much to remove.

What reason can be suggested why a child should not commence geometrical and mechanical drawing contemporaneously with learning to write? Indeed, so soon as it has the power of handling a pencil, the discipline of learning to draw would be equal to the discipline of learning to write. The want of this simple first elementary knowledge is declared by competent authority to be a great barrier to the success of artizan students.

TURTON'S COMPENSATED SPRING SAFETY VALVE.

The object of the peculiar arrangement of the safety valve illustrated herewith is to diminish the load on the valve as



the latter rises, and thus to allow a greater amount of lift than is possible so long as this load remains constant. The device, which we extract from *Engineering*, is the invention of Mr. Thomas Turton, of the Liverpool Forge Company.

The spindle, as shown bearing on the valve, is prolonged upwards into a casing, and, between a collar on the spindle and a pair of single plate springs contained in the casing, are disposed a pair of strut bars. These bars form a toggle joint, and as the valve rises they assume a more nearly horizontal position, the effect being that the downward thrust they exert on the valve is diminished. The plate springs are hinged at the bottom to fixed fulcra, and at the top they are connected by an adjusting screw, by means of which the pressure they exert can be regulated.

Further details will be readily understood from the engraving. The invention seems to be one of utility, and, if properly proportioned, should act well. There is a great demand for an efficient device of this kind.

THE President of the Royal Society of Agriculture, England, offers a prize of $500 for the best treatise on the diseases of the potato and the means of avoiding and remedying the same. The conditions of the competition may be obtained by addressing Mr. H. M. Jentrins, Secretary, 12 Hanover Square, London

PROFESSOR TYNDALL'S THIRD LECTURE IN NEW YORK. CRYSTALS AND LIGHT.

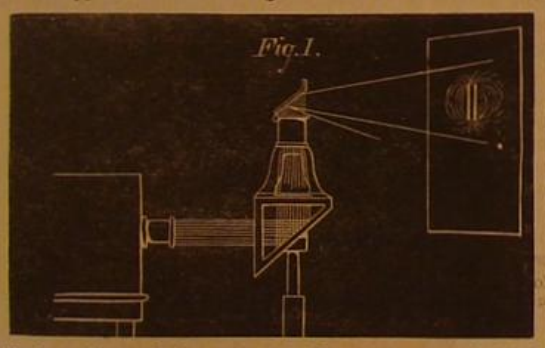
After a brief review of the preceding discourses, Professor Tyndall began his third lecture by referring to the manner in which scientific theories are formed. They take their rise, he said, in the desire of the mind to penetrate into the sources of phenomena. We have learned that in framing theories the imagination does not create, but that it expands, diminishes, molds and refines materials derived from the world of fact and observation. The germ of the conception that the sun and planets are held together by a force of attraction is to be found in the fact that a magnet has been previously seen to attract iron. In our present lecture the magnetic force must serve us still further; but what we must master here are elementary phenomena.

THE GENERAL FACTS OF MAGNETISM

are most simply illustrated by a magnetized bar of steel. Placing a bar magnet some two or three feet in length before the audience, the lecturer then showed its effect upon a magnetic needle. Holding the latter near the bottom of the bar, one end promptly retreated; raising it along the magnet, the rapidity of the oscillations decreased as the force became weaker, and at the center they entirely ceased. Passing further upwards, the end which had previously been drawn toward the magnet retreated, and the opposite extremity approached. This doubleness of the magnetic force is called polarity, and the points near the ends of the magnet in which the forces seem concentrated are termed its poles. Professor Tyndall then explained that the separate halves of the magnet would each be a perfect magnet having two poles, and if a hardened and magnetized piece of steel be broken into any number of bits, the same would be true. This thing that we call magnetic polarity is resident in the ultimate particles of the magnet. Each atom is endowed with magnetic force.

TENDENCY OF MAGNETIZED PARTICLES TO ASSUME DEFINITE FORM.

If we place a small magnetic needle near the magnet, it takes a determinate position, which might be theoretically predicted from the mutual action of the poles. A needle of simple iron will be affected similarly to the magnetic needle, for it is magnetized by the bar magnet. The action of two or more rods of iron near the magnet is more complex, for they act on each other. If we pass to smaller masses of iron—to iron filings for example—we find that they act substantially as the needles, arranging themselves in definite forms in obedience to the magnetic action. The speaker then showed that, by sprinkling iron filings on a sheet of paper held over the bar magnet, various forms were produced. This experiment was represented optically by means of the apparatus shown in Fig. 1. A is an inclined mirror,



B a lens above which are two small magnets around which iron filings were scattered, and C a prism deflecting the ray to the screen, where the image appeared as represented. Professor Tyndall said that he had never seen more beautiful specimens of these curves than those recently obtained by Professor Mayer of Hoboken, "a young professor," he added, "from whom I expect considerable things."

Every pair of filings possesses four poles, two of which are attractive and two repulsive. The attractive poles approach, the repulsive poles retreat, the consequence being a certain definite arrangement of the particles with reference to each other. This idea of structure, as produced by a polar force, leads us to our next subject of enquiry—the action of crystals upon light. First, of

CRYSTALINE ARCHITECTURE.

Crystals are put together according to law. They split in certain directions before a knife edge, exposing smooth and shiny surfaces which are called planes of cleavage, and by following these planes we sometimes reach an internal form disguised beneath the external form of the crystal. We cannot help asking ourselves how they are built. Familiar as we are with the polar force and its ability to produce structural arrangement, the answer will be that these crystals are due to the play of polar forces, with which their ultimate molecules are endowed, and upon which their visible form depends. Large crystals are formed with deliberation. Thus a saturated solution of niter just deposits a minute crystal, which afterwards grows, augmented by molecules, from the surrounding liquid until we have large prisms of the salt of perfectly definite shape. Alum also crystalizes with the utmost ease after this fashion. If the crystallization be too sudden, the regularity disappears.

SUSPENDED CRYSTALIZATION.

Water may be saturated, when hot, with sulphate of soda. When the liquid is cooled it is supersaturated, yet the molecules will not crystalize. Each molecule wishes to unite with both of its neighbors on either side; one tendency neutralizes the other and it unites with neither. But if a single crystal of sulphate of soda be dropped in, its adjacent molecules will precipitate themselves, and others will follow, until the whole solution, as far as possible, is solid. But the crystals are small and confusedly arranged because the process has been too hasty to admit of the orderly action of the crystalizing force. The

FORMATION OF CRYSTALS

was exquisitely illustrated by pouring over a glass plate a solution of chloride of ammonium. Setting the glass on edge to allow the liquid to drain, a thick film was obtained, the evaporation of which was promoted by slightly warming the plate. The glass was then placed in a solar microscope. Reflected upon the screen appeared the most beautiful crystals, forming themselves with extraordinary rapidity. A somewhat similar effect may be produced by breathing on a pane of glass during cold weather, and observing the formation of the frost crystals with a lens.

A second illustration was the placing of thin platinum wires from a small voltaic battery in a solution of sugar of lead. As soon as the current began to pass, the metal was liberated by electrolysis, and attached itself in exquisite crystals to the end of one of the wires. Then the poles were reversed and the tree of metal already formed seemed to dissolve and was built up on the other wire.

ICE AND SNOW CRYSTALS

were then explained. An inflexible power bends spears and spiculæ to the angle of 60°. We may sometimes see in freezing water small crystals of stellar shapes, each star consisting of six rays with this angle of 60° between every two of them. The

REFRACTION OCCASIONED BY DIFFERENCE OF DENSITY,

according to the undulatory theory, was illustrated by the Professor holding a long rod in a horizontal position and asking the audience to consider it a wave of light coming plump downward from a star. Supposing the platform to be transparent, this wave might be expected to pass through it without change of direction. He then held the rod at an angle of 45° to the floor, and, supposing the rod a wave, showed clearly that if on entering the material of the platform it encountered a denser medium, the lower end of the rod would be somewhat retarded before the upper end reached the surface of the platform. This would change the front of the wave and consequently its direction. This change constitutes the refraction of light and is evidently proportionate to the density of the transparent body. Now, in virtue of the crystaline architecture that we have been considering, the ether, which surrounds the atoms of all bodies, in many crystals possesses different densities in different directions, and the consequence is that some of these media transmit light in two different velocities. But refraction depends wholly upon the change of velocity being greatest when the density is greatest. Hence in many crystals we have two different refractions, a ray of light being divided by such crystals into two. This effect is called double refraction.

ORDINARY AND EXTRAORDINARY POLARIZED RAYS.

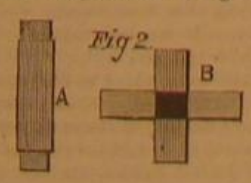
Double reflection is displayed very strongly in Iceland spar, which is crystalized carbonate of lime. Placing a piece of this substance in the electric lamp, Professor Tyndall caused two images of the carbon points produced by the divided rays to appear. They were then concentrated by lenses into two bright spots of light. When the crystal of spar was rotated, one spot became a center around which the other one revolved. One beam obeys the ordinary law of refraction, discovered by Snell, and is called the ordinary ray. The other does not; its index of refraction, for example, is not constant, nor do the incident and refracted rays lie in the same plane. It is, therefore, called the extraordinary ray. In the bright spots on the screen, the most strongly refracted, is, in this case, the ordinary ray. Turning the spar around, the extraordinary image is the one that rotates.

ORIGIN OF THE TERM "POLARIZATION."

It has already been explained that the vibrations of individual ether particles are executed across the line of propagation. In ordinary light, we are to figure the ether particles vibrating in all directions across this line. In a plate of tourmaline, cut parallel to the axes of the crystal, the beam of incident light is divided into two, one vibrating parallel to the axis of the crystal, the other at right angles. One of these beams, namely that one whose vibrations are perpendicular to the axis, is quenched with exceeding rapidity by the crystal, so that, after having passed through a very small thickness of crystal, the light emerges with all its vibrations reduced to the same plane. This is what we call a beam of plane polarized light. The fact that

POLARIZED RAYS ARE QUENCHED WHEN CROSSING AT RIGHT ANGLES

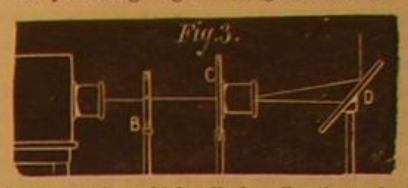
was exhibited by throwing the image of a plate of tourmaline upon the screen. Placing parallel to it another plate, the two gave green images, as at A, Fig. 2. These images



gradually darkened as the plates were rotated until, when at right angles, the center was utterly black, B. On continuing the rotation, they gradually recovered color and transparency. Professor Tyndall then reflected the green images in various directions. When the image was horizontal, on being reflected upward it still remained green; on being reflected sideways, it was quenched, because of the incompetency of the green light to be reflected in that direction. In one case, the mirror receives the compact of the edges of the waves, and the light is quenched: in the other, the sides of the waves strike the mirror, and the green light is reflected.

POLARIZATION BY REFLECTION.

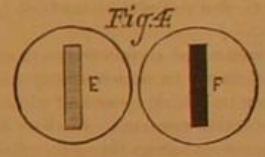
The quality of two-sidedness conferred upon light by Iceland spar may also be conferred upon it by ordinary reflection. If we hold a piece of window glass so that the beam shall make an angle of 56° with the perpendicular to the glass, the whole of the reflected beam is polarized. This is called the polarizing angle. B, Fig. 3, is a lens. C con-



tains Iceland spar, by which all the vibrations of ordinary length are reduced to two planes, right angled to each other. But unlike tourmaline, this spar transmits both beams with equal facility. When, therefore, the light is polarized by reflection, the direction of vibration in the spar which corresponds to the direction of vibration of the polarized beam transmits it, and in that direction only. Consequently, from the two rays which proceed to the glass, D, but one image is possible.

BLACK OR GREEN IMAGES OF TOURMALINE.

Professor Tyndall next threw on the screen two disks of light produced by the double refraction of the spar, E and F, Fig. 4. He then placed before the crystal a plate of



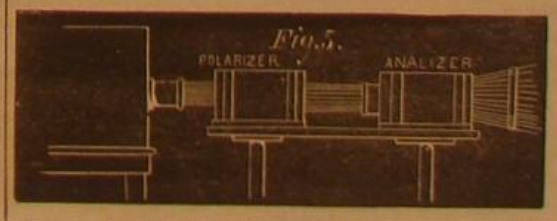
tourmaline, the light emergent from which, he said, was polarized. The spar has two perpendicular directions of vibration, one vertical, the other horizontal. Now when the green light should be transmitted along the latter, which is parallel to the tourmaline, and not along the former which is perpendicular to it, the light in the circles, as represented in the diagram, was white. In the middle of each the strip of tourmaline was represented, in one by a green, in the other by a black, image. The tourmaline was rotated on its center, and when the two images formed a horizontal line, they both appeared of a darkened green. When still further rotated, the images entirely interchanged colors.

MICA TURNS DARKNESS INTO LIGHT.

When the plates of tourmaline were crossed, the intersected spaces were black, but the least obliquity of the crystals allows light to pass through. If we introduce a third plate of tourmaline obliquely, it will abolish the darkness. Having no tourmaline, Professor Tyndall introduced a film of mica between the crossed plates. The effect was almost magical, the darkness being apparently pushed away by the edge of the mica.

THE NICOL PRISM.

We have seen the two beams emergent from Iceland spar and have proved them to be polarized. It is possible that one of these rays may be totally reflected and the other not. An optician named Nicol cut a crystal of Iceland spar in two in a certain direction. He polished the severed surfaces and reunited them with Canada balsam, the surface of union being so inclined to the beam traversing the spar that the ordinary ray which is the most highly refracted was totally reflected by the balsam, while the extraordinary ray was permitted to pass on. Professor Tyndall then explained the apparatus sketched in Fig. 5, in which were two Nicol



prisms. Placed with their directions crossed the light is quenched; on introducing a film of mica between light is received. But we also obtain colored light. Taking a thin splinter of selenite, the lecturer placed it between the prisms, when the image on the screen showed the most magnificent tints. Turning the prism in front, these colors gradually faded and disappeared, but, by continuing the rotation until the vibrating sections of the prism were parallel, vivid hues, complementary to the former ones, appeared.

Placing some films, shaped to represent flowers, between the prisms, by turning the front Nicol 90° around, a red flower and green leaves were shown; rotating it another 90°, a green flower with red leaves appeared. Other beautiful chromatic experiments of similar nature were introduced, which Professor Tyndall said could all be explained by the principle of interference, and he promised to develope the causes in his next lecture.

Correspondence.

The Universal Caravan.

To the Editor of the Scientific American:

My learned friend, the Abbé Moigno, has called my attention to an article on the "Universal Caravan" which appeared in your valuable paper of November 23. I beg to offer my compliments for it to your humorous contributor, and, without taking the least offence at its raillery, which I believe to be well intentioned, I am anxious to set his mind at ease upon one or two points upon which he has incidentally touched.

"How," asks your contributor, "can frequent telegraphic communication be possibly kept up between the caravan, wherever it may be, and Europe? and why are certain States mentioned as calculated to furnish, on their territory, any native troops to the expedition?"

In the States of Asia and several of South America, where the country is devoid of roads practicable for carriages or mule trains, the dispatch service between villages, settlements, and often even between populous towns, is performed by means of native foot postmen, who run for three successive hours at an average speed of six miles an hour. On arrival at the relay station, the package is transferred to a second runner, who goes over his eighteen miles, and so on; so that parcels weighing twelve or fourteen pounds can traverse 144 miles in 24 hours. Suppose, for instance, that the caravan happens to be in the western part of the Province of the Amazons, belonging to the Republic of Equador, at about 200 miles from Riobamba, that is to say, at about ten stages or thirty-four hours from this town, whence a courier starts every day for Guayaquil, which he reaches in thirty-six hours. Our letters are then delivered to an agent of the Havas agency, appointed for this special duty. This agent condenses into the smallest possible number of words and transmits to the nearest telegraphic station all special information respecting the members of the caravan. Transfer the same system into the stony desert of Australia, now telegraphically connected with the European and North American systems of wires, and you will understand how the problem is solved.

I more specially mentioned certain States or colonies (without indicating all of them) in which communication is the most imperfect when travelling alone and without any recognized political or scientific mission. In these States, I have met with aid and protection from the authorities, which has been carried so far that I have been gratuitously accompanied by a certain number of native troops, who were of the utmost assistance to me in the forest.

Although the caravan has an object within the limits of human possibility, and has no encyclopædic pretensions, I am anxious to explain, by one striking example, the practical and immediate services which it may render to science.

Quinine was imported into Europe sixty years before its admission into the pharmacopœias. I will not now inquire why science remained so long deprived of the most efficacious remedy for fever at its disposal. Whenever the natives of the region I am traversing shall point out to me, as an efficacious remedy against such and such a disease, a plant, root or leaf, I will cause this object to be sought for under the inspection of the botanist and surgeon, and will have it submitted to a chemical analysis before its elements have undergone the changes from desiccation or moldiness inseparable from a long sea voyage. If this operation reveals the presence of a chemical principle, an essence, or an alkaloid, explaining the curative virtues attributed to the plant by the natives, I will forward, to the schools of medicine and to the scientific journals, the wood, bark, or root, and the analysis, botanical classification and observations made during the processes carried on under our eyes. By this means, I hope to avoid delays in the admission, by medical men, of new efficacious remedies of which we are now deprived, and they are many, and further to prevent the disgraceful speculations on the credulity of invalids which prevail everywhere.

My itinerary does not contemplate crossing Central Africa, where, thanks to the efforts of the distinguished Livingstone and the recent voyage of your brave fellow countryman, Mr. Stanley, we may easily foresee that civilization will soon necessitate a political action which only a great nation could undertake. The perimeter of the African continent will furnish a field vast enough for the studies we have undertaken.

Finally, independently of ethnography, written impartially and without any prejudiced criticism of races, the Universal Caravan purposes to create a new science, namely, the art of enabling to travel advantageously, almost without danger and without great privations, a group of men of different nationalities, whose objects call for the good will and protection of civilized nations.

BAZERQUE,
12 Boulevard des Capucines, Paris. Captain.

The Bar at the Mouth of the Mississippi.

To the Editor of the Scientific American:

The bar at the mouth of the Mississippi is, as we all know, one of the greatest drawbacks to the commerce of the West that there is, and many plans have been advanced to obviate that trouble, among others, that of digging a canal from the Gulf to the river, some miles above its present mouth.

Vessels of a large size cannot load to their full capacity and cross the bar; indeed they can hardly carry half a cargo. Now if it were so that large steamers could carry a full load, they could take freights cheaper; and, taking freights cheaper, they would cause most of the European shipments to be sent by way of New Orleans, particularly the grain and cotton. Indeed, I think three fourths of the grain and all the cotton shipped to Europe would follow this channel, and thus add much to the prosperity of the South.

To build a canal at the mouth of the Mississippi would cost many millions of dollars; the amount indeed would be incalculable, as it would be more troublesome to keep a sufficient depth of water in it than it is in the Suez canal; for instead of the shifting sands of the desert, we should have to contend with what is worse, the shifting mud of the Mississippi, which has already caused the bar at the mouth; and three of the most expensive dredge boats in the country can hardly keep a channel of fourteen feet depth of water on this bar. And it would be the same in a canal; for as soon as the sediment in the river meets the dead water of the Gulf, it will settle there and form another bar, which no number of dredge boats could clear away as long as the "Father of Waters" empties into the Gulf of Mexico.

The only way that this difficulty can be overcome is by some sort of "marine camel." Instead of trying to dig the bar away, lift vessels over it, which, costing comparatively little, would do everything required of a canal. Let the inventors of the country give us their plans for a "camel."

C. W. STEWART.

Memphis, Tenn.

Steam Pressure on Boilers.

To the Editor of the Scientific American:

Which is the right way? Must we multiply together the pressure and circumference, the pressure and half of the circumference, the pressure and diameter, or the pressure and half of the diameter, for the true answer? I believe that each of these methods has been held to be the true one, by men who certainly write as though they ought to know what they are talking about.

A boiler 100 inches in circumference, sustaining a pressure of 100 pounds to each square inch, would have upon each circle of the boiler of one inch wide, according to the first method, 10,000 lbs., according to the second, 5,000 lbs., according to the third, 3,200 lbs., according to the fourth, 1,600 lbs. This is a serious discrepancy.

If two men, each with spring balance in hand attached to a cord, should test the strength of the cord by pulling against each other till each of the spring balances indicated 100 lbs., would it be held that the cord sustained 200 lbs.? It is, of course, clear that there can be no strain in one direction without an equal resistance or strain in the opposite direction, whether the object tested be a steam boiler or a cord; hence, I consider that the semi-circumference method is the true one.

The breaking point of a strip of good boiler iron, one inch wide and one fourth of an inch thick, is about 13,000 lbs. It is well known that a well made boiler of such iron, 32 inches in diameter, will work safely at 150 lbs. to the square inch, which would be 200 lbs. above the bursting pressure, if the whole circumference method were the true one. On the other hand, if the semi-diameter method were the true one, 150 lbs. to the square inch would be but about one fifth of the bursting pressure.

It seems to me that all of our practical dealing with steam boilers agrees with the semi-circumference method.

Worcester, Mass. F. G. W.

REMARKS BY THE EDITOR.—It is a well known principle in hydraulics and pneumatics that the pressure of a fluid on the internal surface of any vessel is exerted in any given direction with a total effect which is measured by the product of the intensity of the pressure by the projection area of that surface on a plane at right angles to the direction assumed. To determine the force tending to rupture a cylindrical boiler, multiply the pressure per square inch by the diameter and divide by the thickness of metal which must be ruptured, to obtain the stress per square inch of metal; that is, divide this product by double the thickness of the boiler plate. Or, divide the product, of the pressure per square inch into the radius, by the thickness of the sheet.

Our correspondent, B. F. McKinley, in the SCIENTIFIC AMERICAN of December 21st, 1872, gave a correct statement.

Steam Statistics.

To the Editor of the Scientific American:

The following figures relating to steam may be useful:

One cubic foot of water weighing 62·5 pounds, converted into steam of one atmosphere, gives a volume of 1,728 cubic feet of steam. If 62·5 pounds give 1,728 feet, then one pound gives $\frac{1728}{62.5}$ = 27·67 cubic feet.

A displacement of 27·67 cubic feet is made by one square foot, = 144 square inches, traveling a distance of 27·67 feet lineal. Now, a pressure of one atmosphere, 14·7 pounds, on a surface of 144 square inches, through 27·67 feet gives a result of 27·67 × 144 × 14·7 = 58,572 foot pounds; this divided by 772, the number of foot pounds equivalent to one degree of heat Fahr., gives $\frac{58572}{772}$ = 75·87 degrees of heat represented.

It appears to be a very singular fact that if one half of this 75·87, = 37·93, be added to 212°, the temperature of one atmosphere, we have 212° + 37·93° = 249·93°, the temperature of two atmospheres.

Add to this $\frac{1}{3}$ of the same, $\frac{75.87}{3}$ = 25·290, and we have 249·93 + 25·290 = 275·22, the temperature of three atmospheres, and so on. If we add together the fractions $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}=\frac{87}{60}=1\frac{27}{60}$, and multiply this by 75·87, we have $75{\cdot}87\times1\frac{27}{60}=110°$; this added to 212° equals 322°, the temperature at six atmospheres. Thus it seems that the fractions above denote the rate of increased temperature as the pressures pass through that of the number expressed by the denominator of the last fraction used.

Is there any known mathematical analysis of the relations of heat, pressure and volume of steam? If so, what is it?

B. F. MCKINLEY.

Insensibility---When Complete.

To the Editor of the Scientific American:

Much has been written upon the question whether pain follows, or intelligence remains, after decapitation. As positive proof is impossible, unless spiritualism be true, one man's opinions are likely to be worth about as much as another's. Facts, in the history of living persons, throw light on every subject, and, I think, on this.

The stoppage of the breath from any cause is immediately followed by insensibility, both of body and mind. This is susceptible of daily proof. The victim of foul gas in wells falls insensible. This is why so few are rescued in such cases. Any one choked sufficiently to stop the breath immediately becomes insensible. I may be asked how do I know this? I learned it, when a boy, in this manner.

In sport, one evening after school, I drew my "comforter" tight around my neck, and a "big boy," to further the sport, drew it tighter, when I dropped insensible as quickly as if struck by lightning. The comforter was loosened and I immediately recovered and felt no inconvenience resulting. This to me has always been a proof of the foregoing assertions. No one can suppose that consciousness would have returned without returning breath. I have often wondered where the immortal part of me was during that brief period. The barbarous practice of neck-breaking, under the pretense of hanging, to produce death, is sometimes talked of as quickening one's journey to the other world and making the passage painless. It makes it sure, but, in my opinion no less painful, as in either case, if strangulation is complete, there is entire exemption from pain and entire insensibility. The motions of the hanging man are entirely involuntary, and are no indication of pain felt any more than are the contortions of one in a spasm. I have known a child, badly burned on the feet with a hot brick during a spasm, to have no consciousness of it at the time or recollection of it afterwards. The humanitarian, who only desires an execution for the benefit of society and a neck broken for the benefit of the party directly interested, would accomplish his end as well, and the end of he person as effectually, by simple strangulation, as by a six foot drop and a broken neck.

E. H. R.

The Prevention of Fires.

To the Editor of the Scientific American:

In view of the terrible destruction of life and property by fires in our cities, it is surprising that more pains is not taken to prevent such disasters. One of the simplest of all means is to have a stand pipe connected with the service pipe from the city mains carried up through the building to the top, and provided on each floor with a cock, to which a hose can be instantly attached, in case of need. In hotels and factories, there should be a hose for each floor, and it should always be connected, so that the turning of a cock would supply the water at once. The pipe should be located in a hall, or some place from which a hose could be laid to any of the rooms on each floor—the hose, of course, being long enough to reach any room, and being provided with a nozzle and stop-cock like those used for street washing. I have such an arrangement in my own house, and would never think of building one without it, where water could be obtained. In those cases where there is no water supply, or where it will not rise to the top of the building, a cistern should be located as high as possible and receive the water from the roof, or it might be supplied with a force pump, operated by a windmill or other power.

Such an arrangement, with a hose, I consider far better than the plan which has been suggested, both recently and years ago, of placing all through the building perforated pipes for flooding it with water in case of a fire; because with a hose, the water can be thrown just where it is needed, while in the other case it will fall only at certain fixed points, and would flood the house in parts remote from the fire. A net work of perforated pipes in a factory or large building might answer; but as a general thing, the other plan will be found far more practical and much cheaper. Some such safeguard ought to be required by law in every building where it is possible.

W. C. DODGE.

Washington, D. C.

REMARKS.—The method suggested by our correspondent is excellent, and has long been in use in large buildings in New York and other cities. This plan is employed at the Fifth Avenue Hotel in this city, and its excellence was demonstrated during the recent fire in that building. In thirty seconds after the fire was discovered, the hose was stretched and the water was playing upon the fire.

Aniline Inks.

To the Editor of the Scientific American:

An article in a late number of the SCIENTIFIC AMERICAN appears likely to induce a great use of aniline inks. It, however, ought to be known that, as a rule, these inks are the least permanent of any in common use. Still, further, in view of recent great conflagrations, it is to be noted that no inks have been so generally destroyed, where used on books or paper subsequently charred in fireproof (?) safes, as the various aniline inks. A very extensive experience in restoring charred paper in the Chicago, and now in the Boston, fire has convinced me that these inks, as a class, are beyond the power of the chemist to restore to legibility when exposed to a high temperature.

Boston, Mass. C. GILBERT WHEELER.

BY relying on our own resources we acquire mental strength; but when we lean on others for support, we are like an invalid who, having accustomed himself to a crutch, finds it difficult to walk without one.

GLEANINGS IN SCIENCE AND ART.

Regeneration of Limbs.

If a lobster's claw is broken off below the third joint, another will soon appear in miniature at the end of the stump. About the third year it will overtake in size the one on the other side. This explains why the pugnacious creatures are so frequently noticeable with one large and one very small pair of fighting shears.

At a particular season, the males engage in ferocious combats, cutting each other in pieces if they can. Nipping off the sword arm of an opponent is a point of sanguinary ambition. They quarrel worse than a congregation of tailors on a strike.

When, by accident or otherwise, a Brazilian lizard's tail is missing, another crops out immediately, requiring considerable time, however, to develop into full proportions. It is to them as indispensable an appendage as a balancing pole in the hands of a rope dancer, in maintaining their centers of gravity while racing through the top of a tree in pursuit of prey. Could a fox run without a tail? But a second one never grows, so he is crippled for life when that is gone.

Some of the newts have a new eye generated, if gouged out, which will ultimately exactly correspond with the old one in color, function and visual perfection.

All the mammalia, including ourselves, have something of that remarkable regenerating property—particularly exhibited in the re-union of broken bones, which shows a graduated relationship to the lower forms, even to reptile life. Such are the deductions of science, unwilling as some may be to embrace the doctrine of evolution.

Pulmonary Consumption.

An admirably written volume was published not long since by Longmans & Co., London, on that destructive malady which almost defies medical treatment in its amelioration. Dr. Henry MacCormac, of Belfast, Ireland, is the author. Were it republished here, it would lead to reforms in regard to preventing a disease which is often actually induced by violations of the laws of health. Consumption is mowing down the young and the promising before they are prepared for the responsibilities of life. There are two forms of consumption, namely: that which is hereditary, being transmitted from parents to their children, and that which is induced. The latter is the main topic discussed by Dr. MacCormac, which, he is persuaded, has its origin in re-breathing expired air. Those of a delicate organization should sleep alone, and if possible in spacious rooms. That would insure a larger supply of pure, uncontaminated air. On retiring, never omit raising the window sash slightly. When the dormitory is small, if not carefully ventilated, oxygen, the essential element that supports life, is quickly exhausted, and the individual takes back into the lungs carbonic acid gas, which destroys life. Thus the whole system becomes deranged, the air cells ulcerate, and, with the destruction of those, the whole bronchial region falls into disease.

Fresh atmospheric air was intended to be inhaled. It is the source of vitality; therefore, be in no apprehension from exposure to its influences. When the air is charged with excessive humidity, avoid unnecessary exposure; but clear weather, a bright sun and airy sleeping rooms promote health and longevity.

Borax.

Besides having many uses in the arts, borax is an antiseptic. M. Jacquez has been before the French Academy of Sciences with an elaborate paper. The sub-borate of ammonia, too, according to the results of that gentleman's experiments, is of marked importance to the world of science.

A solution of five parts of borax in one hundred of water is represented to prevent the putrefactive process in meats for considerable time. Flesh dipped in the mixture and then dried resists the usual processes of decomposition.

For dissecting rooms, the taxidermist and those engaged in preparing cabinet specimens of animal tissues, the announcement of M. Jacquez should command attention on the score of economy if on no other account, it being no way dangerous or liable to involve assistants in painful accidents, not unfrequent with arsenic, which is commonly employed in modern embalming and in securing anatomical preparations against the depredations of vermin.

Vital Mechanism.

It has been assumed by those competent to form an opinion that there are twenty-five thousand muscles in a silkworm. There are eight thousand in the trunk of an elephant, and in most of the serpents perhaps more than a million. Through the instrumentality of those organs the flexibility of the boa constrictor depends. By an act of will—that is, instantly charging the muscles with an extra force—the great python of Africa crushes a living lion into a shapeless mass for swallowing. Every bone is ground into fragments, so that no opposing obstacles in the form of splinters or projecting points can injure the throat on the way to the snake's immensely large elastic stomach. Neither art or science has yet discovered a method for generating such power by apparently such a simple device.

Musical Sounds.

The longest and largest pipe of the great Harlem organ, thirty-six feet in length, when sounded, actually jars the whole edifice. If there are less than thirty-two vibrations in a second, it is a noise analogous to the flapping of the wings of a huge bird. The human ear recognizes no music in that. All vibrations above thirty-two are musical, till they reach thirty thousand in a second.

Such is the perfection of our auditory sense that the mind is excited, charmed and exalted by acoustic undulations which are transmitted to the brain through a small, soft cord, scarcely larger than a single silk thread.

Reflecting on the laws of sound, the extreme delicacy of the mechanism by which it is received, transmitted and analyzed in a moment of time, who can doubt the existence of a Divinity whose works, independent of moral attributes, are self-evident propositions.

Guinea Pigs.

A writer of distinction says those little, plump, clean animals should be used for food. A mistaken notion is entertained generally that they are a kind of rat, and therefore an unjust prejudice ought to be overcome, since they are excellent eating. Guinea pigs are not pigs. They are harmless, timid, vegetable feeders. Their flesh is nutritious and delicate. If once received into our markets, being easily raised, they would soon be prized for their many desirable dietetic properties. Being prolific, too, they might be raised in vast abundance, their food being an item of no expense, a few cabbage leaves, roots or waste parings being all they would require to grow into proportions to fill vacancies in a gourmand's stomach.

Electric Cautery in Surgery.

Surely the world is moving. One of the last and perhaps greatest improvements in surgery is a new method of cutting away formidable tumors in some of the cavities by electricity. Where it is almost impossible to secure bleeding vessels on account of reaching them, for example in detaching a fungous growth far off in the nasal cavities, throat, etc., a wire is passed round the base, the battery set in motion, and, *presto*, the tumor is separated without loss of blood, the vessels being seared as it were with a hot iron. Better still, under the lulling effects of chloroform or ether, the patient experiences neither pain nor loss of strength from hœmorrhage.

Fatal Flybites.

Deaths very frequently occur from slight punctures made by flies in warm climates. Occasionally such cases occur in temperate zones, but the cause of such a melancholy result from a slight wound in the skin does not seem sufficient to produce excessive swelling, pain, discoloration and other extraordinary appearances which are quickly exhibited. It is, therefore, possible that the insect which makes the tiny wound has its proboscis charged with an active poison from some source where it had recently been foraging, which, introduced into a bleeding wound and rapidly carried by the absorbents into the system, is followed by death.

Observation on those forms of ophthalmia so common in Egypt, ending in blindness of one if not of both eyes, leads to the opinion that the dreadful malady is propagated by flies, carrying, on their feet and feeding tubes, purulent matter from diseased organs whence they are kept away with difficulty, to sound ones, where they are attracted by moisture on the margin of the lids.

Rapidity of Muscular Contractions.

A dragon fly balanced on its wings at the side of a car speeding its way over the rails, at the rate of forty miles an hour, appears to be almost motionless. But to keep up with the car, its wings must vibrate many thousand times a second. The eye cannot detect their up and down action, so exceedingly rapid are the contractions and relaxations of the muscles acting upon them. All at once they dart off at a right angle so quickly that the retina cannot have an impression remaining long enough to retrace their course. Therefore, those same muscles, too small to be seen but by powerful microscopic assistance, must be urged to still more rapid action. Such intense activity far exceeds the vibration of musical chords, and therefore exceedingly perplexes entomologists, because the nervous system of insects is so extremely minute. The question is: How much power is generated for keeping a dragon fly's wings in uninterrupted motion for many hours in succession without apparent fatigue?

Transplantation of Trees and Shrubs.

Vegetable life depends as much on vital functions for its preservation as animal life. But the way trees are treated ordinarily, in their removals from location to another, indicates a very limited knowledge of physiological laws.

Plants repose at night like higher organizations, waking in in the sunlight of morning, invigorated and refreshed. Through the long, tedious months of winter, they sleep profoundly. While the leaves are green and vigorously performing a series of labors, preparations are made for a coming season of cold, ice, snow and other influences which reduce the vital force to the lowest point without destroying it. That is the best time in the life of a tree for transplanting it. That business is admirably managed in France. They don't think of waiting for a mere stick to grow into a broad, spreading tree. No, they select splendidly developed trees, with waving branches, and place them where their grand appearance will be admired.

In the squares of New York, the Park Commissioners are now pursuing the proper and only promising plan of success by bringing in from the country well grown trees, dug up out of the frozen ground, with all the roots covered with two or three feet of the earth in which they grew. Being set out in their new positions, the cardinal bearings being the same, in the spring they will rouse up like refreshed laborers, and bud and blossom as they did before. That is the true system. It may be accomplished at any period if the roots are never injured or exposed but clothed, thickly and securely, with their own attached soil. Never cut off a limb or a twig till they have a secure foothold. Leaves are the breathing organs of trees. Most persons make a fatal mistake in trimming trees when transplanted. They die because they cannot breathe, oxygen being thrown off and carbon absorbed from the atmosphere.

Phosphorus in Medicine.

Besides being extensively used in making matches, astonishing audiences when legerdemain performers blow fire from their mouths, and a prominent source of surprise in chemical laboratories, the physicians are prescribing it. One hundredth of a grain is secured in suet, supposed to be a fireproof covering; thus secured, the dangerous enemy is swallowed. According to the testimony of enfeebled notabilities, these fireballs, small as they are, made them feel as lively as political candidates for office. No patent medicine can be successfully introduced till endorsed by the clergy, say the proprietors. It remains to be seen whether medical practitioners of eminence, those who are conscientious laborers in the vineyard of humanity, will sanction the phosphoric practice, even if fortified by certificates from lame, halt and blind, whose imaginations, as often as otherwise, run away with their judgments. Happily they are not patented.

Life and Matter.

Nothing remains at rest. If a single particle in a living body were quiescent, a chain of disastrous consequences would quickly follow, terminating in death. Such is the fact respecting the necrosis of any part of an injured bone. When the circulation and deposition of new ossific materials is interrupted at any particular point or region, mortification, gangrene and a throwing off of the dead portion immediately commences.

We are perpetually supplying the system with new life material. That is accomplished by food in the stomach. It is there put in a condition to be wafted all through the body. On its route a particle is dropped here and there, and at the same instant an old one is removed. As soon as the vitality of the new piece has been imparted, it becomes from that instant useless. Thus we are perpetually being renewed, and by eating and drinking the supply is equal to the demand. Thus may be explained a law of the animal economy, how it is that we have neither the same bones nor the same flesh to-day that we had years ago Although identically the same individuals, our bodies have been renewed repeatedly in the course of an ordinary lifetime. Whenever that process of assimilation is interrupted—in other words, when neither new matter is supplied nor the old can be removed, as when in health—death is inevitable.

Therefore, it is self-evident that every particle of nutriment is charged with a definite amount of vitality. An aggregation of these elements eventuates in a life-force. Variously arranged, they result in particular organic forms, and who can say that this may not have an important bearing on the gradation of intelligence from one type to another in the ascending scale of animal forms from creeping things to man?

Catching Wild Ducks.

In the published narrative of a traveller in Arabia, the author saw people catch wild ducks very successfully in the harbor of Jidda, an Oriental city, in the following manner:

An Arab stripped himself and then cautiously waded into the water up to his neck. He then covered his head quietly with seaweed. When properly arranged, he walked off to where the birds were busily employed in swimming about, foraging on the surface. They were not in the least alarmed at the approaching mass, which was evidently regarded as floating weeds. Fairly in amongst them, he reached up and caught them by the legs till satisfied with the number for the occasion, which were thus secured, and then wended his way to the shore with extreme deliberation. Thus the ingenuity of man circumvented the watchful instinct of aquatic animals that are so vigilant for life and liberty as to dive on hearing the click of the lock before an explosion of the charge takes place in the gun.

Casting Metals in Vacuo.

With the ordinary process of casting, the air enclosed in the interior of the molds, not being driven out at the moment when the metal enters, forms between the casting and the mold a very thin envelope, which prevents the metal from taking the exact form of the mold, and which occasions air holes and other defects. These inconveniences are particularly felt in casting works of art, and to avoid them MM. Cumin and Martel, of France, have devised a process recently patented by them. This process is based upon the employment of a vacuum. At the moment of casting the mold is placed in communication with an air pump in such a manner that the air is drawn from the mold through the pores of the material of which it is made. The interior surface of the mold is, therefore, covered with a substance sufficiently porous to allow the air to pass, yet of ample resistance to guarantee perfection in the form of the object cast. The material employed varies with the nature of the metal.

1. For those very easily fused, such as type metal, the inventors employ fine plaster well dried.

2. For harder metals, such as bronze, they use plaster mixed in almost equal proportions with plumbago, alumina, and other substances of a similar nature, this mixture having been previously thoroughly dried, to drive off all the water from the plaster.

3. For more refractory metals, such as cast iron and steel, the sand mold is simply covered with plumbago, or other analogous materials.

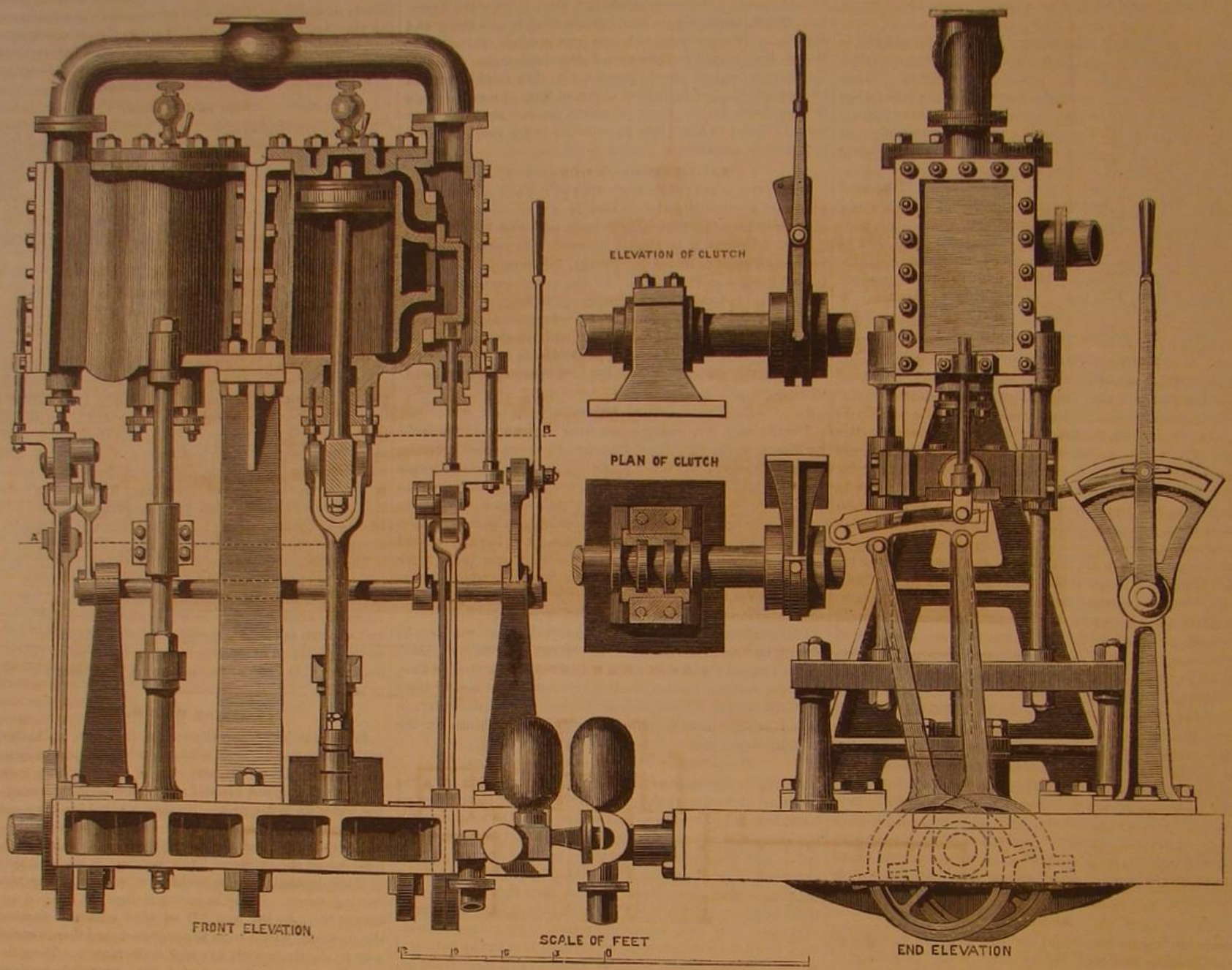
THE BATTERY, NEW YORK.—In connection with this favorite New York resort, it may be noted that a new pier is being constructed. The new pier will be 500 ft. long and 80 ft. wide, and it will be supported on 19 arches. These are placed upon foundations of huge blocks of artificial stone.

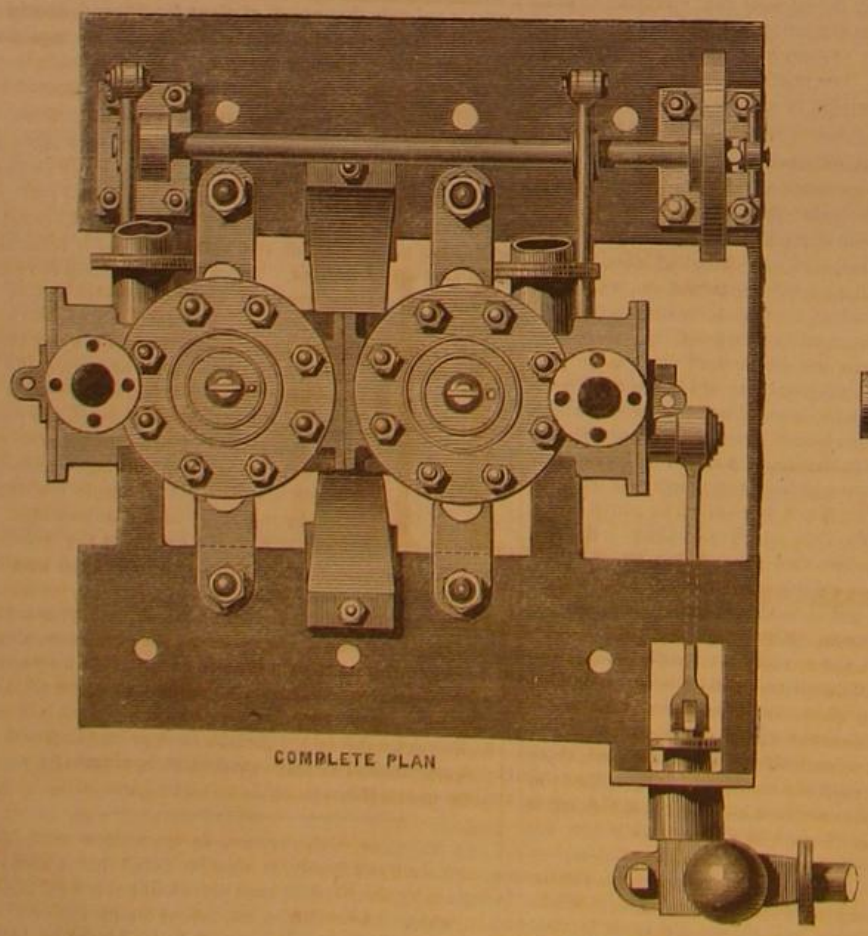
NINE HORSE POWER COMPOUND BOAT ENGINE.

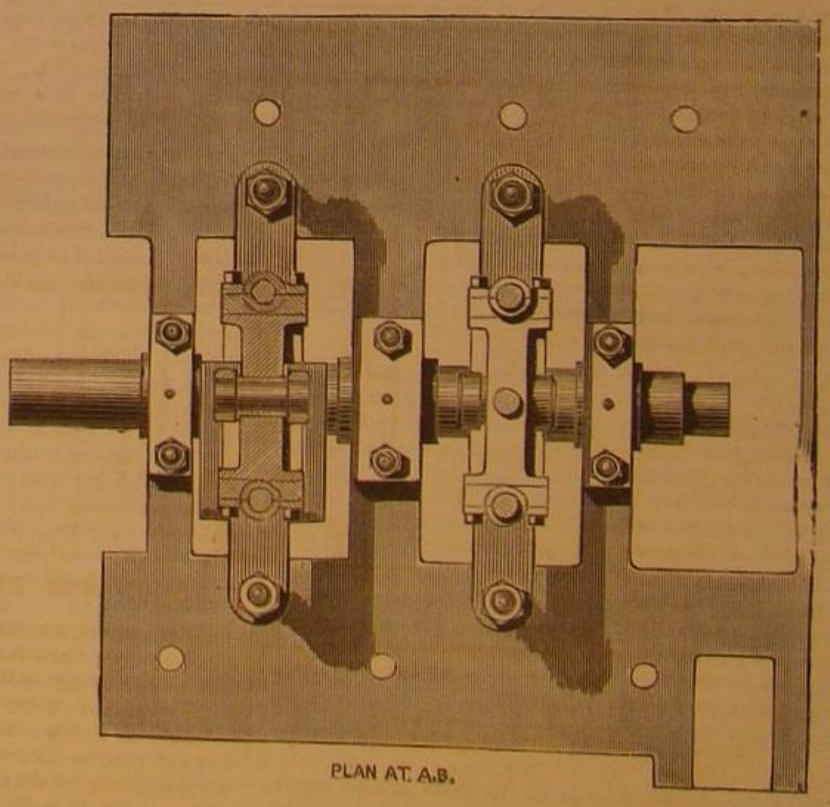
The use of small boats propelled by steam, upon our many inland lakes and rivers, is now so extensive that any improvements in the economy of working, or in the patterns for producing the machinery of such boats, will be interesting to many of our readers. We have therefore engraved, from *The Engineer*, lustrations of a pair of English engines, designed for the purpose mentioned, which, have been found to operate with much satisfaction. These engines are built on the compound plan, and the launch or boat, at Portsmouth, England, in which they are used, is one of the fastest and most economical little crafts that there is afloat.

The engines are of nine horse power, built by A. Verey. The cylinders are of 6 inches diameter and 8 inches stroke. The stroke of the slide valve is 3 inches; the lead, $\frac{1}{4}$ inch, and the lap $\frac{3}{4}$ inch; area of steam ports, 2·65 inches; area of exhaust port, 8·5 inches; diameter of piston rod, $1\frac{1}{4}$ inches; diameter of valve spindle, $\frac{3}{4}$ inch; diameter of crank shaft, $2\frac{3}{8}$ inches; length of connecting rod, 1 foot 6 inches diameter of guide rods, $1\frac{1}{4}$ inches. The engines indicate 24 horse power when working with 60 lbs. steam cut off at five eighths of the stroke and making 300 revolutions per minute.

It will be seen, on referring to the engraving, that wrought iron has been used to an unusual extent in the construction of these engines; by this means space is saved and unusual strength imparted. All the working parts are very easy of access, and the guides and general details are very well designed and proportioned. The engines run at a high speed with great steadiness and absence of noise. The screw shaft is fitted with a disconnecting clutch, by which the engines may be run alone to pump the boiler up, a matter of considerable convenience. We look on these engines as very favorable specimens of the miniature marine engine which has of late become so popular. The boilers used by Mr. Verey are either of the Field type or are horizontal boilers with return tubes.





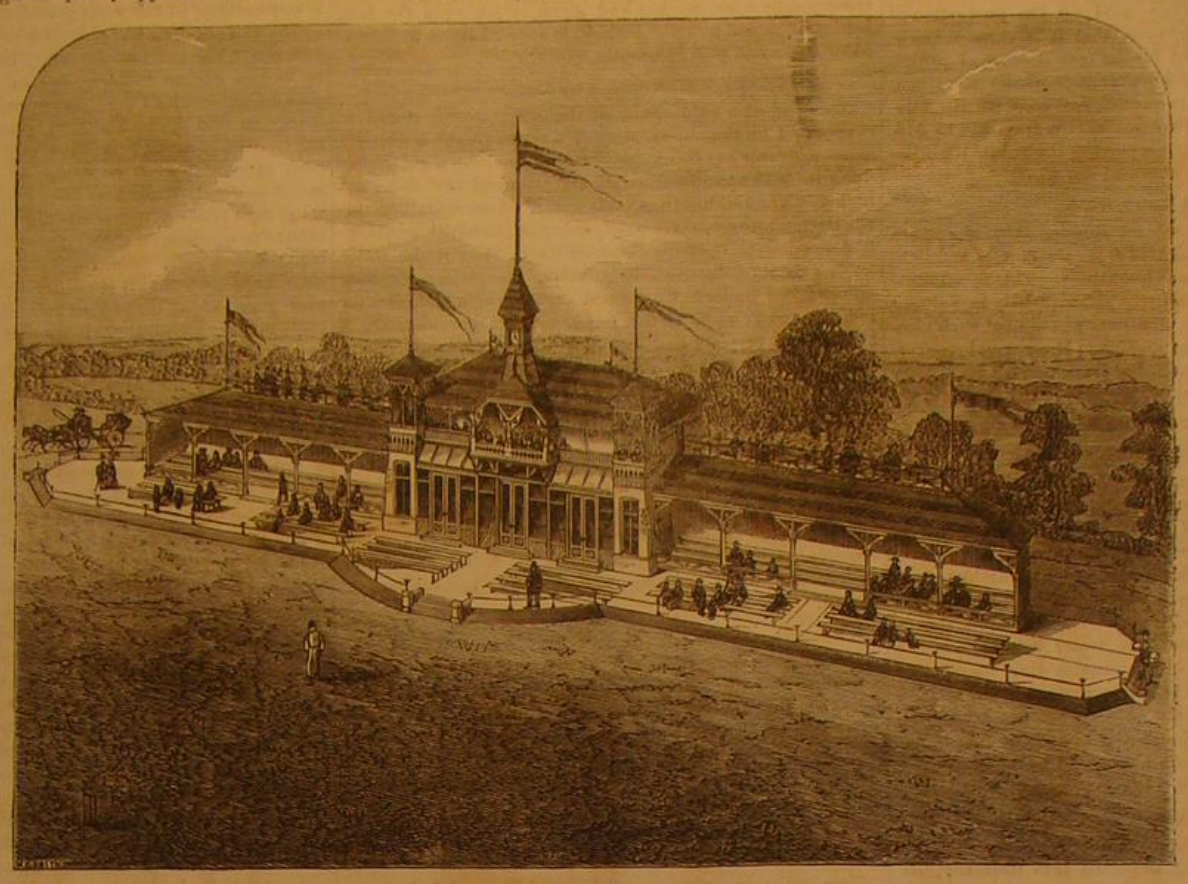


NINE HORSE POWER COMPOUND STEAM ENGINES.

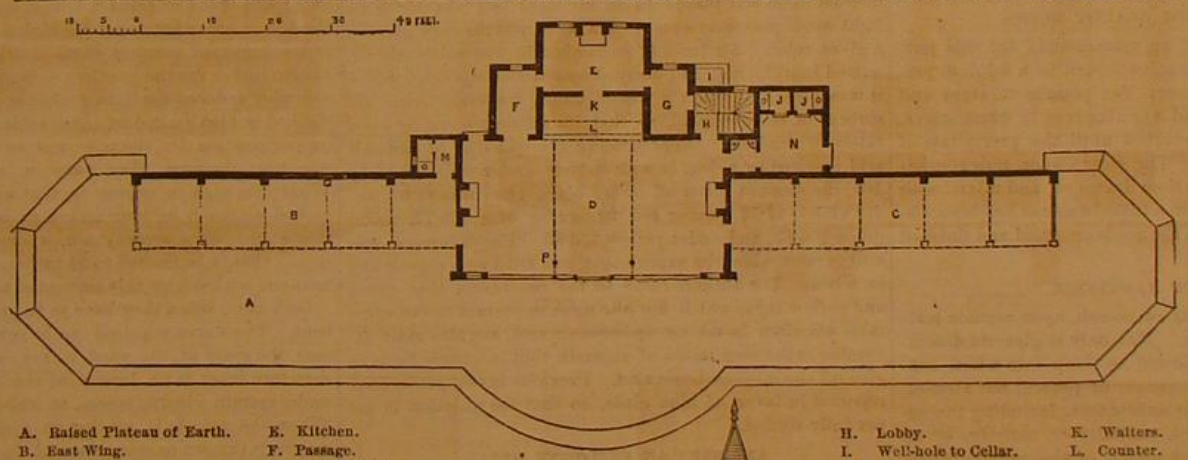
DESIGN FOR BALL GROUND PAVILION.

The structures which are hastily nailed together and located on the banks of our public skating ponds, especially those of Central Park, can hardly be deemed ornamental, however useful they may be. The same is true of the buildings placed for the accommodation of spectators and others on the borders of our racecourses and ball grounds; all partake of a crudeness of design and, even if intended as permanent edifices, a rough temporary appearance, which a little architectural skill and a modicum of artistic taste infused in their plans would fully obviate.

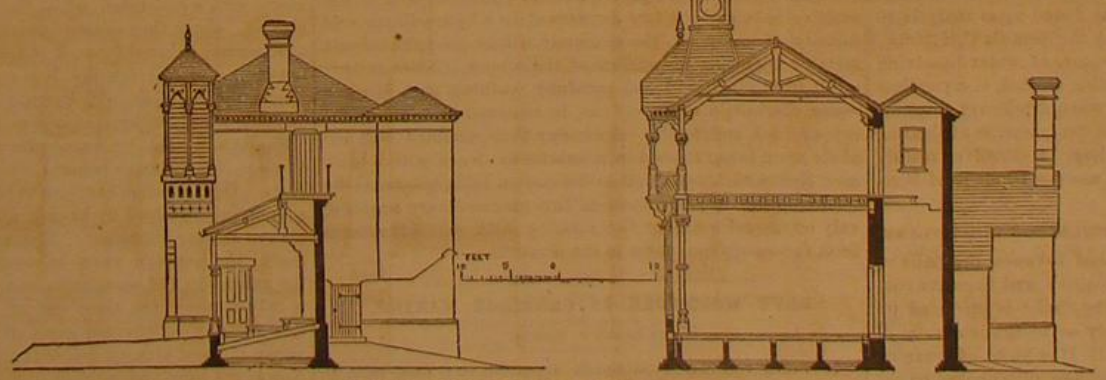
We give herewith, taken from the London *Builder*, excellent elevation and plan views of a pavilion to be erected on the large cricket field of Nottingham, England, which, to our mind, is excellently adapted to its purpose. It combines a handsome and finished appearance with the lightness necessary to such structures, and is spacious and commodious without presenting the too common likeness of a poorly decorated cattle shed. The central feature in the design is the pavilion, two stories in hight, the ground floor being arranged for the purposes of dining and refreshment generally. The upper apartment will form a balcony from which a good view of the whole field may be obtained. The covered ways on either side of the pavilion may be used when a match is being played, and serve as excellent shelter from cold wind and rain. The seats in the wings are raised one above another as galleries. The front seats may be removable if required. In the rear are the kitchen and players' dressing rooms. A fine view of the field will also be obtained from the open air galleries over the roofs of side wings, the floor of which will be on a level with the floor of the balcony. The details of the plan explain themselves.



CARRIAGE DRIVE



A. Raised Plateau of Earth.
B. East Wing.
C. West Wing.
D. Pavilion.
E. Kitchen.
F. Passage.
G. Waiters' Pantry.
H. Lobby.
I. Well-hole to Cellar.
J.J. Closets.
K. Waiters.
L. Counter.
M. Ladies.
N. Open Yard.



DESIGN FOR BALL GROUND PAVILION.

Such a building as this might be advantageously permanently located by the side of the lakes in our Central Park, or in any of the parks in other cities. The necessary accommodations of a boat house might be added, and landing places arranged along the plateau on which it stands. Some of our professional base ball nines, owning their own play grounds, would find it to their benefit to erect some such a structure for the convenience of visitors; or county towns in which fair grounds are situated could employ a similar building for exhibitions, seats for spectators of races, and scores of other uses productive of profit.

How to Insure Conflagrations.

Run your furnaces to their fullest extent; leave everything to servants and porters, says the Boston *Commercial Bulletin*. The latter, in charge of boilers, engines and furnaces, have only to "fix the draft" and go to sleep. Of course, there is no need of any watchman; a boiler or engine, or in fact any apparatus, ought to run itself after being "fixed for the night."

It makes it all right to have the newspapers say, after a block of buildings have been burned down, that the "fire took in the boiler room," or the engine room, or use that convenient paragraph "probably from a defective flue." The questions ought to arise: Who was in the boiler room? Why did it take in the engine room? Who was on duty?

Boiler rooms and engine rooms can be made, in experienced hands, as safe as kitchen fire places, and we are inclined to the belief that a large proportion of the recent fires are due to the neglect of those whose duty it was to have prevented the possibility of their occurrence.

More vigorous care ought also to be used in merchants' stores and private dwellings. Employees and servants seem to have an idea that a furnace, stove, or fireplace, that they have tended all day, will take care of itself while they sleep, and the latter, to ensure themselves against the discomfort of rebuilding fires in the morning, pile on fuel and arrange drafts at night to ensure combustion, and retire with the utmost confidence for the next six or eight hours. That there are not more fires is due more to the strength of heating apparatus than the care of those who run it.

A VALUED subscriber, in sending in the renewal of his own subscription with twenty new subscribers, says: "While I survive, there are only two circumstances that will prevent me from taking the SCIENTIFIC AMERICAN, namely, poverty and blindness."

Turkey Tobacco.

The famous tobacco of Turkey is cultivated in the following manner: The tobacco seed is usually sown about the middle of March, in small beds, and in a few weeks appears thick, like our lettuce beds; then begins the occupation of the farmer's wife or wives, as the case may be, and their numerous children, whose little fingers are engaged day by day in thinning the beds, care being taken to leave the most healthy looking plants. The husband is engaged either in carrying water from the nearest well by the aid of his mule, or in preparing the land for the reception of the plants. The beds are well watered before sunrise and after sundown. When the young plants are about six inches in hight, they are removed from the small beds and planted in fields, like cabbages in this country, and are then left for nature to develope them to a hight of from three to four feet; three leaves, however, are removed from each plant to assist its growth. The farmers calculate always fifty-five days from May 12 for their crops to be ready for gathering.

When the leaves show the necessary yellow tips, they are carried to the house, and there threaded into long bunches by a large flat needle, about a foot long, passed through the stalk of each. These are then exposed to the sun to dry, and some months' exposure is necessary before they are sufficiently matured for baling. Rain sets in at a later period, and the tobacco, becoming moist and fit for handling, is then removed from the threads and made into bundles or "hands" of about sixty leaves each, and tied around the stems. These bundles are piled against the walls inside the dwelling rooms, and a carefully graduated pressure put upon them. The tobacco is next baled, the bales averaging in weight about 110 English pounds. The covering of the bales is a sort of netting made, by the peasants, from goats' hair; it is elastic, and of great strength. The Turk and his family, it will be seen, have now been occupied upon their tobacco crop for nearly a whole year. The leaf is just becoming a bright light yellow when it falls into the hands of the merchant, and it is during this period that the process of fermentation or heating generally occurs, before which the tobacco cannot be shipped. The bales having been placed in the merchant's store, are left end up until a fermentation or baking has taken place, the ends being reversed every three or four days. In the course of a few weeks a bale is reduced to about two thirds of the original size. It is then placed upon its sides to cool. When it is discovered to be cold, it is broken open by the native tobacco pickers, and every leaf sorted and classified. The patience with which this operation is carried out is truly astonishing.

DR LOUVEL has been awarded a prize of four hundred dollars by the French Academy of Sciences for designing an apparatus for keeping grain in a vacuum, or rather within a vessel in which the air is so rarefied as to kill any granivorous insect.

SCIENTIFIC AND PRACTICAL INFORMATION.

UTILIZING SUINT FOR THE MANUFACTURE OF PRUSSIATE OF POTASH.

The suint, which forms almost the third part in weight of the raw wool, has been found to be an excellent material for the manufacture of yellow prussiate of potash, which is used for making Prussian blue and other articles of commerce, inasmuch as, after heating, it consists of an intimate mixture of carbonate of potash and nitrogenous carbon. Formerly this suint was exclusively used for the production of potash. Havrez found, however, that it is three times as valuable when directly used for the manufacture of prussiate of potash. While 100 kilogrammes of dry suint, containing 40 kilogrammes pure potash, cost only $3, 100 kilogrammes of the potash of commerce cost from $14 to $16. Thus it will be seen that, by employing the suint, 100 kilogrammes of potash may be obtained for $7.50.

ALCOHOL FROM MOSS.

In the northern governments of Russia, large quantities of alcohol are at present produced from the mosses and lichens growing there in enormous quantities. This new industry originated in Sweden, and was subsequently introduced in Finland. Several large distilleries exhibited such alcohol at the recent industrial exposition in Moscow, where German, French, and English manufacturers praised its quality highly. The net profit is said to amount to 100 per cent.

PROCESS FOR PURIFYING THE CONDENSATION OF ENGINES FROM FATTY MATTER.

The steam condensing from engines always contains fat, resulting from the material used for lubricating. Cail & Co., in Paris, collect the water of condensation in a common reservoir, and pump it into a receptacle provided with a powerful stirring apparatus, consisting of shovels, Archimedean screw, etc. This receptacle is three fourths full, the remaining space being filled with petroleum; the apparatus is set in motion for five minutes, the water being allowed to settle for fifty-five minutes. Five minutes' time is sufficient to separate all the fat which is then contained in the oil, and the purified water can directly be used again. A hundred pounds of petroleum will absorb fifty pounds of fat; it has then a specific gravity of 0·840, but should be renewed when presenting a density of 0·810. It is regained by distillation.

AUSTRALIAN MINERAL CAOUTCHOUC.

This material (described on page 197 of our volume XXVI.) which is now being imported into Germany, occurs in Coorong in moderately thick layers on the sand. Analyses seem to indicate that it stands in a generic relation to petroleum, but why it has been deposited in that peculiar form must be left to future investigations.

TO PROTECT CLOTH AGAINST MOTHS.

Reimann, in his *Färberzeitung*, recommends for this purpose steeping the cloth for twelve hours in a solution prepared in the following manner: Ten pounds of alum and twenty pounds sugar of lead are dissolved in warm water, the mixture being left undisturbed until the precipitate of lead sulphate is deposited. The clear liquor, now consisting of acetate of alumina, is then drawn off and mixed with 180 gallons of water, in which a little isinglass has been dissolved. When well steeped, the goods are dried and finished by pressure or otherwise.

TARTRATE OF MANGANESE.

The action of permanganate of potash upon organic matter in general is to destroy it. Not only is glycerin decomposed with violence when allowed to drop into a hot, concentrated solution of permanganate of potash, but alcohol, aniline oil, and other organic substances, including the organic acids, are decomposed, partially or entirely, by it. Notwithstanding this violent action of the permanganate upon organic acids, Anton Fleischer has succeeded in preparing both a tartrate and oxalate of manganese. The neutral tartrate of manganese obtained was found upon analysis to have the composition represented by the formula $C_4H_4MnO_6$. It is slightly soluble in water, 1,000 parts of water dissolving only 2·17 parts of the salt. On adding alcohol, it crystalizes out. When moist, it is rose red; when dried over sulphuric acid, it has a lighter color; at the temperature of boiling water or above it, it is almost colorless. It dissolves readily in mineral acids. What practical use can be made of it remains to be investigated.

ELECTRO-POSITIVE STATE OF AN INSULATED CANDLE FLAME.

When an insulated flame is placed between the balls of a discharger connected with the positive and negative conductors of an electrical machine, the flame is attracted towards the negative pole so strongly as to ignite a piece of phosphorus attached to that pole. If a piece of burning phosphorus be placed between them, the phosphorus on the positive ball soon burns, and the long column of phosphoric acid vapor is also attracted to it and forms with it the phosphate of the metal.

COOLING WATER BELOW THE FREEZING POINT.

A glass tube closed at one end and blown to a bulb near the upper end, and the upper limb bent and drawn to a point, is filled to the middle of the bulb with distilled water that has been boiled. The water is heated to drive the air out of the tube, and the tube is sealed by the blowpipe. Another tube of the same form, but not bent and drawn to a point, is filled with water that has not been boiled and hence contains air. The two are now placed in a freezing mixture, and after the water in the open tube has frozen, the other will be found to be still liquid. On taking it out of the freezing mixture and shaking, it will instantly congeal.

HAY MITES.

Some time ago, there died a large number of horses in Nordheim, Germany, from inflammation of the intestines, the true cause not at first being known. At last it was assigned to the hay, in which, upon close examination, an immense number of microscopic animalculæ were found. They belonged to the genus *acarus fœnarius*, to which genus the mites living on dry fruit and in cheese also belong. In times of horse diseases it might, therefore, be proper to microscopically examine hay and straw, since even the best fodder, if stored in a damp place, is very likely to be infested by those and other parasites.

TESTING WATER FOR HYGIENIC PURPOSES.

One third of a fluid dram of the water to be tested is evaporated on the object glass of a microscope, on which a small reservoir has been formed by cementing a glass ring upon it. The temperature should be about 120° Fah., not higher. The residue from pure water, when examined under the microscope, reveals only colorless, dendritic or sharply defined crystals of carbonate of lime. But if the water holds organic substances in solution, the residue exhibits more or less imperfectly formed crystals of a yellowish or reddish color; and, if the impurities are considerable, it shows twin crystals and triangles with obtuse angles and other distorted forms. Experiments prove that less than a one thousandth part of urine or decomposing organic matter is sufficient to change the appearance of the residue considerably.

DURABLE CRUCIBLES FOR MELTING STEEL.

Such crucibles are prepared from a mixture of 10 parts ground and washed chamotte, 10 graphite, 15 asbestos, 3 quartz (not too finely powdered) and 22 fireproof clay. The asbestos, as a fibrous body, prevents the falling asunder of the crucible when cracking, and thus any loss can be prevented.

ORIGIN OF ELECTRICITY.

Dr. Louis Elsberg, of New York city, has communicated a new theory of the origin of electricity. According to this scientist, the number of vibrations executed by the molecules of an electrified body are between those of sound and heat, namely, they exceed 38,000 a second (at which point the consciousness of sound ceases altogether) and are below 200 billions in a second.

EFFECT OF DIFFERENT COLORED LIGHT UPON THE AMOUNT OF CARBONIC ACID GAS IN RESPIRATION.

Two Italian investigators, Selmi and Piacentini, have instituted an interesting series of experiments to determine whether different colors affected the respiration of animals as they are known to affect plants. The animal to be experimented upon was placed in an air tight box into which no light could penetrate except such as passed through glass of a given color. Air freed of carbonic acid was constantly admitted into the box, and escaped by a second opening, where it was passed through a vessel which contained some absorbent of carbonic acid, so that its amount could be accurately determined. Representing the quantity of carbonic acid respired by a dog, in a given time under white glass, by 100, the amount given off under black glass was 82·07, under violet, 87·73, under red 92, under blue 103·77, under green 106·03, and under yellow 126·83. The difference was still greater when the experiment was tried on a pigeon and on a hen. The authors came to the conclusion that green and yellow rays, which are the most important to the vegetable kingdom in taking up carbonic acid, are also most favorable to the respiration of animals, that is, enable them to give off the most carbonic acid. Previous investigators have reported in favor of blue glass, so that the question is not yet fully settled.

ANTIMONY AN EXPLOSIVE METAL.

If a piece of copper foil be attached to the negative pole of a galvanic battery, and a piece of platinum foil to the positive pole, and the two immersed in a hydrochloric acid solution of antimony, the antimony will be precipitated as a metallic mirror on the surface of the copper. After removing it from the liquid and carefully washing with distilled water, the brittle antimony can be removed by bending the copper back and forth. Antimony thus obtained will explode upon being rubbed in a mortar or struck with a hammer, light and heat as well as detonation being produced by the explosion. The reason of this extraordinary action of only one metal is due to the rapidity with which it returns from the amorphous form to the crystaline.

BENT WOODWORK IN CARRIAGE MAKING.

BY HENRY F. PORTER.

It is only recently that much attention has been paid to the bending of different wooden parts of a carriage. Not only in this country, but also in Europe, it has long been customary to saw out crooked pieces, and when lately we resorted in preference to bending, it was not only for the purpose of saving material but particularly for the reduction of weight and the greater durability of the pieces. The latter is a very important point. The saving of weight is twofold. In the first place, a piece which is to be bent can originally be sawn out in a reduced size, for the reason that the grain will all run parallel with the sweep when the wood is bent, and thus such a piece does not require to be stronger at any particular point as a piece sawn cross-grain always must be. The second point in which weight is saved is that a bent piece requires for plating only one half the size of iron of that which must be put on a cross-cut piece. We will illustrate this with the example of a rockaway perch, or, in other words, a perch for the heavier class of work. If such a perch is sawn out cross-grain, it will require to be plated on all four sides, thereby considerably increasing the weight without adding to the durability. We have seen many cases where the incessant vibrations and jerks, to which the perch is exposed under all conditions, have caused the wood to be chawed off by the ironing, occasioned by the exposure of the cross grains. If, on the other hand, the perch is bent a single iron plate on the bottom is all that is required, and there is no possibility of the wood getting damaged by it, as all the grains run parallel and present a smooth surface not easily attacked. The point of durability has long been recognized by leading eastern builders, and, on such work as the Concord coach, of which the proverb says "it wears but never tears," we find the back pillars, bottom pieces, and most of the crooked parts all bent. Scarcely any kind of vehicle has been exposed to such hardships as the old overland stage, and it was early found that cross-cut parts could never withstand such trials as upsetting, rolling down ravines, etc., incidents so common on the old perilous overland route. When bent, such pieces, as a rule, never broke. This example goes far to show that it is preferable to bend perches, whenever practicable, instead of following the old method of cross sawing. Still, there is another and very material point to be obtained in making perches. It will frequently be noticed, on perch carriages, that it seems to have been the aim of the maker to conform the sweep of the perch as near as possible to the lines of the body; and this produces, in many instances, a very crooked perch, a circumstance which is rather unfavorable to durability.

In speaking of perches, it may not be out of place, although not coming under the heading of this article, to say a few words with reference to straight double perches for wagons. It has been customary to plate these underneath, by bolting a perch $1\frac{3}{8}$ inch square with a $\frac{3}{8}$ bolt, which in reality leaves not sufficient strength in the wood to resist an extraordinary strain, such as may be caused by accidents, or even by ordinary wear and tear. It has been tried for this reason, and found to be perfectly practicable that these perches for wagons are not ironed through their whole length, but only sectionally at both ends, namely, nine inches on either side. In this way the inevitable vibrations can take place unobstructed in the middle of the perch, and the resistive power of the wood is not endangered or lessened by any holes. Plating in general is of no account after the wood has given way. Besides perches, there are other important pieces of bent work connected with carriage parts, namely, bottom-beds, futchels, back bars, and shafts. As for the bottom-bed, its arch is, in the first instance, conditioned by the hanging of the body, and next by the hight of the front wheels. If the body is to be hung low, the bed will have little or no arch; and if the wheels are low, it will require more arch on the bed in order not to get too high a carriage part. The extreme hight of carriage parts should never be more than twelve inches for the heaviest work, which of course is considerably reduced for lighter classes of work. The arch of the bed is also limited by the consideration of obtaining the proper position for the pole, and we cannot give here fixed measures, because they vary in almost every instance. What we wish to convey is that a bent bed, even when arched as much as four inches or more, is still safe, and that a bed sawn across grain, whose arch a contemporary thinks should be limited to $2\frac{1}{4}$ inches, is more unsafe than a bent one with double this amount of arch.

Back bars, when they have to be arched, should always be bent. The curve required can be sawn out. In the case of bars, the grain of the wood is not exposed to friction, and therefore there is no danger of checking. Back bars have, under certain circumstances, to stand a considerable strain. When the vehicle is moving on a sloping road, the whole weight is thrown on one side, and the bar is thereby given a tendency to twist. The motion of the springs also is often not the same on each side, for instance, when one wheel meets with a resistance while the opposite runs on smooth ground. Jerks thus caused are transmitted to the bar, with a somewhat reduced force, it is true, but still with such intensity as to call for the best material. On C spring carriages, the back bar will have to be plated with band iron, or made wholly of iron, as is now frequently done.

Shafts and poles for wagons have been bent for a number of years, for the same reasons which we gave for the other parts. Our intention has been to call attention to the decided advantages obtained by having all pieces bent over the old plan of sawing them out. The progress made in bending during the last few years is worthy of notice, and proves the patronage and encouragement given it by the trade. It is only a few years since one of the first leading firms in this country experienced great trouble in bending double sweep ash and hickory top beds to a sweep of five inches. Nowadays they find no difficulty in bending perfectly, and without split, seven to eight inches. A further illustration is the advance made in the bending of rims. A rim bent at present is less in size and just as durable as a heavier rim was some years ago, both for the same size of work. It is made for top wagons at present $\frac{7}{8}$ inch deep, with $\frac{5}{16}$ inch tire. This progress was in a great measure brought on by machinery, and it is but just to say that, for all similar wants of our trade, requiring the ingenuity of others, we are promptly met by inventions of the most excellent tools and materials. This fact in itself should be an encouragement to us to keep on the road to improvement and perfection.—*The Hub.*

FEW things are impracticable in themselves, and it is for want of application, rather than of means, that men fail of success.

An American Doctor in London.

Dr. E. P. Miller is writing from Europe, to *The Laws of Life and Journal of Health*, edited by Harriet N. Austin, M. D., and published at Dansville, N. Y., some very interesting letters. From a lengthy letter from Dr. Miller in the January number, we condense the following extracts:

There are some things in this world so vast that it is literally impossible for finite minds to comprehend them. It is true we are not quite so lost in thought in their contemplation as when we attempt to search the boundaries of space or number the fixed stars, yet we are amazed to find how much there is to learn, and after all we have done, how little we know.

London is a world of itself, and it would require more than a lifetime to know it. There are more than 3,000,000 human beings, crowded into an area of about 122 square miles. There are about 6,000 public houses, wine cellars, and beer saloons, where alcoholic liquors are sold, and these places dispense 43,200,000 gallons of ale, 7,800,000 gallons of wine, and 2,000,000 gallons of other strong drinks every year. As a result they have 129,000 paupers, and it requires 5,000 lawyers, 2,000 ministers, 3,000 doctors, and 500 undertakers to take care of the criminals, sinners and sick people.

Nearly every street you traverse, and public or private building you examine, has a history of its own—many of which date back hundreds of years.

THE LONDON UNDERGROUND RAILWAY.

Dr. Ellis kindly invited me to visit the Crystal Palace with him on the day following my arrival, and I gladly embraced the opportunity of accompanying one so familiar with the grounds. The Crystal Palace is about six miles from my hotel, and the most convenient mode of reaching it was by the Underground Railway. I had wanted an opportunity to examine this subterranean enterprise, and was both surprised and delighted with its workings. It has become one of the indispensable necessities of London. They could no more get along without their underground railway than could New York without horse cars. Trains pass on these roads every ten or fifteen minutes, and a train often carries four or five hundred passengers. The stations are frequent and convenient, and the cars are so constructed that a stoppage of not more than one or two minutes is required to load and unload an entire train. The cars are well lighted and frequent openings of the roadway to the surface secure tolerably good ventilation. The engines in use condense their own steam and consume their smoke, so that these nuisances are almost entirely avoided.

THE CRYSTAL PALACE.

The train I took stopped at the Crystal Palace grounds; and, as I stepped out from the depot, at a short distance in front and above me stood that magnificent temple of glass and iron glistening in the sunlight, while all about, for acres, was one grand parterre of flowers and fountains. I can never forget the sudden change in my feelings as I passed from that subterranean passage of darkness to the magnificent scene which was the very perfection of light. I was literally chained to the spot. It was like a fairy vision, so beautiful; I thought of the Bible description of "the Holy City coming down from God out of Heaven prepared as a bride adorned for her husband," and of the time when "all tears shall be wiped away and there shall be no more death, neither sorrow, nor crying, neither shall there be any more pain, for the former things shall be passed away." It seemed to me that all the beautiful things that were ever thought of in Paradise were concentrated here. I do not think it possible to find another place where can be seen more of the beauties of nature and of art in three or four hours' time than at the Crystal Palace.

The interior fulfilled the promise of the surroundings. Outside there are acres of flowers, tropical plants, trees, shrubs, and vines, native products of different countries and climes, growing in all their freshness and beauty. Acres of fountains, in glass and out of glass, picture galleries of ancient and modern masters, statuary, architectural products and manufactured articles, pictures and wax representations of all the different nations and tribes of people, and of the different beasts, birds, fishes, and insects. I am quite sure Noah's ark was not half as large, nor did it contain half as many curiosities, or cost half as much to build it.

A concert is given in the Crystal Palace every afternoon. The view of the fountains in full play, when seen from the balcony of the Palace, beggars description. There are hundreds of them of every conceivable variety and form, the water being supplied from towers 260 feet in hight, which are erected on the grounds.

The Crystal Palace cost about $6,000,000, and not far from $3,000,000 are annually expended in supplying it with new curiosities and defraying the running expenses. May it always stand an emblem of the ingenuity, industry, enterprise, intelligence, and refinement of the English people!

I must confess my opinion of the English people was essentially changed by an acquaintance with them. They are a great people. They are proud of their race, and justly so. They are honest, industrious, and educated. They are above the average of the human race in health, physical strength, and endurance. They are fond of out-door life, of sports, of physical exercise, and social enjoyments.

REMEDIES FOR SORE THROAT AND NASAL CATARRH.

Dr. Ellis gave me a simple recipe for throat and lung affections with which I propose to close this article. Upon my remarking on my tendency to such affection, he said "Now, Doctor, you may go home and thank God for having seen me, for I will give you a simple remedy that will be the means of prolonging your life many years. Get a silk ribbon an inch or more wide, tie it about your neck and wear until worn out and then replace it, and continue to do so." I confess I was a little surprised to find a man of Dr. Ellis's intelligence relying with so much confidence on such a remedy, and I asked an explanation of its virtues, but this he was not prepared to give. If any reader tries this or the following remedy, I should be pleased to know the result.

A remedy for nasal catarrh which I think of some value, I will also give. Many cases of catarrh are caused by inability of the liver to perform its function properly. In such cases there is often a too alkaline condition of the blood. When this is the case, the liver does not take out as much of the carbon and other substances as it should, and the mucous membrane of the nose becomes a dumping ground for the foul matter. If persons thus afflicted will squeeze the juice of a good sized lemon into half a tumbler of water and drink it without sugar just before dinner, they will, if they live hygienically, be surprised to seen how soon the catarrhal difficulty will diminish. When it fails to do so, it may be considered as due to other causes.

New Apparatus for Testing Quality of Lubricating Oils.

This machine, recently patented by R. H. Thurston, Hoboken, N. J., affords a means of making a combined dynamometrical and thermometrical test of the lubricating value of any lubricant, and also of determining, at the same time, its power of sustaining heavy pressures and its durability under any required pressure.

A journal, on a shaft running in a securely mounted frame, is grasped by a clamp and the boxes are set up to any desired intensity of pressure by a powerful screw compressing a spring; the pressure is known from the reading of a suitably arranged scale.

The pressure being adjusted as desired, the clamp swings about the journal and, by compressing a spring or by raising a weight, determines the exact amount of force required to overcome friction, by the reading of another scale.

A thermometer, set in the journal brass, indicates the commencement and progress of any heating of the journal. The time required to become heated and to burn off, under a given pressure, will indicate the durability of the oil where it may be exposed to such a pressure.

Several forms of machine are described for special classes of lubricants, as for heavy oils for locomotives, at the one extreme, and for the light oils used on sewing machines and other light machinery, at the other extreme.

The Spread of Fires in Cities.

A correspondent, R. B. V., of Md., says:

"It strikes me that the greatest cause of the spread of fires is the falling of the walls of the houses as they are burned out, a dread of which, in very many instances, keeps the firemen back from the work. If that dread was removed they would rush forward and subdue the enemy; but as houses are now erected, many of the valiant men are crushed to death by falling walls; and not this only. Who has not seen rows of houses all on fire in a few minutes from end to end, just because they were so built that the partition walls, one after the other, had fallen, thereby permitting the fire to go from house to house with such rapidity that all efforts to save them were in vain? To prevent this, permit me to suggest: That the walls be of brick (it is the most fireproof material) and of reasonable thickness, with as few windows as will afford the necessary light and air, with tight iron shutters to each. In all the walls on which girders or joists are to be placed, put good substantial upright fastening that will not burn, for the ends of every girder and joist to fit on; so that each of them, while laying horizontally, will be a reliable stay to keep the walls in their proper upright position, and will be so constructed that, as soon as each girder and joist is either burned or broken in two, they will fall out of the wall without injury to it; for, after all that has been said on the subject, the walls are thrown down by the great leverage given to each girder and joist by the present plan of putting them in the walls. When the falling of the walls is obviated, the standing ones will screen the surrounding property, and the damages of fire will be much less, and can be repaired with less than half the expense of labor, time and money."

Vaccine Virus.

M. Chauveau has succeeded in separating, in a pustule of vaccine, a serous matter and molecular granulations, in order to inoculate with each, separately and comparatively. He has found that the vaccinal serum is not virulent, and that the activity of the virus resides in the solid granulations. On the addition of water, the granulations deposit themselves, and so long as the mixture is in repose, the water is unaffected. If, however, the liquid be agitated, the granulations expand and communicate the virulent property to the whole. It has been determined that vaccine thus weakened with fifty times its weight of water is as certain in its action as if in concentrated form. M. Chauveau therefore concludes that in the pus of the variola and of the morbid affection, as well as in the vaccinal liquid, the specific activity which constitutes virulence resides exclusively in the elementary corpuscles held in suspension by the humors.

An African Steam Gage.

H. A. M., an esteemed Southern correspondent, sends us the following anecdote: Not many miles from Panola county, Miss., a certain wealthy planter has a cotton gin run by steam. Upon one occasion, he invited a mechanical friend up into the gin house to see it work. After showing the premises, he called out to his old Ethiopian fireman: "Sam, are you ready to start?" The old man ran his hand backward and forward over the surface of the boiler, and, with a face important with grave judgment, replied, "No, Marse Abe, I don't tink she quite hot enough yet." "Good Lord," exclaimed the mechanical friend, "is that your steam gage?" and he left the gin house. Fact, gentlemen.

Forests and Drought.

T. S., of Pa., writes to say that it lies with us to decide whether our continent shall retain its present luxuriance and salubrity to remote ages or not. He regrets the rapid diminution of our forests, and the decrease of moisture in the interior parts of the country; and concerning the latter point he states that, in some parts of the country, where five feet of snow usually fell in a year, there is not now five inches.

"Sardinia and Sicily, once the granaries of Italy, have suffered the penalty of their thoughtlessness in exterminating their forests. Two thousand years ago, those lands were celebrated for their wonderful productiveness, and were said to be the most beautiful in the world. In 1800, Humboldt visited Venezuela, South America, and was informed by the natives living in the valley of Araguay that they had noticed, with great astonishment, that a lake which lay in the middle of the valley had decreased in volume every year; the cause of this is clearly traced to the felling of a great number of trees which grew on the surrounding mountains. In Hungary the periodical droughts are universally attributed to the annihilation of the forests. In Cairo, Lower Egypt, a great many years ago, rain fell but seldom, only once in three or four years; but since the time of Mohammed Ali, twenty to thirty millions of trees have been planted, and the result is now that the people have from thirty to forty rainy days every year. Surely these few of the many examples are warnings sufficient to put us on our guard."

Facts for the Ladies.—Mrs. D. Magra, Saratoga Springs, N.Y., has used her Wheeler & Wilson Lock-Stitch Machine about two thirds of each year since 1860, and earned annually about $500, with no expense for repairs. See the new Improvements and Woods' Lock-Stitch Ripper.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 5 to December 11, 1872, inclusive.

CLARIFYING OILS, ETC.—F. Kersting, Grand Rapids, Mich.
CUTTING PLIERS.—N. Thompson, Brooklyn, N. Y.
GAS OR LIQUID METER.—D. B. Spooner, Syracuse, N. Y.
HORSE SHOE NAILS.—A. Alden, Cambridge, Mass.
INSULATING COMPOUND.—Z. G. Simmons, Kenosha, Wis.
LAMP.—J. B. Irwin, Philadelphia, Pa.
MIDDLINGS PURIFIER.—W. W. Huntly, A. P. Holcomb, A. Heine, Silver Creek, N. Y.
ORDNANCE, ETC.—W. E. Woodbridge, New York city.
RAILROAD COUPLING.—H. C. Kibbe, San Francisco, Cal.

PATENT OFFICE DECISIONS.

REED ORGANS.—GOODMAN *vs.* SCRIBNER.—INTERFERENCE.—APPEAL FROM THE BOARD OF EXAMINERS-IN-CHIEF.

In an interference between an application and a patent, where it appeared that the patent had been granted during the pendency of the application without an interference: Held, that the parties should be treated as if both were applicants. Goodman's patent sustained.

COMBINED CLEVIS PIN AND WRENCH.—LLOYD *vs.* INGEMAN.—INTERFERENCE.

Held, that a case may be referred to the Commissioner in person when, in the judgment of the Examiner of Interferences, the interference has been improperly declared and the case has passed beyond the jurisdiction of the Primary Examiner.

The mere exchange of a feature of a device for a different but not novel one of the same kind, to be used in the same way, does not indicate invention.

REFRESHMENT CARS.—AMOS M. SMITH.—APPEAL FROM THE BOARD OF EXAMINERS-IN-CHIEF.

An arrangement of rooms in a dwelling, railway car, or other structure is not a proper subject for patent; such arrangement does not constitute patentable novelty.

THACHER, *Acting Commissioner:*

The following is the claim;

I claim the combination and arrangement of the side passage, B, the saloon, H, store room, G, counter, D, passage, E, and open space, C, substantially as and for the purpose specified and shown.

The grant of patents for improvements of this class can operate only as an unwarrantable and vexatious restriction upon architects and builders in the practice of their respective vocations. It is not believed that the spirit of our patent system encourages the imposition of such restrictions. While originality should be shown in the grant of patents for improvements which manifestly tend to promote science, art, or manufactures, it is also important that a wise discretion should be exercised to prevent the placing of unnecessary restrictions upon artisans in a legitimate use of their mechanical skill and ingenuity. Due regard must be had for the rights of all parties in the consideration of questions affecting the right to a patent, and that policy should be adopted which seems most favorable to the promotion of the public good. In my opinion sound policy demands the refusal of all patents for subject matter such as is contained in the present application.

This seems also to be the opinion of Commissioner Leggett, as intimated in his decision of August 26, 1872, refusing a patent to John Gates for an alleged improvement in steamboats, and the decision of this case is understood to accord with the spirit of the opinion therein announced.

The decision of the Examiners-in-Chief is affirmed.

PRACTICE IN INTERFERENCES.

Rule 59, relating to interferences, is hereby amended by inserting at the end of the first paragraph the words here italicized, so that as amended the paragraph will read as follows:

"An interference will not be declared until the subject matter involved is decided to be patentable; and when once declared it will not be dissolved without judgment of priority, unless it be found that neither party is entitled to a patent or that no interference in fact exists, when it will be dissolved, and an appeal may be taken to the Commissioner in person.

M. D. LEGGETT, Commissioner of Patents.

December 30, 1872.

DECISIONS OF THE COURTS.

United States Circuit Court, Eastern District of Pennsylvania.

HARVESTERS.—WM. H. SEYMOUR AND DAYTON C. MORGAN *vs.* JAMES S. MARSH AND OTHERS.

MCKENNAN, *Circuit Judge:*

On the 1st of July, 1856, letters patent were granted to Aaron Palmer and S. G. Williams for "improvements in grain harvesters." This patent was reissued in divisions, one of which was numbered 1,682, which was extended for seven years from July 1, 1863.

On the 8th of July, 1851, William H. Seymour obtained a patent for an "improvement in reaping machines," which was also reissued in divisions, two of which were numbered 72 and 1,683, and were extended for seven years from July 8, 1865.

The title to these several reissued and extended patents, 1,682, 72, and 1,683, has been duly vested in the complainants, and they constitute the subjects of the present contention.

These patents embrace several claims, the three following of which only are the defendants charged with having infringed:

1. The claim of 1,682, which is for a "combination of the cutting apparatus of a harvesting machine with a quadrant shaped platform arranged in the rear thereof, and a sweep rake operated by mechanism in such manner that its teeth are caused to sweep over the platform in curves when acting on the grain, these parts being and operating substantially as set forth" in the specification.

2. The claim of No. 72, for "a quadrant shaped platform, arranged relatively to the cutting apparatus, substantially as described, and for the purpose set forth."

3. The claim of 1,683 for "the combination, in a harvesting machine, of the cutting apparatus, with a quadrant shaped platform in the rear of the cutting apparatus, a sweep rake, mechanism for operating the same, and devices for preventing the rise of the rake teeth when operating on the grain, these five members being and operating substantially as set forth."

The defendants resist the complainants' right to a decree upon the grounds that the reissued patents are invalid; that the inventions claimed are not novel; that such inventions will not work practically, and that they are not infringers.

A reissued patent may embrace whatever was suggested or substantially indicated in the original specification, drawings, or model, and the claims may be broader, therefore, than those contained in the first patent.

If a machine is an advance upon the existing state of the art it is patentable, although it does not at first accomplish perfectly all that was designed nor all that was expected of it, but is found on practice to contain imperfections which can be remedied with ordinary skill.

The opinions of experts that the machine described is impracticable, founded on a literal construction of the specification, are of little weight when compared with evidence of its successful operation in actual use.

The judgment of the Supreme Court upon a question of fact arising afterward in a Circuit Court is entitled to high respect, and, though not binding in law, should be definitive where nothing is alleged which raises a doubt as to its soundness or a suspicion that it would not be repeated on a rehearing.

A harvester with a rake which, by a rotary movement, sweeps the grain from a platform and deposits it in the desired position is an infringement of a patent for a similar harvester with a rake which effects the same result, though by a reciprocating movement.

George Harding, for plaintiffs.
Messrs. Maynard and Parker, for defendants.

United States Circuit Court---Northern District of Illinois.

"GERSTEN" LANTERN DEFLECTOR.—JAMES F. DANE, WILLIAM WESTLAKE, AND JOHN P. COVERT VS. CHICAGO MANUFACTURING CO.

[In Equity.—Before Judge Blodgett.]

The bill of complaint in this case sets forth that on the 25th of January, 1859, a patent was duly issued from the United States Patent Office to one Conrad Gersten, for an improvement in lanterns; that said Gersten afterward duly assigned the said patent to the complainants Dane & Westlake; that after receiving said assignment, said Dane & Westlake surrendered said letters patent, and made application for two new patents to be issued for the same invention, with corrected descriptions and specifications; and that on the 16th day of September, 1867, new letters patent, each for a distinct and separate part of the thing patented as aforesaid, and each for some material part of the original invention, afterward were duly issued to said Dane & Westlake, as assignees of said Gersten, and that one part of said reissued letters patent was numbered 2,765, and that a legal corrected description of that part of the original improvement contained in said reissued patent 2,765, was given in the words of the said Dane & Westlake, annexed to the said part of the said reissued patent; that afterward an equal undivided interest in said reissued letters patent was duly assigned by the said Dane & Westlake to the complainant, John P. Covert; that the defendant is making and vending lanterns containing substantially the improvement and invention described in, and secured to, the said complainants by the said reissued letters patent 2,765, and they ask relief in the premises.

Defendant, by its answer, denies the validity of the said reissued letters patent, and also denies any infringement thereof; and evidence upon both these points has been taken and fully discussed by counsel on both sides.

The main point in regard to the validity of the patent is made upon the question of novelty; and on that question the state of the art at the time, and before the time of Gersten's alleged invention, has been very fully discussed and examined by counsel.

The feature in the Gersten patent, of which the infringement is alleged, is the plate or deflector.

It appears from Gersten's specifications that the general scope and purpose of his invention was a lantern, in which kerosene or carbon oils could be used for illuminating purposes.

It is an indisputable fact that nearly all of the inventors who preceded Gersten, whose devices are put in evidence in this case, called their cone or cap, by which the supply of air is concentrated upon the base of the flame, a "deflector," so that it seems Gersten did not invent the name.

We have not time, however, to settle who invented the cone or deflector. It is sufficient to say that when Gersten entered the field experience had demonstrated the necessity of the cone, the periphery of which must extend far enough to fill the chimney so as to induce a strong current of air through the cone and impinge it upon the flame in the slot; a small supply of air being also admitted into the chimney above the cone to feed the flame after it passed into the chimney, and secure the combustion of the particles of soot which were drawn along with the flame into the chimney.

These burners secured a strong white light without smoking, and lamps with this device for burning kerosene or coal oil had come into general use before Gersten's attempted invention, and Gersten's effort was to make a lantern in which kerosene could be used as it then was in lamps.

No experimenter or inventor had determined just how far outwardly the base of the cone should extend, but all had recognized the inexorable necessity of making the cone form a substantially tight bottom to the chimney, by which alone a draft through the cone could be obtained.

Gersten did this, and nothing more, so far as the cone is concerned. His deflector performs the same function in the same way as the Dietz cone does. It required a mere mechanical alteration and not an invention to expand the base of the cone until it met and filled the walls of the globe at the base of the globe. Thus expanded, it was nothing but Dietz's cone, because it did nothing more. I say Dietz's cone, because Dietz used it in his combination—for he was not and did not pretend to be the inventor—it was old when Dietz took it up.

It might be enough to stop here in the discussion of the testimony on the question of novelty, but the record shows that some months prior to his invention one Max Miller, a resident of Brooklyn, where Gersten also resided, had attempted the construction of a coal oil lantern in which he used the cone or deflector precisely like Gersten, except that he perforated with small holes his cone, near the base of the boss, so that some of the air which came into the flame chamber escaped into the space above the cone without going through the slot.

So that when Gersten claimed broadly a deflector extending to the walls of the lantern, he claimed too much, for Max Miller, his neighbor, had done that before him. If he could show that his cone was better than Miller's, by reason of leaving out the holes through which the air escaped into the chimney at the base of the boss or cone, he might have had a patent on his improvement on the Miller deflector, but he did not ask for or obtain that. He claimed broadly in the reissued patent the deflector as such, and it seems clear to me the testimony proves that Miller had anticipated Gersten in the application of the cone to a lantern in all essential particulars.

Bill dismissed with costs.

REMOVABLE GLOBE LANTERN.—JAMES F. DANE *et al.* VS. CHICAGO MANUFACTURING COMPANY.

[In Equity.—Before Judge Blodgett.]

This is a bill in equity to enjoin the alleged infringement of patents issued by the United States to William Westlake for an improvement in lanterns, dated April 26, 1864, and reissued to complainants as assignees of Westlake on the 23d of December, 1869, designated as reissue No. 2,767.

BLODGETT, *Judge:*

The nature and object of the invention, as set forth by the patentee in his specifications, "consists in the construction of a lantern guard without hooks, projections, or catches sticking out or interfering with the safe and convenient use of the lantern, so that the same can be readily attached or detached; in the employment of a band or disk to fill or cover the space between the enlarged band or ring at the upper end of the guard and the top of the globe; and in the application of suitable fastenings to secure the dome to the guard."

Finding, then, from the testimony that Westlake's alleged invention had been fully anticipated by the prior invention of Waters, it is hardly necessary to discuss the question of infringement.

This bill, or rather these two bills, must therefore stand dismissed with costs

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

ROCKING CHAIR FANS.—Otto Matzke, Durant, Miss.—The invention consists in the mode of operating a fan pivoted in an overhanging rocking chair by means of a single lever and cord. When a person is sitting in the chair and rocks forward, the lever will work upon its fulcrum, and its back end will be depressed, which will draw down the cord and throw the fan outward or operate it in one direction. When the fan is thus thrown from the perpendicular, the back motion is produced by its own gravity. A rocking motion of the chair is thus made to operate the fan and produce an agitation of the air, which is pleasant and agreeable to the operator.

BENCH PLANE.—Jacob Lehner, Galena, Ill.—This invention consists of a combination of screw rods, nuts, and an adjusting bar, with the plane stock and bit, in such manner that the setting of the plane bit is effected by turning the nuts on the screw rods, the latter being attached to the plane stock at each side parallel with the bit. The invention also consists of a combination of a tightening rod with the wedge and plane bit for securing and releasing the latter; the said rod passing from the heel of the plane stock through the plane bit and its cap, which are slotted at the center for the purpose, into the wedge, in which it screws, and the plane bit having two other slots, one at each side of the center slot, for the screws, by which the cap is secured to it, to allow the tightening rod to pass through the center slot.

CHAIR.—Daniel L. Akers, Evansville, Ind.—In this particular kind of chair (the hand plaited bottom chair), the bottom has been usually attached to and supported by the rounds or stretchers, which renders it necessary to complete the chair, which made it too bulky for shipment. To overcome this difficulty the inventor makes the seat separate, and attaches it to the frame of the chair by means of gains in the two back posts and in the two front legs. The bottom is supported by these gains, and when the chair is put together with glue, or is otherwise fastened, the bottom is secured and supported in a most substantial manner.

FRAME FOR SHADE AWNINGS.—Joseph Drechsler, New York city.—This invention has for its object to furnish an improved frame for connecting the lower end of a window shade with the lower part of the window casing or frame in such a way as to adapt the shade to be used as an awning, and which shall be readily detached, and which may be folded together upon the lower part of the shade; and it consists in a frame constructed to adapt it to be applied to a window frame or casing and to the shade.

VEGETABLE GRATER.—John Keagy, Newark, Ohio.—This invention consists of a connection of the hollow sheet metal punched grating cylinder to the shaft detachably, for taking it off readily to clean it, by flanged ends of the spider arms fitting against the inside of the cylinder, and clips of sheet metal soldered on the cylinder and extending around the sides of the flanges. The latter are inserted between the clips and the cylinder by moving the cylinder endwise along the flanges, or the spiders along the cylinder. They are kept in position by a fixed collar on the shaft for one spider and a washer and pin for the other.

APPLE PARER.—William A. C. Oaks, Reading, Pa.—This invention has for its object to furnish an improved apple parer, which shall be so constructed that the parings will fall clear of the working mechanism of the parer, so that they may all be received in a vessel set beneath, and cannot clog the machine; and it consists in the standard or frame made with a bend or angle to throw the upper part of said standard, that carries the fork, forward to allow the parings to drop clear of the operating mechanism of the parer. The knife begins to work close to the shank of the fork, and moves forward as the apple is revolved. When it comes into a position opposite the fork, and has thus completed the paring, the lower end of an arm strikes a guide flange which throws the upper or knife end of the arm back from the apple and holds it back until the said arm has passed beneath the shaft and has come to the place of beginning, thus allowing time for the pared apple to be removed and an unpared apple to be placed upon the fork.

DISH WASHER.—Augustus W. Thornton, Mendocino, Cal.—In using this apparatus after it is attached to the sink or vessel, the dishes to be washed are placed in such sink or vessel, and boiling water is poured thereon, and they are then pushed through between two bars covered with sponges and held together by springs. The grease, being softened or dissolved by the hot water or suds, will be wiped off clean. The dishes are then rinsed in hot water, and then drained and dried automatically by means of the heat absorbed from the boiling water.

MOLD FOR CASTING.—William B. Robinson, Detroit, Mich., assignor to himself and Jefferson Wiley, of same place.—This invention consists of a combination, with metallic molds for making composition castings and the like, of a gate mold of sand adapted to retain a surplus quantity of molten metal above the metallic mold, to flow into the latter as the metal therein cools and shrinks, to compensate for the shrinkage and produce castings of the exact size of the metallic molds.

VAPOR BATH.—Warren Estabrook and Samuel J. McDonald, Gallatin, Mo.—This invention is an improvement in the class of vapor bath apparatus in which the case employed is provided with a top and side adapted to open to receive the patient, and with a perforated seat and a vaporizing furnace and the invention consists in the arrangement of heat fenders or screens with relation to a seat and foot support, and of a receptacle for containing a furnace, the same being provided with a sliding cover, whereby the intensity of the furnace fire may be lessened or inclosed so as to exclude the air and extinguish it, etc.

BARREL STAVE AND VENEER SAWING MACHINE.—John McGrew, Ravenswood, W. Va.—The invention consists in a new mode of advancing the carriage after each hoop is cut, by means of a scroll.

DETACHABLE DRIP CUP FOR BOTTLES.—The invention relates to the cup or circular trough which has heretofore been applied about the necks of bottles in order to receive the drip or waste liquid which exudes from the mouth and trickles down the side of the neck. Heretofore these have always been blown, cast, or otherwise formed in one piece with the article to which they were attached. This invention consists in forming them separately of elastic material, so that they may be rendered attachable or detachable, as occasion may require.

BALE TIE FASTENER.—Robert S. Sayre, Stilesborough, Ga.—The object of this invention is to furnish efficient and convenient means for lessening the labor and time now required to bale cotton and similar material; and it consists in a lever with a slotted swinging plate attached thereto, and in a detached slotted hook plate so arranged as to draw the two ends of the band together and fasten the same in a few seconds of time and with but slight power.

INSECT TRAP.—Chauncy W. Curtis, Osborn, Mo.—This invention consists in a pedestal and standard, the latter of which contains a socket in which fits a spindle attached to a top piece. Said top piece may be freely rotated, and serves as a place of deposit for food, etc., which is protected from insects by a basin of water through which the standard passes.

BRIDLE.—James H. Wilson, Brentwood, Tenn.—The invention consists in a single strap having branches passing through rings of the bit and attached to a rein so that a pull upon said rein will draw the bit upward in the mouth of the horse.

AUTOMATIC CAR BRAKE.—James B. Pelton, Mt. Pleasant, Md.—The invention consists in a new mode of giving a yielding pressure to the shoes; in a novel means for locking a loose windlass to a car wheel so that it will turn with one of the axles; and in a novel means for moving the windlass or drum to or from the wheel to clutch or unclutch it.

GIN FILING MACHINE.—Lewis Monroe Asbill, Ridge, S. C.—The invention consists in providing the file holders of a gin saw filing machine with certain hinged plates, file plates, spring plates, and slides, whereby the whole operation of sharpening is made more uniform, the necessary time curtailed and the whole operation greatly facilitated.

PORTABLE SHOW SEAT.—David C. Price, St. Paul, Minn.—The invention consists in show seats, detachable and folding together; and also in suspending, on a subjacent band of seat board supporters a series of footrests. These improvements not only render the seats much more agreeable to spectators but enable them to be much more easily packed away and conveniently transported.

REVERSIBLE SCREW FAN.—William H. Goyne, Shamokin, Pa.—The object of this invention is to furnish a rotating fan, constructed upon the screw principle, which shall be adapted for the ventilation of mines and for other purposes; it consists in a series of spirally shaped blades or buckets confined between a closed drum on a rotating shaft and a surrounding cylinder or casing. The sides of the drum and cylinder are parallel, and the buckets or blades conform thereto. The drum is closed, but the cylinder is open at both ends so that air can be forced in either direction. This fan may be made of any length and diameter, and of any suitable material. It is calculated to exhaust the air from a mine or to force air in by simply reversing the motion.

PICTURE NAIL.—Cecil B. Jenkins, New York city.—This invention consists in having the hole through the bottom of the cup which holds the porcelain head a little smaller than the nail shank, with numerous radial slots extending from it to separate the metal into sections capable of springing so as to yield and allow the nail shank to enter when forcibly presented, and then so pinch and bind upon the shank as to hold the head on with sufficient strength. As a further security, the nail shank may have a slight groove around it, a short distance from the end, for the ends of the spring to fall into. An inverted cup, with a hole in the bottom coinciding with the hole of the outer cup, is placed inside of the latter to prevent the porcelain head from coming down to the bottom, so as to maintain a sufficient space between the outer cup and the back of the porcelain head for the nail shank to enter as far as required.

DUMB WAITER.—Louis Carrier, New York city.—This invention relates to a new manner of suspending and balancing dumb waiters, with the object particularly of holding the suspension rope tense by the same weight that acts as balance for the dumb waiter. The invention consists in such an arrangement of said rope, and in such a manner of placing the pulleys and devices which hold it, that there will altogether be but one rope used for raising, lowering, and balancing the dumb waiter, the balance weight always holding it tense. The invention also consists in a new style of double acting clamp for taking hold of the rope and holding the dumb waiter at suitable hight.

DRY GOODS RACK.—David Reiser, Reading, Pa.—This invention has for its object to improve the construction of the improved dry goods rack for which letters patent No. 131,221 were granted September 10, 1872, to the same inventor, to make it more convenient in use while being more capacious; and it consists in the combination of the detachable partitions or upper platforms with the pivoted platforms, standards, and detachable bent rods. By suitable construction, by removing the rods the upper platforms or partitions may be lifted off the standards, or raised to any desired hight above the upper ends of the short standards, where they will be supported by the said standards. In the free ends of the platforms and in the corresponding ends of the partitions are formed holes to receive stops, against which the end of the lowest piece of goods rests so that it will not slip upon the said platform or partition while drawing out a piece above and near to it.

BOOT FOR HORSES.—Joseph Fennell, Cynthiana, Ky.—The object of this invention is to provide convenient and efficient means for preventing "interference" in horses, or to prevent all consequences when interference or overreaching occurs; and it consists in a boot constructed in two parts, connected together by a flexible ligature. This lower portion of the boot, in order to fit the place intended, is made somewhat convex on the inside, or is curved from end to end vertically. With the boot thus attached the horse cannot injure himself when going at a high rate of speed by overreaching or interfering.

CHAIN PROPELLER.—John Neumann, Brooklyn, E. D., N. Y.—This invention consists of an endless carrier of wire ropes, chains, or belts running the whole length of the boat, over a drum at each end, in a channel along the center of the boat, at the top, the ends, and the bottom, with numerous buckets extending across the belt or carrier and projecting from it at right angles, with braces for supporting them, which bear upon the belt while in a straight line, but which are not attached to the belt, so they will allow the latter to bend in going around the drums.

FOLDING CHAIR.—Francis B. Fabri, New York city.—This invention relates to a new construction of folding chair. The chair seat is pivoted by projecting lugs or pins to the side bars of the chair back. The lower ends of the side bars of the chair back are pivoted to the supporting legs. These legs are at their upper ends provided with projecting hooks or pins that enter longitudinal grooves in the under side of the chair seat, and bear, when the chair is in position for use, against the front ends of such grooves. The legs stand inclined, thus providing, together with the back, double converging supports for each side of the seat, and are braced by short standards. When the chair is to be folded together, the back is swung on the pivot in line with the legs. The hooks are thereby withdrawn from the grooves, liberating the seat, which can be folded against the legs. Finally, the standards are also folded against the legs.

MANUFACTURE OF WROUGHT IRON.—Pierre Eymard Jay, St. Jean Baptiste, Canada.—This invention relates to an improved process of treating cast iron of all qualities for converting it into wrought iron, the same consisting in the addition of certain proportions of nitrate of soda, oxide of manganese, and oxide of iron to a mass of melted cast iron, and in the employment of a blast of atmospheric air impinging on the surface of the liquid metal during the time it is being subjected to the intense chemical and mechanical action of the ingredients specified. The result is that the sulphur, phosphorus, and arsenic are eliminated along with the carbon, leaving the iron in an approximately pure state, and forming a scum upon the surface of the melted iron, which, upon cooling, becomes scoria or slag. The function of the blast is mainly to separate or so act on this scum as to enable the sulphur to evaporate freely.

MANUFACTURING CAST IRON.—Pierre Eymard Jay, St. Jean Baptiste, Canada.—This invention relates to the combination of slag (the residue of the burning of cast iron with oxide of manganese, nitrate of soda, and oxide of iron), with iron ore placed in a furnace, to be converted by heating into cast iron. The invention also relates to the employment of an air blast pipe connected with the upper part of the furnace, so as to blow down on the liquid metal the gases arising from the ore, and also exert a certain degree of atmospheric pressure on the metal.

BREAST STRAP FOR HORSES.—Charles P. Holmes, Gouverneur, N. Y.—The invention consists in forming a stiffener for the inside of flexible breast straps, out of several metallic plates or strips hinged together so that the breast strap will be flexible and may adjust itself easily to the various sizes of shoulders in different horses without changing the points of bearing thereon.

MIXING SPOON.—William S. Clarke, Ishpeming, Mich.—This invention has for its object to furnish an improved spoon for preparing medicines, mixing drinks, and for other purposes, and it consists in the spoon made with a projection upon the lower side of its point, and either with or without perforations in the side parts of its bowl. In using the spoon it is placed upon the edge of the tumbler or other vessel, the sugar or other substance is placed in it, and the water or other liquid allowed to run upon it; or the medicines or other liquids to be mixed are dropped or poured into it one or more at a time, as may be desired.

DUMPING WAGON.—Edward Williams and Adolphus Kinney, Potosi, Wis.—This invention relates to wagons constructed so that the contents or loads may be discharged at once and in a mass; and it consists in a sliding bar and a lever for dropping the bottom, and in a lever for raising the bottom after the load has been discharged. The driver has the means within his reach for raising or replacing, as well as dropping, the bottom.

PORTABLE GATE POST.—William A. Dillon, Middletown, Mo.—This invention has for its object to furnish an improved gate post which shall be so constructed as to be portable and not allow the gate to sag. The lower end of the main post is framed into or otherwise secured to the ground sill, which is placed upon the ground in line with the gate when closed, and the inner end of which, in the case of the rear or hinge post, projects to serve as a step for the gate to be pivoted to. A cross sill is halved to the sill, a little in the rear of the lower end of the post. The side braces are secured to the outer ends of the cross sill and to the opposite sides of the main post. The rear braces are secured to the opposite sides of the rear end of the main sill, and to the opposite sides of the post. The braces are connected by a number of rounds to receive the ends of the rails or boards of the fence, the weight of which will overbalance the weight of the gate, and thus prevent it from sagging. Upon the upper end of the main post is formed a tenon, which enters the slot of the cap, the inner end of which projects to the gate to be pivoted to, and which is adjustably secured in place by a wedge driven through the outer part of said slot along the outer side of the post. The cap is prevented from rising by a pin.

CAR COUPLING.—Thomas P. Clines, Louisville, Ky.—This invention relates to a new attachment to cars which are provided with ordinary link and pin couplings; and has for its object to permit the raising the links in position to fit the approaching drawheads without exposing the attendant to injury between the cars. The invention consists in hanging said bar in slotted cars so that it may yield back when caught between the drawhead, and thus be preserved from being bent out of shape.

APPARATUS FOR MOLDING BUNG BUSHES.—James More, New York city.—This invention has for its object to furnish an improved apparatus for molding bushes for the bungs of casks and other vessels, said bushes being made with a wood screw thread upon their outer surfaces, to enable them to be screwed into the bung hole. It consists in the employment of leading screws for withdrawing the screw patterns from the sand, and in the employment of match plates for molding the screws and the cores and flanges of bung bushes concentrically in two half flasks.

LATHE.—Hezekiah T. Nickerson, Atchison, Kansas.—This invention relates to an arrangement of levers, knives, and springs, forming an improved attachment to a wood turning lathe for turning balusters, bedstead posts, and other analogous articles. The carriage slides on two rails, which constitute the top of the lathe frame. The wood to be turned is held in the two head stocks in the ordinary manner, and fits through a hole in the carriage. To the carriage is rigidly affixed a knife for cutting the wood down to the requisite diameter. Knives are pivoted to the carriage, and provided with handles, respectively, and with springs. These springs hold the pivoted knives away from the wood. To the carriage is also pivoted a catch to lock it in notches, which are cut into one of the rails. As the carriage is fed along the rails it is locked by the catch or catches in the successive notches, and whenever it is so locked one of the pivoted knives is swung against the wood to impart to it the desired shape at that place. In this manner the wood can be quickly shaped with a proper degree of smoothness and very exact, and a great saving effected on the ordinary method of turning.

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ANSWERS TO CORRESPONDENTS

A. S., of Richmond, Va., says: What are your ideas concerning a cupola, consisting of a cylinder within another, the space between sealed at either end, having a pipe entering at top and a smaller opening at bottom, with a stream of cold water running through, keeping the space between these cylinders filled, and doing away with bricking altogether, the blast to enter as in any other cupola? Again, can you give me some method of mixing plaster of Paris, so as to increase its strength, that it may be worked into patterns, etc., or any new composition suitable for such uses? Answer: We should fear that your water backing would chill the metal and also cause a greater expenditure of fuel. Try mixing your plaster of Paris with good hydraulic cement, using as little water as may be possible, molding quickly, and leave to set just as long as possible. We hope to hear much, in the future, from our Virginia "Birmingham" whose facilities for manufacturing are hardly surpassed on our continent.

P. C. N. asks: Can an ice boat, with no other driving power than the wind, acquire greater velocity on the ice than the wind by which it is driven, allowing the wind to blow from any direction, and regardless of the relative position of the ice boat to the wind? Answer: Yes. Theoretically an ice boat sailed on a proper angle to the wind will make more than double the velocity of the wind, and in practice this velocity is approached but not wholly realized, owing to the friction and imperfections of make. When an ice boat sails directly before the wind it will move with the same velocity as the wind minus the friction of the boat on the ice. But when the boat is sailed at the proper angle to the wind, a constant pressure is maintained on the sails, and the velocity of the boat increases until its resistance equals the wind pressure on the sails. It is on the same principle that the extremities of the arms of a windmill are made to travel faster than the wind by which they are driven.

J. T. W. asks: Why is it that it is always darker just before the break of day than it is one hour previous? Answer: It is not darker just before the break of day.

Querist says: 1. On page 387, last volume, is an illustration of a button hole cutter which you say was "suggested" by H. Walker, of London, etc. This article was evidently patented, as well as "suggested," by somebody, more than a year since. One of your readers here infers from your mention that this is a British patent; I think it an American patent. Who is correct? Upon the decision penda a year's subscription to your paper at a news dealer's. Answer: The description was copied from an English paper, and is only an example of the way in which Yankee contrivances are gobbled up on the other side of the Atlantic. The device in question is the invention of John G. Howell, of Philadelphia, Pa., and was patented in this country May 9th, 1871.—2. On page 385, same issue, is an account of a torpedo craft, the dimensions of which are stated to be "about thirty feet long and three inches wide." Into this queer craft must go "motive power, machinery, electrical apparatus, explosive shells, and 500 lbs. of powder or nitro-glycerin, etc." As stevedores, we are entirely at sea over this statement in our favorite journal. Answer: Read it three *feet* wide instead of three inches, and return to the solid land.—3. The article of Van Bibber in same issue relative to the dangerous properties of bisulphide of carbon rather disconcerted us, as we had been innocently and extensively sniffing at a bottle of the "fragrant" which he so condemns. We shall give it a wider berth hereafter.

J. C. says: There are two boilers supplying steam to an engine 18 x 28, running about 80 revolutions to the minute at 75 or 80 lbs. to the inch. The boilers are 50 inches by 14 feet, with 55 three inch flues in each shell, five sixteenths of an inch thick. They are connected on top by a drum, 20 inch diameter, size of connections 48 inches; they are not connected at the bottom, and are fed by separate pumps, and have no mud drum. They are cleaned out once a week, and burn 70 or 80 bushels of Ohio coal per day. They have about 20 square feet of grate surface. The grates are set 14 inches from the boilers and run up to 12 inches at the bridge wall, and up to within 4 inches at the smoke box. They had not been in use five months when the plates started a crack from the edge to the rivet holes, then across between the holes in the first joint, and the rivet holes in the second joint began to leak badly. In order to put on a patch, there were 4 flues taken out, 2 out of each boiler; they were put back in their places after the patch was put on, when, on firing up and running two days, they stripped the beard off of two of the flues. What is the matter with the boilers? Answer: Such cases are difficult to decide upon without personal knowledge of all the circumstances affecting them. We suspect that the effect described is due to the expansion of metal over a hot fire and covered on its inner side, possibly, with earthy deposit, and to its contraction when the feed water is forced in. Put in mud drums and a feed water heater, and thus avoid this alternate expansion and contraction as far as possible. Such an action is a frequent cause of disastrous explosions, and the boilers described are, probably, very likely to furnish another example. To leave the cause of danger undetermined would be criminal.

J. T. asks: How are the sizes of governor balls determined, for governors intended for different horse power engines, after the number of revolutions and hight of the cone in which the arms must revolve are determined? I think, without such a rule as this, the rules for finding hight of cone and number of revolutions are mere fallacies, because I think it is possible for the balls to be so hight that they would not shut the valve at all; and if it is, it is also possible for them to be too large, requiring too much power to drive them. All our celebrated engineers talk about governor balls resembling the pendulum of a clock; if this is so, take the pendulum of a clock off and put a heavier one on, and it will lose time, put a lighter one on and it will gain time, proving the rule I ask for. Answer: The proper size of balls for the fly ball governor can usually be determined only by experiment. The resistances offered by different valves and connections vary so greatly that there can be no reliable general rule. The rules for determining the hight of cone are reliable and their use is indispensable in designing governors. The difference in the power required to drive a governor with heavy or with light balls is principally due to difference in the amount of friction and, usually, is an exceedingly small percentage of the power of the engine. Many of our best engineers prefer a pair of small balls (driven at a high speed, and weighted down to the proper hight of cone by a weight on the spindle) to a pair of larger balls running at their ordinary speed.

D. L. M. asks: What is the cause of the loud humming or rolling noise heard on telegraph wires? Is it caused by the electricity in despatching messages, or by spontaneous electricity, or is it caused by the wind? The sound is heard when it is wind-still and also at night when no operators are on the line. Answer: The sound is caused by the wind. A very gentle breeze will produce it. The principle is the same as that involved in Æolian harp, which produces musical sounds on being placed upon a window sill so that an air current will pass over the strings.

E. M. asks: What difference of pressure per square inch will there be (at the end of the stroke) in two air cylinders, both being forced by the same pressure of steam, one cylinder being 12 inches in diameter and the other 6 inches, both pistons working to within one sixteenth of an inch of the cylinder head? I believe the pressure in both cases would be the same per square inch; my friend thinks the pressure would be the greater in the larger one; which is right? Answer: The pressure would be the same in each cylinder.

W. G. B. says: As it is not the design of your paper to take sides with those in error, I must be allowed to criticise your decision on the balance wheel question, page 394 of Volume XXVII. R. says a balance wheel (which is always a heavy wheel) may be keyed on to a shaft at an angle of 45° and run fast without affecting the steadiness, except from its resistance to the air. You admit the tendency of the wheel is to turn itself at right angles with its axis. In other words, one side of the wheel will pull its end of the shaft one way, and the other side will pull its end the other way, which would be equivalent to two pulleys, of a certain weight and certain distance apart, with the weight of one all on one side of the shaft and the weight of the other all on the opposite side. I will give you a case in point, which may be a hint to some who have pulleys to balance. I once saw a binder pulley which shook so when running at a high speed, whether in contact with the belt or not, that it was always working its fastenings loose. It was only a ten inch pulley, with eight or nine inches face, and in the very best of standing balance; but instead of running still and smooth, as a properly balanced pulley ought, it kept up a vigorous rattling and shaking. The trouble was that, at one end of the pulley, the rim was twice as thick on one side as on the other, and the person who balanced it put his counter weight in the other end, making both ends out of balance, though they balance each other when standing still. Answer: W. G. B. is right. He is referred to the reply to S. W. H., in last week's paper, on same subject, and to an editorial in this issue, which will, we think, dispose of the subject satisfactorily.

J. A. K., of Allegheny City, Pa., is desirous that we should understand that that illustrious municipality is not a part and parcel of the neighboring village of Pittsburgh. It is his firm belief that the Observatory will remain in Allegheny, notwithstanding the puny efforts of the smoky Pittsburghians to gobble it up. Allegheny has a population of 60,000.

A. J. S. asks: What is, in your opinion, perpetual motion? If a machine is so constructed as to furnish its power and run with no other obstruction than the friction while running, is that perpetual motion or self motive power? Answer: Such a machine as you describe, we should style a perpetual motion. Many forms of perpetual motion machines have been invented. The simplest form is the tub. When a man places himself in a tub and by a steady pull at the handles lifts himself from the ground, then he has produced a successful perpetual motion. All such machines necessarily operate on the same principle, and, until an individual is enabled to operate the simple form above described with success, it will be useless for him to expect that he can work a more complicated perpetual motive machine. The addition of cog wheels and levers will not help the matter.

S. Y. O. asks if adding to the running weight of a clock will cause it to gain time, every thing else being equal? Can the action of the verge on the pendulum be made to quicken its vibrations by thus adding to its power? Of course we might apply enough power to drive the pendulum independent of gravitation. Another question is: If it takes a force of one pound to run a balance wheel at a given rate, what would be the effect of the application of a force of two pounds? I say that in order to double the motion, the power must be quadrupled. Consequently the balance wheel would only move at about one third greater speed. Answer: The escapement of a clock may be so constructed as to cause its effort to turn, under the impelling action of the weight, to accelerate the motion of the pendulum, and it is frequently, probably generally, so made. The effect is very slight, however, and the intention is, we presume, rather to make it certain that the verge shall not retard the motion of the pendulum than to secure a means of increasing the rate. The balance wheel question can be most satisfactorily decided, by the parties interested, by experiment.

[OFFICIAL.]

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For which Letters Patent of the United States were granted.

FOR THE WEEK ENDING DECEMBER 17, 1872,

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Gate, E. B. Whitaker	133,960
Gate, farm, C. E. Gillespie	133,980
Glass press, W. C. King	134,070, 134,071
Glove, J. L. McMartin	133,998
Grain binder, J. H. Morse	134,089
Gum, chewing, N. Wood	134,022
Harvester cutter, H. Mewes	134,085
Harvester dropper, W. H. Forker	133,934
Harvester, rake for, M. K. Church	133,868
Hat, G. Johnson, (reissue)	5,188
Hat, felt, J. T. Waring, (reissue)	5,192
Heater, water, J. S. Woolsey	134,120
Heater, steam, J. C. Kilgore	133,942
Hoe, S. H. Folsom	133,932
Hoe, garden, C. Belden	134,028
Holding machine, S. Van Emon	134,019
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Injector and ejector, W. B. Mack	133,997
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Jack, lifting, J. D. Otstot	133,949
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Shingle machine, N. H. Bolton	133,964
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Spinning ring, B. H. Jenks	134,068
Spoke machine, N. H. Davis	134,037
Spring for furniture, W. T. Doremus	133,971
Spring seat, W. T. Doremus	133,970
Steam generator, D. Renshaw	134,003
Steamer, culinary, H. J. Gale	134,046
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Stove drum, T. F. Hamilton	134,054
Stove heating, E. M. Deey	133,928
Stove, reservoir for, Waters and Lascell	133,958
Stove polish, J. W. Birch	133,917
Telegraph, electro magnet, W. E. Davis	133,968
Thrashing machine, J. T. Watkins	134,114
Ticket printing, J. Dyer	134,042
Toy spring gun, M. Ferrant	133,950
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Tube clasp, E. A. Day	134,038
Tubing, welded, S. P. M. Tasker (reissue)	5,190
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Vehicle brake, W. A. Pier	134,096
Vehicle, pleasure, C. W. Saladee	134,004
Vehicle, pleasure, C. W. Saladee	134,005
Vehicle springs C. W. Saladee	134,006
Veneer cutting machine, C. W. Spurr	134,012
Wagon brake. G. W. Jackman	134,065
Warp setting frame, J. W. Higgins	134,057
Washing machine, A. Haynes	133,985
Washing machine, Spangler and Reich	133,956
Watch key, B. A. Lewis	133,945
Water wheel, E. Dougherty	134,040
Wheels, polishing, F. W. Gesswein	133,978
Wheels, setting boxes in, J. A. Newell	134,091
Whip lash and snap, E. B. Light	133,946
Wire fabric, weaving, D. J. Powers	133,951
Wire, etc., scouring, G. Broomhead	133,965
Writing fluid, N. P. Slade	133,954

APPLICATIONS FOR EXTENSIONS.

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

23,291.—METALLIC BALE BAND.—G. Brodie. March 5, 1873.
23,396.—STOVE.—H. R. Robbins. March 12, 1873.
23,643.—FELT DISINTEGRATOR.—J. F. Greene. March 26, 1873.

DESIGNS PATENTED.

6,286 & 6,287.—CARPETS.—J. H. Bromley, Philadelphia, Pa.
6,288 to 6,290.—CARPETS.—R. R. Campbell, Lowell, Mass.
6,291 to 6,294.—CARPETS.—J. M. Christie, Brooklyn, N. Y.
6,295 & 6,296.—CARPETS.—J. Hamer, Lowell, Mass.
6,297 & 6,298.—CARPET.—H. S. Kerr, Philadelphia, Pa.
6,299 to 6,301.—CARPET.—D. McNair, Lowell, Mass.
6,302.—BOOK COVER.—C. F. Metzger, New York city.
6,303, & 6,304.—CARPETS.—C. Righter, Philadelphia, Pa.
6,305.—PARLOR STOVE.—R. Scorer and R. Ham, Troy, N.Y.
6,306 to 6,311.—STOVES.—N. S. Vedder, Troy, N. Y.
6,312.—RANGE.—N. S. Vedder, F. Ritchie, Troy, N. Y.
6,313.—COOKING STOVE.—N. S. Vedder, F. Ritchie, Troy.
6,314 to 6,317.—STOVES.—N. S. Vedder, F. Ritchie, Troy, T. Helster, Lansingburg, N. Y.
6,318.—RANGE.—A. J. Gilbert, New York city.
6,319.—WASH STAND.—J. R. Lancaster, Morrisania, N. Y.

TRADE MARKS REGISTERED.

1,082 & 1,083.—HAMS, ETC.—R. Beresford & Co., Cincinnati.
1,084.—PAINTERS' SUPPLIES.—E. D. & W. A. French, Camden, N. J.
1,085.—BAKING POWDER.—Steele & Price, Chicago, Ill.
1,086.—FELTING.—Salamander Felting Co., Troy, N. Y.
1,087.—DECRUSTATOR.—J. T. Tyler, Wheeling, W. Va.
1,088.—COFFEES.—Zoll r & Little, Baltimore, Md.

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors.

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

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

HOW TO OBTAIN *Patents*

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

Caveats.

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

Reissues.

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

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

Trademarks.

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

Design Patents.

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

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

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

Canadian Patents.

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

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

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

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

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

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000, and Russia, 70,00,000. Patents may be secured by American citizens in all of these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

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

Copies of Patents.

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

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

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

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

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions, and advice, *no charge is made*. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information and for pamphlets of instruction and advice

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Respectfully, etc., HENRY FULLER.

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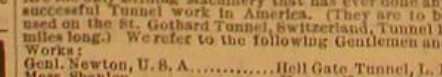
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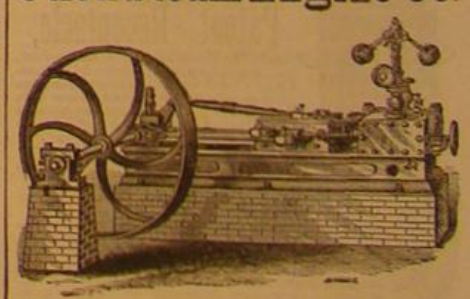
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SCIENTIFIC AMERICAN

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COMPOUND METALLIC COLUMNS AND CONNECTIONS.

This invention systematizes the construction of iron structures where permanence and general stability are required, admitting, at the same time, of great variety in treatment.

The following references will explain the various details of the illustrations:

Fig. 1 is an elevation of columns and section through floors; Fig. 2 a vertical section through columns; Fig. 3 a section on A B of Fig. 1, showing four different modes of bracing; Fig. 4 a section on C D, of Fig. 1; Fig. 5 a top view of the connection casting; Fig. 6 a vertical section of the same; Fig. 7 a top view of the connection casting, showing the skew backs for arches; Fig. 8 a vertical section of the same; Fig. 9 a horizontal section of the junction casting, on the line E F; Fig. 10 the same on line G H; Fig. 11 a horizontal section of connection for a hexagonal column, showing different methods of bracing and attaching girders; Fig. 12 a horizontal section of connection for a ten sided column, showing connections for girders: this can be slotted for ties if required; Fig. 13 a modification, in cases where beams are not required, showing shackle loops for securing ties; Fig. 14 a connection entirely of wrought iron; Fig. 15 an elevation of connection casting, showing the coupling bands, shackle loops, and ties.

Figs. 1 and 2 of the illustration show sections of a portion of a building, and demonstrate that it is applicable to various architectural styles, while the unity of construction is preserved. The main features consist in building, to any required number of tiers or stories in hight, a continuous column, so arranged that the beams supporting the various floors are connected in the simplest manner to their bearings, the provision for springing arches at any point desired, without detriment to the stability of the columns, and the system of both lateral and vertical ties being provided for.

The columns and connections may be all wrought iron, all cast, or a combination of both. The central shaft may be surrounded by any desired number of colonettes, breaking joints where necessary and coupled together with appropriate bands or connections.

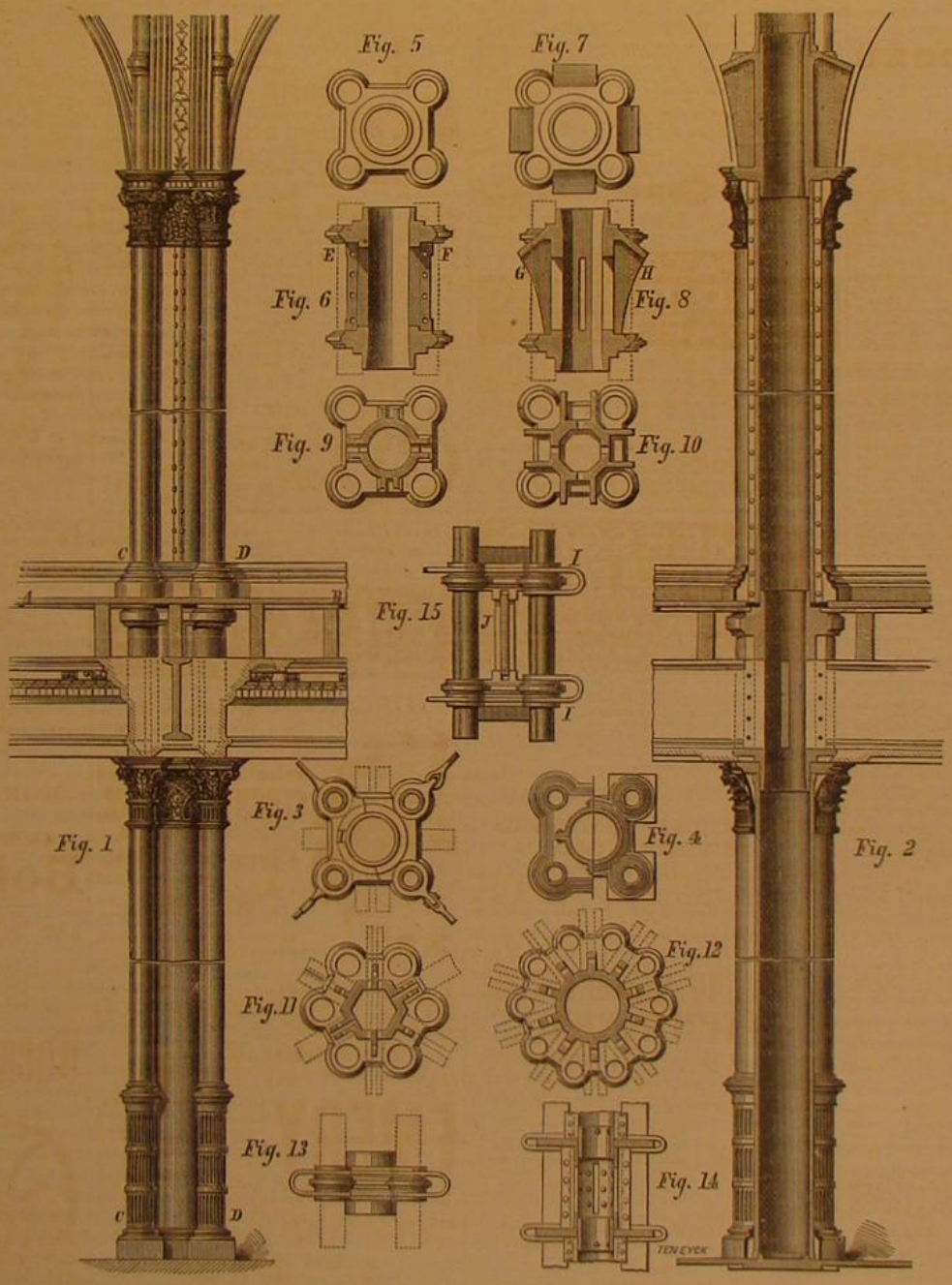
A succession of junctions can be used one above the other, with or without skew backs for arches, as the number of tiers in the structure may require. The skew backs can, if desired, be applied to all, and can be made to spring from any face of a column, irrespective of the number of its sides and angles.

Wrought iron coupling plates, I, can be introduced both above and below the connection casting, J, and provided with openings corresponding in position and diameter to those in the casting. These plates afford an extra security against the contingency of damage from extreme cold, or the effects of the sudden throwing on of water during a fire, either of which might fracture the cast lug and liberate the wrought tie.

The different arrangements shown in the various illustrations as to the modes of attachments, bracing, tying, coupling, etc., will apply to any form of column, whether wrought or cast, which it may be desirable to use for the special purposes required.

The above system has been patented by Mr. John A. Kay, Principal Assistant Engineer, Western Department, Baltimore Bridge Company, and any information can be obtained by addressing that gentleman at St. Charles, Mo. Dates of patents, August 15, 1871, and August 20, 1872.

A carefully constructed set of tables, for strength of these columns, etc., deduced from formulæ based upon the best American experience, has been prepared by the inventor, but its length prevents our publishing it in the present connection. Copies in pamphlet or circular form can doubtless however, be obtained on application to Mr. Kay.



COMPOUND METALLIC COLUMNS AND CONNECTIONS.

Chinese Building.

In China, when a contractor engages to build a house, he encloses the premises and sets up cooking apparatus to supply his hired workmen with regular meals at the most economical rate. Having taken breakfast, they work till noon, rest one hour, and leave off at 5 P. M., and return to their homes. On leaving, each takes a ticket which admits him next morning. These tickets are daily vouchers of the artisan's presence. Counted up at any time, a true account is rendered.

A man on the ground throws several bricks to another ten feet up, and he to another still higher. Thus the masons are supplied as they ascend with the wall. Instead of carrying mortar in a hod, it is thrown by a shovelful from one story to another to any required elevation, without spilling a particle, so expert are they by continual practice.

HOW TO TEST FOR VANADIUM, AND WHAT WE KNOW OF THE METAL.

The metal vanadium, although discovered a long time ago and known to be associated with iron and lead in many ores, is still very little employed in the arts, and there are scarcely any books that show us how to test for it if we suspect its presence in any slags and ores. Mr. Apjohn has been investigating the subject and, as the result of his labors, proposes the following method as the simplest and best for procuring small quantities of vanadium: Eight grammes of the ore are fused with four times the weight of carbonate of soda. The fused mass is mixed with saltpeter and once more fused; it is then pulverized, covered with water, the aqueous solution boiled with carbonate of ammonia, filtered with the filtrate acidulated with hydrochloric acid, evaporated to diminish bulk, and subjected to a current of sulphureted hydrogen gas. The precipitate produced by the sulphureted gas in the acid solution—lead, copper, etc.—is removed, and sulphureted hydrogen is again passed through after the filtrate has been neutralized with ammonia. If the ammoniacal filtrate shows a claret red color, this will indicate the presence of vanadium. The red liquid is to be saturated with hydrochloric acid, and the precipitate which will then be produced will be found to consist of sulphur and sulphide of vanadium; this is to be dried, heated, and fused with saltpeter; the product will be vanadate of potash, from which the chloride and other salts can be subsequently prepared. As there is a close analogy between the vanadates and phosphates, they ought to be subjected to comparative tests to discover if one set of compounds could not be substituted for the other. The vanadates in nature are generally tribasic, which would indicate that they were formed at high temperatures. Some of them might prove valuable as pigments, and we therefore subjoin a list of the colored precipitates produced by soluble orthovanadates: Ferric salts, a light brownish yellow; ferrous salts, a dark gray precipitate; manganous salts, brown yellow; zinc salts, white; cobalt salts, brown gray; nickel salts, canary yellow; copper salts, apple green; mercuric salts, orange yellow.

Considering the possible uses of some of these compounds, it would be well to test the trap and basaltic rocks of the United States to see if vanadium is not contained in them in appreciable quantity, as it is in the basalts of the Rhine and other European localities. A proper place to look for it would be in the slags of iron furnaces, and in many iron ores. Roscoe's researches on vanadium have considerably enriched our knowledge of the subject, and have laid the foundation for further study. It appears from Roscoe's efforts to prepare pure metallic vanadium that the task is a difficult one, and that no one has hitherto accomplished it. He reduced vanadium chloride free from oxygen in hydrogen gas, and obtained a shining crystaline mass, having a strong silver-white luster. The reduced metal absorbs oxygen with so much avidity at a red heat that it must be cooled in a current of absolutely dry hydrogen. When cold it does not oxidize or tarnish in the air, nor does it decompose water at 212° Fah. The specific gravity is 5·5, but as Roscoe was unable to fuse the metal into a compact mass, this determination must be corrected by further experiments.

The metal will probably prove to be somewhat heavier. As vanadium, in its chemical relations, closely resembling arsenic, antimony and bismuth, it may prove valuable in alloys, if not for the electro-plating of other metals. Its physiological properties ought also to be more carefully studied. The salts of vanadium have been used in the manufacture of a fine black ink.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 25, 1873.

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THE PROMOTION OF SCIENTIFIC RESEARCH.

Much is nowadays said and written about the promotion of scientific research, and although everybody is convinced of the importance of doing something, no one is agreed upon the ways and means. It is certainly important to do all we can to help on the progress of invention and discovery; but how to do this, in a way that will not result in more harm than good, is a problem by no means easy of solution. We do not set out with the expectation of being able to settle the question, but our experience with this class of topics entitles us to do a little talking on the subject.

We should say that protection by patents must stimulate the inventive talent of the country. No one would make special effort to perfect a machine or apply a new principle unless he was tolerably certain of reaping the reward of his labors. It is with invention as with the acquisition of wealth; unless the law protects us in the enjoyment of both, anarchy prevails and society can make no progress. It is a well known fact that in Germany a vast number of philosophical principles and mechanical laws have been worked out, but they have remained unapplied for the reason that the government failed to afford any protection from the immediate appropriation of them by any one who chose to apply them. Other nations have seized upon the matured ideas and have put them to practical use, and Germany has lost the benefits that a wiser legislation would have secured to the country.

Another way in which scientific inquiry can be promoted is by the dissemination of correct information upon the commonest affairs of life. There must be sufficient intelligence in a community to offer sympathy and not opposition to the pioneer in new enterprises. A knowledge of common things is indispensable to the growth of scientific ideas. The soil must be well tilled before the seed can take root, and this tillage must be done by teaching, books and journals. The history of invention affords abundant proof of the slow growth of important discoveries in communities where persons in authority have been too ignorant of the first principles of science to understand or appreciate the efforts of some genius who was far in the advance of his age. We can cite the steam engine in illustration. Papin, a French refugee, while residing at Cassel, in Germany, invented a steam pump and steam engine, which he applied to the propulsion of a boat down the river Fulda as far as the ancient town of Munden, in Hanover, where the river Weser begins. Before going any further, it was necessary for him to obtain the permission of the Hanoverian authorities, and he made application in due form, and also wrote to the celebrated philosopher, Leibnitz, to aid him in the matter. Leibnitz, with the keen intuition of the man of science, at once understood and appreciated the importance of the wonderful invention, and made every effort at court to secure the favorable consideration of Papin's application, but his labor was in vain; the minister of foreign affairs could see no good likely to arise from the introduction of steamboats and he sent an order prohibiting the new invention from sailing on the waters of the Hanoverian kingdom. The river boatmen at Munden, hearing of this decision, got up a mob and destroyed the boat, and Papin himself was driven out of the country. This illustration of the importance of general information may be said to be an extreme case, but it is nevertheless true and goes to show what a baleful influence an ignorant minister can exert upon the destinies of a country. We came very near having a similar misfortune in our own country. It is within the memory of many persons now living how violently some of the members of Congress opposed all appropriations in aid of Morse's telegraph. Some of them threw great ridicule upon the project, and proposed to extend the wires to the moon. It required years to disseminate sufficient information on the subject to inspire the faith and confidence of moneyed men in this strange enterprise. These illustrations will suffice to prove the importance of sowing the seeds of knowledge broadcast as a means of promoting scientific inquiry. The question whether it is wise and expedient to grant Government or individual aid to promote investigation is not so easy of decision. It is a delicate responsibility to say that, if a certain course of investigation were to be pursued, it would inevitably lead to important practical results and that therefore the State ought to come in and help the needy inventor. The liability to abuse and the doubt as to the constitutional right of the State to help individuals would seem to put a veto upon this method of aiding science. Individuals can, however, do as they please, and we have numerous instances of money being left by men of fortune to afford aid to scientific men in one form or another. Prizes, medals, fellowships, rewards and pecuniary assistance have been the methods pursued to accomplish the will of the donor. There has been a good deal of curious experience in reference to the effect of this way of encouraging scientific inquiry. The University of Oxford in England is notorious for the immense endowments it has received, and is equally as famous for the small results achieved. It is stated by Sir Benjamin Brodie that $600,000 per annum are expended by the colleges of Oxford in subsidies to students and for the endowment of fellowships. And he very pertinently asks: What return does the State receive for this vast expenditure of money? The unfavorable result of endowments in England has set Parliament at work to investigate the whole business, and it may well occasion some anxiety to ourselves. We have imitated the example of the mother country, and would perhaps do well to proceed with a little more caution. Is there, then, really no practical way in which to promote scientific research? We shall not attempt to answer the question but can make a suggestion. Suppose we organize a society for the promotion of scientific research, to consist of a board of trustees, who shall have the entire management of the property, and who shall give aid when they think it will be judiciously employed. Such a board of trustees must consist of scientific men, not lawyers or merchants, or clergymen, such as make up the majority in all college boards, but the best known scientific men of the city. They would be excluded from voting to each other any of the income, but must use the money to add pure science where they see that it can be used to the best advantage. It often happens that an endowment is made of a professorship in a college because the incumbent is an investigator and first class scientist, but it does not follow that the successor will be equally eminent; on the contrary, it generally happens just the other way. If the money had been put in the hands of a separate board of scientific men, they would not pay out the income to the incompetent successor, but would search out some other institution where the proper individual was to be found. Here is an idea for our scientific men to work up, and we should be glad if it leads to something practical and useful.

GOVERNMENT PAP FOR AUSTRIA.

The appropriation for the Vienna Exposition, as stated in the bill which recently passed the House of Representatives, and is now awaiting the action of the Senate, is one hundred thousand dollars; and this, we learn, the Governors of the New England States have requested Congress to largely increase It would perhaps be more advisable if these gentlemen, before using their valuable influence to procure further disbursements from our far from replete Treasury, would inform themselves as to the amount set aside by England, a nation far more interested in this show than the United States, for a similar purpose. The sum above mentioned is already more than three times the English appropriation. Thirty thousand dollars is all that Parliament has seen fit to devote to the benefit of British exhibitors; and although the smallness of the amount has been made the subject of adverse comment in many quarters, it has not been augmented, nor does there appear to be any chance of such being the case.

It should be remembered that, in addition to this pecuniary aid, two Government vessels are fitting out as free transports for American goods to Vienna, thus entailing an additional expense upon the country of at least eighty thousand dollars. It seems to us that Congress has evinced unusual liberality in this matter, more so than is warranted by the state of the national finances. It will be far more beneficial to the nation if, instead of listening to these requests for increased appropriation, the Senate will reduce that already specified, or even adopt a wiser course, and abolish it altogether.

THE TEMPERATURE REQUIRED FOR IGNITION.

Everybody knows that combustible substances require varying degrees of heat to ignite them; but, even among the best informed scientists, the knowledge of the amount of heat, or the exact temperature at which such substances will take fire, is very imperfect, for the simple reason of the want of data. Extensive experiments have been made to determine the melting points of solids, the boiling points of liquids, even the temperature of flames and the units of heat produced by the combustion of given quantities of different fuels; but with regard to the temperature required to cause the ignition of different substances, experiments have thus far been few. The late fires, and the resulting controversies about their origin, have now given great importance to this branch of investigation; we have therefore judged it opportune to collect some information upon this subject, taken partly from reliable data of some prominent investigators, and partly from original investigation. We give the following table, commencing with substances combustible at the lowest temperatures, and ending with those least inflammable:

TABLE OF THE TEMPERATURES REQUIRED FOR THE IGNITION OF DIFFERENT COMBUSTIBLE SUBSTANCES.

Name of Substance.	*Temperature of Ignition.* Fah.	*Remarks.*
Phosphorus	140°	Melts at 110°.
Bisulphide of carbon vapor	300°	Boils at 113°.
Fulminating powder	374°	Used in percussion caps
Fulminate of mercury	392°	According to Leygue and Champion.
Equal parts of chlorate of potash and sulphur	395°	
Sulphur	400°	Melts at 230°; boils at 850°.
Gun cotton	428°	According to Leygue and Champion.
Nitro-glycerin	494°	" "
Rifle powder	550°	" "
Gunpowder, coarse	563°	" "
Picrate of mercury, lead or iron	565°	" "
Picrate powder for torpedoes	570°	" "
" " muskets	576°	" "
Charcoal, the most inflammable willow, used for gunpowder	580°	According to Pelouse and Fremy.
Charcoal made by distilling wood at 500°	660°	" "
Charcoal made at 600°	700°	" "
Picrate powder for cannon	716°	
Very dry wood (pine)	800°	
" " " (oak)	900°	
Charcoal made at 800°	900°	
" " 1800°	1100°	
" " 2400°	1400°	
Aluminum	1832°	
Iron	about 2000°	

The most interesting feature shown in this table is that even the most combustible substances, usually considered very dangerous, will only ignite by heat alone when the heat reaches a considerable figure; and that, for their prompt ignition, a spark is required, which is in fact a temperature of 900° or 1,000° applied to a very minute spot of the mass.

As the heat of superheated steam ranges from 300° to 500°, it is only able set fire to such substances as sulphur, gun cotton, and nitro-glycerin; it is perhaps able to fire gunpowder, but it certainly cannot ignite wood. It is only when well dried wood, sawdust or rags have been made a source of spontaneous combustion, by the presence of any drying oil or its equivalent, that (by oxidation of this oil, presenting a large surface to the agency of the air) the temperature may be indefinitely raised, and finally reach 400°, 500° or more degrees, and so the point of inflammability may be attained. This may happen in buildings not heated at all; but it must be acknowledged that the heat of summer, and, still more, the heating of buildings with hot air or otherwise, favors this heat production, which is of a purely chemical nature, and is, oftener than the heating arrangements, the cause of fire.

We have stated, on a former occasion, that it is usually very difficult to determine the cause of a fire, as it often destroys all evidence; but it is strange that some minds persist in attributing every fire, originating in a building heated by steam, to superheated steam; and, in order to give an apparently reasonable explanation, they go even so far as to assert that, during the night, when the fires are banked or even withdrawn, there would be heat enough left in the bricks of the furnace to raise red hot steam. It is an absurd theory that the result of the fire should have a more powerful effect than the fire itself, and the true method which Mr. Norman Wiard and Fire Marshal McSpedon should pursue, in order to come to the truth, if this be their desire, is to try, by practical experiment, if they can make steam hot enough to set wood work on fire. This would be more convincing than the diagrams on the black board with which they recently attempted in vain to convince the members of the Polytechnic Club of the American Institute.

THE MYSTERY OF THE INJECTOR.

The steam boiler injector, invented by Henri Giffard, is one of the most beautiful among all known applications of the genius of man to the utilization of scientific principles. Its wonderful simplicity of construction and its effectiveness, when properly proportioned and well made, command the admiration of every intelligent person, as well as of the engineer and the man of science. At the first glance, however, its action seems to contradict the teachings of both science and common sense.

The instrument, which is now in general use on locomotives, and frequently elsewhere, consists, simply, of a slender central tube through which steam passes from the boiler, emerging at its inner end within another tube, concentric with the first, and which latter tube conducts a current of water from a supply pipe into the body of the instrument. Opposite the mouth of this second pipe, but detached from it, is fixed a third tube, open at the end, facing the water supply tube and leading from the instrument to the boiler feed pipe. The steam and water supply tubes are fitted with stop valves and the feed pipe with a check valve. This simple piece of apparatus being attached to the boiler, steam enters it through the little steam pipe, rushes out of the extremity of this pipe into the enveloping current of water, and, picking up the whole stream, leaps across an open space, fairly hissing through the air, and plunges with its burden at a tremendous velocity into the open end of the feed pipe. It thus returns to the boiler, and carries back with it many times its weight of water. Not a drop of water is lost, nor is a particle of steam wasted; all that leaves the boiler returns to it. If there was ever an example of perpetual motion, this would seem to be it.

In the earlier form of this instrument, openings were made in its sides, through which could be seen the jet of

mingled steam and water in its passage across the space between the two nozzles, looking like a solid rod of glass, and frequently leading the observer to suppose that the stream was there carried in a glass tube. The loud hissing noise and the readiness with which the finger or a penknife could be used to interrupt the current and send it flying out of the sight holes promptly dispelled that error, however.

The principles of mechanics upon which the action of this instrument is based, mysterious as they appear to the casual observer, are very simple. They have been frequently referred to in the columns of the SCIENTIFIC AMERICAN, and many of our readers are sufficiently familiar with them to follow us as we describe their application in this elegant device. If an opening were made into the steam space of the steam boiler, the steam would rush from it with a velocity which would be just sufficient, could its direction be reversed without loss of motion, to carry it back into the boiler again. Could the whole force of the stream be concentrated upon a smaller area than that of the opening made for its egress, the resisting pressure which could be overcome by the stream might be correspondingly increased. The resisting pressure remaining the same, the stream might not only re-enter the boiler when thus condensed, but might carry with it a considerable additional weight.

Steam leaving a boiler under a pressure of 60 pounds per square inch occupies, when condensed, a space of but $\frac{1}{3}\frac{1}{6}$th of its original magnitude, and would concentrate its force upon a correspondingly decreased resisting area. A pound of such steam occupying 5½ cubic feet condenses into 27½ cubic inches of water; and, were it not retarded by friction, it would have sufficient energy to take back into the boiler a weight of water more than sufficient to condense the steam. The velocity with which such steam flows into the atmosphere is about 1,500 feet per second, and although it is undoubtedly greatly retarded, in all cases, by friction, the fact stated gives some idea of the immense velocity with which the stream may flow. The Giffard injector is simply an instrument in which these principles are usefully applied. The stream of steam from the boiler, flowing through its central tube and plunging into the current of water which surrounds the steam adjutage, is condensed by it, and, taking it up, carries it all forward with immense velocity, overcoming all frictional resistances, and reënters the boiler with it. It thus acts as both feed pump and heater.

The amount of surplus energy sometimes obtained, by thus concentrating the force of the issuing stream by condensing it, is very great, as is shown by experiments in which steam taken from one boiler has been made to feed another boiler containing steam of nearly double the pressure.

A moment's thought will make it evident that the water supplied to the instrument cannot be highly heated. It must be sufficiently cold to condense the steam without making the quantity of injection water so great as to overload the apparatus and thus prevent the stream from forcing its way into the boiler. Where the feed water is to be heated to a temperature higher than 120° or 150° Fahrenheit, it should be done by carrying it through a worm heater of large heating surface, after leaving the injector.

We trust that we have made plain the principles of operation of this beautiful and wonderfully ingenious invention. Although as simple as those which are applied in the driving of a nail, and, indeed, somewhat similar, their very simplicity and the lack of complexity in the apparatus itself only the more forcibly command our admiration and our commendation.

THE GREAT SEWING MACHINE JOB BEFORE CONGRESS.

The Sewing Machine Ring, composed, as our readers are aware, of the Singer, Howe, Grover & Baker and Wheeler & Wilson Companies, failed to induce our last Congress to sanction their modest attempt to fasten their overgrown and unjust monopoly upon the people of the United States for another seven years. One defeat and the strongly expressed disapprobation of popular opinion for their cause are, it seems, not enough to dishearten them; consequently their efforts are to be redoubled, and whatever influence, political or pecuniary, that can be brought to bear will be unhesitatingly wielded during the coming spring in one last grand endeavor to force the job through the Forty-second Congress.

The patent, which has already expired and on which a third term is asked, is that of Allen B. Wilson for the "feed" motion. The claim is very broad and the owners of the right, up to the expiration of the patent, November 12, 1871, have governed and will, if the present measure be passed, again rule the entire sewing machine trade of the country, rendering it tributary to the co-partners in the above mentioned proprietary combination. Not only is this the case with established concerns, which are taxed for the payment of large royalties, but thousands of inventors, who have devised improvements of great practical value, are subject to the mercy of this Ring, which may in its supreme pleasure see fit to buy their inventions or else drive them from the market and deprive the public of as good machines at cheaper rates. It is estimated, and the fact, although previously alluded to in these columns, will bear repetition, that nearly four hundred thousand dollars has been expended by inventors on sewing machine improvements since the grant of the Wilson patent. If now, the latter be extended, before the seven additional years can elapse many of these smaller patents will expire, and thus meet with practical confiscation.

The indirect object of the patent laws of this country is to benefit the people. The object of granting a patent is to enable the inventor to manufacture and present his device in the best possible form, and by distributing it throughout the country to so instruct the public in its nature, uses and construction as that, after this secured term shall have expired, the people can produce it for themselves. Secondary to this is the policy of stimulating invention, the beneficence of which is well shown in comparing the relative conditions of countries in which patent laws do and do not exist, so that new and improved ideas shall be constantly brought forth. This our patent laws effect by throwing protection around the patentee for a limited period, jealously guarding his rights so that he may peaceably carry on his manufacture, and at the same time affording him a monopoly which, if the invention be valuable, yields him an ample remuneration for his thought and labor. If, in the case of a new device of great or unusual merit, the inventor fails in producing the same in such a manner as to gain an adequate reward within the space of time granted, such period may with justice be extended; but if the invention be thoroughly presented to, understood and appreciated by the people, and the originator obtain a competent return during the lifetime of his patent, we can see no argument tending to carry conviction in favor of continuing the monopoly. More especially, we think, does this view hold true in the instance of a mere modification of an original machine, as is the case with the Wilson patent. Here a simple alteration or improvement in a portion of a machine and not the original invention is made the subject of a right which locks up in the hands of a few individuals a power, the vastness of which may be judged from the fact that it brings them in a yearly profit of several millions. The original Howe patent was extended but once, and a second application was deemed impolitic, so expressed in the opinion of the Commissioner, and therefore denied. This rule, we insist, is equally applicable to the present case, and the precedent thus formed is one which, founded on justice and in harmony with true public policy, cannot be slighted. If it is to be evaded, the benefit should be given to the heirs of Howe, the original inventor of the eye-pointed needle and shuttle, and not to a combination which, from investments trivial in amount, have amassed enormous wealth.

The actual cost of a sewing machine is from $5 to $7, or all complete with table, etc., from $10 to $30. The American public pays from $60 to $125 for the same article, at retail, and the difference is clear profit. To still further prove the enormity of the injustice to our people, the same companies, in spite of our high tariff on cast steel and Swedish and Scotch pig iron, import both metals crude, manufacture them into sewing machines, export the finished goods back, and sell them in Europe at prices less than those for which the articles could be there made even at the cheap existing rates of labor. In fact, the people across the Atlantic pay, for the same machines, only about one half the price charged to our own countrymen.

The strongest argument in opposition is suggested by the thought of the classes from whom this vast wealth has been, and, if the extension be granted, will be, extorted. It is from the wretched earnings of the sewing girl—from the daily pittance which is doled out to the working women who wear away their lives in our great cities—from the meager savings and scanty means gained by the manual work and unending drudgery of the wives and daughters of farmers and mechanical laborers, that the greater portion of this revenue is abstracted. The oppression and cruel injustice of the measure will not be felt by the rich in any very appreciable degree; but the poor, to whom the sewing machine is as necessary as the roof which covers their heads, the thousands of families whose sole dependence for their daily bread rests on untiring labor with the needle, these are they against whom the efforts of this gigantic ring are directed.

We urge upon Congress the denial of the application, and we sincerely believe that, in view of the true state of the case, no influence that wealth can bring or specious argument that political power can carry will cause those to whom the honor and prosperity of the country is committed to give their assent to a measure so oppressive and calamitous to the entire nation.

THE USE OF ARSENIC COLORS.

The most common arsenic colors are the Schweinfurt green, a compound of acetate and arsenite of copper containing about 58 per cent arsenious acid, and Scheele's green, which is an arsenite of copper with 55 per cent arsenious acid. Notwithstanding their poisonous characters, they are largely employed in consequence of the elegance of color and low cost. One establishment in England reported that they consumed 4,500 pounds of arsenious acid every week, and the total annual consumption for Great Britain has been set down at 1,500,000 pounds. The chemical test for arsenic green can be easily made. Plunge the article in warm aqua ammenia; a blue color will betray copper, and a drop of the blue ammoniacal liquid on a crystal of nitrate of silver will show a canary yellow coating if arsenic be present. The articles which are frequently colored with arsenic are the following:

1. Artificial flowers and fancy goods. Imitation flowers are usually cut out of colored material; the pigment is prepared by rubbing up the green powder with gum arabic to make it adhere to the cloth. As no mordant is used, the color is merely on the surface. It is often applied with the hand until uniformly distributed over the surface, and is dried on frames. In this way the workmen are exposed to the dust flying about the room, and their hands and faces are often smeared with the mixture. Unless they hold cloths before their mouths and are very careful to wash themselves thoroughly before meals, they soon contract a variety of dangerous symptoms and have to abandon their work.

The quantity of arsenic that a single artificial flower will hold is sufficient to poison several persons. Hofmann found on one branch 6 decigrammes of arsenious acid, enough to prove fatal to a number of persons who might carelessly breathe the dust arising from it. It is notorious that all persons engaged in the manufacture and sale of this class of goods are frequently disabled by the evils attending the handling of colors that are only externally applied.

Certain light fabrics, such as tarlatan, are frequently superficially dyed with Schweinfurt green applied with dextrin; and in some instances it has been found that one half the weight of the stuff was due to the coloring matter, and an ordinary ball dress would hold three ounces of arsenic. The sale of such goods has been prohibited in England and France, and hence they find their chief market in the United States. We have known of serious cases of poisoning arising to dress makers and to persons wearing green tarlatan in this country, and it would be well if the sale of such goods were everywhere absolutely prohibited.

2. In candies and toys the employment of arsenic green has met with such opposition, and is so easy of detection, that it is rare that any one knowingly uses the obnoxious color. Formerly there were numerous cases of poisoning from this source, but they are fortunately rare at present. The chief danger now arises from the highly ornamental pieces of confectionery which are not intended to be eaten but are made for decoration. They are sometimes broken up and the fragments, falling into the hands of children, occasion much mischief. There is an instance on record where 18 persons in one family were seriously endangered by such carelessness. In the case of toys and paints for children, so much has been said and written on the subject, and so numerous have been the cases of poisoning, that every mother takes care not to expose her children, and the manufacturers are compelled to be on their guard.

The covers of toy books, however, especially in England, are too frequently impregnated with the dangerous green. We have long been in the habit of tearing off the covers of such primers before allowing them to be handled by our children.

3. The employment of arsenic green in oil paint has frequently been noted, and in dwelling houses and sleeping apartments, the consequences have been of the most serious character.

Bakers' shelves, the interior of boxes, wire gauze for bird cages, basket willow, and fly catchers have frequently been painted with arsenic colors.

4. In the coloring of paper to be employed for wrappers, cards, labels, lamp screens, and ornaments, there is the freest possible expenditure of arsenic green. This is perhaps the most dangerous and subtle use of the poison. The utmost vigilance cannot prevent paper of this character from finding its way into every household. It comes in the form of envelopes around chocolate, as a label, and very commonly as a screen to cover a lamp, in which case the heat often volatilizes the arsenic and the air of the room is filled with the dangerous fumes. It is very common for children to cut ornaments out of the polished green paper and to put fragments into the mouth, by which they are unconsciously poisoned.

5. The use of arsenic wall paper has been the fruitful source of disease and death in many instances without the possibility of accounting for the origin of the malady. Professor Gmelin, in 1843, was one of the first to call attention to the danger of occupying rooms decorated with paper colored with arsenic green, and since his time numerous instances have been recorded to confirm the importance of the warning uttered so many years ago. Notwithstanding the accidents that have happened, we constantly see rolls of paper put upon our walls that encase the occupants of the room in a poisoned wrapper and, with absolute certainty, render life a burthen to them by the chronic symptoms which the subtle gases arising from the decomposed pigments occasion. In a room which is kept closed for a few hours, the walls of which are covered with arsenic colors, the peculiar smell of arseniuretted hydrogen is at once perceptible to any one familiar with the garlic odor that this gas gives off. A damp wall is certain to extricate this gas, and on no account ought a room to be covered with such a dangerous preparation. The misfortune is that in most instances the evil effects are not perceived until it is too late. It has been found that the dust which gathers on the furniture is contaminated with arsenic, showing that, in addition to the gas, there are often solid particles floating through the room.

6. Arsenic in carpets and hosiery is of more modern introduction, and hence requires that we should put our readers on their guard to prevent imposition. We were recently shown some carpeting in which the red color, having been put in with aniline dyes prepared by means of arsenic, was said to have poisoned a family. The subject is under investigation and the statement may prove to be erroneous; but as red stockings have produced ulcers and skin diseases analogous to those occasioned by arsenic, it may be well for the protection of all persons concerned to avoid colors that have been suspected of causing the mischief. In the fact that arsenious acid is an incidental product in several metallurgical operations, and its production on a vast scale puts the price at such an exceedingly low figure as compared with other chemical compounds, is to be found the key to its enormous consumption in the manufacture of colors. It is a great misfortune that a substance so deleterious should be so widely disseminated, and it is only by reiterated warnings and the most stringent police regulations that the community can be protected from the insidious danger. Our market is crowded with the cast off and abandoned arsenic goods of other countries, and it is a question whether the urgency of the subject does not demand the interference of the Board of Health.

THE tobacco crop of Missouri this year is estimated at 30,000 hogsheads.

SUBMARINE DIVING.

Loaded with a weight of over one hundred and forty pounds, under a pressure of nine atmospheres, beneath a hundred feet of fluid, two minutes' existence in which is impossible, and in depths where no ray of light has ever penetrated, man cannot only live but work. Not only can he labor but, remaining submerged for hours with impunity, perform operations which require skill; placing the explosives which are to tear up sunken reefs, leveling unequal bottoms or plunging into the holds of wrecks, with marvelous intrepidity he can force the sea to yield up its buried treasures.

Probably no calling necessitates more personal risk. Out of the number of professional divers in the United States, in all thirty or thereabouts, the average yearly mortality is four, though so large a percentage is due more to the recklessness of the men in the face of danger to which they become inured than to mere accident. The armor in which the diver is incased, in comparison with the weight of which that worn by the knights of old is as nothing, is well represented in our engraving. It consists of body, collar piece, helmet, and shoes. The body is composed of one thickness of rubber between two of cloth, and covers the man from his neck to his heels, being closely strapped into the shoes at the bottom and snugly held about the wrists by rubber cuffs. The helmet looks very like an immense copper pot, and when put on is connected with the body by means of the collar piece, which fits closely about the shoulders and is fastened to the helmet and the body by thumbscrews, rendering it perfectly air-tight. There are glasses at the front and sides of the helmet, the piece in front being constructed to open. This is never closed until the man is ready to descend, when it is tightly screwed up, and from that moment the air pump must never cease working even for a single instant, lest the diver suffocate. The air forced to him from above reaches him by means of a rubber hose which, leading from the air pump and passing under his left arm, connects with the back of the helmet, the air passing over his head and down in front of his face. The foul air escapes through a small valve in the back of the helmet, and the rapidity with which it goes is regulated by the preference of the man in the dress. The shoes are soled with an inch or two of lead, and over the shoulders, slung by cords, are two enormous leaden plates, one on the back and one on the breast, thus giving the diver sufficient weight to descend. A life line is fastened about his waist, by means of which he communicates his wants to those above. One pull on the line signifies more air is needed, two, that the pumps are sending him too much and he is liable to float up, and three pulls indicate that he desires to be hauled to the surface.



SUBMARINE DIVING APPARATUS.

Mr. George W. Fuller, of Norwich, Conn., one of the most scientific and accomplished divers in the country, has probably done more to improve diving apparatus than any other inventor. He employs a four cylinder pumping engine to supply air to the submerged workers, which is a remarkable piece of ingenious mechanism. The packing of the plungers, while pressing against the walls of the pump cylinders so lightly that any plunger will descend by its own weight, is still so absolutely tight that not the slightest leak can be detected under the heaviest pressures. The same gentleman has greatly improved the construction of the shoes, and has devised a lantern which is fed by air through a tube from the pumping engine above. As the diver descends the flame becomes brighter and brighter until, at the depth of a hundred feet, it glows with the whiteness and brilliancy of a calcium light. This result is due to the condensation of the air, which increases the amount of oxygen contained in a given volume.

Our second illustration, for which, with the one above referred to, we are indebted to the *Christian Weekly*, represents the divers of the Coast Wrecking Company at work. They were employed some time since in raising the contents of a government vessel wrecked off the coast, and after a long and toilsome search, succeeded in finding nearly all the bags of silver ore composing the cargo. More recently divers have visited the old Spanish hulks which, two or three centuries ago, found their way to the bottom off the West India Islands. We were lately shown by Mr. Fuller a large number of ancient silver coins, with their dates and inscriptions perfectly preserved, that had been recovered from these vessels.

The greatest danger to a diver is, that he may get his air pipe entangled in something and thus stop his supply of air. A man could not live two minutes should this happen. He usually descends with

the hose in one hand and the signal line in the other, taking good care that these articles remain at a safe distance from any projection of rock or any portion of the wreck he is working upon, before he lets go to use his hands.

In constructing the new docks around this city, divers are largely employed to place the concrete on the bottom so as to form a bed for the heavy foundation stones. During the course of the blasting operations at Hell Gate and Diamond Reef, in New York harbor, divers guide the drills worked by the machinery above, insert the nitro-glycerin, and arrange the electric fuses and wires by which the charges are exploded. In raising wrecks, men are first sent down to cover with canvas, or plank, the holes made by the sharp rocks in the timbers of the vessel. This must be done before she can be raised. After the leaks are stopped, the steam pumps make short work of driving out the water. The divers then re-descend, pass chains under the hull, and carry the ends to powerful floating derricks, which hoist the vessel to the surface.

PROFESSOR TYNDALL'S FOURTH LECTURE IN NEW YORK---POLARIZED LIGHT.

In mechanics, we have the composition and resolution of forces and of motions, extending to the composition and resolution of vibrations. We deal with the luminiferous ether in accordance with the rigid laws of mechanics; and, from the composition, resolution, and interference of its vibrations, we deduce all the phenomena displayed by crystals or polarized light.

To illustrate, let a vibration cross a crystal of tourmaline obliquely to its axis; we have seen, by experiment, that a portion of the light will pass through. How much, we determine in this way: Draw a straight line representing the amplitude of the vibration before it reaches the tourmaline, and from the two ends of this line draw two perpendiculars to the axis of the crystal; the distance between the feet of these two perpendiculars will represent the amplitude of the transmitted vibration.

THE INTERFERENCE OF RAYS.

Professor Tyndall next proceeded to explain what occurs when a film of gypsum is placed (as described in the preceding lecture) between the Nicol prisms. It will be remembered that, where two plates of tourmaline were crossed, no light passed through; but when a film of mica was introduced between, the darkness at the intersection disappeared. In certain positions, however, the interposing film has no power to abolish the darkness, because, in the gypsum, there are two directions, at right angles to each other, which the waves of light are constrained to follow; and when rotated to such positions, one of these directions is parallel to one of the axes of the tourmaline, and the other parallel to the other axis. If we cross our Nicol prisms and introduce the film, on its emergence from the first prism or polarizer the light is polarized; and in this particular case, its vibrations are executed in a horizontal plane. The two directions of vibration of the gypsum are oblique to the horizon. The polarized ray, then, where it enters the gypsum, is resolved into two ethers, vibrating at right angles to each other. In one of those directions of vibration, the ether is more sluggish than in the other; subsequently the waves that follow this direction are more retarded than the other. Here, then, the system of waves may get half a wave length or any number of half wave lengths ahead of the other, and interference is evidently possible. But as long as the vibrations are executed at right angles to each other, they cannot quench each other, no matter what their retardation may be. The analyzer or second prism, however, recompounds the two vibrations emergent from the gypsum, reducing them to a single plane, where, if one of them be retarded by the proper amount, extinction may occur. Consequently, when the longer waves have been withdrawn by interference, the shorter ones remain and confer their colors on the film of gypsum. Conversely, when the shorter waves have been withdrawn, the thickness is such that the longer waves remain. Where the direction of vibration of prisms and gypsum encloses an angle of 45°, the colors are at their maximum brilliancy. Following out rigidly the interaction of the two systems of waves, we find that all phenomena of colors, obtained when the planes of vibration of the two Nicols are parallel, are displaced by the complementary phenomena when their Nicols are perpendicular to each other.

RETARDATION OF HALF WAVE LENGTHS.

Supposing that a certain thickness of gypsum produces a retardation of half a wave length, twice this thickness will produce a retardation of two half wave lengths, and so on. Now where the Nicols are parallel, the retardation of half a wave length, or of any odd number of half wave lengths with it, produces extinction; in all thicknesses, on the other hand, which correspond to a retardation of an even number of half wave lengths, the two beams support each other when they are brought to a common plane by the analyzer. Placing a wedge-shaped circular film of crystal, thickest at the center, between the prisms and using red monochromatic light, Professor Tyndall showed the interference rays with great distinctness. The dark bands, he stated, occurred at thicknesses which produced retardations of one, three, five, etc. half wave lengths; while the light bands appeared between the dark ones. On employing blue light, the rays were also seen; but as they occurred at thinner portions of the film, they were smaller than those obtained with the red light. By using white light, therefore, as the red and blue fall in different places, iris colored rings were produced. The lecturer then alluded to the chromatic effects of irregular crystalization, and said that a plane of glass covered with frost crystals and placed between the Nicol prisms would produce the most beautiful colors. A film of horn or shell also yields brilliant hues under polarized light. As a general rule, organic bodies act in this way, but their architecture involves an arrangement of the ether which causes double retraction.

EFFECT OF POLARIZED LIGHT ON BODIES UNDER PRESSURE.

It is possible to confer, by strain or pressure, a temporary double refracting structure upon noncrystaline bodies, such as common glass. Introducing a glass bar between the crossed Nicols, Professor Tyndall bent it slightly, keeping its length oblique to the direction of vibration of the prisms. Instantly light flashed out upon the screen. The two sides of the bar were illuminated, the edges most, for here the strain and pressure were greatest. In passing from strain to pressure, said the lecturer, we cross a portion of the glass where neither is exerted; this is the so-called neutral axis, and along it appears a dark band, indicating that the glass along this axis exercises no action upon the light. Subjecting a square of glass to increased pressure in a vise, its image in light appeared upon the screen. Every pair of the adjacent luminous spaces, which appeared separated by the dark bands, is in opposite mechanical conditions. On one side, the dark band is strain, on the other, pressure. By tightening the vice, the colors appeared more brilliant, taking curvilinear forms which, adding to their beauty, sprang outwards from the two points of pressure. Afterwards, glass prepared by differences in annealing so as to present their colors in various figures was exhibited. The irregular annealing had fixed the particles of glass in a state of permanent strain or torsion.

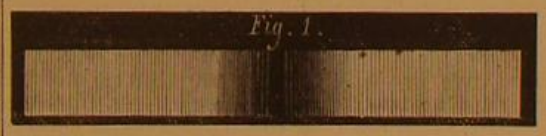
CHROMATIC CHANGES CAUSED BY HEAT.

We know that bodies are expanded by heat and condensed by cold. If one portion of a solid be heated and the other not, the expansion of the heated portion produces strains which reveal themselves under the scrutiny of polarized light. Professor Tyndall first exemplified this fact by introducing a square of common window glass between the Nicols and slightly heating it by a spirit lamp. Light at once appeared on the screen, and spaces of strain, divided by neutral axes from spaces of pressure, showed as before. A small square of glass was then employed, into an orifice in the center of which a heated copper wire was introduced. A beautiful black cross, inclosing four luminous quadrants, appeared, the latter growing up and becoming gradually black by comparison on the screen. In this case, the heat spread from the center of the square outwards.

POLARIZED LIGHT AS AN ANALYZER OF MOLECULAR CONSTRUCTION.

Taking a strip of glass some six feet long, the lecturer swept a wet woolen rag over one of its halves. An acute sound due to the vibration of the glass was heard. What is the condition of the glass during the existence of this sound? Its two halves lengthen and shorten in quick succession, and its ends, therefore, are in a state of rapid vibration. But in the center, the pulsations from the ends alternately meet and retreat; and between their opposing action, the glass at the center is kept motionless. On the other hand, it is here alternately strained and compressed. This may be illustrated by Fig. 1, which represents the strip of glass, with

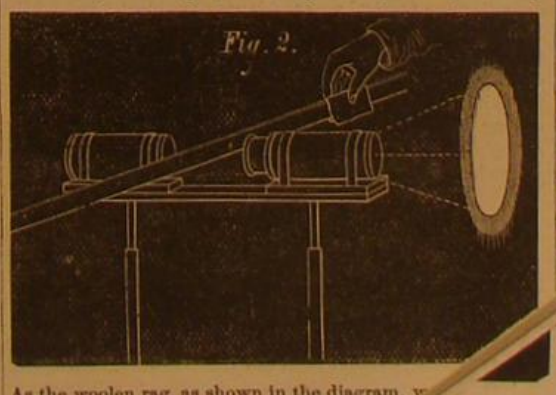
Fig. 1.



equidistant waves marked upon it; and the point in the middle, where the pressure or expansion of the waves strains or compresses, is shown in white.

Professor Tyndall then placed the strip of glass between the Nicols, as in Fig. 2, fastening it in place by a clamp.

Fig. 2.

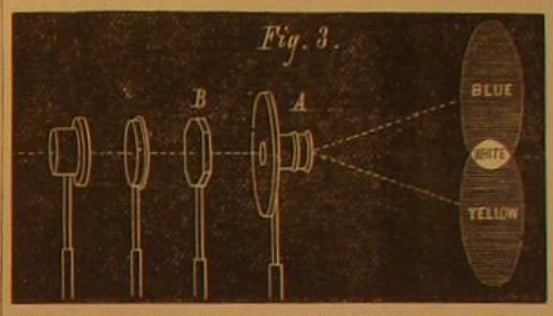


As the woolen rag, as shown in the diagram, w[illegible]as swept over one end of the glass, a loud sound, like [illegible]hat obtained by running the wet finger along the edge o[illegible] a goblet, was given forth and simultaneously a circle [illegible] of light flashed on the screen. At every moment of [illegible] compression, continued the speaker, light will flash thro[illegible]ugh; at every moment of strain, light will flash through; and these states of strain and pressure follow each othe[illegible] so rapidly that we may expect a luminous impression [illegible]n the eye.

MECHANICAL VIBRATIONS SIMILAR TO THOSE OF LIGHT.

If, while a pendulum is oscillating past the middle part of its excursion, a shock be imparted to it, tending to drive it at right angles to its course, the two impulses compound themselves into a vibration oblique in direction to the former one. But the pendulum oscillates in a plane. If the rectangular shock be imparted to the pendulum when it is at the limit of its swing, then the compounding of the two impulses causes the suspended weight to describe an ellipse; and if the shock be competent in itself to produce a vibration of the same amplitude as the first one, the ellipse becomes a circle. These gross mechanical vibrations exactly resemble those of light. A plate of quartz cut from the crystal perpendicularly to its axis possesses the extraordinary power of twisting the plane of vibration of a polarized ray to an extent dependent on the thickness of the crystal; and the more refrangible the light, the greater is the amount of twisting, so that where white light is employed, its constituent colors are thus drawn asunder. Placing the quartz between the prisms and turning the analyzer in front from right to left, Professor Tyndall showed a series of brilliant colors. Specimens of quartz have been found which require the analyzer to be turned from left to right to produce the same succession of colors. Crystals of the first class are therefore called right handed, and of the second class, left handed, crystals. Fresnel showed the action of these crystals to be due to the circumstance that, in them, the waves of ether so act upon each other as to produce the condition represented by one rotating pendulum. Instead of being planely polarized, the light is circularly polarized. Two such rays, transmitted along the axis of the crystal and rotating in opposite directions, when brought to interference by the analyzer, are demonstrably competent to produce the observed phenomena. Substituting a piece of Iceland spar, A, Fig. 3, for the analyzer, and introducing the plate of quartz, B, be-

Fig. 3.

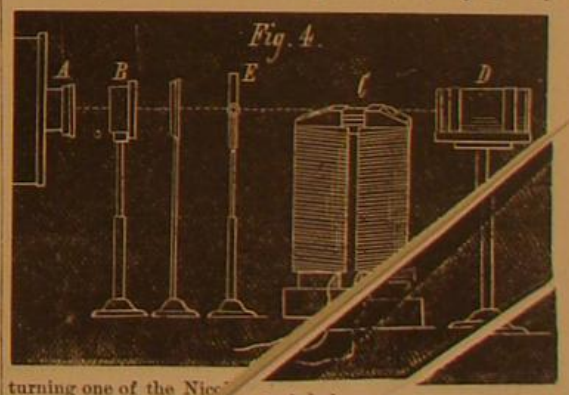


tween the polarizer and the spar, we have an image of the aperture on the screen in the shape of two colored circles, which will always be of colors complementary to each other. Here we can show that, although the mixture of blue and yellow pigments produces green, the mixture of blue and yellow lights produces white. By enlarging our aperture, the images are caused to overlap; and although one is blue and the other yellow, the place where they are superposed is white.

THE MAGNETIZATION OF LIGHT.

In Fig. 4, A is the electric lamp, B the polarizing prism, C an electro-magnet, from pole to pole of which is placed a cylinder of heavy glass, first made by Faraday, and called Faraday's heavy glass. D is the analyzer in front. If we excite the magnet, instantly light appears upon the screen. On examination we find that, by the action of the magnet upon the ether contained within the heavy glass, the plane of vibration is caused to rotate and thus get through the analyzer. The speaker then inserted a plate, one half of which consisted of a right handed and the other half of a left handed crystal in front of the polarizer, E, Fig. 4. By

Fig. 4.



turning one of the Nic[illegible]ols, both halves of the plate showed a common circular ir[illegible]s, a beautiful shade of puce color. This is an exceedingly sensitive m[illegible]ans of rendering the action of a magnet upon light v[illegible]sible. By turning either the polarizer or the analyzer t[illegible]arough the smallest angle, the uniformity of the color disappeared, and the two halves of the quartz show different colors. The magnet produces this effect; exciting the magnet, one half of the image becomes suddenly red, the other half, green. Interrupting the current, the two colors fade away and the primitive puce is restored. The action depends upon the polarity of the magnet, or, in other words, on the direction of the current which surrounds the magnet. Reversing the current, the red and green reappear, but they have changed places. This experiment, however, long remained rather as a scientific curiosity than as a fruitful germ.

NEW INSANE ASYLUM IN CALIFORNIA.—The commissioners appointed for the purpose by the Legislature of California have selected a site near Napa City for a branch insane asylum. The estate comprises 208 acres of land, with fine sites for buildings, and good facilities for water supply, sewerage, etc. The State has appropriated nearly $800,000 for the erection of buildings.

THERE was recently discovered near Staunton, Virginia, a large deposit of red hematite iron ore, probably thirty feet wide and extending several miles.

Correspondence.

Cheap Buildings.

To the Editor of the Scientific American:

About fifteen of my neighbors and myself intend building dwelling houses on our farms next spring. We have often exchanged views as to the best and cheapest building materials. As we have lake sand (costing nothing), some insist that artificial stones made of sand and cement would be the best and cheapest; on this point, my neighbors wish me to ask your experience. By answering the following questions you will give us what we wish to know on the subject:

1. In what proportion are the sand and cement to be mixed? 2. How are the stones molded? 3. Can the stones around the windows and doors be molded in such a way as to require no wooden window or door frames, and how is it done? 4. Could not the stones be molded with a smooth inside surface and laid so compactly as to look like a plastered wall, and so require no plastering? The wall could be painted any color. 5. How are we to prevent possible dampness? 6. I have heard of a method of running up walls in liquid mortar (sand and cement) without molding the stones; how is it done? 7. What will such a building cost, comparatively to wood, brick and stone? 8. I have seen the following articles advertised in your paper: Asbestos roofing, roofing and sheathing felt, asbestos boards, asbestos paper, asbestos asphaltum etc.; what is it and what merits has it as a building material? 9. As it is often expensive and inconvenient to make alterations after a house has been built, I would kindly ask your opinion of the different heating apparatus, with regard to cheapness, health, and comfort. By answering the above questions in your valuable paper, you will oblige many friends and patrons of the SCIENTIFIC AMERICAN.

Cleveland, O. P. S. K. MAIERS.

REMARKS BY THE EDITOR.—We would not advise you to attempt to construct your homes of artificial stone, as, aside from the difficulty of its manufacture by unskilled labor, there will be more or less want of facility in fitting the blocks to the dimensions of the walls and piers in their erection, and much doubt as to its permanency. You are more likely to be successful with concrete construction, which requires no particularly skilled labor, and has been proved to be permanent, beyond a peradventure. To make concrete, prepare a plank floor under a shed; take four barrels of broken stone—no piece larger than an egg and diminishing in size to that of a walnut—and spread it out over the floor so that it will not be more than two inches deep in any part of it; then take three barrels of sand of sharp grit, entirely free from loam, and sprinkle it in among the stone so as to fill up all the interstices of the stone with an even distribution over the whole; now, take half a barrel of lime and sprinkle this also equally over the whole; finally, take half a barrel of best cement and in the same manner distribute it over the lime. With a coarse rake incorporate all these materials thoroughly in a dry state, and then apply enough water to saturate the whole. Let it stand long enough to allow the lime and cement to slacken thoroughly, and then it will be ready for use. Build your foundation sixteen inches and your wall about twelve inches thick; lay the wall one foot high at a time between two planks, kept in place by side buttons and braces at top. Let it stand three days to set well, then remove the plank boxing and let it stand a week before you put on the next layer. The window frames may be set at once, four inches back from outside, and a rough frame made, four inches in width of jamb to form the corners of the opening on the outside, which could be removed after the work becomes hard. A similar frame will be required for the doors, but of 12 inches width of jamb. The wall may be made hollow by having a series of upright blocks, say 1½ by 6 inches and 4 inches apart, suspended from the upper side of the boxing, and with the lower end slightly reduced in size to avoid friction in withdrawing them. When the wall is all up, employ a mason to finish the exterior with a coat of cement, "rough cast," and it will look like stone. The interior plastering may be also finished in one coat.

If your roof is to be flat, cover it with good charcoal tin; but if steep, use slate or good sized shingles. Heat with a good warm air furnace in cellar, or two fireplace heaters in first story, which may be more economical.

To Purify a Room.

To the Editor of the Scientific American:

"A room full of close foul air can be made perfectly sweet and pure without opening the windows. A pitcher of cold water will do the work effectually. It is dangerous, therefore, to drink water which has been long standing. Set a pitcher of water in a room, and in a few hours it will have absorbed all the respired gases in the room, the air of which will become purer but the water perfectly filthy. The colder the water is, the greater the capacity to contain the gases. At ordinary temperature, a pail of water will contain a pint of carbonic acid gas and several pints of ammonia. The capacity is nearly doubled by reducing the water to the temperature of ice. Hence, water kept in a room awhile is always unfit for use. For the same reason, the water in a pump should always be pumped out in the morning before any of it is used. Impure water is more dangerous than impure air."

The above item is being extensively published by the daily and weekly press; and I should like to know if it is true. G.

REMARKS BY THE EDITOR.—The item is full of errors and ought to be arrested in its onward march through the press. It would be dangerous for anyone to close a room and rely upon a pitcher of water to purify the air. The fact that standing water becomes foul is due to the germs that fall upon it or are contained in it; these undergo decomposition and decay, giving rise to bad gases and foul smells. Organic matter in water is the great source of mischief, and hence the necessity of pumping out all that has been standing during the night in contact with the wood. Good ventilation is the best remedy for foul air in a room.

Polar Mutations.

To the Editor of the Scientific American:

Among the facts developed by the geological survey of Ohio, are:

1. The surface of the State was once much higher than it is now. Then one vast *mer de glace* covered the region just north of the Great Lakes, and flowed by various channels, in large glacial rivers, to the sea.

2. Succeeding this elevation was a corresponding depression, so that one great inland sea extended from the Alleghany to the Rocky Mountains, while, here and there, the more elevated portions of the continent peered above the prevailing waters.

3. This submergence of the land was followed by a second elevation, which second elevation is supposed to be still going on.

4. During the first elevation of the land, channels of drainage were deeply carved by various eroding forces.

5. While the submergence was progressing and during its continuance, those channels of drainage were silted up by the arresting in still water of the material borne down by rivers and by depositions from superincumbent waters.

6. Upon the emergence of the land, the surface drainage sought, and mainly found, its old channels and began the work now in progress of clearing them out.

Now what has caused this elevation and depression? I answer, polar mutation, change of position of the earth's axis, a change by which the pole travels through, either in a straight or curved line, many degrees of arc. It is accepted as a demonstrated fact that the equatorial exceeds the polar diameter of the earth by twenty-six and one half miles, and that this oblate spheroidal form of the earth is due to the loss of weight in the particles of matter by the centrifugal force of rotation requiring a greater number of particles as you approach the equator to produce equilibrium with those at the poles. Now this equatorial afflux of water, well nigh cutting the continent in two at Darien and Suez, ever follows up, and keeps at right angles to, the earth's axis. Conceive now that in the remote past the north pole traveled direct, retrograde, or otherwise, until it reached the intersection of the eightieth meridian west longitude and forty-fifth parallel north latitude, bringing with it its eternal allies of change, frost, snow, icy seas, and glacial rivers, and you have a state of things commensurate with that which existed during the first elevation of the northern division of the Western Continent. The oceanic waters, following the equator, submerge Patagonia, parts of Africa, the south table lands of Asia, and, towering up the Himalaya Mountains, reduce to archipelagoes portions of both continents. Let the pole travel on with its geologically measured tread till it passes through ninety degrees of arc, say to forty-five degrees north latitude and ten degrees east longitude; this would bring the equatorial afflux of water across the northern division of the Western Continent, submerging most of it. Let the pole tarry not but move onward till it arrives at its present position, and we have the things of to-day, the second elevation, and if still going on the pole is coming upward. This change, slow but sure, requiring hundreds of thousands of years to complete a circuit, tears and levels down, in turn, by glacial action, earth's rugged surface, to be further smoothed over by a long season of iceberg-harrowing and dredging preparatory to the donning of its coats of marine deposits from tropical seas and lagoon products. Indeed the line of mutations may never return to the same again, but, as the fair moon, waltzing around her consort earth, ever cleaves etherial space anew, so may the normal condition of the things of to-day never return. Thus the all-change-producing panorama rolls on, stratifying, mixing, distributing, *ad infinitum*. J. ARNETT, C. E.

London, Ohio.

A Natural Curiosity.

To the Editor of the Scientific American:

There is, in this neighborhood, a tree with a large stone imbedded in it in a very curious manner. The tree is a gray birch, and its circumference at base is 4 feet. The stone, which has 10 inches horizontal thickness and 14 inches vertical thickness, projects from the tree 2 feet. The singularity is that a stone, weighing some 200 lbs., is solidly grown into the living wood of the tree; but this may be accounted for by the fact that, some time ago, a large tree was blown up by the roots, lifting the stone up to where it now is and holding it there. Soon this sapling birch shot up from the top of the mound of earth thus elevated, and its roots went down and surrounded the stone. As the mound of earth and rotten roots of the old tree receded by the action of frost, the roots of the young tree grew downward and stronger, forming themselves into a continuance of a trunk of the new tree, and holding the stone in their embrace. As the growth continued, the stone is now entirely inclosed in solid wood.

Something like this may be found on a smaller scale, elsewhere; but the instance of so large a stone being imbedded in a tree at such an elevation cannot, I think, be paralleled. L. PENNELL.

West Stockbridge Center, Mass.

Cotton Spinning and Other Industries in the Southern States.

To the Editor of the Scientific American:

It is estimated that, could the cotton crop be converted into yarns in the South, the increased value would be at least one hundred and fifty millions of dollars annually. In a report to the Agricultural Convention held at Charleston, 1869, Colonel J. B. Palmer, President of the Saluda Mills in this State, gave the following figures as to the comparative cost of No. 20 yarns, with cotton at 20 cents per lb.: At the English mills, 35·5 cents; and at the Saluda mills, 29 cents, which, with freight, etc., 1·5 cents, makes 30·5 cents leaving a difference of 5 cents. At the northern factories, 34·8 cents; at the Saluda mills, 29 cents, which, with freight, etc., 8, makes 29·8 cents, leaving a difference of 5 cents, showing an advantage of 16 per cent in favor of the South.

There are tens of thousands of cotton gins, scattered throughout the South, already provided with some kind of power—horse, water, or steam. Could a simple machine be constructed to work with these gins and convert the cotton into yarns before it is pressed, there would be a still greater saving.

The margin of profit which would be afforded by spinning the cotton where it is raised and before the fiber is injured by compression, thus saving cost of packing, wastage, transportation, commissions, profits of middlemen and other incidental expenses, would be no inconsiderable sum. The mechanical genius who could, like Arkwright, Howe, McCormick, and other successful inventors, design a machine which would operate practically in connection with and by the same power now used in ginning cotton, would be certain of a colossal fortune. The difficulties to be overcome are not greater than those already conquered in other inventions. The fleecy staple, as it comes from the gin, is in the best possible condition for being worked; and factories in distant countries would purchase the yarn in preference to the loose cotton to work into fabrics. Then let some of your readers turn their thoughts in this direction, and see if they cannot win the prize.

Near this place are immense quarries of burr stone, which is said by experts to be equal to the French. In the sparsely settled southern countries, where plantations are distant from water mills, a small mill which could be attached to the power which is used in ginning cotton is a great desideratum; and these quarries afford a rare opportunity for some enterprising man to build up a lucrative business.

There are also beds of the finest kaolin, for making crockery ware. As a proof of the quality of the clay, thousands of tuns are annually shipped to northern factories. I recently visited a farm, three miles from Aiken, on which the quantity was simply incomputable, and could be bought at the current price of adjacent lands—say $5 per acre.

The reputation of Aiken as a health resort is increasing each year. Already many who were here last year and the year before can be seen on the streets, and they report that the crowd will be larger than ever this season. Connected as it is with the commercial centers of the South, and noted for its superb climate, Aiken presents many advantages for those seeking homes in the South, and especially for enterprising mechanics who may have sufficient capital to start small factories. NEKIA.

Aiken, S. C.

Shifting Belts and Pulleys.

To the Editor of the Scientific American:

It is a well known fact that, in every manufactory where machinery is used to any extent, a large amount of time is consumed in shifting pulleys and cutting belts, thereby causing many stoppages and costing a large sum of money. For instance, a company that employs one hundred men have occasion to change the size of a pulley on a counter or main line, thereby necessitating the shortening or lengthening of the belt. To do this, we will say it takes ten minutes to get the length of the belt and to get the engine under headway; and as all hands are at work, sixteen and two-third hours at 30 cents per hour will be wasted. This will be $5, which, by a simple rule, can all be avoided. The rule I made some sixteen or eighteen years ago, and have tested hundreds of times since on almost every sized pulley from three inches to five inches (and it has never failed me), is: Take three times half the difference between the diameter of the pulleys, and the result will be the length of belt to take out or put in. For instance, if you wish to change from a sixteen inch to a twenty inch pulley, the difference is four inches; that half of four is two, and twice three is six inches, the length of belt required. In case the belt wanted tightening before, make the necessary allowance on the piece and all will be right. You can mend your belt and put it on without stopping. I hope that mechanics will give this a trial. J. B. DOOLITTLE.

Wallingford, Conn.

The King Snake and the Moccasin.

To the Editor of the Scientific American:

Of the following I was an eye witness:

During the late war, the regiment to which I belonged, the Fifty-first Massachusetts, was stationed at Newbern, North Carolina. There was in our regiment an odd genius, an adept at almost anything, and one of his favorite amusements was catching snakes and bringing them into camp. He was not partial as to varieties; he would as soon undertake to bring a moccasin into camp, alive and squirming, as any other kind. One day he brought in two snakes; one was a lively king snake, the other, a moccasin of about the same size, with the difference that the king snake was a trifle the slenderer of the two. Four boards, eight or ten feet long,

were procured, and a hollow square formed by placing them on edge on a level spot; and many gathered round to witness the programme. When the two snakes were set free in the enclosure, the moccasin seemed stupid and only on the defensive, while the king snake very soon took up the aggressive. He commenced by slowly approaching his enemy, and, when sufficiently near, struck him on the back of the neck; but, probably missing a firm grip, he quickly moved away to strike again, with the same result. He soon succeeded in getting his jaws firmly fastened on the neck of his adversary and immediately twisted himself around his entire length. After squeezing him for a few minutes, he relaxed his jaws, and, placing his head a couple of inches from that of the moccasin, he appeared to listen or watch if there were any signs of life. Probably not being quite satisfied with the symptoms, he at once resumed his grip and firmly held for a few minutes more; then, letting go and listening for a moment as before, he began slowly to unwind himself till completely separated from his victim, who was dead. This may seem a very prosy affair to your readers, but the poetry is yet to come. Immediately after uncoiling himself, he seemingly ordered a change of base, and began prospecting about the body of his victim, calculating its dimensions and the feasibility of making some important disposition of it. Having satisfied himself of his being capable of undertaking the job, he at once began to swallow the moccasin by placing its head in his mouth; and after giving a few spasmodic jerks of the body, a few minutes having elapsed, he accomplished the job in a prompt and workmanlike manner. He did not seem conscious of having done anything unusual; and strange to say he appeared but a trifle larger in size than when just placed in the enclosure.

The above account is given as near as I can remember it, and I think it is wholly correct. As there were many members of the Fifty-first Massachusetts present at the time, I am ready to stand corrected if there be any error in the above.

C. A. HOPPIN.

Worcester, Mass.

Specimen Boiler Inspection.

To the Editor of the Scientific American:

I, in common with numerous other steam users of the state of New York, would like to be posted, through the medium of your valuable journal, in regard to a matter which is to many rather obscure. I refer to that portion of the laws of this State relating to steam boiler inspection.

On the 18th day of last month, a gentleman presented himself at my mill and informed me that he was the deputy inspector of steam boilers for this district, and that I must immediately prepare to have my boiler inspected. I told him that I was ready to have the boiler examined but that there was no water in it, and that the water pipes were frozen so that I could not immediately fill it, and, the manhole being open, he could examine it inside or out as much as he pleased or wait until I could fill it. He stated to me that, although the law required a hydrostatic test, he had authority from the Governor to test it by water, steam, or the hammer. I asked him to enlighten me a little in the law, when he proceeded to read me an extract from the laws of the State of New York, according to which all boilers in use must be subjected to a hydrostatic test, etc., for which the user was to pay five dollars and the expenses of the inspector.

"Well," said I, meekly, "I suppose the law is for our good, and you may proceed to inspect the boiler," which is thirty feet long and forty-six inches in diameter, with three twelve inch flues. He requested me to take off the cover of the opening opposite the middle flue, which I did; he then carefully looked into the flue, turned around and gravely informed me that that boiler was all right, and proceeded to fill out a certificate, stating that the boiler had been subjected to a hydrostatic test of one hundred and twenty pounds to the inch, and was, in all respects, right according to law. For which, under the circumstances, he would only charge me six dollars, although he had charged everybody else seven dollars and a half. The result is, that I have a document, costing me six dollars, signed by the Deputy Inspector and certified by the Inspector in Chief of steam boilers, which you will perceive is a virtual lie.

Now, Mr. Editor, what does this mean? Who is this law intended to benefit or protect, unless it is steam users and their employees? What benefit to me or mine is this paper covered with the seal of the Bureau of Steam Boiler Inspection? Suppose the boiler should burst after this tremendous test, who would be blamed, and who would be responsible? Would it not as usual be attributed to incompetency or neglect on the part of the user? Then I would say again, what good does this law do the steam user, except to periodically lighten his purse of some of its loose change for the benefit of numerous useless sinecurists? Tell me, if you can, what becomes of the money thus collected, and in what way it is used to mitigate the horrors of steam boiler explosions or prevent them, and you will confer a favor on a numerous class of readers and admirers of your paper. It seems to me, for one, that this system of steam boiler inspection, as now conducted, presents a good opening for civil service reform.

CYRUS COLE.

Havana, New York.

REMARKS BY THE EDITOR.—This letter indicates that the official charged with the inspection of his boiler was either incompetent or willfully neglected his duty, and, if clear proof of the facts stated were to be presented to the Governor, doubtless it would result in the prompt removal of the offender. We can assure our correspondent that, if the boiler were to explode in consequence of defects which the owner could have rectified, the owner would be especially blamed, and perhaps the inspector also. Inspection or no inspection, the owner must inform himself about the condition of his boiler. Nothing will save him from the consequences of his neglect to do so. A boiler owner cannot be allowed to plead ignorance as to the state of his own property.

Variation of the Magnetic Needle.

To the Editor of the Scientific American:

While making some land surveys last October, in Fauquier county, Virginia, I had occasion to re-establish an old line of some length which was defined only by partially obliterated landmarks at long intervals apart. The original and only survey of said line was made in 1748, about one hundred and twenty-four years ago, and the bearing at that time was north 38° east. It was necessary, of course, to make a correction of the old bearing for variation, but the question was what correction ought to be made.

It is ascertained from early recorded observations that the secular movement of the needle in 1748 was to the east, and it is equally as certain that its motion is now westerly. From repeated observations which I have made in this section of Virginia, the annual movement of the needle is about 4'. Taking Gillespie as my authority for the change (in the secular motion from east to west) having occurred about the year 1810, the correction for the easterly motion from 1748 to 1810 was, for this period of sixty-two years, to be subtracted from the old bearing; but again the correction for the westerly motion, which must be added to the bearing in 1810, was for the same interval of time, bringing us back to the original bearing. I set the instrument at north 38° east and struck the line. I have written an account of this only because it is a coincidence which does not often occur in an engineer's experience.

D. GARDIE.

Warrenton, Va.

Canal Navigation Prize.

To the Editor of the Scientific American:

Permit me to make a few remarks on the Erie canal navigation. I have carefully examined every invention proposed, and I am convinced that, if another twelve months were given to inventors for the $100,000 prize, there would be boats invented incomparably better than those already in being. I, for one, have invented a boat which will travel eight miles an hour without washing the banks; it will carry 300 tuns freight, and is propelled by a twelve horse power Baxter engine. I have made working models on both the Mahan and Goodwin principles, before I knew they were in existence, and abandoned both for practical reasons. If the commissioners of the award would, or could, extend the time for competition for the prize for another twelve or eighteen months, I think they would profit by it.

R. H.

Utica, N. Y.

GLEANINGS IN SCIENCE AND ART.

Scientific Piscatory Ingenuity.

An English missionary to China, the Rev. George Smith, says that, on one of his aquatic excursions, he saw some Chinese fishermen at their vocation in a way to quite astonish him. They had a model of a fish made of bright tin, which was slowly dragged along at the end of a line fastened to the boat. The fish in all directions swam towards the decoy. It seemed to possess a peculiar fascination. Far back in the rear was another boat, carrying a net; when it was judged there were fish enough congregated about the object of their attraction, the oarsmen slacked a little while the net men approached and dropped the seine, widely extended; they then gradually brought the extremities together, and generally made a successful haul.

Those same people with long hair practice another adroit method of fishing, which might be practiced here with equal advantage. They hang a highly bright varnished strip of board along the outside of the gunwale of a boat, at an angle about that of the roof of a house. When ready on the fishing ground, torches are lighted. The varnished board intensifies the light and throws it at an angle far off into the water. Curiosity, or some other sentiment, prompts the fish to follow up the rays. They rush on with such speed that when they see the boat, which seems to be an obstruction, they leap over the rowlocks inside, just where they are wanted.

Another method practised, which the observant missionary often saw, was by trained cormorants. They dived down from the boat and rarely failed to bring up fishes in their bills. To prevent them from swallowing the captured prey, each had a metallic ring on its neck, through which nothing could pass. Occasionally it was removed that the birds might be encouraged with a few morsels of food.

Both science and art are recognized in these bland and childlike piscatory processes.

Bone Fertilizing.

Enormous quantities of bones are imported into Scotland from Russia expressly for enriching the land. Mr. Stepenoff, a St. Petersburg merchant, has been dealing for upwards of forty years in dry bones, sending abroad annually 70,000 pounds, which are collected on the banks of the Volga. They are purchased there at the rate of three silver copecks a poud, and sold in England at fifty copecks the poud—a profit worth having. Notwithstanding that it is well known what excellent crops are raised where the bone dust is used, the Russians have looked with perfect indifference at the loss of an article quite as much needed at home as in any part of Europe. We have seen an immense collection of bones in upper Egypt—the skeletons of camels and wild animals, all imaginable prowlers of the deserts—gathered by Bedouin Arabs for the refining of sugar. But the golgothas of dry bones on the Libyan and Arabian sands are so exceedingly extensive, far beyond the requirements of the Pasha's sugar works, that a splendid business might be inaugurated by bringing bones to the United States. The long ones would pay well as ivory for cutlery handles and brushes.

An establishment at Newark, N. J., has been in operation for one or two years, and manufactures a splendid fertilizing material from miscellaneous city bone gatherings, deserving the patronage of farmers.

The phosphate of lime is the food our cultivated crops crave most. Fruit trees, too, thrive delightfully when fed occasionally with bone dust. A perfect cast of the bones of Roger Williams, the great man of ancient Rhode Island, was made by the embracing rootlets of an apple tree which found a feast of phosphate in his decaying coffin; and it is now a cabinet curiosity illustrative of the fertilizing influence of phosphates on vegetable growth.

This bone matter is an important department of agricultural science, and should have the helping hand of capitalists.

Preservation of Human Skulls.

At the convent of San Sabi, located on the margin of a horrible mountain gorge between Jerusalem and the Dead Sea, supposed to be the wilderness where John the Baptist preached, there is an immense collection of skulls, piled up like cannon balls in a navy yard. That has the reputation of being the oldest convent in that part of the world, and those stacks of heads are those of monks who lived and died there in the course of thirteen hundred years.

The next extraordinary collection of the remains of humanity exists about four miles from Folkestone, in the town of Hythe, Kent, England; it is traceable to a bloody battle, fought between the Anglo-Britons and an invading army of savage Danes, in the reign of Ethelwulf, A. D. 843. The Britons triumphed and thirty thousand were left dead on the field of slaughter. Being too weary to bury the bodies, they left them to whiten in open air. When quite dry and white the bones, principally skulls, were gathered and placed in a stone crypt, prepared for them 1389 years ago. These skulls indicated men of large size, and were corroborated by bones of the limbs, superior to those of their lineal representatives in England. Their teeth were sound and strong but worn down short, indicating a hard kind of food, habitually. The native skulls are easily recognized.

Perhaps on this continent astounding discoveries are to be made respecting races that preceded the Indians. Skulls of the mounds clearly prove a higher type than is recognized in what are called aboriginal skulls dug up from Indian groves. Phrenology and craniology are sciences that deal exclusively with facts, hence it is probable that curious developments through their agency in regard to a remote antiquity may be anticipated in the progress of events.

Irritability of the Frog's Heart.

Taken all in all, the batrachians are marvelous beings. Besides being obliged to pump air down into their own lungs, which explains why the gular membrane underneath the under jaw is so elastic, acting on the volume of inhaled air in the cavity of the mouth on the mechanical principle of bellows, they catch game with the point of the tongue, drink through the spongy texture of the skin on the back, and live months in succession concealed in the mud bed of a pool without respiring; and yet the systole and diastole, or in plainer words the contraction and expansion of the heart, is not suspended. Their vitality is remarkable, since the small amount of oxygen introduced into the arterial blood when making the final plunge in autumn keeps the spark of life alive till emerging from the water in spring. If the heart of a frog is cut from its connections within the pericardium and placed on a table, it will pulsate and throb energetically for some minutes. When apparently quiescent, the point of a needle will rouse it again into spasmodic energy. Finally, by the touch of irritants, its irritability is completely exhausted. After experimenting full half an hour in that manner, we were struck with the lively vaultings of the frog from which the heart had been taken. Certainly it was conscious of its relations, for it avoided many cautious attempts, to capture it, on the part of the operator. It was some hours before death closed the scene.

The vital tenacity of reptiles, particularly batrachians and chelonians, which takes in the tortoise family, are remarkable and worthy of more extended scientific investigation.

Cathedral Restoration.

Chester, about twenty miles from Liverpool, the only walled town in the kingdom, fortified in that manner by the Romans about eighteen hundred years ago, has within its rural inclosure an ancient dilapidated cathedral. From one century to another it has been patched, partitioned, bedaubed and ostensibly improved, according to the whims or vulgar caprice of those who have had charge of it, till the original character of the interior was well nigh destroyed. Fortunately, the present dean of Chester, the Very Rev. Dr. Howson, a gentleman of culture and refined taste, is re-revolutionizing the grand old antiquity. Defacements are being removed, and modern masonry that concealed splendid arches has been taken down, bringing into view the chaste designs of the original architect. When completed, it will be worth a special pilgrimage to Chester to gaze on the venerable structure. In a rude tower on the wall, still standing, Charles I. sat and witnessed the defeat of his army, which shipwrecked the throne. There are other cathedrals in England very imposing, but none more complete in its antique appointments and solemn beauty than Chester Cathedral in its restoration.

We are prone to underrate and undervalue the attainments of our predecessors, as exhibited in remains of art or science. But every age has its representative men in all departments, in which brain force is recognized as superior to all other forces.

BRIDLE.

It is difficult to imagine a more simple or more cheaply constructed bridle than that which Mr. J. H. Wilson, of Nashville, Tenn., has recently patented. A glance at our engraving renders description almost unnecessary. A single strap passes around the horse's neck, and its two parts are



fastened together just behind the animal's ears and over its face. Branching at the latter points, the separate portions of the straps pass down each cheek to a loop or ring in the bit, and thence extend, in the manner of the reins, over the back of the neck, where they join together.

A single piece of cord or strap constitutes the entire bridle' nothing further being necessary than to pass it, as above described, through the loops and buckles, and adjust it by moving the buckle over the nose, up or down, as may be required. For rights to manufacture address Mr. Wilson, as above.

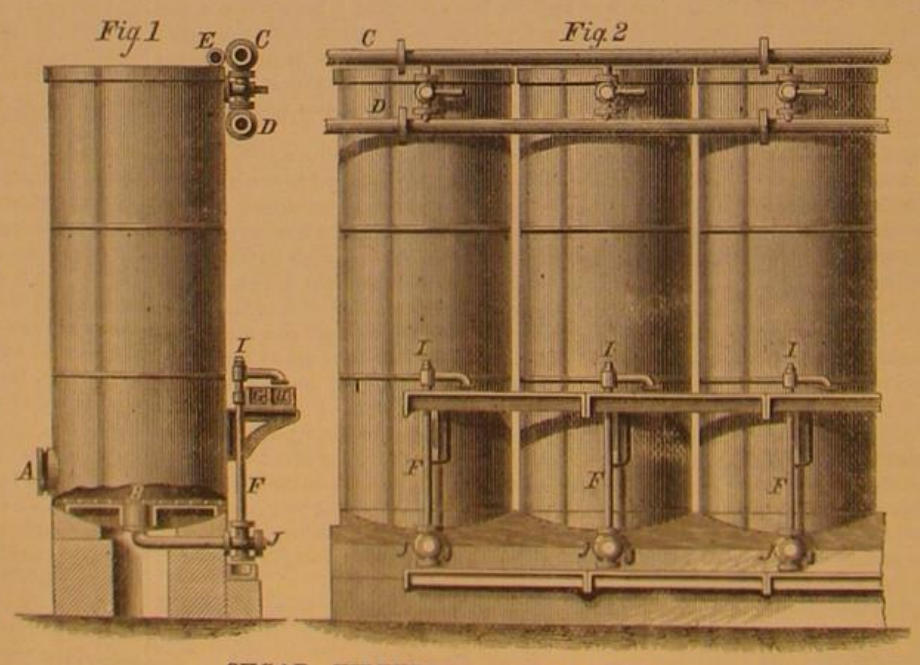
ANIMAL CHARCOAL AND ITS USE IN THE REFINING OF SUGAR.

It is on the process of filtration through animal charcoal that the refiner relies for transforming the scorched and blackened sugars, which he but too often receives from the planter, into the white crystals which he offers to his customers. Animal charcoal is prepared by calcining the bones of animals in vessels closed so as to exclude the air. The ordinary method is just to extract all fatty matters by boiling, and afterwards to place the bones in iron or fire clay pots ranged in a furnace. When the gases cease to be evolved, the calcination is complete. After cooling, the bones are passed through a mill to reduce them into a coarse powder and then sifted, so that the grains of the same size may be kept together.

A new process for this manufacture has lately been introduced in France by MM. Dunot and Bougleux, in which special regard is paid to the recovery of the by-products. The bones are first sorted, freed from bits of iron and stone, then crushed between rollers, and boiled with water under the application of steam. The fat hereby obtained, remelted and bleached in the light, is sold at the rate of $18 per 220 lbs. The boiled bones are piled in heaps so that, at a heat of 60° or 70° C., they undergo a species of fermentation and are then sifted; the portions which pass through the sieve are utilized as bone meal and reduced to various degrees of fineness. This meal is used for manure and contains on an average 4 per cent of nitrogen and 40 per cent of phosphate of lime. The carbonization process consists in employing retorts, of similar construction to those used in gas making, and cooling the distillation products in the same way as in gas manufacture. The gases and vapors escaped from the retorts in use ascend and descend in vertical pipes that are cooled from the outside. At last the gases pass through a holder where they meet a stream of water and are at length burned in the fire of the retorts. About 8,800 pounds of bones yield 34 cubic feet of ammoniacal water, containing an empyreumatic oil which is decanted. The water is conducted to a cistern and pressed into a Mallet apparatus for recovering the ammonia by means of lime. From the ammonia, together with impure carbonic acid, sulphate of ammonia is obtained. The total production of bone charcoal made by this process is annually some seven million pounds.

The charcoal filters employed by the planter are usually about ten feet high and four feet in diameter. They are generally open at the top. Near the bottom is a grating of iron; a piece of filter cloth is laid upon this, and then the vessel is filled with charcoal up to about a foot from the top. In the accompanying engraving, three of these filters are shown. A is the main hole, and B the grating on which the filter cloth is spread. When the filter has been filled with fresh charcoal, sirup will first be run into it by the pipe, C, and it will be supplied with this until its decolorizing power is very nearly exhausted. The supply of sirup will then be shut off and the filter will be used for some time to filter cane juice, which enters by the pipe, D, fresh from the defecators. As the power of the charcoal has already been exhausted, it acts upon this simply as a mechanical filter. The sirup is driven out as the cane juice enters. After the filter has been used for some time in this way, the supply of cane juice is shut off and pure water run in through the pipe, E. This in its turn drives the cane juice before it and continues to flow until it no longer carries away with it sufficient saccharine matter to pay for concentration. It is essential to have several filters at work, in order that, while one is filtering sirup, a second may be filtering cane juice, and the third may have pure water run over it for emptying and refilling.

The side view, Fig. 2, shows more clearly the arrangements whereby the liquor and juice are drawn off through the pipe, F, which discharges into the gutters, G and H, through to the swivel joint, I. The water is discharged through the cock, J, into the gutter below.



SUGAR FILTERING APPARATUS.

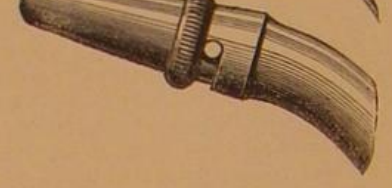
VALVED OIL CAN NOZZLE.

Mr. E. J. Durant, of Lebanon, N. H., has recently devised the ingenious arrangement for the spouts of lamp-filling oil cans represented in our illustration. It is simply a peculiarly shaped cap fitting over the spout. The end of the latter is closed and an opening formed on its under side. A similar aperture, A, is made in the cap, which is secured in place by swaging from the inner side of the spout an annular groove of sufficient depth to extend into the cap.

Fig. 1.



Fig. 2.



To allow of the flow of oil, it is only necessary to turn the device so that the two orifices shall be coincident, as in Fig. 1; while the end of the spout may be tightly covered by simply revolving the cap until the aperture is in the position shown at A, in Fig. 2. This little invention will be of use in preventing the escape of the contents of the can by evaporation or by the accidental upsetting of the vessel.

A Burning Hill in Ohio.

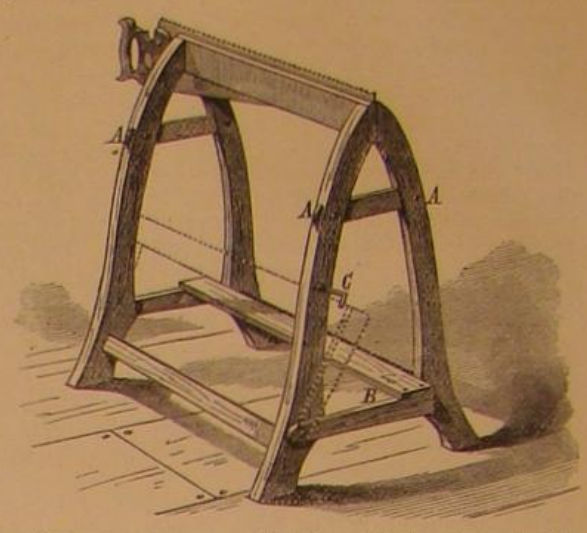
Three miles from Bainbridge, Ross county, Ohio, is located a hill of considerable altitude, known as "Copperas Mountain." Out of the top of this mountain, says the *Circleville Herald*, issues a constant stream of smoke, while on its summit and general surface the vegetation has withered and died until the whole hill presents a barren, sterile and desolate aspect, blasted as if by a whirlwind of fire. It is believed that the entire interior of the hill is a mass of ignited combustible matter, and that the fire is and has been spreading with considerable rapidity. The theory presented to account for it is that, on or about the 1st day of last October, the party to whom the land belongs was burning brush on the hillside, and that the flames communicated to inflammable matter, probably crude oil, coal or other combustible substances, contained in the geological formation of the hill.

THE durability of asphalt as flooring has been tested in the Northampton (Eng.,) cattle market and the decision is against it. It was found that the treading of the cattle soon wore it away, and that it would speedily become necessary to replace it. It was accordingly decided to lay the floor of the market with brick in place of the asphalt. A flooring of hydraulic cement, we believe, would be better and more enduring than either asphalt or brick.

SAW CLAMP.

To mechanics, who frequently find it necessary to file their saws, the accompanying device will prove a useful acquisition. It is a portable saw clamp, so constructed that the tool is held along its entire length with a force proportioned to the power of the lever purchase.

The apparatus consists of two frames, as shown, connected by the short bars pivoted in mortices at A A. B is a hori-



zontal frame serving as a foot piece which, when raised, is in the position of the dotted lines and held by the hook, C. The jaws can then be opened by bringing the feet of the device slightly together. After the saw is inserted, the foot piece, B, is brought down to a horizontal position, thus forcing the frames apart, closing the jaws, and holding the tool firmly during the subsequent filing. The portability, as well as the simplicity of the device, allowing it to be shifted to any desired point in order to obtain the best possible light, renders it of especial convenience. The patentee is Mr. T. L. Kenworthy, of Collinsville, Ohio.

The Difference between English and American Workmen.

A prominent English manufacturer says:—"I think the difference between the way in which the American workman will turn out an article that is wanted, and the way that an English workman will turn out an article that is wanted, is to be described in this way: The Englishman has not the ductility of mind and the readiness of apprehension for a new thing that is required; he is unwilling to change the methods which he has been used to, and if he does change them he makes demands of price by trade rules which actually oppose the change of the article, or certainly attach to it something in the shape of a fine or an extra demand beyond a fair price for the making of an article. An American readily produces a new article. This last year, having made an extensive tour in the United States of 7,000 miles, by land, not so much for my immediate business purposes as for the sake of obtaining general information connected with the comparison of the manufactures of the two countries, as well as upon other social subjects, I have come to this complete opinion: that the cause of the whole difference between us is to be found in the education of the workmen on the two sides of the water. On one side, in fact, there is an almost total absence of education, and that is the main difference. There should be an improvement in the primary education of the English workman, and also given to the working men. The scientific education and the primary education are but parts of one whole. We must have the whole building in order to get what we want. I think, as a matter of fact, that which is most wanted is primary education, or rather a general liberal education, beginning at the bottom. I think if we could get that we should find that those parts of the edifice which come at the top would be arrived at more easily; but we should have those parts of the edifice too. And I do not conceive that we should be doing a work of supererogation or what would not really help us in the right direction, should we at once promote the scientific education of all those who were ready to receive it.

The American workman has received considerable scientific education; he has it chiefly by his own study. He has received, to begin with, a liberal education, something quite different from what we call primary education in this country, an education that puts him on a level with persons in a higher position than we call the lower middle class, on a level, indeed, with almost the upper middle class. And with his mind so trained, he readily applies himself to acquire scientific education."

DUST RESPIRATORS.—Good service is being done in England by calling attention to the great prevalence of lung diseases among the operatives in dust-abounding factories, such as those where cotton, iron, china, flax, lime, etc., are worked. A simple and effective respirator, consisting of a light, flexible frame work lined with a filter of cotton wool, is used. The protection afforded by this apparatus is effectual, and it is simple and cheap.

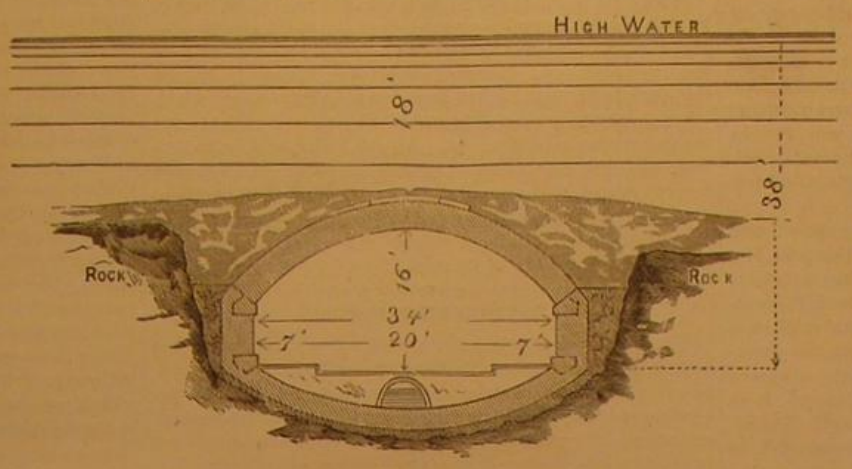
NEW TUNNEL UNDER THE HARLEM RIVER, NEW YORK CITY.

Among the public improvements, now in process of construction in New York city, is a tunnel and roadway under the Harlem river, at the northerly end of the city. This important work will form a continuation of the elegant thoroughfare known as Seventh avenue, which, by means of this structure, will be carried under the river into Westchester county.

We herewith present elevated and sectional views of the work, for which, together with the following particulars, we are indebted to the New York *World:*

This new tunnel is run under the Harlem river at the head of Seventh avenue, the approach on the New York side beginning at 150th street, four blocks from the river shore, and the Westchester approach beginning at 163d street, at about the same distance from the water's edge. The length of the tunnel from one extreme to the other will be 2,641 feet.

At 150th street the road bed and sidewalks on Seventh avenue begin to gradually descend, the sides being built up with handsome blue granite. 151st street will be closed, at least for the time being, but at 152d street the tunnel will have reached a sufficient depth to allow a bridge to be thrown across on a level with the natural ground surface of Seventh avenue. At the beginning of the next block the tunnel will be entirely closed overhead, while the descent continues until the river is reached and the water is found to be directly overhead. At this point the tunnel is built through the solid rock, in order to leave a sufficient depth of water overhead for the navigation of large vessels. As soon as the opposite side of the river is reached, the tunnel ascends until the level of 163d street is reached.

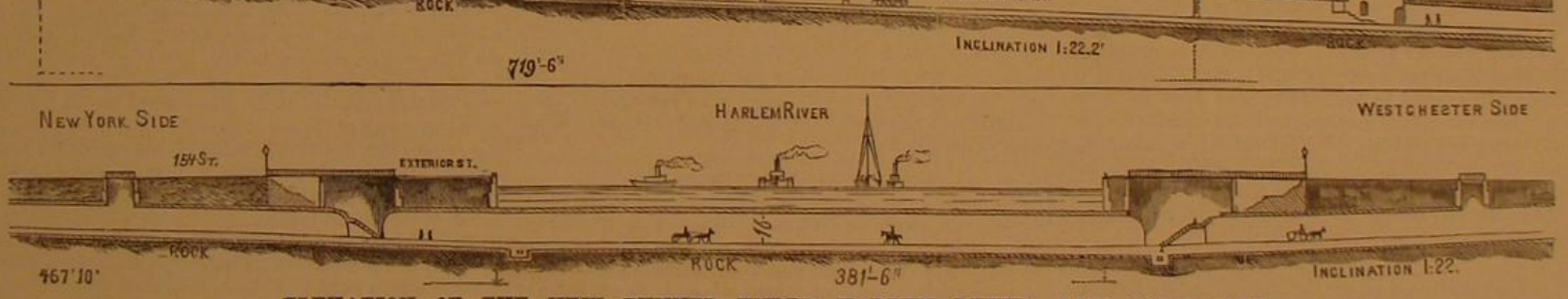


SECTIONAL ELEVATION OF THE NEW TUNNEL UNDER HARLEM RIVER.

The tunnel, when completed, will be simply a well made street, with two sidewalks, each seven feet wide, and a carriage way twenty feet in width. Just above 153d street there is to be a large square opening for foot passengers. A staircase, fourteen feet wide, leads down to the top of the tunnel, where there is a landing from which two stairways descend, leading to both sides of the street below. Between 154th street and the river will be another opening forty-eight feet in diameter, with similar stairways leading down to the tunnel.

The next opening for passengers is near the shore, on the Westchester side. Near Sedgwick avenue, a short distance beyond, there will be another small round opening for passengers. There are also four more openings, at intervals, to admit air and light. The tunnel does not run under the river in a straight line with Seventh avenue, but turns to the right at 155th street, and crosses at right angles with the river, in a direction almost due northeast.

In our engravings, the approach on the Westchester side of the river is omitted.



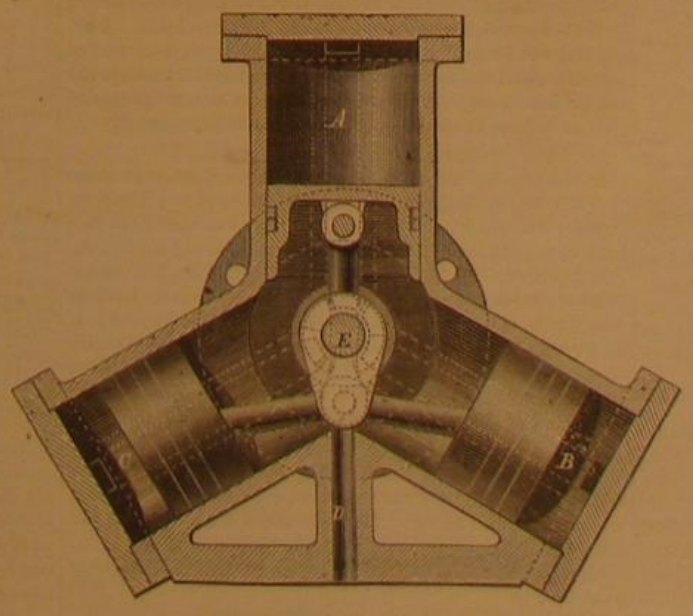
ELEVATION OF THE NEW TUNNEL UNDER HARLEM RIVER, NEW YORK CITY.

THREE CYLINDER ENGINE.

At the recent Smithfield Club Show, England, a three cylinder engine, by Messrs. Brotherhood & Hardingham, was exhibited, which is thus described in *Engineering:*

In this engine, three cylinders are disposed round the crank shaft at an angle of 120° to each other, each cylinder being provided with a deep but light piston, from which a connecting rod is led to the crank, common to all. One of the connecting rods has a single eye at the crank end, while the two other rods are forked at that end, the fork of the one being wide enough to take hold of the pin outside the other, so that the center lines of the rods are all in the same plane. The cylinders are all open at their inner ends, and when the engine is at work the steam from the boiler has free access to the central space, so that it tends to force the three pistons outwards uniformly. The admission of the steam to, and its release from, the outer ends of these three cylinders is effected by a single revolving slide valve. This valve works against a face at one side of the central chamber, as shown in our engraving, being carried round with the crank shaft.

As there is necessarily some throttling in the steam passages, particularly when the engine is running fast the pressure of the steam at the outer ends of the cylinders never equals that in the central chamber, and hence the pistons are always forced outwards, the strain upon the connecting rods being always a tensile one, but varying in amount according to whether the steam is being admitted to or exhausted from the outer ends of the cylinders. In the engine shown in our engraving, the direction of motion would be that indicated by the arrow, the cylinders A and C being exhausting, and that marked B being receiving steam. The steam inlet is at D, all steam for the supply of the cylinders passing through the central chamber; while the exhaust nozzle is at E, in a line with the crank shaft. Owing to the strain on the connecting rods and joints being always in one direction, there is no back lash, and it is possible to run the engine at extraordinary high speeds without inconvenience; in fact, the makers state that they have run it at over 2,000 revolutions per minute without experiencing any difficulty even with the joints of the rods purposely made very loose fits. Of course, if the connecting rods were subjected to an alternate pull and thrust, and if reciprocating slide valves (with the consequently alternating strains on the eccentric rods) were employed, this result would be impossible after a little wear had taken place. As it is, the engine is well adapted for driving fans, centrifugal pumps, etc., and similar machinery requiring high speeds, and for such purposes it appears to us far superior to any rotary engine which we have yet seen. Messrs. Brotherhood and Hardingham are applying this engine to driving Messrs. Boulton and Imray's helical pump, and the arrangement they employ is a very neat one. The makers are also, we believe, contemplating the construction of this class of engine in larger sizes for general purposes.



THREE CYLINDER ENGINE.

SALMON breeding has been remarkably successful at Bucksport, Me., this year; over a million and a half of eggs lie in the hatching troughs.

New Mode of Pivoting Teeth.

I prepare the root as usually performed for ordinary pivoting, says S. Davis, in *Dental Times*, then ream the pulp chamber in a funnel shape to about the depth of a quarter of an inch, and in this cut anchorages. The root is frequently decayed in this shape.

A plate tooth is then taken, and ground to fit the prepared root. It is then backed with gold plate. A portion of the sides of the tooth and backing are then ground off, leaving the labial surface the original size. A pivot is then soldered to the backing, and the frame is cut to the proper length, to allow the crown to leave a space of about a line between it and the root. Then prick the backing and pivot with a sharp instrument, and apply some oxychloride of zinc in the pulp chamber, and force the crown and pivot into position. Gold is then packed into the anchorages, and built up around the pivot, bringing it well up on the backing.

When the crown and pivot are in position, there are but two thin edges, about a line distant from each other, with plenty of space left at the palatine and proximal surfaces of crown for packing gold.

The greatest obstacle in the way is the inflow of saliva; but I think this can be prevented in most cases.

Honor to Inventors.

Inventors are a class—*sui generis*—and their rewards, in lifetime, are mostly *nil*, their honors posthumous, says the London *Mechanics' Magazine.* They are, moreover, cosmopolitan, and in general their labors, when successful, benefit not one class or nation alone, but mankind at large.

As it is therefore fitting that in some shape or form honor should be given where honor is due, we have learnt with much interest and pleasure that the Commissioners of the New York Central Park have allotted a portion of their domain for the erection of memorials to the inventors of all nations, and it is now proposed to erect one of these memorials in honor of Elias Howe, the inventor of the sewing machine.

The good fortune to confer equal benefits on mankind is reserved to few inventors, and while this invention is the world's common inheritance, a large share of the legacy has fallen to Englishmen, who have never yet been found wanting in gratitude to their benefactors. This object appeals directly to the sympathies of the inventive class, of which Mr. Howe was an illustrious representative; and there will, doubtless, besides be many a cheerful giver among the humble users of sewing machines.

The influential committee organized in America to provide the memorial funds will, we learn, be aided by a committee recently formed in this country, which comprises Bennett Woodcroft, F. R. S., David Chadwick, M. P., Donald Nicoll, Esq., Thomas Webster, Q. C., F. R. S., George Haseltine, LL. D., P. Le Neve Foster, M. A., and Theo. Aston, Q. C., of London; William Clarke, Esq., of Glasgow; Sir William Fairbairn, Bart., James Stuart, Esq., William Muir, C. E., William Batty, Esq., Ernest Reuss, C. E., and Mayor Booth, of Manchester. We believe also that Mr. Siemens, President of the Society of Telegraph Engineers, and other eminent gentlemen, have promised their hearty coöperation and material aid. The committee have elected Mr. Woodcroft, of the Great Seal Patent Office, chairman, Mr. Nicoll, St. Paul's Churchyard, treasurer, and Dr. Haseltine, of Southampton Buildings, honorary secretary.

The London and County Bank and John Stuart and Co., bankers to the committee, will receive subscriptions. The estimated cost of the memorial is fifty thousand dollars—ten thousand pounds—and a unique design has been submitted to the committee by an eminent sculptor, a personal friend of the inventor.

The composition of the committee indicates a very general interest in the movement, and is an earnest of its success. Truly the victories of peace are greater than the victories of war, and the due and fitting recognition and veneration of the heroes of these beneficent victories is at once the ornament and illustration of modern civilization.

THE GOVERNMENT SUBMARINE WORKS AT HELL GATE.

A group of detached rough wooden buildings, a few heaps of stone, two or three tall derricks stretching out their giant arms, and here and there a cloud of ascending steam: such is the quiet exterior that marks the site of that great work of modern engineering which is to double the advantages of the port of New York, to shorten the voyage to Europe by many scores of miles, and, from a narrow tortuous and dangerous channel, to produce a broad and open harbor in which the largest vessels may ride in safety.

Near the extremity of Hallett's Point, on the Long Island side of the East River, is sunk the great shaft, thirty feet deep and one hundred and five feet broad at its widest part. A strongly built coffer dam protects it from the inroads of the tide, while into its precipitous sides are hewn ten immense caverns, which, radiating at different angles, extend for hundreds of feet under the bed of the river. These again at about every twenty-five feet of their length are traversed by seven nearly semi-circular galleries, so that, for want of better illustration, the work reminds one of a giant cobweb honeycombed in the solid rock.

We may safely presume, from the many histories and descriptions of the undertaking which, during the past two years, have appeared in our own as well as other columns, that with its general details the reader is reasonably familiar. It was with this conviction that our recent visit was devoted to the eliciting of such information from the directors of the work as would indicate the most recent progress made toward its completion, and the results obtained from the machines, processes, etc., in daily employment. The accompanying map, constructed on an accurate scale of 1 to 3,000, will convey a good idea of the

PRESENT STATUS OF THE EXCAVATIONS.

It is proposed to carry the various headings out until they reach a point above which the depth of water at mean low tide is 32 feet; this is the last contour indicated on our map. The next irregular line marks a depth of 28 feet. Seven headings have already reached the proper length: others are being rapidly pushed forward. Grant, or No. 7, heading has now attained a distance of 230 feet. In Farragut, or No. 1, which when finished will reach 270 feet, there is yet 70 feet to pierce. The solid piers between the cuttings serve to support the roof of rock, ten feet in thickness, together with its immense superincumbent weight of water. Altogether, about 4,000 feet of excavation have been completed, leaving some 2,000 feet more to be done. The average monthly advance is 250 feet, although these figures have been exceeded during the past five months.

HOW THE ROCK IS PIERCED.

The bottom of the river is composed of strata of gneiss, through which run veins of quartz. Here and there thin layers of decomposed mica have been encountered, often causing serious leakage, but the rock generally is of great hardness (as comparatively expressed by geologists, about 6) rendering rapid boring a matter of much difficulty. The bed slopes away from the shore at a considerable declivity, and as the tunnels are necessarily parallel to the inclination, the drills are often placed to work at angles as great as 45 degrees. Excavations are made in the usual manner by continued boring and blasting, one tool cutting a tunnel just high enough to accommodate the miners, while a second drill some forty feet in the rear, removes stone from the roof until the gallery or heading has reached its proper hight of twelve or fourteen feet. The principal

DRILLS

that are or have been used are the Burleigh and the Diamond. The latter, however, has been found unsuitable for the work in small tunnels, and although two machines have been purchased by the Government, they have not been used since last July for tunneling purposes, and now lie idle.

In justice to the Diamond drill, it may be stated that its work at first was satisfactory. There is no doubt that, as a prospecting tool and for deep boring, it is of much utility, but the actual results, as determined by the work of the drill upon the hard rock at Hell Gate clearly indicate that, in the present instance at least, its competitor, the Burleigh, has a manifest advantage. The average work of the Diamond was, for a period of four months, 14·4 feet per shift of eight hours, at a cost of $1·16 per lineal foot; that of the Burleigh, 26 feet at from 42 to 43 cents per similar distance. Four Burleigh drills, from the months of October to April last, completed 20,000 feet; two Diamond drills for the same period, less two months, accomplished 7,000 feet. An average of 5½ Burleigh in one month pierced 7,300 feet. The opinion of the workmen and of those directly in charge of the operations is in favor of the last mentioned machines, eight of which are employed, six in the tunnels and two in the shop as substitutes. The cost of repairs for the six is about $27 per month; that of the steel expended was, for December, $27, for 451 pounds.

As regards the Diamond drills, from all accounts the hardness of the material formed the great obstacle, and we were informed that the machine rarely ran for more than forty-eight consecutive hours without a breakdown. Its cost for repairs was remarkably large, reaching, for the machines used, including replacing of a number of diamonds, etc., in a single month as high as $700. Including stoppages from various causes, shifting from tunnel to tunnel, etc., the average work of the drill was 1·8 feet per hour; that of the Burleigh is 3·5 feet. All of the above facts, we may add, were obtained directly from unprejudiced government officials, and in no case from an employee of either manufacturing company, or from any one having interest in the machines. The former gentlemen state that it is their desire to obtain the best possible tools, and that they will freely afford every facility for testing the same of any maker by applying them to actual work, side by side with the drills now in use.

THE COST OF THE WORK

as it is now conducted under Government auspices is strikingly less than that of preceding operations of a similar nature which from time to time have been attempted in the same locality. When let out on contract, the expense per cubic yard of stone removed, obtained by Maillefert in his workings in Pot Rock, was $44.25. At the present time, $6.42 is the corresponding expenditure at Hallett's Point, and this is about one third of the price asked by contractors. The land on which the buildings, etc., are erected belongs to private parties, to whom two thirds of the stone excavated is given as ground rent. About one hundred and twenty men are now employed. Power is supplied to the drills and to the blacksmith shop by five Burleigh air compressors, which work in winter in oil and in summer in water. All articles for use are made on the spot. An old boiler, otherwise useless, was with considerable ingenuity repaired, mounted on a carriage and, with a small steam engine, makes an excellent dummy, serving to draw away the dumping cars as fast as they are filled with the loose material taken from the headings, thus saving the labor of six men.

ENGINEERING NOTES.

We select from the Reports of Committees and from other papers, submitted to the Railway Master Mechanics' Association during its convention at Boston last summer and recently published, the following items of general interest to engineers:

BOILERS.

The Committee on Boilers and Boiler Materials consider that a necessity exists for better combustion and greater economy in the use of fuel, in furnaces of coal-burning engines, than can be obtained by any known device. The use of the fire brick arch or water table is recommended in furnaces of all passenger locomotives burning bituminous coal.

The wagon top in preference to the straight boiler for locomotives is advocated, especially where impure water is used. It affords greater steam room and larger water surface over the furnace, and it decreases the liability to foam if the water is bad. The admission of air above the fire and two inch flues for wood or coal-burning engines are recommended. American iron for furnace sheets is not considered as free from lamination and liability to blister as Low Moor and kindred brands of English iron. After careful experiments, the Committee advises drilling the rivet holes for longitudinal seams of boilers: the circular seams are not subject to so great a strain and may be punched. Three quarter inch rivets, 1⅛ inches between centers, should be used for all seams in boilers of $\frac{5}{16}$ inch iron, as the ½ rivet is too small to resist the strains. The exclusive use of hollow stay bolt iron is strongly urged, so that if a stay bolt breaks, partly or entirely, the fact will be discovered. The objection that too much cold air will thus be admitted to the furnace may be avoided by driving suitable plugs into the inner ends of the holes in the stay bolts. Experiment has shown that the strength of ⅞ inch hollow stay bolts is more than sufficient to resist the strains to which they will be subjected if placed 4½ inches from center to center.

MERITS OF THE WAGON TOP BOILER.

Mr. H. A. Towne communicated a letter on the merits of straight and wagon top boilers, pointing out the advantages of the latter. As regards strength, a wagon top has never blown off nor even given way under pressure so as to endanger its safety; on the contrary, whenever an explosion of this kind has taken place, the cylinder part of the boiler has in every instance given out first. The extra cost of a wagon top over that of a straight boiler of the same size will not exceed the cost of ordinary domes.

THE SELF-ACTING SLIDE LATHE.

Mr. Coleman Sellers, in a paper on this machine, gives the following as the readiest method of bringing the centers in line after the back head has been set over out of line, in adjusting the centers in the first place or in testing the correctness of a new lathe. A bar of round iron carefully centered is turned up a short distance on one end. This turned end being placed next the live head center, a turning tool clamped to the slide rest is made to just touch the turned part. Taking out the bar, the tool is moved to the poppet head end of the lathe, and the bar replaced with its turned end next to the poppet head center, when, if the tool just touch the turned part as before, the lathe may considered in adjustment.

PURIFYING WATER FOR BOILERS.

In this report, various opinions are given tending to show that it is impracticable to get the impurities out of water by heating it at stations. Experiment proved as follows: In a tank of suitable size, a two inch worm pipe was placed to the full depth of the tub and live steam used to heat the water. With a consumption of 3,000 pounds of coal every twenty-four hours, it was found impossible to heat the quantity of water used during that time—twenty-six thousand gallons—enough to make any possible difference in the appearance of the boiler or flues of an engine which used this water exclusively and of those which used it one day or not at all.

LAP AND LEAD OF SLIDE VALVES.

In regard to balanced slide valves and valves working on rollers, the Committee have received reports from nine roads which have used rollers. Six have taken them out and the other three give no result of their performance. Eight roads have reported using balance valves of different makes with good results.

PACKING FOR STUFFING BOXES.

Of over thirty roads heard from, the majority prefer hemp. It takes a high degree of heat to char it enough to harden it. Steam at a pressure of one hundred and fifty pounds per square inch has only a temperature of 343°, while hemp will easily stand 500°. Soapstone of various kinds gives good results and has its advocates, who say that its first cost over hemp is counterbalanced by its longer use and less friction, consequently wearing the valve rods less. Metallic packing has been used by many, and its use abandoned by nearly all, the result not bearing out its first cost and needed repairs.

THE USE OF FUEL.

Mr. Gordon H. Nott says as follows: All practical trials prove that the fuel, during its preparation for making steam, must be kept away from all parts of the boiler protected by water surfaces, as, for some distance from the actual contact, there will be a constant partial condensation of the fuel. In the plain fire box, the products of an imperfect combustion are thrown, with much force and intensity, against the center of the tube sheet which is the very part where there should be uniformity of action. Here we find a weak part of the boiler subject to an immense heat and imperfect combustion. A remedy that will apply, in the central part of the fire box, to the mixture of the fuel and gaining of time in combustion must serve to modify the force of this column against the tube sheet. The accumulated experience of locomotive railway engineers is that time for a thorough mixture must be gained, whatever may be the size of the fire box—less for a long than a short one. In the use of a long fire box, there is a gathering of injurious gases when the tubes are reached; with a small one, this gathering is not so large, but the mass of the products of poor combustion is more.

BOILER INCRUSTATION.

The Committee consider that to boil sufficient water to supply a locomotive for one year, running 31,200 miles, would require an extra expenditure of $236.25 for fuel. The use of pure water will absolutely prevent all manner of explosions, ruptures and leaks arising from incrustations, besides saving a large proportion of repairs and also supplying pure dry steam free from grit or sediment. The introduction into a boiler of any so-called remedies, be they batteries, powders or any other nostrums, can hold no comparison to this one reliable remedy. Railway companies should be aware of the fact that in the Middle and Western States the expense due to impure water and incrustation would amount to $75,000 a year for every hundred locomotives.

Judging from experiment, it seems hardly possible that any apparatus of filters or series of plates can be got on to an engine of sufficient capacity to purify the large amount of water required for a locomotive boiler. The Committee consider that a series of exhaustive experiments should be instituted in order to definitely determine this important requirement.

THE BEST METHOD OF SECURING DRIVING AND TRUCK BRASSES.

Thirty-five reports on this subject were received. On the use of Babbitt metal, four use gibs with Babbitt; four use the solid octagon without Babbitt; seven use octagon with Babbitt; seven use half round solid brass without Babbitt; four use half round in three pieces with Babbitt, and one makes no report of the use of Babbitt. All, with one exception, report that the Babbitt metal should extend the entire length of the journal and should be put on in strips ¾ to 1½ inches wide, at a point between the top and the front and back points of the journal bearing; one inserts it by drilling holes in the brass and then filling in with the metal. The Committee have observed that, in engines of from thirty-two to thirty-five tuns weight, the half round brass does not give as good results as in lighter engines. Good results may be obtained from a hexagon-shaped brass if properly fitted. The brass will wear until it is cut through into the cast iron. The recess in the top of the brass is of advantage also as a reservoir for oil; and as there is less bearing at that point, the brass wears away and the shaft beds itself into the brass, so that there is no lost motion or pounding between the shaft and the brass. The Committee is of opinion that the use of Babbitt metal is advisable.

NASCENT ELEMENTS AS FERTILIZERS.

A correspondent starts the inquiry as to the relative value of elements as food for plants when prepared in different ways. For example, is the potash derived from the ashes of wood more easily assimilated by plants than the same agent obtained from salt mines? Or is the silica of green sand more readily absorbed than that obtained from quartz? The topic is an important and fruitful one, and has been discussed by many writers on agriculture. There is no doubt that silica derived from infusoria and diatoms of green sand, tripoli, etc., is more soluble and, hence, more available for the growth of plants than the sharp sand of decomposed quartz; and it would also appear that potash obtained from wood was more available than that from a mineral source. We should, however, hardly call these *nascent* elements, as that word is used to describe chemical substances just liberated from their compounds, as nascent hydrogen from decaying organic matter, or nitrogen from a similar source. Potash and silica are not elements but compounds.

NEW INSANE ASYLUM IN CALIFORNIA.—The commissioners appointed for the purpose by the Legislature of California have selected a site near Napa City for a branch insane asylum. The estate comprises 208 acres of land, with fine sites for buildings, and good facilities for water supply, sewerage, etc. The State has appropriated nearly $800,000 for the erection of buildings.

STUDY the past if you would divine the future.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE EFFECTIVE PRINCIPLES OF COFFEE.

Although it is known that coffee and tea contain the alkaloids caffeine and theine, it is not known what percentage of loss of the caffeine occurs by roasting the coffee, or how much of it and other substances are, by that process, extracted; nor is it known whether, aside from the principle mentioned, there are no other effective ingredients in coffee. With a view of settling these questions, Mr. Aubert has carried out some experiments, from which we condense the following: When the coffee was roasted until it assumed a bright brown color, no caffeine was discovered in the collected vapor; but by roasting it until it became almost black and assumed a fatty luster, the alkaloid could readily be found. The loss occurring in this wise amounted to 0·927 per cent. On the other hand, the extract from strongly roasted beans is poorer in caffeine than that produced from the less roasted. With regard to the physiological effects of caffeine upon animals, it produces, in sufficiently large doses, increased excitability and even tetanus, and thus acts like strychnia. And another similarity to this poison consists in that the action ceases as soon as respiration is sustained artificially, five minutes' respiration being sufficient to make even large doses inoperative. With regard to the question whether the effects of the extract of coffee are dependent upon its amount of caffeine, M. Aubert has discovered that an infusion of coffee, from which this principle had been separated, produced different but not less characteristic effects upon animals. However, it seems to be not yet decided to what ingredient coffee owes the invigorating effect to which its extensive use is due.

REMEDY FOR A COLD IN THE HEAD.

Dr. Hager recommends for this purpose a mixture of five parts carbolic acid, six parts sal ammoniac of specific gravity 0·960, ten parts distilled water and two parts alcohol. This fluid is poured into a glass with a wide neck, one half full of pulverized feather alum. It is applied by pouring a few drops upon blotting paper and inhaling the vapor, with closed eyes, through mouth and nostrils, and repeating the operation once every two hours.

IMITATIONS OF MARBLE.

Most marble imitations consist of glue and gypsum or chalk, of paper pulp and gypsum, or of lime and glue. Pichler in Vienna has published the following account of another imitation, said to be peculiarly adapted for plastic decorations of all kinds: Take one pound of good glue and boil it down so that it will be quite thick, add then half a pound of resin or, better still, Venice turpentine, and mix well. Prepare a mixture of fine chalk and such mineral colors, finely pulverized, as are required for certain imitations. The less the ingredients are mixed, the better will be the imitation. The paste formed by blending the two mixtures is then kneaded until of the proper consistence. A few drops of Provence oil may be added to it. This mass can be immediately used, and becomes hard like stone. If desired to be kept for a while, it is only necessary to wrap it in a moist cloth.

WHITE PAINT FOR METALLIC PURPOSES.

When oil paints are used for metallic surfaces that are subjected to heat, they turn yellow and brown from the burning of the organic portion of the paint. If, instead of oil, soluble glass be used, there will be no organic or combustible substance to brown it. Zinc white mixed with soluble glass of from 40° to 50° B., to the consistency of ordinary paint, forms a beautiful and permanent color that will stand any required heat, without browning and blistering, and can only be removed by mechanical means. A not very large quantity should be mixed at one time, as a chemical change takes place and the paint hardens.

SIMPLE FIREPLATING FOR IRON.

By rubbing the surface of iron or other metals with soda amalgam, and then pouring over it a concentrated solution of chloride of gold, the gold is taken up by the amalgamated surface, and it is only necessary to drive off the mercury with the heat of a large lamp to obtain a fine gilded surface that will bear polishing. By writing or drawing a design on the iron, the drawing will be reproduced in pure gold. Silver and platinum salts are said to act in a similar manner to the gold.

A DRYING OIL OF A LIGHT COLOR.

Put about 25 lbs. genuine linseed oil in an enameled iron pot which will hold about twice that weight and put it over a quite hot charcoal fire, and heat to the boiling point for about half an hour. In the meantime, a second person triturates 2 ozs. genuine hydrated oxide of manganese in linseed oil. This is now dropped carefully into the boiling oil, stirring with a wooden spatula. When the oil foams and swells up, the dropping in of the manganese is suspended until the tumultuous action subsides, and then the remainder is added, and the dish containing it is rinsed out with oil which is also added. It is now boiled for an hour, or, if a very rapidly drying oil is required, for 1½ or 2 hours. When taken from the fire, it is closely covered, let stand for 24 hours, and then decanted from the sediment that settles. The pure oil is put in bottles and bleached by exposing it to the action of the sun and moonlight. Mr. Gromann, the inventor, thinks it bleaches more rapidly in the light of the moon than in that of the sun. Whether moonlight really bleaches it better than sunlight, we cannot say.

DETECTING STRYCHNIN.

P. Bert has found another useful and remarkable property of carbolic acid, namely, that it dissolves the salts of strychnin, and may be used in detecting its presence. If 0·2 grain of hydrochlorate of strychnin be dissolved in 100 grains of water, and then shaken up with a few drops of carbolic acid, an emulsion is formed of the acid and alkali. By filtering, all the strychnin is obtained, and this is then separated from the carbolic acid by shaking it with ether and water. Separated in this way from decaying animal tissues, it can be tested in the usual manner.

REDUCING SILVER SOLUTIONS WITH PHOSPHORUS.

The silver residues of the photographer are readily precipitated by common salt or muriatic acid, and the chloride formed is sold as such, or reduced by zinc and sulphuric acid or in any other convenient manner. The chemist, however, has many other silver residues besides the nitrate and the haloid salts; and, in mixing all his waste silver compounds, curious chemical reactions take place in the waste jar, so that the question of recovering the silver is far more complicated with the chemist than it is with the photographer. Many of these salts of silver are not decomposed by muriatic acid, but all are decomposed by phosphorus. The phosphorus is used in the form of phosphoric ether; a suitable amount is added and well shaken; a black precipitate at once separates, the liquid remaining more or less yellow or brown in color. If the precipitate contains little bright specks, the silver is not yet converted completely into the phosphide of silver, and more phosphoric ether is added until the precipitate acquires a uniform black color. It is then filtered, and the precipitate is washed and afterwards boiled with caustic potash. The metallic silver is then at once obtained in a powder. If it is desirable to obtain the silver in a solid mass, it is done by fusing pure potash in a crucible and gradually dropping into the fused potash small portions of the dried precipitated phosphide of silver, which is thus both reduced and fused in the same, operation, at a much lower heat than that required for melting silver, since the inventor of the process, Julius Krüger, informs us that the heat of an ordinary stove or furnace suffices for the procers.

A TENACIOUS COLLODION FILM.

A collodion film of considerable strength may be prepared by making a concentrated solution of gun cotton in equal volumes of ether and absolute alcohol, and adding to it a small quantity of balsam of copaiba. This collodion solution, when largely diluted with ether and alcohol, may be used for rendering linen and cotton fabrics waterproof.

SCIENTIFIC AND MECHANICAL POSSIBILITIES.

In our great desire to increase and add to the comforts of life, we must not lose sight of prolonging life and youthful vigor.

Year by year, the laws of health are better known and observed. We are learning that disease is generally caused by misconduct; by avoiding the causes, we escape the consequences. Hence, in nearly all civilized countries, the average duration of life is steadily increasing. In Geneva, accurate registers have been kept of the yearly average of life since 1560, which was then twenty-two years six months; in 1833, it was forty years and five months. Thus, in less than three hundred years the average duration of life is nearly doubled. In the fourteenth century, the average mortality in Paris was one in sixteen; it is now about one in thirty-two (or, rather, it was before the Franco-Prussian war). In England, the rate of mortality in 1690 was one in thirty-three, now, about one in forty-two. Yet even now, millions all over the world prematurely die. If it is true that people lived in the so-called patriarchial days to be hundreds of years old, why not now, if strict obedience to the laws of our being is observed for successive generations? Some theologian may reason that man's days were afterwards appointed at three score years and ten; but as science pays very little attention to theological notions of this character but aims at a much higher proof, that of undisputable facts, we will embrace her as our standard, and confidently look forward to that glorious epoch, when science will have conquered all absurd and theological whims, when the human mind will be loosed from the galling chains of superstition. Is it not possible that science may yet show the necessity of changing the expenditure of our churches and theoretical gorgious teachings and training to that of common life education? Has not scientific enlightenment opened our public parks and libraries on Sundays, when the body may be invigorated and the mind improved and enlightened? Science marches steadily onward and upward, always victorious. As mechanism perfects the weapons and means of destruction, war becomes more dreaded, and no doubt it remains for the work of science and mechanism to stop human butchery. But "Oh," asks some one, "what is to be done with such a mass of people as will accumulate on the earth?" Why, the fact is that the earth is not one twentieth peopled now. Talk about the overcrowded population of Europe. England itself is not one fourth populated at the present time, and there is not the least call for emigration. I travelled twenty-five miles one day in England through what is called the "dukeries." These are held by law without a shadow of title that they can show, and all of this vast tract of land is not one twentieth part cultivated, and what is cultivated is not producing one fourth which it might even by present knowledge, and this one tract of which I speak is but a very small portion of the vast tracts that are in similar deplorable condition. The Crown lands, of which the New Forest, so called, contains 30,000 acres of forest, all may yet be made to produce like the fancied garden of Eden.

Science is yet to teach man all of the blasting influences of the deadly poisonous uses of intoxicating drinks, and of tobacco, which adds nothing to man's bodily vigor, nothing to his mental ability. Just for one moment think of the corn, potatoes and apples, worse than wasted and used to make whiskey.

Hundreds of thousands of acres of the very best and highest cultivated lands are set apart to raise the most despicable, filthy and vilest of all weeds that grow—I mean tobacco—which lawyers, doctors, parsons, judges and statesmen roll in their mouths—which is as poisonous as the venom of the copperhead. In the beautiful light of the day that is dawning, these vile demons must vanish from the earth.

Our own Dismal Swamp, that in my schoolboy days was pictured with alligators and reptiles, by the glorious light of modern science is being made to blossom like the rose. There is no land so poor that intelligence and industry cannot enrich it.

The Chinese carry earth up the mountains and deposit it on the bare rocks, on which they succeed in raising valuable crops. The very lands that have been cursed by man's ignorance and wickedness, like portions of Virginia, raising slaves and tobacco, may become the orchards of America. Palestine may yet be, what it was once represented as being, "a land flowing with milk and honey," the great valleys of the Tigris and Euphrates be regenerated and be repeopled by a greater population than Nineveh or Babylon ever knew, with free governments that, like our own glorious land, will guarantee to men the fruits of their labor, and, above all, with communities using their capital and intelligence for the welfare of all.

J. E. E.

A TYPO-STATUE TO HORACE GEEELRY.

The printers of New York are uniting in a movement to erect a statue of Horace Greeley at Greenwood Cemetery, near this city, where his remains have been placed. It is proposed to cast the statue in type metal, which from its known tendency to expand a little in solidifying, gives a sharp and definite outline. All printers in the United States are invited to contribute a pound of old types that have been worn out in the service of teaching the people. Printers in all parts of the country are also requested on February 3, 1873, to set up and give the proceeds resulting from the setting up of 1,000 ems towards the object, the money to be sent to the President of the New York Typographical Union, 22 Duane street, New York city.

THE CHINESE FOOT.—The Chinamen, to appear in easy circumstances, are in the habit of wearing ridiculously long finger nails, from one or two inches to half a foot, which require shields to protect them from injury.

Very few barefooted persons are to be seen in Pekin. The beggars, devoid of everything else, are seldom destitute of shoes.

Long toe nails are impossible. They must be pared even to the quick, to prevent injury and severe pain from the shoe, the continued pressure and friction of which often cause serious troubles, suppuration, and even destruction of the bones.

The Chinamen admit the absurdity of their small shoes, but custom, fashion, and the dread of innovation are too strong even for celestials.

ATTACHING SLATES.—A Boston architect says he has been in the habit for many years of bedding his roofing slates in hydraulic cement, instead of having them nailed on dry in the usual way, which leaves them subject to be rattled by the wind and to be broken by any accidental pressure. The cement soon sets and hardens, so that the roof becomes like a solid wall. The extra cost is ten or fifteen per cent, and he thinks it good economy, considering only its permanency and the saving in repairs; but besides this, it affords great safety against fire, for slate laid in the usual way will not protect the wood underneath from the heat of a fire at a short distance.

PROGRESS OF THE HOOSAC TUNNEL TO JANUARY 1, 1873.—Opened from east end, westward, 13,196 feet, and from west end, eastward, 8,706 feet, making the total length opened 21,902 feet. There is 3,129 feet remaining to be opened, being 391 feet less than two thirds of one mile.

FROM scientific pursuits a certain dignity and grandeur result. True, they demand sacrifices, but every good must first be won by labor and energy.

PATENT OFFICE DECISIONS.

SIFTING SHOVELS.—P. A. SABBATON.—EXTENSION REFUSED.

LEGGETT, *Commissioner:*

The substitution of malleableized cast iron for the ordinary sheet metal material does not constitute invention.

IMPROVEMENT IN FRUIT CANS.—W. W. LYMAN.—EXTENSION REFUSED.

THACHER, *Acting Commissioner:*

When a patentee slept upon his right to such an extent as to utterly disregard, for ten years, the general infringement of his claims: Held, that it constituted financial laxity and want of due diligence.

SPRING SEAT FOR WAGON.—J. G. AND J. S. ARMSTRONG.—APPEAL.

LEGGETT, *Commissioner:*

Where parts are dispensed with and other devices employed in their places, rendering necessary certain additions to meet new aspects of the case: Held, that here is presumptive proof of invention, as distinguished from that form of skill which manifests itself in a mere change of expedients, such as the substitution of mechanical equivalents.

The decision of the majority of the Board reversed, and the patent allowed.

IMPROVEMENT IN SOLDERING APPARATUS.—CUTTING ed. KAYLOR.—INTERFERENCE.

LEGGETT, *Commissioner:*

An amendment to a preliminary statement setting up an earlier date than that originally stated and established, will not be regarded.

IMPROVEMENT IN HATS AND BONNETS.—KENDALL & TRESTED ss. SCRYMGEOUR.—INTERFERENCE.

THACHER, *Acting Commissioner:*

A case where an exhibit, relied upon by one party to prove an invention as having been made at a certain previous time, fails to show the feature of the invention as specifically described in and limited by the claims of each of the parties litigant.

A hat, made of a piece of shaped fabric covered with a film of pulp and then pressed so that the materials are intimately united, differs essentially from one in which a piece of woven fabric has been placed as a lining within a pulp hat previously formed.

Facts for the Ladies.—Mrs. A. K. Brown, Galesburg, Ill., has used her Wheeler & Wilson Lock-Stitch Machine since 1867, and it is now in good running order, the first ten years making bags for a flour mill, averaging fifty-five bags a day, besides the sewing for a family of sixteen. See the new improvements and Woods' Lock-Stitch Ripper.

Recent American and Foreign Patents.

Lubricating Journals.

Joseph R. Morris, Houston, Texas.—The invention consists in providing the oil box on the end of journal bearings with a concave distributor, attached to extremity of axle and revolved so as to raise the oil at each revolution and throw it on a shelf, from which it trickles slowly but continuously upon the journal.

Bed Lounge.

Samuel Kennedy, Allegheny City, Pa.—This invention consists of a lounge provided with a large hollow arm or reclining support, which is hinged to the end and closes down on the mattress to conceal the pillows, but swings over from the mattress to make room for the head of the bed, when used as such.

Spring Seat for Chairs, Cars, etc.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring seat for chairs, cars, etc., which shall be simple in construction, strong, durable, very elastic, and not liable to get out of order; and it consists in a combination of elastic blocks or springs with inclined bars hinged at the top and bottom to the seat, and a bottom plate or frame.

Umbrella Stand for Church Pews.

Elbert Snedeker, Brooklyn, N. Y.—This invention has for its object to furnish a neat and simple umbrella stand for church pews or public halls, which shall be so constructed that when not required for use it may be turned up out of the way. To the floor in the forward corner of the pew is secured a small trough of metal, provided with a short pipe, leading down through the floor to conduct off the water that may drip from the umbrellas. The drip or waste water may be led away. The inner end of the plate has a downwardly projecting flange formed upon it to guide the water into the trough. The upper surface of the plate has ridges formed upon it to prevent the ends of the umbrella from slipping around. To the under side of the outer part of the plate is attached, or upon it is formed, a flange or feet, of such a hight as to raise the outer end of said plate a little higher than its pivoted end, so that the water may flow from it freely into the trough. When not required for use the plate is turned up along the end-board, where it is secured in place by a button. A strap or rod, either elastic or non-elastic, flexible or rigid, is secured at one end to the back. When the holder is flexible, it may be hooked upon a hook or other catch. When the holder is rigid, its free end needs no support. A holder is arranged to receive and secure the upper parts or handles of the umbrellas while standing upon the plate.

Wash Boiler Attachment.

William Tinner and John C. Tregear, Stockton, Pa.—This apparatus is a device to be placed within an ordinary wash boiler for creating the desired currents of water through the goods. This inserted device consists of an oval rim of such size as to fit the ordinary wash boiler when placed within the same. This rim holds two bottoms, the lowermost of which is about an inch or more above the bottom of the ordinary wash boiler that contains the device. Above the upper bottom is arranged a sort of rack upon which the clothes to be cleansed are placed. From the ends or sides, or either, of this device project vertical tubes or hollow pillars, which have apertures at their upper parts. The upper bottom is funnel shaped, and open in the middle, so that the water on top of it may flow down into the space which is formed between the two bottoms. This space communicates with two boxes that are arranged beneath the lower bottom. Openings in the sides of these boxes are or may be closed by means of valves. These valves, it will appear, are at the sides of the space which is formed between the bottom of the containing boiler and the bottom of the inserted boiler. The water in the space, becoming overheated to create steam, will, by its pressure of expansion, first close the valves. The steam will then ascend in the hollow pillars with the hot water and cause a constant stream of such heated water to be brought through the tubes upon the clothes on the rack. As quick as the pressure within the chamber is diminished, the valves will be opened by the pressure or weight of the water from within the boxes. In this manner circulation will constantly be going on; but it will be seen that the water poured upon and through the clothes always passes in one direction, thus taking away all impurities.

Car Axle.

George W. Miltimore, Janesville, Wis.—This invention has for its object, principally, to furnish a railway car axle so constructed as to have less friction of the bearing surfaces, to secure greater freedom from torsion occasioned by curves or irregularities of the track, and less liable to injury from the concussion and wear and tear than is incurred under the usual system, while it is likewise adapted to prevent access of dust, etc., to the bearings, and to have its several parts readily taken apart for any purpose. To this end it consists, first, in so combining a revolving sleeve with a solid and stationary axle, and forming annular and other oil reservoir spaces and passages between them, as to maintain a circulation of oil when the car is in motion, whereby it is delivered in a cool, constant stream on the bearings; second, to the arrangement of oil and waste reservoirs in such relation to each other and the bearings that the oil is fed from the former to the latter in a small stream, and thence to the bearings by supplementary passages; third, to so arranging the waste chamber that, when the supply of oil in the reservoir proper is exhausted, the bearings will continue to be lubricated as long as any oil remains in the waste chamber, thus adapting the axle to make a good "run" without the aforementioned supply or circulation of the lubricant; fourth, to providing the oil reservoir with two supply passages or apertures, one being formed in the sleeve, and designed to be utilized when the reservoir requires refilling at long intervals, or at the termination of a long run, while the other is formed in the ends of the solid axle, and communicates directly with the waste chambers, so as to be utilized as conditions may require; fifth, to the construction of the bearing blocks with reference to excluding dust from the friction surfaces: sixth, to employment of a hardened bearing plate and journal boxes for taking the wear, the latter being removable so as to admit of renewal when necessary; seventh, to other features and details of construction. This relates to a very important invention, portions of which were secured under previous patents, and when it has been fully secured in foreign countries, engravings will be executed and produced in the SCIENTIFIC AMERICAN.

Spinning and Drawing Frame.

Hugh McEntee Ward, Loop Bridge Mills, Ballymaconaghy, Ireland.—This invention consists in machinery for spinning and twisting fiberous substances. The object of the invention is to stop the supply of sliver or material to be twisted or spun to the top or feed rollers when the sliver or thread breaks. To this end is provided for each pair of feed rollers an arrangement of mechanism, which, on the breaking of the sliver or thread, will be set in action and will push the sliver out of the bite of the rollers, and will hold the broken end securely until the attendant pieces the broken thread or sliver and the mechanism is restored to its normal position.

Portable Balcony.

Elisabeth Balmforth, Danbury, Conn.—This invention consists in the peculiar construction of a portable balcony, provided with a folding and hinged railing. The platform consists of two stringers, connected together by the floor, made of slats. On this floor is a railing, in three sections, so as to inclose the front and ends of the floor. The end sections are hinged to the floor so that they may be folded down on to the floor when the balcony is not in use. The front section is hinged to a base piece, which raises it so that it folds down on to the end sections. When the balcony is in use, the sections of the railing are confined together by hooks. The platform is placed on the bottom casing of the window, and supported on the outer edge of the sill by means of small blocks, or a strip of wood laid loosely on the sill. The stringers extend inside and are provided with a series of holes, by means of which the platform is adjusted to walls of different thicknesses. Ordinarily a simple pin through the holes will be found sufficient. The foot of each brace is shod with rubber, gutta percha, or similar material, to add to its adhesiveness on the wall.

Die for Forming Basils of Lockets.

Heinrich Henrich, New York city, assignor to himself and Henry Henze, of same place.—This invention has for its object to furnish an improved die for forming locket, stud, and button basils with inwardly inclined sides and inwardly projecting base flanges, enabling the basil to be formed quickly and accurately and in one piece; and it consists in a die, in the face of which is formed a groove having its inner side vertical and its outer side inclined.

Spring for Furniture, etc.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for furniture, such as chairs, sofas, lounges, mattresses, etc., for doors and vehicles, and for other purposes; and it consists in an improved spring formed by connecting rubber blocks and rigid blocks with each other alternately by means of flexible connections. The arrangement of the connectors with the blocks depends upon the use to which the spring is to be applied. One or more sets of the springs may be arranged in connection with each other as the purposes for which the springs are intended may require. For instance, by placing two of the springs back to back a double spring will be produced suitable for a door swinging in both directions, each part of the spring acting in turn, and both bringing the door quickly and surely into a closed position.

Wheel for Vehicles.

William H. Trenwith, Brooklyn, N. Y.—The object of this invention is to provide means whereby the burden of a vehicle and its load may be utilized as an aid in advancing or retarding the progress of the vehicle; and it consists of a movable wheel arranged within a revolving traction wheel of larger diameter, and provided with a diametrical slot in which is a movable axle that supports the body of the vehicle in the usual manner.

Lock.

Joseph Keath, Ash Grove, Ill.—This invention consists of a series of bolts in two parts arranged for being separated after they are shot by a peculiar detaching apparatus, so that the parts of the bolts whereon the keys act may be moved without affecting the parts by which the door is secured, and the bolts cannot be withdrawn till the two parts are connected again. The invention also consists of a regulator combined with the bolts in a manner to readjust the bolts after being disarranged and confused to prevent the picking of the lock.

Carriage Prop Blocks.

Charles H. Davis, Syracuse, N. Y.—The object of this invention is to furnish a prop block for carriages, which shall be in itself durable while it affords a cushion for the bow of the carriage top to rest upon; and it consists in a tubular piece of iron flanged out at each end, and with a longitudinal slot in which is confined a flanged piece of rubber, which is held by an arm up in the slot and has wings that bear against the under side of said tube.

Elevator.

William Eighmie, Beekman, N. Y.—This invention furnishes an improved elevator for ice or other substances. It consists of a horizontal windlass with trucks or carrier blocks operating on inclined planes for elevating ice. Two elevator ropes are wound in reverse directions upon the windlass and connected with the elevator trucks, so that by revolving the windlass, through suitable mechanism, the trucks are caused to alternately descend and ascend the inclined planes for receiving or discharging the load. At the lower or receiving end of the inclined plane is located a hinged or pivoted plate or switch, which operates to guide the carrier truck in rear of the material to be elevated, when by means of the windlass the truck is caused to engage the ice drawing it up the plane, the switch being automatically raised by the truck passing over the same. A hinged open vise applied to the end of the power shaft, connected with the same by means of a revolving iron or collar, furnishes a devise for hitching a horse to said power shaft for moving the same in opposite directions.

Jewelry.

Shubael Cottle, New York city.—The object of this invention is to make, out of a single piece of gold, the bases for buttons, studs, and settings. The blank is placed over and carried down by a male die into a female die. The effect of this operation is to form a blank with bottom and upright barrel, but rounded at the corner. This blank is then inserted over a head of the mandrel, while a ring is placed over the blank. While the blank is held in this position and the mandrel retated in a lathe, the burnishing tool is applied to the rounded corners and pressed thereupon until the bottom and barrel are at a sharp angle to each other. The base for the stud or setting is then finished and ready to be used for its intended purpose.

Ash Sifting Shovel.

George W. Dean, New York city.—The invention consists in forming shovel sieves of flexible wires, hooked to the body by bending the ends after passing them through holes at the front and rear of the shovel. It also consists in a peculiar arrangement of holes whereby the wires may be spaced to suit various sizes of coal.

Saw.

Alfred P. Sproul, Cherryfield, Me., assignor to himself and George H. Coffin, of same place.—This invention consists in a transverse slot at each end of the saw for the bolt, by which the strap, bar, or other device is connected for attaching the saw to the gate so that the saw can be readily shifted forward or back on the said connections to alter the strain or overhang of the saw.

Machine for Scouring and Polishing Wire.

George Broomhead, Paterson, N. J.—This invention consists in a machine for scouring and polishing wire, by means of which a scouring and polishing cloth, or similar substance or material, is given a reciprocating motion on the wire while the wire is drawn through the said scouring and polishing substance or material and wound upon a spool drum or cylinder

Ditching Machine.

Lewis W. Fisher, Rockville, Ind.—This invention consists of a frame adapted to drag along the ground, with a ditching spade arranged to be adjusted lower for each successive cut, and to force the earth raised by it up to the surface in front of a diverging portion of the frame, which spreads the discharged earth upon each bank of the ditch.

Musical Transposing Index.

Joseph Low Ober, Beverly Farms, Mass.—The invention consists in combining, with a sliding index plate and natural scale, a sharp scale and a flat scale on separate plates that are hinged together and notated so that the two scales can never appear simultaneously to the eye of the learner.

Spark Arrester for Locomotives.

Roswell D. Grant, Beardstown, Ill.—This invention relates to a mode of arresting sparks from locomotive and other steam boiler chimneys, and consists in a perforated or wire gauze tube at the bottom of the smoke stack within the smoke box, and in a conical flange around the tube, and in a slip joint at the top thereof, and connected with the exhaust tubes at the bottom.

Saw Setting Device.

Alexander Greeley, Stephensville, Wis.—The object of this invention is to furnish an apparatus for setting the teeth of saws. When a saw is placed upon the plate, a clamp bar is forced down to the saw plate by turning round a lever and screw. The teeth of the saw will strike a guide or gage, and the plate may be so adjusted that the point only of the tooth will receive the jaw. The saw set is therefore adapted to very fine as well as coarse toothed saws. The teeth of the saw are set or bent by raising the cam lever, and forcing down a suitably arranged jaw.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 13 to December 19, 1872, inclusive.

ARTIFICIAL FUEL.—E. F. Loiseau, Mauch Chunk, Pa.

CAR HEATER.—W. C. Baker, New York city.

CAR WHEEL.—J. A. Woodbury, Boston, Mass.

DEODORIZING, ETC.—J. J. Craven, Jersey City, N. J.

GOVERNOR.—O. Marland, Boston, Mass.

MAKING NEEDLES.—Mallett Manufacturing Co., New Haven, Conn.

SETTING CARBON POINTS.—T. W. Baxter, Chicago, Ill.

SHIP'S VENTILATOR, ETC.—J. Reilly, New York city.

STEREOTYPES.—G. Lauder, Pittsburgh, Pa.

WOOD PAVEMENT.—E. P. Morong, Boston, Mass.

NEW BOOKS AND PUBLICATIONS.

THE UNITY OF LAW, as exhibited in the Relations of Physical, Social, Mental, and Moral Science. By H. C. Carey. $3.50. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut Street.

This last emanation, from an author very popular among his own school proposes to demonstrate a unity of law as a necessary complement, in the moral world, to the unity of force, now universally accepted by students of physical science. It is a handsomely printed volume.

ELECTRIC: A Treatise on Electric Phenomena, the Laws governing the same, and Lightning Rods and their necessary Application to Buildings for Safety. By John M. Mott. Chicago: Rand, McNally & Co., 108 West Randolph Street.

This little book contains much information, expressed in the simple and lucid manner appropriate to an elementary work.

MANUAL OF LAND SURVEYING, with Tables. By David Murray, A.M., Ph.D., Professor of Mathematics in Rutgers College. New York: J. W. Schermerhorn & Co.

This is a valuable and exhaustive treatise on the surveying of land, and bears, on every page, the impress of the hand of a master of the science. It is eminently a book for the practical man and the student, and is replete with formulæ and tables of the highest value to the surveyor and engineer.

A MANUAL OF MICROSCOPIC MOUNTING. By John H. Martin. Illustrated with 118 engravings, lithographs, etc. Philadelphia: Lindsay and Blakiston.

This book is more than its title indicates. It gives a description of the apparatus necessary for microscopical research, as well as the methods of preparation and preserving the various objects. It is a complete and well illustrated work on its subject, which is daily becoming more valuable to the scientist and more cultivated as an elegant and interesting study.

A TREATISE ON THE CONSTRUCTION AND OPERATION OF WOOD-WORKING MACHINES, including a History of the Origin and Progress of the Manufacture of Wood-working Machinery. Illustrated by Numerous Engravings, showing the Modern Practice of Prominent Engineers in England, France and America. By J. Richards, Mechanical Engineer. Price, $6. E. & F. N. Spon, Charing Cross, London, and 446 Broome Street, New York.

This is a most valuable and useful book, and, emanating from the pen of the head of the well known firm of Richards, London, and Kelley, of Philadelphia, will need little commendation as a practical and trustworthy treatise. Important, especially in the United States, as is woodworking as a national industry, no complete history and description of the various mechanism employed has heretofore been attempted. The work before us is profusely illustrated with views of the best machines of America and Europe, and it forms a valuable contribution to the mechanical literature of the day.

THE GREAT EVENTS OF HISTORY, from the Creation of Man till the Present Time. By William Francis Collier, LL.D., Trinity College, Dublin. Edited by an Experienced American Teacher. New York: J. W. Schermerhorn & Co., 14 Bond Street.

This book may be called a skeleton history, and in it an account of the principal events occurring in the world is laid before the reader in a manner simple and clear, and calculated to leave an impress on the memory. It is somewhat in the style of Ince's "Outlines," but is an improvement on that popular school book.

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

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

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Notes & Queries

1.—Which is the easiest way to manufacture paints from ochreous earths?—R. M.

2.—How can I combine gum shellac and tallow so that they will not separate on heating?—E. S.

3.—How can I work a blue color into soap? I have tried several times, but the blue turns green.—M. H. B.

4.—How is dynamite exploded, and what force, relatively to that of gunpowder, does it exert?—D. T.

5.—Can any one tell me who is the best author on pyrotechny?—P. L.

6.—What is the best way to wash or otherwise clean a Panama hat, making it look new?—S. L. A.

7.—F. E. A. asks: What is the best method of straightening a circular saw when it gets sprung?

8.—E. S. S. asks: Why is it that the warm water pipe in my house always freezes first? What should I do to repair it?

9.—J. F. asks: How can I prepare bone for manufacturing purposes after it has been boiled by the fat melter?

10.—H. T. S. asks:—What are the materials and processes for staining and varnishing violins?

11.—G. S. T. asks: How can I make a good slate paint? What is silicate paint?

12.—H. B. asks: How can I prepare and apply the varnish to ferrotype pictures?

13.—J. C. asks: How can I make and use the insulating material called kerite?

14.—A. H. asks: In tanning skunk skins, how can I get rid of the disagreeable smell?

15.—J. B. asks: Will some one describe the process by which marble and slate are colored in imitation of colored marbles?

16.—What will take the stains out and renew the color of ivory knife handles, discolored by putting them in water, etc.?—J. S. H.

17.—N. A. K. asks: What are the smallest dimensions for a canvas boat to carry two persons, and will common paint do to waterproof it with?

18.—D. A. asks if Mallet's method for oxygen is patented in the United States, and the probable cost of the machinery described in the SCIENTIFIC AMERICAN of December 28, 1872.

19.—Is it practicable to run a two foot millstone by friction gear? I have never seen a stone run in that way, but from the information contained in the SCIENTIFIC AMERICAN, I cannot see why it will not do.—W. W. St. J.

20.—I should like to know how to tin iron pins, or other small iron pieces, cheaply in large quantities. Can they be tinned in the same manner as brass pins?—I. H. B.

21.—I have a steel square, which I have kept oiled for the prevention of rust, using common machine oil. The steel has lost its spring and will remain bent. Does the oil affect the temper?—S. L. A.

22.—Two boilers are connected by a ¾ inch steam pipe, each of them having a separate fireplace. A gage on the pipe, midway between the boilers, shows a pressure of 60 lbs. How much pressure is there in each of these boilers?—J. W. L.

23.—S. R. G. asks: Is soluble glass (liquid silex) to be relied on as a cheap and durable paint to apply to the outside of buildings? What is the best way to apply it? Of what, and by what process is it manufactured? Will it cover as much surface per gallon as lead and oil? On the whole, is it as economical, taking into consideration the prices of both, as lead and oil?

24.—A. G. C. asks: How can I temper taps? I can temper dies right every time by drawing the temper on a hot plate, but I cannot draw the temper of taps in that way; and if I draw it in the blaze of a fire, they will be so black that I cannot see when the color is right. I want some one to tell me how I can do it right every time.

25.—H. C. K. asks: Is there any rule for laying off wooden axles, so as to give the wagon the right track and the wheels the correct gather and set? What should be the length and taper of the spindle, if it is, say, 3¾ inches at the butt? And should the length be increased proportionately to the diameter?

26;—Having heard it asserted that if the key note of a suspension bridge be sounded (say by a fiddle) dangerous undulations occur, imperiling the safety of the bridge, and further, that a pair of horses keeping time might strike the key note of a suspension bridge, producing alarming vibrations, I would ask you if these assertions are correct, and if so, for a brief explanation of them.—T. P.

27.—S. R. G. says that three inventions are wanted. First, a common sense lard press for family use, made strong, durable, and so simple that any woman can understand and use it. The second is a process for extracting the salt from sea water by some simple and very cheap means, so that a half cargo of fresh water need not be taken to sea with every vessel. The third is a universal need in nearly every family. It is a potato parer, as simple as a common apple parer. If so made it would bring a sure fortune to the lucky inventor.

28.—R. B. M. says: The heat of the street gas lamps, separated from the light and conducted to the base inside of the iron post, would be worth saving for the purpose of clearing sidewalks, preventing the bursting of the hydrants, service pipes, etc. Wire gauze and asbestos may be used to conduct and retain the heat. I have a clumsy apparatus from which these results seem to be attainable—but if experiments could be made on a larger scale, I doubt not valuable consequences would ensue. Now is the time to experiment. I should like to hear from Professor Tyndall on this question through your journal.

29.—C. A. de S. says: I am preparing a work in which a vast quantity of indexing, strictly alphabetical, is required. To do this in the ordinary manner requires an enormous amount of labor. Has there been no mechanical aid invented by which this labor may be lightened? If so, will you state where it can be found?

30.—J. D. B. asks: 1. Can a rack, coarse or fine, be cast in a chill so as to be as true as if worked up by machinery? The danger in casting in sand is that the teeth break for the reason that one or two of them have to sustain all the strain, while others do not touch each other. 2. Can a square thread, 1, 2 or 3 inches deep, be chilled into a block of casting so that a set screw or a clamping screw from 2 to 4 inches long and from ⅜ to 1½ inches diameter will work in the same as satisfactorily as if the thread were cut by a tap or a lathe tool? 3. Can such screws be cast in a chill and be afterwards true when steelified? I fear that the castings will be difficult to remove from the chill and will be full of flaws and porous, and thus they would be unfit to take the place of good wrought iron. 4. Which is the best metal for chills, cast iron, wrought iron, or steel? 5. Can malleable iron castings be annealed after being cast in a chill, as is done after casting in sand? 6. What is the tensile strength of wrought iron and of malleable iron?

Answers to Correspondents

H. W., of N. Y., says: I have a swinging circular saw, the two boxes or journals being 16 inches from centers. One journal will be cool all day, and the other will heat up in an hour and get quite hot. Each has an oil cup attached which feeds the oil well. The shaft is plumb and in line, and level with its corresponding or counter shaft. There are six journals or boxes on the shafts, and five of them will remain cold while the other heats. I have tried different methods to stop it, but they are of no avail. The saw has been running about seven months, and appears to be getting worse. What is the cause of it? The saw makes 1,200 or 1,300 revolutions per minute. Answer: The troublesome journals may be out of line, the boxes may be untrue, or there may be defects in the rubbing surfaces. Our correspondent can determine the cause most readily by a careful examination of brasses and journals. If the defect remains undiscovered, use a little sulphur in the lubricating oil until an opportunity can be found to lengthen the journal giving trouble. Where possible, always use self-adjusting boxes and obtain a journal three or four diameters long, or calculate the proper length, where data are obtainable. Keep the oil holes free and always smooth up the journal with a fine file where it has heated and cut.

W. L. L. asks why frost on the windows assumes such beautiful forms of vegetation. Answer: It is not certainly known, but it is supposed that each atom of matter in ice and other crystals is endowed with a sort of magnetism or polarity, in obedience to which the atoms arrange themselves in the various forms we observe; just as the particles of iron filings will, in the presence of a magnet, always arrange themselves in certain curves, floral in appearance, called the curved lines of magnetic force.

G. W. J. speaks of having seen a lunar rainbow, distinct, with one of the colors of the spectrum plainly visible.

W. H. W. asks: What is the proper mixture for plugs of fusible metal? Answer: Bismuth, 8, lead, 5, tin, 3 parts. Increase or diminish the bismuth to make it more or less fusible, respectively.

E. N. asks: What are the respective areas of Philadelphia, London, and Paris? Answer: The municipality of Philadelphia now covers an entire county, area 130 square miles. London and her suburbs have an area over 200 square miles in extent. Paris, inside the fortifications, contains about 28 square miles, but many Parisians live outside the barriers.

Z. D. asks how to tan cat and wood chuck skins with the hair on. Answer: Wash them in cold suds, then dissolve pulverized saltpeter and alum in hot water, add cold water, and soak the skins in it all night; hang them over a pole to drain; when dry, sprinkle with powdered saltpeter and alum; fold the flesh sides together, lay them where they will not freeze, turn every day till dry, then scrape the flesh side with a blunt knife and rub with pomice stone and the hands.

F. G. W. asks: How much less will a boiler sustain, in the direction of its circumference, on account of the pressure on its heads? Answer: See replies to earlier correspondents. No evidence of such weakening action as is indicated by the last question has been detected by experiment or pointed out by theory.

J. L. J. asks: What is crystallized alcohol? Answer: There is no such thing as crystallized alcohol. Alcohol has not been frozen by the most intense cold that chemists could artificially produce; it was rendered a little thick at 180 degrees below zero, but not crystallized.

W. L. L. says: Can some one inform me when the next comet will appear? I mean a comet visible to the naked eye, as the 1858 comet was. Answer: No one can foretell the appearance of a comet which has not been seen, as observations upon the visible path of a comet are necessary to predict its return. The comet of 1858 is supposed to have a period of about 2000 years.

W. P. P. says: Can I produce a gas or vapor that will take fire immediately on being exposed to or mixed with atmospheric air? Answer: Phosphuretted hydrogen has the remarkable property of taking fire spontaneously in atmospheric air or in oxygen gas. It is generally prepared by heating fragments of phosphorus with a strong solution of hydrate of potash or with cream of lime, taking care that all of the air is expelled from the flask or retort in which the experiment is made. A phosphide of lime has been prepared to be attached to life preservers: when the salt water comes in contact with the preparation, phosphuretted hydrogen gas is liberated, which takes fire immediately and thus indicates the position of the person who may have taken hold of the life preserver. There is another spontaneously combustible gas which does not possess such a disagreeable odor as the above, concerning which very little is popularly known. It is a compound of silicium and hydrogen, called the hydride of silicium or siliciuretted hydrogen. It may be obtained by electrolysis, or by the decomposition of silicide of magnesium, by weak hydrochloric acid. This latter compound is prepared by fusing together magnesium and silicium, also by mixing intimately 40 parts of fused chloride of magnesium, 35 of dried silicofluoride of sodium and 10 of fused chloride of sodium, with 20 parts of sodium in small fragments, and heating cautiously in a Hessian crucible. The slag resulting from this operation, if thrown into weak hydrochloric acid, at once liberates the spontaneously combustible hydride of silicium. It affords one of the most instructive and beautiful class room experiments within the range of chemistry, and was discovered a few years since by Professor Woehler of Goettingen.

A. C. R. says: Why do you encourage the cultivation of fish in your paper? Is there anything in fish as food to nourish the brain? Answer: Fish culture is one of the most important industries recently introduced into the United States. It is regarded of so much importance that commissioners have been appointed by the governors of many of the States to superintend and protect the business. There is a traditional notion that there is not so much iron and phosphorus in the meat of fish as in the flesh of animals; and hence, in Lent and times of fasting, the Papal Church allows its followers to partake of such food. Chemical analysis confirms a part of this theory, but the doctrine of inferior nourishment appears to find few adherents, as every one is fond of fish and will eat it, iron or no iron. We encourage everything that looks to a cheaper supply of food; it is hard work for the poor mechanic to earn his daily bread, and we favor reducing the price of all articles of nourishment, not excepting fish.

C. E. E. asks: What book is best adapted to the beginner in chemical analysis? Answer: There are no books equal to Fresenius' "Qualitative and Quantitative Chemical Analysis." They are large and expensive, but the investment, once made, will prove a permanent one. They will serve for reference during many years, and it is better to start with accurate and complete instruction than to encumber the memory with incorrect methods. Great mischief has been occasioned in trials for poisoning, in examining for precious metals, and in determining the value of composts, by following old and abandoned methods. It is better to start right; even if it costs more money at the outset, it will prove cheaper in the end to procure the large and exhaustive works of Fresenius.

R. A. R. asks: What is the probable value of a bed of cannel coal twelve feet thick, at a depth of one hundred and eighty feet? Are the veins usually extended, or does it lay in pockets only? What is its value compared with bituminous coal? Answer: Cannel coal is bituminous coal; it occurs in beds and seams; and its value depends upon ease of mining and proximity to market.

J. E. D., of Fishkill, N. Y., says: We have lately erected a school house in this village, and have trouble with our chimneys. Our building is of brick, about 65 by 36 feet, with heater in cellar and register in each of three rooms. Four chimney flues, 8 inches square start from the cellar, in the rear (end) wall, about 20 feet apart, rise perpendicularly about 20 feet, then converge at an angle of about 30° till about 4 feet apart, then at an angle of 60° or 70° till they meet, when they are carried up parallel, but separate, three or four feet through the roof, and are capped with a stone with 8 inch holes, and finished with two *terra cotta* tops about 4 feet high, with openings about a foot in diameter. Our heater pipe runs to one of these flues, and recently we have put up a stove, the pipe of which enters the same flue. We connected our heater with the other flue by another pipe but as the draft appeared less we disconnected the latter. Sometimes the flue draws well, and both heater and stove burn briskly, and at other times the fire only smolders. Our chimney is at the rear end of the ridge, and no high object is near except the tower at the other end of the building. Air in abundance is supplied to the cellar, around the windows, and down the stairs in the tower. We have tested the flue by letting down a brick with a string and find it clear. Answer: The difficulty arises from the fact that your flue is altogether too small. Eight by eight inches is the size usually given to flues intended for an ordinary grate fire in a room about fifteen feet square; but when you come to warm a school house, you must have a flue proportionately increased in size. The reason is evident; the greater the extent of the combustion, the more oxygen, and consequently the more air, you require to feed it. But a free supply of fresh air is only possible where an unobstructed outlet is provided for what may be called the burnt air, or that from which the oxygen is extracted. The friction in a small flue is too great to admit of a free discharge of the air, when no exterior force, such as the pressure of the wind, is present to overcome it. No flue should be the outlet for two fires: besides your stove pipe may enter the flue so far as to close it. The remedy is to enlarge the flue to eight by sixteen inches, or build one on the exterior of the wall of that size.

Will you tell me how long the tunnel under the river Thames is?—J. P. G. Answer: The Thames Tunnel is 1,200 feet between the shafts for ingress and egress. There is another tunnel, called the "Sub Way," which is higher up the river, and is 1,320 feet in length between the shafts, although the Thames is there somewhat narrower.

S. C. T. asks: Which makes the best starch, wheat, corn or potatoes? How many pounds to the bushel are there in each? Answer: Wheat flour contains 56 to 66 per cent, corn, 65 to 68 per cent, potatoes, 16 to 20 per cent, of starch. The economy of the manufacture of starch must depend upon the original cost of material and methods of production. Corn is largely used, as it is cheap and can be employed in a damaged state. Potatoes are extensively used in Germany. Wheaten flour unless damaged, is too valuable for bread to be generally recommended for starch.

C. F. F. says: With friction you can heat iron or other metal red hot, and you can burn wood. Could you heat a liquid by friction, by forcing it through a pipe or hole or by stirring it very rapidly? Answer: Yes.

O. A. B. asks: Can you inform me of any simple test for the purity of commercial bromide of sodium? Answer: Bromide of sodium is soluble in both water and in alcohol; any insoluble residue would be suspicious. The solution ought not to yield a precipitate with reagents that throw down potash.

In answer to A. A. O., query 1, page 362, I would say that for stuffing birds a mixture of grated bread crumbs, egg, pepper, sage, salt, etc., is the best. Press well into the cavities. Cure by placing them in a hot oven, for a longer or shorter time according to the age of the birds.—S. E. B.

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 Inventor's Task. By W. F. R.

On the Means of Preserving the Richness and Salubrity of the American Continent. By T. S.

On the Cooling of Dwelling Houses. By W. C. D.

On the November Meteors. By J. H.

On Polar Mutations. By J. A.

On the Direction of Storms. By O. P. B.

On Sundry Problems. By W. K. G.

On the Prevention of Conflagrations. By D. H. W.

On the Employment of Marine Camels at the Bar of the Mississippi. By C. W. S.

On Certain Forces in Nature. By J. A. C.

On the Squaring of the Circle. By C. R.

On the Utilization of Waste Heat as a Preventive of Leaky Roofs and the Snow Nuisance. By R. B. M.

On the Need of Turbine Wheels. By J. B. R.

On the Importance of a Knowledge of Astronomy. By D. P. T.

On the Qualities of Water in Motion. By J. B. R.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

December 24, 1872,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

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

23,344.—FASTENING SKATES.—E. Behr. March 12, 1873.
23,399.—HARVESTER.—I. S. & H. R. Russell. March 12, 1873.
23,416.—SAUSAGE STUFFER.—J. Wagner. March 12, 1873.
23,425.—ROLLING MACHINE.—H. B. Comer. March 12, 1873.
23,512.—FELT FIBER.—J. F. Greene. March 26, 1873.

EXTENSIONS GRANTED.

22,337.—CLEANING RICE.—W. Ager.
22,027.—PRINTING PRESS.—C. Montague.
22,216.—HAY AND COTTON PRESS.—H. Barnes.
22,429.—LOCOMOTIVE AXLE BEARING.—D. Matthew.
22,490.—MANUFACTURE OF STARCH.—S. T. Stratton.
22,443.—CORSET.—A. S. McLean.

DESIGNS PATENTED.

6,320.—CAN BRACKET.—H. R. Frisbie, Chicopee Falls, Mass.
6,321.—BOTTLE STOPPER.—W. R. Green, London, Eng.
6,322.—PARLOR STOVE.—L. W. Harwood, Troy, N. Y. city.
6,323.—SUSPENDING BRACE.—G. W. McGill, N. Y. city.
6,324.—COFFIN HANDLE.—W. H. Smith, West Meriden, Conn

TRADE MARKS REGISTERED.

1,089.—STOVES.—P. D. Beckwith, Dowagiac, Mich.
1,090.—CHEWING TOBACCO.—J. Brown & Co., Detroit, Mich.
1,091.—TONIC BITTERS.—A. Littlefield, Boston, Mass.
1,092.—OILS.—Cary & Co., New York city.
1,093.—CANNED GOODS.—J. F. Mallory & Co., Baltimore, Md.
1,094.—TOILET PERFUME.—Lanman & Kemp, N. Y. city.

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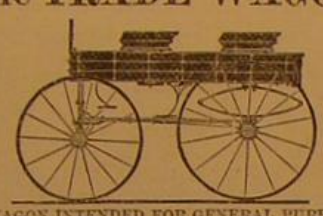
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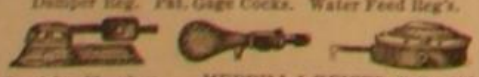
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STOLEN, on the 28th of Dec. 1872, my Valise, containing accounts with different parties. Also, two Patent Papers, dated Feb. 2 and Oct. 28, 1869, covering what is so extensively known as the HAFNER'S Pat. Eureka Coil Spring to prevent backlash on Mill Spindles. Said Patents also cover Spring for Horse Power. The Public are hereby cautioned not to buy any rights of said Patents, nor make any Payments, unless addressed to JOHN A. HAFNER, care of Anderson & Woods, Pittsburgh, Pa.

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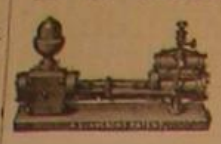
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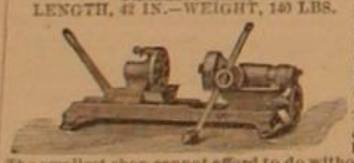
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