SCIENTIFIC AMERICAN

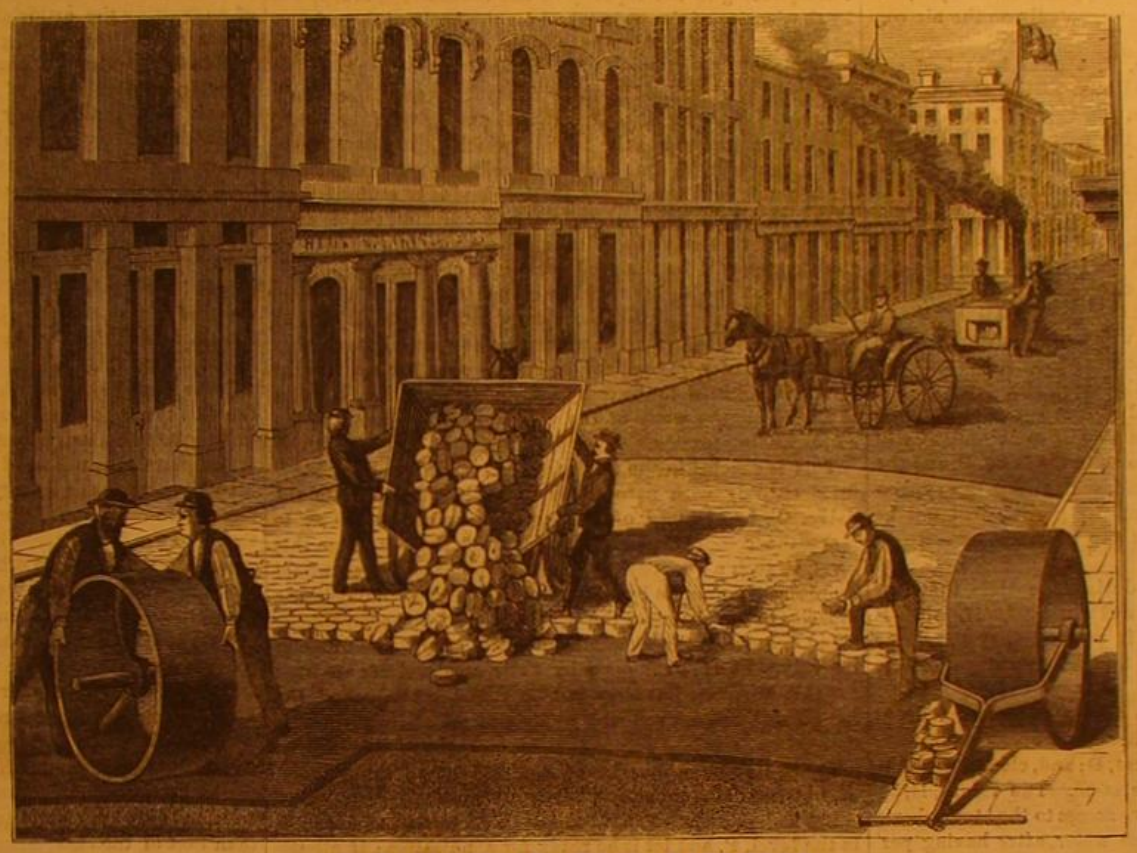
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Improved Wood Pavement.

The subject of street paving still continues to attract the attention of inventors, who cannot fail to perceive the extent of the field open to successful competition, and the rewards possible to any improvement in quality without increase of cost, or to decrease of cost without deterioration in quality. A still richer reward awaits the inventor who shall give to the public a better pavement than has yet been discovered at cheaper rates than those in use.

We do not understand that the inventor claims the pavement under consideration to be better than any yet discovered, but he does claim that it is better than any that can be laid at the same cost, while it is superior to many that cost much more. Having had no opportunity to inspect the pavement under wear, we must leave it to our readers to judge from the nature of the pavement, as derived from the accompanying engraving and description, how far these claims are justified in practice, simply giving it as our opinion that it possesses all the elements of durability to be expected of a roadway composed of the materials employed.



THE FLANIGAN WOOD PAVEMENT.

In putting down this pavement, the street is first graded in any of the well known methods, and the earth made compact by tamping or rolling. Upon this road bed is laid a concrete foundation, composed of broken stone, sand, or gravel, thoroughly mixed and bound together with concrete composition, the cementing material of which is chiefly Trinidad asphaltum. Upon this foundation are placed, on end, cylindrical blocks of natural wood (the bark removed), cut from young trees or saplings of small diameters (say from three to nine inches). Cedar, chestnut, and cypress trees of commonly small growth can be utilized in this pavement with, it is claimed, less liability of decay than pine, hemlock, spruce, or other woods, mostly used in other wood pavements. The irregularities of the natural wood prevent vertical displacement, and make the pavement stronger than when sawn blocks with parallel sides are used. The spaces between the blocks are filled with dry gravel or broken stone, and filled flush to the top with the hot melted asphaltic composition, which cements the blocks together and firmly to the foundation, making the roadway one solid mass impervious to water. The top of the pavement is then covered with the asphalt composition in which, when warm, is rolled coarse sand or grit, so that the water will be kept out, and the wood protected from wear. It is claimed that in this way a very high degree of durability is secured.

It is further claimed that the practically indestructible foundation, giving additional firmness to the roadway, entirely prevents frost under the pavement, and that the blocks and concrete filling are cemented to the foundation with a bond so perfect that the pressure is divided over large areas, preventing portions from sinking under heavy travel, and the surface from becoming uneven and "wavy" as occurs in some other pavements.

It is stated that actual experiments show that a moderate amount of excavation will not disturb the pavement. It seems obvious that pavement made from wood of about the same size and growth will wear much more evenly than that made from trees of various sizes. As small wood, that will be of no great value for lumber, can be utilized, the most durable, like cypress, cedar, and chestnut, can be used at a less expense than the more perishable pine, spruce, or hemlock lumber used in other wood pavements. If the last named woods are used, they can be treated by the most approved process, namely, creosoting, and still, it is claimed, can be laid at a less expense than any other good wood pavement.

Two great advantages in this pavement are its simplicity in laying and equal facility in taking up and relaying where sewer or gas connections are needed. The explanation is, that the concrete can be replaced so as to firmly reunite with the part undisturbed, enabling the blocks to be replaced upon the same uniform surface, cemented as before, making the bond complete, and obviating the unevenness made in the repairs of some other pavements.

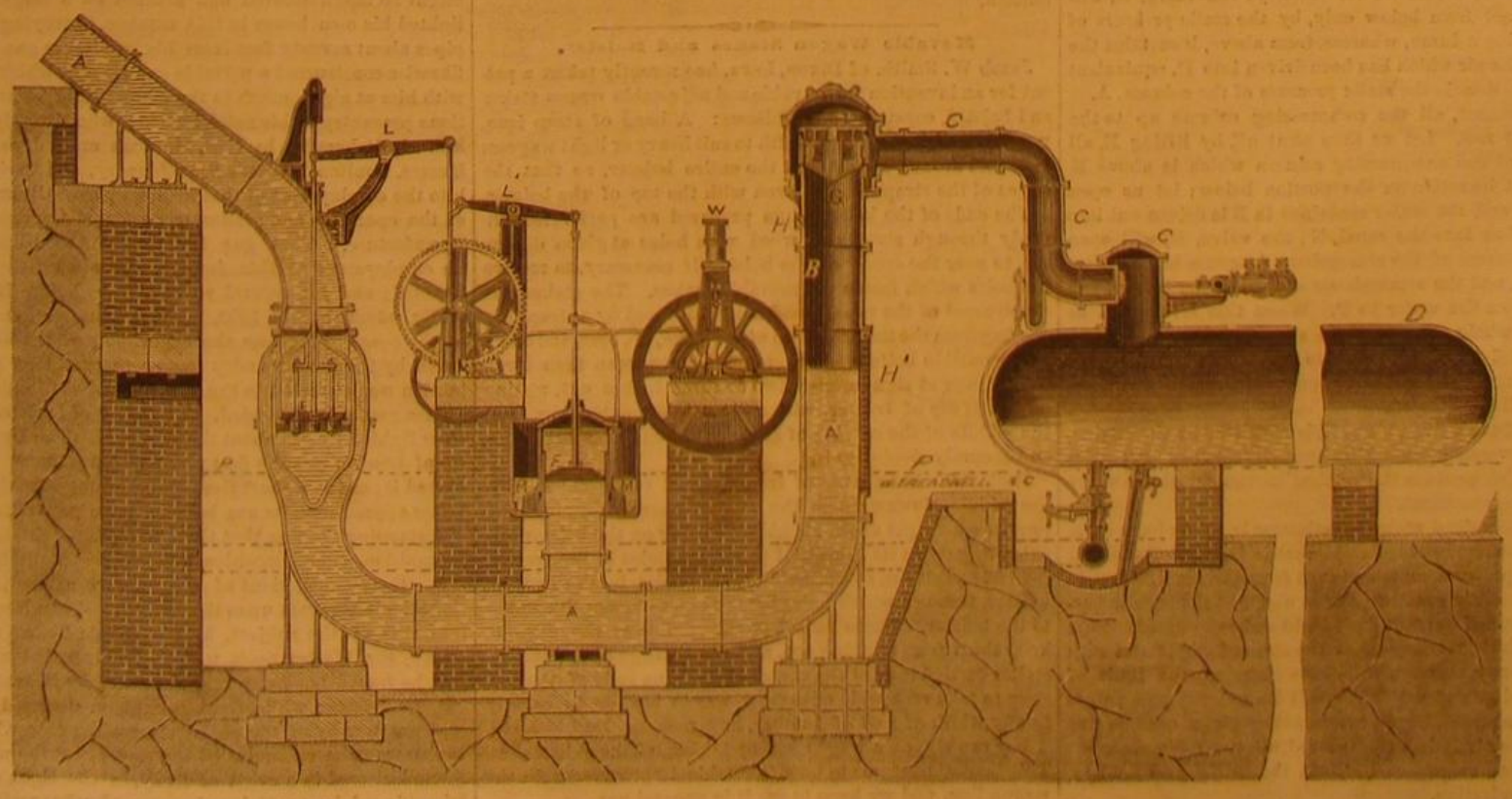
We are told there were about 40,000 yards of this pavement laid in Detroit last season, and that it is considered a success in that city.

This proves, more than any thing else that can be said, in favor of the pavement, as it is only actual use that will convince the public of the value of any new improvement of the kind. We trust a trial of this pavement may be made in this vicinity, that we may form an intelligent opinion of its merits from actual observation and comparison with the many different pavements to be found in New York, Brooklyn, and neighboring cities.

The invention was patented, in May, 1871, by Flanigan & Winser, of Detroit, Mich., who may be addressed by those desiring further information.

THE AIR COMPRESSORS AT THE MONT CENIS TUNNEL.

The motive power used for the perforating machinery in the Mont Cenis tunnel was air, the compression of which took place at some distance from the mouth, the compressing agent being water. The compressors may therefore be termed water column air compressors. The accompanying



THE MONT CENIS TUNNEL AIR COMPRESSOR.

engraving represents a complete vertical section of one of these compressors. For want of space, the reservoir of water from which the compressing column, A, descends, has been omitted. The vertical hight of the fall, through the inclined tube mentioned above, is a constant, the level in the reservoir being permanent.

A is the compressing column, B, the chamber of compression, C, the tubes for conducting the compressed air to D, the recipient for the same, E are feeding valves, and F, discharging valves, G, the compressed air valve, H, the inlet air valves, H' are acceleration valves, L, the motive lever of the feeding valve, L', the motive lever of the discharging valve, M, the recipient of discharge having a canal of escapement, P, the regulating plane.

The supply valve, E, moves vertically. On the spot where it is placed, the compressing column takes an annular form, and the compressing agent, instead of moving along the axis of the column, and remaining cylindrical, is transformed into an annular vein, which runs along the outer side of the valve, E, and becomes cylindrical again below this valve. The section of the annular vein was calculated to be equal to the section of the cylindrical column of compression, so as to leave the section of the compressing column constant throughout its hight.

In the diagram the valve, E, is supposed to be open, and the compressing column acts uninterruptedly on the air contained in the chamber, B.

Now suppose that the valve, E, should be raised, and should close the annular space; all that part of the compressing column which is placed above the valve, E, will be suspended, and will cease to act on the part below, during the whole of the time that the valve, E, closes the annular space and cuts off the column above; and hence the object of the valve, E, is to admit and to suspend the action of the compressing column. The valve, F, is also cylindrical, and moves vertically, opening, as it rises, the lateral orifices of the recipient of discharge, and closing them in its descent. Raising the valve, F, all that part of the compressing column which is inferior to E is put, as well as the chamber, B, in communication with the atmosphere; and hence the water in M and in B will take naturally the level, P, determined by the level of the water in the canal of escapement and in the recipient, M. All the part, B (chamber of compression), will then be full of atmospheric air down to the level, P, and the portions of the compressing column, contained in the syphon under the valve, E, and in the annular portion, will not be submitted to any pressure except the ordinary pressure of the atmosphere.

The valve, E, remains closed during the time that the valve, F, makes its double stroke and *vice versâ*. If, while E is open, F were also opened, it is evident that the water would escape with great impetus through the lateral orifice, M.

The valve, G, placed at the top of the compression chamber, B, by rising allows the air, after it has been compressed, to escape from B into the recipient, D; and, closing again, it prevents the flowing back of the same. The valves, H, by opening from outside inwards, give access to the atmospheric air into the chamber, B, when the water, after having performed the compression, escapes through F.

The use of the valves, H', will be explained hereafter; for the present we assume that they are closed. It is easy to understand the action of the compressor. Suppose the valves E and F both closed, and the level of the water to be at P in the chamber B; let this chamber, B, be full of atmospheric air, and let the valves, H, be supposed shut.

Now, allow the valve, E, to fall; the compressing column, A, will immediately enter into motion; it will rise in B, and will compress the air contained in this chamber; the air in B will be compressed until it has acquired a sufficient degree of force to lift up G, and then the same compressed air will enter the recipient, D, the water rising until it touches G, where it will have lost all its velocity; the valve, G, will then be pressed from below only, by the static pressure of the compressing column, whereas, from above, it sustains the pressure of the air which has been driven into D, equivalent in this case to double the static pressure of the column, A.

At this moment, all the compressing column up to the valve, G, is at rest. Let us then shut off, by lifting E, all that portion of the compressing column which is above E, and intercept its action on the portion below; let us open the valve, F, and the water contained in B is driven out into M, and will flow into the canal, N; the valve, H, will open under the pressure of the atmosphere (vacuum having been formed in B), and the atmospheric air will enter into B, and will drive down the water to P. When this level shall be reached, the whole system will be at rest, and ready to commence a second "pulsation," and to that effect let F be closed and E be opened, and the same evolution which has been described will be repeated.

The play of the valves, F and E, is regulated by the engine, W, which governs L, on which specially formed eccentrics are fixed, which produce the vertical movement of the valve at the necessary moment.

The result obtained with one pulsation is, as we have seen, the compression and the imprisonment in D of all the air at atmospheric pressure contained in B from the level, P, up to the valve, G. This result has been obtained through the action of a column of water of fixed hight and determined section and form, which, starting from the state of rest, flows with variable velocity through a definite space, at the limit of which the column of water loses all its velocity and passes again into the state of rest, after having given over, to the volume of the air it has compressed, all the dynamic effort which has been consumed between the initial and final instant of the pulsation.

Up to the present, it has been supposed that the compressing column, starting from the level, P, in order to rise in the chamber, B, commences immediately to compress the air therein contained; and this hypothesis gives the normal state of the work of the machine; and from it those conditions are derived to which the compressor must answer to develop to the greatest possible industrial effect.

If a compressor were established, with a chamber, B, of a hight corresponding to a compressing column likewise determined, the air would not be compressed to a higher state of tension than the one which would correspond to these data, and this circumstance would be inconvenient; however, the limits of the action of the compressor can greatly be extended, and to such a degree that the amount of compression should not depend on the hight of the compressing column.

Referring to the diagram, we observe that from the level, P, up to the valve, G, the chamber of compression presents a constant capacity. The compressing column, A, will always start from the level, P, and will again return to a state of rest, after having reached G. The effect, produced by the column between the beginning and the end of the motion, is a fixed quantity of mechanical work, the maximum limit of which is represented by the product of the volume of water corresponding to the capacity of the chamber, B, multiplied by the density of the water; and for the hight of the column of compression, the half of the hight of the chamber, B, being deduced.

Now this determined quantity of work is concentrated in a volume of atmospheric air, equal to the capacity of the chamber, and compressed to the tension which is to be obtained. It can, however, be concentrated in a smaller volume if the air is compressed at a higher tension; and it is evident that, as the work to be concentrated remains constant, the smaller the initial volume of the atmospheric air to be compressed, the greater will be the final tension of the air. Whence it results that the hights remaining constant, both of the compressing column and the chamber of compression, it will be possible, with the same compressor, to obtain air at as high a tension as may be required, so long as only such a volume of air is admitted to the compression chamber, that, in order to absorb all the work of the column, P shall assume the corresponding tension.

This is effected in the following manner: The chamber is filled entirely with natural air from the level, P, into the valve, G; but, instead of making such arrangements as to make the compressing column compress the air from this level, P, such a quantity of air is allowed to escape as would represent the volume by which it is wished to diminish the capacity of the chamber, the whole effect of the compression being exerted on the remaining quantity of air. Small hanging valves at H', kept open by their own weight, are used for this purpose; but they can be closed entirely, and the compressor can be reduced to its normal state by closing them all, or any number of them can be closed and the remaining ones left open; hence the capacity of the chamber may be regulated according to requirements.

Let us now suppose that the compressing column has sunk to the level, P, and let it be ready for a pulsation; if all the clapets at H' were closed, the pulsation would be normal, and it would take place as already described; but if these small valves are open, the air raised by the compressing column will not be compressed, but will escape partially through the clapets; when the ascending column shall have reached these clapets, in consequence of its greater density, it will close them successively; and when the last has been closed, the ascending column will begin to compress the air above it, which is reduced in volume to an extent depending upon the position of the top clapet to the valve, G. The motion of the compressing column will be entirely arrested, as in the normal pulsation, and a much smaller volume of compressed air will be obtained, but it will be compressed to a far higher tension.

Movable Wagon Stakes and Bolster.

Jacob W. Smith, of Dixon, Iowa, has recently taken a patent for an invention for movable and adjustable wagon stakes and bolster, constructed as follows: A band of strap iron, varying in thickness and width to suit heavy or light wagons, is passed around the sides of the entire bolster, so that the edges of the straps will be even with the top of the bolster.

The ends of the bolster thus prepared are perforated entirely through strap and wood with holes at given distances, to near the center of the bolster if necessary, to receive the bolts which fasten the movable stakes. The stakes are constructed of the usual wood material, cased by a strap iron passing from the inside bottom of the stake, up, over, and down to the outside bottom of the stake, the iron strap then forming a flange at right angles, two or three inches out, resting on end of top of bolster, with an iron brace extending from the middle of the outside of stake to the end of said flange, and securely riveted to it.

Each stake has a strap of iron fastened to its sides from the middle, downward to the bolster, thence forming two prongs with eight angle shoulders resting on the bolster and extending down its sides half way, with holes in the projecting ends of straps, conformably to the holes in the ends of bolster, through which holes the rods go to fasten the stakes to the bolster. These rods have hand nuts at the ends to keep them from slipping out, and can be slipped out and the stakes carried toward the center or extreme ends of the bolsters to take on a wide or narrow wagon box, or to exactly fit any width of logs of lumber, hay rack or load desired. A boy can slip off a wagon box by taking off the side stakes. This invention seems to be a valuable improvement in the wagon line, and we hope to see it in general use.

ILLUMINATING GAS---NATURAL GAS WELLS---COAL GAS ---WATER GAS FALLACIES.

NUMBER I.

From a lengthy paper in the *American Exchange and Review* for January, we make the following copious extracts:

The history of illuminating gas has been often recounted. From the most authentic descriptions of its rise and progress, it is evident that its manufacture was suggested by the experiments made with natural gas issuing from the earth in close proximity to coal seams. In the writings of ancient authors, mention is made of perpetual fires which were burned on altars consecrated to the worship of mythological deities. Strabo and Plutarch refer to these mysterious fires; while Herodotus, Vitruvius, and other early historians allude to the bituminous wells of the island of Zante, whence issued streams of inflammable vapor, which were used to inspire the multitudes of superstitious worshippers with profound reverence for sacerdotal authority. In India and China, these wells have been known from remote antiquity; and it is said that in the latter country the gas thus naturally exuding from the ground has for a long time been conveyed in pipes made of bamboo, and used for boiling salt. Gas wells of this description abound in various parts of the world; one of which, in England, was probably the means of suggesting the artificial production of gas and its utilization as an illuminating agent. In this country, several wells of more than ordinary interest have been discovered, yielding large volumes of gas of considerable illuminating power. Among them may be mentioned those in the town of Fredonia, New York, where two companies furnish light to a village of three thousand inhabitants, produced solely by burning the natural gas as it rises from the ground. At Bloomfield, in Ontario county, N. Y., there is a well, from which, according to the estimates of Professor Henry Wurtz —one of the best authorities on the subject—the daily flow of gas is upwards of 400,000 cubic feet. In Ohio, near the town of Gambier, remarkable wells of a similar character have been described by Professor J. S. Newberry, where the gas has constantly flowed without apparent diminution of volume since 1866, and which, on being ignited from the orifice of a two inch pipe, produces a flame twenty feet or more in length. Similar phenomena have likewise been observed in the petroleum region of Pennsylvania.

In alluding to the history of this important branch of industry, we cannot pass over the observation of Dr. Watson that coal gas is unaltered by being passed through tubes immersed in water; or, in other words, that the condensation of some of its constituents does not impair its illuminating properties. This fact is noticed in the "Chemical Essays" of this gentleman, published in 1767. Other experiments of this nature continued to be performed by various persons, but with little or no practical results. In 1787, Lord Dundonald, a Scottish nobleman, secured a patent for making coal tar—or, more properly speaking, coal oil, for this was the substance he desired to produce. In condensing this product, the gaseous body eliminated by the distillation of coal was collected for amusement and curiosity; and no other purpose than that of the entertainment of his friends seemed to inspire his exertions. These investigations, however, were not without their fruit. A countryman of his lordship, by the name of Murdoch, then living at Redruth, in Cornwall, who had read of the experiments above described, was led to investigate the nature of the products of distillation, and extended his researches to the volatile bodies obtained from peat, coal, wood, and other combustibles. These investigations were pursued with some degree of system, and it was ascertained that, by properly regulating the processes of carbonization and condensation, a uniform product of high illuminating power might be obtained. The practical mind of Murdoch soon appropriated the idea that by constructing receptacles for the gas, and conveying it through pipes, it might be manufactured and utilized on a large scale. He lighted his own house in this manner, conveying the gas in pipes about seventy feet from his miniature gas works, and likewise constructed a portable gas lantern which he carried with him at night, much to the discomfiture of the superstitious peasantry of his neighborhood, who strongly suspected him of witchcraft. In 1798, Murdoch erected gas works at Messrs. Boulton & Watt's Soho foundry, and having entered into the employment of that firm, he personally superintended the operation and gradually perfected the details of the manufacture. That gas illumination, as illustrated by its employment at this factory, was a success cannot be doubted; and yet several years elapsed before it was generally adopted. In 1802, at the illumination in honor of the peace of Amiens, the superiority of the display produced by the Soho foundry was so marked that general attention was attracted to the new method of illumination, and its use gradually extended. A number of large cotton mills were lighted by gas about the year 1805. The Lyceum theatre of London was the first place of amusement which employed it; and in a short time, its advantages having become better appreciated, its use became more general. But notwithstanding the fact that these advantages obtained a wider recognition, some opposition was manifested to its introduction. Grave predictions of danger were uttered, and no little ridicule was cast upon the project. When Napoleon was informed of the subject, he remarked: "*C'est une grande folie.*" Sir Walter Scott was no less incredulous, and said that he feared London would be on fire by it, from Hackney gate to Tyburn; while Lord Brougham declared that "the idea was worthy of the philosopher who proposed to extract sunbeams from cucumbers"—a remark, by the way, which, though uttered in a spirit of irony, in the light of modern scientific opinions contains elements of sober reality. Even

Sir Humphrey Davy considered the idea of utilizing gas so ridiculous that he contemptuously asked "if it were intended to take the dome of St. Paul's for a gasometer?"

As soon as gaslight became firmly established in England, its merits claimed recognition on this side of the Atlantic, and in 1816 the first American gas light company was chartered to light the city of Baltimore. Six years later, in 1822, Boston adopted the new method of illumination; while the old New York Gaslight Company, which lights the city from Grand street to the Battery, was chartered in 1823. Brooklyn and Bristol, R. I., were lighted in 1825. In 1830, the Manhattan Gaslight Company of New York, now the largest and wealthiest in America and fourth in size in the world, was chartered. The district of this corporation extends from Grand street to Thirty-fourth, and from river to river. Other cities pronounced in favor of the new light as follows: New Orleans in 1835, Philadelphia and Pittsburgh in 1836, Louisville in 1838, Cincinnati in 1841, Kensington (Philadelphia) in 1844, Albany in 1845. From this date, gas works multiplied with rapidity; and as the superiority of the new light became evident, cities and towns in all parts of the country were soon supplied with it.

The Baltimore gas works were originally constructed to make gas from coal tar, but this plan proved a total failure, as might have been predicted. After this unsuccessful experiment, the works were reconstructed by an English engineer; but, this change not proving satisfactory, they were again remodelled, and gas was made from bituminous coal. In Boston, a mixture of coal and rosin was used; while, by the two New York companies, rosin alone was employed. All of these works were deemed more or less defective, and when, in January, 1833, the question of erecting gas works in Philadelphia was brought before the councils, a committee was appointed to consider the question and to make a report. In January, 1834, it was resolved to send an engineer to Europe for the purpose of investigating the best gas works there in operation, and to obtain such information as might be useful in erecting works in the city. The late Samuel V. Merrick was selected for this mission; and, in furtherance of his instructions, he sailed in March, returning in December of the same year. Notwithstanding a violent opposition to the project, gas works were erected by Mr. Merrick; and, on the 10th of February, 1836, Philadelphia was lighted with gas.

All substances of an organic nature, when exposed to a high temperature in close vessels, undergo a remarkable transformation. If the experiment be performed in a retort, and that portion which is volatilized by the heat be cooled and collected, it will be found that the original substance has been split up into three distinct bodies, viz., the solid coke which remains in the retort, tarry matters (including water) which condense to a liquid, and permanent gas. A still further examination of these products would disclose the fact that although they present a homogeneous appearance, they are really mere mixtures of various bodies, which are capable of minute subdivision; and that the liquid tarry matter contains substances which, when isolated, assume a solid form. Complex as these bodies are, they are essentially composed of but two of the elements, carbon and hydrogen; although they include notable quantities of other elements, which however are regarded as impurities, and which, in the details of gas making, are eliminated as completely as possible. Among these objectionable substances are oxygen, nitrogen, and sulphur, which exist in various combinations, and, unless removed from the finished product, greatly impair its quality.

A number of raw materials are available in the manufacture of illuminating gas. Almost every combustible body, when subjected to destructive distillation, yields gaseous products suitable for generating light. Coal, wood, peat, oil, rosin, fats, bones, and a variety of other substances, have been used; but, generally speaking, bituminous coal may be said to be, *par excellence*, the natural source of gas; and as such we find it almost universally employed, although the other substances above mentioned are sometimes used when local considerations render their adoption desirable.

Of the coals which are included in the generic term bituminous, there are many varieties, some of which are admirably adapted to the manufacture of gas, while others are of too inferior quality to justify their employment. As a general rule, it may be said that the larger the quantity of volatile matter yielded by a coal, the better it is fitted for the gas works; and yet this rule is not without its important exceptions. The English cannels, which are regarded as the best gas coals, vary in their content of volatile constituents, ranging from twenty-seven per cent in the Washington, to sixty-nine per cent in the Boghead, with a long list, of other coals of the same variety, intermediate between these two extremes. In Great Britain, cannel coal is sometimes used alone as a source of gas, but it is generally distilled in conjunction with ordinary bituminous or caking coals, for the purposes of enriching the gases produced from the latter. This latter variety of coal is the main dependence of the gas works. In this country it is used almost exclusively, the few exceptions being in large cities near the seaboard, where certain proportions of English cannel are mixed with it. The advantages of ordinary bituminous coal consist in the fact that it is cheaper than cannel, and while it yields a gas somewhat inferior in illuminating power, it produces a coke of great excellence, which cannel does not; and as this material is one of the most important residual products of gas works, its quantity and quality are subjects of considerable moment. Moreover, the quantity of sulphur contained in ordinary bituminous coal is generally less than that in cannel, which is a decided advantage.

Most persons are familiar with the appearance of gas works. Located generally on the outskirts of towns, in places convenient either to water or railway communication, their numerous buildings, gas holders, etc., form conspicuous objects. In the manufacture of this illuminating agent, coal in charges of from 120 to 160 pounds is quickly thrown into retorts, which are maintained at a bright red heat, from which the gases and vapors are conveyed away by means of upright iron pipes projecting from the front end of the retorts, and technically known as standpipes. After being charged, the retorts are quickly closed (the lids being luted) and forced against the mouthpiece either by means of a screw or a lever, so that they make a gas tight joint. An improvement in retort lids has been lately introduced in the Dublin gas works, where the lids are hung on hinges and have machine turned edges, which are brought in contact with the mouthpieces of the retorts, which are also turned true, and the necessity for luting is obviated. The lids are gas tight, and are held in position by means of a lever. A single charge remains in the retorts usually about six hours, at the end of which time the lid is removed, and the gas remaining in the retort is ignited, so that it may quietly burn away while the coke is withdrawn. This is accomplished in a few moments, when a fresh charge is thrown in, and the evolution of gas goes on almost without intermission.

From the standpipe the gas passes through the dip pipe into the hydraulic main, which is a large tube or trunk, usually made of cast iron, extending along the whole length of the retort house. The dip pipes terminate in this main, their extremities extending three or four inches below the level of the liquid in the main, thus preventing the return of gas which has passed the end of the pipe. When the gas works are first put into operation, the hydraulic main is half filled with water, but this fluid is soon displaced by the heavier tar which condenses from the crude gas, so that in a short time the liquid contents of the main consist almost wholly of tar. Through this liquid, the gas bubbles as it is eliminated from the retorts, depositing additions to the fluid contents of the main in the shape of tar and ammonia water, which, by means of suitable pipes regulating their level, flow off to their appropriate receptacles.

From the hydraulic main, the gas, somewhat cooled, but still containing many condensible products, passes on to the condensers; but, as in many works different intermediate efforts are employed to cool and wash the gas, a brief reference to the various steps resorted to in this stage of the process may be advisable; although it must be premised that in many small gas works some of these processes are omitted altogether. In some instances, the gas is caused to pass through a depth of several inches of water, which removes a portion of the ammoniacal products, and causes a further deposition of tar; while sometimes the gas is *scrubbed* by being compelled to pass through layers of moistened coke, and at others, subjected to streams of water conveyed through rose jets. Many engineers, however, still oppose the use of the scrubber, or any direct contact of the gas with water, the reason alleged being that this treatment reduces its illuminating power. The condenser proper, in which the final cooling takes place, consists of a series of upright iron pipes, sometimes exteriorly cooled by water and sometimes by air.

By these methods of cooling, the gas which leaves the hydraulic main in a heated condition is discharged into the purifiers at a temperature but little higher than that of the atmosphere—sometimes, indeed, where water condensation has been used, below it.

The earliest method of purification, known as the wet lime process, was introduced by Mr. Clegg, an eminent English engineer, whose practical mind soon became convinced of the necessity of removing the noxious products of the combustion of gas, by the influence of which much damage was done to pictures, gilding, and other ornamental objects. By this process, ordinary caustic lime was mingled with water in the proportion of one bushel to forty-eight gallons, and through this mixture the gas was compelled to bubble As far as efficacy was concerned, this method of purification was satisfactory; but in the economy of manufacturing operations, it was found that the pressure upon the retorts, which was induced by the gas being compelled to pass through several inches of liquid, caused a decomposition of the richer hydrocarbons, and a corresponding deposition of carbon in the retorts, as well as creating a variable amount of leakage from the latter. These objections resting on valid grounds, endeavors were made to obviate them, which was accomplished by Berard, who introduced purification by means of dry lime. The apparatus required by this modification consists of a series of receptacles, generally square in form, in which are placed a number of trays, containing moist slaked lime, spread in layers of two or three inches in thickness. Through this substance the gas is passed, and when it emerges, after having traversed successive layers, it is finally discharged into the gas holders, whence it is distributed to consumers.

From the foregoing brief and, in the absence of illustrations, necessarily imperfect description of the manufacture of gas, it will be seen that the process is comparatively a simple one, and yet there are questions, continually presenting themselves in the routine of operations, which demand no little scientific and practical knowledge; hence we generally find gas works placed under the supervision of persons of more than ordinary intelligence. In our large cities, gas engineers are generally selected on account of their scientific attainments, which include not only a reasonable acquaintance with the principles of chemistry, but more especially a knowledge of the physical properties of fluids, practical experience in the construction of buildings, furnaces, and the like, together with such other branches of information as are constantly required in the business. In England, and in all countries where large gas works abound, the profession of gas engineering includes among its votaries men of the highest culture and education; and the literature of this branch of technology has been enriched by contributions which are indispensable in every well appointed scientific library.

The Band Saw.

The band saw, we believe, is an English invention; but it has been naturalized and improved in this country, with practical results of an astonishing character. Among the examples of the capabilities of the band saw, perhaps the best are to be found at the large establishment of Van Pelt & Co., Tenth street, East river, in this city. Mr. Allen Ransome lately read a paper, before the Institute of Civil Engineers of London, embodying some of his observations during a visit to the above establishment, from which we gather the following:

The "band saw" is made of the very best steel, in the shape of an endless band, on one edge of which the "teeth" are set all the way round, and varying in length and width, according to the particular kind of work which is required. This endless saw blade is mounted on a pair of wheels attached to a perpendicular beam or upright, termed a "king post." These wheels are seventy-five inches in diameter, and are made of wrought iron, their peripheries being faced with wood, over which is a tire of leather, a combination which secures three very important requisites, namely, strength, lightness and elasticity. The upper wheel, tension governor, feed gearing, shafts, etc., are attached to the king post, near the ceiling and completely out of the way; while the lower wheel, with its shaft, bearings, and a break are attached to the same king post, but situated in a pit beneath the flooring, and so secured against accident or danger. All the sawdust drops into this pit, whence it is conveyed by means of an exhaust fan to the furnaces in the engine room, to be used as fuel, thus keeping the place clean and free from sawdust. The fly wheels on which the endless band saw revolves have their axes about twenty three feet distant from each other, so as to produce the necessary tension on the saw blade; but the operator is enabled, by means of a device known as the "tension governor," to increase or lessen the distance between the axes of the fly wheels, thereby decreasing or diminishing the tension on the saw blade as may be necessary The "saws" are constructed with a special view to the sawing of ships' timbers, which require to be sawn with the grain of the wood. The machinery is so adjusted that, by a peculiar arrangement, the operator can instantly remove the saw and replace it by a newly filed one whenever it is necessary to do so. These mills are not ordinary lumber saw mills; nevertheless, the proprietors, by way of practically testing the capability of the machinery, have done considerable log sawing. The results prove that the "band saw" far surpasses all that was expected of it. It will cut a pine log two feet deep at a feed rate of thirty feet (linear measurement) per minute, walnut lumber at about the same rate of speed, and hard oak about one half as fast. It will cut deeper lumber at a proportionate rate of speed. George Law, Esq., the eminent merchant, sat on a log in the mill several hours one day, in company with a United States engineer and two eminent civil engineers, watching the working of the band saw driven by a sixty-five horse power engine. They timed the saw, and found, as the result of their observations, that it cut through a twenty inch log at the rate of thirty-four lineal feet per minute. Mr. Van Pelt then boasted that it could do what no other saw had ever done, namely, cut a quarter inch board from off a wet pine log, forty-two feet long and eighteen inches deep. The other gentlemen declared that they believed it impossible; but the experiment was successfully accomplished at the rate of twenty-five feet per minute, and without the least variation? One of the gentlemen present —an English engineer—expressed his astonishment, and said: "It appears to me that you Yankees can do almost anything you please." The quality of the work is unexceptionable; the boards or planks are cut out perfectly true, straight, and of uniform thickness throughout; and it effects a considerable saving of lumber, because of the very narrow kerf, which varies, according to the thickness and set of the saw blade from one sixteenth to one eighth of an inch.

A New Method of Nickel Plating.

Dr. Wolcott Gibbs gives, in the January number of the *American Journal of Science*, a brief description of a new process for plating various metals with nickel without the use of a battery, which process was devised by Professor Stolba. Into the plating vessel—which may be of porcelain, though the author prefers copper—is placed a concentrated solution of zinc chloride, which is then diluted with from one to two volumes of water, and heated to boiling. (If any precipitate separates, it is to be redissolved by adding a few drops of hydrochloric acid.) As much powdered zinc as can be taken on the point of a knife is thrown in, by which the vessel becomes covered internally with a coating of zinc. The nickel salt—for which purpose either the chloride or sulphate may be used—is then added until the liquid is distinctly green; and the articles to be plated, previously thoroughly cleaned, are introduced, together with some zinc fragments. The boiling is continued for 15 minutes, when the coating of nickel is completed, and the process is finished. The articles are well washed with water and cleaned with chalk. If a thicker coating be desired, the operation may be repeated. Professor Stolba found that copper vessels thus plated were scarcely tarnished after several months' use in the laboratory.

THE worst misfortune is to be unable to bear misfortune.

KENWOOD TOWER, HIGHGATE, NEAR LONDON.

Highgate is situated on a hill in the northern suburbs of London, 400 feet above the level of the sea, and for a long time was a mere hamlet of houses scattered here and there amid the forests. It was not till the fourteenth century that the Bishop of London allowed a highway to be cut through his park and woods of Harringhay (the hare-inge-hayh, or meadow and wood of hares). A gate was erected and toll taken, and the place is said to have been called Highgate from this gate; but what was the name of the place before that time is not known.

The chapel of Highgate, which occupied the site of a hermit's cell, was granted by Bishop Grindal, afterwards Archbishop of Canterbury, in 1565, to a new grammar school, erected and endowed the year before by Sir Roger Cholmely, late lord chief justice. This was pulled down many years ago, and the church built in another part of the village. Among the tombs, however, was that of Coleridge, the poet and philosopher. The church was built in 1832, at a cost of 10,000*l*., in the parish of St. Pancras; but Highgate was soon afterwards made a district of itself.

The unfortunate Richard II. was conveyed through Highgate, in 1398, on his way from the north, by his haughty rival, Bolingbroke, hooted by the rabble. In 1461, Thomas Scrope, baron of the Exchequer, was beheaded by the insurgents in Highgate. In 1745, the London train bands marched through Highgate to encamp on Finchley Common, to defend the metropolis against Prince Charles and the Scots.

Coleridge settled at Highgate, in the house of Mr. James Gillman, surgeon, about 1800. At an early period he had used opium, and could not shake off that unhappy bondage. His physical strength gave way, and his mind was unstrung. "Here," as Carlyle says, "he sate looking down on London and its smoke tumult, like a sage escaped from the inanity of life's battle, attracting towards him the thoughts of innumerable brave souls still engaged there,—heavy laden, high aspiring, and surely much suffering man." During this time he continued his literary work, and was visited by many of the chief literary men of the day. He died July 25, 1834, aged 61.

Mr. MacDowell, the sculptor of the "Reading Girl," resides at Highgate. His sculptures of "Love Triumphant," and "Death of Virginia," executed for Mr. Wentworth Beaumont, place him in a high rank in the artistic world. His son is a young sculptor of promise. In the old coaching days, travellers for the north stopped at Highgate, and, at whichever of the nineteen public houses it might be, "out came the horns, fixed on a pole, and the passengers were sworn to eat no brown bread when they could get white, unless they liked it better, and not to kiss the maid when they could kiss the mistress, unless they liked her better," and a lot of other nonsense. This probably relates to the old passage toll levied on horned cattle, and gathered by some park keeper, who carried a staff with horns to show his authority.

At Fitzroy Park, an outskirt of Highgate, Dr. Southwood Smith lived, a very modest and clever man of science. He was physician to the London Fever Hospital, and wrote a valuable "Treatise on Fever," also "Animal Physiology," for the Society for the Diffusion of Useful Knowledge. In 1837, he was appointed by Government to inquire into the state of the poor, and many sanitary reforms resulted from his investigations. Dr. Smith died at Florence in 1861, and was buried in the Protestant cemetery there.

Highgate has retained more of its rural character than any other village in the suburbs of London. It has its old buildings, and elm and lime tree avenue; and around it stretch fields and hills.

Oliver Cromwell built Cromwell House, a solid red brick mansion, about the year 1630; but he is thought never to have made more than an occasional visit to it. Prickett, in his "History of Highgate," says: "Cromwell's house was evidently built and internally ornamented in accordance with the taste of its military occupant. The staircase, which is of handsome proportions, is richly decorated with oaken carved figures, supposed to be of persons in the general's army, in their costume, and the balustrade filled in with devices emblematical of warfare. On the ceiling of the drawing room are the arms of General Ireton; this and the other ceilings of the principal apartments are enriched in conformity with the fashion of those days. The proportions of the noble rooms, as well as the brickwork in front, well deserve the notice and study of the antiquary and the architect."

This classic spot, replete with so many historical associations, is the site of Kenwood Tower, now being erected for Mr. Edward Brooke, a wealthy citizen. It is a fine example of modern architecture. It will have the external walls faced with Loughborough red bricks and rubbed Reading red brick quoins, all the dressings of the windows and other stonework being of Doulton freestone. The chimney shafts will be of various patterns, and built up in small molded bricks. The roofs are to be covered with ornamental red and dark grey tiles. The dining room will have a moulded and carved ceiling in wainscot; also dado doors and window jambs, all of wainscot framing, molded on the solid. The floor is parquetry; the chimneypiece will be modelled and carved, with various woods and marbles; it will be the whole hight of the room, and worked into the cove of the ceiling. The principal staircase is to be of wainscot, carved, of Elizabethan design, with an open timbered, ornamental roof, colored. The billiard room, ante-hall, and principal hall will be fitted up with pitch pine, of similar design to the dining room. The upper portion of the windows in the ground floor rooms is to be filled with stained glass, the subjects to be suitable to each room. There will be a stained glass window, too, on the principal staircase, filled in with the armorial bearings of the Brooke family; in the hall, large stained windows, with subjects from well-known fables. Polished marble columns and carved capitals are used inside, both in staircase, hall, and drawing room. The conservatory and vineries will have an entrance from the dining room.



KENWOOD TOWER, HIGHGATE, NEAR LONDON.

Fish Culture in New York.

The Commissioners of Fisheries for the State of New York are now delivering fish and spawn for the stocking of public waters within the State, and the following particulars and directions concerning their method of operations may be of general interest to our readers. Mr. Seth Green, the State Superintendent, Rochester, N. Y., says:

The impregnated spawn of salmon trout and white fish can be sent in October, to such places as have conveniences for hatching it.

Young white fish are in condition to transport from the 1st to the 10th of February; salmon trout, from the 10th to the 20th.

Oswego bass, strawberry bass, white bass, rock bass, and a limited number of black bass, pike perch or wall eyed pike and bull heads can be delivered at Rochester at any time during the winter.

Milk cans are used for carrying white fish and salmon trout; and milk cans and pounding barrels, or other clean barrels, are suitable for carrying other kinds of fish. A five gallon milk can will hold two thousand white fish, or one thousand salmon trout; or from twenty to one hundred of the other fish above named, according to their size.

The wall eyed pike, rock bass, white bass, black bass, white fish and salmon trout are suited to clear waters with rocky bottoms where the crawfish is to be found, and Oswego bass, perch, strawberry bass, and bull heads will only live on muddy bottoms with flags and pond lilies.

It is almost useless to stock rivers which overflow their banks and flood much extent of country, as the fish are stranded by the receding waters, and get into pond holes, where they perish in dry weather.

All fish should be deposited as near the head of the lake as possible, so they will not go into the outlet before they become familiar with the waters. The fish should be deposited during the night, when most large fish do not feed, and will find hiding places before morning.

SOAP.—A young lady, who makes all the family soap, gives the following recipe for a good cheap article: Add to 10 quarts of water, 6 pounds of quicklime (shell lime is best), and 6 pounds common washing soda. Put all together and boil for half an hour, and let it stand all night to clear. Draw off the lye, and add to it 1 pound common resin, and 7 pounds of fat (any fat will do). Boil this for half an hour, then let it stand till cool, and cut into bars.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

The Effect of a Grain of Strychnine.

To the Editor of the Scientific American:

In your edition of Dec. 16th, page 389, is described the effect of a grain of strychnine which had been swallowed for the purpose of committing suicide. The writer has given an account of the sufferings produced by that poison, and, because the patient was "saved by the skill of his physician," thinks the publication of the case useful "for the benefit of science." In view of the fact that the symptoms produced by strychnine are not unknown, and that the remedy which the doctor employed has not been mentioned, I am really at a loss to comprehend in what manner science has been benefitted by the publication of that case.

About ten years ago, I was called to visit a friend of mine who had swallowed about a similar dose of strychnine, mistaking the bottle containing it for one holding a solution of morphine, which he intended to take against toothache. The symptoms, produced by that dose of strychnine, were about the same as described in the above mentioned article, with the addition that the patient thought the whole room (on the floor of which he was lying) to be on fire. Though not knowing the cause of those frightful spasmodic convulsions, I suspected strychnine, and immediately administered chloroform by inhalation, keeping the patient under its influence during twelve hours, till the spasms ceased to return. About a pound of chloroform had been used. The patient was "saved."

So much for "the benefit of science," and more for the benefit of those who, by accident, might fall into the destructive grasp of one of the most powerful poisons known.

In the same number of your journal, there is another article, treating of toothache and earache, which gives a good deal of negative advice as to what should not be done in such cases. Let me give your readers a positive advice in recommending a remedy which will never fail to remove the pain in a few minutes, and which consists in a hypodermic injection of a solution of one eighth or one sixth of a grain of the acetate or chlorate of morphia, applied under the skin of the arm or leg. If care is taken to introduce the solution deep into the tissues, no abscess will follow.

M. SCHUPPERT, M. D.

Gold and Platinum Alloys.

To the Editor of the Scientific American:

I desire to make known, through your valuable paper, a remarkable phenomenon, in connection with an alloy of gold and platinum. I have entertained the opinion, generally received by chemists and metallurgists, that in the alloys of metals there was a fusion of each metal, and a blending of the particles of each that, for all practicable purposes, has caused the compound to be recognized as one body. How this union was formed, when gold and a small portion of platinum were fused, has been, owing to the high melting point of the latter, a difficult problem to solve. Thinking there might be some method of discovering how metals combine when fused, I made the following experiment, producing a result which is entirely new in the history of the noble metals:

I had a lot of dental gold plates, which had quite a number of small pieces of platinum wire attached, after breaking off the artificial teeth. There must have been about three pennyweights of platinum. The mass weighed nine ounces. I melted and poured the whole into an ingot; it was perfectly fused. On examining the bar closely, not a trace of platinum could be seen. I rolled it through the hand mill, extending it to three yards in length; then cut it in pieces three inches long. I then exposed it to the action of acids, in a manner entirely different from my usual method when refining gold for foils. After a few hours chemical action, I observed a bright metallic point gleaming through the bars of a crystal cage, which a glass blower made for me for this special case. I took it out, and, on examination, I found it to be platinum. I placed it back again for further action; and, on its final removal, I have now a demonstration in a friable mass in which are seen six pieces of platinum as clear and perfect as if they had been rolled in a mill, and they are retained together by the undissolved gold, to convince parties who otherwise would conclude such a result to be impossible. This is the first experiment I have made with arrangements devised by myself; what my success may be with metals lower in the scale, further experiments will reveal.

That your readers may appreciate the scientific value of my discovery, it may be well to quote the latest scientific conjectures respecting the combination of metals in fusion and solution. I quote from Fowne's "Chemistry," page 270, (Phil. ed.): "But though metals may combine when melted together, it is doubtful whether they remain combined after the solidification of the mass; and the wide differences between the melting and solidifying point of certain alloys, appear to indicate that the existence of these compounds is limited to a certain range of temperature. Matthiessen regards it as probable that the condition of an alloy of two metals in the liquid state may be either that of: 1st, A solution of one metal in another; 2d, chemical combination; 3d, mechanical mixtures; 4th, a solution or mixture of two or all of the above; and that similar differences may obtain as to its condition in the solid state."

My experimental result demonstrates that there is, in relation to gold and platinum, no chemical union, no mechanical mixture; but that the platina melts and arranges itself in small globules, distinct from one another, retaining their integrity in the melted mass. In view of my discovery, I know the chemist and metallurgist will ask me: What new solvent have I found that dissolves gold, and yet leaves the platinum undissolved at the same time? I desire making further experiments before fully explaining my methods.

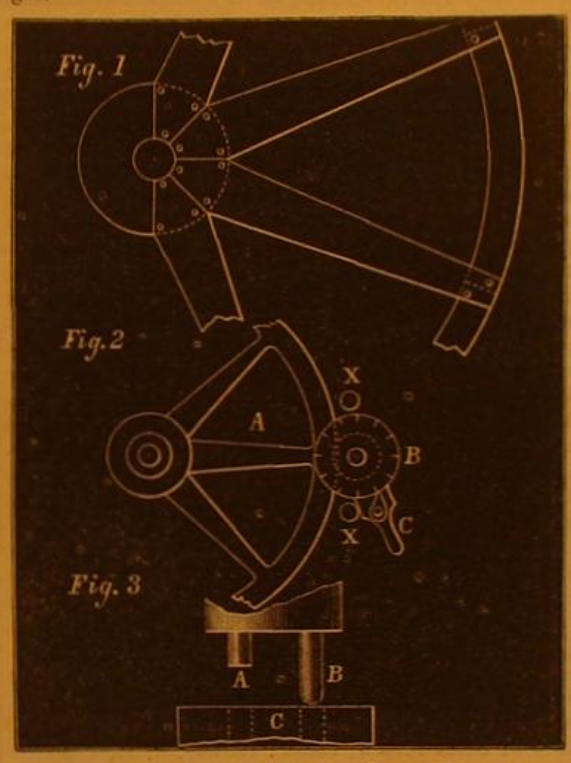
Cincinnati, O. JAMES LESLIE.

[The specimens sent are evidently globules of platinum, flattened and elongated by rolling into miniature spear heads.—ED.

A Dividing Engine.

To the Editor of the Scientific American:

I know not what degree of perfection has been attained in the construction of engines for dividing the circle into equal parts, but I think it would be difficult to improve upon the accuracy of the method recently adopted here for graduating the dividing wheels of a large gear cutting engine. The engine was designed for cutting gears of large radius, both bevel and spur, and is now in use for that purpose. It is constructed upon the wheel and pinion principle, the dividing wheel being some four feet diameter, and having, I believe, 360 teeth in its periphery. Before these teeth were cut, the engine was fully completed and the wheel fixed permanently upon its arbor and in its working position in the machine, where its periphery received its final facing off preparatory to the cutting of its teeth. The cutter head was then accurately adjusted in position for cutting the teeth, upon a firm but temporary rest. A temporary dividing wheel was then firmly and truly fixed upon one end of the same arbor. To insure greater accuracy, this dividing wheel was made much larger than the one to be cut (some eight feet diameter, I think), and to save the expense of a pattern for such a wheel, it was put together as shown in the section Fig. 1.



The divisions for this wheel were made as follows: A strip of untempered steel (about one thirty-second part of an inch thick, one and a quarter inches wide, and of sufficient length to reach around the periphery of the wheel, and about three inches to spare for lap), was prepared straight and even; and the scale, upon its surface, removed by coiling it up and placing it for a short time in dilute sulphuric acid; it was then washed, dried, and oiled. The removing of the scale was necessary in order to preserve the integrity of the punch used in punching a central row of 364 holes along the whole length of the strip, the four extra holes being for the purpose of insuring a perfect job in tapping the ends, as the coincidence of several pairs would be more reliable than the coincidence of one pair of holes. Perfect equality in the distance between the holes was preserved by using two punches in the same plunger, as shown in Fig. 3, A, the punch proper, and B the gage punch, the gage punch being long enough to enter the die, C, fully before the punch, A, made its hole, and large enough to slightly burnish the holes as it enters them. The utmost care was, of course, necessary in this part of the process, namely, the preparation and operation of the punching machine; uniform temperature in the room where the work is done, will, of course, contribute to the perfection of the job.

The punching being completed and the ends properly chamfered for the tap, they were kept in position for fastening by placing a pin (just the size of the gage punch) in each pair of the coincident holes; the ends being secured, the pins were removed, and the hoop, with its 360 holes, was ready to placed upon the wheel; before this was done, however, a groove was turned in the periphery of the wheel, so that the stop points could not bottom when they entered the holes in the steel hoop. For the purpose of greater accuracy, several stop points, each independent of the others, were used, all of them pressing equally upon the wheel; but so arranged as to be operated all at once by a single motion of a lever. Much care was of course bestowed upon every part of this preparation before the cutting was commenced; the workman then passed three times round with the cutter, as in ordinary gear cutting; the first cut removing about three quarters of the stock between the teeth, the second one left very little for the finishing cut.

Uniform temperature was mnintained in the room during the operation.

The method of working the dividing wheel of this class of engine is as follows: Fig. 2 shows the arrangement, A being the dividing wheel, and B, the dog wheel and pinion, both upon the same arbor; the pinion beneath the dog wheel is indicated by a dotted circle. A number of these dog wheels are required, of course, in order to produce all of the numbers required in the business of gear making, and they are made exactly alike, with the exception of the number of notches in their periphery. They are so fitted to the pinion arbor as to be quickly changed, and yet so as to work the pinion without the least slip. The dog handle, C, works between two stops, X X, one of which is adjustable, to gage the movements of the handle to the number of teeth to be cut. The number of teeth in the dividing wheel should of course be a multiple of other numbers; a multiple of twelve ending with a cipher is usually employed. If 360 is the number of teeth in the dividing wheel, 30 may be the number of teeth for the pinion.

All of the numbers of which 360 is a multiple may of course be produced without the pinion and dog wheel, such as 180, 120, 90, 72, 60, 54, 40, 36, 30, etc.; but in order to produce the intermediate numbers, the differential agency of these wheels is necessary; for instance, if a gear with 31 teeth is wanted, the pinion must make $\frac{1}{3}\frac{2}{1}$ of a revolution (or its equivalent, as $\frac{2}{6}\frac{4}{2}$ or $\frac{3}{9}\frac{6}{3}$) for each tooth cut; consequently if the dog wheel contains 62 notches, it must of course be moved 24 notches for each tooth cut. To ascertain what numbers may be produced by any dog wheel, multiply the number of notches the wheel contains by 12, and the product is a multiple of the numbers the wheel will produce. For instance, $62 \times 12 = 744$; this product is the multiple of 372×2, or 186×4, or 124×8, or 93×12, or 62×16, or 31×24.

I make this arrangement of the numbers because they are stamped in this order on the face of the dog wheel, to indicate that a movement of 24 notches for each tooth cut will produce 31 teeth, and that a movement 31 notches for each tooth cut will produce 24 teeth, and a movement of 16 notches will produce 62 teeth, and a movement of 62 notches will produce 16 teeth, etc. Each of the dog wheels belonging to the machine has its peculiar set of numbers stamped upon its face, of course.

Gear cutting engines of this class are very handy and serviceable, and are operated with great facility.

F. G. WOODWARD.

The Educated Ear.

To the Editor of the Scientific American:

Your article on the education of the ear "reminds me of a little story." Years ago, I was an apprentice to a watchmaker, and we had many clocks to repair, averaging, I think, forty. I slept in an adjoining room. After being there a few months, my ears became detectives. When a clock stopped in the night, I would instantly awake, aware of the stopping, no matter how many clocks were running. This became very vexatious. Where so many old clocks were being repaired, it was inevitable that many would stop; and it is a matter worthy of remark that there are more stoppages of such machines in the night than there are in the day time.

At that time I could awake at any time I might wish to; for instance: It is 11 o'clock at night; I am about to retire; I wish to arise seven minutes before five, or at any other particular minute. I would go to bed, sleep soundly until the precise minute, and then answer, "wide awake."

If this was not educating the ear, what was it? A.

[We have doubts as to the correctness of our correspondent's opinion that more clocks stop at night than in the day time. The fact that some persons are able to wake from sleep at a particular hour is one of the mysteries of a yet unsolved mystery. Until we know more of the nature of sleep, it is useless to speculate in regard to its phenomena.—ED.

Builders' Hardware--A Demand for Better Material.

To the Editor of the Scientific American:

I wish that something were said and done to correct the bad practices of some of the manufacturers of builders' hardware, such as nails, screws, hinges, latches, locks, window pulleys, hooks, etc.

I presume that there is not a house carpenter in the country who has not had his patience tried by the poor quality and frequent failure of some of these articles.

Nails, as brittle as cast iron, are quite common articles; the iron of which some of them are made is so poorly welded that they often split by the first stroke of the hammer. Our American screws, in form and finish, are all that need be desired, and yet the material of which some of them are made is so poor that their heads snap in the act of screwing them into soft pine; the round headed ones are especially liable to this fault. The square corner under the head is unfavorable to strength, and a round corner or trumpet form would greatly improve their strength at this point; the slots in some of their heads are so shallow that they are useless until they are reslotted. Those brilliant mineral and porcelain knobs, which add such a pleasing feature to the finish of our doors, frequently jar off from their metal sockets for the want of a stronger and deeper dovetail to the sockets; and the sockets are continually getting loose upon the square shanks for want of a snug and proper fit to the screws that hold them on. The rivets that hold the cheeks to the window pulleys are often so slightly headed that the cheeks spread as soon as the weight is applied.

These are some of the defects which sometimes try the

patience not only of builders and housekeepers, but of everybody who is able to raise a window or open a door. It would cost no more to make these things of good material and strong and serviceable at the points I have named, than it does in the present faulty manner.

It is a matter of considerable importance; and if the manufacturers could appreciate it, as some others do, I think our hardware stores would soon cease to be encumbered with these demoralized articles. F. G. W.

[For the Scientific American.]

EXPOSE OF THE TRICKS OF THE DAVENPORT BROTHERS.

BY P. H. VANDER WEYDE.

[Continued from page 37.]

After the feat of throwing the speaking trumpet through the small hole in the middle door, for which the mouth is used, a few musical instruments are played in the box, a guitar, violin, etc., and a kind of performance takes place on them; at first the strings are only hit at random, such as any one may do by hitting them with the knees or elbows, or by taking the violin bow in the mouth and hitting the loose strings. The believers in the supernatural are delighted with the music performed by the supposed spirits; they declare it to be of a different kind to any executed, even by the most accomplished performers; and in this opinion they are perfectly right.

In the meantime, one of the brothers is working himself loose, by which he is most especially assisted by the smallness of his hands, so that he may soon slip one hand through the usually clumsily tied knot of the rigid manilla rope; as soon as this is done, the rest is easy, and more perfect performances may be indulged in; while, in the meantime, the brothers are from time to time shown to the audience, by opening the doors, of course taking care on each occasion to place the hands behind their backs as if they were still tied up.

I wish here to call attention to the all powerful capacity of the small pliers, such as wire workers use to cut wire with, in loosening the most tightly fastened knots. They must not be sharp enough to cut the rope, but must only take a strong hold; no knot can resist the application of one, or, better still, of two such pliers. It is more than probable that the Davenports are provided with them, and the only real difficulty they may encounter is to get the first hand so far loosened that it can handle the pliers; the rest is then easy. When I was called, by the wish of the audience, to tie one of them, I took my own hemp rope, and used it so effectively that more than an hour elapsed before they were loose; little time was thus left for other performances, and the exhibition of that night, at least, turned out a partial failure, several parts of the programme being omitted.

When the ropes at last, by their continued labor, are totally loosened, all the doors are opened, and the brothers exhibited standing with the ropes laying at their feet. After this preliminary performance, they tie themselves, and then the principal feats are performed, because they tie themselves in such a way that they can slip out their hands at any time, and slip them in the knot again in a few seconds. In order to teach any one to do this, I will describe it minutely: Take a rope of suitable length, and tie the ends around your feet with plenty of heavy knots, so as to leave the middle part of the rope free for the length of about three or four feet; pass this middle part behind the seat of the chair, or through the hole with which the wooden seat in their box or closet is provided. You thus obtain a loop which will be loose when you bring your feet backward, and tight when you bring them forward; through this loop, when loose, you may stick your hands, twist them round a few times, so as to produce an apparent knot near the hands; and then, by bringing the feet forward, the knots appear to be tied down. All this, of course, is done out of sight of the audience. When ready, the doors are thrown open, and the unwary public is surprised to see the hands tied behind the back, and the knots on the feet; and, taking it for granted that the knots were tied after the hands were fastened, the only conclusion of believers in spirits is that the spirits tied the knots. If now they want to take off their coats, the doors are closed, the feet brought backward, which loosens the loop, the hands are twisted back and slipped out, the coat is taken off, the hands are slipped in again, twisted round, and the feet brought forward, which tightens the rope, and the doors are opened. This takes very little time, and, by continual practice, the Davenports do it very rapidly. Of course, in this way, they can do anything—stick their hands through the hole in the door, put them on the head or face of any timid individual they take in their dark box, or play on instruments; and every time that their hands are passed through the loop, they withdraw the bolt and allow their assistant to open the doors and exhibit them to the public, who thus sees them only when they are tied down.

I have performed these tricks at that time repeatedly, and done everything that the Davenports did; it surprised those present before it was explained; of course, after the explanation, all interest ceases.

Before closing, I wish to remark that experience shows that the public is willing to pay for being deceived and amused, but not for being enlightened. This was proved by a certain person, whose name I have forgotten; and who, immediately after the close of the Davenport performance, hired the same hall and spent the required amount of cash to advertise that he was going to reveal all the tricks of the Davenports. The attendance was so small that he lost as many hundred dollars as every night were made by the Davenports. However, I saw that he had, after all, not found out the true *methodus operandi*; he spoke only generally against spiritualism, referred to hidden springs, movable seats, etc.; and his lecture was a failure, in so far as he intended to explain any details of the feats performed. But even if he had given the true explanation, success would not have been better, and his experience was a lesson to those who perhaps felt inclined to enlighten the people in place of deceiving them. The old saying of the heathen Roman priests, "*Mundus vult decipi, decipiatur ergo*," holds, alas! still good in our so-called enlightened nineteenth century.

The Electric Light.

On the 18th ult., a series of experiments was made at Sheerness with a view of ascertaining the applicability of Siemens' dynamo-electric light to torpedo service in time of war. The scientific combination is produced, as its name signifies, by the application of excessively rapid motion generated from the fly wheel of a steam engine to a very powerful set of ordinary galvanic coils in connection with soft iron magnets. The leather strap from a four horse power engine, encircling a small gun metal pinion, causes it to revolve with the extreme velocity of 1,600 revolutions per minute, inducing motion in an electric bobbin at the side of an apparatus consisting of several sets of strong insulated coils. A stream of electricity consequently passes through them. This stream is conducted to a second series of coils, larger and more powerful than the first, which are also in combination with a pinion revolving 800 times per minute, thus intensifying the stream as it passes through them to a very considerable degree. Both negative and positive currents are now alternately given off, from another bobbin at the side of the second series of magnetic coils, to the train of insulated wires, which conveys them to the position from which the dynamo-electric light is to be exhibited. Here there is a delicately contrived apparatus for containing the carbon points, between which the light is to be generated, adjusted at the top of a tripod somewhat similar in construction to that of a surveying instrument. At the back of the two carbon points, and slotted vertically to admit of their holders passing through it, is a concave reflector of white polished metal, which collects the rays of light into a focus and transmits them in any required direction by means of an adjusting hand wheel below. A minute aperture in the center of the reflector, precisely behind the junction of the two carbon points, throws a representation of the flame upon a piece of opal glass in a frame fixed at the back of the reflector; and through the agency of another small hand wheel, which causes the carbon points to approach or recede from each other, the flame can be reduced or intensified at pleasure, by simply turning the wheel, care being taken at the same time to keep a watchful eye upon the picture produced, as the withdrawing of the points to too great a distance from each other will extinguish the light. It should have been remarked before that ample means are taken, by lubricating the electrical apparatus, to counteract the evil effects which might otherwise arise from the excessive friction consequent on the rapidity of motion in the several parts.

The object of instituting the series of experiments which were made was to ascertain if it was possible to throw such a stream of light upon an enemy's working parties (engaged in interrupting communications), with a line of torpedoes at night, as would render them sufficiently conspicuous to be fired at and consequently driven off. The place selected was the new fort at Garrison Point, Sheerness.

Colonel Nugent, R. E., the President of the Torpedo Committee of Great Britain; Colonel Galway, R. E., Commandant of the School of Military Engineering at Chatham; Colonel Hyde, Bengal Engineers, President of the Torpedo Committee of India, and a number of other engineer officers interested in the matter, were present. The experiments were conducted by a representative of the firm, of Messrs. Siemens, Brothers, the inventors of the machine, and were superintended by Lieutenant Anderson, R. E., secretary to the Torpedo Committee. The engine and coils were erected in the enclosure of the fort, while the instrument itself was placed in one of the massive embrasures piercing its sides. No sooner was steam got up and the order given to turn ahead, than the burring noise of the machine indicated that electricity was being rapidly generated, sparks and stars of vivid blue light being given off at the various joints. Another instant, and a vivid stream of light shot across the sea to a number of ships lying in the offing at a distance of about two miles, lighting them up with the brilliancy and distinctness of broad moonlight. The effect was magnificent. Clouds of mist, rendered visible by the intensity of the rays shooting through them, rolled across the broad field of bright light from time to time, not, however, interrupting the view in their progress. By shifting the direction of the rays laterally, each object in turn came within the compass of the portion of horizon rendered clear. In fact, it was sufficiently apparent that no objects of any appreciable size, such for instance as an enemy's boats, could come within a mile or more of one of Siemens' dynamo-electric instruments in operation without being rendered conspicuous to any battery in the vicinity, and consequently involving to themselves the most imminent danger. Hence the result of the experiments may be pronounced a success; whether, however, a corresponding effect might not be obtained by a succession of parachute lights thrown from a rocket or mortar is quite an open question.—*London Artizan.*

THE man who will distance his competitors is he who masters his business, who preserves his integrity, who lives clearly and purely, who devotes his leisure to the acquisition of knowledge, who never gets in debt, who gains friends by deserving them, and who saves his money.

Improvement in Roofing.

This invention consists in a novel arrangement of covering and protecting devices for ventilating passages at the peak of a slanting roof made of boards and cleats, running from eaves to peak, and having grooves in the boards near the edges under the cleats for conveying the water away. The ventilation is required to prevent the water from settling back in the grooves by the melting of snow at the peak in consequence of the accumulation of heat thereat when not allowed to escape, while the water freezes at the eaves and sets back.

The roofing boards are placed side by side from the eaves to the ridge on joists, stretching from one to another of the rafters, the boards being placed so that the edges do not quite meet to allow for expansion. The upper ends are placed a short distance apart to allow air to pass from the grooves and cracks to an escape passage, and are grooved near the edges to prevent the water from running to the joints under the cleats, which cover the joints between the boards.

The boards are fastened at the center only, and the screws or nails which fasten the cleats pass down through the cracks, so as to leave them free to expand and contract without hindrance from the fastenings, which would cause the boards to split if applied to them at the edges.

Air is fully admitted in the grooves and openings under the cleats, and carries off all moisture arising from damp or wet weather, which makes this combination durable. Escape passages are made in the upper ends of the boards, between the cleats, for the escape of the heated air, and vertical plates are placed below them. Metal angle plates are placed over them, to prevent the rain and snow from falling into the passages, and the vertical plates prevent the beating up to the passages under the angle plates by the wind. By thus ventilating these roofs at the ridge, it is claimed the danger of leakage by back water is avoided. Mr. Melvin J. Earl, of Mannsville, N. Y., assignor to Polly M. Earl, of Ellisburg, N. Y., is the inventor of this improvement.

Improvement in the Manufacture of Sugar.

Messrs. George A. Drummond and Thomas Sterry Hunt, of Montreal, Canada, have just obtained a patent, through the Scientific American Patent Agency, for a process of removing iron or other injurious metal from sugar. For this purpose they employ a mono sulphide of one of the alkaline earths, such as calcium, strontium, or barium, in conjunction with sulphate of magnesia.

To the solution of sugar or the sirup, milk of lime is added so as to make it slightly alkaline. Then the prepared sulphide of barium, calcium, or strontium, either in powder, or, by preference, dissolved in water, is added, thoroughly stirring the whole at the temperature of between 100° and 150° Fah.

If the solution now gives a dark color to paper moistened with acetate of lead, the quantity of sulphide is sufficient. If not, more must be added. A quantity of sulphate of magnesia in solution is then added, at the rate of one and a half pounds for every pound of sulphide of barium, or for every half pound of sulphide of calcium. The whole is thoroughly incorporated and heated.

A small quantity of blood or albumen facilitates subsequent filtration. The whole is now passed through a filter, and is then ready for the subsequent process of refining. The amount of sulphide to be used will depend upon the impurity of the sugar or sirup, but will not exceed, in most cases, two or three pounds of sulphide of barium, or about half that quantity of the sulphide of calcium, to the tun of sugar.

The theory of the process is as follows: The iron or other metal, held in solution as oxide in the sirup, is converted by the sulphide of the alkaline earth into sulphide, which is insoluble. The subsequent addition of the sulphate of magnesia converts any excess of the alkaline sulphuret into a very unstable sulphide of magnesium, while the baryta, if used, is separated as a wholly insoluble sulphate, which, with the sulphide of iron, etc., is separated by filtration.

The process may be varied somewhat to suit circumstances, and the ordinary apparatus of sugar refining is usually quite sufficient to carry it out effectually.

Crook's Automatic Oilers for Looms.

This invention has for its object to furnish an improved automatic oiler for looms, so constructed as to keep the requisite parts of the loom all the time properly oiled, thus effecting a great saving of oil and preventing the parts of the loom from being injured by the neglect of the weaver.

The cup, can, or reservoir for the oil, which may be made in the form of an ordinary oiler, or any other desired form, is provided with tubes, one or more of which may be used, and the lower ends of which lead into the lower part of the can. The tubes incline outward and upward, and in them are placed wicks, the inner ends of which enter the cup, and the outer ends of which project from the outer ends of the tubes, to conduct the oil by capillary attraction from the cup to the thing to be oiled. The oiler may be hung from the framework of the loom by having a properly shaped lug attached to it; or it may be placed upon a small shelf attached to the framework.

With a two tube oiler, one tube will oil the two rollers of the picker and the studs or pivots upon which they work, and the said rollers will in turn oil the shoe, making five places oiled by one tube. The other tube oils the small cams, and they oil the lever that works the catches that work the boxes, thus oiling three places, so that a two tube oiler keeps eight parts of the loom constantly oiled. A single tube oiler may be arranged to oil the spindle upon which the picker works. Mr. Joseph Crook, of Ludlow, Vt., is the inventor.

BY bestowing blessings on others, we entail them on ourselves.

New Process for Bread Making.

The object of this process is to increase the amount of bread that can be made from a given quantity of wheat. It does so by dispensing with grinding altogether, and by utilising some of those matters which, under the name of brans, are at present withdrawn from consumption. The inventor does not pretend to rival the quality of the best white bread, but that of inferior quality, technically known as "seconds," and it is to this bread that the following remarks apply.

Given 100 parts of ordinary wheat, grinding converts it into 80 parts of flour fit for seconds bread, and 20 parts of husk and bran. If the miller tries to alter the proportion, by diminishing the weight of the refuse and increasing that of the flour, the bread made from it will be more or less dark-colored in proportion as he has diverged from the recognized rule. Bran forms really only 5 out of these 20 parts, the remaining 15 being made up of fatty and gummy matters, which remain behind, and cannot be converted into flour.

The 5 per cent, which is really the episperme or integument of the grain, is of course useless, and this is the total weight of refuse matter which M. Zézille permits. This is got rid of in his process by such slight friction as arises from shaking the grains together, which he finds sufficient for the the decortication of the grain.

The color of the grain remains unaltered, but the decortication has rendered it fit for treatment with water. Under the outer envelope which constitutes the true bran is found a layer of a yellow substance, almost insoluble in water, and which is blackened by fermentation; this is the gummy matter, cerealine. M. Zézille removes this substance by by steeping the decorticated grain for half an hour in water heated to 80° C., decanting the resinous liquid thus produced and again running on hot water. This washing is repeated three or four times in about five hours, the temperature of the liquor never being allowed to fall below 40° C., or starch would be formed. The grain is now found to be slightly swelled, and to have very much increased in weight. In place of 95 kilogrammes it now weighs 160 kilogrammes.

In this phase of the process the wheat is almost white, and can readily be crushed between the fingers. The last operation is to reduce it to dough. This is done by passing it between rollers similar to those of a chocolate mill. It then loses about one fifth of the water it had absorbed, and is reduced in weight to about 145 kilogrammes.

The paste thus obtained only requires the addition of yeast and the ordinary routine of the bakehouse, to become a good wholesome bread.

If the bread is as nutritive, the gain in this mode of bread making is very great, as 145 kilogrammes can be produced from quantity of wheat from which, at present, we only obtain 108-110 kilogrammes. The question deserves most thorough investigation, as its results point to a very great reduction in the price of the most largely consumed of our food stuffs.

The extreme simplicity of the means by which so great and so important a result is said to be obtained is exceedingly likely to provoke opposition and, indeed, incredulity. It will perhaps be said: How is it possible, with so many able experiments, so many skilled workmen, and thoughtful chemists, during so many centuries, that so simple a process has been overlooked and has not long ago been adopted, if it had any real value? But, on the other hand, such reflections do not authorize the curt dismissal, of so important a subject, as a mere chimera. In France the inventor is supported by the testimony of MM. Parville, Payen, Barral, etc.

Long trial, and most careful analysis, can alone decide on the merits of this new discovery; but if, as we hope, it is really sound, its benefits will be reaped by millions.—*Les Mondes.*

On a Simple Remedy for Dandruff.

There are doubtless few persons, especially among gentlemen, who do not suffer from the inconvenience of dandruff. Physicians seem to consider it not of sufficient importance to engage their attention, and the poor victims are left either to practice their virtue of endurance, or for a cure, to try some of the many nostrums advertised in the public prints.

The intolerable itching which frequently accompanies the troublesome complaint, is not the only unpleasant feature, as to persons of any pretensions to neatness, the appearance of the white scales on the coat collar and shoulders is very objectionable.

The writer, during a number of years, tried the different alcoholic solutions of castor oil and many other preparations without permanent benefit, and as a last resort, was led to adopt the plan of cleansing the scalp with borax and carbonate of potassa. This proved effectual, but after a persistent treatment of some months the hair became sensibly thinner, and perhaps would have soon disappeared all together. The belief that dandruff arises from a disease of the skin, although physicians do not seem to agree on this point, and the knowledge that the use of sulphur is frequently attended with very happy results in such diseases, induced me to try it in my own case. A preparation of one ounce flowers of sulphur and one quart of water was made. The clear liquid was poured off, after the mixture had been repeatedly agitated during intervals of a few hours, and the head was saturated with this every morning.

In a few weeks every trace of dandruff had disappeared, the hair became soft and glossy, and now, after a discontinuance of the treatment for eighteen months, there is no indication of the return of the disease. I do not pretend to explain the *modus operandi* of the treatment, for it is well known that sublimed sulphur is almost or wholly insoluble, and the liquid used was destitute of taste, color or smell. The effects speak for itself. Other persons to whom it has been recommended have had the same results, and I communicate the result of my experiments in the belief that it may be valuable and acceptable to many who have suffered in the same manner as myself.—*John L. Davis, in the American Journal of Pharmacy.*

Measurement of the Velocity of Cannon Balls.

A very ingenious instrument, known as Noble's Chronoscope, is used for measuring the velocity of shot during its transit through the gun. The tube of the gun is fitted inside at certain intervals with metal rings (to the number of six or eight), the outside margins of which are sharpened into knife edges. As a shot passes along the tube and through these rings, the edges of the latter are jammed down upon, and made to cut through, the ends of various insulated wires, one of which is placed under each ring. Each of these wires is connected with an electric battery, and, as one wire after another is cut through and the insulation removed, an electric current passes, and a number of electric sparks follow one after another, according to the number of rings and wires. The recording of signals is accomplished by means of a series of metal disks, one in connection with each, which are made to revolve at a certain known velocity. The surface of the disks is of polished silver, coated with lampblack. As soon as a wire is cut by the passage of a shot, a spark hops over to the recording disk, removing a little of the lampblack coating, and thus marking the place by leaving a bare minute spot of bright metal. From the relative position of the successive spots on the disks, and the known velocity at which they revolve, a simple calculation determines the velocity of the shot. A shot usually takes from one two-hundredth to one three-hundredth of a second to traverse the whole length of the bore of a large gun, its speed being somewhat slow when passing the rings, and increasing as it approaches the muzzle of the gnn. From the extreme delicacy of the instrument, the calculation can be made with precision to a millionth part of a second, and the velocity determined with the greatest accuracy.

Vapor of Mercury.

M. Merget has discovered that by dissolving iridium, pallidium, platinum, gold, or silver, in *aqua regia*, a reagent is obtained which is extremely sensitive to mercury, and which will, he believes, prove of great value in the solution of very many practical and theoretic problems. A paper impregnated with such a solution is marked with an indelible black stain immediately it is brought in contact with mercury or mercurial vapor, no matter how small the quantity, or how low the temperature may be. M. Merget also hopes to be able to throw great light upon the problem of a limited or an unlimited atmosphere, which was investigated without success by Wollaston and Faraday. He expects to be able to prove that mercury constantly sends forth a vapor which ascends to the hight of a mile at the rate of 550 feet per second. As a practical result of his research, M. Merget, by means of these test papers, exhibits the presence of mercurial vapor in all the workshops and warehouses where this metal is used or stored. If a workman passes but one hour in such an atmosphere, his clothing, face, hair, and beard become impregnated with mercury. If he but touches one of the prepared papers he testifies to the presence of the mercury by a well defined black mark.

Calefaction.

M. Laborde has made some suggestive experiments on calefaction. He let a thin thread of water pass through the jet from the blowpipe, and he found on examination that the water which had thus passed, through a heat capable of melting almost any metal, was but slightly warmed; in fact, the difference was but three degrees. If a jet is passed through an ordinary flame, the increase in temperature is considerably higher, probably owing to the incandescent particles carried away by the liquid from the smoke. A sheet of water presents similar evidence. If the jet from the blow pipe is directed against it, it is not pierced, nor is there any sensible heating effect. The finger can be brought to within a few millimeters of the flame, and yet there is no sensation to indicate the close proximity of an otherwise so patent source of heat. It is suggested that if, instead of the metallic curtain used in theatres in the case of fire, a sheet of running water were interposed, so as totally or partly to enclose or shut out the fiery element, that would be an improvement upon the systems at present adopted.

The New Stimulant.

Chloral drinking, according to the physicians, is superseding absinthe, opium and alcoholic stimulants among the better classes. An insidious sedative, its use grows more dangerously on the tippler than more actively intoxicating drinks. The manufacture of this drug is the best evidence of the extent of its use. In Europe, its production has become one of the leading chemical industries, and it is sold by the tun. Baron Liebig affirms that one German chemist manufactures and sells half a tun a week. The London *Spectator* says: "Taking chloral is the new and popular vice, particularly among women, and is doing at least as much harm as alcohol. The drug is kept in thousands of dressing cases, and those who begin its use often grow so addicted to it that they pass their lives in a sort of contented stupefaction. Chloral drunkards will soon be an admitted variety of the species."

Brown's Water Conductors.

An invention, which has for its object to furnish a strong and durable conductor for water and other fluids, has recently been patented, through the Scientific American Patent Agency, by Mr. John W. Brown, of Milton, Vt. An exterior trough and an interior pipe are made of burned or hardened clay or cement laid in the ground, the flat bottom of the trough resting on the bottom of the ditch. The water pipe is entirely surrounded with cement, interposed between the trough and pipe, so that the joints of the pipe as well as of the trough are covered and filled. The parts being thus joined together form a solid and compact mass, which is claimed to be capable of resisting great pressure, the joints remaining perfectly tight. The cement, owing to the moisture in the earth, will harden to the consistency of stone. The inventor does not confine himself to any particular form or size of the pipe or trough, nor to any particular ingredients in their composition, nor to any particular kind of cement, but proposes to use hydraulic cement. The trough may be made to receive branch pipe of any angle, and is adapted to all situations where earthen or cement pipe can be used.

Pollock's Apparatus for Drying White Lead and other Pulpy Materials.

Heretofore these substances have been dried by one of the following processes: First, upon large stationary pans, upon which they had to be placed and spread on by hand and removed in the same manner. Second, in small earthen pots placed upon shelves in a room kept hot by stoves. Third, in kilns, upon tables of tile with heating flues underneath; or upon stationary tables with steam heat applied underneath. But all these plans are very slow, besides involving expensive handling; and when done, the stuff is in hard cakes, which have to be broken up to feed the grinding apparatus.

By the use of this new automatic feed apparatus, in combination with a rotary table, the expense of applying the stuff to be dried to the dryer by hand is saved. By the use of a rotary drying apparatus the substances are dried while continuously passing along from the stock cistern to the mixing tub; and by the application of heat, to the upper side as well as the lower side, the work is not only done much quicker, but the stuff does not cake, being delivered in a pulverized condition, which is attributed to the disturbance of the particles by the water, which is so rapidly expelled when passing under the rollers as to be boiled or converted into steam which, in escaping, prevents the adhering of the particles.

Mr. James B. Pollock, of Port Richmond, N. Y., has recently patented this apparatus through the Scientific American Patent Agency.

New Process of Sugar Manufacture.

There are at present on view at the offices of Mr. Henry T. Chamberlain, sugar and colonial broker, Clare street, Bristol, a number of samples of Demerara sugars which have been manufactured on the island by an entirely new process. The samples are of precisely the same description as were exhibited at the Georgetown Exhibition, Demerara, the special quality of the sugars being that they are prepared without the aid of animal charcoal. Instead of that material being used, bichromate of lime is substituted, and produces, from the raw cane juices, sugars which are not only unusually strong, but which are highly crystallised, and have an elegant appearance. Mr. Chamberlain states that, although the sugars are not known in this country, considerable quantities of them have been sold in America, and have there met with much favor. The samples, which are about a dozen in number, vary considerably in appearance and quality. Some of the crystals are very large and round, and would, probably hardly suit the English taste; others are white and sparkling, while some have a bright yellow color and are really handsome sugars. It is believed that the employment of the bichromate of lime instead of animal charcoal makes a difference in the cost of manufacture of about 2*l.* per tun.—*London Grocer.*

EDITORIAL SUMMARY.

IRON AND STEEL BOILER PLATES.—Referring to the use of steel for boiler plates, tubes, etc., Herr Kretschmer says that before experience could be gained on this subject, it would be necessary to have a brisker demand for the article than hitherto had been known. The employment of steel in this direction is but in embryo, but he considers that there is not much to be said in favor of the replacement of iron by steel for plates. At the Remscheid cast steel works, an explosion occurred under the following circumstances: About five pounds of molten steel were poured into a cast iron vessel filled with water; this vessel was shivered to pieces. One man was seriously injured by some of the flying fragments. The detonation was considerable. It is supposed that the explosion was caused by the generation of oxyhydrogen gas, and not by a sudden formation of steam.

CURIOUS EXPERIMENT.—Mr. Kroeing points out the following mode of determining which of two objects seen from a distance is further off than the other: Let the reader suppose two trees, for instance, standing in a line with the eye; if he moves his eye to the right, the tree which is nearer will appear to move to the left, and the other will seem to follow the motion of the eye.

THE great man is he who chooses the right with invincible resolution, who resists the sorest temptations from without and within, who bears the heaviest burdens cheerfully who is calmest in storms and most fearless under menaces, and whose reliance on truth, virtue, and God is most unfaltering.

PRESERVE your conscience always soft and sensitive. If but one sin force its way into that tender part of the soul, and is suffered to dwell there, the road is paved for a thousand iniquities.

The Beckwith Sewing Machine.

To make a very cheap sewing machine has been the aim of many inventors. To make a very cheap and also a good one has been sought by some, but few have been successful in combining the two advantages of small cost and great utility. We, however, exhibit in the accompanying engraving one that possesses the utility of more costly machines, while it is furnished at a price below anything we have seen of the kind that can perform the same work in as complete a manner. It is capable, as we have proved by operating it, of doing plain seaming, hemming, tucking, stitching, embroidering, and, in short, most of the sewing done in families.

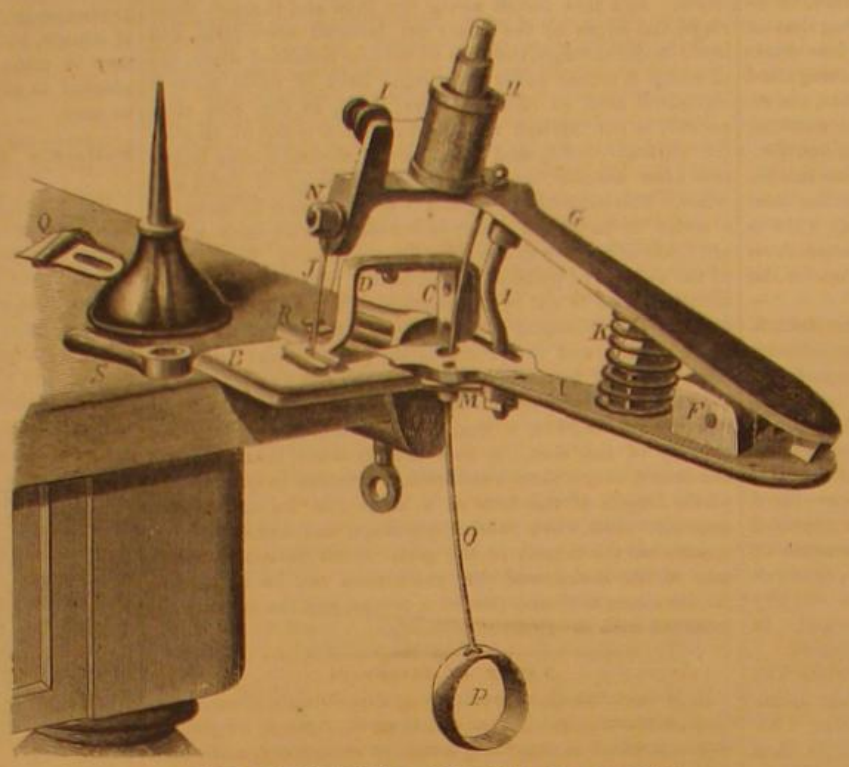
The stitch is the elastic loop stich, which has, against many misrepresentations and much prejudice, gained a wide popularity, many now preferring it to the lock stitch. In fact, a high priced machine, which has had probably as large, if not larger, sale than any other in England, employs this stitch. The machine under consideration fastens off the seam in such a way as to make the work strong and elastic, so that it stands well in washing, and possesses the elasticity, strength, and other advantages which undoubtedly belong to the loop stitch.

The parts of the machine are so few, and its adjustment are so simple, that skill to run it may be acquired almost at one sitting.

The portability of the machine is an advantage which will lead to its purchase even by those who own larger machines, as it can be carried to any part of the house; or, when its owner wishes to spend the afternoon or evening away from home, it can be taken along as easily as a needle case, or carried in a trunk, valise, or satchel, on a journey. The box in which the machine is packed is, in its greatest length, only six and a half inches, and is four inches in hight. It holds not only the machine but the wrench, thread, oil can, bottle of oil, hemmer, different sized needles, etc., which accompany it.

The fatigue of operating it is much less than that of larger machines, so that children and ladies, in too feeble health to use the latter, may employ this without injury. An easy speed for this machine is 240 stitches per minute, as we have found on actual trial. A little practice would enable this speed to be much exceeded, while it may be run as slow as desired.

The machine is nickel plated throughout, so that it will not tarnish with handling. It is substantial and durable, and the appliances shown in the engraving accompany each machine.



THE BECKWITH SEWING MACHINE.

Referring to the engraving, the parts of the machine and their uses are as follows:

A is an L shaped bar that supports all the other parts of the machine; B is the cloth plate. From the bar, A, rises a stud, C, to which the presser foot, D, is attached. The end of the bar, A, next the table, slips through a slot in the clamp, E, which fastens the machine to the edge of an ordinary table or stand, as shown. To the bar, A, is pivoted, at F, the bar G, which carries the spool, H, the tension, I, and the needle, J. When not at work, the bars, A and G, are kept asunder by the action of the coiled spring, K, which surrounds two studs on A, between which plays a stud, on G, by which lateral strain on the pivot, F, is avoided, and the vertically vibrating bar, G, is guided in its movement. From the under side of the bar, G, extends downward the bent bar, L, the inclined part of which plays in a crotch formed in the rear end of the hook, M, thus actuating the latter, which is pivoted to the bottom of the bar, A. The needle is held by the nut, N.

The machine is operated by a strong and tough piece of wire, O (best piano wire) extending from the bar, G, down through a hole in the bar, A, and having a thumb ring, P, at its lower end.

Q is the hemmer, lying loose on the table. R is the guide attached to the plate, and S is the wrench which turns the nut, N.

The needle has its eye, which receives the thread, in the point; and when the bar, G, is drawn downward, it is forced down through the fabric, forming a loop which is entered and held by the looper hook, M, till the needle is raised and forced down again, when the hook releases the loop previously caught, and engages the new loop, and so on.

The feed motion is accomplished by the needle itself, which is set inclined, so that in its descent it draws along fabric enough to gain space for the next stitch. It is obvious that the setting of the needle will govern the fineness of the stitching. The cloth is fed towards the operator, and passes into the lap from the machine, the table to which the machine is attached forming a support for the work, so that it is easily guided by the left hand. The thumb of the right hand is placed in the thumb ring, P, in operating, and depresses the bar, G, causing the needle to penetrate the cloth, and the other parts of the machine to act in conjunction with it. The spring, K, makes the upward stroke.

In conclusion, we will say that a large number of testimonials have been shown us, certifying in enthusiastic terms to the satisfaction the machine has given those who have used it. A large numberhave been sold, and the demand for them is said to be rapidly increasing. It was patented, in the United States, April 18, 1871. Foreign patents have been secured. For further particulars address W. S. Barlow, President Beckwith Sewing Machine Co., 26 West Broadway, New York.

PIG IRON.—Mr. C. R. P., of Milburn, Ky., writes to say that a hog of his died suddenly, and in the intestines were exhibited, by the autopsy, a quantity of nails and screws, besides pieces of copper and tin plate. [It is well known that swine will attack anything when hungry; and, in places where food is scarce or dear, they have been known to swallow pebbles or lumps of clay. They can be restrained from this pernicious practice by keeping the trough full of corn; and, on the other hand, they can be compelled to support animation on anything that lies round, if the supply of the proper sustenance be cut off.—ED.

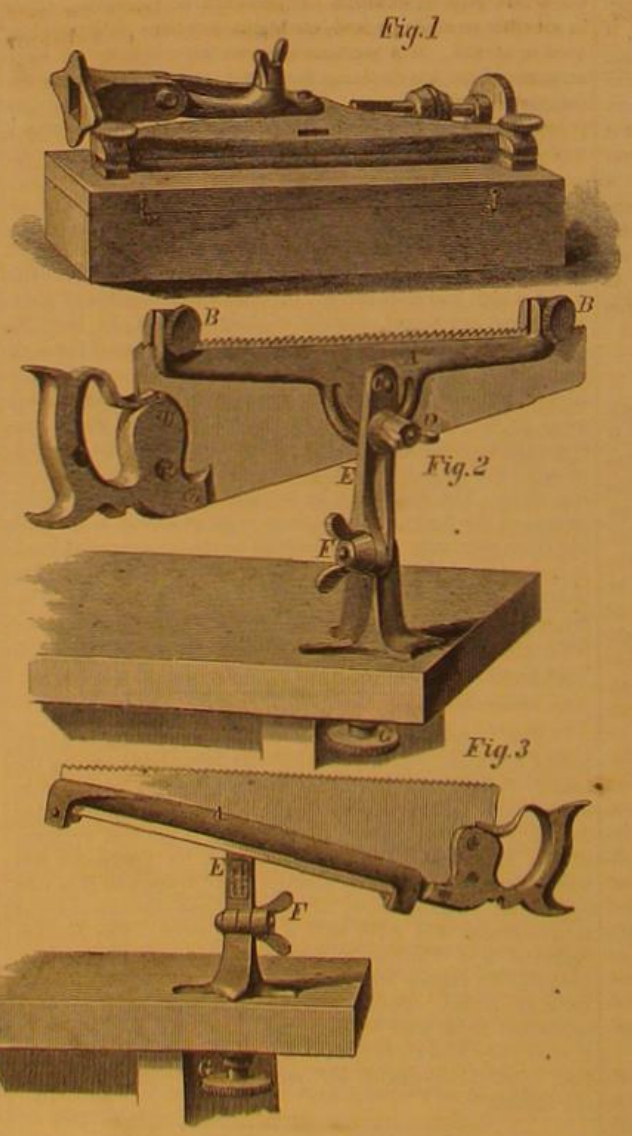
BALDWIN'S SAW CLAMP.

Some one has said, "simplicity is the soul of beauty." Be this as it may, there is no doubt that simplicity in all articles of common use, is an element of popularity that cannot be dispensed with.

Our engraving illustrates an invention of a practical character, in which the inventor has not lost sight of the importance of simplicity. The invention consists in a clamping device for holding saws in the processes of filing and setting, the utility of which will at once impress itself on the minds of practical mechanics.

Fig. 1 shows the implement folded and lying on the top of a neat packing case. Front and rear views of the invention, as it appears in use, are shown in Figs. 2 and 3.

A are the jaws in which the saws are held. They are brought together by the screws, B, Fig. 2. The jaws acting together are pivoted at C, a thumb nut, D, the screw of which passes through a semicircular slot in the jaws, enabling the latter to be set and held at any angle with the upright, E, that supports the jaws. The upright, E, is pivoted to the pedestal at F, the pedestal being socketed to fit the square end of a support, G, inserted through the bench from the bottom. By means of the pivots, C and F, and the thumb nuts, the saw may be held in the most convenient position for filing, no matter what the shape of the blade may be.



In Fig. 3, the jaws are shown rotated about the pivot, C, and reversed for holding the saw while jointing the teeth. This is done by taking out the screw at D. When the jaws are thus reversed, they are held by a simple device not shown in the engraving.

The implement is an exceedingly handy appliance, and will take up but little room in the tool chest. Although the patent has been so recently issued, the inventor states he has received quite a number of orders.

The invention was patented through the Scientific American Patent Agency, Dec. 26, 1871, by Nathan H. Baldwin, of Laconia, N. H. The inventor wishes to dispose of the entire right, or any portion of territory.

NEW MATERIAL FOR CRUCIBLES.—At Wocheina, in Krain, a substance has recently been found which promises to become of considerable importance in the manufacture of crucibles, etc., for cast steel works. It is called Wocheinit, after the place where it was found, and its chief recommendation lies in its large percentage (50·82) of alumina. Richter has demonstrated that the resistence of crucibles to the influence of heat depends largely on the amount of alumina contained in the fireclay. By itself the Wocheinit may not prove plastic enough for molding, but Dr. H. Schwarz says that two parts of Wocheinit with one or two parts of ordinary fireclay gave the best results.

THE FRANKLIN STATUE IN PRINTING HOUSE SQUARE.

The birthday of Benjamin Franklin was celebrated on the 17th January, by the unveiling of a fine bronze statue of that eminent printer, statesman and philosopher, executed by Mr. Ernst Plassman, and presented to the Press of New York city by Captain De Groot. An appropriate site in Printing House Square had been selected, upon which a handsome pedestal of granite had for some days supported the veiled statue. When the banner was removed, general satisfaction was expressed in regard to the artistic merit of the work. The ceremonies were conducted by distinguished clergymen and members of the Press, and in the evening a banquet was held at Delmonico's, with the usual accompaniment of speeches and toasts.

Reward for Electrical Improvements.

By a decree, dated April 18, 1866, of the Minister of Public Instruction in France, a prize of 50,000 francs ($10,000) was offered for the most useful application of the voltaic pile, the period for competition to expire in April, 1871. From a report of the minutes presented by the President of the Republic it appears that candidates are few in number, and that, in the opinion of the *savans* to whom the memoirs were submitted, none is of sufficient merit to have earned the prize. By a decree of the 29th of November, the competition is now extended for another period of five years, to terminate on November 29, 1876.

Chinese Astronomy.

Professor John Williams, of the Royal Astronomical Society, England, has lately published a book of "Observations on Comets, from B. C. 611 to A. D. 1640," being extracts from Chinese annals. The introductory remarks contain a brief summary of the progress of astronomy among the Chinese, together with many particulars of interest relating to that subject, among which the instructions of the Emperor Yaou to his astronomers, extracted from the "Shooking," one of the most ancient of the Chinese records, are the most deserving of notice, being, perhaps, the earliest example of astronomical direction that has descended to us, dating, on the authority of the work just mentioned, the "Shooking" about 2,300 years before the Christian era.

THE manner of giving has been said to show the character of the giver more than the gift itself; yet the character of the gift may often be of even more significance than the manner of giving. It is not the value of gifts in money that renders them precious to any but mercenary hearts.

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Importance of Advertising.

The value of advertising is so well understood by old established business firms, that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising columns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 40,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

HEATING AND VENTILATION OF BUILDINGS.

The great mistake made in many systems of heating and ventilation is the attempt to perform two things together that should always be done separately. To heat a room is one thing, to ventilate it is another. These things should be kept independent of each other, and means of controlling each without interference with the other should be provided.

For example, in heating a room with hot air, as much cold air must issue from the room as there is hot air admitted. The amount of ventilation is therefore proportioned to the amount of heating. Now it is often necessary that a room, a church, or school room, for instance, should be heated in advance of its occupation, when there is no occasion whatever to ventilate it, and all the heat which passes out of it and is not brought back after it has reached the proper temperature, before the gathering of the assembly, is waste, pure and simple. Yet to warm the cold walls and benches, a constant stream of hot air is admitted, which, losing only a small modicum of its original heat, rushes out again into the open air in most instances, instead of being conveyed back to the furnace to be reheated, as it ought to be to secure economy. If means to do this are provided, and the proper adjustment is made, ten to one that the janitor or sexton will neglect to unmake it when the people come together, and they will breathe over and over the same air till it gets completely charged with narcotic poison.

We avow that we have never seen satisfactory ventilation in a building where the system was not independent of the heating apparatus. We do not mean by this that the tendency of cold air to gravitate, and of warm air to levitate, may not be taken advantage of in ventilating, but that the apparatus which heats shall in no way be employed as a means to regulate the outflow of air. If the latter be the case, depend upon it there will be either overheating and under ventilation, or over ventilation and underheating.

As our readers are aware from previous discussions of this subject, we do not regard hot air furnaces favorably in a sanitary point of view. Radiant heat, uniformly diffused, for us. No artificial sirocco, loaded with burned dust particles, and dried till it parches throat, lungs and skin. Yet even this method could be made tolerable, could men of sense be entrusted with the construction and erection of air flues and furnaces, so that (after all) what we complain of is more due to ignorance of the laws of heat than to the system *per se*. It is because through general ignorance faults are so liable to be admitted into the system, that it does not find favor in our eyes.

There is also reason to suspect the cast iron stove of insidiously undermining health. Cast iron is so porous that even water may be forced through the finest varieties of it, under pressure. The coarser varieties are permeable to some light hydrocarbon liquids, without pressure. Gases under the action of heat pass through this material, as has been proved by actual experiment, one product of combustion often thus escaping to such a degree as to cause lassitude, mental depression, and headache. Some physicians maintain that the effect of this gas is cumulative, and leads to typhoid fever and other sanitary evils.

How then shall we heat buildings? All large buildings may be heated by steam, but dwellings are often too small to apply this system economically with any steam heating apparatus of which we are at present cognizant. A field is now open for the introduction of a very cheap and economically working steam heater, could such a one be invented.

Without adopting the expensive porcelain stoves employed in some parts of Europe, it is possible a remedy may be found in some method of rendering hot cast iron impermeable to gases. A cheap, simple method for doing this would be a valuable improvement.

How about wrought iron stoves? Wrought iron is impermeable to gases, and there are facilities now for working iron plate by which stoves could be made, if not so cheap at the outset, yet still, we believe, far better to use, and more durable in wear. Here is another field for inventive thought, which we are confident it will be profitable to explore.

THE ANTIQUITY OF THE IRON MANUFACTURE.

Iron, the most common, as well as the most useful of metals, is undoubtedly the most ancient. Tubal Cain, the half brother of the patriarch Noah, is stated to have been the original "instructor of every artificer in brass and iron;" and though we cannot even conjecture what the primeval "brass" was, we know that iron was then as now the most universally diffused of all metals; although it must be admitted that, from the days of Tubal Cain to those of Henry Bessemer, the manufacture has made considerable strides.

Chalybia, on the shores of the Black sea, furnished the ores of the most ancient European iron of which we have any record; and the Arundel marbles give distinct evidence that its use was known at least two centuries before the supposed period of the Trojan war (about 1400 years B. C.) It is mentioned by Homer, in the Iliad and elsewhere; but his descriptions, and those of Thrasyllus and other ancient writers, all point out that it was wrought iron that was used; and probably this iron was made by welding together some highly ferruginous ores at a red heat. Thus weapons and blades could be easily fabricated without the use of any smelting process. The Chalybes also gave their name to steel (Chalybs), called by the Romans "white iron;" and four distinct qualities of steel were known to the Greeks. The hardening of steel by plunging into water was certainly familiar to the most ancient inhabitants of Greece, for Homer speaks of "hissing, as water hisses when the smith immerses in it a piece of red hot iron, in order to harden it." And case hardening by carbon was also done by the same people, "the finer articles being plunged into oil instead of into water." But while the pedigree of the iron manufacture is thus carried back into the most remote periods of European history, we have historical evidence and still-existing monuments, of much greater antiquity, of iron working by the Egyptians and the ancient races of Hindostan and China; and it is among these only that we have any proof of the knowledge, by the ancients, of a casting in iron. Wilkinson, the renowned Egyptian explorer, states that in the monuments in Thebes and Memphis, butchers are represented, sharpening their knives on a round bar of metal attached to their aprons, and these irons, from their "blue color, must have been of steel." More convincing evidence is afforded by the sickle blade, discovered by the Italian traveller Belzoni, under a granite sphinx at Karnak, as well as by a veritable cross cut saw, found by Mr. Layard at Nimroud, now in the British Museum. These facts certainly show that iron manufacture, involving the application of considerable knowledge and skill, is at least four thousand years old; and, beyond even this, we have evidence that this, like most other of the useful arts, came from the extreme east, and is, in India, of still greater antiquity. In corroboration of this view, we quote from the *Engineer* the following paragraph:

"It is strange that of the iron metallurgy of Asia, the mother land of all the arts, of India the country where, more than twenty centuries ago, King Porus presented to Alexander the Great a wrought bar of Damascene steel, just as Homer's Achilles offered for a prize at the funeral games of Patroclus a like valued mass, whence the Greeks obtained the like material for their 'wonder working sword blades,' where steel dies were employed for coinage when our own ancestors were naked savages, less is known than of the iron working of any other parts of the more or less civilized world."

But carrying our investigation farther back into time, and farther east on the map, we find that, among our slight knowledge of the history of manufactures and technical arts of the vast empire of China, the casting of iron is not only of immense age in that country, but has been carried on with great ingenuity and by processes which our knowledge is unable to account for. The authority quoted above mentions "China, whence cast iron hollow vessels now reach us, of a combined magnitude and thinness that we have not yet been able to imitate, or even to imagine the process by which they are cast, and razor steel, said to surpass all European steel in temper and durability of edge."

The most noticeable Oriental monument in iron is a pillar within the precincts of a mosque near Delhi, of which our contemporary says:

"This wrought iron pillar is as large as the screw shaft of one of our first class steamships, and a forging of the same size would be deemed a piece of first class work for any one of our great steam hammer forges in Europe, and yet it is *more than a thousand years old, and may be as much as fifteen hundred.* Its form is either that of a conic frustrum or of some curvilinear spindle, giving it a very slight swell towards its mid hight. The capital consists of an elaborate Indian design, the whole of which good observers deem to have been carved by the chisel out of the solid iron. The shaft, to near the present ground level, is beautifully smooth and true, and presents the character of having been "swaged," or, if not, "sledge planished" to its finished form. The lower part, for three or four feet above the present ground and below it, is rough and but carelessly rounded; there appear to be some rather large cavities in this part of the shaft. The pillar has been known to Europeans for many years. The earliest printed notice of it which the writer has seen is in the 'Journal of the Asiatic Society of Bengal,' Vol. VII., being part of a memoir 'On Lithographs and Translations of Inscriptions,' taken in ectype by Captain T. S. Burt, Engineer.

'The dimensions of the pillar may be approximated from paint marks in a vertical line placed upon it at distances of twelve inches apart, which have transferred themselves to the photograph and been copied in the engraving. The total hight above ground is 22 feet, that of the capital 3¼ feet, and that of the rough part near the ground the same. But its depth under ground is considerably greater than its hight above ground, as a recent excavation was carried down to 26 feet without reaching the foundation on which the pillar rests. The whole length of the iron pillar is, therefore, upwards of 48 feet, but how much more is not known, although it must be considerable, as the pillar is said not to be loosened by the excavations. I think, therefore, it is highly probable that the whole length is not less than 60 feet. The lower diameter of the shaft is 16·4 inches, and the upper diameter is 11·05 inches, the diminution being 0·29 inch per foot. The pillar contains about eighty cubic feet of metal, and weighs upwards of 17 tons.

"The principal inscription on the Delhi iron pillar is in Sanscrit, the character that form of Nagari which has been assigned to the third or fourth century of the Christian era. . . . . The curves of the letters are squared off, perhaps on account of their having been *punched* upon the surface of the iron shaft with a short *cheni* (punch) of steel and a hammer, as the actual engraving of them would have been a work of considerable labor. The inscription itself is of the most disappointing sort—its purport is merely to record that a prince, whom nobody ever heard of before, of the name of Dhava, erected it in commemoration of his victorious prowess; that he was of the Vaishnair (Hindoo) faith, occupied the throne he had acquired (at Hastinapura?) for many years, and seems to have died before the monument was completed; as no royal ancestry is mentioned, he was probably a usurper."

Such is a short account of a most noticeable instance of the truth of our opening remarks as to the universality of the knowledge of the qualities of iron among the earliest peoples of the earth; and once more do we acknowledge the truth of Solomon's saying: The thing that hath been, it is that which shall be, and that which is done, is that which shall be done; and there is nothing new under the sun.

WHAT TO DO WHEN YOU ARE IN TROUBLE.

Don't try to quench your sorrow in rum or narcotics. If you begin this, you must keep right on with it till it leads you to ruin; or, if you pause, you must add physical pain and the consciousness of degradation to the sorrow you seek to escape. Of all wretched men, his condition is the most pitiful who, having sought to drown his grief in drink, awakes from his debauch with shattered nerves, aching head, and depressed mind, to face the same trouble again. That which was at first painful to contemplate will, after drink, seem unbearable. Ten to one the fatal drink will be again and again sought, till its victim sinks a hopeless, pitiful wreck.

Work is your true remedy. If misfortune hits you hard, hit you something else hard; pitch into something with a will. There's nothing like good, solid, absorbing, exhausting work to cure trouble. If you have met with losses, you don't want to lie awake thinking about them. You want sweet, calm, sound sleep, and to eat your dinner with appetite. But you can't unless you work. If you say you don't feel like work, and go a loafing all day to tell to Tom, Dick, and Harry the story of your woes, you'll lie awake and keep your wife awake by your tossings, spoil her temper and your own breakfast the next morning, and begin tomorrow feeling ten times worse than you do to-day.

There are some great troubles that only time heals, and perhaps some that can never be healed at all; but all can be helped by the great panacea, work. Try it, you who are afflicted. It is not a patent medicine. It has proved its efficacy since first Adam and Eve left behind them with weeping their beautiful Eden. It is an officinal remedy. All good physicians in regular standing prescribe it in cases of mental and moral disease. It operates kindly and well, leaving no disagreeable *sequelæ*, and we assure you that we have taken a large quantity of it with the most beneficial effects. It will cure more complaints than any nostrum in the *materia medica*, and comes nearer to being a "cure-all" than any drug or compound of drugs in the market. And it will not sicken you if you do not take it sugar coated.

A LARGE mass of error is easily embalmed and perpetuated by a little truth.

POLISHING WOOD.

Having had numerous inquiries respecting polishing wood, we propose now to give some plain and simple directions, which, if followed, cannot fail to secure a good result. In doing this, we shall not attempt to give all the ways by which wood is given a fine polish, to do which would extend the article beyond the proper limits; but we will endeavor to give a method which is applicable to nearly all kinds of wood used for purposes in which a fine polish is desirable.

For general use, on hard or soft woods, there is nothing that, in the writer's experience, has proved so good as shellac dissolved in the proportion of four ounces of the gum to one and one fourth pounds, apothecaries' weight, of 95 per cent alcohol. Some have recommended the addition of gum sandarach, in the proportion of about one half an ounce to the above solution of shellac, but we have never been convinced that it was any benefit. It is certain that it renders the polish less hard and durable, and, though it facilitates the work a little, had better, we think, be omitted.

A second preparation, to be used in finishing, will be given below.

If shellac, free from gritty impurities, cannot be obtained, it should be purified by dissolving it in alcohol to a thin solution, and filtering it through porous paper. To obtain a fine polish, the wood must have as perfect a surface as it is possible to give it by tools. The finest sand paper obtainable should be employed. Some use old sand paper, that was coarse when new, to which we decidedly object, as it is likely to have somewhere some coarse grains still adhering, which will make unsightly scratches.

In sand papering, use a light hand and work in all directions of the grain till the wood assumes a soft, velvety fineness of surface, uniform throughout. If you have an old silk handkerchief, it is the best thing to wipe off the dust caused by sand papering. In any case, the cloth used for this purpose must be very soft, and should be warmed, on the same principle that a hatter warms his silk cloth by which he lays the nap on a silk hat after pressing.

Have at hand a little *raw* linseed oil in a saucer. Take a piece of linen and tie up in it a wad of soft cotton wool to make a rubber. The size of the rubber should be proportioned to the work in hand; say from the size of a hickory nut up to that of a hen's egg. The cotton must be compressed in the linen, so as to form a soft, somewhat elastic ball.

To the rubber is applied the polish, taking care to avoid overdosing. Then another linen rag is to be drawn over the ball, and puckered together to form a convenient handle. Now touch the outer rag with a drop of the raw oil from the saucer, and you are ready to begin the rubbing.

Now again use a light hand, especially if the wood has a soft texture. Rub in circles over a limited portion of the surface to be polished. When it is desired to squeeze out more polish, stop the rubbing, and press more heavily, till the polish oozes out through the outer cloth. Then proceed with the polishing till the cloth gets so dry as to risk marring the surface by scratches.

Thus cover the entire surface, putting from time to time more polish between the pad and the outer cloth, and renewing the latter, if necessary. Let the work dry thoroughly, and then put on a second coat of the polish, and let the work stand a day to allow perfect drying and absorption of the polish. When you return to it you will find, if the work was properly done, the entire surface of a dull but nearly uniform luster. A damp cold atmosphere, with plenty of dust floating in the air, are certain conditions of failure; avoid them.

Put on the third coat, and follow it by a gentle rubbing with a soft, clean rag, merely dampened with alcohol. The work is now ready to be finished.

The finishing coat should be given with one fourth an ounce each of purified shellac and gum benzoin dissolved in one and one fourth pounds of 95 per cent alcohol.

The rubber for applying this coat should be new and clean, and the finishing coat should not be applied till the third coat is perfectly dry. You may find that, after all your care, there are some dull spots. You may use "elbow grease" to remove them, as this last coat will bear much harder rubbing than any of the others.

Some practice filling the pores of open woods with glue sizing, but this never gives so fine a result, although it sometimes saves much labor. If a glue size is used, it should be made thin and of the best white glue. It should be well rubbed into the wood with a stiff brush, and after sand papering and dusting, a second coat should be applied. But in polishing wood, as in other nice operations, no good, satisfactory result can be obtained without labor and painstaking. These and a little practice, combined with the knowledge we have attempted to impart, ought to give skill in making what is, in our opinion, the most beautiful finish that can be imparted to wood.

THE SPREAD OF SMALL POX.

The accounts which reach us, in reference to the general spread of this alarming disease in both hemispheres, are calculated to frighten the timid, and to arouse the attention of those who, having little personal dread of the complaint, still feel a philanthropic regard for the welfare of mankind. Of all the fearful diseases that scourge the human race, this ranks among those that are justly feared most. The disfigurating scars it leaves, upon many of those who escape death, are a life long sequel to a most disgusting and painful sickness. The fear of contagion banishes the unfortunate sufferer from home and friends, and consigns him to the care of paid nurses hardened by long familiarity with suffering, and thus adds to the distress which at best attends the complaint.

It would be strange did not some exaggeration creep into the statements of the progress of small pox which reach us from every direction, but there is no doubt an unusual prevalence of the disease both in England and America. So far as can be gathered, it is not remarkably malignant in type, and the average of deaths from it is not greater than is common. It cannot, however, be predicted that it will not assume at any time the form of a malignant epidemic, and its continuance gives ground for the fear that it may become so.

In view of these facts, it is pertinent to inquire whether the periodical spread of small pox cannot be prevented. Facts and statistics fortunately enable a definite answer to be given. In Prussia, where the law requires revaccination to be performed every seven years, death by small pox is of very rare occurrence. Watson's "Practice of Medicine" gives statistics upon this point that will convince any who doubt. Statistics further show that about one half, of those who have had the vaccine disease as a result of vaccination, are liable to a modified form of small pox called varioloid, approaching more or less in violence to malignant types of the disease. The fact is thus fully established that the protection afforded by successful vaccination varies in time with different cases, and that the liability to varioloid is greatest between the ages of 15 and 25 years. To insure safety from the disease, it is necessary that revaccination should be practised not only between the ages specified but even before and after the period included in those limits. It is also a matter of fact that a first or second revaccination may fail and a third impart the disease, though the periods between the introductions of the virus be very short. A case of this kind has recently occurred with a student of medicine at Bellevue Hospital, who only succeeded in producing a true vaccine pustule at the third attempt, the time elapsing between each trial being only long enough to determine that the preceding one had failed.

We think there is no fact better established in medical science than that persistent revaccination will practically exterminate small pox. Had we a law compelling vaccination and revaccination, and could its enforcement be insured, we should soon cease to hear of the ravages of a scourge so dreadful. As it is, it is quite doubtful if such a law could be enforced if enacted. The best we can do at present is for the intelligent to protect themselves without law, against the neglect arising from the prejudices of the ignorant; and if, through neglect, the disease is acquired, to treat it in the most rational manner possible. To this end, we throw out some hints for treatment that have been approved by the medical faculty and which may serve as a guide to the patients and nurses.

First, if there has been exposure, there is time for vaccination to be performed, and to develop the vaccine disease before the small pox shall appear, and to modify the latter into the milder type of varioloid. After exposure, the first thing then should be vaccination.

Second, if the disease be acquired, the attendance of a good physician should, if possible, be secured, and the patient encouraged to accept all the necessary treatment. If delirious, he should be carefully watched, to prevent his disfiguring himself by scratching. Itching during the drying up of the pustules is almost completely controlled by a soft ointment of beeswax and sweet oil, with a little tannin, opium, and carbolic acid incorporated, which has, moreover, the advantage of rendering the smell less disagreeable.

The disease is most infectious during the latter stages. It follows that the most thorough cleansing of apartments, clothing, and the disinfection of every contaminated article should follow the death or recovery of a patient.

It has been suggested that glycerin is a far better liquid, with which to dissolve the vaccine matter at the time of vaccination, than water, as it does not dry, and therefore allows the more thorough insertion of the virus into the punctures in the skin. There are facilities now for obtaining pure matter taken direct from heifers kept for the purpose. Physicians, therefore, who use impure virus ought to be held to the strictest legal account for malpractice.

Now let every intelligent reader, instead of trembling lest he shall be attacked by small pox, take the only known means of prevention, cease his apprehension, and the disease will be mostly confined to the ignorant and the careless.

THE NATURAL FEATURES OF SOUTH AMERICA--NEW AND INTERESTING DISCOVERIES.

The southern half of our great continent possesses very great natural resources, as well as points of interest to the historian, the geologist, the ethnologist, and other scientists; and these resources are being turned to good account with a rapidity which is limited only by the paucity of population. The immense pasturages afford subsistance to countless herds of cattle, and the raising of stock is so cheap that the export of the hides, horns, and tallow well repays the farmer; coffee is a staple production of very great value, and the sugar production is being largely extended. In mineral productions, South America is exceedingly rich, but it will probably be some centuries before these are all made available for the service of mankind. The superior intelligence of the Anglo-Saxon race and the accumulated capital of the United States and Europe will probably be well occupied in developing the metallic deposits of Missouri, Utah, Nevada, Wisconsin and Minnesota for a long time to come. These interesting facts concerning South America are chiefly known to us through commercial enterprises; but we have now intelligence of some recent travels and investigations which we think deserve mention in our columns.

To an enlightened traveller, with a mind capable of learning the lessons spread before him in the great book of Nature, South America offers one of the most inviting fields for labor and study. The vast *flora* of tropical plants, the gigantic mountains and valleys, and the geological formations, of almost infinite extent and variety, have long been the favorite themes of students and writers of science; and from the early days of Humboldt to the present time, South America has been a rich field for the investigator of natural phenomena, yielding abundant and ample reward for the closest and most diligent study. Of its value in this regard, our greatest *savans* have long been convinced; and many among those who have personally examined the great natural beauties and characteristics, interesting and valuable to lovers of each individual *science*, have written, for the world's benefit, long and interesting accounts of the sights, discoveries, and peculiarities that abound in that country.

The chief points in the cosmography are the mountains, forests, plains, and rivers, all of which are of a magnitude surpassing those of other lands. Notwithstanding the tropical latitude of the northern portion of South America, the climate is singularly mild and equable, owing chiefly to the continuance of the trade winds. And plants, of prodigious number and variety, attain here a luxuriance of which the inhabitants of other countries can scarcely conceive. Forests, extending over two thirds of the continent, abounding in trees of great hight, covered with flowers of surpassing brilliancy to the very summit, have given South America a title to be considered the natural garden of the world. Humboldt, in speaking of this wonderful luxuriance states that, "individual plants, languishing in hot houses, can give us but a faint idea of the majestic vegetation of the tropical zone." While the trees and flowering shrubs are clothed with such extraordinary beauty, the forests are populated with birds whose plumage outshines that of the winged tribes of any other region, in variety, brilliancy and vividness of color. Many of the most useful animals, moreover, are indigenous to the soil; of these are the alpaca, the vicuña, and the guanaco. The winged insects rival the birds in beauty of color and form. Reptiles, on the other hand, are unusually numerous and noxious, many species of snakes being natives of Brazil. White ants abound, and are so destructive that Humboldt states that he was unable to find any manuscript one hundred years old. And the geological features are no less remarkable. Coal is found at a hight of nearly 15,000 feet above the sea level; and porphyry and others of the primary formations have been similarly upheaved by some vast convulsion of Nature.

There is now in progress a most interesting investigation into the geological and other remarkable phenomena exhibited in South America, especially in the Amazonian valley and the Brazilian empire generally. It is eighteen months since Professor C. F. Hartt, of Cornell University, accompanied by Mr. O. A. Derby as assistant, left our shores in charge of an expedition to the Amazon. His intention was to make a complete investigation into the geological character of the shores of the mighty river, and, possibly, to ascertain the truth of the supposition that the valley through which it flows was originally hollowed out by glacial progression. This theory was originally promulgated by Professor Agassiz, and Professor Hartt now reports that he has discovered evidence of the existence of totally different causes for the formation; and he also describes the whole valley as being full of choice relics of the most ancient races, and of the earliest geological formations. In his long and adventurous journey, Professor Hartt encountered many new features worthy of remark, visiting among others the Sierra of Paranaquara, which is one of the highest of the table-topped hills of the valley of the Amazon. This mountain is entirely composed of beds of clay and sand, deposited horizontally.

One of the most important contributions to ancient history is the fact that Brazil was once populated by a race which has left behind it relics of pottery, and mounds of urns, implements and weapons, and other indications of a *quasi* civilization. Many travellers have penetrated into Brazil and directed especial attention to this subject without arriving at any certain decision; but the point must now be considered settled. The claims of philology have not been neglected by Professor Hartt, he having compiled a grammar and dictionary of the Tupy language, which is spoken by the native tribes of Western Brazil; and he has also been successful in making a collection of the legendary traditions of the Brazilian Indians, some of which are said to bear a marked resemblance to the fables which have long been known to Europeans and Asiatics.

It is intended to give permanent interest and value to Professor Hart's labors by the publishing of a full and elaborately illustrated account of the expedition; and, pending the publication, further tidings from the distinguished traveller will be gratefully received by our people as the expedition progresses.

How to Fasten Rubber to Wood and Metal.

As rubber plates and rings are nowadays used almost exclusively for making connections between steam and other pipes and apparatus, much annoyance is often experienced by the impossibility or imperfection of an air tight connection. This is obviated entirely by employing a cement which fastens alike well to the rubber and to the metal or wood. Such cement is prepared by a solution of shellac in ammonia. This is best made by soaking pulverized gum shellac in ten times its weight of strong ammonia, when a slimy mass is obtained, which in three to four weeks will become liquid, without the use of hot water. This softens the rubber, and becomes, after volatilization of the ammonia, hard and impermeable to gases and fluids

SCIENTIFIC AND PRACTICAL INFORMATION.

MEERSCHAUM.

This curious mineral is known to chemistry as an hydrated silicate of magnesia. Of the lightness, porosity, and friability of this familiar substance there is scarcely any need to speak. It has been found in Spain, Hungary, and in Asia Minor, but recently large quantities of it have been found in Patagonia. This discovery will probably reduce the price of meerschaum, as the supply has hitherto been limited. The manufacture of meerschaum articles has been for many years carried on in Europe, chiefly in Vienna; and Parisian workmen have recently produced some excellent specimens of carving in this remarkable material.

AMMONIA AS A CURE FOR SNAKE BITES.

We recently called attention to the fact that as many as 8,000 persons die annually, in British India and Burmah, from the effects of snake bites. The Inspector of Police to the Bengal Government now reports that of 939 cases, in which ammonia was freely administered, 702 victims have recovered, and in the cured instances, the remedy was not administered till about 3½ hours after the attack, on the average. In the fatal cases, the corresponding duration of time was 4¼ hours.

BLACKING.

The lustrous qualities of blacking are frequently derived from ingredients which are most deleterious and destructive to leather. Herr Artus publishes a new formula, and claims several advantages for it, to which we may add its cheapness and accessibility: Three or four pounds vegetable black, 1½ pounds ivory black, 5 pounds molasses, and 5 pounds glycerin, mixed thoroughly together. Six ounces gutta percha, cut in small pieces, are then melted, and when fluid, 20 ounces olive oil are added, and subsequently, 2 ounces stearine. The second mixture, while quite hot, is stirred into the first; and then a further addition of 10 ounces gum Senegal, dissolved in about 3 quarts water, is added. This compound is the stock; for use, it should be diluted with about three times its quantity of warm water.

COPPER AND EPIDEMIC CHOLERA.

Among the many facts which have been observed by the collectors of statistics concerning epidemic visitations, one of the most remarkable is the almost complete immunity from cholera enjoyed by persons dwelling in the vicinity of copper works, or toiling in manufactories where copper or brass are manipulated. The best medical authorities mention it as a fact, that, among more than 30,000 persons thus employed in Paris and other European centers of population, the recent outbreak of cholera was fatal in only sixteen instances. This is the more remarkable when we consider that the salts of copper are all virulent poisons, and would seem to be another instance of the mutual destruction of deleterious influences.

ANTIDOTE TO OPIUM.

In a recent case of accidental poisoning by an overdose of morphia, the administration of 18 drops of Norwood's tincture of green hellebore was followed by a complete cure. The narcotic had obtained such mastery over the unfortunate patient that the pupils of the eyes had contracted, and the jaws had to be forced open to give the medicine, which was mixed with two ounces of brandy. All appearance of poisonous effects had vanished within an hour.

THE NEW YORK COMMISSIONERS OF PHARMACY.

This body has issued a report of its proceedings for the last six months of the past year. Six hundred and sixty-six persons, out of over nine hundred candidates, have been licensed, and of these, less than thirty succeeded in passing the examination at the first trial. Egregious and discreditable failures in chemistry, pharmacy, and toxicology, as well as in "doctor's Latin," characterized the large majority who were turned back by the ordeal. Only three out of over seven hundred applicants could read the simplest Latin sentences; but more than this number were familiar with the jargon of the prescription counter. "To express the idea of 'the same,' the word *ejusdem*," says our informant, "was used; and the Commissioners, with apparent satisfaction at the success of the trap, report the results of this test. One clerk, it is stated, replied that in no store where he had been employed had he ever seen or heard of "infusion of ejusdem." This famous prescription was presented at eighteen drug stores in the most populous part of Broadway, and in each the same answer as the above was returned.

WELDING COPPER.

To unite two pieces of copper by welding has puzzled many mechanics and metallurgists, but we read, in a cotemporary, of its recent successful achievement. A compound of 358 parts phosphate of soda and 124 parts boracic acid is prepared, and is used when the metal is at a dull red heat; the heat is then increased till the metal becomes of a cherry wood isred color, and the latter is at once hammered. A hammer of recommended for this purpose, as the metal is liable to soften at a high heat; and the hammer should be used cautiously. All scale and carbonaceous matter must be removed from the surface of the copper, as the success of the welding depends on the formation of an easily fusible phosphate of copper, which would be reduced to a phosphide by the presence of carbon.

LIQUID SPECTROSCOPES.

The use of transparent liquids, such as bisulphide of carbon, for the manufacture of lenses is making rapid progress on the ground of economy, large pieces of glass, free from flaw and blemish, being difficult to obtain and expensive. Poggendorff's *Annalen* calls attention to possible disturbances of the accuracy of liquid prisms, the lines in the spectrum varying with the temperature. The divergence, owing to changes of heat and cold, of the lines of solid prisms is quite insignificant. A glass prism, heated in the sun and then removed to the shade, was observed to possess an increased refractive power as it cooled, while a bisulphide prism exhibited a reversed result. These facts point out the importance of the use of the thermometer in conjunction with the spectroscope, and also show that there is room for great improvement in the manufacture of glass for optical purposes.

ELECTRICITY AND NERVE FORCE.

Mr. J. St. Clair Gray, of Glasgow University, Scotland, has recently observed the mutual action of sulphur and phosphorus in alkaline solutions, and the idea, that such action might be the source of an electric current, occurred to him. Accordingly he prepared a cell containing caustic potash in solution, and placed in it sticks of phosphorus and sulphur; and he found, half an hour afterwards, that the sulphur remained unaffected, while the phosphorus had settled in an oily mass to the bottom of the alkaline fluid. Phosphoretted hydrogen, spontaneously inflammable, was given off during the first six days; but after this time, the gas became somewhat sulphuretted, and no ignition took place. The test by Sir W. Thomson's electrometer, made by a qualified assistant of that eminent philosopher, showed the electromotive force to be 162, while a Daniell, acting under similar conditions, exhibited 120 only. A remarkable feature of this battery was that the fluid phosphorus on being removed and washed, still retained its liquid state. Sticks of solid phosphorus were introduced, and they not only did not help the liquor to solidify, but speedily became deliquescent themselves.

Mr. Gray's object was to obtain data to support a theory on the origin of nerve force, he being convinced that the power of the nerves has an electric element in it. He was induced to make the experiment described above by the well known facts that phosphorus is largely present in the brain and sulphur in the liver, and that an alkaline fluid is in constant circulation between them. He has tested this theory by experiments on a rabbit, and considers that he is justified in assuming that his explanation of the existence of galvanic action between the brain and liver is correct and well founded. We shall probably soon be enabled to lay further results before our readers.

PORTLAND CEMENT AND IRON FILINGS.

Abbé Moigno, in his valuable scientific journal *Les Mondes*, relates his personal experience with a concrete formed of fine wrought and cast iron filings and Portland cement. The Abbé states that a cement made thus is hard enough to resist any attempts to fracture it. As he states that the iron filings are to replace the sand usually put into the mixture, we presume that the relative quantities are to be similar.

FRENCH TEACHING AND DRAMATIC RECITATIONS.—Professor Favarger is forming a new class for instruction in French, by his peculiar system of Oral Teaching. The opportunity for improvement in French conversation, afforded to those availing themselves of Mr. Favarger's instructive lectures and recitations, is obtainable in no other way in this city. The lectures are to be held in Chickering Hall, and his patrons heretofore have been composed of the leading ladies and gentlemen in New York literary society. Mr. Favarger will be happy to communicate with persons wishing to join his classes, at No. 8 East 9th street.

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NEW BOOKS AND PUBLICATIONS.

SCIENCE RECORD FOR 1872. Being a Compendium of the Scientific Progress and Discovery of the Past Year. 400 pages, octavo. 100 Engravings, Steel Plate and Wood. Handsomely bound in muslin, $1.50: extra binding, half calf, $2. Munn & Co., Publishers, 37 Park Row, New York, Office of the SCIENTIFIC AMERICAN.

This new and elegant work presents, in convenient form, notices of the leading subjects and events, pertaining to science, that have occupied public attention during the past year. The progress of the more important public works is duly chronicled, with illustrative engravings. The leading discoveries, facts, and improvements, in chemistry, mechanics, engineering, natural history, and the various arts and sciences, are recorded and illustrated. Sketches of prominent scientific men, with illustrations, are given, and among the portraits are those of Faraday, Murchison, Darwin, Agassiz, Huxley, and Herschel. The Mont Cenis tunnel, the Hell Gate works, the Brooklyn suspension bridge, the Hoosac tunnel, the St. Louis bridge, the United States Patent Office, and other works are illustrated. A large amount of useful information, tables, descriptions of improvements, with engravings, are likewise presented. The book is one of much interest and value, and should have a place in every library.

LA AMERICA ILUSTRADA (ILLUSTRATED AMERICA).

This is the title of a new and beautiful illustrated semi-monthly paper, in the Spanish language, published by J. C. Rodrigues & Co., Times building, New York. Its illustrations and typography are of the most elegant description; its contents, varied and interesting. All classes of readers will take pleasure in its study. In his opening address, the editor states that the object of the periodical is to diffuse among the Latin races of America a knowledge of those social and political principles that have elevated the United States to their present position of dignity and splendor. In *La America Ilustrada* our country will have a worthy representative before the Spanish speaking populations of the two great western continents, and we heartily wish for its editors and proprietors the most abundant success.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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.

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.

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.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention, in 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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Notes & Queries.

[We present herewith 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.—FIREPROOF PAINT.—Will some one please give me a recipe for a good, durable fireproof paint? And also for a whitewash?—A. L.

2.—FRENCH FINISH FOR LEATHER.—Can any of your correspondents inform me, through your valuable paper, how to make French finish for leather, and how to apply it?—W. L. C.

3.—SCALE IN BOILERS.—I wish to know whether soapstone is known to be a preventive of scale in boilers. I have used it in certain forms, and think I have secured favorable results.—G. M.

4.—INKED RIBBON.—Please inform me how to make carbonized tape or ink ribbon, such as is used in stamping the date on railroad tickets.—E. V. R.

5.—ELECTRO-DEPOSITION ON FLOWERS, ETC.—How can I make the surfaces of leaves, flowers, insects and delicate objects, conductors of electricity, so that I can electroplate them with copper, etc?—D. W.

6.—PREPARING GLYCERIN.—Will some of your many readers inform me, through the SCIENTIFIC AMERICAN, of the easiest method of preparing glycerin? Also their opinion as to its application as a lubricator?—C. F. E.

7.—SAW FILING.—Will any of your subscribers inform me as to the best way of filing a cut-off hand saw? Some hold the point of the file toward the point of the saw, and others hold the point toward the heel.—C. M. B.

8.—HARDENING CAST STEEL.—Will some of your readers be kind enough to inform me of the best method to harden good cast steel, to combine toughness with hardness? Something that will stand without snapping or breaking, like a file temper, is required. I have tried a great many ways of hardening cast steel, so as to get something like what they call a diamond hardness, but I have failed to get the article to the desired quality.—D. H.

9.—CONCRETE BUILDING.—Will some one favor me with some more of the same sort as the article on page 359, Vol. XXV? Would it be as well to mold the concrete into convenient sized blocks first, and then lay them, like brick? What kind of mortar should be used in laying? How thick should the wall of an ordinary two story house be? Will the concrete answer for the cellar walls and foundation? Will it also answer for the chimney? Does it shrink or expand any in hardening?—B. L. V. A.

10.—STEAM HEATING BOILER.—I heat a factory by steam, having a boiler 8 feet 6 inches in length, and 29 inches in diameter; there are thirty-four two inch tubes in it, and it has a steam dome, 2 feet in hight and 16 inches in diameter. Is this boiler large enough to supply steam for 2,000 feet of heating pipe one inch in diameter; or will the pipes condense the steam faster than the boiler above described can supply it? Would a superheater be an improvement? and if so, how should it be placed to produce the best results? What will prevent the water from rising to the top of the dome, and rushing through the pipe when the cock is full open?—R. G. W.

11.—CONCRETE BUILDING.—Will some of your readers inform me if I can build a two story cottage of concrete, composed simply of lime and sand? Or will it be necessary to mix with it Portland cement? If so, in what proportion?—T. P.

12.—REFUSE ACID.—Can some one inform me of what use or value is a mixture of equal parts of nitric and sulphuric acid in which a small proportion of cotton has been once dipped? I am at present wasting large quantities of this mixture.—C. P.

13.—TEMPERING SPRINGS.—Will some of the readers of your paper be kind enough to inform me how to put a good temper in locomotive springs, of both cast and spring steel? And also tell me the easiest way to form the leaves.—R. N.

14.—STOVE CEMENT.—Can any of your readers give us a formula for making a good stove cement, such as is used by foundrymen?—B. & Co.

15.—TINNING SHEET IRON.—I wish to know how to tin iron plates, from six to twelve inches by three inches, and one eighth thick.—W. P. P.

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 00 a line, under the head of "Business and Personal."

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

LIQUEFYING SULPHUR.—F. C. A. can melt sulphur in an iron pot or dish, as it becomes liquid at a temperature far below a red heat.—J. A. L., of O.

STAMPING LETTERS ON STEEL.—C. T. can do this by punching with steel punches before the saws, etc., are tempered and polished.—J. A. L., of O.

HEATING STEEL ARTICLES.—W. S. K. can heat small iron or steel articles in a lead bath heated to redness. A covering of cinders or charcoal dust will prevent the dross from forming.—J. A. L., of O.

FASTENING LEATHER TO IRON.—If L. P. will give his pulleys a good coat of white lead paint, let it dry, and then use common glue, he will have no more trouble in making the leather stick.—C. D. A., of N. Y.

NEATS' FOOT OIL.—M. B. E. can clarify his neats' foot oil by putting shot or scraps of lead in it.—E. O. McC., of S. C.

J. S., of ——.—Your query was answered in the second editorial of our last issue.

G. M., of Ill.—We do not see how a spring attached to a fusible plug in a steam boiler, the design being to pull it upward to insure its release, would be an improvement.

J. S. B., of Ill.—The sample of sheet copper sent would not, in our opinion, sustain a pressure of 135 pounds per square inch in the center of an ordinary locomotive fire box.

SAW GEAR.—If E. L., query 14, January 6, 1872, will place his mandrel directly above or below his line shaft, he can drive his saw with quarter twist belt; but his shafts are too close together to give satisfaction. In order to get quarter twist belts to do much good, they should be as long as possible, and work on small diameter pulleys.—J. E. G., of Mo.

PROPORTIONS OF CUT OFF.—Let A. H. G. proportion his valve according to the following table, and he will find it right. He will have to slip the eccentric around on the shaft, in proportion to the amount of lap he wishes to add to the valve. To ascertain the amount of lap necessary on the steam side of a slide valve, to cut off at various fractional parts of the stroke: To cut off at half stroke, multiply the valve stroke by .354; seven twelfths, .323; two thirds, .289; three fourths, .250; five sixths, .204; seven eighths, .177; eleven twelfths, .144. The product will be the lap of the valve in terms of the stroke.—H. P. R.

FACING OIL STONES.—In your paper of January 1st, R. J. McC. states that he has spent a good deal of time in facing his oil stones, and that emery glued to a board is a good and easy way of doing it. I do not doubt this, but emery is an article not much used in carpenters' shops, and a grindstone is always found there. If R. J. McC., or any other person, will hold his oil stone against the side (not the periphery) of the grindstone, I think he will find it a great deal easier and quicker, if not better than emery, and he will save the trouble and expense of making the board. If the stone is run by steam, he will have to be careful not to press too hard at first. I always use water, as otherwise the stone will become glazed and not cut.—S. C., of Pa.

HEATING IRON ARTICLES.—In answer to the query of W. S. H., in your paper of January 6, 1872, in regard to heating small iron articles rapidly and without scale, I would inform him that, if he will use the hot lead bath, he will no doubt find it to answer his purpose. By building a small furnace, and placing therein a cast iron crucible of from four to eight inches or more diameter, and deep according to the depth of his articles, he can heat as many articles at once as he desires; and as fast as he takes one of them from the crucible to stamp, he can return one in its place to heat; and by keeping some four or five articles in the crucible at one time, and working from one to the other, they will keep him going as fast as he likes, and no scale will be produced. I would advise him to keep the surface of the lead covered (to prevent oxidation) with the ashes or small coke from a blacksmith's forge. It will be necessary for him to use hard coal in heating, and to regulate the heat by a damper. I have tried the above process on different kinds of work, and find it to answer.—D. H., of Pa.

CANE STAINING.—W. H. is informed that, by the following simple process, the writer has stained canes and similar sticks of a richer brown color than any other he has ever seen: Dissolve a few grains of sulphate of manganese in sufficient water to take it up. Moisten the surface of the cane with this, and hold it over the flame of a small alcohol lamp close enough to scorch it. A little care will enable the operator either to bring the whole surface to a rich brown, or to beautifully variegate it by heating some parts more than others; thus varying the color from white to the deepest black. The color will appear dull at first; but, on oiling it with raw linseed oil and rubbing it with a smooth piece of hard wood, it will be beautifully developed. Give the cane no other finish, unless it be another oiling some days after the first. The writer has not tried this method on white holly; but will be glad if W. H. will give him an opportunity to do so by sending him, in its rough state, a somewhat stout stick of that wood by express, addressed, F. B., Winchester, Va.

H. W. asks for a remedy for a gun that scatters. Sometimes very slow powder will be a remedy. It is a twist in the barrel that makes it scatter. If it was rifled down perfectly straight, I think it would prevent it.—L. C. K., of N. H.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ARC OF A CIRCLE.—W. D. C.
CAST IRON GIRDERS.—W. A.
NEW MOTIVE POWER.—A. S.
PREVENTION OF BOILER EXPLOSIONS.—C. L.
PSYCHIC FORCE.—A. V.
TO SMOKE OR NOT TO SMOKE.— ——.
ANSWERS TO CORRESPONDENTS.—J. E. G.—B. W.—J. C.—T. McK.—E. N.—E. C. J.—H. L. C.
QUERIES.—L. S.

Recent American and Foreign Patents.

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

CORN HARVESTER.—John Johnson, Mott Haven, N. Y.—This invention consists in a triangular frame mounted on rollers, with handles at the rear end, a bent finger at the front for running along the ground under the stalks lying thereon and lifting them up to the top, a long cutter on each side, and a finger in communication with each cutter for bringing the stalks up to the cutters. The cutters are fitted in a groove in the side of the side piece of the frame, pivoted to them near the front end, and arranged to swing out and back at the rear end, according to the distance between the rows. They are provided with the curved arms having holes for inserting pins to hold them in any position. They are also provided with a bent finger at the heel, to run along the ground on the opposite side of the row, which is to be received in the angle between the cutter and finger for gathering the stalks into said angle for being cut, two rows at a time, as the machine is drawn between them.

FRUIT JAR.—Hassan U. Allen, North Bennington, Vt.—This invention has for its object to furnish an improved square or rectangular fruit can which shall be simple in construction, easily opened and closed, while at the same time it is entirely air tight. It consists in a rectangular body provided with inclined grooves at the top, a cover with a rounded top and with a groove and bead upon its under side, and a clamping strap of a novel design.

CARRIAGE TOP PROP BLOCK WASHER.—Abraham D. Westbrook, Asterian N.Y., assignor to Fletcher W. Dickerman, New York city.—In manufacturing such articles, it has been found that there is a difference in the length of prop blocks generally, and that, therefore, the making them of definite lengths with flanges proved unprofitable. It has, therefore, been considered advisable to make the prop blocks without flanges, and to cut the material from rubber tubing of suitable length. But although the prop blocks could be made of the proper length required, they were without finished ends, and not as elegant in appearance as the flanged prop blocks. Leather washers have been used, but were not durable, nor as yielding to the varying positions of the bows as is desirable. This invention consists in the introduction of removable rubber washers, that can be applied to the ends of the rubber prop blocks, and securely held in place to constitute a perfect finish.

BUTTER TUB.—Mr. James Gilbends, of Jamestown, N. Y., has invented an air tight butter tub, which must prove of value in the keeping of butter sweet during storage and shipping. The basis of the tub is wood, made in a prismatic or any other suitable form, the example given in the patent being square in ground plan, with flaring sides. This basis may be made of staves and head, like the ordinary tub, if preferred. In all cases it is covered with galvanized sheet iron, and has a cover of wood which is also covered with galvanized sheet iron, made so that the metal of the cover overlaps the metal of the body of the tub, and can be soldered thereto, making the package air tight; thus isolating the butter from exterior odors, and deteriorating influences, to which it is subjected in warehouses and during shipment.

TWEERS.—Stephen Parsons, of St. Francisville, Mo.—A tank or water-reservoir, having a tubular projection, is employed, the blast pipe passing through them both. The tubular projection enters the fire and the blast pipe receives the pipe of the bellows or fan blower. Tweers of a construction somewhat similar have been long in use by the public; but they are made up of a number of separate parts jointed together; whereas this tweer is cast in one piece, thereby dispensing with all joints and connections. This not only produces a simpler tweer and one not liable to leak or get out of order, but also one which can be manufactured and sold to the public at a much cheaper rate than those now attainable.

GRINDING MILLS.—John B. Smith, of Bowensburg, Ill.—This invention relates to an improvement in mills for grinding grain. The spindle is hollow down to the bed stone. The hopper has a tubular neck, which enters the tubular portion of the spindle. There are apertures in the spindle, through which the grain which is put into the hopper is discharged between the stones. The flour or meal is discharged by a spout. There is a bushing in the bed stone where the spindle has a bearing. Projections on the spindle enter notches in the lower end of the bush. The runner acts as driver, but the bush is fast in the stone and the spindle is fast in the bush. By constructing the mill in this manner, the inventor is enabled to adjust the hopper by means of a hand wheel, according as the riddle or large hopper from which the grain is delivered to it is adjusted for slow or fast feed. By means of the hand wheel and a sleeve screw, the spindle is held more steadily in place, while a nut serves the purpose of securing the bushing in the eye of the stone and in connection with the lugs or projections on the spindle. The method of feeding the grain through the spindle is claimed to economize space and reduce cost, and no open annular space is left round it in the eye of the stone, as is the case in mills of the ordinary construction.

MODE OF CONSTRUCTING STRAINING LEVER AND BALE TIE FOR PACKING BANDS.—James C. Colt, Cheraw, S. C.—The invention consists in a bale tie and lever tool, by which a single hand may both compress and tie up the contents of a bale without the aid of machinery.

HARVESTER CUTTER.—John A. Bonham and Alvah J. Harrington, Lovely Dale, Ind.—This invention relates to an improvement in harvester cutters, and consists in the peculiar construction of sectional cutters and in the manner of attaching the same to the cutter bar.

MACHINE FOR SHELLING PEANUTS.—Joseph W. Sands and Benjamin F. Walters, Norfolk, Va.—The invention consists in combining certain old instrumentalities in a new manner, so as to form a new, efficient, and practical machine for shelling peanuts.

JEWELRY FASTENINGS.—Robert James Pond, of New York, N. Y., assignor to Hodenpyl, Tunison & Co., of same place.—Gold chains are often loaded to such an extent that the snap must be fully reliable to insure a proper connection of the ends. Bracelets, too, are subject to strain, and generally give way at the snap. This invention consists in making the snap and spring of one continuous piece, which is inclosed within a tube and provided with a knob, whereby a firm connection, and one that will not spontaneously open, is secured.

BALING PRESS.—Jeremiah Randolph, of Huntsville, Tex.—This invention consists in a novel arrangement of levers, connecting bars, and cords, in combination with the follower and windlass, whereby the follower is worked in the downward direction for pressing, and in the opposite direction for elevating it to recharge the press, by the said windlass. The combination evidently forms a press of great power, easily manipulated, and which can be worked by hand, horse, or steam power.

BAIL DREDGE.—Nehemiah A. Williams, of Warwick, R. I.—This invention is claimed to be free from the objections brought against the ordinary scraper dredge, used in dredging for scallops, oysters, etc. A bar or rod bent at the center forms a bail, having a center or eye for the attachment of the draw rope. The arms of the bar separate from each other at an angle, and are made straight. To the ends of the arms of the bar are pivoted the ends of a curved or semicircular knife so that the knife may be flat upon the bottom whether muddy or hard, and whether drawn by a long or short warp—that is to say, at whatever angle the draft may be applied to it. To the rear edge of the semicircular or curved knife is attached a metallic netting, which forms the bottom of the dredge. To the rear and end edges of the metallic netting and other parts of the device are attached the edges of a twine netting. The nettings are constructed and arranged in the ordinary manner. With the rear edges of the nettings is connected a curved wooden bar, which serves to keep the nettings extended, and which also serves (and this is its especial object) as a hand piece for lifting and emptying the dredge into the boat. By this construction the knife will not sink into or gather up the mud in places where the bottom is muddy, and in the case of hard and irregular bottoms it does not strike dead against the irregularities, but glides along them, gathering all the shell fish. The knife does not sink into the mud when the draft stops, but lies upon the surface, which is claimed to be a great advantage, especially in flawy weather. The angular positions of the arms of the bail also part the sea grass and keep it away from the dredge.

SHAWL OR OTHER DRESS PIN.—Henry C. Strong, of Lansing, Iowa.—This invention consists in an improved and cheaper construction of that class of dress pins which have two pins. The object of the arrangement is to increase the capacity of such pins for connecting more than two pieces or plies of goods together. This pin is more particularly intended to fasten bows upon a lady's collar, and, at the same time, fasten the collar to the dress, which is very readily accomplished by using one of the pins or prongs for fastening the collar to the dress, and the other for fastening the bow to the collar. It is also useful in like manner for fastening many other articles of dress.

SPADE BAYONETS.—William Shephard Wetmore, of London, Eng.—The object of this invention is to provide an improved attachment for bayonets adapted for use as a spade in intrenching, and also as a defensive armor or breast plate for the soldier when in battle. These improvements are used, in connection with the blades of the spades, either as defensive armor or for digging or intrenching, the blades, when used as armor, being carried in any convenient manner; and the modes of connecting the handles of the spades to the blades can be varied to an indefinite extent. For enabling the blade of the spade to be used as a shield or mantlet to the soldier lying behind it, a section of the socket of a bayonet is prolonged to a greater length in order that it can be forced into the earth, there being a hole for the soldier to insert his musket through it.

WHEEL CULTIVATORS.—Nathan Earlywine, of Centerville, Iowa, assignor to himself and Charles A. Davis, of St. Louis, Mo.—This invention relates to an improvement in the class of machines designed for use in cultivating cotton, and chiefly distinguished by a combination of rotary choppers, adjustable scrapers, and furrow or track openers. The improvement consists mainly, in the arrangement of a set of cultivators whose V shaped stocks are bolted to a pendent bar of the main frame of the machine, so as to allow of their adjustment vertically. The invention also consists in the arrangement of said cultivators with reference to scrapers, whereby the surface of the ground is first furrowed or pulverized slightly, and then scraped or cleaned off, so as to leave it in the best condition to produce the desired result. It is proposed to use the machine also for cultivating only when the chopper is not required. The chopping apparatus being detached, it is applicable for cultivating corn as well as cotton.

FIFTH WHEELS.—Robert Denham Wilson, of Pittston, Pa.—This invention consists of a front gear or platform for carriages, composed of two D shaped bars of wrought iron, arranged in peculiar shape, calculated, it is claimed, to greatly cheapen the cost of such gear, and provide sufficient strength with less weight than any heretofore made. This gear is all formed of two bars of metal, is very simple, and may be made up of pieces of scrap-iron, of different shapes adapted to form the several parts, welded together.

HOSE COUPLINGS.—Edward S. Kennedy, John Putnam, and Henry Smith of Birmingham, Pa.—This invention consists in improving hose couplings, so that, in attaching a nozzle to the end of a hose, one part of the coupling may be formed as a solid part of the nozzle, or the nozzle may be screwed into the nut of the coupling. The outer surface of the collar is squared off to enable a wrench to hold it from turning while the inner part is being screwed in and out. The outer surface of the nut is also squared off to enable a wrench to take hold of it to screw it on and off. This construction enables a hose to be conveniently mended by any one, should it burst or cut, without its being necessary to take it to a plumber, as must be done with the ordinary construction.

APPARATUS FOR PRODUCING PLANE OR PARALLEL MOVEMENT.—Albert G. Barrett, of Barrett, Kansas.—The improved plane or parallel movement is designed for attachment to the piston rod and pitman of a steam engine, and for use in other places where slides are used, and is so constructed as to greatly diminish the friction while causing the object to move in a straight line. Two sweeps or levers have their lower ends pivoted to the bed of the engine, or to some other suitable support. To the upper ends of the sweeps are pivoted the ends of a bar bent at its middle, so that lines joining its ends and center may form the sides of an isosceles triangle. The arms of this bar may be made straight or curved, and its ends may be connected by a straight or curved bar, if desired. To the center of the bar which is the apex of the isosceles triangle, is pivoted the end of the piston rod, the pitman, or whatever it may be that is required to be carried back and forth in a straight line. The sweeps must be so arranged with respect to each other that the stroke or movement can never carry them outward beyond a vertical line. It is designed to use two sets of these bars, one upon each side of the piston rod. By this construction the friction, it is claimed, will be greatly diminished, the heavy cross head being no longer required.

PLOW CLEANER.—George W. Burr, of East Line, N. Y.—This invention consists in a flat wheel provided with teeth projecting from the circumference at a downward angle and mounted in advance of the throat of the plow on a pivot, so as to revolve in a plane of about forty-five degrees to the surface of the earth, being turned by the contact of the teeth with the solid earth on the land side in such manner that, at the rear side and at the throat, the teeth will come in contact with any straw, grass, weeds, and the like, clogging therein, and thrown them out with the furrow slice. The support of the said wheel is made vertically adjustable, to vary it according to the depth the plow is to run.

TOY PISTOL.—Henry M. Quackenbush, of Herkimer, N. Y.—A barrel and aperture in combination with an air chamber and piston are made to operate, by means of a groove and spring in conjunction with a case, in such a way as to give very efficient action and cheap construction of an air pistol.

APPARATUS FOR CLOSING BARRELS AND CASKS.—Adolph Koegler, of Newark, N. J.—This invention has for its object to provide an apparatus for removing barrel taps, injecting into the barrels suitable liquid or matter, and then reclosing the barrels. In breweries and other places it frequently occurs that the barrels containing fresh or other beer, ale, or beverage, should, after having been closed for a specified term, be reopened and charged with liquids, gases, or "finings," whereby their quality is improved or their character finally determined. This invention consists in the new arrangement of an ingenious apparatus whereby the tap can be forced into the barrels, a connection established between the opened barrels and an injecting pump, and the barrels finally retapped. The device is also constructed with the view of permitting the escape of gases or liquor from the barrels, if desired.

LUBRICATING AXLE FOR VEHICLE.—Jesse S. Eggleston, of Auburn, N. Y.—This invention relates to means for lubricating axles of cars and carriages, revolving journals, and other frictional surfaces. It consists in an oil chamber and plate with a tube and capillary conductor or wick in the stationary frictional surface to be lubricated. The axle or journal being properly secured at the ends of frictional surface, the oil cannot escape or be wasted, and will be constantly circulating in the box and lubricating the axles or journals with the use of a very small quantity of lubricating material.

CAR BRAKE.—Albert A. Weidemeyer, of Williamsburg, N. Y.—This invention has for its object to furnish an improved double clutch brake for attachment to railroad cars, so constructed that the brake may be applied to all the cars of the train from the engine, and either quickly or more slowly as may be desired. The engineer, by throwing parts of a clutch together, and operating a capstan in the direction to draw upon certain rods, can apply the brakes quickly to all the cars of the train. By operating the capstan in the other direction, without throwing the parts of the clutch together, the brakes will be applied more slowly.

APPARATUS FOR LIGHTING GAS BY ELECTRICITY.—Professor William Klinkerfues, of Gottingen, Germany, has just patented, through the Scientific American Patent Agency, a recent improvement upon his well known apparatus for lighting gas by electricity, described at length on page 393, Vol. XXIV of this journal. The invention has for its object to produce the requisite contact of the exciting liquid with the carbon and zinc elements of the battery by increased pressure of the gas flowing to the burner to be lighted, and thus to dispense with the necessity of mechanical action, except in as far as the turning on of the gas is concerned. The apparatus contains one of the elements suspended above and the other dipped into the exciting liquid which surrounds the capped end of the gas supply pipe, so that the gas at all times exerts a certain degree of pressure upon part of the surface of the liquid. When this pressure is properly increased, the liquid is raised to the suspended element, and causes, by contact therewith, a current to be established. The platinum wire held over the burner is thereby catalytically affected and causes the ignition of the gas escaping from the burner.

ADJUSTABLE UMBRELLA HOLDER FOR CARRIAGE.—William C. Doolittle of Marion, Conn.—This invention has for its object to furnish an improved umbrella holder for attachment to the seats of buggies, pony phaetons, or other vehicles, which is simple, inexpensive, and convenient to use, being so constructed that it may be readily adjusted to hold the umbrella inclined at any desired angle.

MACHINE FOR HEADING BOLTS.—Charles E. Hunter, of Hinsdale, N. H.—This machine is designed to improve bolt heading machines so that the corners of the heads shall be filled out sharp, like the heads of hand made bolts, and not left imperfect as machine made bolt heads ordinarily are. A movable nut or bolt head plunger, a cam, a ratchet and a stationary pawl are combined with a movable holder to form a means for gradually advancing the compressing plunger, in order to secure the desirable result above named.

MODE OF COVERING HARNESS MOUNTINGS.—William Fawcett, of New York city.—This invention has for its object to furnish an improvement in covering harness mountings, which is inexpensive, and which at the same time will give a neat and elegant appearance to the mountings. It consists in covering mountings upon the outer side only with leather or hard rubber, leaving the inner side uncovered to receive the plating and the wear, thus avoiding facing the mountings with metal, and the attending trouble and expense. Wires are used in combination with the covering and mountings, covered by or imbedded in the said covering. A shoulder or recess is formed upon the outer surface of the mountings to adapt them to receive the cover upon their outer sides.

SAFETY WHIFFLETREES.—Albert H. McAllister, of Cotton Plant, Miss.—The object of this invention is to provide ready and convenient means for liberating a horse or horses from a carriage or other vehicle while the horse is in motion; and it consists in the construction of the trace hooks and in two liberating levers attached to the whiffletree, and in the construction, arrangement, and combination of parts, whereby if a cord be pulled, the bits of the trace hooks, which are held by concave ends of the tripping levers, will be forced off plates which hold them, and will liberate the traces from the whiffletree. Springs keep the levers in position, and securely confine the traces when everything is all right; but if anything breaks and the horse or horses become unruly, and danger is apprehended, all the driver has to do is to pull the cord and let the horse or team go.

FEED WATER HEATER.—William E. Walsh, of Jersey City, N. J.—This invention relates to a feed water heater for boilers, the arrangement of which is such that the holder may be constructed very cheaply by casting; but it may be constructed of sheet metal, if preferred. This invention has been made with special reference to the facility with which the holder can be molded and cast, so as to provide a cheaper heater, with larger heating surface in a small compass than can be made of wrought metal or of tubes; but it may be made of rolled sheet metal.

METALLIC PACKING FOR PISTON RODS, ETC.—David Devore, of Philadelphia, Pa., assignor to himself and Frederick A. Churchman, of Wilmington, Del.—This invention has for its object to furnish an improved metallic packing for piston rods, valve rods, pumps, etc., so constructed as to produce a secure and reliable packing, and one which will enable the wear to be conveniently taken up. It consists in the construction and combination of three lip and tongue jointed sections, with a stuffing box cap and shaft.

BOX FOR SEIDLITZ POWDERS.—Charles A. Browne and Isaac S. Browne of North Adams, Mass.—The object of this invention is to provide a box for seidlitz powders and other effervescing powders composed of different ingredients, wherein the acid and the soda or other ingredients may be kept separate and each in its proper quantity; and it consists in a box—made of wood or other material—with compartments, each of which is of suitable size or capacity to contain the exact proportion or quantity of the ingredients required. The advantages are that each compartment when filled contains the proper quantity, and much time is therefore saved in packing. The contents are more readily discharged and less likely to be spilled or wasted in using. The powders may, in the packages, be much more conveniently carried and handled, and are much more perfectly protected than they are at present.

WATER HEATER AND PURIFIER.—Perry Almy, of Williamson, assignor to himself and A. B. Williams of Sodus, New York.—The object of this invention is to provide efficient and convenient means for purifying water for use in steam boilers and for other purposes, having especial reference to what is known as "hard water," or water holding lime in solution. It consists in an apparatus in which the water to be purified is heated by means of steam to the boiling temperature, and then filtered through successive layers or beds of oyster shells, or similar material or substance, the apparatus being a tight vessel having a series of slatted partitions covered with shells, a steam chest, induction ports, exhaust pipe and water pipe, arranged in a peculiar manner and combined with the pipes proceeding from the exhaust pipe. By this apparatus the water is first heated and the carbonic acid expelled and then passed through heated shells, on which the lime is precipitated. The invention is based upon sound chemical principles, and will undoubtedly prove valuable in many localities.

GRADING AND DITCHING SCRAPER.—Charles D. Meigs and Montgomery C. Meigs, of Romney, Ind.—This invention has for its object to furnish an improved scraper for grading roads, opening ditches, etc., simple, inexpensive in manufacture, convenient and easily handled, and of very light draft. The rear part of the body of the scraper is curved upward to adapt it for receiving and holding the load. The body may be made of metal, or of wood faced or plated with metal. To the ends of the body are secured short axles, upon which are placed small wheels. To the body are attached two handles, the outer ends of which may be connected by a cross bar. The rear ends of the draft chains are secured to the ends of the body. The forward ends of the chain are attached to a ring, to which the draft is applied. The scraper may be made of any desired size, but for ordinary purposes a convenient size would be five feet long and two wide, the wheels being from eight to ten inches in diameter. With this construction, when the scraper has been loaded, by bearing down upon the handles, the entire weight of the load will be thrown upon the wheels, so that the loaded scraper can be conveniently drawn to any desired place, when, by releasing the handles, the scraper will turn over and thus unload itself. It is claimed this construction enables a single horse to do more work with greater ease than two horses can do with an ordinary scraper.

SEED PLANTER AND GUANO SPREADER.—Thomas Snow, of Social Circle Ga.—This invention consists in a novel combination of simple mechanical elements whereby not only seeds can be planted and fertilizers distributed, but by which seeds of different kinds, as corn and peas, may be discharged from two hoppers and planted in alternate hills.

TUCK MARKER FOR SEWING MACHINES.—George McFadden, of Worcester Mass.—This is a simple and useful invention, designed for attachment to the plates of sewing machines, to aid in the operation of "tucking," upon which three claims have been allowed in the letters patent. The device is well adapted to the purposes intended, as will be admitted on inspection by those acquainted with the tuckers now in use.

NAIL CUTTING MACHINE.—Thomas M. Laurence, of Piqua, Ohio.—This invention consists in the improvement of nail plate feeders, whereby the nail plate is turned and drawn back by a new combination of devices upon which three claims have been allowed. The machine appears a substantial and practical invention.

PROJECTILE FOR SMALL ARMS.—Carlos Maduell, of New Orleans, La.—This invention relates to an improvement in the class of missiles or projectiles for firearms in which the balls or bullets are formed in transverse or longitudinal sections. Hitherto these have been so constructed that when fitted together they were free to move one upon the other, and hence the slightest obstacle in flight of the ball may induce the sections to become separated, and thus frustrate the purpose of the missile. To remedy this defect, and provide a sectional ball capable of being rapidly, conveniently and even carelessly handled, without liability of the parts composing it becoming misplaced in the slightest degree, the inventor forms the sections with lateral angular projections and recesses, whereby they are adapted to fit together in a perfect manner.

APPARATUS FOR TRANSMITTING MOTION.—Peter Mehrhof, of Croton, N. Y., and Fernando Healy, of Barrington, R. I.—This invention consists in producing two revolutions of the crank shaft to one of the engine, by a connection of the engine to the walking beam by two rods connected together at one end, one of said rods being connected by its other end to an immovable body, and the other jointed at its other end to the walking beam, the connecting rod of the engine being jointed to the said rods, where they are jointed together in the manner of a toggle jointed connection. It is thought by the inventor that this mode of transmitting motion will be desirable for driving the paddle wheels of steam engines, and particularly so for driving propellers, being a cheap and simple substitute for the geared marine engines commonly used for driving them. In using it for driving propellers, the engine and walking beam can be placed in line with the propeller shaft by interposing a cross head and guides between the walking beam and connecting rod, and arranging the latter to vibrate perpendicularly to the beam. The apparatus may, of course, be used for driving machinery of all kinds, but is more particularly applicable for paddle wheels and propellers.

PIPE WRENCH.—Charles Neames, of New Orleans, La.—This invention has for its object to furnish an improved tool, so constructed as to adapt it for use as a gas pipe wrench, a gas pipe vise, and a square wrench for large bolts, effective in use in either capacity. The tool may be arranged for use as a vise for holding gas pipe while cutting screw threads upon it, and when thus used it can be adjusted for holding pipe of various sizes. By taking off a clevis or slotted bar and its attached screw, and removing two bolts the tool can be used as a gas pipe wrench for screwing and unscrewing gas pipe, and may be adjusted to various sized pipes. By shifting a bolt and pin, the tool becomes a good gas pipe wrench, and the harder it is pulled, the firmer it will grasp the pipe, bearing upon the four sides of the pipe equally, a vibrating fulcrum always throwing a toothed bar forward against the pipe to be grasped. By removing a bolt and thus detaching a lever, and placing pins in the holes of two bars, the tool becomes a very strong square wrench for large nuts and bolts.

SUPPORTING BUSK FOR CORSET FASTENING.—Melissa E. Bulkley, Providence, R. I.—This invention relates to a new device for conveniently attaching busks to corsets to support the fastening by which the two parts are united, and protect the body of the wearer from injury when a stee breaks. It consists in attaching two sliding plates and one stationary plate to the busk. Each of the former is made of a single piece of sheet metal, with its two ends bent over toward each other, and one of them bent back and transversely slotted. The stationary piece is constructed in the same form as the sliding pieces, except that the slot of the former is in the line of the length of the metal. This piece is passed over the steel of the busk and fastened thereon about midway, all being under the cover except the slotted and projecting end. The two sliding pieces are made to slide upon the cover of the busk, and there is sufficient friction to readily retain them wherever placed.

FOLDING BUREAU.—John E. Lawrence and John S. Young, Philadelphia Pa.—This invention consists of a bureau with a detachable top and back and the end pieces hinged to the front in such manner that the said ends and front may be bolted together and packed in a compact bundle when the drawers are taken out and the top and back removed. The back and top may be packed with the front and sides so as to economize space in storage and transportation. Thus, these articles of furniture—which formerly occupied much space, and were difficult to move about from room to room especially up and down stairs—may be readily taken apart and folded small packages, for storage and transportation.

WAGON WHEEL.—Christian Anderegg, Lawrenceburg, Ind.—Unlike mortises in ordinary wagon or carriage hubs, the inventor makes this hub mortise to receive a double tenon, the mortise consisting of an upper and a lower portion, the former receiving the real tenon of the spoke, and the latter the butt end of the spoke itself. These shoulders of the tenon are all sunk beneath the surface of the hub, and rest upon the bottom surfaces of the upper portion of the mortise. By this construction, it is claimed, the entire strength of the spoke is preserved. The shoulders of the tenon cannot act as fulcrums for the spokes to pry upon the tenon, which is the case where the shoulders of the tenon rest upon the surface of the hub. The mortises in the hub are arranged so that the spokes stand bracing to the center of the felly of the wheel. The tenon and the butt of the spoke are made to tightly fit the mortise, so that the whole strength and elasticity of the spoke is secured.

CHURN.—Miles Fisk, of Adrian, Mich.—This invention has for its object to furnish an improved churn, simple in construction, conveniently operated, and effective in operation, bringing the butter thoroughly and quickly. It consists in a novel construction and combination of various parts, which the inventor will explain, to parties interested, on application.

CORN PLANTER.—Joseph Pies, of Sparland, Ill.—This invention relates to a new corn planter, which is entirely self acting and double, and which prepares its own furrows, deposits the corn in proper succession, and covers it when in the ground. The invention consists in a very novel general arrangement of parts by which the object sought is effectually accomplished.

ROLLER SKATE.—John H. Fenton, of Indianapolis, Ind.—This invention relates to a new construction and arrangement of devices whereby wheels or rollers are attached to the foot support of a skate in such a manner as to enable the performer to execute all of the varied evolutions of skating on a smooth floor by the same or a similar motion of the body as employed in propelling the skater on ice. A saddle plate having a concave segmental bearing, pintle, socket, and wheel frame or hanger, slotted and provided with a convex segmental bearing, a pivot and a rubber cushion are the parts for which, together with their arrangement for the purpose described, a patent has been granted.

COTTON PRESS.—Thomas D. Simpson and William S. Lamkin, Marshal, Texas.—This invention relates to improvements in friction clamping apparatus used on vertical bars or rods of presses for holding the follower and lever in working the follower down upon the bale. The operation is similar to that of other presses of like character—that is, the upper block and dogs and the follower being raised as required for filling, the lower blocks are raised sufficiently to apply the levers, which, being raised at the free end to force the follower down and then lowered, the blocks will slide down by gravity for a new hold. But as it is inconvenient to work the levers at first when the follower is at or about the highest position, the inventor employs a long link with a hook in one end for connecting with the bottom of another link, and having the lever hooked into its lower end in a way that obviates the inconvenience. Curved blocks on the follower, combined with dogs pivoted in blocks that slide on the vertical bars, are the features upon which a patent has been obtained.

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DESIGNS PATENTED.

5,472.—CARPET PATTERN.—Jonathan Crabtree, Philadelphia, Pa., assignor to John Gay, same place.

5,473.—TABLE.—William H. Groff, Lawrenceburg, Ind.

5,474.—BORDER FOR KNIT FABRICS.—Thomas Langham, Philadelphia, Pa., assignor to Thomas Dolan, same place.

5,475.—FIGURE FOR LAMP BASE.—David Mosman, West Meriden, Conn., assignor to Bradley & Hubbard, same place.

5,476.—FIGURE FOR LAMP BASE.—David Mosman, West Meriden, Conn., assignor to Bradley & Hubbard, same place.

5,477.—TYPE.—Richard Smith, Philadelphia, Pa., assignor to Mackellar, Smiths & Jordan, same place.

5,478.—ORNAMENTATION OF BUCKLES.—James O. West, New York city.

TRADE MARKS REGISTERED.

863.—PAINT.—Nathan L. Dearborn, Dover, N. H.

633.—PRESERVED FISH.—Israel C. Mayo, Gloucester, Mass.

634.—PREPARED PLASTERING PAPER.—The Rock River Paper Company, Beloit, Wis.

635.—HARROW.—J. J. Thomas & Co., Geneva, N. Y.

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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:

19,347.—INDIA RUBBER DOOR MAT.—E. M. Chaffee. January 31, 1872.
19,490.—METAL BALE TIES.—F. Cook. February 14, 1872.
19,328.—CANE GUN.—J. F. Thomas. January 24, 1872.
19,300.—STRAW CUTTER.—J. H. Mumma. January 23, 1872.
19,465.—CARPET BEATER.—J. Harris, Jr., and D. Holmes. February 7, 1872
19,321.—PLOWS.—G. Watt. January 24, 1872.
19,696.—GRINDING ATTACHMENT.—D. H. Gage. March 6, 1872.
19,318.—LAP BELT JOINTS.—H. Underwood. January 24, 1872.
19,384.—CHECK CANCELER.—W. M. Simpson. January 31, 1872.
19,370.—KNITTING MACHINE.—J. K. and E. E. Kilbourn. January 31, 1872.
19,346.—CANAL BOAT.—H. Camp. January 31, 1872.
19,388.—HYDRAULIC VALVE.—C. and G. M. Woodward. January 31, 1872.
19,377.—HARVESTER.—F. Nishwitz. January 31, 1872.
19,349.—SHINGLE MACHINE.—G. Craine. January 31, 1872.
19,420.—HORSE RAKE.—W. Horning. February 7, 1872.
19,462.—STRAW CUTTER.—T. H. and D. T. Willson. February 7, 1872.
19,412.—SHOVEL PLOW.—P. Dennis. February 7, 1872.
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19,555.—RAIL SPLICE JOINTS.—M. Fisher. February 21, 1872.
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19,517.—METAL PAN MACHINE.—E. A. Smead. February 14, 1872.
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19,572.—PACKING FLOUR.—J. Mattison. February 21, 1872.
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19,638.—FLOATING ANCHOR, ETC.—J. Humphries. February 28, 1872.
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19,548.—SECURING KEY OF JOURNAL BOX.—L. Dederick. February 21, 1872.
19,619.—PLANING BLIND SLATS.—C. Carlisle and L. Worcester. Feb. 28, 1872.
20,235.—FLY NET.—R. Wilson. April 24, 1872.
20,238.—SASH FASTENER.—F. W. Brocksleper and J. B. Sargent. April 24, 1872.
19,594.—ENGINE VALVE.—I. Van Doren. February 21, 1872.
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19,806.—ROTARY CUTTER.—J. A. Woodbury. March 13, 1872.
19,637.—GRAIN SEPARATOR, ETC.—S. Howes and G. E. Throop. Feb. 28, 1872.
19,654.—TRIMMING MACHINE.—A. C. Semple. February 28, 1872.
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19,683.—HOT AIR FURNACE.—J. Child. March 6, 1872.
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20,353.—ELECTROTYPE PLATES.—S. P. Knight. May 8, 1872.
19,914.—TRUSS PAD.—W. F. Daily. March 27, 1872.
19,966.—WATCH CASE.—E. Bliss. March 27, 1872.

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

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Inventions Patented in England by Americans.

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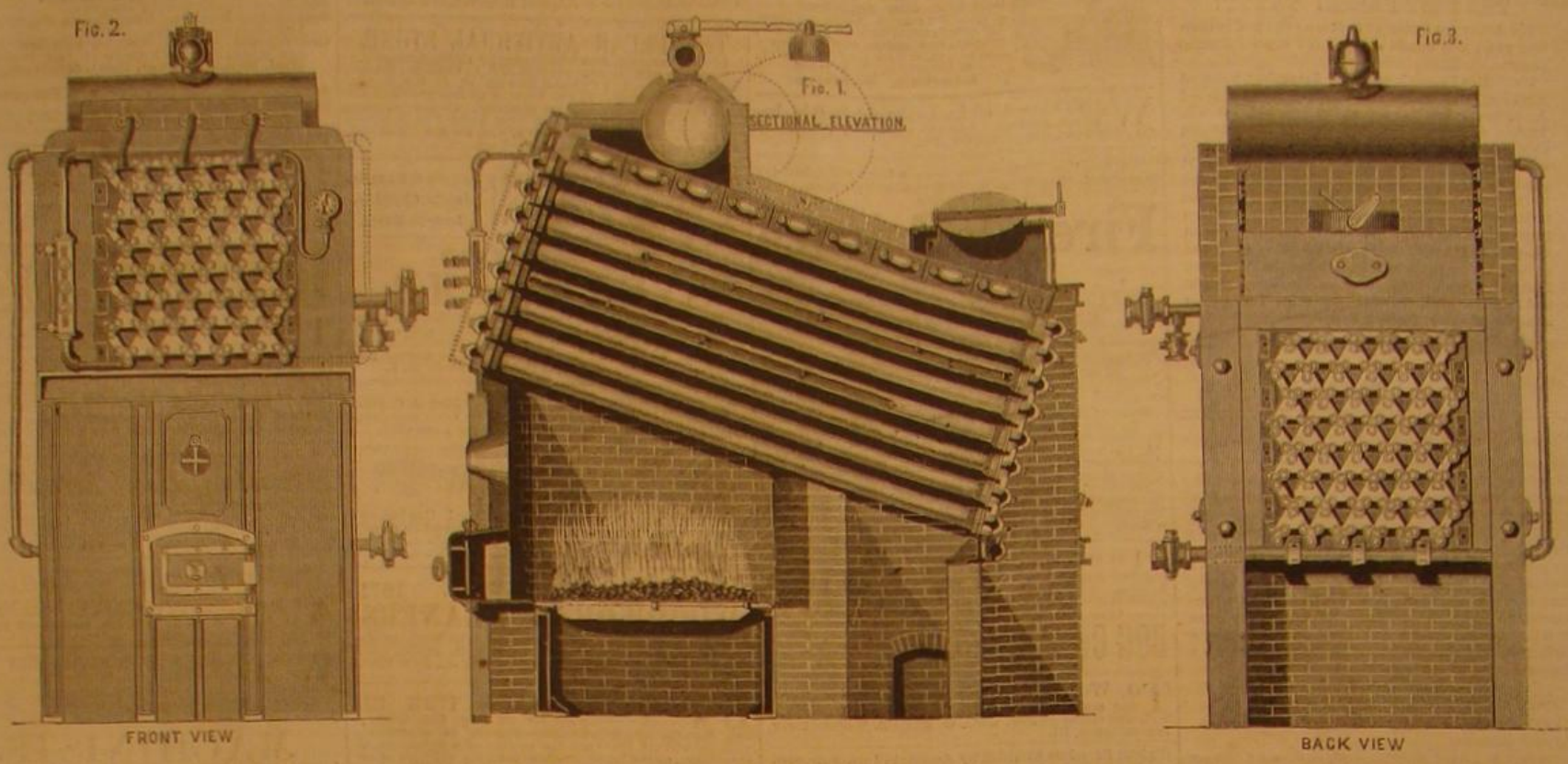
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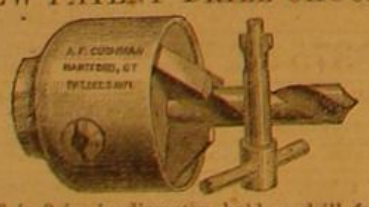
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SCIENTIFIC AMERICAN

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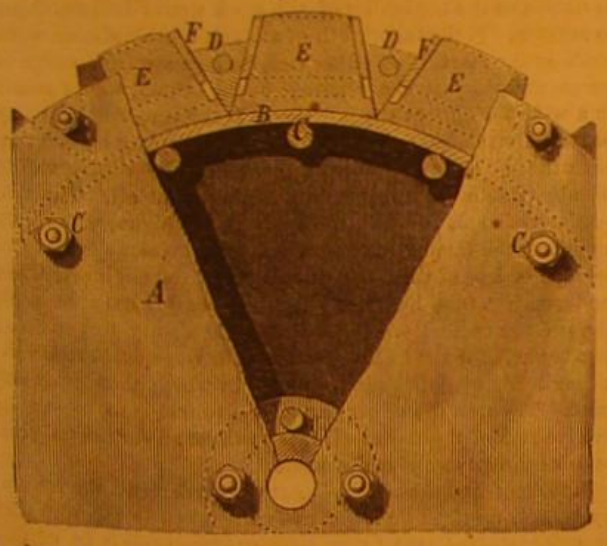
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THE ROAD STEAMER "AMERICA."

The engraving which forms our first page illustration this week is an excellent representation of a new road steamer, invented by Mr. George W. Fitts, and upon which three patents have been granted, dated respectively Feb. 28, 1871, Oct. 17, 1871, and Aug. 8, 1871.

There are many good points in the design of this road steamer, aside from the peculiarities upon which the patents are based. The diameter of the driving wheels of the locomotive, represented with side plates and rubber blocks in plan,

Fig 2



s about 66 inches over all. The diameter of the guide wheel is 31 inches. The boiler is 38 inches in diameter by 6 feet 6 inches in length. The total length of the machine is about 10 feet. The extreme width of track is 76 inches. The breadth of the faces of the driving wheels is 10 inches, and that of the guide wheel 6 inches. The capacity of the water tank is 250 gallons. The fuel bunkers carry hard coal for ten hours labor. The cylinders are 7x12 inches. The total weight is from 7,000 to 8,000 lbs.

The structure of the driving wheels and the guide wheel (with the mechanism for operating the latter) being the most prominent features of the locomotive, we will first notice them in connection with Figs. 2 and 3, which illustrate their details.

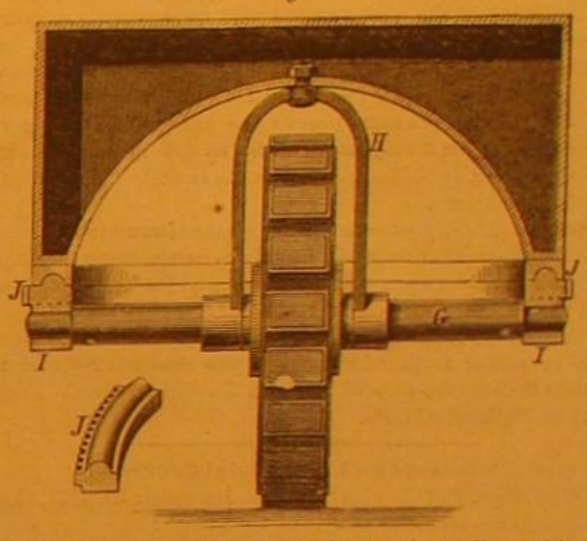
Fig. 2 is a side elevation of one of the driving wheels with a portion of the side plate broken away to show its construction.

The side plates, A, are bolted to the hub of the wheel, as shown. B is a rim supported by the bolts, C, the latter also holding the two side plates of each wheel together. These side plates are also braced between the rim and the hub, and they extend out beyond the rim, as shown. The space exterior to the rim, C, and inclosed laterally by the side plates, A, is divided into chambers or pockets by triangular partitions, D. The pockets thus formed are larger at their base on the rim, C, than at the outer edges of the side plates. In them are placed blocks of elastic rubber, E. Around the outer extremity of each rubber block is placed a band or cap, F, corresponding in shape to the part of the rubber block inclosed. The inner portion of this band or cap is inclosed in the pocket, from which, on account of the inclination of the sides, it cannot escape.

These wheels are driven by gear wheels attached on their inner sides, as shown in Fig. 1. The steam cylinders are placed to the rear of the axle and above it, and the connecting rods pass over the axle to cranks in front of the axle, on the shaft of which are pinions which mesh into the gears that turn the driving wheels. The guide wheel (front view) is shown in Fig. 3. The general construction of this wheel is like that of the driving wheels, with side plates, triangular partitions, pockets and rubber blocks. Its axle, G, has a yoke, H, attached near the wheel, the yoke being pivoted at the top to the framework of the machine. The boxes, I, of the axle are bolted to the under side of a toothed circle, J, which corresponds in its action to the fifth wheel of ordinary vehicles This circle is made convex on the top, its convexity fitting a corresponding concavity in a fixed circle, which guides it in its movement about the central vertical axis. The pivoted yoke prevents the displacement of these two parts. A pinion, K, meshes into the toothed circle, and is actuated, in steering, by a vertical shaft and hand wheel.

The general arrangement is more compact than that of other road steamers before the public, and is of such a form as will admit of its being constructed very light or very heavy, as may be desired; at the same time it is claimed that

Fig 3



it retains all the necessary points for a successfully working machine. It is built with special reference to its adaptation to all the various uses to which a self-moving power may be applied, and it is claimed that it can be used, and is as well adapted for a local or stationary power as it is for a movable one, as by simply blocking up the driving wheels they



FITTS' NEW ROAD STEAMER.

may be used as band wheels for sawing wood, thrashing grain, shelling or grinding corn, or for any purpose where a stationary power is needed.

The driving wheels are, we believe, an entirely new invention. From actual trial the inventor considers them as good, if not the best, traction wheels that have been constructed. The points of merit claimed for this wheel are its great strength and lightness, the arrangement of the blocks of rubber in the face of the wheel to get the elasticity so much needed in a machine of this kind, combined with the most effective traction surface, its simplicity of construction, and the arrangement of the triangular partitions, by which any of the rubber blocks may be removed and repaired by simply unscrewing a nut and removing the bolt which holds the partition in place, so that, if any part of the wheel or blocks should be damaged, it may be repaired without interfering with any other part of the wheel, thus making the cost of repairs much less than with other forms of rubber tired wheels.

It is claimed that, in the peculiar construction of the guide wheel, a superior advantage in compacting the entire machine is attained, as this wheel may be placed in any desired position under the water tank and entirely out of the way.

The machinery is all thrown around the boiler and directly upon the driving wheels by placing the cylinders upon one side of the axle of the drivers and gearing upon the opposite side, and we believe this is the only machine where this is accomplished.

The boiler is fed by a small steam pump which is placed upon the top of the tank, and is used for a variety of purposes, such as feeding the boiler, filling the water tank by attaching a hose pipe, and throwing one end into a pond or well, etc. It will draw the water from the water tank and force it through the same pipe to the hight of sixty or seventy feet. Thus it may at times be useful in putting out fires, washing, sprinkling, etc. It works entirely independently of the engines.

It is confidently expected by the manufacturers of these road steamers that they will be able to demonstrate its adaptability to travel upon common roads, and its usefulness for all the purposes for which traction engines are needed.

A machine from which our engraving is taken has been built; and for further information the reader is referred to Davis & Canavan, care of Davis & Foulke, 24 South Front street, Philadelphia, Pa.

Scientific and Industrial Progress.

The *Illustrated London News* of December 30, 1871, thus sums up the scientific results of the month:

The cattle show, held in London annually in the month of December, is accompanied by a show of agricultural machinery in the same building. But this year there was no feature of novelty or interest in the mechanical part, the most prominent features of which were mediocrity and stagnation. Yet it cannot be supposed that in agricultural machinery we have reached a point which renders further improvement needless or difficult. The mechanisms employed for plowing by steam are still slow and cumbrous; and it is time that an engine should now be introduced which plows a furrow at a time as it travels onward, and which will dispense with the use of wire ropes and other tackle altogether. It is not necessary that such a machine should imitate literally the action of the plow, as if no other method of turning up the earth would answer; the fact being that the plow itself is an imperfect instrument, as it does not break up the soil sufficiently and is only tolerated for the facilities it affords for engaging horses in the work. In the portable engines exhibited at the cattle show of this year, there is no visible improvement upon former years, either in workmanship or design; and, as a rule, the quality is indifferent. The Smithfield Club might advantageously induce steam engine manufacturers accustomed to a higher class of work to enter the agricultural field, as the appearance of such competitors would stimulate improvement among those by whom agricultural engines and machines are now exclusively produced.

The Austrian Government has arranged to carry out a very comprehensive scheme for the improvement of the Danube, by which it will be rendered navigable, by steamers drawing five or six feet of water, for the greater part of its length. The requisite works for carrying this important undertaking into effect have been designed by the Hon. W. J. M'Alpine, an American engineer of eminence, who is also a member of our own Institute of Civil Engineers, and who is well known in this country from the numerous important works he has completed. The Danube, though a large river and deep at certain seasons, is very shallow at other times, when the water is spread thinly over a wide bed. At one point, called the Iron Gates, where the river makes its way through the Carpathian mountains, the depth of the water does not exceed eighteen inches in the dry season, and the bottom is composed of rock. The leading feature in Mr. M'Alpine's plan of improvement consists in the confinement of the stream in the shallow parts by low, rough walls of stone, which will be surmounted by the water during the floods; but which, during the dry season will, by contracting the width, increase the depth of the water. There can be no doubt that the Danube, if its navigation were effectually improved, would become one of the most important arteries of commerce in the world, and the Austrian Government has at length become conscious of the important issues hanging upon the accomplishment of such improvement. The total cost of the undertaking will be moderate. The work will be executed by a company, and a guaranteed interest upon the capital will be given by the Austrian Government.

An improvement in the blowing apparatus of iron furnaces, by Messrs. Hyde and Bennet, of Sheffield, has latterly been introduced at some smelting works. It consists in the application of centrifugal fans to *force* the air into the blowing cylinders, the effect of which is that the blowing cylinders may be made smaller than would otherwise be necessary; or, if the blowing cylinders are kept the same size, a larger volume of air will be discharged. It cannot be said that there is any good blowing apparatus for furnaces at present in use. Fans give too small a pressure of air to be available for use alone. Roots' blower will give a pressure of air of 1½ lb. per square inch without much leakage, but most modern furnaces require a pressure of twice this amount. Probably a series of Roots' blowers—the air from the first feeding the second, and the air from the second feeding the third—would be an efficient arrangement; and it would take up little room, as one shaft might drive the whole.

Mr. Redgrave, the Inspector of Factories, in a report recently issued, gives an interesting account of the Royal clothing factory at Pimlico, at which clothing is made for the army. The separate pieces of the garments are chalked out in the usual manner upon the surface of the cloth, and the piece of cloth with the pattern so chalked upon it is placed above seventy-nine similar pieces of cloth, when the whole are cut out at one operation by a band knife resembling a band saw, but without teeth. The sewing of the parts together to make garments is performed partly by sewing machines and partly by hand. The seams, after having been sewn, are ironed in the usual manner; but the irons are heated by jets of gas, and the iron is pressed down upon the ironing board by a pedal, to reduce the labor of the operator. The work is paid for by the piece. The price paid for making a tunic is 3s. 4d., and that paid for making a pair of trowsers is 1s. A woman can make about one tunic per day, or four pairs of trowsers.

A series of trials of cotton gins suitable for use in India is being carried out in Manchester, under the inspection of Dr. Forbes Watson and Major-General F. Cotton. These gins are being tested with the different varieties of seed cotton which occur in India, and it is expected that the result will be the discovery of a species of gin which can be employed in India with advantage. We are very doubtful whether any species of saw gin will do for Indian cotton, the staple of which is both short and tender, and we believe that some modification of the native *churka* will be found to be the least injurious species of machine that can be employed.

According to a report recently published in Germany, the working plant of Krupp's steel works at Essen was, during the last year, 514 melting, annealing, and cementing furnaces, 169 forges, 249 welding, puddling, and reheating furnaces, 245 coke ovens, 120 miscellaneous ovens or kilns, 256 steam engines (collectively of 8,377 horse power), 340 lathes, 119 planing machines, 65 shaping machines, 144 boring machines, 120 unclassed machines, and 90 grindstones. There were also fixty-six steam hammers, one of which weighs thirty tuns. The number of workmen employed was 7,100, and 70,000 tuns of steel were turned out. Nothing is said in this catalogue of Bessemer converters, of which there are several at work, and much of the steel produced by Krupp is made on that principle.

Wagner, in a paper lately published in Germany, describes the results of his experiments with kreatin as a source of nitrogen for plants. Maize grew and produced seeds in a solution in which kreatin was the only nitrogenous substance present, and the kreatin was absorbed unchanged and was detected in the plant.

Bender states that so injurious is sulphuric acid in any form to Portland and Roman cements that 3 per cent in any sample unfits it for building purposes. The usual source of the contamination is gypsum (sulphate of lime).

The Detroit River Tunnel.

Although little mention has been made of the progress of the great engineering work which is to open railway communication, under the Detroit river at Detroit, between the Michigan Central Railway and the Great Western Railway of Canada, the enterprise has been pushed forward as rapidly as circumstances would admit. The thousand and one hindrances, unexpected and, of course, unprovided for, have retarded its progress, but what has been done has been well done. From the Detroit *Post*, we learn many facts which we are sure will be found of much general interest. The first step in the work of construction consisted in the sinking of a large coffer dam, similar to those generally used in laying the foundations of bridge abutments. Immense planks were then driven down, in double rows, upon which were securely bolted six-inch planks, also in double rows, thus making an immense box, or sheathing of wood, a foot thick. Hard blue clay was then filled in and a solid pier constructed. Through this newly made land, the shaft is to be sunk.

The shaft itself is a massive one of iron, weighing eight tuns. Its diameter is fifteen feet, its thickness nearly two feet. The water was found to be about fifty feet deep, and the shaft is to be sunk a distance of over fifty feet before the drainage tunnel will be commenced. It has been placed in position, and upon it the brick work has been built to a hight of ten feet. Owing to the frost, and the necessity of rendering everything perfectly solid and impervious, the bricks are laid in asphalt. A temporary structure has been erected over the whole ground, and within fires are kept up continually, that the frost may not penetrate the earth. Some twenty men are constantly employed. The base of the shaft is larger than the top, so as to allow of the passage of the same through the ground. By this there is less friction to overcome, and the earth around the shaft is much more easily loosened and broken.

The great weight of the iron base and the additional weight of the brick work will gradually sink it to the required depth. At what rate of progress this can be done it is impossible to say at present, as the shaft has yet hardly made more than an impression. The sinking is, of course, a comparatively easy matter. The real difficulties commence when the bottom is reached. The first movement, then, is to excavate the drainage tunnel. This will be twenty-five feet lower than the main tunnels at their respective entrances, and will lie between them. From both the Detroit and Windsor sides, this tunnel will approach a gradual elevation to the center, at which point it will be put slightly below the main tunnels. It will have a diameter of five feet, and be connected with the others by iron pipes. The construction of this drainage tunnel will be comparatively easy, though, of course, the surveys and calculations must be made with great accuracy. This part of the work will be rapidly pushed forward, and will doubtless determine, in a great measure, the further progress of the undertaking. In the various borings made from time to time through the river bed, it was found that the strata of soil were not all uniform.

In constructing the tunnel it is, of course, necessary to obtain as firm a wall as possible. (For this the hard blue clay is considered the best.) In order to obtain this, it was found impossible to construct a straight tunnel, and moreover the otherwise too steep grade must be obviated. This the circuitous course will render less, the grade being estimated at one foot in fifty.

The nicest calculation will be necessary, as the slightest deviation at the beginning of the work would be hazardous to success. If but an eighth of an inch miscalculation were made at the start from either end, its increase from curve to curve, and through the windings of the tunnel, would result in a wide variance at the junction. If the construction party on the Detroit side should thus vary, the place of meeting with the Windsor party in the center of the course would be altered—in fact, they would not meet at all. The two sections of men at work under Lake Michigan, while constructing the famous lake tunnel at Chicago, came out within an inch or less of the place calculated by the engineer. That undertaking was, however, small and easy compared with the present one. Here it is deemed necessary to construct two tunnels for the trains passing both ways. There is also a possibility of getting into a strata in which there is quicksand. Then, as the upper part of the tunnel is to be within twelve feet of the river bed, there will be an enormous pressure as the excavations are made.

Massive frameworks to support the earth until the masonry is built up must be made, and care taken lest before this is accomplished there may be a sudden caving in of the earth. These and other contingencies must be provided for, and the magnitude of the work and difficulties in the way can hardly be sufficiently appreciated. The most skillful workmen that can be found will have charge of the various sections into which the work may be divided, men skilled in mining, and well versed in the "underground science." The fame and well known skill of Mr. Chesebrough, as a civil engineer, gives confidence in the success of the undertaking. Mr. Chesebrough is also city engineer of Chicago, whose lake and river tunnels are widely celebrated. The other engineers are Mr. E. S. Chesebrough and Mr. E. C. Clark, under whose direct charge will come the details of the work upon the tunnel, and who are both men of ability and experience. The great work is, as we have said, already under way, and is surely though silently progressing.

Buscher's Improvement in Clapboarding.

This invention has for its object to prevent the frequent cracking of clapboards on houses, to provide a reliable connection between the several boards, and to hide the fastening nails.

The clapboards are grooved on top and bottom. They are interlocked so that the inner tongue at the lower edge of each board enters the groove on top of the board below, the outer lower tongue overlapping the lower board.

The clapboards are applied as follows: The lowest board is first put on in proper position and nailed to the scantlings or uprights, the nails being put through the upper part of the board. The next board is then put upon the first, so that the outer tongue will cover the nails of the former, and so that also the lower board will sustain the upper. This being nailed on top, serves again to support the next board above, and so forth. After the lower board has been properly righted, none of those above need be adjusted, as the upper edge of every lower board will constitute a reliable guide for the upper. The labor of clapboarding is thus greatly reduced.

Boards so grooved can only properly be made of strong material. The half inch clapboards hitherto usually employed will therefore hardly answer the purpose. The inventor, Mr. Franz Buscher of Dunkirk, N. Y., therefore proposes to use boards of about seven eights or one inch thickness.

THE oldest woolen cloth factory in the United States is probably that of Mr. Thaddeus Clapp, of Pittsfield, Mass. This manufacturer has in his possession specimens of cloth of his own manufacture, selected from the production of each year from 1812 to the present time. Such a collection is obviously interesting to any one who is curious to observe the progress in the United States of the art of making woolen cloth. This manufacture has long been narrowed, as far as the finest qualities are concerned, to England, France, and Germany; and its gradual improvement towards perfection, by American mill owners, is a matter in which many thousands of our population are concerned

Aurine.

Messrs. R. S. Dale, B.A., and C. Schorlemmer, F.R.S. add a few facts to our present knowledge of aurine, the coloring matter discovered by Kolbe and Schmitt in 1861, and which is now known in commerce under the names of yellow coralline, or rosolic acid. The commercial product, which is obtained by treating phenol with oxalic and sulphuric acids, is a mixture of different bodies, from which these chemists have isolated the pure coloring matter by dissolving the crude aurine in alcohol, and treating this solution with ammonia. A crystalline precipitate then separates, which is a compound of aurine and ammonia, and the other bodies present remain in solution. They next wash this ammonia compound with alcohol by means of Bunsen's filter pump, decompose it with dilute acetic acid, and render the aurine thus obtained still more pure by repeated crystallizations from strong acetic acid.

They find that aurine retains water and acetic acid most obstinately, and that the color, of the rhombic needles or prisms with which it crystallizes, varies very considerably, according to the concentration of the acid. They have obtained it in needles having the color of chromic acid, with a diamond brilliant luster; at other times the crystals have been dark red of varying shades, with a steel blue, greenish blue, or splendid beetle green reflection.

From concentrated hydrochloric acid, aurine crystallizes in fine, hairlike red needles, which, dried at 110°, contain a large quantity of hydrochloric acid. They tried also to obtain this compound pure, by precipitating from a dilute alkaline solution with weak hydrochloric acid, which it only parts with at temperatures above 110°. By spontaneous evaporation of an alcoholic solution, aurine is obtained in dull red crystals, with a green metallic luster. Dried at 110°, this body contains no alcohol, but still retains water, which only escapes at 140°-180°, the crystals not changing their appearance at all.

The authors find that, contrary to Fresenius' observation, aurine crystallized from alcohol does not melt at 156°. The analysis of aurine dried at 200°, which they believe to be pure aurine, gave numbers agreeing with the formula $C_{20}H_{14}O_3$, and the mode of its formation may, if this formula be correct, be expressed by the equation:

$$3C_6H_6O+2C_2H_6O_6=C_{20}H_{14}O_3+8H_2O+2CO_2.$$

Carr and Wanklyn obtained, by the action of nitrous acid or rosaniline, a body which they believe to be identical with aurine, and to which they assign, from the mode of formation, the composition, $C_{20}H_{16}O_3$. Nascent hydrogen converts aurine into colorless leuco-aurine, $C_{20}H_{18}O_3$. This reduction may be effected by heating it in an alkaline solution with zinc dust, but at the same time a dark resinous body is formed, from which the leuco-aurine cannot be easily freed. The best results are obtained when leuco-aurine is formed from a solution of aurine in acetic acid, by zinc dust It crystallizes in compact colorless prisms.

A body much resembling leuco-aurine is contained in crude aurine, but has not yet been separated from it. It differs, however, from it, by yielding a purple precipitate on adding potassium ferricyanide to its alkaline solution; leuco-aurine, under the same conditions, being oxidized, and reproducing aurine, which dissolves in alkalies with a magenta red color.

By passing sulphur dioxide into a hot alcoholic solution of aurine, brick red crystals separate, being a compound of aurine and sulphur dioxide; at 100° they are decomposed, but undergo no change if exposed to the air at ordinary temperatures. By heating aurine with alcoholic ammonia in closed vessels to 110°, red coralline is obtained, a body which has great resemblance to the yellow aurine, but dyes a redder shade. This compound also forms fine crystals.

The Loss of a Leg.

An ex-army officer, who lost a leg during the recent civil war, has been so impressed, with the peculiarities of his situation and the novel adventures and incidents growing out of that situation, that he has written a book on the subject, entitled "John Smith's Funny Adventures on a Crutch." The author complains good naturedly that he is looked upon as public property, and almost bored to death by the many inquisitive strangers he meets in his travels. "I can never" says he, "obtain a moment's rest in any public place. I no sooner take a seat in a car, restaurant or a lecture room than some one near me, whom I have never seen before, introduces himself with the stereotyped remark, 'I see you've met with a misfortune,' and on my assenting, proceeds to ask the following questions:

'Did you lose your limb in battle? What battle? Did a cannon ball take it off? A rifle ball, eh? Did it knock it clear off? Did it sever an artery? Did it hit the bone? Did it break it? Did you afterwards find the ball? Was it crushed out of shape? Did you fall when hit? Did you walk off the field? Who carried you off? Did you feel much pain? How long after you were wounded was it amputated? Who performed the operation? Did you take chloroform? Did it put you to sleep?' And didn't you feel the operation? Not even the sawing of the bone? Could not your limb have been saved? Was it taken off right where the wound was? Can you wear an artificial leg? Would the government furnish it if you could? Do you draw a pension? How much? How old are you? What is your name? What did you do before the war? Don't you often wish you hadn't lost your leg? How does a person feel with a leg off? Does it ache when the weather changes? Would you rather lose a leg than an arm? I have heard persons say that an amputated limb still feels as if it were on; is that so? How do you account for that?'"

Milk.

Milk is a liquid, containing the salts of sugar and caseine in solution, and fatty globules in suspension. Let us examine if it is possible to imitate these globules of fat, by making an emulsion of an oily or greasy substance in a viscous liquid.

Many years ago I showed experimentally that the natural globules of milk fat are protected from certain physical and chemical reactions by a true membranous envelope. Admitted by some, contested by others, this fact appeared to me entirely to put out of the question the possibility of imitating the milk of mammals by any kind of emulsion.

The existence of this membrane is proved by two chemical experiments. The first depends on the property possessed by sulphuric ether of dissolving fats and of collecting those which are suspended in liquids, provided that they are free. Now if, after having shaken together a mixture of milk and ether, it is allowed to rest for a short time, the ether comes to the surface of the liquor without having dissolved anything, and the milk is neither changed in appearance, nor has it lost any of its butter. If, however, previous to treatment with ether the milk is subjected to the action of acetic acid, which has the power of attacking the membranous envelope, the reaction is altogether changed; the milk agitated with ether at once loses its opacity, and cedes its butter to the sulphuric ether. An inverse experiment leads to the same conclusions. A neutral salt, such of sulphate or chloride of sodium, added to milk, enables one to collect on a filter the fatty globules, while the serous liquor passes through perfectly clear. If then washed with a saline solution, these globules can be freed from all the soluble constituents of the serum. Now if butter were formed of simple fat globules, there would not remain any albuminoid matter; but to whatever length the washing may be prolonged, a certain portion still remains, and without doubt forms the envelope of the cells which, coagulated, forms butter.

The microscope also adds its testimony to the same fact. It is sufficient to squeeze milk by means of a press, to convince oneself that, after the escape of the fatty matter, the butyric cell loses its shape altogether, thereby proving that the vessel and its contents have each a separate existence.

For these reasons, as well as for many others—for no conscientious chemist can affirm that analysis has revealed the whole of the natural constituents important for the physiologist, which this aliment contains—we should entirely disavow, at all events for the present, the pretension of manufacturing milk; and above all, we should abstain from likening any emulsions (of however complicated a description may be) to this wonderful natural product.—*M. Dumas.*

Blasting Ice.

The Eastern of France Railway Company constructed over the Meuse, at Charleville, a temporary timber viaduct to replace the stone bridge destroyed by the necessities of the war. The recent cold having frozen the river, much apprehension arose for the safety of the piers when the thaw should arrive, as they were unprotected by ice guards. The use of dynamite was suggested, and, thanks to the employment of this explosive, all danger was avoided.

The mode of conducting the somewbat interesting and decidedly novel work was as follows: The river, which was frozen between the bridge of Charleville and that of Méziéres for a length of about 1,400 yards, was besides impeded with an accumulation of piled up ice. Holes were broken with a hatchet, and through them were introduced charges of dynamite, of one or two cartridges of 1,150 grains, each fitted with a cap heavily charged with fulminate of mercury, and a fuse. The charge, suspended from a thread, was sunk to a depth of about three feet in the water. The explosion generally produced blocks of ice sufficiently small to pass through the openings of the bridge without inconvenience. Such blocks as were too large were afterwards again attacked in a similar manner, and subdivided. The operation lasted three days, and about 55 pounds of dynamite were sufficient to completely clear the river and relieve the viaduct.

Ice may be broken by the explosion of dynamite on its surface, and the employment of this explosive is suggested to our North river ice men in lieu of saws and plows. The ice thus broken would not pack as well in the ice houses, that is certain.

The Fire at Warwick Castle.

From the recent accounts of this conflagration which have reached us, it appears that the state apartments were saved from destruction by the solidity and thickness of the interior walls of the castle, which are of stone, built of the most massive proportions. Great as was the damage done, lovers of the arts in all countries will be glad to know that the collection of paintings, comprising some specimens of inestimable value, was rescued from the flames. The more celebrated of the pictures, including the Rubens and the incomparable equestrian portrait of King Charles I., by Vandyke, were saved from the fire. The latter picture is most probably familiar, by means of copies and engravings, to our readers. The horse and rider are apparently coming out of the picture towards the observer, the illusion being almost complete on account of the marvelous accuracy of the foreshortening.

It is strange that this noble building, filled with many objects of such interest and value, should be left without any adequate means for the suppression of fire. The reconstruction, however, is already commenced, workmen being engaged in removing the damaged woodwork from the corridor leading from the great hall to the gilt and other state rooms, and otherwise preparing generally for the extensive and necessary repairs. The quantity of *débris* is enormous. Everything is carefully examined, and the exhumed articles assorted and placed in different heaps. They consist of masses of lead, iron, etc., melted by the intense heat; relics of costly furniture, valuable ornaments, broken curiosities, etc. The work of restoration, though expensive, will be far less costly than has been anticipated; and when completed, the castle will only appear to have been thoroughly renovated throughout the private apartments. The exterior will be wholly unchanged. It is understood that the old battle axes, tomahawks, and ancient weapons of warfare formerly hanging in the corridor, near the great hall, were of great service in wrenching the pictures from the walls and getting them down. But for the fact that they were there, and came handy as crowbars and jemmys, a great deal of the property would not have been saved.

Embalming the Dead.

There are some specimens at this moment on the table which show how well the process of preservation of dead structure may be maintained by the contact of gases and vapors. Here are two kidneys, showing the extreme congestion of these organs that is found in fatal cases of congestive fever—that sudden nervous lesion of the vessels of visceral organs, during which the heart pours its blood into them until, from engorgement, they cease their function. These parts have been in vapor of ammonia for the period of twelve years, and here they remain nearly as at the moment they were removed. There is a specimen of portions of intestinal tract studded with minute and large hæmorrhagic spots, in which the lesions are equally perfect, and in this instance the preservation has extended over twelve years.

I found this method, of preserving animal substances, of great use to me in teaching. Dissections of various organs, as of the heart, I have kept from week to week, and have demonstrated readily from them, without the trouble of new dissection.

Pursuing this subject of preservation still further, but in a slightly different course, I attempted to bring back animal tissue, that had undergone actual putrefaction, to something like a recognizable pattern of natural condition; and once, in the interests of justice, I manipulated on an unrecognizable putrid body, and so far succeeded as to enable important evidence of identity, which could not before be obtained, to be secured.

Still pursuing the same research, I constructed a fluid for treating organs of the body that had become absolutely offensive from putridity, so that they could be examined for marks of injury or other lesions. This fluid, some of which I send round, is made as follows: Iodine, 1 dram; methylated ether, of sp. gr. 720, (by measure), 10 oz.: absolute alcohol (by measure), 1 oz.; strong sulphuric acid (by measure), 4 drams. Dissolve the iodine in the ether and alcohol mixed together, then slowly drop in the sulphuric acid.

The fluid, when it is poured upon the putrid tissue, is almost instantly absorbed; the soft mass is deodorized effectually, and is rendered sufficiently firm to admit of being dissected with ease. In the open bottle I hand to you is a piece of once putrid lung that was thus treated three years ago; and you can see how perfect it remains. The action of this solution is that the iodine deodorizes, while the sulphuric acid engages the water and the alkaline products of decomposition, and produces the necessary firmness of structure. The ether escapes; it is simply the fluid of menstruum for the other agents.

The process of embalming is a scientific process, equal certainly with that of conducting a *post mortem* examination; and it is sometimes a useful process. It is often so imperatively demanded that, on the refusal of men of science to do it, the ignorant are paid large sums to attempt it. Lastly, it is an art which essentially belongs to the professors of medicine, who can never let anything, that pertains to the physics of the body, living or dead, pass out of their hands without proclaiming that part of their legitimate occupation has gone.—*Dr. B. B. W. Richardson.*

Guano.

The anchors of ships moored in the vicinity of the Chincha Islands frequently bring up guano from the bottom of the ocean, which is rather contrary to the doctrine that these marvellous deposits are the excreta of birds. The recent researches of Dr. Habel go far to corroborate Professor Edward's view that guano is really a stratified deposit. When the portions of guano which are insoluble in acids are examined, they are found to consist entirely of skeletons of *Diatomaceæ*, *Polycystina*, and sponges, all of which are invariably of marine origin, and sometimes identical with those still living in the adjacent ocean. These forms are also found in patches exactly as they occur in nature. From these and other facts, recently obtained by chemical and microscopical investigation, there appears to be but little doubt that guano is an accumulation of the bodies of animals and plants; which, either by heat, by chemical action, or both combined, has had its organic matter converted into bitumen, while the mineral constituents have been preserved in those beautiful forms which make up the infusorial strata in various parts of the world.

FREEZING BY MECHANICAL ACTION.—M. Foselli has announced to the French Academy of Science that he has succeeded in producing an amount of cold just below the zero of the Fahrenheit scale, by simple mechanical action creating rapid evaporation. He employs a wheel formed of a spiral tube, both ends of which are open, set vertically and half immersed in the fluid to be cooled, so that the latter passes constantly through the whole length of the tube, half of which is constantly above the liquid, and, being wet, gives rise to active evaporation and consequent refrigeration within it.

Dead Stroke Power Hammer.

The peculiar advantages claimed for this hammer, which has, in a less perfected form, been before the public for some years, are as follows:

It strikes a square true blow at all times and under all circumstances. It can be run at a high speed without danger of breakage. It has neither cylinder, valve, nor piston rod, fruitful sources of expense in steam and atmospheric hammers.

The improved form of this hammer is shown in the accompanying engraving.

The ram, or striking part of the hammer, suspended by an elastic belt on the extreme points of a semicircular steel spring, obtains for it, it is claimed, a far more effective blow than is given by any other hammer of the same weight and stroke.

The upper part of the steel spring is connected by a rod with a crank pin, which, being set in motion by belting from any convenient line of shafting, gives the reciprocating movement necessary to raise or lower the ram in its guides with a speed and force entirely regulated by the friction pulley, which is always under the control of the operator.

Another peculiarity of this hammer is that the rebound is taken up, by the spring and belt on which it is suspended, before reaching the working parts above it. In this way the shaft bearings, crank pins, and set screws are preserved from breaking.

The convenience of this hammer is a great point in its favor, for, although it may readily be adjusted to work exclusively on thick metals, yet for ordinary work, a 50 lb. hammer, for example, will strike good alternate blows on a 3 inch or ¼ inch bar without any change in the adjustment. This is readily understood when it is explained that the ram, in ascending, has a stroke inside the spring, into which it rises by the flexibility of the leather belt to which it is attached, and the compression of the points of the spring as the ram is rapidly forced up between them.

It will be observed that the anvil block and sole plate are all connected with the frame in one piece, excepting in hammers in which the ram weighs 1,000 lbs. and upward.

Great improvements have recently been made in this hammer. The friction gear now supplied renders it much more controllable, and permits a tight belt to be run at any angle.

Persons using loose belts, which are constantly flapping about and have to be run at a certain angle, will appreciate this change. The frame is much stiffer, than it formerly was, by reason of its shape; the guides are bolted on, and the gib at the back of them discarded. The dies in the ram and anvil block are all keyed in, and the workmanship is good in every respect.

A new method of fitting the crank pin in the 25 lb. hammer has been devised, by which the stroke can be changed from 12 inches to 8 inches, thus permitting the same hammer to be run very rapidly on light work, as small as ¾ inches in diameter. By this arrangement, the machine may be run at a very high rate of speed, and the 15 lb. and 25 lb. hammers combined in one machine, thus giving a much greater range of stroke.

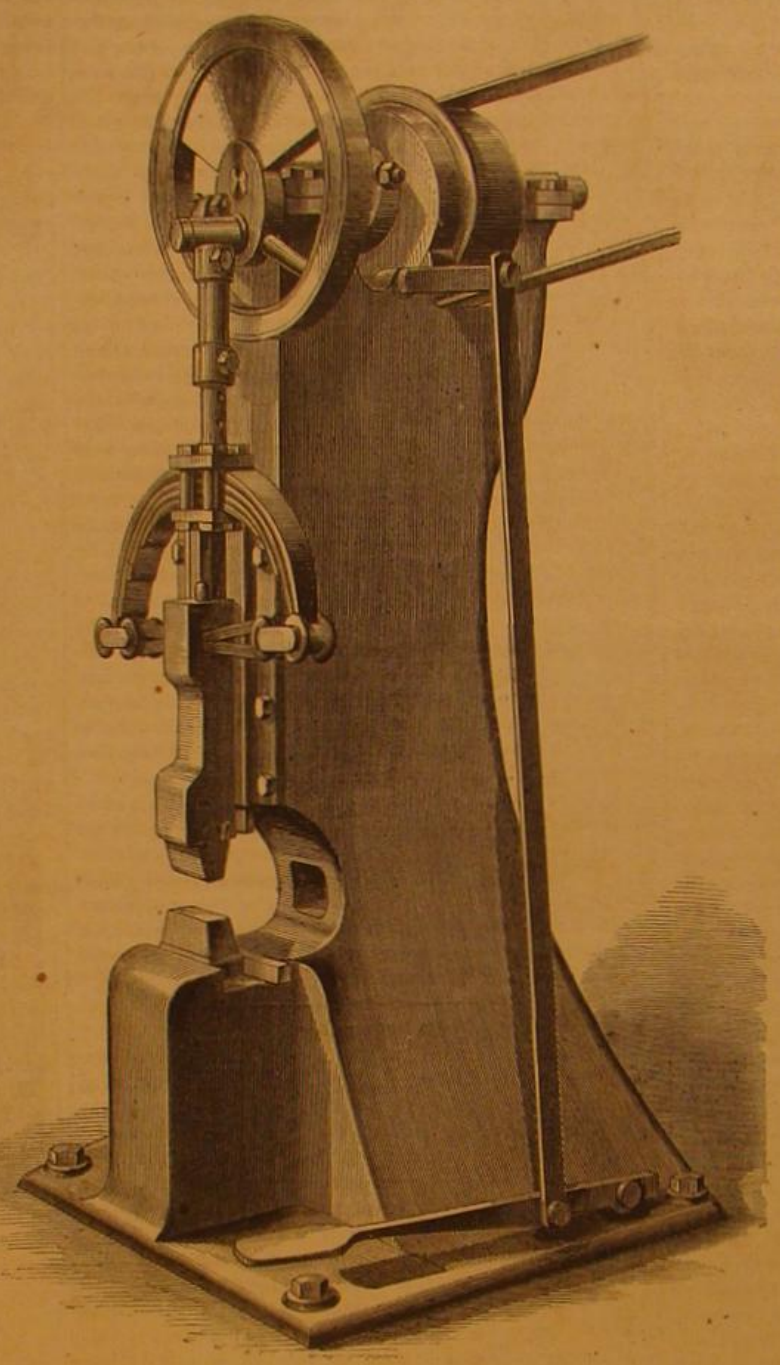
For manufacturers taking up a new line of work, requiring a larger hammer than they at first anticipated, this 25 lb. hammer is considered a superior tool.

These hammers are used in the Government workshops of the United States, France, and Russia, and have been sent to all parts of the United States. Many are in use in England, Scotland, France, Belgium, Holland, and Russia. A prize medal was awarded to it at the Exposition of Paris, as well as at the Lowell Mechanics' Association.

A small hammer, to be attached to walls, is the same in principle as that shown, but has advantages that the latter has not; as, for example, greater space between the anvil block and the back of the frame. This renders its useful for straightening saw plates or frames of any kind, planishing copper or other metals, and a variety of purposes which will occur to the mechanical reader.

Upwards of two hundred and fifty of the standard hammers are now in use, and are said to give satisfaction.

It was originally patented Feb. 27, 1866, but many improvements have been since added. For further particulars address Philip S. Justice, manufacturer, 42 Cliff street, New York, or 14 North Fifth street, Philadelphia.



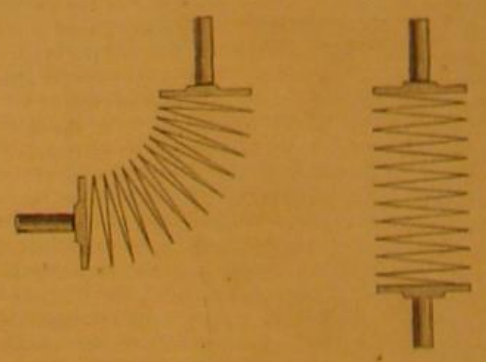
THE SHAW & JUSTICE DEAD STROKE POWER HAMMER.

Hydrogen in Meteoric Iron.

In a paper recently communicated to the Royal Astronomical Society, Mr. Proctor dwelt on the inferences deduced by the late Professor Graham from the presence of occluded hydrogen in meteoric iron. The iron of the Senarto meteorite contains more than three times its own volume of occluded hydrogen, whereas the iron of horse shoe nails contains scarcely its own volume of hydrogen, and a much greater proportion of carbonic oxide. Hence Professor Graham had inferred that the meteorite had been extended from a star whose atmosphere contained hydrogen in large quantities. M. Le Roux points out (in *Les Mondes*), however, that this conclusion is not inevitable, for M. Lenz has ascertained that the galvanoplastic iron, prepared by Klein's method, can contain no less than 185 times its own volume of occluded gas, hydrogen forming 60 per cent of the gas thus present (the remainder chiefly carbonic, oxide, and nitrogen). M. Le Roux notes that the presence of carbonic oxide is as remarkable as that of hydrogen. It shows that occluded carbonic oxide is no proof of the igneous origin of a mass of iron; since in the case mentioned, the carbonic oxide was introduced through the decomposition of the carbonates in the galvanoplastic trough. He asks further whether the peculiarities of structure observed in many ferriferous meteorites may not perhaps be recognized in galvanic deposits obtained under certain conditions.

TRANSMITTING ROTARY MOTION AT ANGLES FROM THE PLANE OF ROTATION.

This ingenious invention is shown in the engraving. It is a spiral formed of a plane iron, or rather steel, band which is attached at its opposite ends to the two shafts to be connected. The diameter will necessarily, in order to secure sufficient strength, be considerably larger than that of the shaft; and the attachment may be made by means of a cast



iron cap, having on one side a socket for the shaft and on the other a flat surface to receive the spiral. The breadth of the iron band or ribbon which forms the spiral is about an inch and a half, and its thickness a little more than a quarter of an inch. The total diameter of the spiral is about one foot. For a joint of transmission forming a right angle, about fifteen turns of the spiral will suffice. The entire spiral may be made of a single ribbon, or it may be made up, as it has been in some cases, of a number of parts connected together by tongue and groove.

Experience has proved that this mode of transmission performs perfectly, without being liable to get out of order or to give way. Its strength is very considerable, but cannot be indefinitely increased, since a thickness exceeding that which is adopted would bring too great a cross strain on the metal. A number of these joints have been in operation without accident for several years. It is the invention of Mr. Thirion, of Belgium.

Pavements for Streets.

While in this country our engineers and pavement authorities are still undecided as to the best and most economical covering for city streets, in France, more especially in Paris, the question appears to have been definitely settled, after ten years experience, in favor of the steam rolled macadamized roadway.

On the first introduction of macadamized roads, the stones were prescribed to be absolutely clean, and the use of any detritus was severely prohibited. This idea has not been adhered to. But generally it can be said that it is better to sin in the direction of too little than of too much binding, and the general tendency in Paris is to reduce the use of binding materials to the lowest quantity possible.

The operation of rolling is always begun at the sides. The roller at first executes a certain number of passages over one of the edges of the macadam. When the stones begin to be brought together, the surface is slightly watered from a barrel or by a jet, and by means of a spade a very thin layer of the sand provided is spread. At each passage the roller is gradually brought nearer to the crown of the road. The operation is continued in this way for some time, and when the one side of the road is sufficiently bound, the other is begun with, and brought to the same state as the first. The central part is done last and in the same mode. The roller thus passes over the whole surface, staying longer over those portions less squeezed together than the others. During the operation, the road is moderately sanded and watered. Towards the end, the excess of water runs to the surface, taking with it also any excess of binding material. The rollers then produce no impression. By this means a smooth, hard road is obtained, and it can be at once open to traffic. The heaviest carts leave no trace.

Since the steam roller has been used in Paris, the bottoms of the roads have been improved and the duration of the surface has much increased. Some roads which, when steam rolling was first employed, were covered with fresh metalling and rolled every six months are now rolled only once a year. This proves a very great economy in the metalling. Steam road rolling is done in a time much shorter compared with that required for horse road rolling. It thereby much diminishes the labor required in the necessary operations of watering, sanding, and managing the work. At the same time, it prevents the considerable losses produced by the stoppage or the delay of the traffic. This stoppage is otherwise always considerable, whether the stone be spread without rolling it, or whether it is rolled with horses. This loss represents, even without there being very much traffic, a considerable sum.

With steam road rolling, which is done almost entirely during the night, the ends of the street being closed, only a temporary deviation of the night traffic takes place, without any additional work for vehicles, and with much greater safety for the workmen employed in spreading the stone, and in watering and sanding.

Ice Manufacture in India.

During the short winter, which ranges from the end of November to the middle of February, the natives are enabled to procure a supply of ice by a skillful application of the principle of evaporation. The process of manufacture is to expose the water at night, in shallow earthen ware pans, which are arranged in regular order, close to each other, to the number of 5,000 or 6,000. The ice begins to appear a little before midnight, and as soon as a slight film of ice is formed, the contents of several pans are mixed together, and the freezing liquid sprinkled over others. By sunrise about an eighth of an inch of ice will generally be found in each pan, except on very favorable nights, when the whole contents are sometimes frozen. This, however, is a very rare occurrence. The ice is then removed by women, who use a blunt semicircular knife, with which they scoop it out and throw it, together with any unfrozen water, into earthen vessels. When these vessels are full, their contents are emptied in conical straining baskets placed over the large water jars from which the pans are filled, a supply of cool water thus being collected for the following night's operations. The drained ice is next deposited in wells.

J. H. GREGORY, Marblehead, Mass., whose advertisement appears in another column, raises over one hundred varieties of Vegetable Seed, and is constantly producing new varieties. His business extends over all parts of the country, orders being received and promptly filled from more than fifty thousand customers annually.

ON ICE, WATER, VAPOR, AND AIR.

A SERIES OF RECENT JUVENILE LECTURES, BY PROFESSOR TYNDALL, LL.D. F.R.S., AT THE ROYAL INSTITUTION, LONDON.

As far as our observation goes, says the *Mechanics' Magazine*, the popularity of Dr. Tyndall as a lecturer is, in a great measure, derived from his exact and logical, as well as imaginative form of mind. His lectures are by no means accompanied by such brilliant and numerous experimental illustrations as may be seen at far humbler lecture rooms; but, as he himself remarks:

"The human mind is not satisfied with observing and studying any natural occurrence alone, but takes pleasure in connecting every natural fact with what has gone before it, and with what is to come after it."

Dr. Tyndall in all his lectures, discourses, and papers, never seems to lose sight of this fact; hence the beauty of his scientific logic, which, by completing the parallel between apparently opposing phenomena, has, on more than one occasion, reconciled them to a general law. If, in our schools and colleges, this principle were more acted on than it is, we should have better teachers and better scholars.

WHENCE COMES WATER?

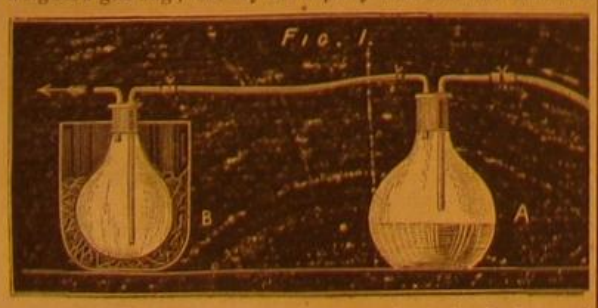
Dr. Tyndall proceeded to describe the growth of a river, beginning with such a stream as the Thames at the sea; the course is traced farther and farther back till its source is reached in the Cotswold Hills, whence a number of small streams start, and join together to form the first definite brook, which afterward swells into the great river. But here, as he pointed out, where the ordinary observer's task ends, the philosopher's begins. Whence comes the water? Observation of the streamlets in summer time shows that the supply slackens, dwindles away, and in some cases ceases altogether; but in winter, the same little brooks are swollen into bounding torrents by the rains. Rain is then the source of a river. But then, rain must have a source. Can science go farther back still? It is the tendency of the human mind to analyse backwards, and to enquire whence things have come. When they enquired as to rain, they soon came to the conclusion that it came from the clouds. But what are clouds? This is exactly the way in which philosophers examine nature; they go from link to link of the chain, as far as they can, by observation, and then they experiment and compare details, results, etc. What are clouds? Is there anything in our experience which resembles clouds? The steam from a locomotive not only resembles, but is a real cloud.

ARTIFICIAL PRODUCTION OF CLOUDS.

A jet of steam was here allowed to escape from a small high pressure boiler on the lecture table, and the electric light being thrown on it, a very pretty cloud was exhibited, looking very much like one of those silvery fleeces seen sometimes near the moon. This cloud was then discussed. It was nearly constant in shape and volume, though ever changing, and apparently ever rolling forwards, yet it had limits; but the source of the cloud, as far as vision was concerned, seemed as far off as ever, for next the nozzle of the steam jet was a clear transparent space between it and the cloud. What is the substance in that dark space? Vapor—and this vapor, which must never be confounded with cloud, is the latter's true origin. The hot invisible vapor issues from the boiler, meets the cold air, and is condensed into the visible cloud, which is in its turn dissolved by the air, when the cloud becomes again vapor; the hotter the air, the greater the quantity of this vapor which it will dissolve. This the lecturer showed by cutting off the cloud altogether, by making the jet of steam play upon the flame of a spirit lamp. The solution of vapor in air takes place in even the driest weather. On the very driest day of the hottest summer, the air is always charged with aqueous vapor. This was proved by a freezing mixture being placed in a large glass vessel, when the vapor present in the air of the lecture room made itself evident by the condensation of dewy moisture which increased until it became a mass of snow, frozen to the outside of the flask, in sufficient quantity for the Professor to indulge in a joke at the expense of his assistant, by throwing a snowball at him, which very nearly hit—to the great delight of the boys. Thus, water and heat produce steam, steam and cold reproduce water. This was also illustrated by a small still, with worm, &c. The abstraction, or rather precipitation of aqueous vapor, was very prettily shown by means of the apparatus of which we annex a sketch.

ARTIFICIAL PRODUCTION OF SNOW.

The flask A contains tepid water, over which a current of air is passed in the direction of the arrow, by means of a weighted gas bag; the dry air rapidly dissolves the invisible

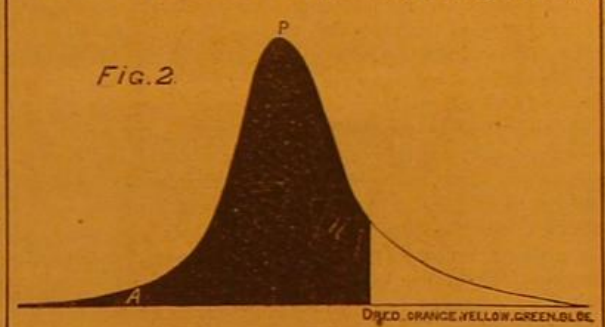


vapor in the upper part of the flask, and carries it forward into flask B; but this flask is plunged in a freezing mixture, which fills the vessel surrounding it: hence the air is no longer sufficiently hot to support the mass of vapor it had so far borne forward, and it is consequently precipitated, not, however, as water, but as snow which, during the course of the lecture, nearly filled the flask B. Two things are alik concerned in producing the snow in this experiment: heat to produce the aqueous vapor, and cold to produce the snow. Now the heat of a fire was required to produce the vapor that formed the cloud that has been discussed;—what fire is there in nature to produce these things? That great and glorious fire the sun, which warms the lakes, rivers, seas, and thus produces that volatilization of water which forms vapor.

THE RAYS OF THE SUN.

Dr. Tyndall then proceeded to demonstrate what part of the sun's rays caused the constant and immense evaporation of water which is always proceeding from the surface of the waters of our globe. The sun throws out two different kinds of rays—one capable of producing light, and one altogether incapable of producing light. To prove this, he first showed Newton's celebrated experiment of the solar spectrum, using for this purpose what Dr. Tyndall called his *domestic sun*, the electric light: passing a bundle of rays from which through a slit, and then through a prism, the slice of light formed is pulled in different parts, and, as it were, unravelled into the different parts of which it is constituted, the spectrum being of the most gorgeous description. Indeed there is no artificial arrangement of colors which can give such delight to the eye as the wonderfully beautiful way in which these appear when thus pulled asunder, at the same time remaining sufficiently linked together to show the extremely harmonious disposition of the infinitesimal waves producing the sensation of light.

But what is seen in this glorious spectrum does not in any degree mark the main quantity of rays coming from this domestic sun. The lecturer then proceeded to bring the colors



under a diagram, which we reproduce (Fig. 2) the colors coinciding with the colors above, and then went on to explain that the colors could be seen, their amount, and the relative space they occupy could be accurately measured.

THE INVISIBLE RAYS.

The "Matterhorn," B, that lofty peak, represented the relative proportion of the immense mass of rays which are not seen, and these are the invisible rays which act most vigorously upon our lakes, rivers, and glaciers.*

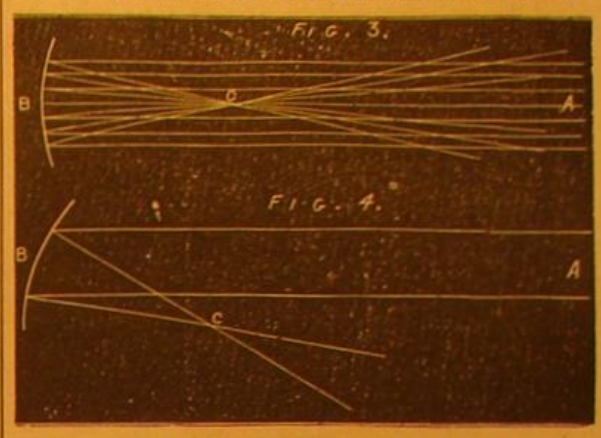
No doubt exists, on the part of our most profound thinkers, that light is propagated by waves. "Before such an idea could have taken any real root in the human mind, it must have been well disciplined and prepared by observations and calculations of ordinary wave motion. It was necessary to know how both water waves and sound waves, passing through the same medium, act upon each other. Thus disciplined, the mind was prepared to detect any resemblance presenting itself between the action of light and that of waves. Great classes of optical phenomena accordingly appeared, which could be accounted for in the most complete and satisfactory manner by assuming them to be produced by waves, and which could not be otherwise accounted for. Let me use an illustration. We infer from the flint implements, recently found in such profusion all over England and in other countries, that they were produced by men, because, as far as experience goes, nothing but man could form such implements. In like manner, we infer from the phenomena of light the agency of waves, because, as far as our experience goes, no other agency could produce the phenomena.

He then proceeded to show how some substances allow the swift "light rays" to pass through them, whilst they altogether stop the more tardy "heat rays," and *vice versâ*. There are also substances which, perfectly opaque to the luminous rays, are nevertheless transparent to the invisible heat rays. A glass cell containing water was placed in front of the camera containing the electric light, and the luminous rays were shown to pass through without any visible alteration. But when a similar cell containing a solution of iodine in bisulphide of carbon was substituted for it, the disk of light on the screen entirely disappeared. Nevertheless the iodine solution is transparent to heat, though opaque to light, and the rays that escape through it, though invisible, are far more numerous and powerful than those that are stopped.

Dr. Tyndall then proved this statement by concentrating the rays of the electric beam by means of a concave mirror, Fig. 3, the parallel rays proceeding from the lamp placed at A, falling upon the mirror at B, and being brought to a focus at C. The particles of dust in the air of the lecture room made, by their illumination, a cone of light which appeared almost tangible. He, by canting the mirror (as in the lower part of the diagram), then threw the focus outside the beam, so as to render the subsequent experiments more visible. Thermometers are the usual means employed to make evident changes of temperature, but these changes could not thus be seen by an audience; he therefore made use of a Melloni's thermo-electric pile, attached by means of long wires

*The heating power of the successive colors of the solar spectrum was first determined by Sir William Herschel, afterwards with the perfect instruments by Professor Müller, of Freiburg; that of the spectrum of the electric light by Dr. Tyndall.

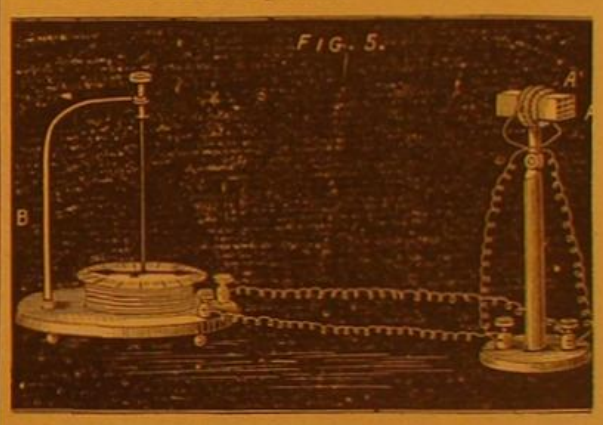
to a galvanometer in front of the lecture table (Fig. 4. This instrument, when there is a difference of temperature between its two faces, generates an electric current. Such a current



has the power of deflecting a magnetic needle, if it is parallel to it.

THE THERMO-ELECTRIC PILE.

The galvanometer consists of such a needle, suspended over a collection of parallel wires, through which the current from the thermo-electric pile must pass, before it returns to it to complete the circuit. The needle being at rest, by merely breathing on one face of the pile, a considerable deflection of the north end of the needle to the left was immediately caused, which was plainly visible throughout the lecture room. The focus of the mirror, C, was then made just to touch the tip of a long vertical index on the lecture table, which it illuminated, and made as brilliant as if it were itself a tiny sun, and the needle was next brought to rest parallel with the wires of the circuit. The cell containing the solution of iodine being then placed at A, a momentary exposure of the face of the pile at the non-visible focus of the mirror was sufficient to cause a strong repulsion of the needle from its normal position.



GREAT POWER OF THE INVISIBLE RAYS.

It was therefore proved that the heat rays have passed through the opaque iodine cell, and have been concentrated in the same manner by mirror as were previously the intensely luminous rays of light.

A more powerful electric lamp and a larger and more perfect mirror were then substituted for those just used; and, a cell of distilled water being placed in front of the lamp at A (the focus in the dust of the room remaining apparently unaltered by its introduction), a piece of gun cotton was placed at focus C, which remained unaffected, but the instant the water cell was removed it exploded.

If the matter rested here, it might be justly argued that as the full beam explodes the cotton, and the luminous part does not inflame it, that therefore it must be the dark invisible rays which are the heat producers of the spectrum; but scientific reasoning is never complete unless a fact is established positively, as well as by inference. The two cells, the iodine solution, and the water, were therefore together placed in front of the lamp at A; and the water cell being removed, although there was no visible change as far as the intervening space was concerned, gun cotton held at C immediately exploded. A number of very striking experiments were then made. At the still invisible focus, platinum foil was heated to redness; zinc and magnesium were inflamed, paper ignited, and the juveniles much amused by the narration of an anecdote, in which the lecturer suited the action to the word of, how he smoked a cigar, which he lit with these dark heat rays, in the Senate House at Cambridge before the dons.

EFFECT OF THE INVISIBLE RAYS UPON THE EARTH.

Having seen what these rays of heat can do, the question follows: What do they do as regards the production of our atmosphere? A small tube containing water, placed in the focus of the mirror, very quickly began to boil, the full beam being employed. This was made visible to the audience in a very ingenious manner; light reflected from the upper surface of the water was received on a sheet of white paper, placed on the lecture table; as long as the water remained quiescent, the paper appeared to be slightly lit up—nothing more; but as soon as ebullition took place, the white surface at once testified to the rough handling its mirror was receiving from the steam bubbles, by the irregular dancing of the patches of light which now illuminated it. When a water cell was interposed at A, the bubbling immediately ceased. The whole beam boils water—the luminous rays do not—the dark rays do.

Thus we may safely conclude that when the solar rays fall upon the earth, the luminous part of the rays are not sensi-

bly efficient in producing evaporation, but that it is the dark invisible rays which do this, and which also melt the ice and snows of the Alps. One of the glass vessels used at the beginning of the lecture to condense the moisture from the air of the theatre, and which was now covered with hoar frost, was here inserted in the luminous beam; the water cell having been previously inserted at A, the hoar frost was seen to be most beautifully and brilliantly lit up, rivalling the lime light in dazzling splendor; but the delicate film of congealed water nevertheless remained, hard as adamant, unaffected by the beautiful flood of light pouring upon it not the slightest sign of melting being perceptible. But when the water cell was removed, a ring instantly appeared in the white crust surrounding the flask, from the now copious melting in the place where the focus fell, but in that place only (the surrounding air remaining as cold as it had all along been); while by turning the flask round, the focus acted upon the frost as a diamond would upon a plate of glass, cutting its way through wherever it impinged.

On Exhaustion as a Power for Underground Purposes.

I have long been convinced that working engines by exhaustion, for underground purposes, is more profitable than by compression. My reasons for thinking so I will lay before you.

More than twenty years ago, at the Low Side Colliery, in Oldham, there were four engines working in the pit, being actuated, that is, motion given them, by one exhausted cylinder at the surface. Of course, the exhausting cylinder is nothing more than the compressing cylinder reversed, which, in the case referred to, was about two feet six inches in diameter, and a stroke of, say, five feet; it was fixed vertically, and worked by a beam from the connecting rod end of a beam engine, about twenty horse power, which engine also drove the circular saws, a lathe, etc., for the requirements of the colliery. The exhausting cylinder gave motion to four vacuum engines at the pit bottom, two of which were placed a considerable distance in the workings, being coupled oscillating engines, 12½ inches diameter in cylinders; the bthers were single engines, and fixed at suitable parts of the mine for doing the haulage work of the mine generally.

My father had an engine works at the time, and made two of the vacuum engines. I, myself, erected one, and attended to the repairs of the colliery. I had opportunities of seeing the workings for a few years, and I can assure the members of this Institute that the engines worked extremely well. Scarcely any heat was set up, save at the two delivering valves at the exhausting cylinder, which continually worked a little warm; neither were we ever plagued with ice. I may add that the two coupled oscillating engines worked a very long jigbrow at first motion, which would be an inclination of about one in four. The jigbrow was worked intermittingly, while the other two engines worked continuously.

I have noticed, when there has been a heavy load drawing up the jigbrow, and all engines working at once, they did not go quite so fast, but still worked at a reasonable speed. These vacuum engines resemble steam engines, save that the slide valve is exposed to the atmosphere; consequently, the drawing pipes are attached to what would be the exhaust pipe of a steam or compressed air engine; and the size of the cylinder of the vacuum engine can be arranged for the work you wish it to perform, that is, the motion parts of a vacuum engine do not require to be as strong, proportionately to the size of the cylinder, as they require to be for a steam engine. Let us consider what is the effect on the air, by contrasting the two systems, exhaustion *versus* compression. Mr. Wat burton, in his paper, very ably describes the amount of heat set up by compression, and lost at the compressing cylinder, and it requires to be kept in remembrance that this loss takes place before your compressed air has rendered you any service whatsoever, or is in a position to do so, and when used sometimes requires heat at the exhaust to prevent the formation of ice.

On the other hand, the effect with exhaustion is a great contrast; for the vacuum engines below are using the air at once, as fast as exhausted, and the engines are working cold, while the air delivered by the exhausting cylinder is warm, certainly, but nothing like the heat expended in the act of compressing the air; while the little heat contained in the air delivered at the exhausting valves may be accounted for by its quick passage through, and friction in, the pipes connecting the vacuum engine below with the exhaust engines above; therefore a reverse action takes place, though, in exhaustion, heat is so small as to be easily accounted for. I gather, in my experience of exhaustion that a transmittable power is produced for long distances, the most economical for mining purposes, being in ratio instantaneous; and I consider besides that, for mining purposes, as is the depth of the mine so is the increased proportional or differential density of the air, which is all in its favor; and the denser the atoms are, in consequence of its weight and attraction, the easier it is to keep up a good workable vacuum. I certainly look upon exhausting engines as being a sound power, and one that requires the least attention of any that I know of. I am not aware that anything of this description has been practically carried out in this district or any other, except at the place and time named. If any of the members have used the principle, perhaps in discussion they will throw more light on the subject. I do not by any means assert that it is not understood, or claim it as my own invention; and it may seem to some to be a resuscitation of a useless principle; but from what I gathered from it in early youth, and the little that has yet been done with compression as a substitute, I consider it the most useful. Allow me to add that if I was using my own means for underground purposes, I should adopt the system by first having my fixed engines, which should be two coupled, for exhausting purposes at the surface, then my fixed vacuum engines at the bottom, and a number of light removable vacuum engines, that could be fastened and used directly in any part of the mine.—*Read before the Midland Institute of Mining Engineers, by Mr. H. Ogden.*

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Public Laboratories.

To the Editor of the Scientific American:

Man's knowledge of nature is increased in two ways: by the diffusion, and by the advancement, of science.

For the former, provision has already been made to a considerable extent in all civilized countries; though even in this respect there is need of an increase in the requisite teaching facilities. But, as regards the direct cultivation and advancement of science, and the actual addition to that glorious structure of facts and principles on which the progress of society and the relative strength and prosperity of nations depend, little or nothing has yet been done, even by the most enlightened communities. All discoveries made are due to the labors and sacrifices of individuals.

It is therefore with great pleasure I notice that, in some parts of the United States, laboratories stocked with philosophical apparatus are being thrown open, for experimental purposes, to the general public. This movement is calculated to render immense benefit to mankind, and I may therefore perhaps be allowed to mention, very briefly, one or two considerations in its favor.

In the history of inventions and discoveries, how often do we read of men carrying with them, under a long series of oppressive and wasting misfortunes, some burden of genius in the shape of a great original idea, which, if fairly and promptly tested, would have brought to its possessor relief and honor, and to the general community a new source of wealth, power, and enjoyment! But for want of the means and conveniences, required to try a few simple experiments, the gift of originality has too often proved rather a curse than a blessing to its possessor. And not only have many of the greatest inventors thus suffered, but scientific truths of immense importance have doubtless often been kept back and lost for want of facilities for experiment. For instance, Priestley tells us, in as many words, that, without assistance, he could not have carried on the experiments which led to the discovery of oxygen and the composition of the atmosphere and of water. And it was only by a private subscription to defray the necessary outlay for apparatus that Humphrey Davy was enabled to pursue the experiments leading to the discovery of the alkaline metals.

It is sad to think how many germs of thought, capable, if properly nurtured, of conferring lasting benefits on mankind, have, from this one cause, been allowed to die away in silent barrenness.

It is evident, then, that a great impulse may be given to scientific progress, both in the abstract and as connected with the improvement of the useful arts, by the provision of laboratories, chemical and physical, wherein, under certain specified regulations, experiments based upon new combinations may be tried at a small cost. Upon the judgment with which those regulations are framed, much of the utility and success of this noble effort will depend. Nor have I had an opportunity of ascertaining the exact arrangements under which this boon to students and inventors is to be conferred. But happily the existence of a journal like the SCIENTIFIC AMERICAN is a guarantee that the requisite information will be imparted to its numerous readers, and that so important a means of stimulating scientific research, whether provided at the public cost or by private munificence, will receive all the aid and encouragement that an enlightened and patriotic press can supply.

GEORGE ROBINSON, M.D.

New York city.

The Davenport Tricks.

To the Editor of the Scientific American:

The exposé by Dr. Vander Weyde appears to me to be incomplete. He fails to explain how some of the most remarkable performances are done. For example:

How do the Davenport Brothers exhibit a naked arm and hand, projecting from the hole in the center door of their cabinet; this hand grasping a large bell and ring it violently, the operators having been previously tied down to their seats at the ends of the cabinet, both their hands and feet being fastened together by pieces of ropes, the tieing having been executed by persons selected by the spectators, the fastenings being apparently unbroken when examined by the Committee immediately after the bell stopped ringing?

Again, how do they exhibit *five* arms and hands projecting at the same time from the small window in the cabinet, waving about in different directions, the brothers being secured in the same manner as in the previous trick?

If the Doctor is unable to show these up in a satisfactory way, I will then furnish a full and complete explanation. Teeth are not used in their execution.

Harrisburg, Pa. WM. P. PATTON.

Rotary Engines.

To the Editor of the Scientific American:

In answer to one of your correspondents concerning rotary engines, we would say that we have had one of 10 horse power running at our works for three years, and we desire to have it inspected by all experts.

We also have one, 34 inches diameter, 20 inches face, now working on board the propeller General Francis Sigel around New York harbor, belonging to Messrs. Shortland Brothers, corner of Front and Wall sts. New York. This engine makes from 60 to 80 revolutions with from 40 to 50 pounds high pressure steam, driving a seven feet propeller wheel of nine feet pitch. We consider this engine equal to any eighteen inch reciprocating engine in New York harbor, as regards power or fuel consumed, and we can put them up and take care of them for 25 per cent less than others.

Brooklyn, N. Y. LIGHTHALL, BEEKMAN & CO.

ABRIDGEMENT OF THE ANNUAL REPORT OF THE COMMISSIONER OF PATENTS FOR THE YEAR 1871.

The law requires the Commissioner of Patents to lay before Congress, in the month of January, annually, a report, with such information of the condition of the Patent Office as may be useful to Congress or the public.

Moneys received, $678,716·46; moneys expended, $562,091·64.

STATEMENT OF THE BUSINESS OF THE OFFICE FOR THE YEAR 1871.

Number of applications for patents during the year 1871		19,472
Number of patents issued, including reissues and designs		13,003
Number of applications for extensions of patents		304
Number of patents extended		158
Number of caveats filed during the year		3,366
Number of patents expired during the year		2,654
Number of patents allowed but not issued for want of final fee		1,007
Number of applications for registering of trademarks		505
Number of trademarks registered		486
Of the patents granted, there were to—		
Citizens of the United States	12,511	
Subjects of Great Britain	432	
Subjects of France	30	
Subjects of other foreign governments	60	
		13,033

The patents issued to citizens of the United States were distributed among the citizens of the several States, Territories, etc., as follows:

Alabama	29	Montana Territory	2
Arkansas	12	Nebraska	12
California	243	Nevada	21
Colorado Territory	15	New Hampshire	192
Connecticut	667	New Jersey	496
Delaware	46	New Mexico Territory	1
District of Columbia	156	New York	2,254
Florida	10	North Carolina	31
Georgia	73	Ohio	905
Idaho Territory	2	Oregon	39
Illinois	871	Pennsylvania	1,542
Indiana	393	Rhode Island	184
Iowa	225	South Carolina	26
Kansas	40	Tennessee	104
Kentucky	125	Texas	52
Louisiana	26	Utah Territory	—
Maine	197	Vermont	111
Maryland	240	Virginia	108
Massachusetts	1,286	Washington Territory	1
Michigan	393	West Virginia	42
Minnesota	53	Wisconsin	227
Mississippi	18	Wyoming Territory	3
Missouri	248	Persons in the Army and Navy	6

COMPARATIVE STATEMENT OF THE BUSINESS OF THE OFFICE, FROM 1837 TO 1870, INCLUSIVE.

YEARS.	Applications filed.	Caveats filed.	Patents issued.	Cash received.	Cash expended.
1837	—	—	435	$29,380·08	$32,500·98
1838	—	—	520	41,123·54	37,402·19
1839	—	—	425	37,460·00	34,549·51
1840	765	228	473	30,056·51	36,419·07
1841	847	212	405	40,413·01	37,000·97
1842	761	209	517	36,503·98	31,241·68
1843	819	315	551	35,515·81	30,776·96
1844	1,045	380	501	42,309·26	30,244 77
1845	1,246	452	502	51,975·14	30,330·05
1846	1,272	448	619	50,264·16	46,154·71
1847	1,581	503	572	60,111·19	41,878·25
1848	1,628	607	660	67,326·69	56,205·84
1849	1,955	596	1,020	80,752·78	77,136·44
1850	2,193	622	795	86,287·63	80,199·26
1851	2,258	760	869	95,738·61	86,548·35
1852	2,609	906	1,020	112,656·34	95,918·9
1853	2,673	801	1,138	121,547·43	122,805·81
1854	3,324	868	1,902	163,749·84	167,146·92
1855	4,435	1091	2,024	216,459·26	179,540·23
1856	4,960	1,024	2,302	192,568·02	19 ,931·32
1857	4,771	1,010	2,910	190,132 61	211,582·09
1858	5,364	934	3,710	201,716·16	193,198·74
1859	6,325	1,067	4,258	245,942·15	210,228·41
1860	7,053	1,084	4,819	256,384·59	252,830·80
1861	4,643	700	3,340	187,334·44	271,491·91
1862	5,028	844	3,571	215,752·99	192,819·39
1863	6,014	781	4,130	195,5 3·29	180 414·14
1864	6,932	1,001	5,020	240,915·8	229,968·03
1865	10,664	1,067	6,016	348,791·84	274,199·34
1866	15,409	2,723	9,430	495 993·28	361,724·28
1867	21 276	3,597	13,015	646,58 ·92	439,383·22
1868	23,429	3,705	13,374	681,565·96	6 8 879·77
1869	1 ,271	3,624	12,946	6 3 143·81	486,239·78
1870	19,171	3,278	13,3 1	660,456·76	557,142·19
1871	19,472	3,366	13,033	678,716.46	660,565.08

The reproduction of the past drawings is absolutely necessary to the proper management of the business of the Office, and is also a matter of great interest and profit to inventors and manufacturers. When once done, the expense of the work will cease, while the Office and the country will forever reap the benefits resulting from it. I would respectfully recommend that liberal appropriations be made for this work, that it may be completed as soon as possible.

PUBLICATION OF PATENTS.

The demand of inventors, mechanics, manufacturers and others, for accurate information of what is being done in the Patent Office, is great and increasing. The old annual reports were unsatisfactory for two reasons: first, because they were always about two years behind date; and second, because in furnishing, necessarily, only illadvised abstracts of the specifications and drawings, they seldom gave full information of what was covered by any patent, and consequently were very often misleading and deceptive.

Those reports, however, with all their defects, were read and studied with great avidity by inventors and mechanics throughout the country; and the perusal of them has undoubtedly resulted in giving to the world very many valuable inventions and improvements. It is only after the first thought has been embodied and presented to the world, and improvements to adapt it to the various uses for which it is calculated have been invented, that it becomes of most profit to the original inventor or most useful to the public. The value and importance of giving promptly a wide circulation to correct information of the character of all inventions and improvements patented can hardly be over estimated.

In abolishing the old form of Annual Report, which was very unsatisfactory and expensive, it is questionable whether the law has provided an adequate substitute.

The joint resolution of January 11, 1871, provides that one copy each of the specifications and drawings of the patents issued be placed for free public inspection in the capital of every State and Territory, and one copy, for like purpose, in the clerk's office of the district court of each judicial district, where said clerk's office is not at the capital

of any State or Territory. This will give only one copy each to most of the States and Territories, two copies each to a few of the States, and three copies each to a still less number. These State and district-court libraries are open only during the business hours of the day; and, while they will be very convenient and useful for the courts and for a limited number of attorneys, yet they will prove valueless as far as the great body of mechanics and inventors of the country are concerned. They are, practically, "sealed books" to nearly all of the class most interested in them, and whose perusal of them would most benefit the public. The only remaining provision for giving inventors, mechanics, and others any information of patented inventions is found in the clause that directs the Commissioner to have printed additional copies of specifications and drawings for sale to persons desiring to purchase. This would make a full set of the patents, unbound, for one year, cost about thirteen hundred dollars—a sum which would be paid by very few.

The sale would be largely increased by a reduction of the price to five cents per copy, which would pay the cost. I would recommend such reduction to persons subscribing for an entire class. For single copies the price should remain as it is. I would further recommend that, where parties desire to purchase copies of the specifications and drawings of all the patents issued, the Commissioner be authorized to sell them at net cost.

MODELS.

Under the provisions of section 14 of the Patent act, I have sought to dispose of the models of rejected cases by permitting regularly incorporated institutions of learning to select from among them such as they could make useful in teaching the practical sciences. The models thus selected have been carefully invoiced and receipted for by the institutions taking them, to be held subject to the order of the Commissioner of Patents. In this manner about twelve thousand models of rejected cases have been disposed of, and a large number of colleges and polytechnic schools have been supplied with a valuable means of instruction. Any one of these models can be recalled, should it any time be needed by the Office or by the courts in the trial of patent causes.

The act approved July 8, 1870, known as the Patent act, has been carefully tested by fair trial, and in most particulars has been found sufficient and satisfactory. In some features, however, I would respectfully suggest that it should be amended.

Section 23 should be so amended as to require the final fees to be paid in at the Patent Office—or, if the money be paid elsewhere, as provided in section 69, to require the proper evidence of such payment to be presented to the Office—at least two weeks prior to the latest date allowed for the patent to issue.

PATENTS TO CANADIANS.

Section 24, considered in connection with section 30, gives to citizens of all governments the same rights and privileges before the Patent Office as are granted to citizens of the United States. The spirit of this section is praiseworthy, and, to the citizens of countries whose governments reciprocate with similar favors, it is unquestionably just. In other cases, however, the wisdom of this provision is by no means clear. Citizens of the dominion of Canada, under our general law, can obtain patents here on precisely the same terms as citizens of the United States, while the latter must have resided in Canada one year before they can apply for patents at the Canadian office.

The effect of this law, practically, is to exclude all citizens of the United States from obtaining patents in Canada, and often the result is disastrous to our inventors.

It has been suggested in various quarters that, with view to furnishing the Canadian government a motive for modifying their practically prohibitory law, our own law should be so amended as to limit the rights, granted by the section above referred to, to the citizens of such foreign countries as accord to the citizens of the United States the same protection as is granted to their own citizens. I think, however, that the wiser course may be to open correspondence with the Canadian authorities through the proper diplomatic channels, with view to representing the nature of the injustice to which our inventors are now subjected; and it is hoped that, when the matter is thus brought home to the attention of the Canadian people, the proper remedy will at once be applied. I withhold any special recommendation in the premises to await the result of such correspondence.

FOREIGN PATENTS.

Section 25 provides that, where a patent is first obtained in a foreign country and afterward here, the patent obtained here shall expire at the same time as the foreign patent. This law is just and equitable in cases where the applicant is himself a citizen of a foreign country. In such cases his monopoly here should cease when it ceases at home. But in cases where the patentees are citizens of the United States, I see no reason for the rule.

ASSIGNMENTS.

Section 36, providing for the recording of assignments of patents or territorial interests therein, I think should be so amended as to provide in some manner for the recording of licenses to manufacture or use under the patent.

INTERFERENCES.

Section 48 provides that parties, except parties to interferences, if dissatisfied with the decision of the Commissioner, may appeal to the Supreme Court of the District of Columbia, sitting in banc. I see no good reason for making an exception of interference cases. I would recommend that section 48 be repealed, and that in its stead a section be introduced authorizing appeals, to the Supreme Court of the District of Columbia sitting in banc, from the decisions of the Commissioner on questions of law, and that such appeals be in the nature of *writs of error*. If such amendment should be made, sections 49, 50, 51, and 52 should also be amended to correspond.

REISSUES.

Section 53 provides that, in applications for reissues, the model and the drawing may be amended each by the other, but that neither shall be amended by the specification. This section works great hardship to inventors in many cases. I think it should be so amended as to authorize the Commissioner in person to permit, in applications for reissue, either the specifications, drawings, or models to be amended so as to show what is already clearly shown in either one of them. To guard against fraud, I would suggest that section 53 be so amended as to require that a notice of all such applications for reissues as seek to enlarge the original claims be published in the *Official Gazette* for at least four weeks previous to the day set for examining the same, and that opposition be allowed, as in extension cases.

It often happens that, by a misapprehension of the law or the facts, parties in good faith make joint application for a patent when only one was the real inventor, or the two were inventors of different parts so distinct as to be divisible; but the Office, not learning these facts in an *ex parte* examination, grants a patent to such parties jointly. Under the rulings of the courts, such patents are worthless, giving no protection, and the inventor is without remedy. I would suggest that section 53 be further amended so as to make a misjoinder of parties in an application, where no fraud was intended, a good ground for reissue.

EXTENSIONS.

Section 64 requires that a notice of all applications for extension shall be published for at least sixty days in one paper in the city of Washington, and in other papers in the section of the country most interested adversely to the extension. I would recommend that section 64 be so amended as to require, in lieu of the publication now demanded, that all notices of applications for extensions be published in the *Official Gazette* of the Patent Office for at least six weeks prior to the day set for hearing the same.

I would suggest that section 66 be so amended as to authorize the Commissioner to withhold and cancel certificates of extension in cases where the final fees are not paid within thirty days of date of notice that extension has been granted.

DESIGN PATENTS.

I am clearly of the opinion that the present mode of patenting designs is radically wrong, injurious to real inventors and the public, and not calculated "to promote the useful arts." Under section 71, the Office issues patents for mere changes in form or color, without regard to construction, function, or utility. This class of patents has been, to some extent, subversive of the fundamental object of the patent law. Very many design patents which cannot, under the law, be denied, are a fraud upon the public. Patents have greatly increased in popularity within the last few years, and manufacturers regard it as an advantage to have the right to affix the word "Patented" upon the products of their shops or factories. This fact has led to very great abuse of the privileges granted by the section authorizing patents for designs. The protection of the public and of true inventors alike demands such modifications of the law as to distinguish widely between designs and inventions. Designs are in the field of taste, beauty, ornamentation; while inventions have to do with utility, resulting from new constructions and combinations. Designs look to æsthetic effects; inventions, to economical productions. Each has its proper sphere, but so distinct that they ought not to overlap each other in the Office practice. Each should be protected, but by instruments and marks easily distinguishable by the public. I therefore recommend such modification of the Patent act as will place designs upon substantially the same basis as trade marks. If a design is new, let the applicant have a certificate of registry, with authority to mark his productions "Registered" instead of "Patented." The fact is that a very large proportion of designs are used merely and solely as trade marks. A man adopts a peculiar form or color for his articles of manufacture, that they may be known as his in the market, that he and his place of business may be pointed out by the peculiarity of the color or conformation. Such a modification of the law, I believe, would furnish ample protection to designs, and, in fact, would enable the Office to issue certificates of registration in many cases where, from public policy, it now refuses design patents. I earnestly recommend early legislation on this subject.

TRADE MARKS.

By section 77, the right to apply for registration of trade marks is limited to citizens of the United States and to residents of such foreign countries as, "by treaty or convention," afford similar privileges to citizens of the United States. This restriction excludes residents of Canada and England, and perhaps other countries which, by statute, in the absence of "treaty or convention," afford the right of registry to citizens of the United States. I therefore recommend that this section be amended by striking out the limiting phrase "by treaty or convention."

THE ENGLISH AND AMERICAN PATENT SYSTEMS COMPARED.

The discussion that has been going on in England during the past year, on the comparative merits of the English and American patent systems, has excited considerable interest in this country. The English system finds a few honorable and able advocates here, but a very large majority of inventors and others intelligent upon the subject seem to be ardently attached to our own system. The American system secures a preliminary examination by experts on the question of novelty, and the issue of the patent is made dependent upon the result of such examination. Consequently, the patent when issued carries with it a presumptive right to its claims, and immediately has a value in the market, the amount of value depending principally upon the importance of the invention covered by the claims. The strength of the presumption in favor of the patent will, of course, depend upon the reputation the Patent Office may have for making honest and thorough preliminary examinations.

In England, patents are granted to every applicant without any inquiry into the questions of novelty or usefulness; and the patent is utterly without value until the patentee has, by litigation in the courts, established the fact that the invention to which it relates is new and useful. Unless an inventor is able to pay court costs and liberal fees to attorneys and experts, he is much richer without a patent than with one. A poor inventor, under the English system, is entirely at the mercy of capitalists, and must in general assign a controlling interest in his patent to secure the means to establish even a presumption in its favor.

The objections urged against the American system, so far as there is any validity at all in them, are chargeable, I believe, against the mode in which the system is organized and operated rather than against the system itself. The more thorough and searching the preliminary examination, the more valuable will be the patent when issued; the better the organization of the Office to secure such examinations, the greater will be judicial and public confidence in the validity of patents. To secure the best possible organization for this purpose is a matter of the highest consideration. That the present organization of the examining corps has some radical defects cannot be denied. That these defects can, in a great measure, be remedied, I feel very confident. On this subject I propose soon to address a communication to the Honorable Secretary of the Interior, and, if it meets his approbation, it will probably be forwarded to Congress with such suggestions as he may be pleased to make.

Protection to inventors is encouragement to every branch of industry. Such protection has already placed our country far in advance of all others in development and adaptation of labor-saving machinery. In addition to this class of wealth which inventors have contributed to the country, they have paid, directly, the entire cost of our patent system and three fourths of a million of dollars in excess. They do not now ask that the fees shall be reduced, nor that the excess shall be returned; but they do demand that the organization of the Office shall be such as to do better work, and that the force be made sufficient to do it more promptly. On these matters, I would commend cautious but liberal legislation.

Respectfully submitted. M. D. LEGGETT,
Commissioner of Patents.

Hints to Brewers.

Never purchase malt which has the slightest moldy appearance, as the spores of the fungus (mold) will, in time, affect any other malt with which they come in contact.

Never mix moldy malt in your brewings, as it is apt to spoil the beer.

Every brewer ought to be able to examine samples of malt, roasted and unroasted, in order to detect barley, when present. This is easily done. Take from each sack, at random, from 30 to 40 grains, and raise the skin or husk from the back of each grain with a sharp pen knife; the acrospire will then be readily observed, if the grain has germinated. Another method is to examine the rootlet end of the grain. Those grains which have the ends closed are barley, while those having the ends open are malt. This latter mode, however, is not always to be relied on.

The secret of making a first class beer is good malt and hops, healthy yeast and good water. The yeast should be fresh and free from acidity. (Frequent changes are generally beneficial.) The water should be free from organic matter, and neither too hard nor too soft; hard water, however, being preferred. It is also of consequence that the water should retain most of its hardness, even after boiling, this being of great importance in brewing.

The water used in brewing ought to be tested at least twice a year, the presence of organic matter tending to set up a secondary fermentation, and to prevent the beer from fining. Organic matter gets into wells in different ways—sometimes through the leakage of drains, at other times through the sides of the well giving way, etc.

The yeast should also be frequently examined, as good beer can never be obtained when bad yeast has been used to start fermentation. Samples we recently examined were almost entirely composed of exhausted yeast cells and acetous cells, and were therefore of no use whatever to a brewer. A farmer might as soon expect a good crop of wheat by sowing bran as a brewer a good fermentation by using bad, unhealthy yeast. As yeast can only be examined by one skilled in the use of the microscope, we have made arrangements with a microscopist for the examination of samples forwarded to us. Quantity of yeast required, about two ounces.

Never use rain water in brewing; the strength of the malt and hops is certainly more thoroughly extracted by it, but the beer is more difficult to "fine;" and as rain water can never be got free from organic matter, a secondary fermentation may be expected, which will impair the flavor, and prevent the beer from keeping properly.—*Brewers' Gazette.*

A LOCOMOTIVE consumes, on the average, forty five gallons of water for every mile that it runs.

ICE BOATING ON THE HUDSON.

Among all the ice sports which delight the dwellers in northern climes, there is perhaps none that can equal ice boating in excitement. The employment of the force of the wind to propulsion of vehicles upon ice has, moreover, been applied to useful purposes. Dr. Kane, in his arctic explorations, more than once relieved his toilworn men by calling into his service the fierce wind that chilled them, and making it transport boats, crew, and sledges, while the men were buried under furs, thus obtaining the warmth and rest so essential to their safety. We have ourselves made trips in such a boat, upon the smooth ice which occasionally forms upon the upper Hudson, at a speed rivaling a fast railroad train; and it is on record that, last season, the ice boats near Poughkeepsie actually distanced the Chicago express train, which is one of the fastest trains on the Hudson River Railroad. Our engraving represents this impromptu race.

On the 17th January, of this year, a most remarkable feat was performed, the *Whiz*, of the New Hamburgh Ice Boat Club, making the astonishing speed of nine miles in eight minutes. She left New Hamburgh in the morning, in the face of a sweeping north-easter, with reefed mainsail and jib, and with three men on board bound for Poughkeepsie. It was a tedious sail up, as scores of tacks had to be made and the weather was bitterly cold; but they got there safely, and having some business up town, transacted it, and returned at noon to their boat. The wind was still blowing a gale.

"Now, then, boys," said the helmsman, "let us shake out the reefs and go for time."

All agreed, and every inch of the boat's canvas was soon spread. "Get aboard, quick!" shouted the owner, and in an instant the craft was put before the wind. With a fearful whir-r-r-r! she started down the river, a perfect fog of fine ice flying from her rudder runner. Persons gazing at her held their breath at the exciting scene. She had attained fearful speed, and one had hardly time for thought before she was a mile away, and in less than two minutes she was off Blue Point, two miles away. She flew by Milton like a bird on the wing, and was abreast of Marlborough in almost a minute afterward. The men on board could hardly see. Their eyes were greatly affected, and water flowed from them freely.

She had performed a feat which had not been equalled by an ice boat before in a number of years.

In the afternoon the *Ella* and *Zig Zag* had a magnificent race to Milton and back. Both carried full sail though it blew a gale, and each carried five *men*. Going down, they sailed five miles in five minutes. It was a close contest—the closest on record. They were never more than one hundred feet apart, and when the *Ella* turned the stake boat ahead, the *Zig Zag's* bowsprit lapped her boom. It seemed impossible for one to draw away from the other. When they got above Blue Point, they were so close together that the greatest interest was felt among the observers who stood upon the home line off the Kaal rock. The judges eyed both boats intently as they neared home, but could come to no conclusion. The *Zig Zag* made for the eastern end of the line as the *Ella* made for the western, and as the former's bow glided over the latter's matched it, and there was great cheering. Neither could be declared the victor.

On the 18th, with a very light breeze at starting, an eight mile race was accomplished in twenty-eight minutes and fifty-five seconds.



ICE BOATING ON THE HUDSON RIVER.

Scientific American.

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HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 40,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

MUNN & CO.,
37 Park Row, N. Y.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

We are indebted to the Honorable M. D. Leggett, Commissioner of Patents, for a copy of his Annual Report for 1871, which he has just laid before Congress. It is a straight forward, common sense document, and shows that the Patent Office is in a very flourishing condition, with everything about the establishment working smoothly. We present an abridgement of the report on another page.

Thirteen thousand and thirty-three patents were granted last year, which is a slight falling off from the previous years. The Commissioner makes a few useful suggestions for amendments to the present patent law, although, on the whole, the law is working well and giving general satisfaction.

PRINTING OF PATENTS AND PATENT REPORTS.

The suppression of the former Patent Reports, with their abridgements of drawings and claims, is shown by the Commissioner to have an unfavorable influence upon invention; and he recommends their restoration in an improved form, and their weekly publication in the *Official Gazette*, without any increase in the subscription price, which is $5. Such publication would undoubtedly be a convenience and a benefit to the public. But we are sorry the Commissioner does not go a step farther and recommend the weekly publication of the patents in full, in a condensed style of printing. This might be done at no very great increase of expense over the cost of the proposed abridgements. The public would then be placed in full possession of each patent.

At the present time the patents are printed in full, and in excellent style, and all persons may obtain them, but the cost is excessive. They are spread over so much paper that it requires fifty-two large sized bound volumes to contain the patents of a single year, and their cost, without binding, is one thousand three hundred dollars. One half of the entire space occupied by the patents is blank paper, the drawings being printed only on one side of the sheet, one drawing upon the sheet, while the margins of the printed specifications and the types are unnecessarily large. By photographic reduction, it would be practicable to publish the drawings of twenty patents on the same amount of paper now consumed for one drawing; and the type printing might also be greatly reduced. Probably for $10 or $15 a year, the government could thus supply full copies of all the patents.

CANADIAN PATENTS.

As to the Canadians, the Commissioner's eye teeth are evidently not yet cut. Our neighbors are permitted to come here and take patents at the same rate as our own citizens, but Americans are practically prohibited from obtaining patents in Canada. The object of this prohibition is to encourage Canadians in the piracy of American inventions, an art in which they have, by years of experience, become adepts. The thing works well for Canada. All our best inventions are quickly picked up, taken over the border, and put into use, without any compensation to the inventor. In some cases, our improved machines are run in Canada and the product sent here to market.

To remedy this, Commissioner Leggett recommends that correspondence be opened with the Canadian authorities, in the hope of securing a modification of their law. But the Commissioner might as well talk to the wind. Canadian meanness in respect to patents is too deep for cure. They have been written to and expostulated with, for the past twenty-five years, on this subject. Every year some honest minded member introduces a bill in Parliament to reform the matter; but when it comes to the vote, it is invariably defeated. The most flourishing part of Canadian manufactures is derived, directly or indirectly, from piracy of American improvements; and, as long as it pays well, our neighbors are not going to be such fools as to give it up.

THE ENGLISH AND THE AMERICAN PATENT SYSTEMS.

The Commissioner compares our system of official examination and rejections with that of England, where patents are granted to all applicants, none being rejected if the papers are presented in proper form. The Commissioner assumes that our system is the best, on the ground that when one of our patents is issued "it carries with it, by reason of the official examination, a presumptive right to its claims, and immediately has a value in the market."

But an English patent, he says, is "utterly without value until the patentee has, by litigation in the courts, established the fact that the invention is new." From these premises, he draws the conclusion that an inventor is better off without than with an English patent, and that a poor English inventor must generally assign a controlling interest in his patent to establish even a presumption in its favor.

The Commissioner's premises are incorrect in this matter, and equally so his conclusions. We are surprised that he should give utterance to statements that are so contrary to the facts. The truth is that, both in this country and in England, the first thing that a sensible person does who proposes to purchase a patent, is to make a careful examination as to all previous patents, to see if it is new and the patent valid. In England, this may be more readily done than in this country, because the patents there are all printed and accessible to the public. But in this country, the examination cannot be so conveniently done, because the patents are not all printed. Delay and additional costs are the result.

Our Patent Office examinations are full of errors and are not considered trustworthy by patent lawyers. Many of the adjudications of "experts," to whom the Commissioner alludes, are unjust and productive of great injury to the inventor. We will give a few practical illustrations of the American system, and no one will deny that they are fair, since they were presented by Commissioner Leggett himself, in the Moore case, 1871.

Says the Commissioner:—Some examiners are very quick to detect resemblance, and will reject almost everything. Others are equally quick at finding differences, and will grant patents on mere shades of variation. Hence, a picket fence is rejected on reference to a comb; a urinal, on reference to a blacksmith's furnace; a surgical instrument for injecting spray into the throat or nasal organs, on reference to a fireman's hose; a rubber packing for fruit jars, on reference to a pump; a device for lacing ladies' shoes without the use of holes or eyelets, on reference to an old mode of cording bedsteads; an ore crusher, on reference to a nut cracker."

This is the way that the American system of examination works practically. It is full of error, and always must be, where, as in our Patent Office, so many men of many minds, changeable with every new administration, are required to make independent decisions.

Much the more sensible plan, we think, would be to restrict the examinations simply to an inspection of the form of the papers, issue a patent to every applicant on correct papers, publish the drawings and specifications of all the patents at the lowest rates, and leave to each patentee to examine for himself, in the first instance, as to the validity of his patent, the final decision being with the Courts as at present. The adoption of this simple measure would do away with all the errors of the Patent Office, relieve inventors from injustice, reduce their aggregate expenses in procuring and prosecuting patents, and enable the Patent Office better to fulfil its mission as the encourager of the useful arts.

HOW GENERAL BUSINESS IS INFLUENCED BY PATENTS

The effect of our patent system upon the general business of the country is hardly appreciated even by those in positions most likely to give accurate knowledge of the extent of the manufacture and sale of patented articles, the manufacture of staple products under patented processes, and the stimulus often given to decaying industries by patented improvements. The fact is that not only is this influence felt all through the business of the country, but that a large portion of this business is directly based upon improvements and processes upon which patents have been granted. We shall, a little further on, give ample evidence of this to such as have not the proof at hand.

It would be well for those, who doubt the policy of granting patents, to reflect a little upon the significance of this fact. We use the word "policy" by preference instead of right, for, as we have previously explained, we believe in the policy of patents, and not in the abstract rights of inventors. The privilege of patenting an invention, and thereby getting protection in the open use and manufacture of it for a term of years, is eagerly embraced by intelligent men as a much better alternative than the attempt to secrete an improvement, or to manufacture by secret processes that which may be at any moment discovered to the world, thus rendering all their toil and expenditure vain. The public, too, by granting this privilege gains the assurance that nearly every valuable improvement will, after a few years of exclusive use by the inventor, become common property, and not be lost to the world through the death of the inventor, or from other cause. The government says to the inventor: You shall have every facility given you, to make money out of your invention, for seventeen years, and for the facilities thus afforded, at the expiration of the term, your improved machine or process shall be free to the use of all. So valuable are the advantages thus offered that every year sees thousands of inventions made public, out of which there are many that prove of permanent value. Such a stimulus to industrial processes can, we maintain, be secured in no possible way, other than through a good patent system; and although our patent laws are far from proving faultless, they have been, still are, and will continue to be of inestimable value in the development of the industrial and commercial resources of the country.

As our readers are aware, it is now the season for the publication of the reports of joint stock companies, as organized under the New York State law. The following exhibit is compiled from the advertising columns of three evening papers, published Saturday, January 20th, of the present year From it may be gathered how far our opinions regarding the influence of patents upon general business are justified.

The Hughes Atmospheric Quartz Crusher Co. Capital stock, $500,000.

The Wiard Safety Boiler Appliance Co. Capital stock, $20,000.

Union Gold Mining Co. of Colorado. Capital stock (all paid in), $1,200,000.

Metropolitan Manufacturing Co. Capital stock (issued for patents and property), $200,000.

Hudson River Copper Co. Capital stock, $1,500,000.

The Prall Hydro-Caloric Pump and Engine Co. Capital, $500,000.

La Manche Mining Co. of Newfoundland. Capital stock, $1,000,000.

The Mendota Mining Co. of Lake Superior. Capital stock, $750,000.

The Feather Insole and Foot Cloak Co. Capital, $100,000.

New York Broom Co. Capital stock (issued for patents, machinery, etc.), $100,000.

The Stackpole Broom Sewing Machine Co. Capital stock. $300,000.

The Iron Mountains Co. of Lake Champlain. Capital stock, $2,000,000.

American and French Burr Stone Co., 32 West Street, New York. Capital stock, $250,000.

New York Head Light Manufacturing Co. Capital stock, $5,000.

Buchanan Farm Oil Co. Capital, $400,000.

Kanawha and Ohio Coal Co. Capital, $2,500,000.

The Mabett Railway Chair Manufacturing Co. Capita stock (issued for patent right and property), $500,000.

The Huron Silver Mining Co. Capital stock, $500,000.

The Home Flax Co. Capital stock, $525,000.

Richmond Iron Mining Co. Capital stock, $1,000,000.

The Excelsior Petroleum Co. Capital, $500,000.

The Horicon Iron Co. Capital, $500,000.

The National Oil Co. Capital, $200,000.

New York Produce Exchange Co. Capital, $175,000.

Ophir Gold Mining Co. Capital, $625,000.

New York Safety Steam Power Co. Capital, $60,000.

The New York and Delaware Slate Co. Capital, $500,000.

The Lexington Copper Mining Co. Capital stock, $1,000,000.

The Hope Manufacturing Co. Capital, $25,000.

The Doctor Fitler's Medicine Manufacturing Co. Capital $200,000.

The National Meter Co. Capital, $200,000.

The Eagle Gold Co. Capital stock, $1,000,000.

The Wiard Locomotive Attachment Co. Capital stock, $500,000.

The Telegraphic Supply Co. Capital, $1,000,000.

The Urbana Wine Co. Capital stock, $250,000.

The New York and Hughes River Oil Co. Capital stock $1,000,000.

The Lincoln Iron Co. Capital stock, 50,000.

Central Park Hotel Co. Capital stock, $100,000.

Consumer's Air and Gas Carburetting Co. Capital, $200,000

The Knickerbocker Hotel Co. Capital, $100,000.

The American Spiral Spring Butt Hinge Manufacturing Co. of Mamaroneck. Capital, $100,000.

National Coal Gas Co. Capital, $1,000,000.

National Asphalte Composite Co. Capital, 1,000,000.

The United States Metalline Co. Capital, $1,000,000.

The Colwells, Shaw & Willard Manufacturing Co. Capital stock, $300,000.

National Ice Co. Capital stock, $250,000.

Kraffert Ice Machine Co. Capital, $500,000.

This enumeration has been made in just the order in which the reports of the several companies appeared. Those familiar with the objects and business of these companies will see at once that by far the *larger* portion of them have more or less to do with patents and patented processes, while many are organized for the avowed purpose of manufacturing some patented machine or article. The inference cannot be avoided that our patent system has become a powerful modifying and directly beneficial influence upon the business of the country. We might extend this article by remarks upon the indirect way in which manufactures, arts and commerce are stimulated by the patent system, but will defer this until a future occasion.

FACTS AND FIGURES--IMPORTANCE OF THE LATTER TO SUBSTANTIATE THE FORMER.

In a recent article advocating the introduction of drawing as a branch of instruction in public schools, we asserted that the statement of facts in figures is the most important element in business, study, and science. Of course, we used the word figures in a figurative sense, meaning thereby the expression of the general relation of quantity in mathematical notation, of whatever kind it may be.

To make the proposition more plain, we propose to enlarge somewhat upon it in the present article. That there is need of the lesson which such a discussion will convey, is evident from the fact that a very large share of the blunders, committed in business, study, and science, arise from the neglect of habitually reducing facts to figures.

In nothing are these blunders more apparent than in the invention and construction of machinery. It is this neglect, either through incapacity or indisposition to make the proper calculations, that allows men's minds to get befuddled with ideas of perpetual motion, the indefinite multiplication of force and power, and other mechanical absurdities. The same neglect admits elements of weakness into structural designs of all kinds, which disappoint their projectors, and involve endless repairs and serious expense.

There are those who scoff at algebra. The senior editor of the New York *Tribune* once fulminated a protest against it as useless, yet its language, as all know who are acqnainted with it, gives a much freer scope for the accurate and easy expression of mechanical principles than is possible to ordinary written or spoken language. In it and the higher mathematics are found the means of expressing not only abstract quantity, but of coupling, with such expression, qualifying and directing ideas. Thus, to use one of the simplest illustrations, we may express not only a given number of miles, but give the direction, from a certain fixed point at which the measurement begins, by the use of a single sign. We may, in expressing degrees of a thermometer also, by the use of a single sign indicate whether the temperature is above or below zero. In accounts, we may show whether the balance is debit or credit in the same manner. This illustration shows how the expression of facts in figures may be shortened by algebraic notation, and this is one of the first things the learner discovers in his algebraic studies. But this is only the merest beginning. By the use of mathematical notation, many ideas and conceptions of the relations of quantities are expressed, that cannot be uttered or written in any other language. Any one who has advanced far in mathematical knowledge has discovered this truth, and has, moreover, found that the notation employed has in many cases been invented solely for the purpose of conveying ideas that common language is incapable of expressing.

To the expert mathematician a simple formula, like $x^3 + y^3 = axy$ may express a beautiful curve called the foliate curve, which he may construct geometrically to correspond with the equation.

We have said enough to serve the purpose of a denial to the assertion of the inutility of mathematics. No one makes this charge except such as are ignorant of what they speak. Without the higher mathematics, the theories that have given the present status to mechanical, astronomical, and even chemical science could never have existed. It is very doubtful whether there would have been railroads or telegraphs, and it is quite certain that the modern locomotive and ocean steamer would have had no existence.

History would be nothing without dates. Chemistry would be nothing without weights. Engineering science must deal with measurements, strength, weights, motion, momentum, inertia, etc., correct ideas of which are only attainable by the aid of higher mathematics. Even the processes in use in common arithmetic are many of them derived from, and capable of demonstration only through the use of, algebraic and geometric notation; of these may be mentioned the extraction of roots, certain operations in alligation, mensuration, etc.

In conclusion, it may be said that only as the various sciences attain to the expression of facts in their definite relation to quantity are they sciences at all. Chemistry was no science till the law of combination in definite proportions was discovered. Till astronomy was aided by geometry, it had no existence, save in a few crude observations of shepherds and navigators that had become traditional. As soon as mathematics became the handmaid of observation, the most important knowledge was given to mankind, by the aid of which ships now traverse by night and day vast wastes of water, on which there is to be found no guide whatever save that which mathematics has charted down from the light of the stars, and the magnetic needle, whose vagaries and variations are only compensated for by mathematical calculations.

The business exigencies of the world have for a long time enforced the importance of arithmetical knowledge. Scientific and mechanical exigencies now urge the importance of more extended mathematical knowledge. Steam, as a motor, is now so generally used that the chances are nine in ten that every boy in our public schools will have, at some period, more or *less* to do with it. The boy may grow up into a mere stoker, or may become a finished and accomplished engineer, but he will never be the latter if he is limited in mathematics to a common knowledge of arithmetic.

But we are extending our remarks further than was intended. What we have written has been to supplement what we said in the article above referred to, lest it should be thought we underrated those branches of study to which arithmetic is only the fitting introduction.

RUSSIAN INTERNATIONAL EXHIBITION.

We alluded, a few weeks ago, to the international exhibition now in preparation in Austria. Russia is now in the field for a similar show, and, like Austria, invites the inventors and manufacturers of the United States to send over their choicest productions and their latest inventions. If our people comply, it will, of course, be a very fine thing for Russia, as it will put her in possession, gratis, of useful information and the best industrial examples; but precisely how our countrymen are to be benefitted by the operation does not appear. In the matter of new improvements, Russia offers but little encouragement to American inventors. The charges incident to the obtaining of a Russian patent are heavier than in almost any other country, while the term of the patent, if the invention is wholly new, is only ten years, with no extension. If the invention has been previously patented in any other country, the Russian patent only runs six years. The ten years patent is void, unless worked within 2½ years from its date; the six year patent is void, unless worked within 1½ years. The owner of the patent cannot form a joint stock company or sell to a company. Military improvements are not patentable at all. It will thus be seen that Americans have little to gain by going to Russia with their good things.

But in England and France, a more liberal policy prevails. In England especially, Americans may obtain full protection for their inventions, may sell to whoever they choose, and are not obliged to work them except at their own convenience.

THE SOLAR ECLIPSE, DECEMBER, 1871.

In our number of December 23, 1871, we were able to report the success of the endeavors of the European astronomers, who travelled to India and Australia, in obtaining definite and important results as to the phenomenon referred to. The central line of the occultation commenced in the Arabian sea, and passed through Ceylon, Java, Sumatra, and part of Australia. The British astronomers were divided into three sections, devoting their attention respectively to photography, polariscopy, and spectroscopy, the latter observations being naturally regarded with the most interest. Professor Young's asseveration that, at the moment of total obscuration, the dark lines in the spectrum change suddenly into bright ones was confirmed, although a defined cause for the phenomenon is still being sought for. Mr. J. Norman Lockyer, not content with the aid of his Government, and the instruments placed at his disposal by the Royal Society and the Royal Astronomical Society, had an instrument especially constructed for the observation of the corona, and went to Ceylon, whence he has not yet returned. The intensity of the sun's flames necessitates the use of a battery of prisms to ensure dispersion of the light, which would otherwise be too brilliant for the eye. But as the light from the corona is feebler, and the congregated prisms would further weaken it by dispersion, a special instrument for the purpose is necessary. It was, in fact, a telescope with a focal length of only six feet, and a reflector of 9½ inches diameter, so arranged as to concentrate the light, in the slit of the spectroscope, of a very bright and small image of the sun.

Mr. Lockyer also took out, some glass vacuum tubes for the ignition of attenuated hydrogen, iron vapor, and other gases, under various pressures, the ignition of course being produced by electrical discharges from an induction coil. The object of this was to throw the lines produced by the ignited gases into the same field of view as the lines expected to be thrown by the corona, so that the two might be directly compared, and all mistakes as to their absolute coincidence in position or otherwise avoided.

Although telegrams have been received from other observers, no news has yet come to hand from Mr. Lockyer, says the *Engineer*, he having been stationed too far from any telegraph station. By the time these lines are printed, the results he has obtained may or may not be known in England, but all must wish him success in his anxious and responsible two minutes of work. When he went to the Mediterranean last year, the weather prevented him from seeing the eclipse, and it would be hard indeed if the same fate awaited him in Ceylon. His report will be given to our readers as soon as it arrives, and will doubtless add to our information on the subject of the elements of the sun.

HOW TO BUILD AN ICE BOAT.

Of all manly sports, we can conceive of nothing so exhilarating and so full of all that pertains to a noble recreation as ice boating. On sound ice, such boats are even more safe than pleasure yachts. They sail very close to the wind, can beat to windward, and perform all the maneuvres of water craft. We never heard of one capsizing. They make no lee way, and are easy to steer.

It may be interesting to some of our readers to give some practical details of the construction of these boats. Those shown in an engraving published on another page, are the kind used for racing, but a cheaper form, cat-rigged and more convenient for pleasure parties in which ladies are to share, can be made in the following manner:

Frame *together*, in the form of a triangle, two 8x4 oak scantlings 15 feet in length, with one of the same cross section 10 feet in length. At each of the corners, formed by the junction of the shorter with the longer scantlings, put a skate of good iron or steel, fastened in the most substantial manner by strong bolts. At the other angle, place the steering skate, on a strong pivot, to which the tiller is attached. All these parts must be made very strong, as they are those most likely to give way, especially if the ice be somewhat rough. Now, upon the frame thus made, put a strong plank floor, which braces the frame. Upon this platform, erect a box like a sleigh box with seats on the inside entirely around the boat. Step the mast through the middle of the front seat and into a stout socket spiked to the plank bottom, giving it a little rake toward the stern. Then rig it precisely like a cat-rigged water boat. You cannot sail quite so close to the wind with this as with the jib boats shown in our engraving, but with a party of laughing *houris*, *smooth* ice, a good wind, and plenty of fur robes, you can get your money's worth of fun in a shorter time than in any other way we can recommend.

The skates should have ample bearing surface so as not to cut the ice too deep. When sailing with the wind, the latter even if strong is scarcely felt, as the speed of the boat will come so near to that of the wind itself. These boats also sail before the wind better than yachts, the bows of which are depressed so that they draw more water.

In conclusion, there seems a possibility that the knowledge of ice boating acquired by the study of it as a sport may give rise to something very useful in traversing the frozen lakes and hard snow fields of the "Far North;" so that, both as a sport and as a matter of utility, the practice of ice boating is commendable.

THE HEATING OF BUILDINGS BY STEAM.

One of the most important applications of the latent heat of watery vapor or steam is the heating of buildings. The amount of heat thus readily transmitted through buildings, by comparatively very narrow tubing, is really surprising. While, in the system of heating buildings with hot air, every middle sized room requires a separate tube of some eight to ten inches diameter to carry to it a sufficient amount of hot air to keep its temperature comfortable in winter, a whole house, containing eight or ten such rooms, may be heated by the steam passing through a single tube of about one and a half inch diameter, which is connected in each room with a set of coils or disks into which the steam condenses, leaving its latent heat behind, and from which it returns in the condition of water to the boiler to be reconverted into steam.

It has been shown, on page 5 of this volume, that the evaporation of one pound or twenty-seven cubic inches of water produces twenty-seven cubic feet of steam; and that, in this transformation, 962 units of heat are made latent, which may be carried by the steam anywhere as long as it remains in the condition of steam. It has been shown, also, that these 962 units of heat are only set free or given out at the time and place where the steam is condensed or reconverted into water, that is, in every room of a building where there is a set of tubes accessible to this steam. As it does not take very long to discharge twenty-seven cubic feet of steam through a 1¼ inch tube, it is readily seen that these 962 units may be quickly conveyed to any part of a building, and heat 962 lbs. of water one degree, or 96 lbs. 10°, or 24 lbs. 40°. But air has only one fourth of the specific heat of water, that means, it takes no more heat to raise the temperature of 4 lbs. of air than of 1 lb. of water, so that the 962 units of latent heat conveyed and set free by the condensing steam may heat 4 × 24 lbs. — 96 lbs. of air, 40°. As now one cubic foot of air weighs 1¼ ounces, 96 lbs. or 1,536 ounces of air have a capacity of 1,536 ÷ 1¼, or 1,229 cubic feet, corresponding nearly to a room of 11 feet square by 10 feet high. The temperature of the air in such a room then may, by the steam conveyed from the evaporation of one single pound of water, be raised 40°; and if this steam is conveyed in two minutes, it will, in that short period of time, have that addition of temperature. The necessity of a provision to regulate the heat is evident from this consideration; a simple stopcock is sufficient, and by this the steam may be turned off, or rather the coil, intended to heat the room, disconnected from the main steam pipe.

It must not be forgotten, however, that it is not only the air of a room which must be heated, but the walls, the furniture, and every thing in the room must be brought to the same temperature., say 68°, before the room is comfortable, and this takes more heat than the mere heating of the air. The amount of heating surface of the steam coils has been shown by experience to be most appropriate when taking one square foot for every 100 cubic feet of air in the room, but this proportion may vary according to climate, local circumstances, and the steam pressure used.

It is also well to have a small stopcock attached to the steam coil, so as to blow from time to time a little vapor into the room, for obtaining a more wholesome degree of atmospheric moisture, which by continual heating becomes deficient.

It is unnecessary to mention here proper ventilation; it has been objected, and with good reason too, that these steam coils only heat the air which is in the room, however bad it may be, and do not introduce fresh air; therefore, it has been proposed to place such coils under windows, so as to be able to heat fresh air when admitted in the room, or to make openings behind the coils, which may be used to admit fresh air when required; with such provisions the steam heating is undoubtedly preferable to hot air furnaces, where the air is oftentimes drawn only from cellars, kitchens, etc., and heated, or rather scorched, by passing along the often red hot sides of a large stove. It is, therefore, not to be wondered at that many persons of delicate constitutions cannot live in houses with ill constructed hot air furnaces, without being continually subjected to headaches and other inconveniences.

The system of heating by steam tubes is becoming more and more prevalent; among the many buildings thus provided, we may mention the large building in which the SCIENTIFIC AMERICAN has its office, the Cooper Institute, the Astor Library, hundreds of banks and other public buildings, and thousands of private residences.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE EFFECT OF LIGHT ON SMALL POX PUSTULES.

Among the many investigations now being made of the chemical action of light, there are none more interesting or more important than those which are directed to the observation of its effects on the health. It has been observed by Dr. Weber that the sensibility of the skin is very much increased in those parts of the body which are always exposed to the light, and this difference has even been measured by that eminent physician. This remarkable fact is especially observable on persons suffering from small pox, the severity of the skin disease being visibly augmented if the patient be not confined in a dark room. Dr. Waters has recently published a paper on this subject, in which he states that if the room be so darkened that not a single ray can enter it, the effect is to arrest the disease at the papular or vesicular stage; it never becomes purulent, and the skin between the vesicles is never inflamed or swollen; the *liquor sanguinis* is not changed into pus, nearly all the pain and itching are absent, and the smell is, if not entirely removed, greatly diminished. Another advantage, important in a therapeutical point of view, is the assistance given to medicines, the absence of light increasing the excretory powers of the skin.

CARIES OF THE TEETH.

The acids which cause the decay of the teeth are conveyed in the secretions of the gums and the mucous membrane of the lips and cheeks; and the usual points of attack are in the interstices and the grooves in the facial walls of the teeth. The calculary nature of the saliva is antagonistic to the acids, and preserves the teeth from their dilapidating influence. Teeth are protected from this disease by the following conditions: Their regular shape and order, that the situations for the deposit of acid be as few as possible; the conservation of the teeth from noxious influences, by constant brushing; the healthy structure of the tooth itself, and of the mouth generally. Heider observed that the yellowish white teeth are less subject to the attacks of caries than those of a bluish shade, the enamel of the former being much harder; and the molars have been found to contain more mineral substance than the incisors. In this connection, we would recommend a patent tooth soap preparation which we have used for some time past with much satisfaction, manufactured and put up neatly in glass boxes, by J. O. Draper & Co., Pawtucket, R. I.

DYEING BLACK SILK.

A German authority forwards us the following directions for dyeing black silk piece goods: Clean the silk in the usual way with soda, wash off the fluid, and pass the fabrics through a tepid bath containing a little turmeric and vitriol. Wash them once more, and leave them during one night in a bath of a solution of nitrate of iron of the strength of 6° B. On taking out, wash them well, and put them in a bath containing fustic and logwood, increasing the heat by degrees. If the silks be overdyed by the last process (this will be detected by its brown color), put them through a slightly acid bath. If not, put them in a lukewarm bath, containing soda and the double muriate of tin in the proportion of two parts to three; leave them in this bath till the requisite shade is produced.

ARCHITECTURAL COMPETITION IN BERLIN.

The German government intends to erect a new Parliament house in Berlin, and architects of all nations are invited to send in designs for the building before April 15th next, appending their names, to the Imperial Chancery in Berlin. A prize, amounting to about $1,250 of our money, will be awarded for the accepted design, and smaller premiums will be given for each of the next four, in the order of merit.

IMPURITIES IN WOOL.

M. Féron, a French expert of large experience, has recently given to the world a valuable paper on the above subject, from which we extract the following: If it sufficed that the carded wool of commerce should be of good color, and its fibers smooth, clean, and parallel, we might congratulate ourselves on the progress made of late years in wool carding. But it is different when we come to consider the same wools with regard to their industrial value, that is, their aptitude for taking dyes and their suitability for spinning and dressing. The great majority of wools used in France are but imperfectly purified from the earthy and fatty manners which they naturally contain, and from those with which they become contaminated in the process of carding, either accidentally or to facilitate the operation. Now, these impurities are the essential cause of numerous imperfections in each of the subsequent operations, and if not removed, perfection is impossible, either in dressing, spinning, or dyeing.

In conditioning wool, that is, in ascertaining by absolute desiccation the true weight of wool in any bale, samples are taken of clean carded wool, and carefully weighed; they are then submitted to a temperature of from 105° to 108°. By this means, the water they contain is evaporated, and, on re-weighing, the absolute weight is supposed to be obtained. If the wools were pure, this mode of ascertaining the value would be very rapid and exact; but all substances dissolved in a liquid hinder its evaporation and elevate its boiling point, and the influence thus exerted becomes greater with increase of the affinity of the liquid for the substance in solution.

Among the most common impurities of carded wool are to be found: Salts of lime, derived from the water in which the wools are washed, which form, with the oils of the wool and with the soap used, insoluble soaps, which add to the weight and deteriorate the wool, rendering it dusty and greasy; soap, and the substances used to adulterate it; starch, kaolin, resinous matters, silicate of potassa, etc., animal moisture, and glycerin, all increasing the boiling point of water; so that the effect produced on wool by heating to a temperature of 105° is proportionate to its degree of purity, and in no way to the amount which it contains. Under these circumstances, it is useless to deduct the amount of moisture evaporated and estimate the remainder as so much pure wool, since it really contains salts of lime, insoluble soaps, glycerin, etc., which hold water with a tenacity incapable of being ruptured at 105°. With this state of things, conditioning will never be anything but an empty word, and an illusion.

ADULTERATION OF LARD.

A Canadian druggist lately obtained some lard from a respectable pork dealer, the article being noticeable on account of its extreme whiteness. In using a portion of it in the preparation of ointment of nitrate of mercury, the color became gradually deeper till it was of a slaty hue. The lard was tested and was found to contain a large proportion of lime, and it was subsequently stated, by a man in the trade, that the mixing of two per cent or more milk of lime with melted lard is a common practice. The combination of the alkali with some portion of the fat saponifies, and allows 25 per cent of water to be stirred in without being detected.

SILKWORMS' EGGS.

The trade in silkworms' eggs has assumed large proportions. In 1869, two millions of cards, costing on an average three dollars each, were sent to Europe from Japan. Special steamers are chartered to bring home this valuable cargo as speedily as possible; and during the voyage, in suitable weather, the boxes are opened and the contents ventilated. In each box, which is three feet long, and on which a freight of fifteen dollars is paid, are packed 200 cards in separate grooves, so as to allow of ventilation between each card, and to avoid friction. Each card contains about five sixths of an ounce of eggs, and costs from three to four dollars in Japan. It is a matter of the greatest importance to export eggs as soon as possible after they have been laid, and before they have been exposed to any chill from cold weather, especially if they have to travel long distances.

A SUBSTITUTE FOR BUTTER.

It may interest many of our readers, in Texas and several countries of South America, to know that the demand for clarified beef suet, as a substitute for butter for cooking purposes, is increasing. It is sold in London for half the price of the best butter; and it will keep good much longer, without the admixture of salt.

A western paper gives the following recipe for keeping potatoes, and asserts that it will preserve them for years: Dust over the floor of the bin with lime; put in about six or seven inches deep of potatoes, and dust with lime as before. Put in six or seven inches of potatoes, and lime again, and repeat the operation till all are stowed away. One bushel of lime will do for forty bushels of potatoes, though more will not hurt them, the lime rather improving the flavor than otherwise. The lime may be used for fertilizing after this use of it.

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Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

s 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.

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.

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.

To Make an Application for a Patent.

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

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Notes & Queries.

[We present herewith 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.—VOLUME OF HYDROGEN.—Will some correspondent inform me how many cubic inches a volume of hydrogen weighing one ounce contains?—W. W.

2.—SCREW CUTTING GEAR.—I wish to fit the slide rest of a small foot lathe for screw cutting. Can the motion be transmitted with sufficient accuracy by means of friction gears?—E. C. J.

3.—GRINDING STEEL TOOLS.—Does grinding edge tools on emery wheels injure the temper?—E. C. J

4.—BLOW PIPE LAMP.—Can any of your readers tell me how to make a portable blow pipe lamp for use with a Berzelius blow pipe?—E. C. J.

5.—NON-EXPANDING LIQUID.—Is there any liquid that will not expand or contract at ordinary temperatures? What is it? And what liquid expands more than any others?—R. L. H.

6.—PAPER FOR TELEGRAPHY.—How is the coloring band, that is used in House's telegraphic printing apparatus, made? How can paper be prepared, so that a current of electricity in passing through it will leave a black mark or stain?—R. I. H.

7.—CEMENT FOR ALABASTER.—Can any one give me a recipe for mending alabaster? I have a vase that is broken where the cup joins the pedestal; it is not quite an inch across.—B.

8.—SPECIFIC GRAVITY OF LINSEED OIL.—Can any of the readers of the SCIENTIFIC AMERICAN give me the specific gravity of linseed oil made from American seed, and of oil made from East India seed; and also the specific gravity of cotton seed oil?—C. O.

9.—CLEARING DUST FROM MACHINE SHOPS.—I have a room for cleaning castings, eighteen feet square. The dust from the iron tumblers permeates the machine shop adjoining. Is there any method of forcing the dust out of the room into the open air?—L. B.

10.—WILD TEA.—Will Mr. J. B. Williams, who mentions this herb (on page 5, current volume) as a cure for cancer, give such an explanation as will enable me to obtain it, as I cannot find any one who knows of such a plant?—J. W. McA.

11.—SPEED OF CIRCULAR SAW.—I wish to know how many revolutions per minute a 52 inch circular saw should make to cut from 5,000 to 8,000 feet of lumber in ten hours working time; and also how high a speed it would be safe to run such a saw.—D. S. B.

12.—POUNDING OF PISTON.—Can any of your readers tell me what is the trouble with an engine, that thumps or knocks and has done so for some years? By drawing the keys on main rod, I can stop it for a day or so; then it will be as bad as before. There have been some experts looking at it, but they cannot tell how the trouble arises.—W. M. T.

13.—FREEZING WATER IN STEAM ENGINE.—Can water collect and freeze in the cylinder of an engine in cold weather when the engine is still, so to burst the cylinder, when the cylinder cocks are open and the throttle valve leaking slightly? Mine was burst before or at starting on a cold morning, both followers being burst, and the rings broken square across.—A. G. L.

14.—PLATINUM SPONGE LAMPS.—Can any one tell me how to make the platinum sponge more substantial and durable than it is in its present form?—C. C. W.

15.—POLISHING WOOD.—There have lately appeared in your paper some recipes for varnish and polish for work in the lathe, in which an alcoholic solution of sandarac is to be mixed with beeswax and made into a paste with turpentine. I have tried this but have not succeeded in mixing the solution with the paste, even when added in very small quantities at a time. Perhaps the parties who gave the recipes will kindly state how the difficulty is to be got over.—C. M.

16.—QUESTION IN MECHANICS.—If a pair of fluted feed rollers are so arranged as to feed blocks horizontally into a straight box, one directly upon the other, and if the first block be opposed in its progress by a force of say 50 pounds: after that say 100 blocks had passed through the rollers into the box, the opposing force remaining continually on the first block, would the hundredth block bear more strongly upon the ninety-ninth than the second upon the first, leaving out of the question the power required to overcome the friction of the blocks in passing through the box, were the 50 pounds opposing force removed? The principle is in use in several branches of mechanics. Can some one demonstrate it scientifically?—H. W. U., of Wis.

17.—SLIDE VALVE QUESTIONS.—Some weeks ago I was called upon to put in repair a steam engine and some other machinery for a saw, grist, and planing mill. I found the engine (with a ten inch cylinder and two feet stroke) well made but badly run. The cylinder was at least three-sixteenths of an inch out of line with the slides and crank, and the slide valve and the eccentric were set so as to give nine sixteenths of an inch lead on that end on the engine that threw the saw sash up, and five sixteenths of an inch lead on the other end, and this was done by a man who had run an engine for twelve years and claimed to know his business to perfection. I set the eccentric so as to give as near three thirty-seconds of an inch lead as I could measure, putting the key in its original seat on the shaft, and making the lead alike at each end of the cylinder. The engineer thought hardly of me for undoing all his work. The slide valve had a great deal of lap over the ports—very nearly one and one quarter inches. It commenced to open the exhaust about one eighth of an inch before it opened the steam port on the opposite end, which I think is wrong. Am I right, or not? The owner of the mill complained of being slaughtered in the most wicked way for six months; is it any wonder? Yet he won't take the SCIENTIFIC AMERICAN.—C. G.

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 00 a line, under the head of "Business and Personal."

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

H. H. B., of Ga.—Nelson Goodyear's hard rubber patent will expire May 4th, 1872.

L. D. C., of S. C.—The grooves in rifled guns serve only to direct, not to impel, projectiles. They give no increased initial velocity, but rather decrease it.

L. A. S., of Pa.—We advise setting your engine close to the boiler and transmitting the power through the distance named—300 feet, by a telodynamic cable. However, you may carry the steam the distance named, by fitting the pipe properly, and without very great loss or inconvenience.

W. R. S., of O.—To make a superior red ink for our office we do as follows: Dissolve pure carmine in aqua ammonia, enough to make a thick paste; let stand one day and then add water until the desired shade is produced.

W. A. W., of N. C.—The description of meerschaum as a hydrated silicate of magnesia is correct. The name *meerschaum* (sea foam) was given to the material, as a figurative appellation, on account of its white color and lightness.

WATERPROOFING BOOTS.—C. B. should take: India rubber, 2 drams; mineral naphtha, 2 ounces; asphaltum, ½ ounce; ivory or lamp black, ½ ounce; spirit of turpentine, 1 ounce; and dissolve the rubber in the naphtha, mix the two solutions, add the black, and mix thoroughly.—G. L., of Mich.

B. F. S., of O.—We think an excellent foundation for an overshot water wheel might be made of concrete, under the circumstances you name.

F. E., of Mass.—If your teeth are so irregular as to be unsightly, a good dentist will be able to remedy, at least in great measure that defect. Seek the advice of such a one and follow it to the letter.

HARDENING SCREWS.—If E. N. G. will fuse together, in an iron vessel or crucible, one part of prussiate of potash and ten parts of common salt, and allow his screws to remain in the liquid thirty minutes, and then put them in cold water, they will be case hardened. Don't put a wet tongue in the liquid.—W. B. C., of Cal.

G. E. G., of N. Y.—Your suggestion for an improvement on Calle's hydro-aero-dynamic wheel is worthless. No power would be gained by the application proposed.

C., of Ont.—The hydrostatic pressure, on the interior of a vessel having a pipe inserted into which water is poured, is as the entire internal surface of the vessel, and not as its cross section.

BRONZE PAINT.—In your query column of January 13, R. S. B. wishes a recipe for bronze paint. I submit one, which, I feel sure, will answer his purpose: Ivory black one ounce; chrome yellow, one ounce; chrome green, two pounds; mix with raw linseed oil and a little Japan varnish to dry the paint.—W. J. D., of N. Y.

TELEGRAPH GROUND WIRE.—No. 4, page 42, current volume. A plate is better than a mass of metal, as it exposes more surface. A piece of old tin roofing answers excellently. It should be buried to a depth sufficient to insure its being always surrounded by damp or wet earth. This depth will vary according to the nature of the soil. A piece of sheet metal four or five feet square is ordinarily large enough. A short telegraph line requires a greater superficial area of ground connection than a long one. A gas or water pipe makes the best ground connection.—F. L. P., of N. Y.

INDELIBLE INK.—To C. T. H.: Take nitrate of silver, 11 grains, dissolve it in 30 grains aqua ammonia. Dissolve 20 grains of gum arabic in 85 grains (2½ teaspoons) of rain water. When the gum arabic is dissolved, put in the same vial also 22 grains of carbonate of soda; when all are dissolved, mix the contents of both vials together, and place the vial containing the mixture in a basin of water and boil several minutes, or until a black compound is the result. When cold it is ready for use. Have the goods starched and ironed and perfectly dry, then write with a quill pen.—J. H., of Mass.

THISTLES.—To J. H. M., query No. 5, January 6, 1872: All thistles, except the Canada thistle, are biennial; growing from seed one year, and blossoming the next, they mature their seed and die. Remedy: Never let a thistle mature. If all the seed, from your own ground, as well as from your neighbors' and the surrounding country, grows, treat it thus, and you will be rid of thistles that is of biennials. If you have Canada thistles, cut them in June and August, at the time the stock is hollow; if it rains and fills the stock, the root will rot.—A. K. J., of O.

INDELIBLE INK.—Let C. T. H. take: Nitrate of silver, three drams, and strong liquid ammonia, two drams; and then make a separate solution of half a dram of metallic copper in a sufficient quantity of nitric acid, and add liquid ammonia to the point of saturation. For a third solution, take three grains of pure indigo and reduce to fine powder in one ounce distilled water; then add six grains pure carbon and one ounce pulverized gum acacia. Mix the whole together, and add a sufficient quantity of ammonia to form a clear mixture. And when a gentle heat has been applied, the fluid will be ready for use.—G. L., of Mich.

UTILIZING HUSKS.—To L. S. P.: The most recent method of utilizing them is by preparing them for use in beds, by a removal of the stems and splitting of the husk. They are being introduced in our large cities as a substitute for straw in the filling of loose beds and the manufacture of mattresses, and are greatly liked on account of their toughness, elasticity, and durability. The time is not far distant when straw will be discarded entirely and husks will take its place. A firm in Chicago is purchasing large quantities of husks in the country, and shipping them to the city, where they prepare them by machinery for sale to wholesale houses and manufacturers of bedding. The business is a growing one, and is remunerative to the farmer and all else concerned.—W. T.

BELTS IN WET WEATHER.—S. S. F., January 1, answers a query in regard to leather belting by saying that they are always tightest in wet weather. I run machinery, in a planing mill, and I find that the belts which will slip in wet weather are tight enough in dry weather.—A. G. L., of O.

INDELIBLE INK.—Let C. T. H., query 9, January 13, take one dram of the fused nitrate of silver and ten grains of sap green, dissolved in one ounce of water, and add to it half a dram of gum arabic. This ink must be kept in a bottle which is covered with black paper to exclude the light, which affects it. (This bottle must be marked No. 2). Then prepare 2½ drams of best powdered soda, and 2½ drams of gum, dissolved in two ounces of distilled water. (This fluid should be marked No. 1). When wanted for marking, take No. 1 fluid and wet a place as large as required for the name and dry with a smooth iron; then write with a quill pen and dry in the sun or with fire. The writing gets darker by time.—P. K., of N. Y.

BRONZE PAINT.—If R. S. B., No. 11, January 13, wants a real bronze color, let him galvanize the iron and brighten it; then prepare, with a proper brush, powder bronze with thin varnish on a glass plate; and rub well into the brush to a medium consistence; then go on and brush it on the iron. When properly coated, take another brush and a piece of shamois leather; rub off some of the elevated places according to taste, then varnish over with bronze varnish. Bronze paint is prepared of powder bronze and varnish, rubbed in a mill. When used, make the iron first black, using lamp black and water with a brush; then warm the iron, and brush the paint on with a camel's hair brush while hot.—P. K. of N. Y.

SUBSTITUTE FOR FRICTION MATCHES.—In your column of queries, I find J. H. T. inquiring if the hydrogen lamp could be made to take the place of friction matches. I use no matches in my house, but take my light from this lamp by the use of tapers made of wood. It costs me twenty-five cents a year for the material to run the lamp; the only fault I find with it is that the sponge is too frail to use in public rooms, like drug or cigar stores, or other places where an instant and cheap light is wanted. If the sponge could be made more solid, so that it would stand a little force, it would be an improvement. Sometimes there are persons who are not satisfied with getting a light, but want to punch the sponge to see what it is; and the consequence is, they break it or jar the wire. If this sponge could be made and hung by a wire in the thimble of the lamp, so that it would have a chance to swing and to keep solid, these lamps could be used in a great many places; for they are cheap in use and a light can be obtained quickly.—C. C. W of Ill.

TREATMENT OF GRAPE JUICE.—In your issue of December 2, 1871, your correspondent, M. T. M., asks how he can make good wine from his grape juice which he now has in casks. In answer, I can give him a process, lately discovered in France, and now largely practiced for improving the quality and making the most ordinary kinds into high class wines. The process consists in plunging, into the vat containing the wine, two plates of platinum or of silver, having attached to them two wires of the same metal, which are connected with the poles of an electric battery. The Bunsen and Daniell's batteries are much used here for this purpose. The time necessary to transform a low grade wine to one of an agreeable and superior quality is from two to three weeks, with the battery continually working. By this method, wines which were considered only fit for making vinegar are changed to such an extent that they are used as good, and in some cases superior, table wines. If desired, at some future time I will give the history of this discovery.—AMATEUR, of Paris, France.

TINNING SMALL ARTICLES.—I notice an *inquiry*, about tinning small articles, in a late number of the SCIENTIFIC AMERICAN. I have used the following process with success, though there is a better for use on a large scale, but it is a trade secret: Clean the articles with sulphuric acid diluted with ten parts of water. A little heat and stirring will save acid and time. Wash the acid off with water, and dip the articles, with a perforated ladle, from the water into a kettle containing melted tallow. Place over the fire, and boil out the water. Be careful not to scorch the tallow, or it will boil over every time it is used. Have your tin melted with a little tallow on it, and keep it at such a temperature that the tallow will not burn. From the first kettle, dip the articles into this. After a few minutes, the tin will take hold, when the articles can be taken out and cooled. If they are very small, they may be dipped out and thrown into a chute. This should be lined with sheet iron, and have one or two jumps to knock them apart and jolt off the surplus metal. If there is room, have a large floor for them to scatter over, so as not to solder together. If there is not room for this, they may fall into a tub, which should have a stream of water, flowing in at one side and out over the opposite edge, to carry off the tallow and flakes of tin which float on the surface. With a little experience, this process can be made very easy, rapid, and successful.—W. W., of O.

W. H. B., of Ill.—According to the United States statute, the register tunnage of a vessel is her entire internal capacity in cubic feet divided by 100. Full information on this subject, relating to all sorts of vessels, is given in Meade's treatise on "Naval Construction."

HYDRAULIC RAM.—If a hydraulic ram has ten feet head and four inch feed pipe, will it raise a four inch column of water above its head, that is, more than ten feet?—J. S. F., of Ill. Answer: The only difference, that the size of the cross section of the column of water raised by a hydraulic ram can make (provided the dimensions of the ram be properly adjusted), is in the velocity at which the column is raised.

P. H. O., of Me., sends us some peculiar crystals, deposited from exhaust steam, and asks what they are. Answer: The analysis of the crystals shows S O3 for the acid and Fe O, Zn O, and Na2 O for bases, in other words, a sulphate of iron, zinc, and soda. It is a multiple salt of a species of alum. Of soda, there is but a trace. The black substance found in the other drip pan is mainly sulphate of zinc (white vitriol) colored by coal tar. The multiple salt is a curious compound, and is noticed in Thomson's "Chemistry."

J. M. E., of Tenn.—There is such an article as wood hanging for covering walls, in place of paper hangings. We do not know its merits or relative cost.

HORSE POWER.—Answer to query No. 7, January 13. After using a horse power machine for three years, I find that a horse would do more work and not get dizzy in a circle of 22 feet diameter. A less diameter causes dizziness and soreness of shoulder, which can be obviated by decreasing the length of inside of trace to equalize the draft on collar, so as to conform to the position of the horse in walking.—A. V. S., of O.

J. H. F., of N. Y.—Air in a cylinder eight inches long and four inches in diameter, and submitted to a pressure of 200 pounds, would occupy only six tenths of an inch in length of the cylinder. The volumes of all gases diminish directly as the pressures to which they are subjected. Compressed so as to occupy one fourth of the cylinder, the air will give sixty pounds pressure above that of the atmosphere.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ATLANTIC AND GREAT WESTERN CANAL.—J. A. L.
BOILER EXPLOSIONS.—H. W.
ELECTRO-MOTORS.—J. C.
LUNG EXERCISE.—E. S.
TO SMOKE OR NOT TO SMOKE.—T. W.—E. M. D.
ANSWERS TO CORRESPONDENTS.—I.—A. V. M.—A. G.—A. H.—S. C.
QUERIES.—J. T.—A. T. B. D.—P. E. McD.—C. E. O.—M. H. B.

Recent American and Foreign Patents.

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

COFFEE ROASTER.—Charles C. Butt, of Duck Hill, Miss.—This invention has for its object to furnish a simple, convenient, and reliable coffee roaster, so constructed as to adapt it for use upon a hearth with a fireplace fire, or with a stove, as may be desired, and which will roast the coffee evenly and in such a way as not to allow the aroma to be driven off and be lost; and it consists in the construction and combination of an outer cylinder and an inner corrugated cylinder, in combination with each other for receiving and holding the coffee while being roasted, and a combination of the cylinders named with a crank shaft, standards (whether detachable or attached to a base frame), connecting rod, crank, treadle shaft, and base frame.

COMBINED AXLE BOX, SAND BAND, AND CASING FOR CARRIAGE WHEEL HUB.—Michael McNalley, of Houston, Texas.—This invention has for its object to furnish an improved cast iron axle box, sand band, and casing to be applied to the wooden hubs of carriage wheels, simple in construction, easily applied, neat in appearance, and strong and effective in use. Through the center of the wooden hub passes the axle box that receives the axle. The rear end of the box is made with a shoulder or enlargement to receive the collar or shoulder of the axle, and is cast solid with the inner end of the part of the casing, so formed as to fit upon the inner end of the wooden hub. The sand band is cast solid upon the inner part of the casing. The outer part of the casing fits upon the outer end of the wooden hub. The outer end of the outer part of the casing is formed with a projecting flange or band to cover and protect the projecting end of the axle. The outer end of the axle box projects through a hole in the end of the outer part of the casing, and has a screw thread cut upon it to receive a nut which locks the parts to each other and to the wooden hub. The parts of the casing are further secured to the hub by rivets or screws passing through the ends of the said parts and through the wooden hub. The adjacent edges of the parts of the casing meet at the middle part of the hub. Sockets are formed upon the parts of the casing to receive the inner ends of the spokes, the tenons of the spokes entering mortises in the wooden hub in the ordinary manner. The spoke sockets are formed partly upon the inner part and partly upon the outer part of the casing, the flanges that form them extending continuously around the parts, and being made with offsets or ribs to bear against each other between the spokes and thus more strongly support the sides of the spokes and prevent them from breaking off at the shoulder of the tenons.

NUT LOCK.—Edwin H. Dooley, New York city.—This is a new and effective but very simple nut lock, to be applied to railroad rails and other purposes; and consists in the use of a locking pin which enters a groove along the whole length of the bolt, and has a sharp edge or edges near one end for cutting the thread of the nut, while the other end is bent over the head of the bolt. In this manner an absolute lock is produced which cannot possibly work loose, and therefore greatly insures the safety of the bolts. The pin can be readily removed, when desired, by bending its inner end straight, or cutting it off, and then driving out the pin to enable the nut to be unscrewed.

HAND CAR.—Jairus Collins Fairview Ohio, assignor to himself and John D. Saltsgaves, same place.—This is a new arrangement of hand car which is propelled in either direction by the exertion of the persons occupying it. The invention consists in combining an operating lever with a double pair of pawls, which engage in a ratchet rail secured to the ground parallel to the track. The propulsion is effected by the alternate contact of the ends of the pawls with the ratchet teeth of the bars on the track.

MACHINE FOR FINISHING HORSE SHOE NAILS.—Harry A. Wills, Vergennes, assignor to Julia A. Wills, same place, and Lucy S. Kingsland, Burlington, Vt.—This invention consists in certain improvements in a machine for cold rolling horse shoe nails, after they have been formed, to harden and finish them, in which the guide of a feeding screw, that is used to conduct the nails to the pusher, by which they are delivered to the dies, is arranged to change the nails from a vertical to a horizontal position, so that they can be delivered to horizontal dies. In these dies the nails are held by a movable disk or pin clamping them by the narrow sides between it and a fixed die over a bed former, and rolled on the upper side by a roller die in the end of a reciprocating bar, which is governed by a roller guide and former above the bed die. A holder is hung above the bed die and arranged to come over the head of the nail as soon as the roller die passes therefrom toward the point, and prevents the nail from bending upward by the action of the roller. The clamping dies open when the roller die passes off the point of the nail, the head holder recedes, and a pusher discharges the rolled nail.

RATCHET DRILLS.—John J. Switzer, of Williamsburg, N. Y.—In this invention a ratchet head is formed in the body of a tube, by depressions instead of the usual method of forming projecting teeth. It is stronger and protects the bearing surface of each tooth at the sides, similar to a flanged ratchet wheel, but is much cheaper to make than the same. The handle and eye are formed in one piece, and a chamber is provided in the handle for the pawl and spring, also a more economical and simple plan than any hitherto in use. A sliding feed center, threaded and longitudinally grooved, is also combined with a swiveled nut, and the tube above described.

TOY.—John W. Beatty, of Petroleum Center, Pa.—This invention relates to apparatus for the amusement of the young, representing in miniature the machinery employed in boring for oil. The engine house, the derrick or tower by means of which the drill is raised, the pulley over which the hoisting rope passes, one end of the rope being attached to the drill and the other end to the windlass, the stand for the working beam, and the working beam, the drill shaft attached to one end of the working beam, and the beam operated by a crank, to which the other end is connected by the pitman, the belt from the engine pulley that revolves the band wheel, are all shown in motion, being driven by clock work as a motive power in the engine house. Pen holders are formed on the side of the derrick, and an inkstand is placed on the platform. A flange around the platform makes a safe receptacle of the latter, for pens, rubber, or other articles.

COVER FOR WATCH FRAME.—Abel Combs, of Burlingame, Kan.—This invention consists in a hinged plate for excluding dust; not arranged as a common hinged cap to a case, and intended in place of a common cover, but which constitutes a part of the watch movement. Its especial object is to exclude air, light and dust from the oil in the pivot holes of the plates. It also serves to carry the pivot or arbor of the winding barrel, which can be let into this plate and entirely through the under plate, without exposure to the breath when the cap of the case is lifted and the watch being examined. With this plate the movement can be looked at by inserting a glass over the balance. This dust plate is more particularly intended for a three quarter plate movement, and, it is claimed, combines all of its advantages, with the added advantage of protecting the balance and the whole movement. The plate is hinged to permit the removal of the escapement exposing the whole machinery.

TELEGRAPH PRINTING APPARATUS.—Henry Van Hoevenbergh, of New York city.—This invention has for its object to produce a simple and convenient mechanism for reversing the motion of the type wheel of a telegraph printing instrument. It is intended for use more particularly on an instrument for telegraphing stock quotations, etc., where it is desirable to have a reversible type wheel, and thereby avoid frequent necessity of making almost complete revolutions to reach types that may be brought to action by a short back movement. The invention consists in a new revolving gear actuated by a separate current through an independent wire, and in a new double pawl mechanism for actuating the type wheel shaft. The invention also consists in the application to the latter of a stop whereby its motion is arrested, if and as long as it is not in concert with the other instruments that are operated simultaneously by the same keys.

MACHINE FOR TAPPING GAS AND WATER MAINS.—George Shelley of Easton, Pa.—This invention consists of a drill case for clamping upon the main, divided vertically in two parts for separating, to be detached from the pipe when it is connected to the main which case is provided with a divided flexible packing ring in an annular groove in the bottom; a valve chamber and a check valve, to be opened by the drill when it is inserted, and closed by the water when said drill is withdrawn after boring and tapping the main, and then opened again when the pipe is put in. A packing ring above the check valve prevents the escape of the water when the valve is open, and the valve chamber is provided with a cock to be opened when required to let the cuttings or chips be washed out, so that they will not obstruct the closing of the valve.

BOOT CLAMP FOR BASE BALL PLAYERS.—Edward S. Ellis, of Trenton, N. J.—This invention consists of an adjustable clamp, having points or spikes projecting from the bottom thereof, to be applied to the sole of the boot for the purpose of preventing slipping. It is claimed these clamps are fastened to the boots of base ball and cricket players more securely, in a shorter time, and can be removed more easily, than by any other contrivance now in use.

SASH HOLDER.—George W. Warren, of Bristol, Ind.—This invention relates to the class of sash locks in which catches are employed to secure the sash to a T-headed nail or stud driven into the sill. It consists in an arrangement of a hook spring lever in the sill in connection with a treadle located in the wall and projecting through the mop board. A key hole furnishes a means of access to a dwelling, independent of the ordinary entrance—a convenience to which recourse is quite often necessary.

WALKING PLANTER.—Mills W. Stephenson, of Pickensville, Ala.—This invention has for its object to furnish a simple, convenient, effective, and reliable machine for planting corn, cotton, peas, and other seeds, and for distributing guano and other fine fertilizers. In this machine the reciprocating movement of the lower parts of the sides of the hopper causes the seeds or fertilizer to pass out regularly and uniformly. When desired the seed, such as corn, peas, etc., may be dropped in hills by lowering movable boards until the discharge opening is closed. A hole in the lower inside edge of the movable board, while inside the hopper, gathers the seed, and on passing out deposits the same. The rollers from which this motion is obtained being one foot in diameter, the seed is dropped every three feet. By sinking a hole on the opposite movable board, the seed will be deposited half this distance or every eighteen inches, and by sinking holes in the opposite ends of the boards the seed will be dropped every nine inches. The size of these holes will govern the quantity dropped. These holes are easily closed by inserting cork stoppers. But this is necessary only when it is desired to increase the distance in the dropping, the holes not being in the way when planting in drills.

IRONING MACHINE.—Charles C. Thomas, of Natchez, Miss.—This invention has for its object to furnish an improved machine for ironing clothes and other cloths. It consists in the construction and combination of the various parts, whereby, through a rack pinion and winch the smoothing irons are actuated.

ELECTROMAGNETIC ENGINE.—Henry S. Daggett, of Lafayette, Ind.—This invention relates to a new arrangement of stationary magnets and vibrating conductors, and to a new combination of the same with a sliding piston rod and vibrating link movement, whereby a complete electric engine is produced, imparting a reciprocating motion to the piston and other suitable action to the mechanism connected therewith. Magnets arranged in rows and connected with wires and pendent chains, a piston provided with a swivel lever which moves under the chains and thereby produces successive connections with the several rows of magnets, stops affixed to the frame for swinging the lever at the end of every stroke, and thereby reversing the motion of the engine, and an electric engine, consisting of frame rack, magnets, wires chains, piston, lever, and stops, all combined to operate as described, are the features upon which a patent has been obtained.

DEVICE FOR UTILIZING POWER AT RAILWAY STATIONS.—William J. Pleeker, of Bushnell, Ill.—This invention relates to an improvement in securing, storing up, and utilizing the power of passing locomotives. It consists in a mechanism or apparatus by means of which power for driving a pump, sawing wood, or for other purposes, may be stored up by a locomotive in passing a station or any locality wherever the apparatus may be located. The inventor does not limit or confine himself to any particular apparatus or mechanism for thus obtaining power from passing trains, as the various parts of the apparatus may be varied in many ways without departing from the invention.

CAR COUPLING.—Churchill Eastin, of Louisville, Ky.—This is a self coupling apparatus in which the coupling pin is suspended from a holder upon the top of the buffer, and is moved backward by a lever to trip or release the link by lifting the lower end above the part of the buffer, behind which it is locked when in the working position, the said holder being moved up an inclined plane to lift the pin as it moves back. Two tripping levers are used for uncoupling, one to be used by a person standing on the ground and the other when on the car.

MICA LAMP CHIMNEY.—George M. Bull, of New Baltimore, N. Y.—This invention has for its object to furnish an improved lamp chimney constructed of mica.

SPINNING MULES.—William Lees, Coatesville, Pa.—This invention has for its object to prevent drawing rolls of a mule delivering, to the spindle of the same, more silver than the latter can properly spin at any one stretch, the invention consisting in a mechanism whereby, when the proper length of silver has been delivered, the spool shaft is stopped, and whereby it is started again during the next run of the carriage inward.

CONSTRUCTION OF WALLS FOR BUILDINGS AND VENTILATION OF THE LATTER.—William L. Stauffer, Allentown, Pa.—This invention in architecture consists in a peculiar relative form of facing, binding, and filling brick, to form a hollow wall through which a circulation of air may be kept therein, and in all the rooms of a building.

COTTON PRESS.—William C. Banks, Como Depot, Miss.—This invention relates to a press having a wooden top piece or cap hinged at one side, through which cap passes the platen screw, said cap being, by means of the hinges, made capable of turning back to one side, so as to remove the platen from the top of the box, and leave a clear space for the insertion of a fresh charge, the cap aforesaid being kept in place, when turned down on the box, by means of bales and loops.

COTTON PRESS.—William W. Anderson, of Wartrace, Tenn.—This invention consists of a system of pulleys and a cord at each end of the follower for working it, the said cords, after passing over the pulleys, being run over a guide pulley to a drum for winding them up, and the drum being operated by a cord, pulley, and a capstan, all arranged for obtaining great leverage, whereby the bale may be pressed with great force, and the work accomplished by one person.

FIRE PLACE.—Miles Moore, of Bartlett, Tenn.—This invention has for its object to furnish an improved fire place heater, which may be taken down and put up when required, and will enable the heated air to be discharge from the hot air chamber in any desired direction. It consists in a construction and combination of parts whereby the desired objects are attained, and fire place heaters thus constructed may be connected with single flue chimneys, or with double chimneys, or with stack chimneys, as may be required.

GATE.—Allen Gaskill, of Neoga, Ill.—The horizontal bars are all pivoted to the vertical bars, so that the swinging end may be raised or lowered; and the braces are pivoted to the gate at the upper ends, while the lower ends are jointed to the ends of levers pivoted to the second horizontal bar from the bottom. These levers extend from the pivot to the top of the gate at the front end, where they are secured by a bridle or yoke, when the gate is closed and latched. By swinging the levers backward, the swinging end of the gate will be lifted up, raising the latches out of the notches in the post, so that the gate may be opened. The said levers will hold the gate in this position until moved back again by hand, so that the latches will be in position to enter the catches again when the gate closes, after which it will be locked by turning the levers up to the vertical bars, and securing them by the yoke.

PRUNING SHEARS.—Samuel J. Beigh and Eli F. Beard, of Republic, Ohio.—A semicircular jaw is formed on the end of a long shank, the two forming a single piece, while the latter is attached to the staff by clips, so that it will readily slide up and down on the staff. The cutting blade is also of a semicircular form, the outer circle forming the cutting edge with the inner circle of the jaw. The jaw and the blade are pivoted together, and the two work together similar to the blades of a common shears. To enable them to thus work, the blade is provided with a shank which is hinged to a rod, the rod being hinged to the end of the staff. A wire is attached to the end of the shank with a loop or ring at its end, by which the jaw is drawn down and pushed up in the operation of cutting. The shank and the rod form what may be called a "grasshopper" connection, the connection being operated entirely by sliding the long shank of the jaw upon the staff. In cutting, the blade acts as a lever whose fulcrum is the joint pivot. The blade, owing to the circular form of the cutting edges, gives the twig to be cut a drawing stroke, thereby greatly lessening the power required in giving a cut square across the grain of the wood.

SPRING BED BOTTOM.—Sylvester Logan, of Greenville, Pa.—This invention consists of india rubber springs let into the ends of spring bars of wood, extending nearly from end to end of the bedstead, with hooks connecting the bars with eyebolts or other connection in the ends of the bedstead, the said hooks engaging the bars by said springs in such manner that there is an endwise or longitudinal as well as a vertical springing action of the bottom, and so as to form a cheap and desirable means of connecting the bars to the bedstead.

PROPULSION OF VESSELS.—Thomas B. Raymond, of Winona, Mich.—This invention consists in applying, to a stationary tube surrounding the propeller for preventing lateral displacement, diametrical plates to receive the water at the rear from the propeller and prevent it from whirling around in said tube. Stationary tubes surrounding the wheel, and likewise spiral vanes, have been used, but they have been found impracticable, on account of the whirling of the water while subject to the screw and separated from the surrounding water; which, in this improvement, the inventor proposes to overcome in great measure, if not entirely, by the employment of these vanes behind the propeller, and thereby to render the employment of the tube a success.

SCREENING APPARATUS.—David Kahnweiler, of New York city.—By this machine it is claimed that hulled or cracked seed is cleaned or separated from the hulls, fibers, etc., connected with it as it leaves the hulling machine in the most effectual manner, when heretofore a blast of air has been applied, which blast was the occasion of much loss as the fine meal or dust was expelled or blown away thereby. A screen box with a chamber and apertures therein arranged, and a combination of an agitator, an inclined and curved screen, with the chamber having apertures, are the features of the invention on which a patent has been obtained.

SOIL PULVERIZER.—David Osborn, of Paoli, Ind.—This invention relates to a new agricultural machine, intended to combine the functions of the harrow and land roller—that is, to pulverize and level the soil. It is intended for use, principally subsequent to sowing, to cut the clods and cover the grains. The invention consists in the general new arrangement of a sled, adjustable pulverizing tools, and graduated ground coverers.

LIME KILN.—Daniel T. Barrett, of Port Byron, Ill.—Front and back horizontal bars are cast with grooves for the reception of the ends of horizontal sliding doors. The front horizontal bar is perforated at lower side of the same, opposite the outside of horizontal sliding doors, and to support and serve as a fulcrum therefor. The horizontal sliding doors have lugs cast upon them at or near the center of the outside of each for the reception of levers, the said doors being fitted into the grooves of the horizontal bars by working the levers to the right and left. The horizontal doors are moved and lime is drawn in quantities limited as desired, and by reversing the action of the levers the doors are closed. The horizontal grooved bars should be made of heavy iron castings, and at both ends let firmly into the masonry of the walls of the recess of the kiln, and secured by heavy bolts. The horizontal sliding doors should also be made of heavy iron castings, all of sufficient weight to support the contents of the kiln. Cross bars or plates are arranged with their ends fitting in the grooves of the bars, so that a square or rectangular opening is formed through which to deliver the lime.

WATCHMAKERS' LATHE.—Gaspar Hunziker, Summit, Miss.—This invention pertains to an improvement in lathes for watchmakers' use, whereby the beam, being supported in a stand of any kind as the beams of this class of lathes commonly are, will support a wheel a short distance below it, in a position where it will be more convenient for turning the pulley by a continuous rotary motion than it is to turn it by the bow commonly used, thus giving continuous rotary motion with less labor than is required to produce the back and forth motion of the bow; the supporting arm being adjustable on the beam, makes it convenient for any kind of work, and removes all objection to the use of a driving pulley on the score of inconvenience.

SPRING BED BOTTOM.—Benjamin R. Otis, of Havana, Ill., assignor to himself, M. D. Rhame, and Thomas Covington, of same place.—This invention consists in the construction and combination of a bed bottom formed by two end cross bars, provided with pins, longitudinal spring slats having end slots, the spring levers, loops, and fulcrum blocks, all constructed, arranged, and operated in a peculiar manner, which, it is claimed, makes a superior and uniformly elastic basis for a bed.

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19,033.—SHINGLE MACHINE.—R. Law, January 5, 1858.
19,052.—ELECTROMAGNETIC SPEED GOVERNOR.—G. M. Phelps, Jan. 5, 1858.
19,083.—MOWING MACHINE.—H. Fisher, January 12, 1858.
19,105.—CARPENTERS' RULE.—L. C. Stevens, January 12, 1858.
19,074.—CUSHIONS FOR BILLIARD TABLES.—H. W. Collender, January 12, 1858; reissued March 19, 1867.
19,147.—ICE CREAM FREEZER.—H. B. Masser, January 19, 1858.
19,119.—STEAM ENGINE.—E. D. Barrett, January 19, 1858; reissued to said E. D. Barrett and H. B. Bigelow, August 29, 1861.

DESIGNS PATENTED.

5,479.—BRAWL.—H. Boot, Philadelphia, Pa.
5,480.—TASSEL HOOK.—H. L. Judd, Brooklyn, N. Y.
5,481.—CARPET.—A. Heald, Philadelphia, Pa.
5,482.—CARPET.—E. Pine, Morrissania, N. Y.
5,483 to 5,490.—CARPETS.—C. T. Meyer, Lyon's Farms, Elizabeth, N. J.
5,491 and 5,497.—FLOOR OIL CLOTHS.—C. T. Meyer, Lyon's Farms, Elizabeth, N. J.
5,495.—TYPE.—C. Schraubstadter, Brookline, Mass.
5,494.—TOY SAFE.—A. M. Smith, Brooklyn, N. Y.
5,496.—SHUTTER FASTENER.—W. E. Sparks, New Haven, Conn.

TRADE MARKS REGISTERED.

636.—SAW.—E. M. Boynton, New York city.
637.—LABELS AND SHOW CARDS.—S. Crump, New York city.
638.—STOP FOR REED ORGANS.—J. Estey & Co., Brattleborough, Vt.
639.—WOOD CARVING.—Sorrento Wood Carving Company, Boston, Mass.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
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On an application for Design (seven years)	$15
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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:

20,233.—WORKING SHIPS' SAILS.—S. Very, Jr. April 24, 1872.
20,214.—CARTRIDGE CASE.—G. W. Morse. April 24, 1872.
20,503.—FIRE ARMS.—G. W. Morse. May 22, 1872.
20,727.—CARTRIDGE.—G. W. Morse. June 12, 1872.
19,984.—COOLING AND DRYING MEAL.—J. Denchfield. April 3, 1872.
20,120.—COTTON GIN.—J. N. Wilson and G. W. Payne. April 10, 1872.
20,337.—LEVELING DEVICE FOR HAND SAW.—H. Disston and T. L. Morse May 8, 1872.
20,086.—COTTON GIN.—S. B. Parkhurst. April 10, 1872.
20,313.—DEVICE FOR HAND SAW.—H. Smith. May 1, 1872.

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

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Inventions Patented in England by Americans.

From December 26, 1871, to January 1, 1872, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

AXLE LUBRICATOR.—W. Painter, Owing's Mills, Md.
CARDING MACHINE, ETC.—C. J. Goodwin, Hampden Co., Mass.
CARRIAGE WHEEL.—H. Silvester, St. Louis, Mo.
CARRYING LOADS, ETC.—F. B. Colton, Philadelphia, Pa.
CURTAIN FASTENING.—W. Z. W. Chapman, New York city.
EXCAVATING MACHINE, ETC.—S. Sweet, Dansville, N.Y.
GAS APPARATUS.—H. Wurtz, New York city.
HORSE NAIL MACHINE.—E. W. Kelley, Boston, Mass.
LOOM FOR NARROW FABRICS.—W. Day, Newark, N. J.

Foreign Patents.

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This new and elegant work presents, in convenient form, notices of the leading subjects and events, pertaining to science, that have occupied public attention during the past year. The progress of the more important public works is duly chronicled, with illustrative engravings. The leading discoveries, facts, and improvements, in chemistry, mechanics, engineering, natural history, and the various arts and sciences, are recorded and illustrated. Sketches of prominent scientific men, with illustrations, are given, and among the portraits are those of Faraday, Murchison, Darwin, Agassiz, Huxley, and Herschel. The Mont Cenis tunnel, the Hell Gate works, the Brooklyn suspension bridge, the Hoosac tunnel, the St. Louis bridge, the United States Patent Office, and other works are illustrated. A large amount of useful information, tables, descriptions of improvements, with engravings, are likewise presented. The book is one of much interest and value, and should have a place in every library.

AMBAS AMERICAS CONTRASTES (THE TWO AMERICAS CONTRASTED). Por R. P., de Venezuela. New York: D. Appleton & Co., 549 Broadway.

This is a handsome volume of 300 pages, in the Spanish language, in which the author, a political exile from Venezuela, contrasts the relative prosperity of the United States and of Venezuela. He points out the astonishing richness of the latter country, its beautiful and healthful climate, its varied and wonderful scenery, its easy capability to support immense populations, and its marvellous mineral resources—all combining to make it the natural home of a gigantic and thriving nation. Instead of this, he shows that the constant feuds of its unworthy politicians have converted in into a terrestrial hell, from which the better class of the population flee whenever they can find sale for their properties, or otherwise procure the means of escape. The author then proceeds to point out the method of regeneration for Venezuela, which he believes consists in adopting a general system of education, by which intelligence among the masses will be promoted, and their minds inclined after the higher and better forms of industrial arts. He believes the example of the United States to be worthy of imitation, and gives a general view, with illustrations, of the history of this country sketches of our leading men, institutions, and industrial appliances; of the latter, those that would be especially useful for adoption in Venezuela. The general circulation of this work would, undoubtedly, be of much benefit to the distracted people of Venezuela and Mexico.

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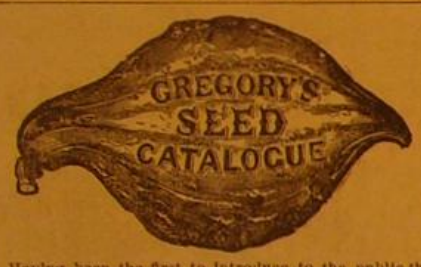
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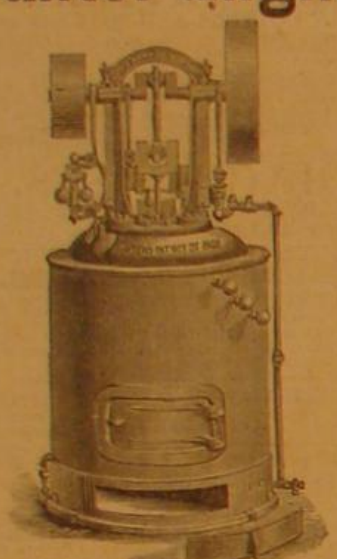
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Vol. XXVI.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 10, 1872. $3 per Annum [IN ADVANCE.]

The Pennell and Zimmer Dovetail and Shaping Machine.

This machine is designed to supply a want long felt by all sash makers.

The formation of the dovetail mortises on the stiles, and tenons on the check rails, of sash have heretofore been the most tedious and expensive parts of sash making, requiring skilled labor, and the use of at least four different machines, as well as from six to ten times handling the material to accomplish the purpose. With this improvement, the work is all done on one machine, and more perfectly than is possible by any method we have seen employed. An ordinary hand can, it is claimed, make at least ten dovetail mortises or tenons per minute, or the joints for 1,500 windows per day, being the work of some twenty skilled men.

The rapidity of production, in comparison with the old modes, is sufficient to attract attention to this machine, yet there are other advantages quite as important.

A shoulder is formed on the side of the stile, which makes a perfect fit, and a much better and stronger joint. By a slight change, which requires but a few minutes, it is made to do the work of a shaping machine for circular sash or any irregular molding, thus obviating the necessity of a separate machine for that purpose.

Figs. 1 and 2 are front and rear views of the machine, and Fig. 3 is a detail view, showing the arbor, F, referred to below.

For dovetailing bottom stiles for check sash, the carriage, A, is placed on the rails, D. The arbor, E, is adjusted to the bevel desired for the dovetail. On the arbor, G, are placed two cutters, which form the straight side of the dovetail and the shoulder on the side of the stile, which is then laid on the carriage and passed through the cutters on E and G.

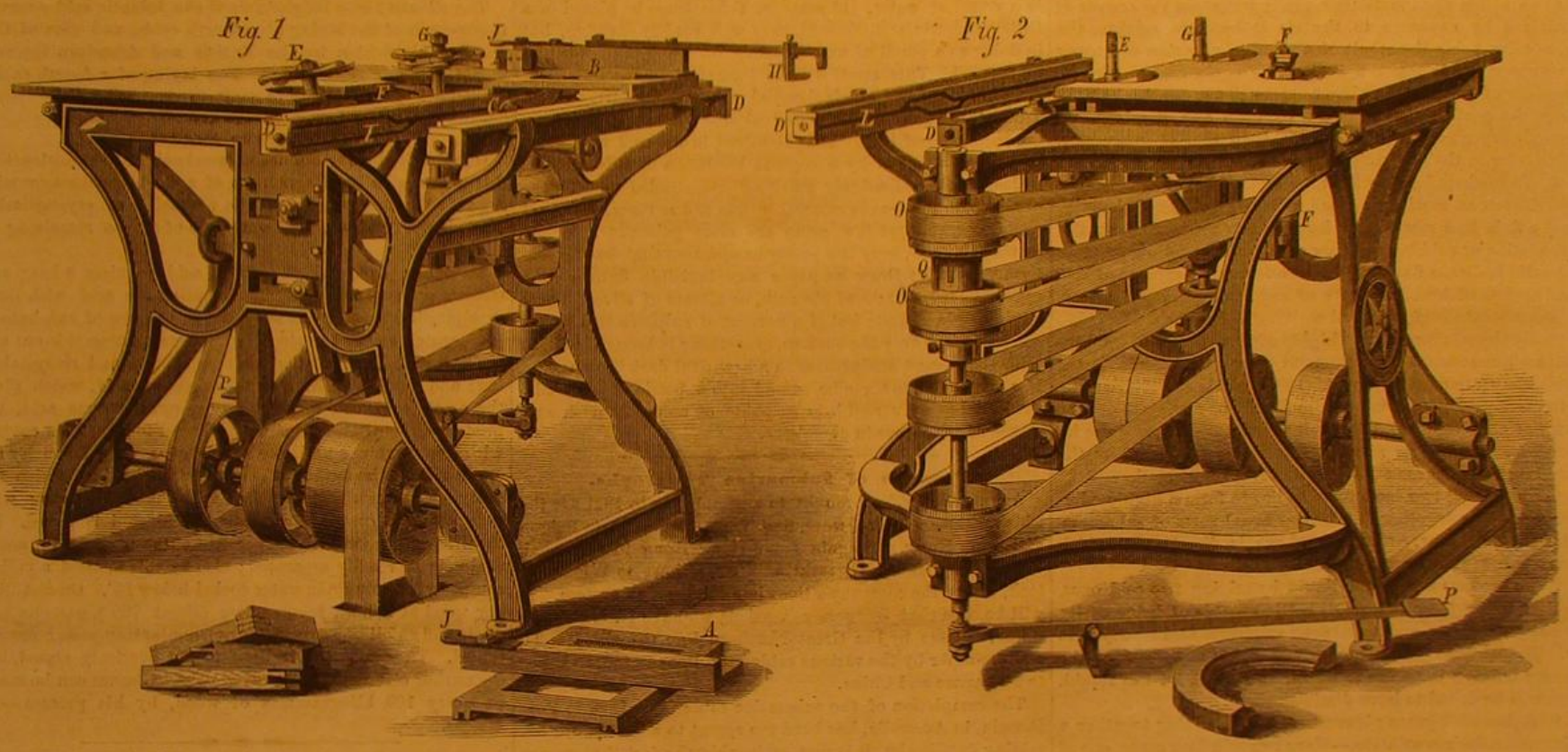
For top stiles, the cutters on the arbor, F, Figs, 1 and 3, are adjusted to form the shoulder on the face side of the stile. The upper cutter on the arbor G being removed, the stile is passed through as before.

For bottom, check, and common meeting rails, the carriage, B, is placed on the rails, D, (as shown in Fig. 1) with the lever pin, C, in the *lower* branch of the slot, I, and the arbor E is adjusted to a perpendicular position. The rail is placed between the chipbreakers, K, and passed through all the cutters. When returning, the carriage lever, C, is guided into the *upper* branch of the slot, I, and the rail is reversed, with the shoulder placed to the gage, H, (which gives the length desired) and the operation is repeated.

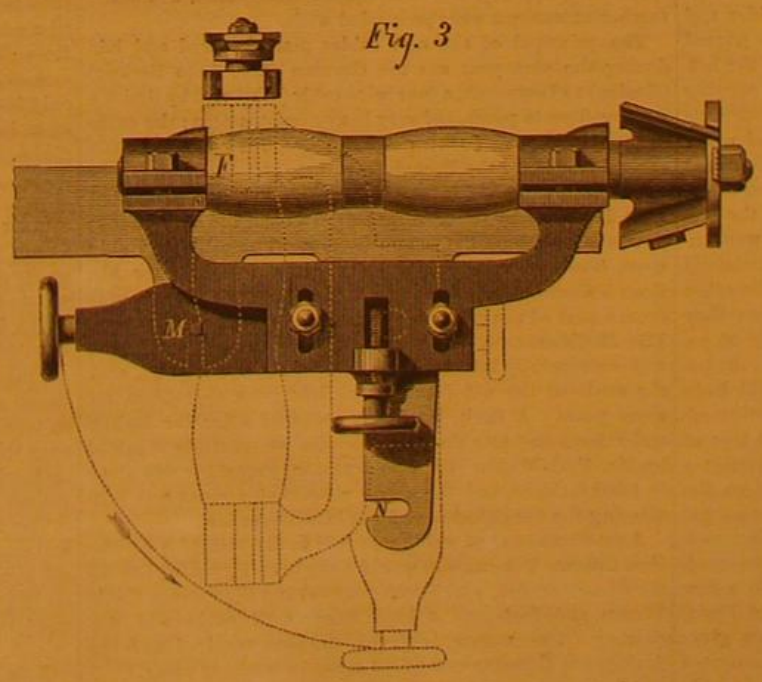
For top check rails, the carriage, B, is reversed, and the lever pin, C, is placed in the slot, L, (Fig. 2) and operated as for bottom rails.

For shaping circular sash or irregular moldings, the bolt, M (Fig. 3), is loosened, and that end of arbor, F, is dropped to the position indicated by the dotted outline bringing the bolt, M, into the hook, N, which places the arbor in a perfectly upright position. The belts are then put on the clutch pulleys, O, (Fig. 2) the upper belt being crossed. The motion of the arbor is reversed by a slight pressure of the foot on the lever, P, which connects with the clutch, Q. The cutters are so constructed that the work is done equally well with the arbor running in either direction to cut with the grain of the wood. It is claimed that by this machine are gained the advantages of rapidity of work, the obviation of the necessity of skilled labor, perfection and strength in the joints, and the means of manufacturing check rail sash as cheaply as common sash, with uniformity of work, so that parts may be made and laid away for future use and easily put together at any time, and an appliance for shaping circular sash and moldings.

The machine is on exhibition at the S. A. Woods Machine Co's. salerooms, 91 Liberty street, New York, and 67 Sudbury street, Boston. For further particulars, address Van Gilder & Goodlander, agents for the United States, Williamsport, Pa.



THE PENNELL AND ZIMMER DOVETAIL AND SHAPING MACHINE.



CHEMICAL EXPERIMENTS FOR YOUTHFUL READERS.

From the British Photographic Journal Almanac.

The series of experiments here presented are intended for the younger readers, for whose benefit they are presented in as attractive and even sensational style as possible, in the confident belief that no experiment here indicated will be performed by a youth without gaining by such trials an insight, however small it may be, into some chemical action of which he previously may have been quite ignorant; and they will thus serve an educational purpose as well as conduce to the occasional spending of a pleasant hour. All the chemicals to be mentioned can be obtained readily.

1. To make a milky liquid by the admixture of two colorless ones.—In one vessel, which ought to be made of glass, pour a little water, so as to half fill it, and add to it a few grains of common salt, which will speedily dissolve. In another vessel, also half full of pure water, dissolve a few grains of nitrate of silver. Both liquids will be bright and colorless. Now pour one of them into the other, and the resulting mixture is thick and white like milk. When a solution of common salt, which is the chloride of soda, is mixed with a solution of nitrate of silver, the nitric acid of the latter salt combines with the soda of the former, forming nitrate of soda, which is soluble in water, leaving the silver in combination with the chlorine, forming chloride of silver—a white powder which is insoluble in water, to which it therefore gives the appearance of milk. If paper were washed with one of these solutions, and then, after being dried, were brushed over with the other, the chloride of silver would be formed on the surface or in the texture of the paper. In this way is sensitive printing paper prepared.

2. To produce a yellow, cream-like liquid from two colorless ones.—To make cream instead of milk, it is only requisite to substitute for the common salt in the previous experiment a little iodide of potassium or any other soluble iodide. The resulting precipitated powder is iodide of silver. When an iodide of a soluble kind is dissolved in a clear varnish, such as albumen or collodion, a plate of glass coated with such a body becomes of a dense yellow color when immersed in nitrate of silver. This is what takes place whenever a plate is sensitized.

3. To make smoke issue from two empty tumblers.—Moisten the inside of one of the glasses with strong ammonia, and treat the other in a similar way with strong hydrochloric acid. Keep the glasses thus prepared at a distance of two or three feet from each other. Now, taking a juggler's li-

cense with facts, direct the attention of the spectator to the perfect emptiness of the glasses, and, taking one in each hand, hold them up and bring them together slowly mouth to mouth. When a few inches apart from each other, smoke will be seen to issue from them; and if they are held closely together, they will be seen to be filled with a dense white vapor, which will soon condense in the insides of each glass in the form of a white powder. This is a capital experiment for astonishing a few friends; but in performing it as a "trick," care must be taken that the previous preparation of the glasses is not shown. *Rationale:* The vapor from the hydrochloric acid, which is invisible, combines with the ammoniacal vapor, also invisible, and produces, by their combination, chloride of ammonium, or sal ammoniac, in the form of a white powder. If, instead of being moistened with the hydrochloric acid, the glass be filled with chlorine gas, the effect will be somewhat better.

4. To make a liquid that is blue when the bottle containing it is open, and colorless when corked.—Fill a small bottle with liquor ammonia, and place in it a few turnings or filings of copper, corking it immediately. It will remain colorless as long as it is closed, but after the cork has been removed for an hour or two, the liquid will have become of a blue color. Recork the bottle and it soon again becomes colorless; reopen it and it becomes blue as before. Ammonia has no action upon metallic copper; but when the copper is oxidized by exposure to the air it becomes soluble, the blue color being the result of a solution of oxide of copper in ammonia. When the bottle was again corked, the remainder of the metallic copper extracted the surplus oxygen from the portion that had been oxidized and dissolved. It is only when copper is highly oxidized that it produces a blue color in the above circumstances.

5. To produce fluids by the rubbing together of solid bodies.—Triturate an amalgam of lead with an amalgam of bismuth, and a fluid like mercury is immediately produced. By the trituration or rubbing together of any of the following pairs of solid bodies, a fluid will also be formed: Sulphate of zinc and acetate of lead; sulphate of soda and nitrate of ammonia; or sulphate of soda and carbonate of potash.

6. By the mixture of two highly odorous bodies to produce an inodorous one.—The pungent odor of ammonia is too well known to need comment. Into a bottle containing some of this liquid pour, some hydrochloric or nitric acid. The odor of each vanishes, the resulting mixture being quite inodorous. Muriate or nitrate of ammonia is formed by the admixture, and these salts are quite free from smell.

7. By mixing two inodorous bodies to form a highly odorous one.—Mix together in a mortar equal parts of sal ammoniac and quicklime. Ammoniacal gas is disengaged, which has a powerful and pungent odor.

8. To produce a very hot liquid by mixing two cold ones.—Half fill with water a small bottle capable of being easily held by the grasp, and then pour sulphuric acid slowly into it. The mixture will soon become so hot as to compel the person holding it to set it down. The bulk of the liquid, too, will be found to have diminished.

9. A fine solid green pigment made by mixing together a blue and colorless solution.—Have two solutions made, one of them being of sulphate of copper and the other of carbonate of soda. Pour a little of the latter into the former, and the richly colored paint known as French green will be immediately formed and precipitated. Remove the liquid by filtration. By this mixture, subcarbonate of copper, the pigment above named, is formed.

10. To convert two clear and colorless liquids into a solid mass.—There are several ways of performing this experiment, which never fails to excite intense wonder in those who are unacquainted with the working of chemical miracles. Here is the appearance presented by one of them, as I once saw it performed by a parlor magician. On the table stood two bottles containing apparently water, a glass tumbler, and two glass rods for stirring with. The "Professor" first poured into the tumbler a portion of the contents of one of the bottles, and then followed with some from the other, stirring the mixture briskly for a few seconds, when, to the surprise of all present, it became an opaque and almost solid mass. After this had been thoroughly examined by the astonished spectators, the "Professor," uttering a few meaningless words from the jargon of jugglery, touched the mass with the end of one of the glass rods, and immediately the whole was converted into a clear liquid. Explanation: One bottle contained a saturated solution of chloride of calcium, and the other a saturated solution of carbonate of potash. When they were mixed together, they were decomposed, chloride of potassium and carbonate of lime being formed; and as the latter absorbs the whole of the water of solution, a solid body is maintained. The cause of its becoming fluid on being afterwards touched with the glass rod is simply this: One of the rods was a hollow tube, and contained in its interior a little nitric acid, which, having been adroitly poured on the solid mass, immediately converted the insoluble carbonate of lime into the soluble nitrate of lime. There are other compounds by which results of a similar nature can be produced. To a saturated solution of chloride of calcium, add a few drops of sulphuric acid. Sulphate of lime (plaster of Paris) is formed by the reactions. One other method we give: Pour a saturated solution of caustic potash into a saturated solution of Epsom salts, and a similar result will follow. In this case, the sulphuric acid of the Epsom salt (which is sulphate of magnesia) leaves the magnesia to combine with the potash, the magnesia being precipitated as a white powder.

11. To produce an exceedingly intense light.—Into a dish like a child's saucer, put a small heap of saltpeter (nitrate of potash) that has been finely powdered and well dried. In the middle of this make a nest, in which place a bit of phosphorus the size of a small marble. Now turn down the lights in the room, and apply a lighted match to the phosphorus, which will then burn with a light so intense as to dazzle the eyes of those present. The heat caused by the burning phosphorus decomposes the nitrate of potash, and the oxygen thus liberated causes the flame of the phosphorus to become intensely luminous. The room in which this experiment is tried must be well ventilated, as the fumes of phosphoric acid are noxious.

12. Experiments with iron.—(*a*) Write or draw on paper with a solution of sulphate of iron. When dry, it will be invisible; but if a sponge moistened with a solution of gallic acid or pyrogallic acid be passed over it, the previously invisible writing is made as visible as if written with ordinary black ink. The sulphate of iron and the gallic acid react on each other, forming gallate of iron, which is of a black color. Writing ink is made from this mixture. (*b*) If, instead of the gallic acid mentioned in the former experiment, a solution of prussiate of potash be employed, the invisible image will be developed as a fine blue color. By mixing solutions of sulphate of iron and prussiate of potash, Prussian blue is formed; hence the blue color as the result of the experiment. (*c*) Make a rod of iron very hot (a white heat), and then apply the end of the rod to a piece of sulphur. The iron will immediately be fused and fall down in large drops, which must be caught in a vessel of water. If some of these drops be placed in a little sulphuric or nitric acid, they will readily dissolve, but in doing so a smell of an extremely offensive character will be emitted. This smell will be immediately recognized as similar to that for which decayed eggs are so justly noted. The hot iron combines with the sulphur when melting, forming sulphuret of iron. This dissolves in the acid with great readiness, attended by a copious liberation of sulphuretted hydrogen, the offensively smelling gas alluded to. To the presence of this gas in mineral waters is due their medicinal properties, and yet few gases are more poisonous. Before leaving this gas, here is a pretty experiment that can be performed with it: Draw on paper any invisible figures with sugar of lead, nitrate of bismuth, or nitrate of silver. These are invisible at first; but if a current of sulphuretted hydrogen be passed over the surface, everything is brought to light with the utmost distinctness in a beautiful dark brown color. If a current of the gas be passed into a bottle of ammonia, the liquid is converted into sulphide of ammonium—a substance of much use in chemistry.

Progress of Submarine Telegraphs.

Among the cables brought to a completion in 1871 are the China cables. These were, first from Singapore to Saigon and Hong Kong, and again from Hong Kong to Shanghai, from Shanghai to Nagasaki, and from there to Wladiwostock, where the company's lines join the Russian system. It will be seen that by these extensions we have two routes to China, the one by the Great Northern line through Russia, and the other by the various cables and lines to India, thence to Singapore and China.

The completion of the submarine cable from Java to Port Darwin, in Australia, has been too recent to admit of our obtaining details; but it is unquestionably the fact that we are at length telegraphically connected with our antipodes. How soon it will be before communication is established with the southern and most inhabited portions, we are unaware, but in all probability the difficulties of erecting the overland line have been found greater than was anticipated.

Among the other completions are the Holyhead and the several West India cables. The majority of the islands have been connected, and are now in telegraphic working order, but the largest extension, that from Jamaica to Panama, is still incomplete. It may be remembered that, in the attempt to lay this section, the cable broke, and, after some time spent in grappling, was temporarily abandoned, while the further extensions were proceeded with.

The principal of the new cables manufactured and laid during the past year are the German cable from Borkum (Emden) to Lowestoft, a four wire cable (Willoughby Smith's improved gutta percha) of very heavy construction; the cable in the Grecian and Turkish Archipelago, 554 knots; and the several cables for the French Government.

The Channel cable, it may be remembered, was prevented from departing by the Government, who had the opinion that it was a breach of the neutrality law. The cable and ship were, however, released, and the cable was laid for the French Government; but some little time after the war was over, a part of the cable was picked up to be used elsewhere. The Mediterranean cable was a greater undertaking, and was successfully laid between Marseilles and Algiers, over the route of the old cable, which had been speechless for some years. A fault, however, occurred after the laying and after some trouble the cable was successfully repaired by Mr. F. C. Webb. On this occasion, grappling was done in 1,000 fathoms, and the cable recovered, a great feat, considering the rough bottom of the Mediterranean.

A small amount of cable was laid in the Hebrides by the Post Office. This amount would have been increased but for the disastrous fire, which took place at the Silvertown Cable Works and destroyed a large amount of cable and machinery. The damage, however, was soon repaired, and the factory has been for some time again in working order.

A large amount of cable will be noticed as being manufactured for the Anglo-American and Falmouth and Malta Telegraph Companies; this was for repairs and alteration of routes. The Atlantic cables (both) were broken down during the early part of the year, and were not repaired until June. The 1866 cable, being found to be in very bad ground, as was imagined, was removed further south, and an extra amount of cable expended; they have since remained in good working order, and it is hoped they will remain so. The only other Atlantic interruption occurred on the Duxbury section of the French Atlantic cable. This was soon repaired, no interruption to communication being caused by it.

The repairs to the Lisbon and Gibraltar section occupied some time, and they not only included the removal of a portion of the cable from bad ground to a better place nearer the shore, but also laying a duplicate cable from Gibraltar, some little distance above the coast towards Lisbon.

Of the other lines, no interruptions have occurred except to the Great Northern, China, and Japan extensions, the Hong Kong cable having to be repaired; and the Japan section is now again in working order.

The Spanish Government have had their connection with the Balearic Isles renewed, and the Dutch Government have had a cable laid in the Straits of Sunda. The traffic from the West Indies to America has been found sufficient to allow of the duplication of the International Ocean Company's line from Punta Rossa to Key West (Florida).

From present appearances, the progress of submarine telegraphy this year will be small. A company appeared for the extension of a cable from Spain to the Cape de Verde Isles and to Brazil, but as several parties appeared to lay equal claims to the concessions, the project has for the present fallen through.

The silence for so long of two of the Atlantic cables seems to give talk of the laying of a fourth cable, and also of the possible acquisition by the British and American Governments of the existing cables. The laying of a fourth cable, we believe, is very likely to come to pass.

Pyroligneous Products.

One hundred kilogrammes of wood subjected to destructive distillation give 50 kilogrammes of a crude product containing: 2 kilogrammes of methylic alcohol, 3 of crystallizable acetic acid, 10 of tar, 15 of water, 20 of carbon remaining in the retort.

To obtain from this the acetic acid, requires a long and tedious process, consisting in saturating the acid with lime, precipitating this lime as sulphate by the use of sulphate of soda, which leaves acetate of soda, crystallizing this out and igniting it to drive out the tar, crystallizing and recrystallizing; and finally distilling with sulphuric acid, which gives the acetic acid. In manufacturing pyroligneous acid, the product of distillation is simply allowed to remain in contact with iron turnings until the acid is saturated. To purify the crude article, the author offers a new method, by which the acid may be sufficiently purified to be made to unite with soda, alumina, copper, etc., while the alcohol is saved. By distilling the wood with ten per cent sulphuric acid, the acetic acid may be readily separated; also by this method a yellow compound, insoluble in water cooled below 15°. On distilling dry wood at a *high* temperature (about 700°), gaseous products and an oil of extraordinary illuminating power are obtained. The method to be used is not precisely stated, but the author claims that a profit of over 18 francs can be made on every 100 kilogrammes of wood, by his process.—*M. Maiche.*

How to Bend Glass Tubes.

It is well known that it requires some tact to bend a tube with an even curve and without collapsing its sides, and many chemists never do succeed in bending them skillfully. Although having no particular skill in this matter, I never fail to bend them perfectly satisfactorily by using a flame different from the one usually employed; the flame is one given by the Bunsen burner, described in my article on alkali determination in silicates. (See *American Chemist*, Vol. I, page 407.) Use a Bunsen burner, having the extremity flattened out so as to give a short and thin but broad flame, something like the flame of an ordinary gas burner. The tube is placed in this flame and turned round and round until a good heat is given to the tube; it is then withdrawn from the flame and bent, when it does so with a perfect curve and no collapse of the sides of the tube. Of course this is only intended for the smaller tubes, but a tube of one third of an inch and more can be thus bent very readily.—*J. L. Smith.*

The San Gregorio Meteorite.

Six meteorites from this region have been thus far noticed five of which have been analyzed by the writer. Of the sixth, no specimen has as yet been detached. They were found within or very near the boundaries of the Mexican Desert, which is about 400 miles in width by 500 miles in length, and situated in the provinces of Cohahuila and Chihuahua.

Professor J. Lawrence Smith advances the conjecture, based upon his analysis and examinations, that five of these meteorites were derived from the same original mass, moving over the territory from northeast to southwest. Two of these meteorites are estimated to weigh three and four thousand pounds respectively.

The San Gregorio meteorite has an extreme length of six and one half feet, is five and one half feet high and four feet thick, and is estimated to weigh about five tons. An analysis gave: Iron, 95·01, nickel, 4·22, cobalt, 0·51, copper, a minute trace, phosphorus, 0·08.

THE WEST BLOOMFIELD GAS WELL.—Prof. S. A. Lattimore, of Rochester University, has recently made a careful photometric test of the illuminating power of the gas of the West Bloomfield well, and found it to be 14·42 candles. He estimates the flow of the well to be 800,000 feet per 24 hours. The main to convey the gas to Rochester is being rapidly laid down, and it is thought that the city will, before long, derive all its light from this well. Who knows but gas wells are to play a more important part in the world than oil wells?

STATE EDUCATION AND THE LABOR QUESTION.

There is every probability that these two subjects will occupy a large share of the attention of our legislative bodies for some time to come. Rudimentary education is free to all in this country, and the opportunity afforded to every one to acquire an education sufficient to read and write is a result of which we have some right, as a nation, to be proud. But technical education is sadly wanting in most of our States; and owing to this, and to the want of some good system of apprenticeship, the supply of native skilled labor does not keep pace with the demand, and the result is that our shops and manufactories are filled with mechanics and artisans from abroad, who bring with them the prejudices, existing among the laboring classes of the countries they come from which are antagonistic, in some respects, to our notions of free rights.

These truths are acknowledged by all our best thinkers and writers on the questions of labor and education, and recently Governor Washburn, of Massachusetts, in his inaugural address to the legislature of that State, has spoken candidly and sensibly on the subject. We are unable to give more than a few extracts from his excellent address; these are as follows:

"We shall not reach our highest development as a commonwealth until our elementary and classical schools are supplemented by institutions for instruction in the industries on which our prosperity so largely depends. Of our present population, probably two thirds are engaged in mechanical or manufacturing pursuits, or dependent upon those so engaged. The State has established an agricultural College for her farmers, and from the beginning of her history has dealt generously with such of her sons as aspired to knowledge of the higher branches of learning; but has done little for the education of her mechanics in their particular field of labor. Her duty to encourage and promote the special education of these classes rests upon two grounds; first, the welfare of the individuals directly concerned; and, second, the preservation of our manufacturing supremacy. A great part of the work of many manufacturing establishments is so dependent upon scientific attainment that it must ultimately take rank as a learned profession. Not only are a knowledge of chemistry and a somewhat extended acquaintance with mathematics highly desirable to the mechanic who aims at an advanced position in his trade; but skill in drawing is universally important and valuable, and it is with pleasure that I notice the introduction of teachers of drawing into some of our public schools."

On the subject of the condition of the working population, the Governor spoke to the following effect:

"I commend to your candid and cordial consideration the varied interests of those who are denominated the laboring portion of our citizens. The question of practical concern is not so much whether the condition of this class is better or worse here than in other sections of the country as whether that condition is satisfactory—whether it is what it might be made by honest and resolute endeavor, what it should be made by those who have the well being of the commonwealth deeply at heart. To this question I am sure no one will venture an affirmative reply. Neither is it of paramount importance to determine whether the situation of this large body of persons is better or worse than it was formerly. Our view should be forward and not backward. Many seem to hold the opinion that if the working men and working women, as they are commonly designated, receive constant employment and are adequately remunerated: if they gain the needful bread and meat in exchange for their labor, if they have comfortable homes and enough for the decent support of themselves and their families, it is their duty to be therewith content. But this is a narrow judgment of the matter in issue. They ought not only to perform their daily tasks faithfully, but be so circumstanced that they will perform them cheerfully. In so far as lies within our power, we ought to remove every just cause of complaint. Every human being should have higher and nobler aspirations than merely to provide food and clothing for the body. This should never content him. The head of a family ought to have time for study, thought, reading, recreation, innocent pleasure; he properly desires to give his children a better education than he had, and furnish them advantages superior to those he himself enjoyed.

The fact that there is unrest and dissatisfaction when man is confined to unremitting toil, is one of the brightest and most healthy omens of the times. It is an indication that his better nature is struggling for emancipation; it is a hopeful sign of finer and nobler manhood in the future. Such efforts for improvement should never be discouraged, but always encouraged. That there ever have been and ever will be grades of society, is true enough; the statesman should seek to diminish the distance between the extremes by elevating the lower. It has been said that as soon as the materials for the construction of society were brought together, they proceeded forthwith to arrange themselves in layers—the stronger, more nimble and more cunning of the living constituents climbing to the higher places, and forcing upon those below the office of upholding them in their elevation. As the pyramid was originally built, so it remains in its general design. Within the heaving mass of multitudinous life, individual atoms are constantly changing places, but without destroying, however much disturbing, the primitive distribution into layers. These are still disposed one above the other, in a gradually diminishing series.

Standing still is not the province of society; it must either advance or retrograde. Especially under such a government as ours, change is almost a normal condition and an inherent necessity. The pyramid continues to uplift itself as an entirety; but atoms in the bottom layer of to-day may be in top layer of to-morrow. Hence one reason why it becomes us to fairly and honestly examine the conditions of the laboring classes, upon whom the whole superstructure of the social organism rests. Because they are a part of ourselves, it devolves upon us to relieve them, as far as possible, from the grievances to which they are subjected. Their existence is not separate from the existence of the State; what tends to to their welfare is calculated to promote the general welfare; in the last analysis their interest is identical with the interest of the upper classes; the least addition to their comfort is a gain to the whole community; and if their case is considered in the right spirit, there is no good cause for antagonistic feeling.

The question raised by them and in their behalf can never be adjusted by the two extremes—those anxious to secure the greatest possible amount of pay for the least possible work, and those anxious to obtain the greatest possible amount of work for the least possible pay. Nor will relief come with the determination how many hours shall constitute a legal day's work. For no period can be fixed which should be applicable alike to all. The ingenious, skilled laborer who uses mind as well as muscle cannot apply himself the same number of hours to his task as he who merely handles the hoe or shovel, holds the plow or drives the oxen, uses the trowel or weaves at the loom. The great *desideratum* is to determine what would be a fair division of profits between the employer and the employee. Settle the question as to compensation per hour, and there will be no serious difficulty about the number of hours. Let us not expect to adjust the issue confronting us by lecturing the laboring classes. We must be willing to meet them on their own ground and discuss the matter at stake from their point of view."

Artificial Milk.

M. Dubrunfant contends that milk is simply an emulsion of neutral fatty matter in a slightly alkaline liquid, such as can be artificially imitated; and that the process of churning consists in hastening the lactic fermentation, thereby acidifying the serum of the milk, and at the same time agglomerating the fatty matter which the acidity sets free from its emulsion. He further controverts the cellular theory, by showing that the fat globules of milk do not display any double refraction, as do all organized membranous tissues.

Having thus examined the theoretical constitution of milk, he proceeds to the practical method of imitating it, and gives the following directions: Add to half a pint of water, an ounce and a half of saccharine material (cane sugar, glucose, or sugar of milk), one ounce of dry albumen (made from white of eggs), and 20 or 30 grains of subcarbonate of soda. These are to be agitated with an ounce or more of olive oil or other comestible fatty matter until they form an emulsion. This may be done either with warm or cold water, but the temperature of from 50° to 60° C. is recommended. The result is a pasty liquid, which, by further admixture with its own bulk of water, assumes the consistency and general appearance of milk.

Luxuriously minded people, who prefer rich cream to ordinary milk, can obtain it by doubling the quantity of fatty matter, and substituting 30 or 40 grains of gelatin for the dry albumen. The researches of Dumas and Frémy having reinstated gelatin among the nitrogenous alimentary materials, M. Dubrunfant prefers gelatin to albumen; it is cheaper, more easily obtained, and the slight viscosity which it gives to the liquid materially assists the formation and maintenance of the emulsion. He especially recommends this in the manufacture of "siege milk" on account of the obviously numerous articles from which gelatin may be obtained.

The uses of artificial milk need not be limited to supplying the wants of the residents of besieged cities. As an ordinary element of the human breakfast table, it is not likely to supersede the product of the cow, but calves are suggested as being superior to vulgar human prejudices. In the ordinary course of rearing, these animals demand a large proportion of the milk of their mothers, and are commonly ill fed or prematurely sacrificed on that account. By feeding them luxuriously on artificial milk (which may be still further cheapened by using colza oil, which has been rendered tasteless and alimentary by the frying process), the milk, butter, and cheese of the cow may be considerably economized, and the supply of veal improved, both in quantity and quality, by keeping the calves a much longer time before they are killed.

I might make further suggestions in the direction of "dairy fed pork," etc., but this is unnecessary; the commercial instinct is sufficiently strong to avail itself of all such cheapening applications of science. Those who are professionally engaged in detecting the adulterations of food will do well to study the physical peculiarities by which M. Dubrunfant's milk may be distinguished from that of the cow, both in ordinary and condensed form. By substituting vegetable albumen for the white of egg or gelatin, the vegetarian may prepare for himself a milk that will satisfy his uttermost aspirations.—*Nature.*

The *Milk Journal*, commenting on the foregoing, says:

Prejudice, *Nature* appears to think, would prevent this excellent concoction from being taken at breakfast times instead of the produce of the cow. But our contemporary believes that calves would rise superior to human prejudices, and accept it with thankfulness, or greediness which, in such cases, would be a calf's substitute for thankfulness.

Such of our readers as are familiar with the composition of milk will be amused with the expedient of substituting carbonate of soda for the phosphate of lime and salt, which form the mineral constituents of real milk, and will suspect that "the strictly scientific manner" which governed this procedure consisted in falling into the vulgar error which was exposed in our pages some time ago. The albumen derived from white of egg is a very different thing from casein chemically considered, as we have pointed out, and as Hlasiwetz and Habermann have also shown still more recently. Butter fats, too, we think, may easily be distinguished from olive oil.

Marble Dressing and Carving Machine.

This machine consists in a tubular stock or case, containing a drill or carving tool capable of reciprocating or rotating, or both, jointed, to the end of a rod or shaft mounted in a tube pivoted in the top of a stand, so that it can oscillate, around the vertical axis of the stand and also on its own axis, while it can slide freely endwise.

This rod carries at one end a pulley and crank or eccentric shaft for actuating the drill for causing it to strike blows, while it is slowly turned by the hands of the attendant. Or the shaft may gear with the shaft of the drill by bevel gears, to give it a constant rotary motion while being held in contact with the work by the attendant; and motion is imparted to said shaft by a belt working from a driving pulley below, over a guide pulley in the top of the stand, under the rod, and thence in one direction to the pulley working the drill, and in the other direction on a guide pulley in the opposite end of the drill holding rod, in such manner that its action is not interfered with by the shifting of the drill holding rod endwise.

When this machine is run at a high speed—say two thousand strokes per minute—it is claimed to be very efficient in carving and sculpturing upon marble, being perfectly manageable and capable of having the drills pointed in any direction, and will do the cutting required in lettering marble as fast as the tool can be properly guided and directed on the surface by an expert,

The inventor and patentee is Mr. Greene V. Black, of Jacksonville, Ill.

Professor Tyndall and the Boys.

Professor Tyndall—the best of all living *savans* for making the truths of science familiar to the meanest understanding—signalized the Christmas anniversary in London by a talk to the boys. A correspondent says of him:

Dr. Tyndall, talking to boys, is more like an older and better informed boy than the others, chatting with them, than I thought it possible for a Professor to be; while his illustrations and asides take his address completely out of the dull and dry category, and put his young audience completely at their ease. Why, he lit a cigar in one of his experiments, and positively smoked it for a second or two; telling us all that when he did the same thing some years ago at Cambridge, he astonished the dons there very much. "I don't suppose any one had ventured to light a cigar in the Cambridge Senate house before," remarked the Professor, "and the great people assembled in it looked as if they thought I oughtn't to have taken the liberty." This said, while a cigar is being lit, and as a prelude to its being put between the professional lips and puffed at, delighted the boys and girls. One professor outraging the conventional susceptibilities of other professors, and telling the story as a good joke, is just the thing to hit boy nature, and if Dr. Tyndall had wanted volunteers for a desperately forlorn hope, my opinion is that he might have counted upon half the lads present.

Again, when explaining the process by which frost and snow had been produced on one of the vessels before him, and scraping the snow from its sides, the lecturer won all hearts. "There's more snow than I expected to find; enough, you see, to make a snowball; and if I were very wicked, I could actually (doing it) make a snowball out of what is here, and pelt Mr. Blank (the lecturer's assistant) with it." Professor Tyndall suited the action to the words, and having compressed the snow until it was hard and compact, took elaborate aim at the gentleman assisting him (whose back was turned), and sent the snowball spinning past him and within a foot of his head. It may be imagined how the boys roared at this; and though these illustrations were exceptional, the pleasant, friendly, and familiar manner and speech maintained throughout were equally noteworthy, as were the surprising pains taken to follow each chain of reasoning fairly out. The boys or girls who fail to master the principles of what is being put before them at the Royal Institution must be singularly obtuse.

The Air in Wells.

Mr. J. S. Kessler, of Allentown, Pa., writes as follows: "I was sent, to an ore bed in the vicinity, to examine or repair a pump in a well about 80 feet deep. The well was open, with a temporary shed over it; it was close to the engine house. The sky was cloudy, and the atmosphere very damp. On descending, the light was extinguished at about 20 feet from the surface; and a similar thing occurred on a second attempt, which was made after throwing several buckets of water into the well. As I did not feel inclined to go down, the engineer assured me that he had been down on several occasions under the like conditions; whereupon I agreed to see him go down. Finding him to be all right after an interval of a few minutes, I ventured down, having previously opened the roof directly over the well to admit the light. Nearly an hour was spent in repairing the pump, during which time the engineer made several attempts to strike a light, but had no success. I did not experience any inconvenience other than the very fast breathing caused by any physical exertion, and on coming out I felt as well as before. Being somewhat acquainted with natural philosophy, which teaches that air which does not support combustion cannot support animal life, I am puzzled at the apparent contradiction. What could have been the cause of it? I cannot entertain the opinion that it was carbonic acid gas."

REMOVAL OF OIL FROM WOOL.

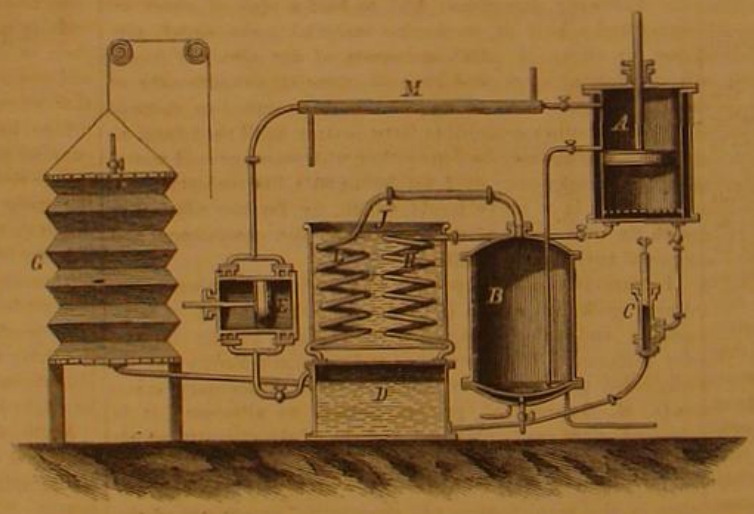
This method of separating oils, fats, and resins, from the solid substances with which they are mechanically combined has been heretofore in use for the purpose of removing the animal oil from wool, and also for the purpose of cleansing and restoring to use those portions of fleeces which have been made unavailable by marking the sheep with tar or other resinous material. It has been employed for supplementing the mechanical process of separating oil from seeds or olives by operating on the solidified residues which are known under the name of oil cake, *marc*, etc. At the International Exposition of 1862, Mr. E. Deiss, of Paris, exhibited specimens of superior oils extracted in this manner from the *marc* of olives. Mr. Payen, in his report on that exposition, has described the process as originally applied successfully to the cleansing of wool by Mr. Moison, of Mouy, Department of the Oise, in France; and as this process illustrates the principle of the operation in other cases, though the details may be different, Dr. Barnard, in his report, gives it in abridged form.

It is to be observed, in the first place, that the case of wool presents a difficulty, which is not encountered when the object in view is only to obtain the oil which the substance operated on happens to contain.

The wool itself is in this case the important material, and the value of the oil separated from it is a trifle of secondary consequence. In the original experiments the point of difficulty in the practical problem was found to be how to expel the bisulphide from the wool after the operation of solution had been completed, without injury to the wool itself. Too great heat, in whatever manner applied, was found to have the effect of hardening the fibers, making them cohere, and giving them a tinge of a yellowish brown color, which was variable in intensity according as the material had been a longer or shorter time in contact with the fatty matters removed. The mere volatilization of the bisulphide was effected without difficulty. It sufficed for this to introduce, into the vessel containing the material to be operated on, either boiling water or steam; but the injurious effects above described invariably followed. Mr. Moison discovered at length that with proper arrangements a current of air heated to a temperature considerably below that of boiling water, 70° or 80°C—160° to 175° F., would remove the liquid entirely, and leave the fiber of the wool wholly uninjured.

The apparatus employed in conducting this process is shown in the engraving. The wool to subjected to the operation is introduced into a cast iron cylinder, A, surrounded by a jacket into which steam may be conducted when it is necessary to raise the temperature. One hundred kilogrammes, say two hundred and fourteen pounds, of wool are placed in this cylinder at once.

There is within the cylinder a false bottom perforated with numerous holes, with a small free space beneath it. Upon the top of the wool is placed a circular follower or compressor, fitting the interior of the cylinder, and perforated also with holes like the false bottom. Three rods connected with this follower pass through stuffing boxes in the lid, and may be driven downward by means of fixed screw nuts, the rods having screw threads cut upon their prolongations above the cylinder. The object of this arrangement is to compress the wool to a certain extent, since the success of the operation is always most satisfactory when the mass of the material is reduced in advance to about one half its original volume.



The lid is secured air tight by means of bolts and screws, a leaden washer being introduced into the joint. Matters being thus prepared, liquid bisulphide of carbon is thrown into the cylinder beneath the false bottom by means of a forcing pump, C, which draws the liquid from a reservoir, D. This liquid rises through the perforations and completely immerses the confined wool, reaching at length a point above the perforated follower, where it finds a lateral overflow tube. This conducts it into the still or alembic B. Here the bisulphide is volatilized by the heat of steam, which is introduced into the double bottom of the vessel and also into the midst of the liquid mass itself by means of a spiral tube within the alembic, not shown in the figure. When the process is complete and the oil in the alembic is entirely free from the bisulphide, the stopcock beneath permits to withdraw the product. Before this is done, however, steam is introduced into the mass of the impure oil by means of a second spiral tube, which is also not shown, and which is perforated with numerous holes. The design and the effect of this part of the process is to remove the last traces of the solvent.

The vapor of the bisulphide is conducted from the alembic to the refrigerator J, where it is condensed in the spiral L, and is finally returned to the reservoir D.

There is a stopcock in the overflow tube which leads from A to B, through which may be withdrawn at any time a few drops of the liquid passing through the tube. When the specimen thus withdrawn, on evaporation upon glass, leaves no trace of oil or other residuum, the operation of the pump C, may be suspended. For a short distance, this tube is of glass for the purpose of enabling the attendant to observe the color of the passing liquid.

The process of solution being complete, communication with C, is cut off by means of a stopcock, and two other stopcocks are opened. One of these permits the liquid, in A, to descend through the spiral H, to the reservoir D. The other allows air to be introduced into the upper part of A by means of the double acting piston blower, E. The air, as the figure shows, may be drawn from D; but the stop cock beneath E is a three way cock, and it allows the supply to be taken also from the atmosphere. In passing from E to A, the air is conducted through the jacketed tube, M, and steam is introduced into the jacket to heat it to a degree sufficient to complete the volatilization of the bisulphide in A. But the first part of this operation, which consists in the mechanical expulsion of the bulk of the liquid in A, may be conducted without heat. The cock in the tube leading from A to H is a three way cock, as well as that beneath E. At the close of the operation, the air blown through may be discharged into the atmosphere without passing through H. In that case it is conducted, by a long tube not shown, out of the building, in order that any disagreeable odor which may accompany it may not annoy the attendants. The two spiral tubes, H and L, pass out of the refrigerator J, before entering the reservoir D. At these points they are provided with small stopcocks not shown, to permit the examination of the substances passing through them. Into each of these tubes, also, as into the one leading from A to the alembic, is introduced a short glass tube as a part of its length, so that the interior of any one of them may be inspected.

There remains one additional portion of the apparatus to be mentioned, which is the gasometer G. While the process is proceeding without any communication with the atmosphere, the volume of the confined air may vary with the temperature, or with the compression in A, and the volatilization of the bisulphide will also add something to the bulk of the aeriform mass. The gasometer, which may be as represented of the bellows form, or may be the ordinary bell and cistern, will serve to keep the capacity of the apparatus properly adjusted to the varying volume of the contents.

The boiling point of the bisulphide of carbon is 48°C—118° F. If the air introduced into A is therefore heated to 70° or 80° C., the volatilization will be rapid; and this temperature does not effect injuriously either the structure or the color of the wool.

A considerable economical advantage is obtained by this process, in the mere recovery to use of considerable quantities of wool which have been ruined by the pitch employed in marking. The animal oil separated has also some value.

But the same process employed to dissolve the oils contained in the strippings of machine cards in factories, which amounts to one third of the entire weight, is the source of a considerable saving. This oil is what has been added in previous stages of the manufacture; and, after being thus recovered, it may be used again.

The wool which has been freed from oil by the process above described, on being subjected to the operation of the picking and beating machines preliminary to carding, yields a large proportion of fine fragments, or what may be called wool dust, said by Mr. Payen to amount to forty-two per cent of the total weight. This is valuable as a fertilizer in in agriculture, and is so turned to account. Under former modes of treatment, it was a total loss.

But the application of the process above described has been more recently extended to a great variety of purposes. Thus, when the pitchy glycerin deposits formed during the saponification with sulphuric acid—which is made a preliminary to the distillation of fatty bodies—are acted upon by the bisulphide, they yield a considerable quantity of stearin amounting to eighteen or twenty per cent of their weight. The waste grease of the kitchen, the exudations which take place from the axles of vehicles or the journal boxes of machinery, and all similar forms of oils and fats, contaminated by impurities which, though they form but a small part of the weight, destroy entirely the value, are completely restored by this process, which recovers the valuable portion, and leaves the impurities behind. Rags, swabs, and fibrous materials of any kind, which have been employed in cleaning machinery or the parts of locomotives which it is necessary to oil, soon become saturated to such an extent that they are commonly thrown aside as useless; but these give up a large amount of oil to the solvent employed in the new process, which is in itself a gain; and the process also gives to the rags themselves a value which they had lost, since it permits them to be re employed for the same purposes as before, or to be used in the manufacture of paper.

In the direct extraction of wax by pressure, there is left in the solid residue a proportion of twenty per cent of valuable material which may be recovered by solution in bisulphide of carbon. This does not render the residue unfit for use as a fertilizer (the purpose to which it is commonly applied), but rather improves it. Sawdust, which has been used for the filtration of oils purified by sulphuric acid, yields to this process fifteen or eighteen per cent of its weight. The acid impurities separated from oils in the process of purification by agitation with a small proportion of sulphuric acid, furnish by proper treatment with bisulphide of carbon half their weight of pure oil.

Bones of animals obtained from shambles, from the streets, from kitchens, and from various other sources, are used to the extent of many millions pounds annually in every country, for the manufactures of glue and of animal charcoal. These are usually to some extent exhausted of their oils by boiling, before being used in the manufactures for which they are intended; but the boiling separates only six or seven per cent, while the bisulphide process extracts ten or eleven. The oil cakes, which are formed in the mechanical process of the expression of oils from seeds of various kinds, furnish, as mentioned above, a large proportion of oil which the press has left behind. These cakes are sometimes *broken* up, reduced to powder, and pressed again with the aid of heat. But the labor of the second compression is greater than that of the first, and the product is less, while it still leaves the residue unexhausted. The cakes have a value as food for animals. It was at first supposed that the complete removal of their oil would injure them for this use, but experience has shown this impression to be an error. It is asserted by Messrs. Schlinck and Rutsch, the exhibitors, to have been fully proved by experiments on a large scale already made, that in regard to the production of milk, butter, and flesh, the residua from which the oil has been thoroughly extracted are far superior to the pressed cakes, and that they retain their good qualities as food for animals though kept long in store.

The compacted masses, left in the extraction of tallow or lard by pressure, furnish twenty per cent additional when treated with bisulphide of carbon. The residue from the compression of cacao gives a similar increase of product on similar treatment. Finally, the *marc* of olives, as exemplified in the exposition of Mr. Deiss, furnishes quantities of excellent oil, which the press fails to separate.

The peculiarity of the industry of Messrs. Schlinck and Rutsch is that they do not take the trouble to use the compression process at all in their treatment of the oleaginous seeds from which their oils are obtained; that is to say, they do not first extract a portion of the oil by pressure, and then subject the residuum to the action of the solvent, as has been done by others before them.

Cleaning Watches and Clocks.

This invention consists in immersing the "movements" of clocks and watches in naphtha or some equivalent volatile liquid, and exposing them to heated air, thereby, it is claimed, saving much time and expense.

The inventor thus describes his process: "In carrying out my invention and discovery, I in the first place take the "movement" of the watch or the clock from its case; and in case the watch has a "dust-proof cap," that also is removed, so that the liquid will have a free circulation through the works. I now hold the movement with a pair of pliers or other instrument, and immerse it in pure naphtha or other pure volatile liquid of a similar nature. While the movement is immersed it is moved about or twirled in the liquid, so that all parts will be exposed to its action, and so that the liquid will pass rapidly through the works, and wash the dust and clean away the old oil. This operation is completed in a few minutes, after which the movement is exposed to air heated to a temperature a little above that of the surrounding atmosphere.

The evaporation of the naphtha or other volatile liquid is so rapid, after the movement is taken from it, that, unless it is exposed to artificial heat, the moisture of the common atmosphere will be condensed upon it, giving it the appearance of "sweating." From this higher temperature, the movement is cooled down gradually to that of the surrounding atmosphere. The pivots or frictional points are touched with lubricating oil, and the work is done.

The whole process necessarily occupies not more than six or eight minutes of time. The result is satisfactory in every particular, as frequent experiments have proved, while the actual cost is almost nothing when compared with the price ordinarily charged for cleaning watches and clocks. No taking to pieces and brushing can make the parts more perfectly clean and bright than my process."

Mr. William W. Thompson, of Smithville, Ga., has just patented this invention through the Scientific American Patent Agency.

BLEACHING.—The residues from the manufacture of chlorine, consisting chiefly of chloride of manganese, are treated with chalk to precipitate the iron; after separating the liquid from this precipitate by decantation, the manganese is precipitated as sesqui-oxide by lime. This last, by heating with soda in a current of air, gives the green manganate of soda. The mass contains 50 to 60 per cent of pure manganate. On mixing it with sulphate of magnesia and adding water, a solution of permanganate is obtained. The principle on which the bleaching depends is the deoxidation of the permanganate in contact with the coloring matters accompanying vegetable or animal fibers. A deposit of oxide of manganese is formed on the goods, which, by the action of sulphurous acid, is converted into sulphate of the protoxide, and may be washed out, leaving the goods white. The sulphurous acid is prepared by heating dry copperas with sulphur to a low red heat.—*Tessie du Motay.*

WROUGHT IRON AND STEEL POSTS.

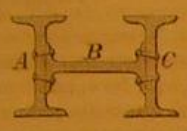
The accompanying engravings show the construction of a wrought iron or steel post, for which a patent has just been obtained by W. A. Gunn, of Lexington, Ky., through the Scientific American Patent Agency. It is intended to take the place of cast iron columns, and box, cylindrical, and other forms of posts, chords for bridges, and columns for buildings, for which it is claimed to be a very economical device.

It consists simply of three I beams united in the form of

Fig. 1



Fig. 2



the letter H. The inventor claims for it the following advantages: All the material is useful to sustain the weight, no loss being incurred to obtain stiffness; the component parts of the post, being among the most rigid forms of wrought iron, may be regarded as perfectly stiff for longer distances than the parts of boxes or columns, and hence less riveting is required than in others, less cutting of the material, less labor, and less weakening of the post, so that, it is claimed, one fourth the rivets used in the ordinary forms will be sufficient in this; as a post yields by flexure, it is strong in proportion to its ability to sustain a cross strain; the I beam being considered the strongest form to resist a cross strain, and this post being really an I beam in both directions, the inventor adopts it as adapted to this purpose; it will also, on this account, be useful for girders and bridge chords; the riveting, being on the interior part of the post, weakens it less than when on the exterior part; it is also adapted to the parts of bridges which may be subjected to tension as well as compression; as different sizes of beams may be used at will, the dimensions of posts may be easily graduated to any size required; the parts being quite a common form of iron, no special machinery is required for their construction; the whole surface is exposed and can be painted readily, while hollow posts are liable to be injured by rust on the inner surfaces.

In the engravings, A, B, and C represent I bars or beams of wrought iron or steel. The bars, A and C, are placed with their sides against the edges of the bar, B, and are riveted as shown, the rivets passing through the flanges of B, and through the webs or bodies of A and C. The rivets are not placed opposite each other in the different bars, and, as above stated, are placed further apart than in ordinary beams.

Patented January 2, 1872. For further particulars, address the patentee as above.

Elevators for Private Houses.

This is a small, light, cheap, and economical elevator, principally adapted for use in private houses, the "cage" or "car" of which is constructed of wire, the elliptical shape being preferred, and attached and detached at pleasure, by suitable means, to an up and down, continuously moving, endless chain.

The chain passes around pulleys at the top and bottom of the passage, and is propelled by a motive power competent to pull up and down about one half the maximum weight proposed to be elevated or lowered. The cage is guided up and down by a suitable number of wire rods or ribs, which press outward against the guides, in which are gaged suitable slots for retaining the rods.

The counterpoises are so attached as to pull against the weight, which causes the ribs of the sides to spring inward, away from the guides, so as to move freely up and down. Whenever disconnected, the ribs of the cage spring outward and bind against the guides, the friction being increased, if necessary, by short bends in the rims at the top, which, when not pulled by the counterpoises, will enter notches cut at the back of the slots. One of the ribs has a bend or two to catch in notches in that guide which is between the up and down running parts of the chain, and has a hook on each side, so that by springing the rib inward and sidewise a hook will catch in the chain, and the rib will be released from the guide.

The hook on one side will, at pleasure, catch on that part of the chain running upward and thus pull the cage up; or the other hook, at pleasure, will catch on the down running part of the chain and pull against the counterpoises and lower the cage. There is on each side of the rib an eccentric button, held in one position by suitable springs; by pulling properly attached cords or wires the buttons are turned so that either one, at will, will pass behind the rib, and first press it inward and then sidewise until the hook catches the chain on the opposite side; by turning the other button, it will be released, and the rim will then fly back into position and hold the cage stationary. There are suitable projections arranged—one at the top, the other at the bottom—which will catch upon a button and release the rib which is attached to the chain, and prevent the cage from being pulled against the ends of the passage way. If the chain should break, the hook being released will allow the rib to fly back into its normal position and hold the car stationary.

Although an endless continuously moving chain is employed, the inventor does not limit himself to it, for it may, at pleasure, be varied, and the cage be moved in both directions by one part; or a chain winding on and off drums at each end of the way, and having reversible driving gear, will be applicable to the apparatus without any material change of the latter.

Mr. James D. Warner, of Brooklyn, N. Y., is the patentee of this invention.

ALBERT'S METHOD OF SECURING FLAG HALYARDS.

Flags are used in the aggregate not more than one month in twelve, yet, in the usual way of securing halyards, they are subjected to constant strains during wet weather, and are whipped by the winds in dry weather, so that they are worn fully as much when out of use as when employed. On the ferryboats, they are usually wound spirally about the pole, forming by their attrition a stripe where the paint is worn away, making the staff appear like a veritable barber's pole. When flags are used on buildings, the halyards are usually wound so tight on the cleats that when wet they are either parted, stranded, or weakened by the contraction of the rope, and are unable to support the flag when again hoisted. To repair and readjust them requires some one to climb the flagstaff, a kind of operation for which few are fitted except telegraph pole climbers, who, with their artificial spurs, mar the pole and injure its beauty. Now, by the invention illustrated in the accompanying engraving, all these evils and inconveniences may be avoided, and the halyards, which are the most expensive kind of rope of equal weight used on shipboard, may be preserved for a long time in perfect order, and at all times ready for use.



The invention consists of three pieces, namely, a bent bar having a footstep which is attached by three screws to the flagstaff, or having this part modified in form so as to be conveniently seized to the backstays on shipboard, a traveller or weight which slides up and down on the vertical part of the bent rod aforesaid, and, third, a fair-leader, which keeps the bite of the halyards separate in all weathers and prevents them from whipping the mast. When the flag is up, the halyard is belayed to the cleat. When the flag is down, it is belayed to the traveller.

The traveller has a belaying pin to which the halyard is belayed, as shown, the pin being wound with tarred cord to prevent wear of the rope, as is also the fair leader. This simple and common sense invention can be applied at small expense, and would, if employed, save much money and trouble to the users of flags.

The invention was patented September 26th, 1871, by Captain William Albert, an old sea captain, who has learned by experience the value of a better method of securing halyards than existed before his ingenuity supplied the deficiency.

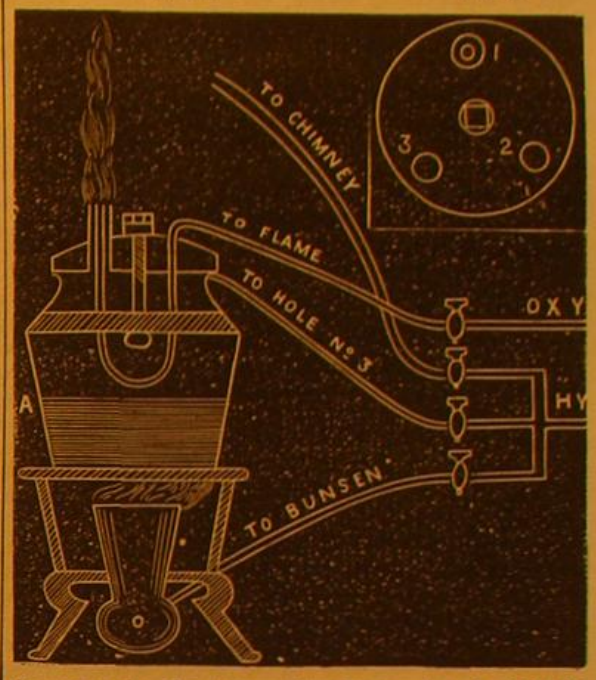
Further information may be obtained by addressing Capt. James Borland & Co., Ship Chandlery, No. 53 South street, New York.

SULPHIDE OF BISMUTH.—Bismuth, in the presence of or in combination with sulphur, yields a beautiful red coating, when passed before the blowpipe on a large piece of charcoal, upon the addition of a little pulverized iodide of potassium. A finely pulverized mixture of equal parts of sulphur and iodide of potassium is best kept for such purpose and makes an excellent test material for bismuth. In making these investigations, V. Kobell met a green mineral which occurs associated with joseite at St. José dí Madureira, Brazil, and which proved to be bismuthite, not previously noticed at that locality.

THE PHOSPHORIC LIGHT.

The apparatus consists of an iron vessel, A, into which sticks of phosphorus are introduced. That used at the Manchester Photographic Society's meeting was five inches in its largest diameter and three and a half inches in depth, having a capacity of twenty eight fluid ounces. This vessel is fitted with an iron cover of substantial thickness, ground so as to fit air tight to it, and secured in its place, when required, by a cross bar inside, fastened with a bolt and nut. Three other holes are also bored through this cover, as seen in Fig. 2, that marked No. 1 being half an inch in diameter, and having a piece of brass tube about an inch long screwed into it, with a narrower tube inside. This is the jet through which the phosphorus vapors issue, and the smaller tube conveys the oxygen required to supply the flame, the oxygen passing through the tube, entering the hole 2, and being conveyed, as seen in Fig. 1, through the vessel, A, containing the phosphorus, up through the middle of the jet at which the phosphorus vapors are burned. It is indispensably necessary that

Fig. 1. Fig. 2.



the oxygen should not escape into the vessel, A; for, if it did combustion would take place in the vessel itself, and would probably lead to an accident. The other hole, 3, is for occasional use, and is fitted with a pipe for the introduction of common coal gas under such circumstances as will be hereafter mentioned. The vessel, A, is placed upon a stand over a large Bunsen burner, and with it is enclosed in a capacious lantern, furnished with plain glass front, and with silvered reflectors behind. The lantern is also supplied with a chimney communicating with the outer air, and having a gas burner inside it to produce a strong up draft before commencing to experiment.

When all is arranged, three or four ounces of the element phosphorus are thrown into the chamber, A, and the lid screwed down. The apparatus is then placed in the lantern, and the Bunsen burner beneath it is lighted. The phosphorus inside soon melts and inflames, burning until the oxygen in the chamber is consumed, and causing the emission, at the jet, of a small quantity of white smoke (phosphoric anhydride). After a while ebullition takes place, and bright flashes of flame spontaneously appear at the nozzle. If the heat be sufficiently applied, the flame becomes continuous, and extends in hight in proportion to the rapidity with which the gaseous phosphorus is evolved, burning with considerable brightness. If, however, sufficient heat be now applied to make the flame quite continuous, and a current of common coal gas be passed directly into the chamber through hole 3, this gas and the phosphorus become associated together, and burn at the jet with a brilliant flame entirely under the control of the experimenter. When the experiment was performed before the Manchester Photographic Society, this flame varied between fifteen and twenty inches in hight; and upon the introduction of the oxygen, its brightness became so greatly augmented as to render it almost unbearable to the eye. The readers of this journal may judge for themselves whether or no a room is not brilliantly illuminated by a flame eighteen inches in length, and so bright throughout the whole of that eighteen inches as to be almost unbearable to the sight. When the writer says the illumination of a room by this light is far greater than is possible by a single oxyhydrogen light as ordinarily employed, he is not making any idle boast of one inflated with his own idea, but is simply stating what was proved to be the fact at the most numerously attended ordinary meeting ever held by the Manchester Photographic Society.

In making use of the apparatus here described, the writer found it convenient to have all his taps near together, as shown in the diagram, so that, without moving about, it would be possible to increase or diminish the heat beneath the phosphorus chamber, accelerate or lessen the draft in the chimney, augment or suppress the supply of hydrogen to the chamber, and add to or take from the quantity of oxygen introduced into the flame.

What efforts have been made for the commercial introduction of the phosphoric light have, thus far, been unavailing, because of the strong prejudices which are entertained against the use of phosphorus. It is true, an accident with this substance might prove a very disastrous affair, as acci-

dents with gunpowder and steam have proved; but gunpowder, steam, and phosphorus, may all be used, in suitable appliances and with ordinary care, with a very small amount of fear of any mischance.—*British Journal of Photography.*

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Condition of the Models at the Patent Office.

To the Editor of the Scientific American:

Permit me to call your attention to the condition of the models in the Patent Office. For want of room to properly store them, these models, in many instances, are left around on the floors, piled on the tops of the cabinets and on each other on the shelves, so that it is almost impossible to make an examination of them; many are also broken from this cause. In some cases, there are bushels of broken pieces of models, the uses of which can only be guessed at.

The present efficient head of the model room is doing all that he can in properly arranging and classifying the constantly accumulating models; but with the limited amount of space at his disposal it is impossible to do all that should be done. Some space has been made by disposing of parts of the rejected models, and also by placing small shelves between those already in the cabinets, but in many instances these shelves hide the models and interfere with their proper examination, thus necessitating a frequent handling where sight alone would be sufficient but for the second set of of shelves. Even with the most careful handling, models are frequently broken.

To remedy this, two things must be done immediately. More room must be provided, and the models dispensed with in all new applications not absolutely requiring them to explain the invention sought to be patented. To continue the present system, a new set of model halls as large as those now used would be required every seven years at the present rate of accumulation, which amounts to about twenty thousand annually. At this rate, without counting any increase in the number of patents granted, the number of models now in the office would be doubled in the period mentioned. You can thus see the necessity of some immediate change.

Some additional space might be obtained by building more galleries on the top of the cases in the north and west halls, which could be lighted through the roof. This would help for a year or two, but sooner or later the present system will have to be abandoned—useful as it is to point out what has already been done—and so prevent inventors from wasting their time, money and talents on machines that are already patented by others.

In every case where the model is dispensed with, as proposed, the applicant should be required to furnish drawings in perspective, where the case could be properly illustrated in this manner, a copy of which, at the patentee's expense, should be mounted on card board and varnished, and placed

with its appropriate class in the model cabinets. Such a drawing would last a long time, and should it be defaced or worn by handling, it could be easily replaced by one of the photo-lithographs issued with the patents. The necessity for perspective exists in the fact that a majority of non-professional people cannot readily understand a mechanical drawing.

If some such system as this is adopted at once, it will be comparatively easy to find room for the models of such applications as absolutely require them for the proper illustration of the invention; but under the present style of proceeding, the halls are being filled with a large number of models of devices that drawings would show just as well, without taking up a tithe of the room, and at the same time save inventors the difference between the cost of the drawings and models.

The present Commissioner has been too short a time in his office, or too busily employed in his other duties, to appreciate the difficulties caused by the present limited space in the model halls; and I, therefore, appeal to you, as "the power behind the throne" and the special guardian of the rights of inventors, to see that some remedy is applied immediately.

There are now about seven hundred and fifty thousand dollars in the Treasury belonging to the Patent Office, nearly all of which has been taken from poor inventors who could ill spare it; and the least that should be done is to provide sufficient room, for the models that applicants are compelled to furnish, and to so arrange them that they shall be readily accessible for examination; and if space cannot be found, then the inventor should not be required to go to the expense of a model which the Patent Office cannot find room properly to exhibit.

Washington, D. C. INVENTOR.

Expose of the Tricks of the Davenport Brothers.

To the Editor of the Scientific American:

As Dr. Vander Weyde has finished what he considers to be an expose of the Davenport Brothers, I submit for the consideration of your readers a totally different view of the matter: they can judge who is right.

The Davenport Brothers do not depend on their ability to untie the cords with which they are bound; in almost every case, this would be impossible for them to accomplish in time to satisfy the spectators. A statement of what I have witnessed will serve to illustrate and prove what I assert. I have seen the brothers tied by experts, with such a number of ropes and complexity of knots, all drawn as forcibly as a strong man could pull them, that it would have taken at least thirty minutes for the most dexterous manipulator to have loosened one hand, the knots of the ropes on the wrists and legs being sealed with wax. In five seconds by the watch, after the doors were closed, a naked arm and hand were projected from the hole in the middle door, grasping a large bell and ringing it. The doors were opened upon the indrawing of the hand, and the fastenings on both wrists and legs examined critically and found to be secure, and the seals unbroken. The fact is they perform all of their tricks with free hands and at the same time do not untie a single knot. Dr. Vander Weyde says that the smallness of their hands aids them to undo the fastenings; this is true, but not in the way the Doctor understands it. They have false hands and wrists] these are made of gum, and so closely resemble nature, both in *form* and color, as to mislead all who are not expecting deception in that way; the feeble light in which they perform their tricks assists to secure them from detection. The wrists of these counterfeit coverings extend up the arm a sufficient distance to be covered by the sleeve of the shirt, and have flat hoops or rings of thin sheet metal embedded in the substance of which are composed, so as to keep them open and prevent a collapse under the pressure of the cords. These counterfeit hands and wrists are of ordinary size, and yet are large enough to permit of the ready insertion, or removal of the hands of the Davenports, owing to the remarkable slimness of their natural members. The position in which the hands are placed, and the tying of the ropes on the under side of the seat after they are passed through the holes made for their reception, aid greatly in keeping them in proper position for the easy insertion of the hands. The coat sleeves above the wrists are padded to make the arm of a relative size in proportion to the hands. In the trick of exhibiting five arms and hands at one time extending out of the window in the cabinet, they employ four counterfeits made of thin gum, capable of being inflated, the fifth and smaller one being one of their own arms. They do not open the door after this performance until they have had time to exhaust the air out of the frauds, and roll up and deposit them in their coat pockets. In regard to freeing themselves of the fastenings, they simply cut the cords off; others of a proper length are produced from their capacious pockets to throw on the floor; the cut fragments are put safely away in those same pockets. A moment's reflection will convince any one that it is simply impossible for the Davenports to endure, for three fourths of an hour, the torture of tightly knotted cords upon their naked wrists; try it for five minutes and see if it will not convince you of the truth of my demonstration.

Harrisburg, Penn. WM. P. PATTON.

C. W. Williams on Coal and Smoke.

To the Editor of the Scientific American:

Is Mr. Charles Wye Williams the latest and best authority upon the consumption of coals and the prevention of smoke? I have read his book, and he seems to make these remarkable points:

1st. That the prevention of smoke is impossible. He enters into very learned statements and calculations, which, as he leaves them, condemns us poor inhabitants of bituminous regions to the unrelieved prospect of endless carbonization—in being lined inside and outside with smoke.

2d. He learnedly thinks he shows that smoke isn't worth much, and that its prevention wouldn't be much of a saving.

3d. He states that Mr. Charles Wye Williams has invented the only useful mode of approximating the prevention of smoke; and that any other invention shows either that the inventor deceived himself, or intended to deceive others, that is, is either a knave or a fool.

The arguments of the book do not seem, to the present writer, satisfactory; and its tone savors more of magisterial self conceit, than of that humility which science, like every other great subject, ought to engender in minds above mediocrity.

Is there not a better book on the subject? B. F.

[The criticisms of our correspondent upon C. W. Williams' works are not without foundation, whether relating to matter or manner. That author's views contain, in our opinion, so much admixture of error, that he is hardly entitled to be styled an authority in the strictest sense of the term. As our old readers are well aware, we have had occasion to differ from Mr. Williams in many points besides the ones enumerated.—ED.

Mississippi Bridge at Rock Island.

To the Editor of the Scientific American:

The new iron bridge over the Mississippi river, from Rock island to the city of Davenport, is being hastened to completion, and will be ready for travel in about six weeks. It is a Whipple truss bridge, and is built to accommodate wagons, with a foot way below and a railroad overhead.

The bridge consists of five spans and a draw; the spans vary from 200 to 210 feet in length, and weigh six tuns to the linear foot. The draw span is the longest on the Mississippi river, and the heaviest in America; it is 366 feet in length, and weighs 871,784 pounds. The draw is built in reverse way of the fixed spans, that is, the Whipple truss is inverted, bringing the top chord into tension, and the bottom chord into compression, and carrying the entire strain from the ends to the center or main posts. In the fixed spans, the strain is transmitted from the bottom of the posts to the top chords by means of the tie bars. This throws the top chord into compression.

The turntable, on which the draw span rests, is indeed a novel affair, and is the invention of C. Shaler Smith, President and Chief Engineer of the Baltimore Bridge Company. The bed circle, which is 32 feet in diameter, with a 12 inch upper surface, and weighs 36 tuns, rests on the pivot pier. The top surface is beveled, the inner side being the highest. The rotary table, five feet in depth, and resting on 36 cast iron wheels 30 inches in diameter, is placed on the bed circle, the 36 wheels resting on the beveled face of the circle. Each wheel, which has a 12 inch face, is beveled, the outer side having the greatest diameter. Thus each wheel, from its formation, tends to travel in a segment of a circle, and avoids the tendency, which square faced wheels have, to travel on a tangent. From the center of each of the above wheels runs a rod to the center pin, which is 32 inches high, with a base four feet in diameter, which pin is mounted on the radial center of the masonry. The rotary power is not yet finished, but will consist of an iron reservoir containing about three barrels of pure glycerin, which will flow into four hydraulic pumps worked by a steam engine. The glycerin will be forced by the pumps into two large rams on each side of the center of the draw span. An iron cable will be led from the plunger of each ram one quarter around the circle, and there made fast to an iron eye let into the masonry. The machinery is so arranged that, while one ram winds in on its cable, the other will be laying out its cable, ready to pull in, or when it is desired, to reverse the motion of the draw.

This huge draw was recently swung into position for the first time, the united muscular power of twelve or fifteen men being amply sufficient therefor. Three persons only had the honor of being on the draw while it was making its first swing, one of whom was your correspondent,

Davenport, Iowa. LUKE COPPERTON.

[For the Scientific American.]

VARIANCE BETWEEN HYDROSTATIC AND STEAM PRESSURE IN BOILERS.

The hydrostatic force is the only force present in applying the water test to ascertain the strength of steam boilers. But, if heat be applied to a boiler to generate steam, two constant forces are present:

1st, the expansive force of steam, and 2d, differential expansion.

Besides these, two inconstant forces: 1st, repulsion of the water from the metal, and 2d, dissociation of the water arising from expulsion of the air by continual ebullition, sometimes make their appearance.

If the drift pin has been used, the damage it has done will be increased by heat.

One or more of these forces, combined with the expansive force of steam, becomes irresistible; and when in operation to that extent detracts from the possibility of working steam at the pressure of the previous hydrostatic test. The presence of these additional forces in a steam boiler is clearly attributable to extraneous causes, and not to any destructive but hidden agency inherent in steam. For, while no force will rebel at a violation of its laws sooner than steam, yet its controllability in conformity with its laws is not exceeded by that of any other active force. In proof of this, we find that when steam has been generated in one boiler and forced into a second one, it requires a greater steam pressure than water pressure to rupture the one containing steam only, owing to its greater fluidity and elasticity.

Further proof, of its controllability and even harmlessness when isolated, is seen in its easy confinement in every variety of vessel and under varying circumstances, extending even to rubber hose at high pressure. The thinness of a plate capable of confining isolated steam is surprising.

On comparison of two boilers tested, the one by water pressure and the other by steam forced into it, their conditions will be found to be the same in kind, and different only in degree of temperature. Every part of each being of uniform temperature, the force of differential expansion is absent from both. The plates not being heated above 600°, the point of maximum vaporization, the force of repulsion is absent from both; therefore the only remaining force left is the steam pressure in the one case and the water pressure in the other. The behavior of steam, isolated in one boiler, being identical, then, with that of water isolated in another, and the two being convertible, the one into the other, according to temperature, it is presumable that there can be no antagonisms due to their contact and union in the same boiler engendering other and additional forces besides those above enumerated.

This inference is fortified by the fact that there is not known an instance where the forms, in which the elements of water present themselves, whether in that of gas, vapor, liquid or solid, manifest any antagonisms, the one to the other, in any possible combination. To assume therefore that the contact and union of steam and water in the same boiler can possibly engender a dangerous force, is not only an assumption without foundation, but is contrary both to reason and analogy. It appears, therefore, that there are known to exist in some boilers, besides the expansive force of steam, other illegitimate forces which are not resistible by any strength of material, and are consequently capable of producing all the phenomena of explosions; and it further appears that these illegitimate forces cannot be present in those boilers possessing uniformity of temperature not exceeding 600°, and containing water from which the air has not been expelled.

The question now arises: Can these conditions be permanently maintained in boilers generating steam?

No problem in mechanics is more simple. By an application of the law of gravity, the water will flow from the cold end of a boiler (in a properly adjusted pipe) to the hot end, and the water in the hot end will flow in the barrel of the boiler to the cold end, thus interchanging places with such rapidity as to insure a temperature substantially, if not theo

retically, uniform. The greater the heat, the greater the speed of flow. The constant force of differential expansion being thus practically obviated, it remains to dispose of the inconstant force, repulsion. But there can be no repulsion of the water until the plates are heated above 600°, the point of maximum vaporization, an excess of which degree of heat it is well known metal cannot receive while a current of water is flowing over it.

It follows, therefore, that neither differential expansion nor repulsion can be present in a boiler having rapid and perfect longitudinal circulation.

The salutary consequences of this action of water in steam boilers are not limited to their immediate safety only, but extend to their cleanliness, economy, and efficiency and regularity in generating steam.

The flow of water from the fire box to the cold end of the boiler will produce a current adequate to sweep into the mud drum all deposit on the sides and bottom. This mud drum may be so constructed as to form an eddy, retaining the sediment while passing the clarified water again to the fire box.

The efficiency of the steam will be increased by freedom from priming, which is occasioned by the throw of the water into the steam pipe, in consequence of the conflict between the descending water to take the place of that water which is ascending with the steam from the bottom. But if this conflict is avoided by the return of the water to the bottom of the boiler through a different channel, a more quiet separation and delivery is made of the steam into its pipe leading to the engines, lessening by that much its tendency to prime. The violence of this conflict may be ascertained by measuring the temperature of ebullition at various pressures. In a vacuum it occurs at 98°, at great elevations, as the top of Mont Blanc, at less than 200°, and, at ordinary levels of atmospheric pressure, at 212°. But in a steam boiler with a pressure equal to eight or nine atmospheres, the automatic separation of the steam from the water is not only more difficult, but the difficulty is magnified by the multitude of tubes and narrow water ways through which both the ascending and descending columns of water must travel at the same instant. Hence, when sudden relief from pressure is given by a supply of steam to the engine, the violence of the ascending column must occupy the water spaces to the exclusion of the descending one, with resulting damage, sometimes greater than that of priming.

The economy is promoted by the maintenance of that temperature most productive of the greatest amount of steam. This point fluctuates slightly above or below 600°, according to circumstances. As an increase in the temperature of the plates, slightly in excess of that figure, say to 800°, will render them nearly eight times less efficient in the generation of steam than a temperature of 600°, and as the circulation of the water will prevent the possibility of their rise in temperature above that of maximum vaporization, it follows that, in so far as this is effected, the circulation of water in a boiler, longitudinally, contributes to its economy by utilizing a heat which otherwise may become a source of disaster.

Again: Regularity of steam cannot be maintained in a boiler, while a part of the water contained in it (that around the fire box) is heated excessively, and another part (that in the lower legs and lower part of the barrel) has not attained a temperature above that of fever heat. But, by longitudinal circulation, all the water having been brought nearly to one temperature, it is in a condition to yield steam with the greatest regularity.

It is, moreover, maintained that groovings and corrosions are impossible in a boiler with longitudinal circulation of the water sweeping among the superheated steam, which is their cause.

But the weakest place of a locomotive, and that which firs gives way, is the point of union between the flue sheet and the flues. The difference in the thickness of their materials exposes them to the greatest strains of contraction from the chill occasioned by opening the furnace doors. The effect is visible in the varying shades of color, like that passing over steel in the act of tempering. But if the heat on the inside is made constant by the rapid circulation of water of uniform temperature, the strain of contraction is in a measure counteracted by diminishing the chill.

There being therefore no force inherent in steam itself, so far unmanageable as to destroy by sudden violence a boiler containing aërated water, nor to affect its integrity by gradual deterioration, it appears that the variance between the pressures of water and steam in producing these ruptures is due to other disturbing forces, whose presence is wholly prevented by the rapid and perfect longitudinal circulation of the water. ONSLOW.

Lecture at Sea by Agassiz.

During the recent outward passage of Professor Agassiz' exploring ship to St. Thomas, the venerable chief made a sensation one day by delivering a scientific lecture on the deck of the vessel. A correspondent of the New York *Herald* says that a blackboard was improvised, a portion of the ship's crew was invited to be present, and a most attentive audience listened to the Professor's descriptions of the animals which they had found living in, on, or about the Gulf weed.

"On examining a fresh specimen carefully, it is found to be a floating colony of animal life. It has inhabitants which are bound up with it, and depend on continual contact with it for their very existence. Others, which use it for shelter and protection, are still free to make occasional excursions beyond its limits; and still others—suburban residents—independent in disposition and predatory in character, cruise around its borders and descend upon unwary "carpet baggers." Among the lower classes, the acalephs are represented by the hydroids, animals living in a community, having a common stem, with a central cavity communicating with numerous branches. These branches support little cup like projections, in each of which resides an individual of the species.

Each has a mouth in the center, a digestive cavity extending into the common canal, and a number of radiating tentacles. There are two varieties of the Gulf weed, the narrow and the broad leaved, and it was noticed that one species of these hydroids was found only on the narrow variety. It was the campanularia; and even where, in large masses of the weed, the two varieties were intermingled and in direct contact, this species was never found in the other.

The crustacea were well represented by crabs, shrimps, and lobsters, a great number of species being found, about half of which are entirely new. It was found that the crabs were represented by members of the highest order—the decapods furnished with five pairs of legs, the anterior being better developed than the others, showing that tendency to differentiation of structure which is characteristic of the higher groups and reaches its perfection in man. The earlier stages of life correspond to the similar stage of society; and, as in savage tribes, each man is his own lawyer and physician, builder and architect, so in the lowest animals, each portion digests and assimilates, respires and contracts. It is not until we ascend in the scale of creation that we find separate organs with distinct functions.

In one of our hauls, we captured a curious instance of the physical inferiority of the male sex, which generally increases as you descend. It was in the person of the male of a pipe fish, belonging to a curious genus in which the jaws are prolonged and surrounded by the integument, forming a tubular mouth. He was encumbered with a mass of eggs, which he was compelled to carry around in a sort of abdominal pocket until they were hatched.

It seems to some so called "practical" minds that there is no utility in such investigations, and that such lives can have no important connection with our vastly superior human existence. A single, rather trite, but very applicable instance to the contrary may be adduced.

There is a little mollusk—the *teredo navalis*—which was at one time the terror of all ship owners. It would quietly and unsuspectedly pierce with thousands of holes the hardest timbers. Ships were rendered valueless, docks destroyed, and at one time all Holland was in consternation at the discovery that the piles of her embankments were bored through and the country in imminent danger. A distinguished naturalist discovered that at certain seasons the female of this species carries her eggs in the folds of her respiratory organs. They remain there until they are fecundated by the milt of the male floating in the water. He also found that a weak solution of mercury thrown into the water destroyed the milt and so prevented the fecundation; and thus, in a few seasons, ship owners were enabled to clear their docks of this hitherto unconquered marauder.

This is but one of hundreds of cases; but it serves to show that size is no criterion of importance in the study of zoölogy.

Lasche's Improvement in Decorative Oil Painting.

Jean Marie Laschè, of Paris, France, has invented and patented, through the Scientific American Patent Agency, certain improvements in decorative oil painting, the object being to replace the painting in oil executed directly on surfaces for buildings, ships, carriages, carpenter's work, cabinet work, furniture, ornaments, etc., and also the gilding by a portable oil painting or gilding already executed, finished, and dry, which is applied by sheets, strips, or pieces upon said surfaces by the aid of a sticky varnish or waterproof cement. The invention consists in executing, or in other words, to execute, such painting in oil, either in plain tones, imitations of wood, marbles, in ornamental subjects, or the gilding on tin foil, whereby the work may be performed in special workshops by skilled workmen, either by hand or by machinery, in a manufacturing and commercial manner, and afterward be transported, so as to be used and applied where it is required, thereby preventing delays, dirt, smell, and all the annoyances occasioned by the presence of painters in a dwelling.

The invention also includes the applying of tin foil upon which oil painting has been executed, or tin foil which has been gilded, upon surfaces by the aid of a sticky varnish or waterproof cement, to replace the gilding or the oil painting of such surfaces. The invention then, is to oil painting and oil gilding what paper hanging is to fresco painting, with the great difference and advantage that, while paper hanging interposes paper (a hygrometric substance) between the surface and the painting, this system of interposing tin foil and a waterproof cement between the surfaces and the painting will protect said surfaces with greater efficacy than ordinary oil painting. The process is as follows:

Tin foil of the greatest thickness—that is to say, foil of tin or composite metals therewith, which are rolled very thin and known as tin foil in the trade—is spread evenly upon a hard and smooth surface, which, by preference, is slightly moistened to assist in the process of spreading the tin foil. Upon this tin foil any desired effect of oil painting is executed, from the plain oil painting in flat tone, to the most elaborate ornamentation in all its branches; and this can be done either by hand or by processes of printing, stenciling, through the aid of machinery, in whole or in part, imitation of costly woods, stones and marbles, subjects in flowers, birds, shells, landscapes, subjects of interior, imitation of carving as well as plain gilded, ornamental gilding, and a combination of gilding and oil painting. In short, anything which is executed in oil paint may, it is claimed, be executed upon this tin foil.

The work, when finished, is varnished; and when thoroughly dry is removed from the hard surface upon which it was sheathed. It is then ready to be transported from the shop, and for that purpose it may be rolled like wall paper.

To apply this portable paint, the surface or object upon which it is to be placed is coated with a sticky varnish or hydraulic cement; the portable paint is cut of the suitable size and applied, carefully pressing in against the surface or object, so as to drive away all intervening air. The sheets may be applied to irregular surfaces, carving, sculpture, moldings, etc., as the tin foil and the oil paint and gold thereon are each very pliable.

New Railway Bridge at Albany.

The new railway bridge over the Hudson at Albany, N. Y., begun in June, 1870, has lately been completed. The main bridge is 1,525 feet long from Quay street to Van Rensselaer island, and the whole length, including approaches, 2,250 feet. It is 30 feet in the clear above low water mark of 1857. There are two bridges above Van Rensselaer creek, (the first comprising three spans 62 feet 6 inches each) one connecting with the New York and Boston railways, and the other for Troy local trains. The portion of the bridge across the basin descends three feet from the pier to Quay street. The trusses in the superstructure are 26 feet apart. All the tension bars of the bridge are of double refined iron, and it is calculated that the bridge will stand a load of 6,000 pounds per lineal foot, exclusive of the weight of the structure, the strain of which will not exceed one sixth of the breaking weight. The draw weighs 350 tuns, and is to be worked by a ten horse power engine placed beneath the roadway. Clark, Reeves & Co., of the Phœnixville Bridge Works, Phœnixville, Pa., were the contractors for the superstructure.

Housatonic River Bridge.

The new iron bridge over the Housatonic river at Stratford, Conn., on the New York and New Haven Railroad, is completed. This bridge is one of the handsomest in the State. It was commenced in March, 1871, and has been pushed, in spite of the cold weather of the early winter, to completion in a wonderfully brief time. The bridge is 1,091 feet long, 27 feet wide, with two tracks, and the hight of the iron work is 24 feet. It has five spans, three on the east side of the draw and two on the west, and the draw is 206 feet feet long. Five piers and two abutments of solid masonry support the iron work of the spans; and the hight of the piers, except the draw pier, is 36 feet 8 inches, they being 7 feet wide at the top and at the bottom. The draw pier is 30 feet wide at the top and 35 at the bottom, and rests upon 427 piles, sawed off by divers, level with the river bottom. Total cost, about $300,000. The contractors were F. C. Lowthorp, of Trenton, N. J., patentee; John Beattie, of Stony Creek, stone work; S. A. Hammond, of Bridgeport, piling and timber work, and George Everett, of Allentown, Pa., superintendent of the iron work. The frame work of cast iron came from Birmingham, Conn., and the tension rods from Trenton, N. J.

Patenting Small Articles---The Result to Manufacturers.

The advantage of patenting small articles is forcibly illustrated in the success of the Meriden Malleable Iron Co., whose works are located at West Meriden, Conn.

They are constantly obtaining patents on small articles of utility and ornamentation in their line of manufacture and, however small the improvement, they consider it a paying investment to incur the trivial expense attending a patent.

Among the last novelties of their production is a very ornamental drawer pull, made of gilt and ebony or other hard wood, so constructed that the knob drops down out of the way when not in use. To the knob or handle, which is hinged to an ornamental gilt base, is inserted a piece of india rubber, which prevents the pull knob from defacing the bureau or furniture, to which it is attached, by constantly dropping against it. Such handles are more convenient than ordinary knobs, and their application renders an ordinary piece of furniture very attractive.

If manufacturers of all kinds of small wares would devote more study and ingenuity in getting up new and original designs, like trimmings for harness, wagons, furniture, household implements, and articles of every kind where it is possible to display taste, they would be astonished at the increase of their business and profits.

What one Firm has Done, others may Do.

We will not occupy the space of a page, which we might fill, with complimentary letters received from our friends and patrons since the new year. But the following, from the manufacturers of the fire extinguishing apparatus illustrated in the last volume, we beg space for. How many other manufacturers will take our subscription list and go among their employees and get subscribers? We pause for a reply.

MESSRS. MUNN & Co.

Gentlemen: We take pleasure in enclosing you a small list of subscribers to your valuable paper, with check for the same. We have ourselves received so much benefit from the articles published by you, on our system of sprinklers that we feel it our duty to at least canvass our building in your behalf. We shall endeavor, as opportunities occur in the future, to extend our limits and help swell the list of your subscribers.

Tendering to you the compliments of the season, we are,

Yours truly, HALL BROTHERS.

Boston, Mass.

ICE HARVESTING ON THE HUDSON.

It has been estimated that the domestic consumption of ice in New York, Brooklyn, and vicinity is a tunnage equal to that of the domestic consumption of coal. Whether this estimate be too large or too small, it is certain that ice has become an article of almost as universal demand as coal. The comfort, economy, and convenience secured by the use of ice is so great that it may now be classed as one of the indispensable articles of city consumption. Its harvest and supply has grown into an enormous business, which at times assumes the attitude of a merciless monopoly, and, in the absence of effective competition, is enriching the companies that conduct the business. It has also called into existence the use of improved appliances for cutting and storing ice, by which advantage, can be taken in even short seasons, to secure the quantity needed. It has been proposed to use steam appliances for cutting the ice, but at present the ice plow drawn by horses is the principal method employed.

Our engraving shows the way in which the ice is cut into suitable blocks for storing. In our next issue, we shall give engravings of the method employed for elevating and placing the ice in the large buildings employed for its storage.

The harvest this year is late; but if the present cold term continues during February, there will be no difficulty in securing a crop.

There have been some difficulties, between the employers and workmen, which have retarded work, but these have been settled, we believe, and ice of fine quality is now being rapidly housed. Horse power cutters, steam elevators, and an army of laborers are busily at work, and the houses will undoubtedly be filled before the opening of spring.

The ice plow used for cutting the ice is not very unlike an ordinary plow. For the solitary pointed blade are substituted several long, sharp prongs or teeth, which act saw fashion, and are so adjusted that the ice is cut but half through. When thus cut, the blocks are easily separated from each other. The furrows are opened in parallel lines, giving a surface dimension to the blocks of two and a half feet by two feet. As the plow passes over a small area, the men, furnished with long poles terminating in strong iron hooks for the purpose, haul the blocks to the source of the canal, where, after twenty-five or thirty blocks are collected, attachments are made, and another horse tows the blocks to shore through the channel previously cut. This channel often extends a mile from the shore, and forms a canal for the transport of the ice rafts.

While the harvest is going on, the ice field presents a busy scene, being dotted all over with laborers. The work is often, in short seasons, pursued by moonlight, and pushed unremittingly to secure the crop before a thaw destroys it.

When the ice reaches the bank, it is hoisted up inclined planes and down others, into the storehouses. These, as well as the methods of hoisting, etc., will form the subject of the article promised for our next issue.



ICE HARVESTING ON THE HUDSON.

Scientific American.

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WHAT SHALL BE DONE WITH THE MODELS AT THE PATENT OFFICE?

It is to be presumed, that, at the time the Patent Office Building was erected, and inventors were required to deposit, with their drawings, models of the devices for which they solicited patents, the steady growth and ultimate magnitude of the collection was not anticipated. A letter, published in another column, informs us that many of these models now lie about on the floors, there being no room to store them elsewhere. Others are piled on the tops of cabinets, and on each other, so that the original purpose of the collection is defeated, so far as the public is concerned, while it is difficult for the examiners to perform their duties. Many of the models are broken and thrown in heaps of promiscuous rubbish.

The head of the model department, who is represented to be very efficient, is doing all he can to bring order out of chaos; but it is painfully evident that there must, sooner or later, be a clearing out of useless and broken models. There are a great many that it is of no consequence whatever to keep. There are others so dilapidated that their inspection reveals nothing without the drawings, and the latter are sufficient to guide the examiners. The rubbish might as well be removed at once, and space made for the well preserved and important models. It is also certain that more room will be needed, if the present system is maintained; and this might well be supplied by buildings erected from the money, now in the Treasury Department, belonging to the Patent Office.

It will, however, be useless to expect that it will be possible to continuously supply space to store models. At the present rate of accumulation, to arrange and store them properly will require an addition equal to the present accommodation once in about seven years. What, then, shall be done with the models, is a question that must in some way be answered. We say, do without them; that is, do not attempt to preserve them in a public collection. It has been wisely suggested that, for purposes of general information, good perspective drawings, reproduced by photography and cheaply obtainable on application, would be far more efficient than a great central museum of models that not one in ten will ever visit, or, if they should, could ever find time to examine a tithe of its contents.

Of course, models would be needed to assist the examiners with probably about one fourth the applications made; these, after each case had been attended to, might be returned to the applicants. It is certainly folly to attempt their preservation in a collection. As the coral insect, particle after particle, builds islands of vast extent, so the constant accumulation of models will result in an enormous reef of ingenious contrivances, which will wreck the patience of any who attempt to explore it. Better at once abandon the attempt to preserve models, and only endeavor to keep the drawings and specifications. This is our view of the subject. If any one has anything better to suggest, we shall be glad to consider it.

DRYING BY COLD.

Most people have an idea that to dry anything rapidly requires the agency of artificial heat. This is a mistake. Chemists are cognizant of many methods of drying substances where heat, above the ordinary temperature, is not employed.

One of these consists in placing the substance to be dried in a close compartment, in which is also placed an open vessel containing strong sulphuric acid. Sulphuric acid has a strong affinity for water, and takes water from the air surrounding it. The air, which also has a strong affinity for water—though weaker than the acid—thus dried, takes moisture from the substance to be desiccated. This moisture is seized by the sulphuric acid, and so the air, acting as a conveyor, goes on taking water and giving it up to the acid till the desiccation is completed. In this way, substances may be dried that could never be made to yield their moisture under the action of heat in an ordinary atmosphere, or which would be injured by heating.

Moist gases may be dried by passing them through the interstices in a collection of fragments of chloride of calcium, quicklime, fused potassa, or soda, each of which has stronger affinity for water than gases have.

Whenever any substance has a greater attraction for water than the expansive force of heat can overcome, it cannot be dried by heat; and the converse is also true. In the process of evaporating a liquid in an open vessel, or in the desiccation of a solid in a common kiln or oven, the moisture driven off by the heat is seized upon and absorbed by the air. If the air has less water than it has capacity to hold in suspension, the water evaporated disappears from sight and assumes the condition of a transparent vapor intimately mingled with the gases of the atmosphere. If, however, the capacity of the air be satisfied, the moisture assumes the form of a cloud of fog or mist, or is even deposited in the form of rain, perhaps in the form of snow or hoar frost, if the temperature be sufficiently low.

The capacity of air to hold suspended water vapor increases as its temperature rises, and *vice versâ*, so that by heating it, it may be made to take from substances moisture which it will deposit on cooling, thus becoming a conveyor of moisture, as in the process mentioned above where sulphuric acid is employed.

We have seen the moisture so far extracted from air admitted into a chamber, the walls of which were surrounded by a refrigerating mixture, that the weight of the volume was considerably diminished.

By thus continually extracting its moisture through the agency of cold, air at low temperatures might be made the vehicle for rapidly desiccating many substances that heat would injure; and there is no doubt this principle might be applied to advantage in some industries. We have ourselves employed it with excellent results, in an experiment, using the same air over and over, as previously explained, and have thus satisfied ourselves of its utility in some delicate operations.

TO OUR READERS.

It is with pleasure that we inform our readers of the large and gratifying increase in the circulation of the SCIENTIFIC AMERICAN. During the single month of January, we received upwards of ten thousand new subscribers, and they are still pouring in upon us from all parts of the country.

This unparalleled increase has exhausted our large stock of back numbers, and of late we have been obliged to commence all subscriptions with the date of their receipt by us.

This is the best we can do under the circumstances; but if there is any considerable number of our subscribers to whom this arrangement is not satisfactory, and who really desire to receive the back numbers, we propose to have them reprinted.

To enable us to determine as to the propriety of thus reprinting, we respectfully request all persons who desire to receive the back numbers and have their subscriptions correspondently dated back, to inform us of the fact by mail without delay.

If any of our friends have any of the first five numbers of the present volume, for which they have no use, we should esteem it a favor if they will return them to this office, and we will add to their subscriptions accordingly.

THE EDUCATION OF THE DEAF AND DUMB.

In ancient times, the Hindoo pundits decreed that any one born deaf, or any one dumb from whatever cause, should be incapable of succeeding to property; though the same law arranged for the sustenance of the sufferers by making it a charge on the person who superseded them in the inheritance. It has been stated that, among the oldest nations of the East, the destruction of such children as useless burdens on society was connived at, if not authorized, by the governments. But instances of the care and sympathy of individuals for these poor creatures begin to occur after the advent of Christianity; and in the writings of the venerable Bede and elsewhere, we read of the partial success of attempts to teach the deaf and dumb to communicate by signs. The first noticeable attempt at a plan for this purpose is the publication, by a Benedictine monk named Bonet, of a treatise called "The Reduction of Letters and Arts for Teaching the Dumb to Speak." In this book, the author professes to have invented a system of finger talking or "dactylology;" and he published engravings of the one hand alphabet, now used nearly everywhere. The desirability of such means of communication subsequently caused many physicians and other scientists to bestow great attention and ingenuity on the subject; and, among many treatises publishing suggestions, one of the best was written in the year 1680, by one Dalgarno. He was a Scotchman by birth, and a school teacher in England; and his work, called "Didascalocophus, or the Deaf and Dumb Man's Tutor," even goes so far as to assert the superiority of written language and a finger alphabet over reading and talking by the organs of speech. Professor Porter republished this treatise in the year 1857, and states that it is "a work of such preëminent ability, and so replete with sound principles and important suggestions of practical value, that it ought to be familiarly known to every instructor." A German named Heinicke did good service to this cause by giving his time and attention to teaching a few deaf mute pupils; and his success was rewarded by the Saxon government inviting him, in 1772, to Leipsic, to superintend a school which is in existence and prosperity to this day. Without, however, enumerating all the various advances made in this branch of education, by mingled science and philanthropy, we come to the labors of Americans in recent days.

In the year 1815, the deprivations of all the pleasures of life, which deafness and dumbness visited on a young lady of Hartford, Conn., interested some gentlemen of the same city in the subject; and they despatched a clergyman to England, to learn the system taught by some persons named Braidwood, who had met with much success and some celebrity. With a narrowmindedness strangely out of place in such a connection, these people declined to instruct the visitor except on terms at once exorbitant and burdensome; and the clergyman journeyed to France, accomplished his mission, and returned to the United States with M. Laurent Clerc, a well educated deaf mute, and one of the best teachers, on the system of Abbé Sicard in use in his country, then to be found. In 1817, the American asylum at Hartford was opened, the Rev. Mr. Gallaudet, the clergyman above mentioned, taking the post of principal, and M. Clerc that of assistant. From this small beginning, which, like many other noble and useful works, originated in the sense and liberality of a few private individuals, has grown up an extended system for the education and improvement of these unfortunates, whose claim to our wisest, best, and most strenuous efforts needs no recapitulation. A column might be filled with the names of deaf and dumb persons who have become valuable and useful members of society, some of whom have obtained eminence in art, science and literature.

But the greatest success in teaching those born deaf to speak has been recently attained, in the United States and in Germany, by the use of a system of lip talking. By this method, the language is communicated to the pupils solely by the motion of the speaker's lips; and such excellent results have followed the introduction of this method that, in an asylum at Northampton, Mass., general conversation is carried on with such rapidity and vivacity that it is at first difficult to induce a spectator to believe that the little pupils have been, many of them, stone deaf from their birth, and that the observation of the movements of the lips is the only opportunity for instruction that they have ever had. So thoroughly efficient is it that education is being carried on, through its means, up to the higher branches, many of the pupils being proficient in physiology, botany, and mental philosophy, as well as in drawing and other arts. Such results indicate the great superiority of the new system, and encourage us to hope that the terrible afflictions of deafness and dumbness may be soon deprived of their worst evils.

PRODUCTION OF STEAM IN BOILERS.

The economical and safe production of steam in iron boilers is, in this steam using age, a matter of primary importance; notwithstanding which, it is somewhat astonishing how little is generally known of the principles which must be observed to secure both safety and economy. The theories and speculations, indulged in by various authors in regard to the precise nature of the molecular motion produced in solid, liquid and gaseous bodies by the agency of heat, have—at least until they are subjected to experiment—no practical value. We must seek light alone from such facts as are demonstrated, and be guided solely by that light.

The only motion that takes place in heated water, with which the steam maker has to do, is that caused by the difference in the specific gravities of the molecules by unequal heating. The motion in steam which the steam user needs to comprehend is that caused by the mutual repulsion of the heated particles of water in a gaseous state.

When heat is first applied to water, the heated particles rise because their specific gravity is lessened. Other particles are in turn heated, and give place to others, and so successive strata of particles are heated over and over, till at last some of them arrive at the required temperature to expand into gas. In assuming this form, that portion of water so converted takes suddenly, under atmospheric pressure, a little more than four and one half times as much heat as it previously had, which heat disappears as temperature or sensible heat, and, becoming latent, imparts its expansive energy to the steam, a small part of which energy is subsequently converted into work in the engine to which the steam is supplied. In thus suddenly absorbing so much heat, it as suddenly expands to a much greater volume than it previously occupied, causing upheaval of the superstratum of fluid; and, rising to the top, it escapes with such rapidity as to cause bubbling, a state of things we call ebullition or boiling.

Now in the construction of steam boilers, we have to consider only these simple and elementary facts, with such modifications as arise from pressures above that of the atmosphere, and the expansion of metals by heat, and we must provide that the movements which take place naturally in steam generation shall not be artificially interfered with. Neglecting these provisions, we fail in economy, and increase the danger of steam production. The water must have free circulation and the steam must have ample avenues of escape from the liquid. Then if the boiler can withstand safely a given pressure and the strains caused by unequal expansion, and if the steam finds a ready escape from the boiler before that limit of pressure is reached, we have, so far as the boiler proper is concerned, the required conditions for economy and safety.

But to generate steam we must generate heat, and here the element of economy is the one most important to be considered. To get the greatest available amount of heat from

the combustion of a given quantity of fuel, we must obey the law that governs all chemical combinations, the law of definite proportions in the union of substances to form other substances. Combustion is only such a chemical combination. Every pound of carbon in the coal, wood, peat, or other combustible, will require for its perfect combustion two and two thirds pounds of oxygen. Every pound of hydrogen will require eight pounds of oxygen to form nine pounds of water, and to develop in the combination all the available latent heat of the two substances. If not enough oxygen be admitted in the draft, there will be imperfect combustion and the loss of carbon in the form of smoke which passes into the uptake.

Again, it is important that the carbonic acid, caused by the burning of the coal, and the steam which arises from the union of the hydrogen of the coal with the oxygen of the air should have the heat as far as possible extracted from them and passed through the shell of the boiler into the water and steam confined therein, and that as little as possible should be wasted through the uptake or by radiation from the furnace or boiler. But now a little thought renders it evident that, as heat always passes from a warmer to a colder body, if the gases in the uptake are cooled down to the temperature of the steam on the other sides of the plates over which they pass, that must be the extreme limit to which their heat can be economically extracted. Steam at 60 lbs. above atmospheric pressure has a temperature of 307° F.: therefore if a boiler carries steam at this pressure, and its circulation is perfect, it is useless to attempt to get any heat from gases at the temperature named. Practically it is impossible to work down the gases of combustion to the extreme theoretical limit at which they will pass into the chimney at the same temperature as that of the steam in a well constructed boiler.

But to insure perfect combustion, it is necessary not only to admit oxygen in the right quantity, but to give the combining materials the proper temperature, and to so commingle them that they shall combine and develop their heat before they have passed over the surfaces to be heated. Combustion in the chimney is waste, and a waste too often to be observed with ill-constructed and arranged furnaces. The oxygen entering in the usual way is cold, and, before it will support combustion, has to be heated. To effect this in the most thorough manner, it is far better that the draft should be diffused, that is, enter at many points rather than at one. This accelerates both the heating and the commingling of the air with the unconsumed gases.

Now what we have written has been, in substance, often repeated in these columns, and we have often gone into details of setting, as well as the discussion of various forms and designs, of boilers, but it seems so difficult to keep the mass of our readers educated up to the true principles of steam generation, that it is probable we shall have to repeat "line upon line and precept upon precept" so long as our paper is sought for instruction in such matters. If those young readers who of late have so often besought us to answer queries relating to boilers, will endeavor to apply the principles we have laid down, they will soon be able to decide for themselves the points upon which they solicit information.

IMPERFECTION IN LAMPS, WICKS, FLUIDS.

To those who, dwelling in cities, enjoy the blessing of paying exorbitant prices for impure gas, and who, in consequence of large bills and inferior illumination seek a refuge in the next best resource, lamps, and to that less favored portion of the human race who, beyond the reach of gas mains and monopolies, are obliged to use lamps, and to those who are struggling to devise improvements in these useful household utensils, these remarks may prove useful.

The primary object sought in the use of lamps is light. Some of them are used for heating, but of them we do not speak at present. That lamp which gives the most light with the least consumption of illuminating material will, if it be safe, cleanly, and convenient, be the best. Safety is best secured in the use of safe materials, and no consumer of petroleum oils should be without the means and knowledge requisite to determine those which are safe from those that are unsafe. Cleanliness and convenience are matters of considerable importance. Lamps for ordinary use should be portable and free from the liability to get out of proper adjustment in carrying them about. But details of this kind need not be dwelt upon at length. Of much more importance is the correct knowledge of the principle of illumination by hydrocarbon fluids consumed in lamps.

No one who has paid much attention to the subject has failed to discover that wide irregularities in efficiency exist in lamps of different construction, and even in lamps of the same general style and finish. In fact no single lamp will perform its office with perfect uniformity. The cause of these variations will appear upon an examination of the common elements of lamps which burn liquids such as animal oils, melted fats, or the products of petroleum distillation.

The essential parts of all lamps are a receptacle to hold the material which is burned, and a means of conveying this material to the place of burning as it is needed. To these essential parts may be added the chimney, which in most lamps is necessary in order to bring the air which supports the combustion to the flame in sufficient quantity to secure perfect burning.

Any known compound of hydrogen and carbon burns with a luminous flame, but, in order that the greatest illumination with the most economy may be secured, it is necessary that the amount of oxygen supplied to the flame should be nicely adjusted. If too much is given, the flame supplies too much heat and too little light; if not enough oxygen is furnished, a part of the carbon is not consumed at all, but passes off as smoke.

Now, in stoves and furnaces we make provision for regulating the amount of air supplied to the fuel; but in the majority of lamps used for lighting purposes, the amount of admission is adjusted at the outset, the only change being that caused by the clogging of air passages by dirt, oxidization, etc., so that lamps, which when new work well, often fail to give a good light after a little time, and require frequent attention to keep the draft free from obstruction. There have been some fine lamps provided with dampers, yet, notwithstanding the scientific and practical value of such an attachment, we know of no lamp in general domestic use that has it.

The quality of wicks is also a matter of no small importance; for, although most lamps provide for regulating the flow of oil by raising or lowering the wick, this alone will not insure a good result. Some wicks do not burn evenly, so that a portion will be too high while other parts will be too low, and the flame streams up from the high parts. This arises partly from unequal admission of air, and also from the want of uniformity in the texture of the wick. If the threads which, through their capillarity, convey the oil to the flame be twisted unevenly, so that some are hard while others are soft, it will be impossible to make use of them with satisfactory results. Wicks, also, which in burning throw off branches of charred material instead of burning squarely down in all parts, always give trouble.

The burning of petroleum oils in lamps without chimneys is a problem presenting many difficulties. It has been solved by the use of mechanism to produce a current of air directed to the flame, but such machinery adds so much to the cost of lamps, and is attended with so many inconveniences that it probably will never come into such general use as to supersede the old method. It is, however, so desirable to avoid the use of chimneys that, barring its difficulties, the problem is a tempting one to inventors. It is needless to say that a device which would accomplish such a result, and not add materially to the cost, or necessitate greater attention than ordinary lamps do, would be second in value to scarcely any invention ever produced.

Every year brings forth some new invention pertaining to lamps, which shows, that though the field has been long worked, there yet remains something to be gathered. The direction that any study to improve lamps must take hereafter is toward the better application of general principles of construction, as it is not probable any new principle will be developed. It is, however, very desirable that the inconveniences attending the use of most lamps in use should be obviated. Among these are the accumulation of oil upon the outer surfaces of lamps, which renders them uncleanly to the touch; the frequent trimming and cleansing required; the accumulation of soot on the chimney; the liability of lamps to smoke when left unwatched and unattended, or when carried about; the very disagreeable smells emitted, etc. While these defects remain, there will continue some desire and effort to remedy them; and we believe that, by a thorough investigation of the causes of the annoyances specified, the means to avoid them would ultimately become apparent.

RELIGION AND SCIENCE.

Genuine truth being uncontrovertible, the truths taught by religion and by science must agree in the end. Where discrepancy appears to exist, it is only because either the theologian takes the individual opinions of a certain class of scientists for the teachings of science itself, or the scientist, in his turn, takes the individual opinions of certain theologians for the teachings of religion. In this way, a kind of antagonism is cultivated, which would not exist if the training of those destined for religious teachers was less one sided, and if, in place of confining their preparation chiefly to literary pursuits, they were also trained in the knowledge of those scientific principles, the application of which, during the last half century, has produced the most stupendous changes in the relations of man to his fellow man.

On the other hand, the training of many prominent investigators of science of the present day has been not less one sided; the unwise antagonism, displayed by many religious teachers against scientific pursuits, has reacted on several of the prominent leaders of science, and, in their writings and teachings, they accordingly ignore religion; thus, a class of scientific scholars has sprung up, chiefly in Germany and France, who, to speak mildly, do not consider religious training to have any important value.

Herbert Spencer, whatever opinions many may have of him, has the merit of having clearly pointed out the demarcation line between the knowable and unknowable, between that which science can demonstrate, and that which is beyond the field of science, and which pure science can never reach. Certain minds appear to be constituted in such a manner that they can be satisfied with adhering to the knowable, to only that which science teaches, keeping that which science cannot determine out of their thoughts. But such a condition of mind is only temporary; sooner or later, there grows in them a desire for light in this direction; and happy are those who obtain it—happier in proportion that their work in obtaining it was more laborious. A simple mind may feel happy with a faith accepted without mental labor; but such an individual has no conception of the enjoyment and supreme happiness of the cultivated mind, that finds the truth by searching and working, and whose cares and doubts at last come to rest in the consciousness of having found that precious gem, which all intelligent beings are interested in searching for—*Truth*

For many ages, the teachers and priests of religion constituted the most influential class of human society. With the progress of knowledge, however, this influence has grown less and less, and, at the present day, it is only very prominent where civilization is least advanced. This undeniable fact, however, must not be construed to mean that civilization is antagonistic to religion. We maintain the contrary; but it has been caused by the neglect of the priests of religion to remain at the head of civilization and in the vanguard of the searchers after positive knowledge, as was the case with the ancient Egyptian priesthood. Those men, supposing that the knowledge of the truth, by the mass of the people, would be dangerous to the maintenance of the existing order of affairs, instituted secret rites, to guard jealously, for the benefit of the few initiated, their precious knowledge; of these rites, certain degrees of the Masonic order of the present day are the degenerate descendants. In proportion as the influence of abstract religious dogmatic teachings, on the mass of the people, was growing less, the influence of the discoveries of science, of the increase of positive knowledge, concerning the material universe, grew stronger and stronger. The invention of printing has, for more than four centuries, been flooding the world with books, so that now almost every man may possess his own library, at a less cost than in ancient times a single book could be obtained for; to this is added, in our day, an unparalleled development of journalism, scientific, political, and religious. Not only our stock of knowledge has increased; its diffusion has increased in a still greater ratio; and, if our religious teachers and leaders only take this into account, and provide such measures as will cause their profession to be at the head of civilization, as well scientifically as in other respects, as was the case with the ancient Egyptian priesthood, there is no doubt that their useful and necessary influence will become greater than ever before, for the simple reason of the immense moral power which must be the necessary result of the combination of scientific knowledge with a religious mission and strict morality.

THE NAVY OF THE FUTURE.

"When the Navy estimates for 1872-3 are laid upon the table of the House of Commons, we understand it is very probable that they will be found to contain provision for the construction of a vessel the armament of which will consist of torpedo artillery carried below the water line. Some time since, trials were made with the Whitehead fish torpedo, under conditions, entered into between the inventor and the Government of this country, that if the torpedo proved to be as effective upon trial as it was asserted to be by its inventor the latter should recieve the sum of £15,000, the Government obtaining the right to the use of the torpedo as part of the national armament. Upon its trial, the torpedo exhibited powers exceeding those which had been claimed for it by its inventor, and he received from the Government the sum agreed upon. As it is to further test the torpedo as a new form of sea artillery that the new vessel will be constructed, we may presume that she will, as a test vessel, be of very limited dimensions.

The facts of the great success which attended the trials of this torpedo, that the Government has paid so large a sum for it, and that the Admiralty are about to construct a vessel to test its merits as a new form of submarine artillery for our fleets, would appear to indicate that little or no doubt is entertained of its successful application. If it should be found in practical work that a ship can thus carry her battery of torpedo guns at any required distance below her water line, or say from seven to 12 feet below her line of flotation, the nation will be committed to another reconstruction of its navy. Armor plating will have to be extended to ships' bottoms and not cease at their top sides, while chain cables, coals, provisions, etc., will then, in all seeming probability, have to be stored above the level of the ship's water line, and in about the positions where she now carries her guns."

The foregoing from the London *Times* indicates that a wide field for invention in the naval line is open for ingenious minds. The London *Engineer* in a recent number makes the following frank avowal concerning the British navy: "It is certain that we have not a single ironclad afloat that cannot be penetrated by shot and shell at close range, while the majority of our ironclads are not invulnerable save at a range of a mile and a half. Such a thing as an absolutely impregnable ship or turret has at this moment no existence."

What is true of the British navy is also true of every navy in the world.

Now, where is the new invention which, shall remedy this state of things, to come from? It can only be developed by the persevering study of ingenious persons. Not power, position, influence or riches can bring out a new discovery. Thought, persevering thought, is the true mother of progress. For the revelation of the most brilliant secrets, we most generally look to obscure persons of simple habits, humble minds, in lowly places. But the comfortably situated, well-to-do individual, having conceit of knowledge, is rarely original. The poor inventor has a clear road before him.

HOW TO SHAVE.—As you strap your razor, strap the two sides alternately, and keep the back of your razor always on the strap, as you turn it from side to side. You thus avoid cutting your strap and turning the edge of your razor. As you shave, keep your razor almost parallel with the skin, and not at a great angle with it. Give your razor also a slight lateral motion. In fact, to borrow the simile of the artist, "the more you can make your shaving like mowing grass with a scythe, the better." Do not make faces as you shave, with the object of making a better surface for your razor to act upon. The skin when strained is easily cut. Adopt these hints and you will bless the unknown giver.

SCIENTIFIC AND PRACTICAL INFORMATION.

NEW PROCESSES OF WATERPROOFING.

The desirability of rendering cloth waterproof without interfering with its permeability by air has attracted a great deal of attention; and a somewhat elaborate process for the purpose has just been published. The mixture is prepared as follows: Place, in a metal vessel of about six gallons capacity, 20 lbs. sulphate of alumina cut in thin slices; and, in a similar receptacle, 8 lbs. of oleic acid, and six quarts of alcohol. Thoroughly dissolve the latter compound, and stir it with a wooden stick for twenty minutes, gradually adding the sulphate of alumina. Leave the whole for about twenty five hours to settle. The oleic acid and the spirit will then be at the surface, and can be decanted; the remaining deposit should be filtered through flannel, and pressed into a cake. This can be dried by heat, and ground to a powder. For use on silken or linen clothes, one pound and a half to 20 gallons of water will be ample; wool will not require more than one pound. It is as well to strain these solutions, and the fabrics require only to be thoroughly saturated and dried in the air.

Another mode of applying the sulphate of alumina is as follows: Thirty grammes of acetate of lead is dissolved in a pint of water, and a similar solution is made of twenty-four grammes of sulphate of alumina. The two solutions are blended, and the fabric, after being soaked in the compound for twenty minutes, is dried by the atmosphere.

DYEING WOOL.

An eminent French authority recently gave the following directions, in a paper read before the Association of Commerce at Roubaix:

Good dyeing is not possible, unless the wool has previously been thoroughly purified from all fatty matters, and from animal moisture. Bleaching—that is to say, this thorough cleansing and purification—therefore, constitutes an integral part of dyeing, and it is of the utmost importance that it should be most efficiently carried out; in fact, the dyer should watch this part of the process constantly. The next point to be attended to is mordanting. Nearly all the colors used in dyeing require, in order to form a stable dye, that they should have for their base some metallic substance, the bodies used for this purpose being the mordants. Now, if the compounds formed between the coloring matters and the dyes are insoluble, the compounds formed between the mordants and many of the impurities in the wool—the soap in badly washed wool, for instance—are not less fixed and insoluble. If the mordant be a salt of iron, for example, it forms an insoluble iron soap, which effectually prevents the wool from taking a good pure tone of color. In order to get a good result under such conditions, dyers are constantly in the habit of evading the obstacle, and dyeing without any mordant whatever; so that mismanaged cleansing gives rise to fraudulent dyeing, colors thus put on being merely superficial and valueless.

THE COMMUNICATION OF DISEASE.

A further contribution to our knowledge of this subject has recently been made by M. Chauveau, a member of the French Academy. He states that contagion depends, not on virulent humors in a state of solution, but on solid matters held in suspension by gases; and he cites, as evidence of the truth of this theory, the facts that the inoculation with dissolved substances remains without result, and that with corpuscles is followed by the appearance of disease. He also proves, by experiment, that miasms in the air are not disengaged gases, but solid corpuscles. A person may be inoculated, with a fluid formed by the condensation of the vapor of evaporation of a virulent liquid, without danger, while the primitive liquid contains all its contagious properties. These results were observed in experimenting with the virus of small pox, epizoötic typhus, and other diseases.

DISCOVERY OF GOLD IN SIBERIA.

Accounts from the river Amour, which divides eastern Siberia from the northeastern provinces of Chinese Tartary report the discovery of large and rich gold deposits in that region of country. Washers and diggers are at work in the tributary streams of the Amour, and gold to large amounts has already been extracted. The Olakonta and Sega, two of the small streams, appear to flow through valleys of surpassing wealth in this metal, a gang of men having obtained as much as 170 pounds of gold in a day from the banks of the latter river. A company has been originated, at St. Petersburgh, for carrying on extensive mining operations, as well as for the ulterior object of opening up trade with China and Japan, and with Western North America. A large influx of Chinese population into Siberia may be predicted.

SOUND PRODUCED BY THE MOLECULAR MOTION OF MAGNETIZATION.

Professor Tyndall, in a recent lecture, made the following statement:

"The effect I wish to make manifest was discovered by Mr. Joule, and was subsequently examined by MM. De la Rive, Wertheim, Marian, Matteucci, and Wartmann. It is this:—At the moment when the current passes through the coil surrounding the electromagnet, a clink is heard emanating from the body of the iron; and, at the moment the current ceases, a clink is also heard. In fact, the acts of magnetization and demagnetization so stir the particles of the magnetized body that they, in their turn, can stir the air and send sonorous impulses to our auditory nerves. The sounds occur at the moment of magnetization, and at the moment when magnetization ceases; hence, if a means be devised of making and breaking, in quick succession, the circuit through which the current flows, we shall obtain an equally quick succession of sounds. I do this by means of a contact breaker which belongs to a Rhumkorff's induction coil. A thin bar of iron stretches from one of the bridges of this monochord to the other. This bar is placed in a glass tube, which is surrounded by copper wire; the contact breaker is placed in a distant room, so that you cannot hear its noise. The current is now active, and every individual in this large assembly hears something between a dry crackle and a musical sound issuing from the bar, in consequence of its successive magnetization and demagnetization."

THE CRYSTALLIZATION OF IRON AND STEEL.

The various qualities of iron and steel may be compared by observing the forms of their crystals through a microscope. Cast steel of fine quality exhibits fine crystals of a needle-like shape, parallel to each other; and the axes of these crystals are in the direction of the hammering to which the metal has been subjected. The surface of iron exhibits crystals of the shape of a double pyramid, the proportions varying with the quality of the metal. The pyramids more nearly approach a cubical form as the carbon in the metal is increased in quantity.

VACCINATION.

There are three methods of inserting the vaccine lymph in the human body. One is effected by drawing the skin tight, and making four or five punctures quite through it with the proper lancet, taking care to penetrate to the *cutis vera* or true skin, the innermost of the several integuments of which the covering of our bodies is composed. The lancet should have a groove, down which the lymph can flow, running to the point, and should be held in the wound for two or three minutes to give the lymph a certainty of being absorbed. In the second manner, the ordinary phlebotomy lancet is used, and two or three scratches, parallel to each other, are made, care being taken that the abrasion is only just sufficient to allow the slightest exudation of blood. The third process is by vesication; three small blisters are raised raised a few hours previous to the vaccination, and the lymph is inserted under the skin after the serum of the blisters has been pressed out. Dr. Richard Wilson, of London, gives most emphatic testimony to the superiority of the second method, but deprecates its use on persons advanced in years or of an unhealthy condition of body. The results in such cases are frequently large swellings and considerable inflammation of the parts; and frequently sloughing sores follow, which are to be healed only by the slow process of granulation.

EDITORIAL SUMMARY.

HYDROSULPHURIC ACID.—When sulphur acts upon paraffin, at a temperature a little above the melting point of the sulphur, this gas is evolved in large quantities, and this method may be advantageously used for its generation in the laboratory. A flask, holding about a pound of the material, is fitted with a tube, bent at right angles, about one half inch bore and 12 to 18 inches long, containing cotton wool, and to this is attached the small tube for precipitation. The production of gas may be stopped by removing the heat. Heavy paraffin oil, stearic acid, or suet may be used as a substitute for paraffin.—*John Galletly.*

A NOVEL ADDITION TO THE DINNER TABLE.—The *Brewers' Gazette* says, and it ought to know, that we are to have a revolution, it appears, in wine glasses. London porter requires pewter, and hock a green glass, and it has now been discovered that sherry is not sherry unless drunk out of wood, so that we shall shortly have our dining tables laid out with tiny carved cups, instead of the orthodox wine glass with which we have long been familiar. At present the idea is only in its infancy, awaiting the artists who have under consideration the design of the new sherry cups. We may, however, mention that they will be larger than the present wine glass, more like the old port glasses which our grandfathers used.

CAMELS IN NEVADA.—The Virginia city (Nevada) *Enterprise* says that a train of over a dozen camels recently arrived in that city, having journeyed from the Carson River valley, below Dayton. These "ships of the desert" were loaded with hay, in bales, for Adam's hay yard on North D street. The huge, ungainly beasts presented quite a picturesque appearance as they filed into town with their cumbrous freight. Upon arriving at the hay yard, at the word of command they all knelt down to be relieved of their loads. These animals appear to thrive quite as well in this country as in the wilds of Sahara. There is an abundance of deserts here, if they are necessary to the comfort of the beasts.

PRUSSIAN TORPEDO BOATS.—These boats are cigar-shaped and shot-proof against the rifle and mitrailleuse. In the bow is the rudder, and in the stern, an observatory, with a peep hole about the size of a thaler; the funnel is hardly three feet above water and of very small diameter. The whole boat is about forty feet long, and the only parts above water are the funnel and observatory. The bridge is on a level with the water and protected by a double shield. It is of a gray color and very fast. It will carry torpedoes whose construction is unknown, dash into an enemy's fleet, especially at night, blow up the ship and make away again. Should it prove a good sea-going boat, and England ever dared to thwart Germany, the prediction in the "Battle of Dorking," will probably be realized. Three are already finished and in the port of Dantzic; three unfinished, destined for Kiel, and a number more under construction.

DETECTION OF ARSENIC IN PAPER HANGINGS, DYED AND PRINTED FABRICS AND IN COLORS.—The arsenical copper colors may best be detected by Bettendorf's process. The sample is covered with pure hydrochloric acid containing 25 per cent of real acid, in such quantity that after it has been digested for 15 or 30 minutes, 20 drops of the clear liquid can be poured off. If the liquid is dark or turbid some more hydrochloric acid must be added, and the solution filtered. About 20 drops are poured into a test tube in which a knife-point full of chloride of sodium and the same quantity of protochloride of tin (stannous chloride) have been placed. When these salts have become a thin paste, pure concentrated sulphuric acid is quickly but carefully added to about double the volume, so that the mixture grows hot, and fumes of hydrochloric acid gas escape. After the first violent reaction is over, more pure hydrochloric acid is added. Arsenic, if present, separtes in the metallic state, rendering the liquid a dark grey brown or brown and turbid, and is readily deposited in diluting the liquid.

BOSTON FIREMEN.—The dormitories of the Boston firemen are model apartments, as are all the engine houses. They are carpeted and furnished with the best of furniture. The firemen have a parlor or sitting room, and here the stranger is surprised. There are Brussels carpets, black walnut furniture, ornamental book cases well stocked with useful volumes, facilities for writing, a piano, and the walls are ornamented with choice paintings backed by handsome paper. The department supplies all necessary comforts; but so great is the rivalry between the respective companies to show up the most inviting quarters that the firemen themselves make heavy outlays, and respective friends aid them in their work of refinement with liberal hands. Among the many good regulations of the department is the strict observance of the Sabbath and prohibition of intoxication and profanity, discharge following the breaking of the rule.

F LUDWIG had just published, in the *Wiener Anzeiger*, p. 220, 1871, an account of some researches on the action of chromic acid on certain common gases, namely, carbonic oxide, hydrogen, marsh gas, and olefiant gas. Even at ordinary temperatures, and in contact with dilute as well as with concentrated solutions, carbonic oxide is transformed into carbonic acid. Hydrogen gas, on the other hand, is oxidised with tolerable rapidity by concentrated solutions, but either not at all or very slowly by dilute solutions. At common temperatures, marsh gas is unattacked. Olefiant gas is oxidised to formic and possibly to acetic acid, as well as to carbonic acid and water at ordinary temperature. Operating at higher temperatures, Chapman and Thorp found only carbonic acid and water.

MR. J. W. BAUGHMAN, of Baltimore, Md., writes to inform us that a lady recently ran a needle into her flesh, about three inches above the knee, breaking it off under the skin. She preferred to risk the consequences rather than to have it extracted by a doctor. Mr. Baughman thought of using a magnet, and applied one of the horse shoe shape, 8 inches in length. She wore it for two days, more or less, and then found the point end of the needle protruding from the skin, one inch from where it entered. The needle was easily removed. Our correspondent is curious to know how the needle could come to the surface point upward, having thus turned round in a space less than its own length, which was $1\frac{1}{16}$ inches, and he suggests that the muscles may have turned it about.

HEATING WINES.—To destroy the germs in the wine which may produce deterioration of its quality, M. Tellier proposes to pass steam into a double copper helix which is introduced through the bung hole of the cask containing the wine. This steam, condensing, is forced up in the form of water through the interior tube by the pressure of the fresh steam boiler, and thus gotten rid of. The wine may by this means be heated to a temperature sufficiently high to destroy any germs in it, and at the same time its volatile constituents preserved.

BROWN TINT FOR IRON AND STEEL.—Dissolve in four parts of water, two parts of crystallized chloride of iron, two parts of chloride of antimony and one part of gallic acid, and apply the solution with a sponge or cloth to the article, and dry it in the air. Repeat this any number of times, according to the depth of color which it is desired to produce. Wash with water and dry, and finally rub the articles over with boiled linseed oil. The metal thus receives a brown tint and resists moisture. The chloride of antimony should be as little acid as possible.

A DRESSING for goods, according to Finckh, may be made by boiling two parts of caustic soda, with four to five parts of palm oil to a soap, which is then dissolved in more water and mixed with thirty parts glycerin of 30° Beck. The mixture should then be cooled, and eight parts of wheat starch stirred in, and water added to bring the weight of the whole up to 1,000 parts. The addition of a little carbolic acid will protect this from fermentation. Of this mixture, add 6 to 8 pounds to every 100 pounds of potato starch used.

SPECTROSCOPIC REFLECTOR.—A slightly convex mirror is fastened on a stand, in such a way as to receive the rays from a Bunsen burner near the operator, and reflect them to the prism or slit of the spectroscope. The introduction of any substance into the flame may be easily accomplished by this arrangement, and the lines are said to appear much brighter than in the ordinary instrument. Prof. Fleck tested, with this apparatus, lime which he had obtained in five different quantities by partial precipitation, and states that different lines appear in different portions; this may be owing to the presence of different elements in the precipitates.

A NEW SCIENTIFIC WORK.

We have received from Professors R. H. Thurston and Richard H. Buel, their prospectus, issued from the Stevens' Institute of Technology, Hoboken, N. J., for a new and popular work, to be descriptive, in detail, of some of the most important of recent inventions and discoveries in mechanics and engineering. The idea is an excellent one, and we have no doubt, from the eminent ability of the editors, that the work will be of much value. If it were to be a sensation novel it would go with a rush, and a hundred thousand copies would quickly be called for. But, confined as it is to subjects that require study and intelligence in their mastery, no such rapidity of demand is, in the ordinary course of things, to be expected; scientific books generally have but a limited circulation. The editors have, however, adopted a special expedient to secure large sales. They propose to publish descriptions of good improvements, provided the holders thereof will furnish, at their own cost, first class essays accompanied by the best possible engravings. In addition thereto, each applicant is expected to pay to the editors, in cash, the sum of seventy-five dollars for each page occupied by his essay—which is equivalent to six hundred dollars, besides the cost of essay and engravings, for a space equal to one page of the SCIENTIFIC AMERICAN. At first blush, this outlay seems large; but it is only a seeming, for in return, the applicant is to receive twenty-five copies of the work free of charge, for every page of space he has paid for. Thus he receives the full *quid pro quo* for his money, and secures the additional benefits of the publication. We wish every possible success to the editors in this novel undertaking.

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Standard Twist Drills, every size, in lots from one drill to 10,000, at ¼ manfacturer's price. Sample and circular mailed for 25 cents. H. E. Towle, 176 Broadway, New York.

Taft's Portable Hot Air Vapor and Shower Bathing Apparatus. Address Portable Bath Co., Sag Harbor, N.Y. Send for Circular.

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

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

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

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N.Y.

Over 1,000 Tanners, Paper-makers, Contractors, &c., use the Pumps of Heald, Sisco & Co. See advertisement.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 1202 N. 2d street, St. Louis, Mo.

For Best Galvanized Iron Cornice Machines in the United States, for both straight and circular work, address Calvin Carr & Co., 26 Merwin St., Cleveland, Ohio.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 61 Nassau st., New York.

Railway Turn Tables—Greenleaf's Patent. Drawings sent on application. Greenleaf Machine Works, Indianapolis, Ind.

Blake's Belt Studs. The cheapest and best fastening for Rubber and Leather Belting. Greene, Tweed & Co., 18 Park Place, N. Y.

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

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

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

Notes & Queries.

1.—PRESERVING NATURAL FLOWERS.—Will some one furnish me with directions for preserving natural flowers?—R. A. L.

2.—COPPER DIP FOR IRON CASTINGS.—Will some one give me a recipe for making this fluid?—S. D. R.

3.—HYDRAULIC CEMENT.—Will some one tell me how hydraulic cement is made, and of what material?—J. A. T.

4.—CEMENT FOR CROCKERY.—Will some of your readers inform me how to make a permanent cement for mending broken crockery.—B. F. T.

5.—HARDENING STEEL.—In the process of hardening steel, does a chemical change take place in the nature of the steel? If so, what is that change?—A. K. S.

6.—CRACKING OF LEATHER.—What is the cause of the leather, used for the front boards of wagons, cracking? I have tried to find a solution of this mystery and also a remedy for it.—E. O. V.

7.—MELTING GLASS.—Can any one tell me how I can melt glass in small quantities, getting it sufficiently liquid to pour freely?—C. F.

8.—MIXING PAINT.—Could any one inform me how to mix up paints, and what varnish is best to use in getting up Venetian blinds, so that they will neither blister nor crack?—D.

9.—EXPANSION OF MILLSTONES.—Can any one tell me if, and how much, French burr stones are expanded by the heat generated by friction in grinding?—J. C. B.

10.—IRON SHIP BUILDING.—I wish to know who made the first iron boat, and when it was constructed.—W. C.

11.—CONCRETE FLOOR.—I wish to know what will make the best concrete floor for a cellar, without the use of gravel.—J. A. S.

12.—IGNITION OF COTTON YARNS, ETC.—What degree of heat, created by dry air from a furnace, will cotton yarns or cloth stand before igniting, the yarns or cloth being placed in a chamber, and the hot air driven through by a fan?—J. R. K.

13.—RHUMKORFF COIL.—What is the method of constructing the coil of a Rhumkorff induction apparatus? I particularly wish to know the sizes of wire when covered, and the method of securing the most efficient insulation. I have seen described the Ritchie method of winding the wire, but it was very unsatisfactory, being too indefinite for any one, not already well informed, to understand.—J. J. S.

14.—JOURNAL BOXES.—What is the best material for journal boxes for a water meter, where the pressure is against the end or small point of the shaft, which is of brass or some other material that will not corrode? The lubrication is with the water. How do brass and hard rubber run together?—I. C.

15.—RELATIVE WEIGHT TO HORSE POWER OF ENGINE.—Can any one tell me the lightest weight of engine, to each horse power, that can be obtained by the best modern construction?—O. T. H.

16.—ELECTROPLATING WITH ALLOYS.—Can an alloy be deposited by electricity, on a metal surface, as gold, silver, and other metals are done, if the ingredients of the alloy are good conductors?—R. T.

17.—STEAM ENGINE PHENOMENON.—Last summer, I was running my engine after dark. The boiler was well filled with water, and the steam gage indicated 30 pounds pressure. Casting my gaze toward the top of the boiler, I saw a pale yellow light, at a small leak in a connection of the steam pipe; being alarmed lest the building was on fire in the story above, I seized my lamp, hastened up stairs, and satisfied myself that all was safe up there. I returned to the engine room and saw the light as before, not only where I first saw it, but at different points where steam was escaping in jets. The lights disappeared when the lamp was brought near them. When my hand or some other substance was brought in contact with the jet of steam near the point of issue, the light seemed to attach itself to the hand or other substance. This continued for about forty minutes. What was the cause?—J. A. L. A.

18.—PRESERVING RUBBER BOOTS.—Is there any preparation to preserve gum boots from cracking? I find that always, after wearing awhile, they lose that fine gloss which they have when new, and get full of fine cracks. Can any one tell me how I can patch them in case they get torn, so as to make them waterproof again?—J. R. M.

19.—COKE FOR IRON MANUFACTURE.—Has coke, similar to our gas house coke, been used for melting iron in this country to any extent, and, if so, with what results? Does it melt iron as rapidly as coal, and does it have any chemical action on the metal? I am aware that it has been used in England, but I would lik to know whether that coke is similar to our gas house coke.—G. W. C.

20.—VALVE FOR MINING ENGINES.—Can any reader, who is using Davis' piston valve, tell me if it is suitable for an engine used in the shafts of deep mines? I am using the common slide valve, and the empty car, in descending, acquires considerable velocity and overcomes the friction of the engine, causing an unpleasant rattling of the valve and wear on the threads of the spindle. I think Davis' valve will answer the purpose, but it is comparatively unknown in this country; and I should like the opinion of some one well acquainted with it.—F. L.

21.—TRISECTION OF AN ANGLE.—Mr. N., of Ind., sends us the construction of a geometrical problem to trisect any angle of less than ninety degrees; and he ends his communication with the question, customary in such attempts, "If not, why not?" The point which has so long defied the powers of the best geometricians is the solution and demonstration of the problem by elementary geometry, and this Mr. Naylor leaves to his readers. The practical trisection of an angle has long been understood; the demonstration Mr. Naylor leaves just where he found it.

22.—SEPARATION OF GASES.—I wish to know if there is any simple way of separating the different elements of the air from each other.—L. M.

23.—TRANSIT OF THE PLANET VENUS.—Is there any reliable rule for computing the transits of Venus?—C. E. P.

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 $1.00 a line, under the head of "Business and Personal."

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

GEARING FOR SAWS.—In reply to query No. 2, January 20, I beg to say, for the information of A. K., that it is practicable to run circular saws with bevel gearing. There is a circular saw mill in our town running at the present time (and has been for the last ten years) with bevel gearing, a crown wheel, on upright water wheel shaft, four feet six inches diameter, 2 inch pitch, 6½ face, pinion 1 foot 6 inches diameter. I have made several mills on the same principle by substituting a mortise crown wheel and chipping and filing cogs in pinion.—W. H., of Ontario, Canada.

BLUEING IRON.—"Gun Barrel" will find the information he requires in this column.

GENERATING STEAM.—J. H. McC. is referred to pages 55 and 88 of our current volume.

S. T. A. E., C. E.—You will find an answer to your question in any elementary work on physics.

FACE WORMS.—Let H. E. A., query No. 4, January 20, try the water cure and keep his face washed clean.—K., of N. Y.

J. M. C., of Honolulu.—We know of no reason why the albumen from sea birds' eggs should not be as good as that of domestic fowls: Dix & Morris, 56 Cedar street, are dealers in the albumen. The price is about $1.25.

STAINING CANES.—Query 10, January 6, 1872.—Dragon's blood dissolved in water or alcohol, with burnt umber added until the desired shade is obtained, is the right thing. Apply with sponge. To get a matted appearance, make a second application in spots. Polish with shellac.—E. F. H., of Iowa.

WEARING OF SLIDE VALVES.—I would state, for the benefit of W. C., that the concavity is attributable to two causes: First and mainly, to the center of the seat being in constant wear, while the ends are worn only alternately; secondly, to the unequal distribution of the wearing surface.—A. K. S., of Neb.

COPPER SALTS.—L. H. B. is in error in stating that copper salts have been recommended for cleaning statuary. A wash of nitrate or sulphate of copper on stone work has been suggested as a preservative the object being to fill the surface pores of the stone with the metallic copper. The salt should be dissolved in water, and the hands kept from contact with it.

CRYSTALLIZATION OF HONEY.—Strained honey, if scalded and skimmed, will keep any length of time without change. The scalding will slightly alter the flavor, but will not impair it materially.—J. B. F.

A. W. P. S., of O.—A fall of 17 feet will give a rise, in a fountain, of 17 feet, minus the loss of head due to friction and the resistance of the air to the jet. The material of the conduit will not make very great difference in friction, but the larger it is the less will the friction interfere with the hight of the jet.

RED SPIDER.—How can the minute red spiders, which are found upon house plants and around windows in great numbers, be destroyed?—A. F. W. Answer: It is very difficult to get rid of the red spider. The florists sell certain soaps, intended for that purpose, which are to be dissolved in water and applied with a syringe. These insects flourish where it is warm and dry. But they cannot stand wet. Treat them to as much moisture as possible.

CAUSES OF CHANGE OF COLOR IN THE STARS.—C. B.'s theory is probably correct, but it is no new discovery. Mr. Proctor, we believe, has already written to the same effect.

TENSILE STRENGTH OF SWEDISH IRON.—H. L., of Ind.—The breaking weight per square inch of Swedish iron ranges from about 70,000 lbs. to 112,000 lbs., but 85,000 may be taken as an average. This information will answer your other questions, if you calculate the area of the cross sections of the round rods, by multiplying the radius by .7854.

S. S. B., of N. Y.—Coke, like other forms of carbon, absorbs more or less of all gases floating in the air to which it is exposed. In burning, it liberates such of these gases as are not combustible, and by its own combustion produces mostly carbonic acid with traces of gases from substances which have been imperfectly removed in the process of coking.

SONOROUS STONE.—To W. S. B., page 138, Vol. XXV.—The stone near Pottstown, Pa., must be of volcanic origin, known as trachyte. An island in the West Indies, elevated 310 feet above the ocean, contains masses of the same character of rocks. Livingston, in his "South Africa," page 101, speaks of the Bamangwato Hills of the Bakaa Range, 700 or 800 feet above the plains: "The rocks, in falling, produce a ringing noise, which leads many to fancy that they contain abundance of iron. In many places, the lava streams may be recognised."—C. H. K. of the West Indies.

INDELIBLE INK.—Ink for marking linen can be made by dissolving five cents' worth of lunar caustic (nitrate of silver) in half an ounce of water. Equal parts of starch and saleratus must be used to stiffen the linen. Iron it smooth, write on it while hot, dry and iron again and if there be any blots, cover them with lard. Then lay it in the sun for several hours, and immediately wash in very strong hot suds.—E. E. S., of O.

BLUEING IRON.—On page 42 of the current volume, I find that J. C. C. wants to know how the peculiar blue surface is put on gun barrels. Let him apply nitric acid and let it eat into the iron a little; then the latter will be covered with a thin film of oxide. Clean the barrel, oil, and burnish. A very pretty appearance is given to gun barrels by treating them with dilute nitric acid and vinegar, to which has been added sulphate of copper. The metallic copper is deposited irregularly over the iron surface. Wash, oil, and rub well with a hard brush.—R. T.

GUN SCATTERING SHOT.—Mr. Abraham Heaton, of Ada, Mich., states that a gun will always scatter if the barrel be crooked. As a gunsmith of experience, and being now retired from the business, he thinks he can give H. W. good advice, and has no hesitation in imparting trade secrets. To straighten a barrel: Let it rest on the backs of two chairs to keep it level; take the breech out and lay a fine needle in the muzzle. Look in at the breech and turn the barrel round; and if the needle can be seen plainly all round, there is not much the matter with the straightness of the tube. But the barrel may be smaller in the middle, a frequent cause of scattering. To correct this fault, take a wooden rod, about six inches longer than the barrel, fit it snugly to the barrel from end to end. The end of the rod is to be the handle to draw it through the tube. The rod should have a small float file fitted in, about one inch from the end, even with the wood. If the middle of the barrel's length be smaller than the muzzle, it will be discovered on drawing the rod in and out of the barrel, and then the latter should be held in a vise, and the rod worked in and out till it passes easily. Then withdraw the rod, pry out the file, raise the latter by putting a piece of thick paper underneath, and proceed as before. After filing away the light part, sand paper should be used to finish it with. Keep the breech pin in, so that the thread cannot be injured. The file must be of the best cast steel, with the temper drawn to a straw color.

PROPORTIONS OF ENGINE.—On page 42, Vol. XXVI., J. R. L. wants to know whether the builder's idea of increasing the power of his engine is correct, and the true cause of the engine's not doing one fourth more work with 80 pounds of steam than it will do with 45 pounds. I think if the builders will put on a 1,500 pound fly wheel instead of a 4,200 pound one, and enlarge the steam pipe as well as the governor, the engine will do the work. There is trouble with the governor, which causes the phenomenon of the engine doing three fourths of the work with 45 pounds and not the whole with 80 pounds.—S. F., of Pa.

FACE WORMS.—To H. E. A., query No. 4, January 20. The best remedy for the eradication of flesh worms that I have ever seen tried is the following: Rub with dry sulphur at night before retiring; at the same time, take internally a tablespoonful of sulphur and magnesia mixed with molasses (measured after mixing). In the morning, wash off the face with bran water and afterwards with pure cold water. Repeat this treatment on alternate nights till a cure is effected.—J. B. Jr., of O.

LIGHT ENGINES FOR SAW MILLS.—In answer to NEMO, query No. 16, January 20, I would advise him to try a saw with inserted teeth, and take out the teeth at equal distances, until he has power enough to run it. Of course he must replace the teeth with worn out ones, to keep the strain on the saw equal, so that it will run true. A saw will bear feed much better with only a few teeth that cut a good kerf than it will with many of them, each scraping out a little dust.—E. K., of N. Y.

PAINT BRUSHES.—Query 5, January 1, 1872.—If the brushes are not hard, wash them with soft soap and water, or turpentine; if hard soak in a moderately strong solution of concentrated lye.—E. F. H., of Iowa.

Declined.

Communications upon the following subjects have been received and examined by the Editor, but their publication is respectfully declined:

ARTIFICIAL FUEL.—J. J. C.—E. F. L.
BOILER EXPERIMENTS.—W. H.
CANAL NAVIGATION.—C. B.
DIAMONDS.—A. D. R.
THE DAVENPORT TRICKS.—C. B.
TO SMOKE OR NOT TO SMOKE.—F. H.
WORMS IN TIMBER.—J. O. M.
ANSWERS TO CORRESPONDENTS.—Y. S.—J. A. C.—E. A. D.—G. S. & Co.—J. R.—C. O.—J. P. N.—R. E. O.—L. S.—E. H. G.—P. C., JR.—E. W. K. P.—W. S.
QUERIES.—W. A. A.—J. H. P.—J. D.—S. C. P.—J. O.—J. L.—S. G. S.

Recent American and Foreign Patents.

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

GIN GEARING.—Harris R. Easterling, M.D., Bennettsville, S. C.—This invention relates to the combination of two gins, placed diametrically opposite each other, and gearing with a master wheel driven by horse or other power, the connection between said gins and the pinions that gear with the master wheel being effected by means of sliding clutches, so that either gin may be stopped without stopping the other gin or the master wheel.

MACHINE FOR POLISHING AND VARNISHING MOLDINGS.—Charles and John Gschwind, of Union Hill, N. J.—This invention has for its object to devise a reliable apparatus whereon moldings, to be gilt, silvered, or otherwise ornamented, can be automatically and rapidly polished and, if desired, also varnished. This object is attained partly by a novel and ingenious arrangement of polishing tools and mechanism for moving the same over the moldings, and the combination therewith of an adjustable table on which the moldings are secured. It is also partly attained by a new system and arrangement of brushes, mechanism for dipping the same, and means for increasing their pressure upon the moldings in equal ratio to their distance from the varnish reservoir, and by further items of invention of greater or less importance.

HARNESS BUCKLE.—John H. Morris, Normal, Ill.—The invention consists in constructing and shaping the frame and tongue so that the buckle is held by pressure on heel and point in a very ingenious manner that gives great security. The device is a most useful one in connection with harness.

DITCHING MACHINE.—George W. Nevill, Richmond, Va.—This invention consists in a ditching machine which gradually cuts down to the depth desired, carries the excavated soil up over a flanged wheel, and discharges it at the side. Practical experiment has demonstrated its peculiar adaptability to the Western prairies.

CARPET STRETCHER.—William P. D. Claybrook, Palmyra, Mo.—This Invention relates to an improved device for stretching carpets and for holding them in position while being fastened, the same being of a simple and convenient form or construction, and adapted for operation in rooms of various sizes.

SULKY PLOW.—John H. Robbins and Samuel Robbins, Bethel, Oregon.—The invention consists in a very ingenious method of adjusting the depth and pitch of plows in a sulky carriage frame by a peculiar and simple construction of beam and graduating mechanism.

WATER ELEVATOR.—John L. Burch, Franklin, Tenn.—This invention relates to an endless chain water elevator, of simple and convenient arrangement of parts whereby they may be readily taken apart for transportation, or more easily placed in or removed from a well than others heretofore employed.

CANAL BOAT.—William Henry Newell, Jersey City, N. J.—This invention relates to a new fender attachment for canal boats, whereby the lateral disturbance of the water is prevented, and undue friction during the propulsion of the boat avoided. It consists in hinging fenders to the sides or at the ends of the boat, so that they will protect the propellor or wheel and tend to prevent the disturbed water from reaching the banks. It also consists in the application to side fenders of extension pieces. The fenders may, on their hinges, be swung out or in more or less, according to the amount of water acted on by the propeller and depth of draft. To one or both the ends of the fender, are or may be applied extension fenders, which permit the proper lengthening or shortening of the main pieces. Instead of extension sections, there may be hinged sections at the ends of the fender, which may be folded against the main fenders, when to be carried out of the way. These hinged end pieces may also be used as rudders if desired. Canal boats having stern propellers may have fenders hinged only to their stems and bows, or either, and none at the sides. Where the fenders are caused to meet forward of the boat, they will, it is claimed, increase the speed by cutting through the water with less friction.

ROTARY STEAM ENGINE.—Thomas B. Van Pelt, of Spring Hill, Kan.—This invention relates to improvements, in rotary steam engines, intended to secure the full power of steam. A single rotary shaft, with cylinders, connecting with the steam chest, disk pistons, eccentrics, cams, yokes, sliding heads, levers, rock shaft, and cut-off valves, are employed to secure the object sought, and are covered by the claims allowed in the patent.

SASH HOLDERS.—Oscar W. Noble, of Darlington, Wis.—A bolt having a slot and pin, and a plate having a pin and slot applied in combination to the recess of the sash, also a cam bolt having a slot and pin, and a plate having slots and a pin, applied in combination to the recess of the sash are the features embraced in the claims upon which a patent has been obtained. By applying a projecting tongue to the cam, the same can be made to lock into mortises provided for its reception at proper intervals in the window frame, and thus constitute an absolute support for the sash; and the device, locks the sash when the latter is closed.

ELECTRO-MAGNETIC ENGINE.—Claude Victor Gaume, Williamsburg, N. Y.—This invention has for its object to furnish an improved electro-magnetic engine, simple in construction and effective and reliable in operation, being so constructed as to be free from the "pull back" or retardation which is a great objection to such engines as usually constructed. The armatures consist of a central bar, attached at its center to the face of a wheel, and having cross heads formed upon them about midway between their centers and end, the cross heads having short bars formed upon their ends parallel with the central bar, and the ends of which project to equal distances upon the outer and inner sides of said cross heads. Armatures thus constructed are claimed to be free from the retardation or "pull back" which was the great difficulty to be overcome in making electro-magnetic engines practical as a motive power.

MEDICAL COMPOUND OR BITTERS.—Richard G. Turner, Columbia, Texas.—This invention consists in a compound, more especially designed as a remedy for miasmatic fevers, but is claimed to be valuable in many other diseases and ailments of the human system, as general debility, torpid liver, dyspepsia, constipation, jaundice, and many others.

MARBLE POLISHING MACHINE.—Michael Mallon, Rahway, N. J.—This invention consists of a horizontally swinging polishing stone holder, with driving gear and supporting apparatus therefor, adapted to be mounted on the surface of a large stone to be polished, and adjusted along it from one position to another and secured at any point, or to be used on a stationary table or platform. The machine may be used to polish metal and other substances. Sand may be carried upon the top of the stone and fed down through passages, from time to time, to the working surfaces.

EXTINGUISHER FOR STREET LAMPS.—George S. Dunbar, of Pittsfield Mass.—This invention has for its object to improve the construction of a gas light extinguisher, for which Letters Patent were issued, to the same inventor, October 3, 1871, so as to make it more satisfactory in operation, enabling the lights to be extinguished by a slightly increased pressure of the gas. It consists in the construction and combination of a lever, catch, shoulder or flange, with a flexible diaphragm and its attachments; also a combination of a pin with the catch, flexible diaphragm, and a case; also a combination of a pin or slide, with the lever and a slot in the case in which the said lever works. The invention is extremely ingenious, the gas being instantly extinguished by a pressure upon a pin passing through the case.

THILL COUPLING.—Lyman Derby, of Franconia, N. H.—This invention pertains to an improvement in the class of thill couplings in which rubber or other suitable elastic substance is employed to prevent rattling. The invention consists in a construction and arrangement of parts, whereby provision is made for causing two coupling screws to retain a secure hold, under all circumstances, by a single block or piece of rubber inserted between their adjacent inner ends, special provision being made for expansion of the rubber or compression of the same without material change in its elastic force, as applied to or exerted upon the screws; so that, if the block of rubber should be of undue size or firmness, the screws may notwithstanding be easily screwed home without injury to the rubber.

HARROW.—C. Hairgrove, of Jacksonville, Ill.—Two central bars are hinged together in the usual way of hinging harrows, or any other convenient way. To these bars are pivoted cross bars which are again pivoted to longitudinal bars at the outside, so that they may be inclined at an angle to the middle hinged bars. A clamping device holds them fixed when thus inclined. It is obvious that the more the cross bars are inclined from a right angle with the central hinged bars, the nearer will the teeth which they carry be brought together, and *vice versa*, the object being to construct a harrow in which the teeth may be adjusted in a simple manner, at a greater or less distance from each other.

TIRE SETTERS.—Joseph Pailca, of Ledyard, N. Y.—This invention consists of a bench, whereon the wheel is laid, with the tire adjusted upon its face at one side, and held by a holder suitably adapted therefor, while the other side of the wheel, on which the tire is to be forced, rests against a curved bar at the end of the frame, and a lever with a hook engaging the upper edge of the tire, while the end takes under the frame, which contracts the wheel and stretches the tire down upon the face of the hub in such manner as to allow of setting the tire without heating it at all.

EARTH CLOSET.—Hamilton Sherman, of Waverly, Pa.—This invention relates to that class of earth closets wherein the soil is transferred forward and dropped automatically at every raising of the cover by a carrier having an opening and closing bottom; the object being to improve the construction and the mode of operating grate bar slides with hinged metallic flaps underneath, closed by entering a narrow channel as the cover is raised and opened, successively, by their own gravity.

TRAVERSE MOTION.—Duncan Walker, of East Hampton, Mass.—This invention consists of a three pointed star wheel, combined with a pair of inclined faces or cams, arranged on said bar reversely to each other, and on opposite sides of the wheel at one end of the traverse bar, in such manner that said faces are alternately acted upon by the said star wheel, and the bar alternately moved in opposite directions, the movement in one direction beginning as soon as the movement in the other ceases, and the said movement being uniform in speed throughout the whole length, which is the essential object of the invention, and distinguishes it from those arrangements in which the bar is moved by eccentrics, which give a variable motion to the bar, and allow it to rest or move so slowly at each end that the wear of the threads or "ends" on the leather rollers is very much greater at the extremes of the movements than between them. The traverse bar assumes the form of a wide plate at one end, in which is a large hole whose walls are perpendicular to the bar and have each an inclined plane or cam which, beginning at a corner of said hole, inclines toward the center of it to some extent, and stops at a line parallel with the bar and passing through the center of said hole. One of the cams is on the same side of the center that the bar is, and the other is on the opposite side. The three pointed star wheel revolves horizontally in the hole on the axis of a worm wheel below which is turned by a worm on the shaft of one of the draft rollers. This star wheel and the cams are so adjusted relatively to each other that one of the points will begin to act on one of the cams to move the bar in one direction at the moment another point escapes from the other cam, and ceases to move said bar in the other direction. These cams will not be straight inclines, but will have such form that the motion imparted to the bar by the revolving points will be uniform in respect of speed throughout each movement.

AIR SUPPLYING ATTACHMENT FOR STOVES.—Wesley Wright, of Lee's Summit, Miss.—This article is proposed for manufacture and sale in the market as a suitable attachment to stoves, by which the air (required to furnish oxygen) may be drawn from the outside of the chamber, and its supply to the fire graduated according to circumstances. It is a compound metallic hearth and air chamber constructed in a single piece and adapted to the uses set forth.

WASHING MACHINE.—Isaac J. Wells, of Spring Valley, N. Y.—This invention has for its object to furnish a simple, convenient, and effective washing machine which shall be so constructed as to wash the clothes quickly and thoroughly and without injuring them. It consists in a washing cylinder and boiler, the washing cylinder being provided with buckets, and also a combination of stirrer pins with the washing cylinder.

ORGAN ACTION.—John H. Odell, New York city.—This invention embraces the employment of a pneumatic tube action for organs, in which the valves of the organ pipes are opened by the inflation of a pneumatic lever, which is inflated by the admission of air through a pneumatic tube, whereby the key board may be removed from the organ and placed at a considerable distance therefrom, and the usual arrangement of squares, levers, rollers, trackers, and electric wires, may be dispensed with. The invention also embraces the combination of a self acting exhaust valve with the pneumatic lever, and the employment of certain other novel devices in connection therewith, so as to produce a quick return movement of the pneumatic lever. The pneumatic lever may be operated by air pressure; but it may be also operated by an air exhaust or suction, in which case the pneumatic lever and connected parts would need to be specially arranged for the use of such exhaust. The inventor does not limit or confine himself to the particular form construction, or arrangement of any of the parts herein described, as they may be varied in many ways to suit the requirements of the construction without departing from the invention.

ELEVATOR.—William Livingstone and William F. Holske, Brooklyn, assignors to William F. Holske and William H. Silberhorn, New York city.—The first part of this invention consists of a combination of toothed eccentric wheels or pawls and weighted levers gearing with them, with the carriage, its actuating rope, and wood or other elastic guides, in such manner that the said toothed eccentric wheels will be caused to engage or bind against the wood guides by the gravity of the levers, or by the same and a series to lock the carriages and prevent falling in case of accident. The essential object of this invention is to avoid the expensive toothed or notched iron bars and the iron pawls now used, which, besides being expensive, are also objectionable on account of their liability to break for want of elasticity by the sudden shock when catching the car. The second part of the invention consists of a system of intermediate driving and reversing gearing between the driving belt, by which the carriage is actuated, and the drum o the hoisting rope, whereby the carriage is operated at will in either direction by the said driving belt constantly moving in one direction, the shifting being readily effected by suspended cords, such as are commonly used in elevators for actuating the reversing gear. This part of the invention also comprises a novel friction brake device, which, being also worked by the reversing cords, comes into action at that moment when in the reversing of the clutches the drum is entirely disconnected from the driving belt, and retains the drum until, by the continuation of the action of the shifting gear after the clutch has been released, the drum becomes completely disengaged and the connecting one fully engaged, thus positively holding the carriage during the time of changing the connection and while both clutches are disconnected to allow the carriage to rest. The essential object of the second part of the invention is to provide a simple and efficient system of connecting reversing gear, whereby elevators may be worked from shafting of factories, etc. continuously moving in one direction, and thus save the necessity of employing special engines for reversing the carriage by reversing the valves. Thus the inventors are enabled to drive the carriage in either direction by a power constantly moving in one direction, and to hold said carriage while shifting from one connection to the other, so as to insure the entire disconnection of one clutch and the cessation of the motion of the drum and carriage before the other reversing connection is formed, so that there is no clashing of any counter forces; also to allow the carriage to stop as required by apparatus set in motion by the same act by which the reversing is effected.

SELF-ACTING MULE FOR SPINNING.—Joseph P. Sweet, Hebronville Mass.—This invention relates to a new arrangement of apparatus constituting a positive "wind" motion, and the gearing and ungearing devices therefore adapted for the Franklin mule, which we regard as a positive improvement upon this class of machines. A ratchet wheel, pawl, tapered pin, disks, combined with a cylinder shaft, a lever, spring, spring catch, dagger, and tripper, constituting the mechanism embraced in the patent which has been obtained upon the invention.

TRUNK LOCK.—Joseph Stanton, New York city, assignor to Adolphus Hagelin, same place.—This invention has for its object to furnish an improved trunk lock, so constructed that the lock itself will act as a guide to bring the parts of the lock into proper position for locking, thus counteracting any bad effects from the springing or warping of the side of the trunk body, and preventing any damage to the lock should the cover be accidentally dropped, even though the locking bolt be thrown forward.

SALVE.—Louisa Masters, Jackson, Miss.—This preparation has for its object to furnish an improved salve for the cure of sores, cuts, bruises, etc., whether they be of long standing or not. It is prepared of various ingredients, in specified proportions, and in a peculiar manner.

LIVER INVIGORATOR.—William L. Simmons, M. D., of Weatherford, Tex.—This preparation has for its object to furnish an improved medical compound, called "Liver Invigorator and Cholagogue," which is claimed to be very effective as a corrective of biliousness, indigestion, etc., caused by miasmatic influences, torpor of the liver, headache arising from disordered stomach, bowels and liver, or produced by malarious poisons, etc.

BIT BRACE.—James Rice, of Prairie Creek, Ind.—The first peculiarity in this brace is that it may carry several bits at once, those not in use being turned up out of the way. Second, a very ingenious device enables the sweep or leverage of the brace to be increased or diminished as may be desired. The precise form or arrangement of any of the parts described is not claimed, as they may be varied in many ways without departing from the invention.

ACCOUCHING GARMENT.—Harris R. Easterling, M.D., Bennettsville, S. C.—The invention consists in two corsets, leg pieces, and certain intermediate connections by which a lady is enabled to manage the whole business of parturition without the assistance of midwife or physician.

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5,496.—SHAWL.—H. Boot, Philadelphia, Pa.
5,497.—LABEL.—C. H. Collins, Cincinnati, Ohio.
5,498.—CUPBOARD TURN.—O. F. Fogelstrand, Kensington, Conn.
5,499.—COAT AND HAT HOOK.—O. F. Fogelstrand, Kensington, Conn.
5,500.—CHAIN BOLT.—O. F. Fogelstrand, Kensington, Conn.
5,501.—WINDOW CATCH.—O. F. Fogelstrand, Kensington, Conn.
5,502.—DRAWER PULL.—O. F. Fogelstrand, Kensington, Conn.
5,503.—DOOR LATCH.—O. F. Fogelstrand, Kensington, Conn.
5,504.—CUPBOARD CATCH.—O. F. Fogelstrand, Kensington, Conn.

TRADE-MARKS.

640.—REFINED PETROLEUM.—F. M. Backus & Co., Cleveland, Ohio.
641.—EMERY.—Tully & Davenport, New York city.
642.—COMMERCIAL FERTILIZER.—Walton, Whann & Co., Wilmington, Del.
643.—BOOT OR SHOE.—F. Winslow and J. W. Rogers, Boston, Mass.

SCHEDULE OF PATENT FEES:

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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:

19,988.—BURNISHER.—C. G. Frampton. April 3, 1872.
20,100.—DRAWER FOR CLOSETS, BUREAUS, ETC.—H. R. Taylor. April 10, 1872.
20,013.—BREECH LOADING FIREARM.—T. Lee. April 10, 1872.
20,106.—WARM AIR REGISTER AND VENTILATOR.—E. A. Tuttle. April 10, 1872.
20,111.—APPARATUS FOR DAMPING PAPER.—C. A. Waterbury. April 10, 1872.
20,051.—COTTON GIN.—J. Du Bois. April 10, 1872.
29,056.—PENCIL SHARPENER.—W. K. Foster. April 10, 1872.

Inventions Patented in England by Americans.

From January 4 to January 8, 1872, inclusive.

[Compiled from the Commissioners of Patents' Journal.]

BINNACLE.—J. Low, Boston, Mass.
FURNACE.—G. H. Sellers, Philadelphia, Pa.
FURNACE.—W. & G. H. Sellers, Philadelphia, Pa.
LUBRICATOR.—C. Mettam, New York city, and J. S. Sanson, Morrisania, N. Y
PRINTING MACHINERY.—R. M. Hoe, New York city.
SELF-RELEASING HOOK.—J. L. Cathcart, M. Ezekiel, and E. F. M. Fachtz Washington, D. C.

NEW BOOKS AND PUBLICATIONS.

SCIENCE RECORD FOR 1872. Being a Compendium of the Scientific Progress and Discovery of the Past Year. 400 pages, octavo. 100 Engravings, Steel Plate and Wood. Handsomely bound in muslin, $1.50: extra binding, half calf, $2. Munn & Co., Publishers, 37 Park Row, New York, Office of the SCIENTIFIC AMERICAN.

This new and elegant work presents, in convenient form, notices of the leading subjects and events, pertaining to science, that have occupied public attention during the past year. The progress of the more important public works is duly chronicled, with illustrative engravings. The leading discoveries, facts, and improvements, in chemistry, mechanics, engineering, natural history, and the various arts and sciences, are recorded and illustrated. Sketches of prominent scientific men, with illustrations, are given, and among the portraits are those of Faraday, Murchison, Darwin, Agassiz, Huxley, and Herschel. The Mont Cenis tunnel, the Hell Gate works, the Brooklyn suspension bridge, the Hoosac tunnel, the St. Louis bridge, the United States Patent Office, and other works are illustrated. A large amount of useful information, tables, descriptions of improvements, with engravings, are likewise presented. The book is one of much interest and value, and should have a place in every library.

BRITISH JOURNAL PHOTOGRAPHIC ALMANAC. London: H. Greenwood. New York: E. & H. T. Anthony.

This is a valuable little publication, presenting, in compact and convenient form, the principal photographic improvements and processes of the past year. Of use and value to every person interested in the art.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, foundries, rolling mills, architecture and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of engraving in advance of its execution, so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 40,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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:

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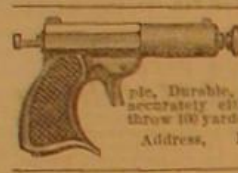
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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXVI.—No. 8. [NEW SERIES.] NEW YORK, FEBRUARY 17, 1872. $3 per Annum. [IN ADVANCE.]

Improved Horse Power.

An objection, to portable horse powers now in use, is the loss of power in transmitting rotary motion along the shafting with angles connected by couplings, these angles being necessary to place the shafting near the ground, so that the horses can step over it. These couplings and angles cause friction and wear, the result of which is loss of power, and a lack of durability which it is very desirable to obviate.

While overcoming these objections, the inventors of the machine herewith illustrated have succeeded in simplifying its construction so that the levers and other detachable parts may be easily carried on the axles of the wheels, that support the principal part of the machine, and between the sills. This is a great advantage, as other powers require extra appliances, to render the transportation of these parts convenient; which appliances increase cost, and are more or less troublesome in use.

The main feature of this improvement, which secures the advantages named, is the arrangement whereby the toothed wheel that drives the tumbling shaft, with its vertical shaft, and the pinion upon the upper end of the shaft may be raised together from the position shown in Fig. 2—the working position—up to, and held in, the position shown in Fig. 1, during transportation from place to place.

In working, the wheel that drives the tumbling shaft is thus brought down to the level of the shaft, and the objectionable angular transmission of motion is avoided. Another advantage is that the power may be transmitted from the front or rear, or from either side of the machine. The cost of construction is also lessened by dispensing with parts used in other more complicated powers.

When the wheel under consideration is raised, the whole under side of the vehicle is left clear, so that obstructions like low stumps or protruding rocks do not interfere with the progress over rough and uneven roads or fields.

The inventors state that they thoroughly tested the invention during the last season, and that its operation is very satisfactory in all respects.

The framework of the wheel that drives the tumbling shaft is sustained by four strong upright beams, which slide up and down in strong sleeves cast upon the framework of the upper driving gear, and which is held in the working position by nuts running upon threads cut on the bearers, the nuts abutting against the under ends of the sleeves, and the collars on the upper ends of the bearers being brought down against the upper ends of the sleeves.

The improvement is simple and practical, and, we judge, will add much to the convenience of this class of machines.

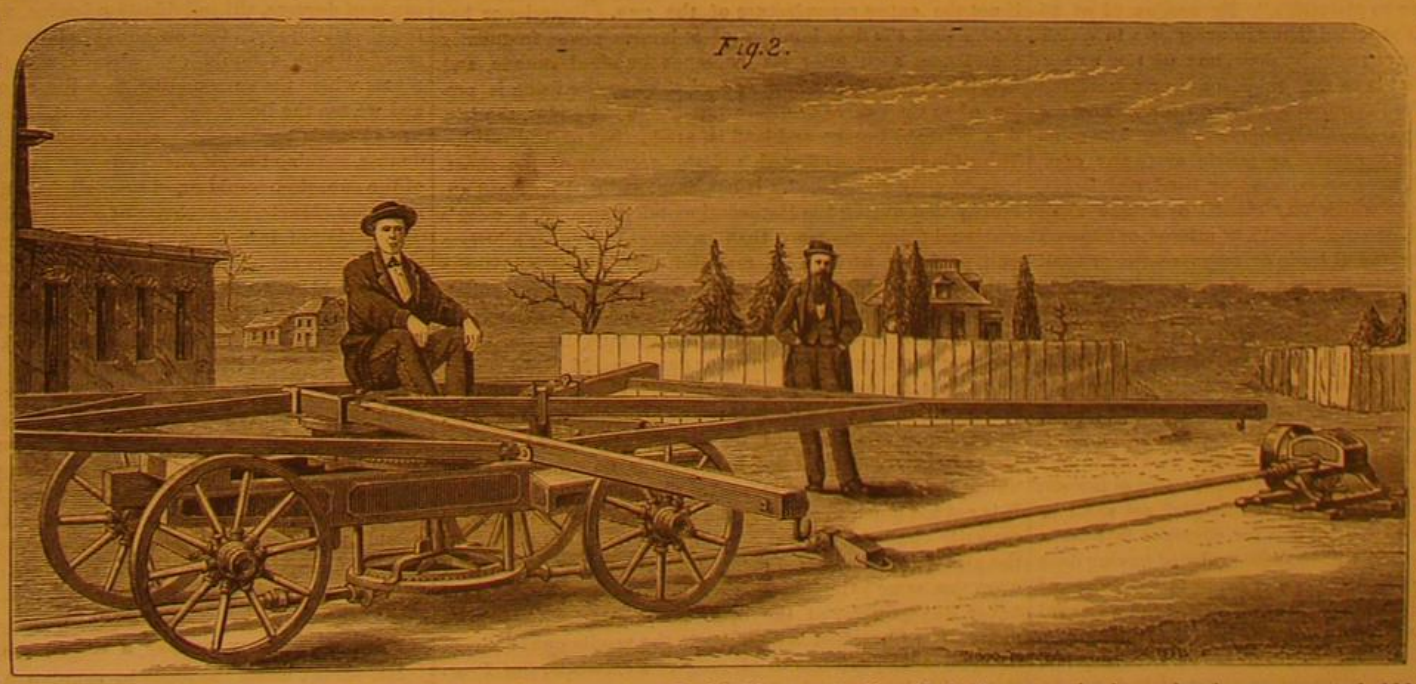
The invention was patented May 9, 1871, through the Scientific American Patent Agency. For further information address Harrison & Co., Belleville, Ill.

Fig. 1.



HARRISON'S MOUNTED HORSE POWER.

Fig. 2.



Mastodon Remains.

A farmer in the town of Mount Hope, Orange county, N. Y., digging recently in a swamp on his premises, exhumed from the muck, about eight feet below the surface, a number of bones which, from their size and formation, are supposed to be those of a mastodon. There are two ribs nearly five feet long, and two sections of vertebræ six inches wide. What would give strength to the supposition that the bones are a portion of the skeleton of one of those old time monsters, in the absence of other proof, is the fact that several discoveries of mastodon remains have been made in this county during the past thirty or forty years. In 1841, an entire skeleton was exhumed, in the vicinity of Scotchtown, from a marl pit. Its tusks were over five feet in length, and with the head bones weighed nearly 600 pounds. It was found near the surface, lying at an angle of about forty-five degrees, head uppermost. Previous to this, portions of over twenty skeletons of mastodons had been found in the Wallkill Valley. One of these was the monster that for years was the wonder of visitors at Peale's Museum, in New York City. There is in a Boston museum the complete skeleton of a mastodon, which was exhumed near Newburgh, only a few years ago. One was found in a swamp in Sussex County, N. J., fifteen years ago; a farmer, taking an exposed part of it to be a stump, hooked his oxen to it and broke off the tusks, which led to its discovery.

JESSE MEYERS leaned against a shaft revolving three hundred times per minute, in a slaughter house, Muncy, Ind. He undressed in about ten seconds, but strange to say he was not at all injured. Not a stitch of clothing remained upon him.

NEW USE FOR PARAFFIN.—Dr. Vohl announces that mixed with benzole or Canada balsam, paraffin affords a glazing for frescoes much superior to soluble glass. By covering the interior of wine casks, with a film of pure white paraffin poured in melted, he has effectually prevented the spoiling of the wine and its evaporation through the wood.

Sulphuric Acid---New Mode of Manufacture.

The large and constantly increasing demand for this chemical product gives interest to any information as to its character and the best modes of preparing it; we therefore translate the following article from *Le Génie Industriel*, a well known Parisian scientific magazine, the new process being the discovery of M. M. Langlois and Thomassin, of Paris:

"This new method of manufacturing the sulphuric acid of commerce has for its object, first, to permit a more rapid fabrication of the acid, and, secondly, to dispense with a large number of the leaden chambers. The apparatus by the aid of which these results are obtained can be applied in any sulphuric acid factory, whether the process be with sulphur or with pyrites, furnaces being employed. To obtain the proposed object, the vapors of sulphurous acid (SO_2) are first produced by the customary methods, and by the aid of the ordinary furnaces, from sulphur or from pyrites; to which is added, by the combustion of a nitrate (ordinary nitrate of soda, for instance), in or out of the furnace, the third equivalent of oxygen which is necessary to transform the said sulphurous acid vapors into sulphuric acid (SO_3.)

The vapors of the sulphurous acid are collected in a small chamber or drum of lead, into which, if it be necessary, a small jet of steam can be turned. The combustion of the nitrate can be replaced by a spray of nitric acid which would operate in the chamber itself or, if convenient, in a separate one.

Thus far the process is known and understood by the public; but, to oxydize the sulphurous acid, MM. Langlois and Thomassin use ozone or active oxygen; first, by substituting it for the spray of nitric acid or the combustion of the nitrate, and secondly in using the ozone conjointly with the following nitrates or the products of their decomposition: hypoazotic acid, nitrous acid, or binoxide of azote.

A pump constructed of material indestructible by acids, such as lead, gutta percha, caoutchouc, etc., exhausts the sulphuric vapors, which form and collect in the chamber, and compresses them in a cylinder. This cylinder is a closed utensil, capable of resisting a pressure of at least five atmospheres. It is similarly constructed of material which resists acids, and is furnished with appliances, such as valves, manometer, etc., arranged purposely to ensure safety. This cylinder contains water, of which the quantity is determined approximately, according to the desired concentration of the acid. The sulphuric or sulphurous acid vapors begin, under the pressure, to bubble in the water, with which they are not slow to combine by reason of the great affinity of the sulphuric acid for water; and thus they produce, in a short time, a commercial sulphuric acid, at least as concentrated as the acid in the chambers. From the generating cylinder branches a lead pipe, communicating with a safety valve for the escape of azotic gas (hypoazotic or nitrous acid, or binoxide of azote) which would create pressure in the generating cylinder and be forced into the chamber. Instead of ordinary water for feeding the generating cylinder, oxygenated water (binoxide of hydrogen), prepared by well known processes, can be used; this substitution will have the recommendation of dispensing not only with the return pipe, but also [illegible] the combustion of the nitrate in or out of the

furnace, or with the nitric acid jet in the chamber. The pump can be worked by manual or steam power, according to the extent of the manufacture, as the process, as applied to sulphuric acid apparatus, can be used for making so small a quantity as five or six carboys of acid in twenty-four hours, if desired; and superficially it occupies but little space."

The inventors have taken out letters patent which cover the novel features of the above described method, namely: the use of the pump for exhaustion and compression, and of the cylinder or generator furnished with valves and safety appliances, the employment of ozone or active oxygen, alone or in conjunction with combustion of a nitrate or the jet of nitric acid, and the employment of oxygenated water (binoxide of hydrogen.)

THE LAW OF TRADE MARKS IN ENGLAND.

We believe this much debated question will have a practical settlement in the forthcoming session of Parliament; and it is, indeed, time that something was done to prevent even the most innocent infringements. Very properly, the Vice Chancellors are not disposed to strain the laws in favor of any particular houses, when it is shown that the copying of a trade mark has been purely accidental, yet, at the same time, it is extremely hard upon a firm to be told "I bought some of your brandy or champagne"—as the case might be—"the other day, and it was so inferior that I shall not purchase any more." Messrs. Martell & Co. had occasion, in 1871, to complain very seriously, not only that their trade mark had been infringed in a general way, but that a country printer had actually struck off a number of labels for brandy in bottle, in direct imitation of those so well known in the trade as connected with the genuine article. Of course an injunction was immediately granted by a Vice Chancellor, but we must say, that unless we can get an Act of Parliament, with penal clauses to be rigidly enforced in all these cases, very little good, in the shape of reform, will ever be done. Relative to the Chancery and common law rights anent trade marks, it will not now be at all out of place to quote one or two opinions that have been given in reference to existing statutes.

The Lord Chief Justice says—"An action for counterfeiting a trade mark is, in law, an action for fraudulent misrepresentation. Courts of equity exercise a jurisdiction for the protection of rights to trade marks upon the ground that they are rights of property. In law, no exclusive right of property in a trade mark in the abstract is recognized; but the exclusive right, to use such a mark for the purpose of authenticating a vendible commodity, is one for the invasion of which a remedy is given by an action in the nature of deceit." This is substantially what we have urged for so long; and we fancy, after all, that the common law courts would be the best tribunals to deal with these matters, provided a fine could be added to the damages; for not only is the owner of the trade mark damnified by the action of piracy, but the public also come in for a share of the wrong. In the case of Rodgers *vs.* Nowill, it was ruled that "as there is, therefore, no abstract right to trade marks recognized, the plaintiff in an action at law must show that the defendant had an intention to deceive and make the goods pass as his. The questions in such a case for the jury are: "Is the resemblance such as to deceive ordinary persons? Was the mark adopted by the defendant with that intent and in order to supplant the plaintiff's goods?" And in the case of Blofield *vs.* Payne, it was decided that "it is not necessary to show that defendant's goods are inferior to plaintiff's." By section 22 of 25 and 26 Vic., c. 68, it is provided that "in every case in which any person shall do, or cause to be done, any of the wrongful acts following (that is to say) shall forge or counterfeit any trade mark; or, for the purpose of sale, or for the purpose of any manufacture or trade, shall apply any forged or counterfeit trade mark, to any chattel or article, or to any cask, bottle, stopper, vessel, case, cover, wrapper, band, reel, ticket, label or thing in or with which any chattel or article shall be intended to be sold, or shall be sold, or uttered, or exposed for sale, or for any purpose of trade or manufacture, or shall enclose or place any chattel in, upon, under, or with any cask, etc., to which any trade mark shall have been falsely applied, or to which any forged or counterfeit trade mark shall have been applied: or shall apply or attach to any chattel or article, any cask, etc., to which any trade mark shall have been falsely applied, or to which any forged or counterfeit trade mark shall have been applied; or shall enclose, place, or attach any chattel or article in, upon, under, with or to any cask, etc, having thereon any trade mark of any other person: every person aggrieved by any such wrongful act shall be entitled to maintain an action or suit for damages in respect thereof against the person who shall be guilty of having done such act, or causing or procuring the same to be done, and for preventing the repetition or continuance of the wrongful act or the committal of any similar act." In the above quotation, the law of trade marks seems to be very clearly laid down, and when the words forged or counterfeited are inserted in any clause in an Act of Parliament, something like a criminal motive or intention is implied. While foreign houses are contending so strongly for their rights on this side of the Channel, they might in their own courts do something for the English manufacturer, who has often been a great sufferer through the cleverness (or something worse) of talented French and German copyists. Whatever happens, it cannot be denied that the English Government is bound to protect the trade, and we must all keep a sharp look out for those very clever gentlemen, who imagine that, so long as there is a handsome binding, it matters not what is in the book.—*Grocer.*

A Wonderful Curiosity.

Under this heading, the Virginia newspapers have raised an excitement over a slab of curious stone, lately brought to Wheeling, Va., and put on exhibition in front of one of the stores. The editor of the Wheeling *Intelligencer* pronounces it "the most wonderful curiosity it has ever been our privilege to examine," and describes it as "a slab of common white American marble, thirty-eight inches long, seventeen inches wide, and two inches in thickness, which is as flexible as a piece of soft rubber of the same size. It was cut for and used as a hearthstone in the Moundsville Seminary Building which was destroyed by fire about three years ago. Now the question arises, what strange chemical action took place, or in what manner precisely the intense heat, to which the slab was subjected without its calcination at the time of the burning of the building, and its subsequent burial among the *débris* for the period above named, produced so remarkable a change in the character of the stone. This mystery no one has yet been able to answer or explain. Surely if this knowledge were given to mortals, there is no telling the amount of valuable aid that art would derive therefrom. The same chemical process, if understood, might give us flexible glass, the real value of which could never be told.

The oldest workmen in stone and marble declare that they have never before seen anything like it, and we doubt if a similar specimen was ever before discovered. In all the ruins of Chicago, nothing of the kind has been found or reported. Since the slab has been taken indoors and placed near the stove, it has daily become more and more flexible, a fact which all the more mystifies its character. We hope our scientists will give Mr. Holliday a call and see for themselves the wonderful curiosity, and that at least some one of them shall be able and willing to tell us all about the process of making a marble slab as yielding as a sheet of bonnet pasteboard."

"Yesterday," says the same editor, "several gentlemen from Pittsburgh, also two or three from Cincinnati, came to see it, and they confessed to be not less puzzled, as to the whys and wherefores, than the wisest of our own citizens who have, up to this time, fruitlessly attempted to explain the process by which a slab of common white marble may be made as flexible as a piece of india rubber of the same size.

We understand that Mr. Holliday has refused an offer of $500 for the slab, also several tempting inducements to visit other cities with the stone. We suppose he is waiting for better offers than have thus far been received."

The *Intelligencer's* book on mineralogy must have been absent from the library when the above was written. The stone is undoubtedly itacolumite, flexible slabs of which may be seen, in several college cabinets, without going to Wheeling. It is extensively developed in Stokes county, North Carolina. When cut into slabs, it might be very easily mistaken by the uninformed for marble. The itacolumite of different localities (as the Brazils and Carolinas) differs somewhat in constitution; but the flexibility in all cases is doubtless due to the disseminated *laminæ* of talc, mica, or chlorite, which bind together the grains of quartz. A more full account of the mineral will be found in the SCIENTIFIC AMERICAN of April 22, 1871.

European Field Artillery and Small Arms.

If the Prussian artillery is to be regarded as the model, it possesses three features which are indispensable to its efficiency. These are loading by the breech, firing the shells by percussion, and the employment of steel in the partial if not the entire manufacture of the gun. Experience has shown that the deterioration of a bronze piece frequently commences soon after six or seven hundred rounds, and that it becomes nearly *hors de combat* when the firing is prolonged to the twelve or fifteen hundredth. Besides, the friction between bronze and lead is productive of bad results. The rifling becomes affected, and the accuracy of the shooting seriously diminished. It has been asserted on good authority that during the last continental campaign, a week's continual firing was more than sufficient to render a bronze gun perfectly useless. A material which will resist the action of the injurious friction is to be found in Krupp's steel. A Belgian gun which is constructed of that metal is enabled to be fired from six to eight thousand times without evincing any signs of weakness or damage. M. Nicaise says so, at least, to our no small surprise. There is no doubt that the French would be very much disinclined to draw upon a German establishment for a supply of steel to manufacture their cannon from, but there is no other resource unless they are prepared to make the material themselves. It is not too much to assert that a considerable time must necessarily elapse before they could rival the productions of the great workshops of Essen. Had the French guns been upon the same principle as their small arms, they would never have displayed the manifest inferiority they have done. The Chassepot is superior to the needle gun, both in accuracy of fire and length of range. But while the Prussian and Belgian guns and shells are merely enlarged imitations of the Chassepot small arm and ball, the French guns resemble equally closely the needle gun, with the additional misfortune of magnifying its disadvantages. With regard to small arms, the Belgians are better off than the Prussians, since their infantry rifle is nearly identical with the Chassepot. The principle of rifling and the length of bore of the barrel are the same, and the same similarity prevails with respect to the weight of the arm, the charge, and the shape and size of the ball. It is to be hoped, in the interests of peace and humanity, that the last continental struggle may never be repeated; but should future years cause the strife to be renewed, it is evident the French must remodel their field artillery before they can expect to cope with their northern neighbors.—*Engineer.*

Applying Plaster to Walls and Ceilings.

The object of this invention is to provide means for utilizing plaster and other similar compositions in a more full and satisfactory manner for building purposes than heretofore. It consists in the use and manner of applying molds against the walls or ceilings, to permit the casting of the plaster or other matter to its place. This, it is claimed admits of economical application, and in more or less elaborate or artistic style, bringing the finest productions of genius to the humblest homes.

The artistic advantage of this method of applying plaster or other composition to walls or ceilings is, it is claimed, surpassed by the utilitarian benefits arising from its adoption. Building fronts can be provided with cheap and durable coatings, and wooden structures can be made fireproof by having the walls on both sides and also the ceilings lined with heavy coats of plaster or cement. The old mode of applying such substances by means of trowels, makes it very costly to use them otherwise than very thin, and to obtain nicely finished surfaces. With the aid of molds the question of greater or less thickness is only one of cost of material, and the surface finish is spontaneously obtained by the very act of application.

To cover the surface of a wall, either inside or outside, a bertical mold or false wall is used, which is placed at the requisite distance from the surface to be coated. The plaster or other composition is then, from above, poured into the space between the false and real walls until the space is entirely filled. The outer surface of the coating will, when the false wall is removed, be an exact impression of the mold. The finest wood graining, as well as moldings, carvings, etc., of most difficult make can thus be cheaply multiplied. Thus the inner or outer sides of walls can be covered in sections of greater or less extent until perfected.

On ceilings, it is proposed to use a pendent ceiling, which is supported or suspended a suitable distance under the beams or laths, according to the thickness of the plaster to be obtained. The surface of the pendent ceiling may be ornamented in suitable manner or quite plain.

The plaster is, from above, poured upon the pendent ceiling. It will adhere to the beams and laths, while the surface of the pendant is so prepared, by the application of glycerine or other material, that the plaster cannot adhere to it. The plaster may, on such ceilings, be so thickly applied as to coat the flooring beams, and thus make the floors fireproof. The application of glycerin or other material to prevent adhesion of the mold is also used for facing the walls. Mr. Andrew Derrom, of Patterson, N. J., is the inventor of this improvement.

The Sun.

A correspondent of the Oneida *Circular* says that Professor Young, of Dartmouth, in a recent lecture at New Haven upon the great luminary, imparted much interesting information. The theory which he most seemed to favor respecting the sun's constitution, he illustrated very simply thus: Put a pail of water in a room, the temperature of which is below the freezing point; the temperature of the water settles slowly till it reaches 32°, and there remains till every drop is frozen. The sun may be a vast quantity of merely gaseous matter, which is gradually liquefying, and accordingly will not change its temperature till this process is entirely accomplished; then the temperature will fall, perhaps thousands of degrees, till solidification begins, when it will again remain stationary. One authority believes the sun to be surrounded with a liquid coat already, and the sun spots are places where the surrounding metallic clouds have opened, and we see the liquid surface below it. The theory that the sun's heat is kept up by matter constantly falling into it, he doubts, arguing that, if such masses of matter existed outside of the sun, they would exert some slight influence on the surrounding planets, no evidence of which is discernible.

Speaking of iron, he said that if the word were written in great letters across the sun's face, the proof of its existence there would not be so satisfactory as that afforded by the spectrum. He pointed out lines in the spectrum made by metals which exist in the sun, though entirely unknown to us.

He gave several illustrations of the heat of the sun. If a pillar of ice covering nine square miles extended from the earth to the sun, and all the heat of the latter should be directed upon it, the whole mass would be melted in exactly one second. If an icicle forty-five miles in diameter were to be thrust into the sun with the velocity of light, say twelve million miles a minute, it could never touch the sun; it would melt as fast as it came. Still, physicists are as yet unable to determine the exact temperature, one placing it at 67,000° Fahr, another at 20,000,000° Fahr.—some difference.

How to Use a Grindstone.

1st.—Don't waste the stone by running it in water; but if you do, don't allow it to stand in water when not in use, as this will cause a soft place.

2d.—Wet the stone by dropping water on it from a pot suspended above the stone, and stop off the water when not in use.

3d.—Don't allow the stone to get out of order, but keep it perfectly round by use of gas pipe, or a hacker.

4th.—Clean off all greasy tools before sharpening, as grease or oil destroys the grit.

5th.—Observe: When you get a stone that suits your purpose, send a sample of the grit to the dealer to select by; a half ounce sample is enough, and can be sent in a letter by mail.—*Franklin Journal.*

EFFECT OF ANIMAL EXCRETA IN WATER.

BY PROFESSOR CHARLES F. CHANDLER.

The products of the decompo ition of animal matter in water, are the most objectionable impurity. Organic matters, produced by the decomposition of vegetable substances, are not especially dangerous, but the products of decomposing animal substances are highly dangerous, even when in minute quantities. These impurities do not make themselves apparent to the taste. On the contrary, such waters are frequently considered unusually fine in flavor, and persons go a great distance to procure them. Nevertheless, they contain an active poison. Many diseases of the most fatal character are now traced to the use of water poisoned with the soakage from soils charged with sewage and excremental matters. Sudden outbreaks of disease of a dysenteric character are often caused by an irruption of sewage into wells, either from a break in the sewer or cesspool, or from some peculiarity of the season. Such contamination of the water is not indicated by any perceptible change in the appearance of the water. The filtered sewage, clear and transparent, carries with it the germs of the disease. At a convent in Munich, 31 out of 121 of the inmates were affected with typhoid fever. It was found, upon investigation, that the well was polluted by sewage, and the disease disappeared as soon as the proper repairs were made.

At Pittsfield, Mass., the typhoid fever suddenly broke out in a large boarding school for young ladies. The water was found to be contaminated with sewage owing to a leak in the cesspool.

At Edgewater, on Staten Island, in 1866, the inmates of a small block of houses were afflicted with typhoid fever, several deaths occurring. On making investigation, the health officers found that a neighbor, through whose land the underground drain passed, had taken the liberty of closing up the drain, thus sending its contents back upon this block of houses, contaminating the well, and actually murdering the unfortunate victims with sewer poison.

Dr. Stephen Smith, one of the health commissioners of this city, describes an interesting case that came to his knowledge. He visited an old schoolmate, a clergyman, in the country, and in the course of conversation his friend told him of a family in which typhoid fever had made its appearance, five members having already died, while another was then fatally sick. The physician called the attention of his friend to the fact that typhoid fever is now attributed to the poisoning of the water by animal refuse. This was new to his friend, the clergyman, who had not thought of attributing it to anything else than to the visitation of Providence. They went together to visit the locality, and found the house situated on an elevation, with all its surroundings admirably arranged for health. One readily believed the statement that there had not been a case of sickness in the house for twelve years. A few weeks before the fever appeared, when the laborers on the farm were busy taking in the crops, one of the valves of the pump got out of order. Being unable to get their usual supply of water, and being too busy to send for the pump maker, they sent a man down to a neighboring spring to draw water, who, finding that it was not easy to dip the water from the spring, owing to the shallowness of the pool, drew his supply from a brook near by. From this source the family was supplied for two or three weeks. This stream, higher up, ran through several farm yards and received the surface drainage. The first symptoms of poison by this water were a slight nausea and mild diarrhœa; after several days, typhoid fever in its worst form was ushered in. Of the entire family, but two escaped an attack, and they did not use the water.

This city, during the last century, and before the introduction of sewers or the Croton water, was ravaged every few years by deadly epidemics, which are now believed to have been favored and invited by the defilement of the wells then in use, by sewage and fæcal soakage. No such visitation has occurred since the introduction of the Croton water, and the completion of the very perfect system of sewers.

Cholera, though it does not originate from polluted water, is disseminated chiefly by the aid of wells and other impure water supplies.

At Exeter, England, in 1832, 1,000 deaths occurred from cholera. A purer supply of water was then introduced from a locality two miles higher up the river, above the point at which it received the sewage of the town. When the cholera again invaded the city in 1849, only forty-four cases occurred, and in the cholera season of 1854, there was hardly a case.

In London, in 1854, the water supplied by the Southwark Company contained much sewage, while that supplied by the Lambeth Company was very pure. Both companies had pipes in the same streets, supplying water indiscriminately on both sides. Among those who used the Southwark water, the deaths amounted to 130 in 10,000, while among those who drank the Lambeth water, they amounted to only thirty-seven in 10,000; 2,500 persons were destroyed by the Southwark water in one season. On the previous visitation of 1848-9, the case was the reverse. The deaths from the Lambeth amounted to 125, while those from the Southwark amounted to 118 in 10,000. At that time, the Lambeth company took their water from a point lower down the river.

Another very striking instance occurred in London. The famous Broad street pump supplied water in one of the most fashionable localities of the West end. During the visitation of 1848-9, this pump killed 500 persons in a single week, by disseminating cholera. The wealthy people of the west end went to Brompton, a fashionable summer resort, about five miles up the Thames, and soon the cholera broke out among them there. The health officers soon discovered, on investigation, that these people had been in the habit of sending to the Broad street pump for tea water, and had brought the cholera with it. A curious case was that of an old spinster who had moved to Hampstead, three miles from the pump, but who sent her maid daily, for a kettle of the highly prized tea water. She and her maid were the only persons who suffered from cholera at Hampstead.

A similar story might be told of an outbreak of cholera in a shanty village, west of Central Park, and another in a shanty village on the hights across the river. In both cases, it was clearly shown that the cholera germs were distributed among the unfortunate squatters by the waters of the single well in each village. There is a famous pump in the twelfth ward of Brooklyn, at the corner of Van Brunt street, from which over fifty families obtained their water supply. In 1866, cholera broke out in five or six of these families, but the spread of the disease was prevented by the prompt action of the health officer, who removed the pump handle.

From these facts, it is seen that water aids in disseminating two of the most fatal diseases which affect the human race, the typhoid fever and the deadly cholera. During the ten years from 1856 to 1866, there were 21,000 deaths from cholera in England and Wales, and 150,000 deaths from typhoid fever. There is every reason to believe that at least three fourths of these deaths might have been prevented had proper attention been paid to the purity of the water supply. This poisoning by bad water is now fully established, and must awaken communities to the vital importance of securing a pure and unfailing supply of this indispensable beverage.

In Iceland, it is stated that one sixth of the deaths are caused by hydatids in the liver. These are the larval forms of the tænia or tapeworm of the dog. Young leeches, contained in drinking water, sometimes fix themselves on the pharynx. In a march of the French in Algiers, 400 men were in the hospital at one time from this cause.—*American Chemist.*

ASBESTOS PISTON ROD PACKING.

[From the Engineer.]

Few engineers who have to do with the steam engine are ignorant of the trouble which is met with in obtaining a really good piston rod packing. Sound hemp, properly "laid up" and copiously lubricated, makes a tight joint enough for a time, especially if the rod is in first rate condition; but the period of tightness is usually short, and the gland requires constant screwing up, and much friction results, which is very prejudicial in small engines. If hemp is bad in the case of low pressure engines, it is infinitely worse when we have to do with high steam, especially if the steam is slightly superheated. A process of slow carbonisation appears to go on, the hemp packing loses its elasticity, and becomes nearly useless for its intended purpose. All manner of schemes have been tried to get over the difficulty; combinations of cotton, india rubber, and wire gauze, such, for example, as Crickmer's patent packing, have hitherto given on the whole the best results. One inventor, indeed, dispenses altogether with cotton and rubber, and uses copper wire gauze alone. In this case, the tightness of the joint is no doubt secured by the presence of water and oil lodged in the meshes of the gauze; and we have received very favorable reports from those who have tried this packing. It is still certain that something, better than anything hitherto in use, is required, and we have a strong belief that this something is supplied by asbestos.

Asbestos is a mineral fiber consisting of silicate of magnesia, silicate of lime, and protoxide of iron and manganese. In mineralogical parlance, it is a fibrous variety of actinolite or tremolite. It exists in vast quantities in the United States, also in the Tyrol, Hungary, Corsica, Greenland, Wales, Cornwall, Banffshire, and in the north and east of Ireland. It is found under various forms, from that of soft silky fibres to that of a hard block capable of taking a polish. As a rule, the lumps or blocks taken from the vein are easily broken up and separated into fibers extremely flexible, elastic in the sense that each fiber admits of great extension in the direction of its length without contracting again, greasy to the touch, and very strong. The fibers vary in length from a couple of inches to about two feet. They can easily be spun or woven if proper precautions are used. Furthermore, asbestos is an admirable non-conductor of caloric, and is practically indestructible by heat. All these conditions are just those which are required in a material for piston rod packing; and it is therefore somewhat strange that, until a very recent period, no one thought of utilising asbestos for this purpose. The credit of suggesting it as a piston rod packing is due, we believe, to Mr. St. John Vincent Day, C.E., who on the 5th inst. read a very interesting paper, on "Asbestos, with special reference to its use as steam engine packing," before the Institution of Engineers and Shipbuilders in Scotland. The new packing, we learn from this paper, was first used in America with much success, and it has since been tested in this country with results of which we shall speak in a moment. In referring to the value of the new packing, Mr. Day said: "The packing used for piston and valve rods or spindles has, as we all know, three prime elements of destruction to contend with, namely, an elevated temperature, friction, and moisture; and one of them only, namely, friction, has any appreciable effect on asbestos packing when the mineral is pure and properly prepared. No matter how high the temperature of the steam, how rapid the stroke of the piston, or how great the pressure of the steam, the packing seems to be unaffected by those conditions. In America, where the new packing was first used, some of it was taken from the piston rod stuffing box of a locomotive engine, after having been in, and the engines at constant work, for three months, with steam at 130 lb. pressure per square inch, and making an average daily run of 100 miles, including Sundays; and, as you can see by the sample shown, the fiber, with the exception of being discolored by oil and iron, is just as flexible and tenacious as originally. After having been once disintegrated, it appears impossible to so pack or mat the fibers together that they are not easily separable by the fingers."

Asbestos packing was first used in Great Britain by Mr. Benjamin Conner, locomotive superintendent of the Caledonian Railway, and Mr. Day exhibited to the members of the Institution the packing of a locomotive stuffing box which had been used on that line from the 27th of July to the 18th of November, 1871. The engine in which it was used has outside cylinders, and single drivers 8 feet in diameter. The piston stroke is 2 feet. The engine was employed in working the fastest train on the Caledonian line: to wit, the 10 A. M. express from Glasgow, reaching Carlisle at 1 P. M., with three stops on the journey. The best ordinary packing lasts, under these conditions, two months at most, rarely so long, and the gland requires constant screwing up. The asbestos packing was apparently as good as when it was put in, and the engine had run a distance of 2,000 miles in three weeks, during which the gland screws had never been touched. The following letter from Mr. Conner to Mr. Day contains valuable testimony to the excellence of the packing:—

"The box herewith contains the asbestos packing put into a piston rod stuffing box of one of our main line service passenger engines on 27th July, and taken out on 18th November; in that time the engine had run 14,070 miles.

As the packing was put in coiled instead of being cut into rings, the gland was nearly home on 12th September, and an additional ring was put in at that date."

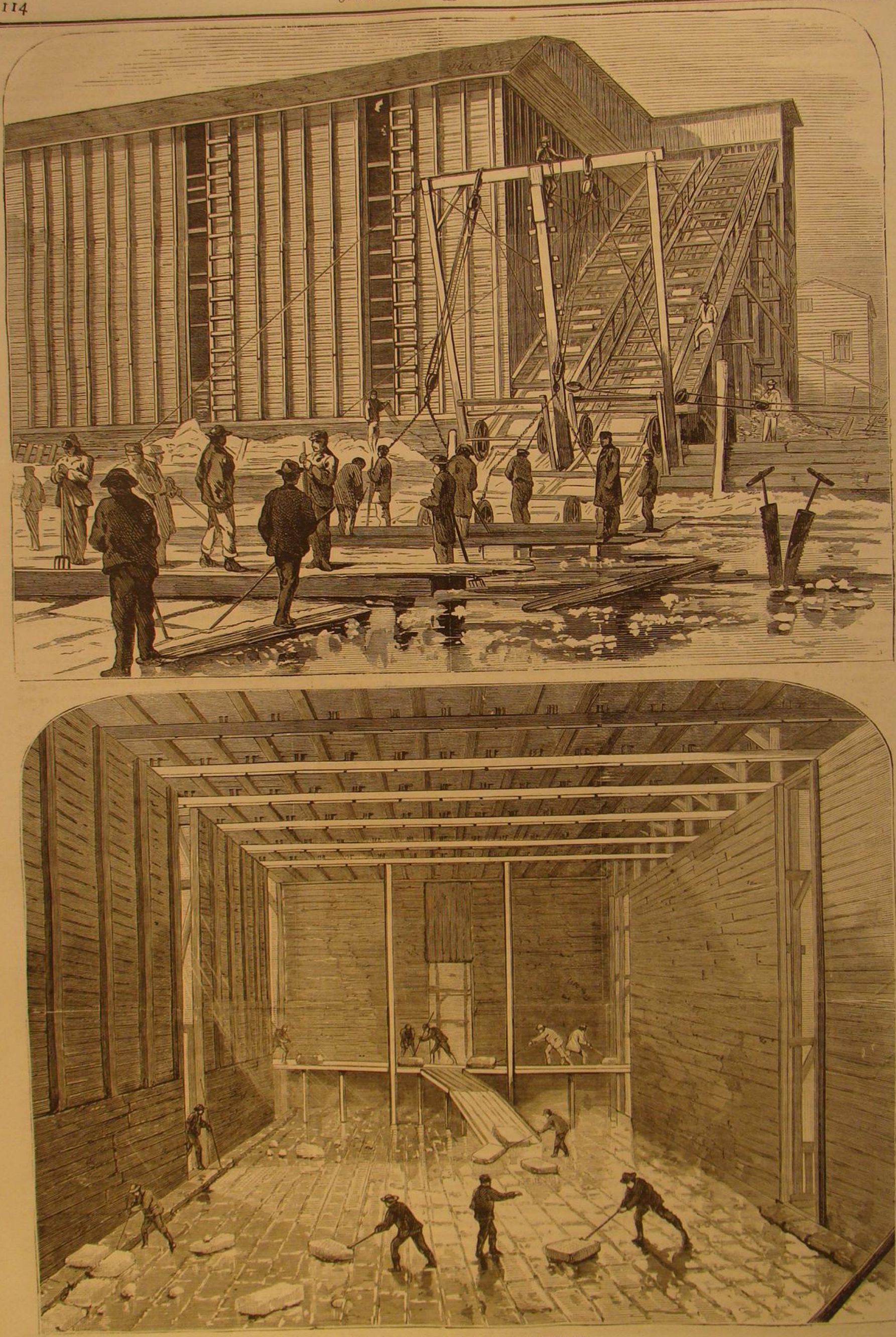
In the course of the discussion Mr. Conner stated that: "The advantage of the asbestos packing over the soapstone packing was that, with the latter, at the high temperatures of steam from 125 lbs. to 130 lbs., the lower portion of the packing got thoroughly charred, and another ring had to be put in after the first week; so that in course of a month the packing had almost entirely changed. The asbestos packing, being practically incombustible, did not waste; and I suggest that the covering of the packing should be made of incombustible material also. At first I had applied it coiled round the piston rod continuously; but I think it should be applied in rings. The inside of the packing seemed to me as fresh as when first put in. I believe it takes less oil to lubricate the piston rod, for the oil remained on the rod, not being absorbed by the packing. It kept the rod beautifully polished, more so than any other packing."

We think that with such testimony as this before us, supported further by that of Mr. David Rowan, who spoke to the value of asbestos packing for marine engines, we are fully justified in holding the belief that this mineral will supply a way out of one of the most troublesome obstacles to the use of very high pressure steam. There is, furthermore, not the slightest chance of the supply being exhausted; on the contrary, it is likely to last as long as our coal fields. We are unable to say at present what the price of the asbestos packing is, or where it can be obtained. It is probable, however, that when once the value of the material as a packing is recognised, its regular manufacture in this country will follow.

Action of Heat on Germ Life.

Dr. Crace Calvert, in a paper "on the action of heat on protoplasmic life dried on in cotton fabrics," published in the London *Chemical News*, relates a series of experiments which have a direct bearing on the question of the disinfection of fabrics and wearing apparel by exposure in heated stoves with the object of destroying contagion or animalcule life. To carry out these views, a piece of ordinary gray calico was treated chemically, and washed until free from any sizing material, and dried; this prepared cloth was then steeped in a solution of putrid albumen, containing abundance of animalcule life, wrung out, and dried at the natural temperature; it was then cut into small pieces five centimeters square. Each of the pieces was rolled up and introduced into a strong glass tube which was hermetically sealed. Some of these were exposed to temperatures raised successively to 100°, 200°, 300°, 400°, 500°, and 600° F. Other pieces were placed in pure distilled water, and another series of pieces were placed in tubes containing an albumen solution, each being successively subjected to temperatures varying from 100° to 600° F. In all cases it was found that, at 300° F. vibrios were present in small numbers, while in the water series bacteria were also detected. At 400° F., no evidence of life was found. In order to ascertain what changes the calico had undergone, one of each of the small tubes which had been heated to the different temperatures was broken, and its contents carefully examined. The pieces heated to 200° were quite sound; that heated to 300° was of a slightly brown color, much injured, and for practical purposes completely spoiled. At 400°, the cloth was very much charred. These results show that the temperature which will not destroy germ life is quite sufficient to materially injure cotton fabric; hence, it is concluded that no beneficial results can be obtained by the employment of public stoves as a means of destroying germ life and contagion.

THE total annual circulation of newspapers printed in the State of New York is 492,770,868 copies, being more than twice the number issued in any other state. The next greatest number of issues is in Pennsylvania, where 233,380,532 copies are annually printed. Massachusetts prints 107,691,952 copies, Illinois, 102,686,204, Ohio, 93,592,448. Next comes California with 45,869,408 newspaper sheets per annum.



ICE HARVESTING ON THE HUDSON

HARVESTING ICE ON THE HUDSON.

As we promised in our last, we herewith give engravings of the interior of one of the many great ice houses on the banks of the Hudson river, and of the method employed for raising the ice from the river and storing it in these buildings. As the ice accumulates near the shore, being towed thither by horses as described in our former article, it is hoisted as described below. The ice houses are constructed with every regard for atmospheric changes, and are models of simplicity. The large one shown in our illustration contains six rooms, four of which are 75x50 feet in area, and of an altitude sufficient to allow a packing of ice 30 feet high, and an open space of 20 feet for air. The two remaining rooms are 150x50 feet in dimension, and the entire building has a capacity of 48,000 tuns of ice. The walls of the houses are double, and filled in with sawdust and tan. At the end of the houses nearest the canal, the apparatus for raising the blocks is constructed, extending from the water to the roof. From a distance this looks like two heavy ladders laid upon an inclined plane, each furnished with a pair of hand rails. At the base of each are two pairs of wheels, over which pass endless chains, stretching to the summit. To these, bars are attached, at a respective distance of six feet, which with the chains form the "apron." On a level with each floor of the building, a platform connects the plane and door sill, on which the blocks are deposited in order to fill each story in succession.

As the ice reaches the base of the plane, the blocks are pushed one by one close to the lower pairs of wheels. Then the o fledges are depressed, and, as the chains force the bars along' they catch the blocks—like the safety cars that grasp the passenger trains on the famous switch-back railroad leading to the summit of Mount Pisgah, at Mauch Chunk, Pa.—and carry them up to the second floor, where the removal of several slats, forming the surface of the plane, allows them to fall on the platform before mentioned. A strong staging is built in the interior of the house, extending to the different rooms, on which the blocks are pushed to the apartment intended for their storage. From this staging an incline extends to the highest layer of ice. As the blocks are deposited on the platform, the first is pushed towards the incline in the nearest apartment, the second in the next, and so on, the entire floor filling up evenly.

In order to prevent the blocks crushing against each other, as they slide from the plane, a number of large headed nails called "scatchers" are driven in it, and greatly diminish their velocity and render their "shooting" of short range.

When the first story is thoroughly packed, the slats are replaced in the plane, and those by the second platform removed, when the rooms are filled like those below.

Five per cent of all ice received into the building becomes useless by cracking and scratching. After a layer of blocks is completed, the workmen shovel from the surface all the loose pieces and the snow, and throw them out of the building through the high, narrow air passages, shown on its sides.

Railway Tunnel under the British Channel.

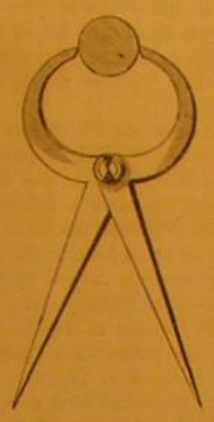
The successful completion and operation of the Mont Cenis railway tunnel through the Alps has given new impetus to the project of establishing railway communication between England and France, by means of a tunnel under the British Channel. The distance is 22 miles. If a railway tunnel can be carried seven miles through the hard schist and quartz of the Alps, why not for three times seven miles, through the softer chalks under the Channel?

A joint stock company has been formed in London for the purpose of solving the problem. It is called the "Channel Tunnel Company," and the tunnel is to extend from Dover, England, to Calais, France. The capital of the company is $150,000, which is being privately subscribed with the immediate object of making a trial shaft and driving a driftway on the English side about half a mile beyond low water mark, with the view of proving the practicability of tunnelling under the Channel. The completion of this work will furnish data for calculating the cost of continuing the driftway from each shore to a junction in mid-channel, and capital will then be subscribed for that purpose, or for enlarging it to the size of an ordinary railway tunnel, as the engineers may deem most expedient. The engineers are Messrs. John Hawkshaw, Thomé de Gamond, James Brunlees, and William Low. The tunnel will be made through the lower or gray chalk, chiefly, if not entirely; and by the adoption of machinery, of which the promoters of this company have recently made practical trials, it is expected the passage can be opened from shore to shore within three years from the time of commencing the work, and at a cost very considerably less than any previous estimates.

COST OF TUNNELLING.

The Mont Cenis Tunnel cost $975 per linear yard. The three most costly tunnels made in England have been the Kilsby, the Saltwood, and the Bletchingley, each of which was executed in treacherous strata, giving out large quantities of water. The Kilsby tunnel cost $725 per yard. The Saltwood tunnel cost $590 per yard, and the Bletchingley, $360. The cost of the railway tunnels in France has varied from $150 per yard, being that of Terre Noire, on the Paris, Lyons, and Mediterranean Railway, to $475 per yard, that of Batignolles, near Paris, on the Chemin de Fer de l'Ouest. In Belgium, Braine le Compte tunnel cost $230 per meter, and the tunnels on the Liège and Verviers line $250 per meter. In Switzerland, the very difficult Hauenstein tunnel, between Basle and Berne, cost $400 a yard. In America, the Hoosac tunnel in Massachusetts, through mica slate mixed with quartz, has up to this time cost $900 per yard, and the Moorhouse tunnel, in New Zealand, through lava streams and beds of tufa, intersected by vertical dykes of phonolite, cost $345 per yard. It will be a convenient standard of comparison for these amounts if we remember that $125 per yard would represent very nearly $5,000,000 for the 22 miles. Any estimate for the Channel tunnel must at present be purely conjectural, and an estimate professing to embrace contingencies must be more conjectural than any other; but it is reckoned that the work, if practicable at all, could be completed within five years of time and for $25,000,000.

Caliber Compass.



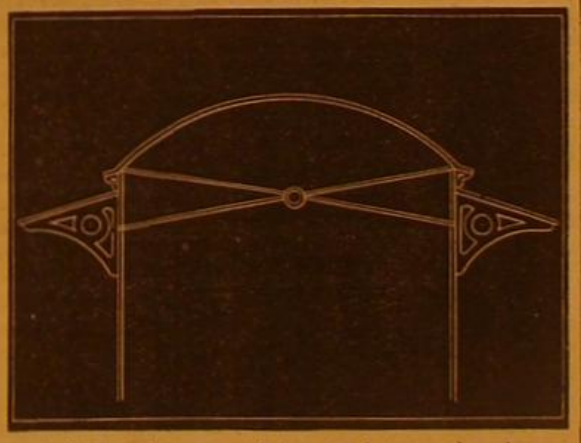
M. J. Koch explains the construction of his caliber compass, illustrated, as follows: The distance of the lower points is 3·1416 times as great as that of the upper points. (This number is the well known π used in the mathematical calculations of circles.) Hence, if the upper points are adjusted to any circular bar or other object, so as to measure its diameter, the distance of the lower points gives the circumference without any further calculation.

FALL OF THE ROOF OF THE RAILROAD DEPOT AT SARATOGA SPRINGS.

We are indebted to our old friend E. J. Huling for the sketch and brief account of the destruction of the new passenger depot, at Saratoga Springs, N. Y., on December 18, 1871.

The iron depot of the Rensselaer and Saratoga railroad, at Saratoga Springs, was a beautiful structure; but, in planning it, the builder seems to have sacrificed everything to make it airy in appearance and beautiful to the eye, neglecting plain rules which the architect of a common shed should have borne in mind. Because the materials used were iron, the builder seemed to think that such ordinary things as internal bracings were unnecessary.

The following is an illustration of one bent of the structure as it stood. The structure was an open arcade, supported by cast iron columns, four inches in diameter, standing fifteen feet apart on the sides, and thirty feet apart across the building. The roof was of corrugated iron, arched, the base of the arch resting on the top of the columns. The columns were tied together crosswise by iron rods five eighths of an inch in diameter, crossed as shown in the engraving. On the sides, or lengthwise of the building, there were cast iron girders of a light and ornamental character between the columns; but there was no internal bracing to prevent the columns from falling in, unless the five-eighth tie rods were considered as such. Along the side of the building was a shed ten feet wide, supported by light cast iron brackets fastened to the columns; these brackets extended ten feet from the side of the column, and their bearing on the column was about six feet ten inches, or, in some cases, three feet ten inches below where the lower ends of the cross tie rods were fastened into the columns. These brackets are reported to have been tested to sustain over ten tuns; and by their combined weight, with the iron roof which they sustained, they must have exerted a heavy and continuous pressure inwards on the sides of the iron columns. The iron columns were anchored at their foot into square blocks of stone. There was a solid rock, underlying the whole depot and parts surrounding, only a few feet below the surface. The railroad track ran along beside the structure, partially beneath the piazza or shed, supported by the brackets.



On the day of the fall of the structure, the ground was hard frozen, and there had been a light fall of snow. A heavy freight train ran up so that the locomotive stood about against the first column, and stuck there, the snow obstructing it so that the wheels turned without going ahead. After some abortive efforts to go along, the engine driver reversed his machine and backed down. He had scarcely got below the corner of the arcade when the column, near which his machine had stood, crumbled inwards, and the whole affair fell nearly together. Three men who were under the roof escaped, but one lad was caught and crushed, his back being broken so that instant death seemed to have occurred. An inquest was held on the boy killed, and, among others, Mr. Cummings, of Troy, the architect employed by the railroad company to supervise the building, was sworn, and testified that he relied upon the experience of the builders, the American Corrugated Iron Company, Springfield, Mass., and did not make the plans or drawings for the building; that he had feared somewhat that the wind might lift the roof, but had not thought that it would fall inwards. The opinion of other builders was that the leverage of the heavy brackets, bearing upon the outside of the columns, without anything inside to counteract them, had caused the columns to break. The locomotive, running up beside the column and stopping there, had seemed to cause a vibration; and, as the train backed down, the first column, where the vibration commenced, was pushed inwardly, and then the others fell nearly together. The coroner's jury censured the builders for not properly doing their work.

Now that the building has fallen, it is considered somewhat wonderful that it stood as long as it did.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

The Davenport Tricks.

To the Editor of the Scientific American:

Allow me, in answer to the note of Mr. W. M. Patton, page 84, in No. 6 of this paper, to state that when the Davenports stick their hands and naked arms through the hole of the center door, they are no more tied down by the knots made by persons selected by the spectators, but have got loose, shown this, and then tied themselves again in their own way, as described by me on page 68. The spectators are very apt to overlook this, and not to notice that, ordinarily, very few tricks are performed as long as the brothers are tied down by others, and less in proportion as this has been done more thoroughly.

In regard to the number of hands shown, I have heard persons in the audience who assured me they saw five or six of them, while I am sure there were only four, having carefully watched the whole proceeding; but when four hands and arms are rapidly moving about through a hole, one may be easily mistaken and count five. If there really were more, it would only prove that they had one or more false hands hidden in their sleeves, but I think this improbable, because, when I tied one up, I carefully examined his arms and sleeves, and am sure there was nothing hidden about the individual. The ringing of the bell is not more wonderful than the taking off of their coats, which I explained on page 68.

Mr. Patton asserts they use no teeth in their execution; how does he know? And why should they not use them if expedient? To satisfy himself, let him tie up two school boys, of ordinary intelligence, opposite one another, so that each, by stooping forward, can reach with his teeth the knots wherewith his fellow is tied down, exactly as is the case with the Davenports, and let him see how expertly they will use their teeth for mutual delivery.

On page 100, Mr. Patton gives, as *his explanation*, that the Davenports "have false hands and wrists, made of gum and so closely resembling nature as to mislead by the feeble light," and says further that these are inflated and have hoops or rings imbedded, "so as to prevent a collapse under the pressure of the cords," that these are tied down, and that they slip their real hands out of them to perform the tricks. This explanation is very ingenious, but rather far fetched and unfortunately not in agreement with the facts. When I tied up one of the Davenports, I am sure I was not deceived in such a way, as the hall was fully lighted with some 300 gas jets; and besides I felt the pulse of both of them, before and after the tying up, in order to find if the individuals got excited by my careful watching, and I doubt if even those whose confidence in M.D.s is least, would suppose that I would be so obtuse as to be cheated by a gum arm when feeling the pulse, or not able to distinguish true skin, flesh and bone from gum, extended with hoops and painted flesh color. The sealing up of the knots at the ends of the rope does not amount to anything, as they can slip their hands out of the loop just as well, whether the knots are sealed or not, when only they have tied themselves in the manner described by me on page 68. They do positively not cut the cords, but unfasten every knot, for I used my own hemp ropes, and got all back in the original condition; while finally, in justice to them, I must state that they have no "capacious pockets," and no ropes either whole or cut in them. I have examined also this point.

If Mr. Patton had seen and watched the performance as closely as I have done, he would be satisfied that his hypothesis is untenable.

New York city. P. H. VANDER WEYDE, M.D.

Motion.

To the Editor of the Scientific American:

What is motion? This question might be confronted with another, namely: What is not motion? The latter would be the most difficult to answer. It is certain that we do not know of any condition of matter wherein there is no motion. Until the universe comes to a standstill, everything must be in motion. The idea of cessation of motion is inconceivable, as much so as is a limit to infinity, or similarly, an end to eternity. Motion is universal, so is matter, and motion and matter are inseparable; one cannot exist without the other. Motion is the primordial condition of matter, and Herbert Spencer, in his "First Principles," invests even nebulous matter—that which is sometimes denominated chaotic, such as was "void and without form"—with the function of motion, or that of possessing the power of contraction and expansion.

Physical or mechanical forces can only be the result of a transfer of motion; and this transfer of motion can only be

made at the expense of matter. The combustion of the fuel under the steam boiler is only a transfer of the force which had been employed in the formation of the wood and coal; and it is so with every other motor that can be used. The ball propelled from the cannon had its force equivalent transferred from the labor of the manufacturer of the powder. Not only the powder but the ball as well, in its rounded or elongated shape, had to contribute its part in the play of projection. This system of compensation, as manifested in the correlation of forces, holds its equivalents to as strict a measure of relation as the fulcrum of the scale beam does the things that are weighed in the balance. The seven or eight per cent of the units of heat, which are all that are at present utilized in the transfer of motion from the fire under the boiler to the machinery in the mill, so far from invalidating the science of mechanical forces as correlated, only goes to prove that we are far behind the constructive perfection which ought to give us much more, and which ought to stimulate the inventive genius of all mechanical engineers. The conduction and conveyance of power, that is the transfer of it from the fuel to the propelling wheel, is much, in the condition as to economy, as that of carrying water in a sieve. There is too much lost on the way side. The bushel of oats put in the horse's combustion chamber does a great deal more work than the bushel of oats (with its steam included) will do when burned under the steam boiler; and yet the force-equivalent in both cases must be the same.

The economizing of motion is a good deal like going a fishing. He that understands the nature and the habits of the fish that he goes for will be likely to succeed the best. So in the mechanical profession: he that understands the law of motion and mechanical forces will be most likely to get the most work out of a certain expenditure of motion-transferring appliances. There is yet a broad domain and a wide track for the exercise of mechanical and engineering skill; and the man who adds a single increment of improvement in the economy of the transfer of motion becomes a benefactor to the human family.

The *inertia* of the old doctors has given way to the *vis viva* of modern scientists. The old *inertia* was defined to do and not to do: not a very comprehensive definition. The ball, when it stops rolling on the philosopher's board, goes only to show that it has played out the motion that was transferred to it by the motor, whatever that motor may have been.

There can be no such thing as increasing the amount of force in a given quantity of matter; but there is such a thing as economizing that power, that is to say, enabling it to do more work through one instrumentality than through another; and the perpetual motion makers ought to take it to themselves that they will not succeed in the solution of their problem by simply adding wheels and levers, unless they hope to move them by the psychic force; a force whose existence can be called into action somewhat in the way that the sailor whistles up a wind. Mr. Crookes is of the opinion that a force, without the intervention of cognizable matter, does exist and that it can be called into action. Mr. Dauskin, an estimable gentleman and spiritualist of Baltimore, told the writer of this article that he had witnessed such phenomena with his own eyes; but Mr. Coleman Sellers, President of the Franklin Institute, gave an illustrated lecture, at the Philadelphia Central High School the other evening, on "the Science of Delusion," in which he demonstrated that it is not altogether safe to trust implicitly to our eyes.

Motion, like matter, is constant and universal. It cannot be annihilated, nor can it be increased or diminished; but it is transferable, and the best we can do is to devise means through which this transfer can be accomplished by the least cost of labor and material.

Philadelphia, Pa. JOHN WISE.

London International Exhibition.

To the Editor of the Scientific American:

It may be of considerable interest to many of your numerous readers to be informed that articles for the London International Exhibition of 1872, which opens May 1st, must be delivered at the buildings at South Kensington, London, if belonging to the class including "Machinery and Raw Material," on the first day of March, and, if included in the class comprising "Recent Scientific Inventions and Discoveries" on Saturday, March 2. Other classes have other specified days for the delivery of the articles for exhibition, but the list would be too long to trouble you with in this letter. The above information is officially promulgated by Major General Scott, Secretary of Her Majesty's Commissioners.

HAMILTON E. TOWLE.

COLORED CANDLE LIGHT.—Wax candles are made of different colors, but they all emit a white light. Why may not candles be manufactured, by introducing certain chemicals into the material from which they are made, so as to show a variety of colors, such as blue, red, green, etc.? By arranging such candles in tasteful groups, beautiful effects may be produced in illuminating buildings. If some ingenious chemist will devise a way of embracing a cheap chemical with any of the material used for illuminating candles so as to render the light emitted from them of any desired color, he will make a fortune by his discovery.—*Commercial Bulletin.*

[This is what we told our chemists several years ago, and still no advance has been made in this direction. If chemicals could be introduced into any safe illuminating material so as to produce a variety of colors, the discoverer would reap a rich harvest for his invention.—ED.]

[Correspondence of the Scientific American.]

JAPAN.

Interesting Letter from Professor Griffis--Establishment of a Scientific School at Fukuwi--General View of the Japanese Status--Rapid Progress of the Japanese in European Knowledge and Arts --Mineral and Agricultural Resources of Japan.

FUKUWI, Province of Echezen, Japan, Nov. 25, 1871.

One of the constant readers of the SCIENTIFIC AMERICAN, responding to the invitation extended by you to the American citizens to keep you informed of the progress they are making, would send greetings to you from this end of the earth, and would hope to point out a few signs of progress among the people now beginning their "second life in the history of nations."

The writer, who had been an instructor in chemistry in America, and had among his pupils thirteen of the Japanese students, received an invitation from the Prince of the Province of Echezen, to come to Japan, organize a scientific school, and give instructions in the physical sciences. It seemed rather a discouraging place to go to (nearly the antipodes of New York); but, being earnestly urged by the young men from Japan, the writer came to Fukuwi, arriving here March 4th. To a pioneer in the interior of Japan (foreigners not being allowed to penetrate more than twenty-five miles from the treaty ports) it seemed at first like beginning in the stone age. However, we found that several of the young men had been diligently studying medicine and chemistry through the Dutch language, which has been for centuries the language of high culture in Japan. As fruits of this, I found that vaccination was practiced, dissection slily carried on, a powder manufactory with a national reputation established, also a gun factory in which very fair specimens of smooth bores and rifles were made and finished, and even a creditable attempt made to construct a breakwater at Mikuni, the sea port of this city.

In visiting the mines, we found that blasting was known, but not yet fully applied. Pumping was not in vogue, though it has been estimated that fully one third of the profitable mines of Japan have been abandoned by reason of the invading water. The Japanese are very quick to apply machinery, however, and in several provinces we know of pumping machines, driven by steam, being applied. In several of the provinces, foreign engineers are engaged on contracts of three years, and are revolutionizing the old methods of mining. There seems to be abundance of copper, mercury, zinc, tin, and iron, the latter being mainly in the form of magnetic iron ore.

Manufactures are not backward. The Japanese, while welcoming the foreigner and eager to get his knowledge, his inventions and productions, are yet anxious to be independent and to "do it themselves." They not only run their own steamers, and drive their own factories, but each mechanic seems desirous of trying his skill at something foreign, when said foreign thing is undoubtedly worth making. Hence, glass blowing, drug manufacture, wood carving, leather working, furniture, silk winding machinery, etc., etc., though in their infantile stages, are yet striding on towards perfection.

In fitting up our own laboratory, many pieces of apparatus and peculiarities of building, etc., requiring great patience and considerable mechanical skill, were furnished by workmen who were eager to learn; and, considering their rude tools and appliances, they succeeded remarkably well.

It must be remembered that the normal Japanese house, not excepting those of the Daimios and rich men, are excessively plain, walls and neatly matted floor under a roof being the main necessities; no furniture, no chairs, nothing suggests the luxurious civilization of Europe or America. In the city in which we dwell, the only chimneys are those upon the chemical laboratory, and our own dwelling house—a house, by the way, built by a Japanese carpenter under our directions, and exceedingly American and complete in every respect.

We do not propose to speak of the railroads now building, or of those projected, or of the telegraphs and steamships owned and worked by the Japanese. These evidences of advancing civilization are most visible at the sea ports, and will be duly chronicled. We speak only of the pulsings of the new civilizations in the interior, two hundred miles from any foreigners. We may say in passing, however, that we have seen the "report" or "Blue Book of the Department of Civilization" of the Imperial Government, and find in their schedules full preparations made for light houses, railroads, telegraphs, a postal system, introduction of machinery, cattle breeding, scientific farming, navy yards, coast and inland survey, road making, and numerous other enterprises. Of course, it will require years even to fully organize these plans; but when it is remembered that all this apparatus of civilization has been suddenly grafted on a nation hitherto hermetically sealed to the world, the marvel will be that such gigantic enterprises can be entertained. The Japanese, while liberally engaging professors, engineers and agents, are yet determined not to let Japan become as India, nor be passive recipients. They have now at least three hundred picked young men studying in America and Europe, and on their return they will personally engage in the business of superintending the great public works of the country.

The timber of Japan is marvellously rich and abundant, and is mainly grown on the mountains. Indeed this is the land of "the everlasting hills," and the practically waste land is in very great proportion to the cultivated soil. The latter, however, is very fertile, and the whole country is cultivated like a garden. The tools are pretty much the same as those used ten centuries ago. The plows are simply sticks pointed with iron. The rice is cut by hand with a small hook, and threshed by drawing it through iron teeth. They get very good crops on their irrigated lands; but much reclaimable soil exists neglected, and scientific farming is entirely unknown as yet, except in one or two provinces in which American farming machinery has been introduced. Cattle breeding claims much attention, and we can assure your readers that the superstitious fanaticism concerning beef and pork is rapidly vanishing.

In many provinces beef is eaten, and in the large cities it is sold at the corners of the streets as a delicacy, and devoured with gusto by gray heads and urchins. Whenever our cook slaughters a cow, he has no trouble to sell the meat; and five magnificent specimens of California cattle, recently brought here, promise to leave offspring more promising than the stunted native cattle. Several sharp Japs, who read the signs of the times, have herds of swine, and our local government is very desirous of having works on cattle rearing and breeding translated, and have imported the cattle spoken of.

We are trespassing on your crowded columns, and will, therefore, hasten to a close. We forgot to mention the coal which is found here near Fukuwi; it is not very abundant, nor of first class, though extended exploration might reveal formations of a better, quality. However, were you to come to our house, Mr. Editor, and see our sparkling grate heaped with the black diamonds of Japan, you would think civilization had really begun.

As Rome was not built in a day, nor our country settled in an hour, we must have patience to await fully the flowering of this nation. Patient toil and faith are needed, but even in the everyday prose of the pedagogue we feel something of the glow of poetry, while reading the faces of our Japanese scholars. We have nearly 125 promising pupils in chemistry and physics, and with two good interpreters, apparatus from America, a printing press up, and earnest young men to help in translating and applying the knowledge gained in school, we hope to make the "Fukuwi Scientific School" one of the centers whence shall radiate the new civilization. In conclusion, I cheerfully acknowledge the great help in practical hints, etc., from your valuable paper, which we are glad to tell our pupils is the SCIENTIFIC AMERICAN.

WILLIAM E. GRIFFIS,
Professor of Chemistry, Fukuwi, Japan.

[Reported for the Scientific American.]

MEETING OF THE SOCIETY OF ARTS OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

HELD IN THE INSTITUTE IN BOSTON, JANUARY 11, 1872, THE PRESIDENT, J. D. RUNKLE, IN THE CHAIR.

AUTOMATIC REGISTERS.

Dr. Sternberg, U. S. A., exhibited and described a new application of electromagnetism. He asks this subtile agent for the automatic regulation of temperature. His apparatus is applicable wherever artificial heat is employed, as in the warming of buildings, and also in various processes in the laboratory and the arts.

To watch a thermometer and operate a damper or register by following its indications, is, to say the least, unscientific, besides requiring more time and attention than can ordinarily be given. The attempt has frequently been made to effect the automatic regulation of temperature by using the expansion of a metallic bar or of a volume of confined air to operate a damper; but satisfactory results have never been obtained by these methods, and their application is limited, as the regulator must be placed near the furnace, and the expansion of a metallic bar for a variation of a few degrees of temperature is so slight that it would be impracticable to use a bar long enough to regulate the temperature to a nice point. The use of confined air for this purpose is still more unsatisfactory, as the air is affected by barometric changes. And though such an apparatus might regulate the temperature of the hot air chamber of the furnace with sufficient exactness, it could not control the temperature of distant apartments, which is far more important.

Dr. Sternberg's invention is intended to obviate these difficulties, and is at once simple and efficient.

The battery wires are so adjusted in connection with a thermometer that when the temperature reaches the desired point, the mercury in the thermometer establishes a circuit, by which the register or damper is shut; upon the slightest reduction of the temperature, the mercury falls, the circuit is broken and the register or damper opened.

It is obvious that the thermometer may be placed at any distance from the furnace, and may regulate the temperature of an apartment by controlling either the register or the damper of the furnace.

If the wires from the thermometer be made to operate a damper which controls the supply of air to the furnace, fuel will be saved.

Automatic ventilation may be secured by the same apparatus—electricity controlled by a thermometer.

Where a number of rooms are warmed by one furnace, he would let the thermometer in the room most used control the damper of the furnace; and the temperature of other rooms would be regulated by automatic registers controlling the flow of heated air to them.

The mechanism for operating the registers and dampers is simple and requires but little power; one battery cup being sufficient to perform any of the operations.

The point of contact between the wire and the mercury is easily adjusted to any required temperature, and a change of a fraction of a degree will make or break the circuit and cause the apparatus to act.

ELECTRIC CLOCKS.

Mr. James Hamblett addressed the Society upon the sub-

ject of electric clocks. He said: One of the first attempts to propel clocks by electricity was made by Alexander Bain about 1842. His battery consisted of a plate of copper and a plate of zinc buried in the earth. The pendulum rod was of wood, with a large coil of copper wire for a bob; the ends of the wire were carried up the pendulum rod to its point of suspension, and were there connected with wires from the buried plates; two brackets, about half way up the rod, supported a sliding breakpiece, which was so situated that it would be pushed a little at every vibration of the pendulum, and by this means an electric circuit was made and broken. The operation of these clocks was not satisfactory, as they were liable to error from fluctuations of the battery power.

Batteries have always been a source of trouble to electric clock makers, for upon their constancy the accuracy of the clocks in a great measure depends. Mr. Hamblett uses the Smee battery; the elements are pure zinc and platinum; the solution consists of pure water and chemically pure sulphuric acid. He uses no screw cups, as they are liable to become loose and are frequently the source of much annoyance. The wires connecting the elements of his battery are soldered together.

An electric clock invented by Mr. Charles Shepard has been much used in England. In these clocks the impulse is given to the pendulum by the falling of a lever, which is raised at each vibration of the pendulum by an electromagnet. As the weight of the lever and the distance which it falls are constant quantities, the impulse imparted to the pendulum will be constant, and the accuracy of the clocks will not be affected by fluctuations of the battery power.

The mechanism of these clocks is such that an electric circuit is established and broken once every second, which operates dials at distant places.

Electric contacts are usually made of platinum or of an alloy of platinum and iridium. When the circuit is broken, an electric spark passes between the contact points, which causes a slight oxidation of the platinum, and, where an electric current is established every second, this oxide may accumulate and become a cause of error.

In Mr. Hamblett's clocks, this difficulty is obviated to a great extent by establishing the circuit, which moves the dials only once in a minute. The dials are made very simple and tick once in each minute; and all the dials controlled by one clock will move together, indicating exactly the beginning of each minute.

Clocks cannot only be propelled, but may be controlled and corrected by electricity. Clocks controlled by electricity have two small magnets, placed at the lower end of the pendulum, which are so arranged in relation to two stationary coils of wire that at each vibration of the pendulum one of the magnets will pass into the opening in one of the coils. Once each second an electric current is sent through the coils from the controlling clock, and if the controlled clock be inclined to go slow, the current from the controlling clock, acting upon the magnets, will tend to accelerate it, and *vice versâ*.

Mr. Hamblett believes this to be the best method yet devised for distributing time.

One standard clock may control many other clocks at different points, and if an accident happens to the wires the controlled clocks will not stop, but will go on at their own rates. Methods similar to this have been adopted in Edinburgh, Glasgow and St. Petersburgh.

A clock, erected by Mr. Hamblett in the observatory at Alleghany City, Pa., controls all the clocks of the Pennsylvania Central Railroad, and those of connecting lines westward to St. Louis.

This is the longest line of time distribution in the world. He made brief mention of the various time signals and time balls used in different countries, and explained at length the distribution of time and the operation of time signals in England by the mean time clock in the observatory at Greenwich.

LIGHTING GAS BY ELECTRICITY.

At a meeting, held January 25, Dr. Van Zandt of California brought to the notice of the Society an invention of his, the object of which is to light the gas in street lamps by electricity. The gas is not only lighted, but is also turned on and off by electricity. All the lamps are connected by underground wires with a central station, where the apparatus consists of a galvanic battery, an induction coil, and a switch to throw the current on or off the wires in any portion of the city, so that all or any part of the lamps may be lighted or extinguished as required.

Two independent circuits are necessary, one for operating an automatic apparatus in each lamp by which the gas is turned on and off; the other for conveying the current which lights the gas.

The wire for the last circuit passes across the slit in the burner, where it is broken so that the passage of the electric current produces a spark which ignites the gas. The wire near the burner cannot be insulated by caoutchouc or cloth, as these are destroyed by the heat; it is insulated by winding it around non-conducting trunnions on the burner. Above these insulators, the wires are of German silver tipped with platinum.

He has made a successful trial of his apparatus in this city, using thirty-seven burners and over a mile of wire. He illustrated his remarks with drawings, and by lighting and extinguishing a gas jet before the Society.

ETHER ENGINE.

Professor Watson then made an interesting communication on the ether engine.

The idea of utilizing the heat of waste steam, by using it to vaporize some liquid more volatile than water, is as old as Humphrey Davy

In 1830, Mr. Ainger suggested ether as a suitable liquid for this purpose, but the idea was first practically worked out by M. du Tremblay in France.

The engine of M. du Tremblay was, in most essential particulars, similar to the engine constructed by Mr. Ellis of this city, with the exception that he used sulphuric acid instead of sulphide of carbon.

His engines were used on screw steamships by the French Government, and were of seventy horse power. A considerable saving of fuel was effected by the use of these engines; when using the ordinary steam engine alone, 95 lbs. of coal per horse power per hour were required; but with the vapor of ether and steam engines combined, 25 lbs. of coal were found sufficient to produce the same result, showing a saving of nearly seventy-five per cent.

The great difficulty in the construction of these engines, and that which caused their final abandonment, was the practical impossibility of making tight joints. It was found that the tightest joints were obtained by using true metallic surfaces and numerous bolts; between the surfaces was placed paper soaked in a solution of gum arabic; but even these joints would leak. In consequence of the leakage, one of the ships caught fire and was burned.

The Professor then, by means of mathematics on the blackboard, demonstrated the superior efficiency of the ether engine compared with the ordinary steam engine, and showed that the adoption of some volatile liquid—as sulphide of carbon—not liable to produce explosions or conflagrations was an important step toward the complete utilization of the heat now wasted by the steam engine.

W. O. C.

The Phosphorescence of Marine Animals.

Professor Panceri, of Naples, has been studying for some time past the phosphorescence of marine animals. He has examined *Noctiluca, Beroe, Pyrosoma, Pholas, Chætopterus,* and has lately published a paper on the phosphorescence of *Pennatula.* He finds in all cases that the phosphorescence is due to matter cast off by the animal—it is a property of dead separated matter, not of the living tissues. In all cases (excepting *Noctiluca*) he also finds that this matter is secreted by *glands,* possibly special for this purpose; but more probably the phosphorescence is a secondary property of the secretion. Further, the secretion contains epithelial cells in a state of fatty degeneration, and it is these fatty cells and the fat which they give rise to which are phosphorescent. Hence the phosphorescence of marine animals is brought under the same category as the phosphorescence of decaying fish and bones. It is due to the formation in decomposition of a phosphoric hydro-carbon, or possibly of phosphoretted hydrogen itself. In *Pennatula* Professor Panceri has made phosphorescence the means of studying a more important physiological question—namely, the rate of transmission of an irritation. For when one extremity of a *Pennatula* is irritated, a stream of phosphorescent light runs along the whole length of the polyp colony, indicating thus by its passage the rate of the transmission of the irritation. This admits of accurate measurement, and furnishes data for extending Helmholtz's and Donder's inquiries to animals so widely separated from their "Versuchs-thiere" as the *Cœlenterata* It is also a proof of the thoroughness of Professor Panceri's investigation that he has made use of the spectroscope for studying the light of phosphorescence.—*Nature.*

A Marine Novelty.

A new iron steam vessel, of peculiar design and novel arrangement, constructed by Messrs. W. Simons & Co., has just been launched from the London Works, Renfrew. It combines in itself the respective properties of a powerful dredger, a steam hopper barge, and a screw tug steamer. It is intended to keep the harbors and rivers of North America clear of silting and obstructions at a moderate expense, as it has, in one bottom, all the properties of the more expensive dredge fleet usual in extensive operations; and by its use ordinary rivers and harbors can be deepened and improved at much less expense than is customary with dredgers, barges, and tug steamers, with their crews and necessary detention. The mode of working, as described by the *North British Daily Mail,* is as follows: "The vessel propels itself to the place requiring dredging; it is then moored by the steam winches to the guide buoys at both bows and quarters; the dredging girder is then lowered to the bottom by steam; the machinery connected therewith is then set in motion, and drives a range of steel mounted buckets, which cut, lift, and deposit, into the vessel's own hopper cavity, about 200 tons of spoil. The vessel being now loaded, the girder is then raised flush with the deck, the moorings are disconnected from the buoys, and the vessel assumes the properties of a screw steamer. Another connection of the machinery is then put into gear, driving the propeller. The pilot takes his station at the rudder, and the captain takes his station on the bridge, the dredging crew convert themselves into sailors, and the vessel steams away to deep sea water, say from 10 to 20 miles, at a speed of eight knots per hour, where, by another arrangement of the steam machinery, the bottom hopper doors open and the 200 tons cargo is in a moment dropped in thirty or fifty fathoms depth of water. The bottom doors are then closed and the steamer returns for another cargo and becomes again a dredger, the process being repeated. This vessel is consequently well suited for exposed localities, and is capable of lifting, conveying, and depositing 500 to 1,000 tons of spoil per day; and by its use, in limited operations, the cost of dredging is greatly reduced. There are many rising seaports and rivers, which can be deepened by this system, whose trade and prospects would not warrant the heavy expenditure of an entire dredge fleet. We understand Messrs. Simons have patented the arrangements of this vessel, and that after a trial on the Clyde it will shortly steam itself across the Atlantic to its destination.—*Mechanics' Magazine.*

An Expedition in Search of Dr. Livingstone.

At a recent meeting of the Royal Geographical Society, London, Sir Bartle Frere, Vice President, explained the grounds on which the Council had determined to despatch an expedition from England for the search and relief of Dr. Livingstone. He said it was now more than two years and a half since anything in the shape of written communication had been received from Livingstone. In one of his last letters he had described himself as in great want of men, stores, clothing, and medicine; in short, of everything that was necessary to enable him to continue his explorations. It was necessary to remind the meeting that, on the receipt of those letters, Her Majesty's Government and the Geographical Society took immediate action to supply the wants of our great traveler, a grant of money being made by the Treasury, and the amount entrusted to our Consul at Zanzibar to be expended, in the hire of men, purchase of stores, and their transmission into the interior. Various causes had intervened to prevent some portion of this assistance reaching Livingstone; and, lately, disturbances had broken out in the district about midway between Lake Tanganyika and the coast, which, without affecting him personally, had increased the difficulty of communication. That Livingstone was alive, and had been pursuing the great plan of exploration which he had marked out before leaving England, was to be concluded from the rumors that had reached Zanzibar from the interior; and that plan was the tracing of the sources of the Nile and the limits of the great lake region of the African interior. His latest letters gave a vivid picture of his destitution as regards the commonest necessaries of a traveller. It would be in the last degree disgraceful to them, not only as a body of geographers, but as Englishmen, if they allowed him to perish without making an effort to relieve him. The fortunate chance of a private steamer preparing to leave London in the course of the month, direct *via* the Suez Canal for Zanzibar, had compelled the Society to act rapidly in this matter. The expedition was being organized, and an appeal had been made to the public for funds to defray the expenses. Already subscriptions had been received to the extent of twelve hundred pounds.

News from the Navigators.

The people of the Samoan group, known as Navigators Islands, in the Pacific Ocean, have sent to the Secretary of State at Washington a request for annexation to the United States, signed officially by all the chiefs and many foreign residents of the islands. These are the only valuable islands in the Pacific Ocean not absorbed by France, England, Germany or Russia, and the natives say they are more favorable to the United States than any other country, because they believe that the American religion is the same as theirs. The islands in question contain three thousand six hundred square miles, and a native population of thirty thousand. The people are copper colored, and the productions are cotton, coffee, sugar cane, dye woods and every species of tropical fruits and plants. The Australian mail steamers have selected the islands as a port of call for coaling purposes, and men have gone there to erect buildings and construct wharfs. The natives are friendly and Christianized, American missionaries having been there twenty years.

Water Power by Telegraph.

The large establishment of James Richmond, at Lockport, N. Y., the well known maker of bran dusters and grain cleaners, is driven by water power from the waste of the Erie canal. Mr. Richmond also supplies a considerable amount of power to other establishments in Lockport, some of which are over half a mile from his water wheels. This he does by means of endless wire cables, carried on telegraph poles, to neighboring factories and mills. A very simple arrangement of cogs enables any number of endless wire cables to run to central points in the city, and thence in all directions. In this way, the printing presses of the *Journal,* the *Times,* and the *Union* are run by deputy, at a cost of so much per hundred feet per annum. Mr. Richmond also furnishes power to a whip factory, a cabinet shop, a glass factory, 2,500 feet away, a shirt factory 2,000 feet in the opposite direction, a foundery, and a machine shop. He has some valuable patents in connection with this distribution of power, and has lately fitted up a series of distributing wires at Fulton, in Oswego county.

Scarlet Fever Non-contagious.

Dr. E. H. Lewis, in an interesting article published in the *Northwestern Medical and Surgical Journal,* states some striking facts bearing upon the contagiousness of scarlet fever. From data, gathered during an epidemic in 1870, the doctor concludes that scarlet fever is not caused by sewer gases, or marsh miasms, or decaying vegetable matter, impure water, or the habits of people; for in the cases observed by him all these causes were absent. The epidemic traveled directly and rapidly through well drained and elevated regions of country, sweeping everything before it. In the cases observed, the doctor could find nothing to enable him to believe in its contagiousness. He says: "I have not the slightest doubt that the causes of scarlatina depend upon some peculiar condition of the atmosphere favorable to the propagation of the scarlatina poison, and that it travels in a manner similar to epidemic cholera, the principal feature of which it simulates, the difference being that in cholera the force of the disease is spent upon the bowels, while in scarlatina it is expended upon the skin and throat."

Improved Gage Cock for Steam Boilers.

Our engravings illustrate an improved gage cock for steam boilers, which is extremely simple, though quite unique in design. We judge it is not likely to get out of order, and that it must be very convenient in use.

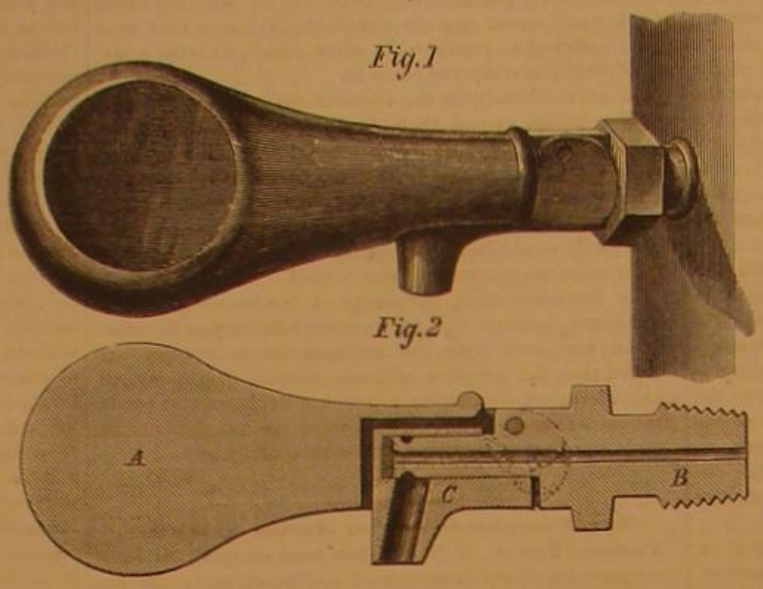
It consists essentially of only three parts, a weight lever or ball, A, Fig. 2, a barrel, B, which screws into the boiler in the usual manner, and a nozzle, C. The nozzle, C, telescopes over the barrel, B; the barrel has a straight steam passage through it, closed by the nozzle which abuts against the end of the barrel, and has a gasket on its interior to make the joint formed steam tight. The use of the weighted lever or ball is to hold the nozzle against the end of the barrel, when the cock is shut, and to withdraw the nozzle when it is desired to open the cock. This is done in the following manner:

The weighted lever is pivoted to the barrel. It also has a recess that shuts down over the outer end of the barrel. On the inside of each of the two lateral walls of this recess is formed a cam groove, into which lugs, on the sides of the nozzle, enter, so that when the weighted lever or ball is turned upward on its pivot, the cam grooves force the nozzle outward, and when the weight descends, force it inward again, so as to bring the gasket firmly down against the end of the barrel. The cock thus automatically closes itself.

A small annular groove is turned about the outer extremity of the barrel, and collects any steam or water that may escape through between the barrel and the enveloping nozzle, and directs it downward out of the mouth of the nozzle. This renders a tight fitting of these parts unnecessary, and they may work with scarcely any friction.

The gasket may be renewed if desired, when the boiler is under pressure, by raising it up to and a little past the perpendicular, where it will remain. The nozzle can then be slipped off the barrel, the latter being plugged with wood while the repair is made. Upon withdrawing the plug, the nozzle may be replaced while the steam and water are escaping.

Patented, Jan. 16, 1872, by William Painter. For further information address Murrill & Keizer, Baltimore, Md.



PAINTER'S GAGE COCK FOR STEAM BOILERS.

GERHART'S IMPROVED WAGON BRAKE.

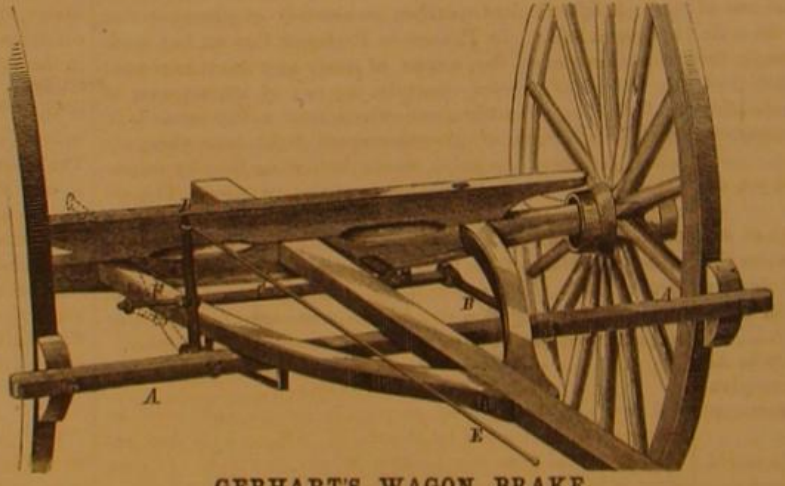
It is nearly as severe labor for horses to hold back a load in descending a hill as to draw it up the same grade. The use of a good brake upon uneven roads, therefore, both in economy and convenience, so strongly recommends itself to men of good sense as to scarcely need a word of argument. A great many forms of brakes have been made and used with advantage, but it appears that the useful combinations of devices adapted to this purpose have not yet been exhausted.

Our engraving illustrates a new combination of levers and links, by which the wheels of vehicles may be very effectively braked.

The brake bar, A, is supported by keepers attached to the under side of the rear hounds of the wagon, the keepers being sufficiently long to give the bar play to and from the rear wheels. About midway between the middle and the end of the brake bar is attached the link, B, which joins the brake bar to the lever, C. This lever is pivoted to a support extending forward from the rear axle, as shown, its short arm being on the side of the link, B. Its long arm is joined by the link, F, to the lever, D. The lever, D, is joined at its lower end with the brake bar, and is actuated by the connecting rod, E, which, when drawn forward, causes both ends of the brake bar to move backward, bringing the brake shoes very forcibly against the wheels to be braked. It will be seen on close inspection that a very powerful leverage may be thus obtained.

The dotted outline shows a mode of placing the lever, D, so that it shall drop back down on the bolster, in which case it is actuated in a slightly different way from that described.

The invention was patented through the Scientific American Patent Agency, Dec. 12, 1871, by John A. Gerhart, of Easton, Pa., whom address for further information.



GERHART'S WAGON BRAKE.

The Erie Canal Locks.—Lockport.

An enlargement of the locks is urgently demanded, so as to permit the transit of steam canal boats carrying 600 tuns of cargo, instead of 200 tuns, the limit of most of the present boats. It is said that it will cost no more to propel a boat with 600 tuns cargo, if the locks are made larger, than it now costs to tow the 200 tun boats. A writer in the New York *Times* gives an interesting description of the locks at Lockport, N. Y.:

On approaching Lockport, the eye is at once attracted by a sort of giant's staircase in the Erie canal, of even more imposing dimensions than the celebrated Giant's Staircase in the Doge's palace at Venice. Immediately the exclamation involuntarily escapes one: "Ah! *Lock*port! I see." It is at this point that, by an extensive system of lockage, the heavily laden barges are enabled to ascend and descend the low range of hills down which the canal takes its course, and on the extreme edge of one of which stands the active little city of Lockport, looking over one of the most extensive level plains in the State of New York.

There are five double locks, ten in all, at Lockport, each lock being 110 feet long by 20 feet wide. They have a uniform rise of a little over 12 feet, making the total rise about 64 feet. The two head locks have 20 feet, the four lower tiers 18 feet of water. The time occupied in the passage of the boats from one lock to another varies according to their construction and running. Going east, a boat will pass through all the locks in from fifteen to twenty-five minutes; going west, more time is occupied, as the boats have to be pulled through by horse power on a rising tow path, instead of being forced through by the subsiding water, as is the case in going east. The boats have a tonnage of 200 to 240 tuns, and going east generally carry about 7,500 bushels of grain, or from 140,000 to 170,000 feet of lumber.

There are no lock fees whatever, the State government including all charges in the State toll of two cents per mile on the boat. Still there are what amount to charges, and it is against these demands that the boatmen call out so loudly. The lock officials will get a boat through in fifteen minutes or be half an hour about it, according to the receipt or refusal of a quarter of a dollar from the captain of the boat. Considering the number of locks on the canal between Buffalo and Albany, these black mailings become quite a serious tax, and, when refused, involve a still more serious loss—the loss of time.

QUINBY'S GEOMETRICAL ARCHING BRICKS.

Represented in the accompanying engraving is a new form of bricks for the construction of arches, without the use of

FIG. 1.

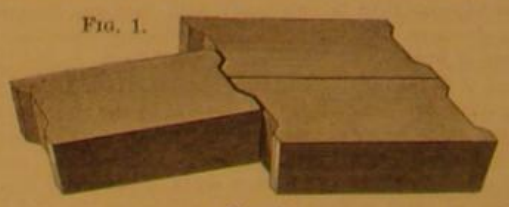
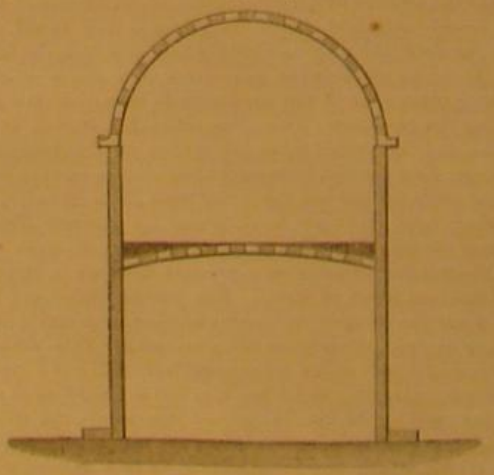


FIG 2.



forms, and which, it is claimed, will be of great use in the construction of the bases of concrete bridges, fireproof roofs, etc.

The form of the bricks is shown in Fig. 1. It will be seen that they have a concave inner surface and a convex outer surface, as laid in the arch, and the sides are straight and parallel in their vertical planes. The ends are inclined, to correspond with the radii of the outer and inner curved surfaces. Each end is recessed vertically, so that each brick interlocks at the ends with two others, as shown, and is thus held from lateral movement, the entire arch, made by successive courses, being thus bound together.

This interlocking enables forms to be dispensed with after the first course is laid, as this course will give the same curvature to, and sustain, the next while it is laid and so on.

For arched roofing, as shown in Fig. 2, the bricks may be made lighter by being made hollow, or their composition may be modified, by the admixture of coal or other combustible substances, in the formation of the bricks, in ways familiar to brickmakers.

Floors will be made by first building an arch of low spring, as shown in Fig. 2, then leveling up the top with mortar, and, lastly, covering with cement.

Where light porous bricks are used for roofing, an outer coating of some waterproofing material will be needed. Cornices and gable ends can be made with ornamental bricks to give an appropriate finish.

This invention was patented through the Scientific American Patent Agency, August 9, 1870, by Watson F. Quinby, of Wilmington, Del. Address as above for further information.

Seals of Alaska.

The islands of Alaska are the summer resort of seals in immense numbers, but where they spend their winters is an unsolved mystery. Sufficient search has been made for their winter abodes, with a view to taking their skins, to show that they do not land in any considerable numbers on any known ground. They begin to leave the islands early in October, and by the middle of December have all left, and none are seen again until April or May. A few hundred, mostly young pups, are taken by the Indians around Sitka, 1,200 miles east of the islands, during the month of December, again in March, on their return to the islands, and in February off the coast of British Columbia; but in such small numbers as to make no appreciable difference in the immense number that visit the islands annually. It is claimed by the natives that the seals return invariably the second year to their places of birth, and, when not too often disturbed by driving, continue to do so. In order to test the truth of this story Mr. Bryant, Special Agent of the Treasury Department at St. Paul's Island, has instituted an experiment of an eminently practical character, although it might not command the entire approval of Mr. Bergh, whose jurisdiction, however, does not extend to Alaska. He had one hundred male pups selected before leaving, on a rookery one mile north of the village, and marked by cutting off their right ear; and a like number by cutting off the left ear, on a rookery to the south of the village. This has been done for two years, and next year the first will be old enough to be taken, when the result will be ascertained.

It is evident that sharks or other voracious fish prey on the young pups while in the water, from the fact that of more than a million pups annually leaving the islands, not one third return to them in the spring.

Walrus Hunting.

Probably not less than fifty thousand walrus, with their young, were killed and destroyed last year by our arctic whalemen. Three fourths of the fleet were engaged in the business, but the walrus had gone far into the ice, and they did not do so well. The arctic walrus, says the New Bedford *Mercury*, "never forsake their young, but will take them in their flippers and hold them to their breasts, even when their destroyers are putting their sharp lances through and through them and the blood is streaming from every side, uttering the most heartrending and piteous cries until they die. The walrus averages about twenty gallons of oil and four pounds of ivory. But the worst feature of the business is that the natives of the entire arctic shore are now almost entirely dependent upon the walrus for their food, clothing, boots, and dwellings. Twenty years ago whales were plenty and easily caught; but they have been driven north, so that now the natives seldom get a whale. This is a sad state of thing for them. The question now is, shall our whalemen keep on taking the walrus, and eventually starve and depopulate these arctic shores? It will certainly come to that soon."

The Knoxville Cave.

Evidences multiply to show that Knoxville, Tenn., is built over an immense cave. The *Chronicle* of that city says that, in digging cisterns at the hotels, "the bottom fell out," and what were intended for cisterns made excellent sewers. Similar results followed excavations on other premises. The other day a public cistern, designed to hold 3,500 barrels of water, had been completed; and seven feet of water had been measured, but it had all disappeared. Further investigation showed that part of the bottom had fallen in, and the water had run off somewhere into the interior of the earth.

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THE HEATING OF BUILDINGS BY STEAM.

Our articles, published on pages 55 and 88, current volume, appear not to have cleared up some points, connected with this important subject, in the minds of all our readers. Of the difficulty those not thoroughly acquainted with the theories of heat and steam find in comprehending these principles, the following quotation from the letter of a correspondent may stand as a fair specimen. He writes: "I am heating two drying rooms with about 2,000 feet of pipe in each. Am I to understand by what I read on page 55, present volume, that I get as much heat from 40 lbs. of steam as I do from 80? If not, how much do I gain by doubling the pressure? Is there any way I can bring the steam back into the boiler after it has passed through the drying rooms?" We propose to answer these questions in their order, not as to the single correspondent from whose letter we have quoted, but to numerous inquiries of similar import which we constantly receive.

The first question shows that our correspondent does not understand the difference, made by writers on steam, in the terms *pound of steam* and *pound pressure of steam*. Our assertion was that one pound of steam (saturated steam, of course), that is, one pound of water converted into steam,—one pound weight of steam—not one pound pressure, always contains the same amount of heat, at any pressure. The entire heat in a body of steam cannot be measured by its pressure, but only its sensible heat—its temperature—is so measured. Thus steam at 20 lbs. pressure has a temperature of 307° Fahr.; but this multiplied by the entire weight of steam gives a product representing only a little more than one fourth the entire heat the steam will impart before it congeals to ice, or less than one third the heat it will impart before condensing to water at 212°.

Now what we say is that, by taking the same weight of steam and increasing or lowering the pressure to which it is subjected, we shall not practically alter the amount of heat it contains, which is specific and constant at all pressures; and that the amount of fuel required to produce this amount of steam will be a constant, except that, in producing steam at high pressures and temperatures, there is greater waste by radiation from the furnace and boiler, and a larger waste through the uptake. This waste is more than compensated in the use of high pressure steam in engines, because of the increase of work obtained by using steam expansively; but in heating buildings it is an unnecessary waste, for which there is no recompense except that heat will radiate more rapidly from pipes carrying high pressure steam, and consequently a less extent of radiating pipe will be required to heat a given space. Hence the cost of the pipes would be less at the outset; but this would in most cases be offset by the increased cost of a boiler constructed to withstand high pressures. The use of high steam for heating is then a fallacy, which increases danger and lessens economy.

The third question is: How can I get the steam back to the boiler? We answer you cannot get it back as steam, unless you pump it or force it back by some other mechanical means, and this leads us to the consideration of another popular fallacy, namely, that steam circulates in pipes precisely as air does.

The difference between steam and hot air is this: Air is a mixture of gases that at any temperature known to science remains a gaseous mixture. Saturated steam is a gaseous compound, that *never loses any portion of its heat without a change of a part of it to water.*

Let us see if we can make this plain. A pound weight of steam, under a pressure of 60 lbs. to the square inch, contains 307 units of sensible heat, and 711·5 units of latent heat. Now, these quantities of sensible heat and latent heat being specific for steam at the pressure named, it follows that the subtraction by radiation of a single unit will result in the condensation of a portion to water, which can exist at atmospheric pressure as water with 966·5 less units of heat per pound weight than steam can. So if we go on subtracting heat we go on condensing; and if we maintain the pressure by new accessions, we are constantly condensing steam by robbing it of its latent heat; and the water thus produced gravitates toward the lowest part, which, if properly connected with the water space of the boiler, will allow the water in the system of pipes to seek and maintain the same level as that in the steam generator. Coming from the boiler as steam, it returns only as water. If the steam be used at atmospheric pressure, every 1,640 cubic feet will, by its condensation, be reduced to only one foot of water. This enormous reduction of volume creates, so to speak, a vacuum into which the live steam rushes with a velocity far exceeding that which could be created by the difference in the specific gravity of heated and cold air.

This is the secret of the rapidity with which heat is carried by steam to long distances from the boiler, a rapidity so great that we once saw, in a large dyeing establishment, sixty hogsheads of water in one vat raised to the boiling point in five minutes. No possible application of heated air, circulating by virtue of differences in specific gravity, could accomplish such a result in five hours, if indeed it could do it at all. The fact is, that there is no vehicle for heat known to science that, in rapidity, can at all compare with steam. But there is for this purpose no need of high pressures. So long as we have *steam*, it is enough. Condensation will produce the partial vacuum, which the steam will expand and swiftly fill, and thus the circulation, of steam outward from the boiler and water returning, will be steadily maintained. This is true, of course, for all cases where the temperature of a substance, to be heated or dried by steam pipes, does not require to be heated above 212°. If higher temperatures than this are needed, the pressure of the steam must be increased accordingly.

SUBSTITUTING OTHER VAPORS FOR STEAM.—ETHER AND BISULPHIDE OF CARBON.

The consideration that the latent heat of watery vapor is greater than that of the vapor of any other substance (see the table, page 5 of the current volume), and that, consequently, more heat is consumed by the evaporation of water than by the evaporation of any other fluid, has given rise to the idea that it would be more economical to use another fluid than water for the production of steam and the transformation of heat into power. Thus the amount of heat required to evaporate one pound of turpentine is scarcely one seventh of that required for water, but then the boiling point of turpentine is so much higher that the advantage might be counterbalanced by the stronger fire required; but it is especially alcohol and ether which have attracted attention, as these liquids, besides requiring for evaporation respectively only about one third and one sixth of the latent heat required by water, combine with this property that of possessing the low boiling points of 176° and 95° Fah. As ether in particular appeared very advantageous in this respect, it has been extensively and thoroughly tried; and we remember to have seen, among other attempts, a very large ether engine, built at the Novelty Works, New York. The execution of this undertaking was as thorough and perfect as can be expected only from a workshop possessing the superior capabilities of that excellent establishment, now, alas! suspended by the results of our unwise legislation on shipbuilding. The engine worked, of course, on the condensation principle, as ether is too expensive not to be used over and over again; and the method of surface condensation was here especially advantageous. Experience proved that there was no advantage in the supposed lesser amount of latent heat consumed, the only advantage being the lower boiling point, and this was largely overbalanced by the disadvantages in the practical working of the machine, the ether being a powerful solvent for the fats and oils, used for lubricating, and the ether vapors would pass through seams, cracks, and stuffing boxes which were perfectly steam tight, so that it was found next to impossible to keep it any length of time in the boiler; and, last but not least, anywhere this hot vapor escaped it was in great danger of taking fire, and would cause local heat, generate undue pressure, and become totally unmanageable; and it alarmed the experimenters repeatedly to such a degree that finally they threw up the ether experiment in utter disgust, and sold the machine for old iron.

The reason that there was found to be no advantage, in the fact that ether vapor contains less latent heat than water vapor, was simply in overlooking that these amounts of latent heat are always given by weight and not by volume; as, however, in driving a piston by means of a vapor, we have nothing to do with the weight of the vapor used, but only with its volume (for, by every stroke, we must fill the cylinder, whatever be the weight of the vapor), we see at once that, in order to come to a correct conclusion in regard to the economy of the latent heat consumed, we must compare this latent heat for equal volumes, and not for equal weights. In order to do this, we may reconstruct the table (given on page 5) for the latent heat of equal weights, into one for the latent heat in equal volumes of vapor; and this we may easily do by multiplying the latent heat of each vapor with its specific weight. The figures contained in the third column of the following table representing the relative amounts of latent heat in the vapors of different substances which are there reduced to the standard of water—1000, by dividing each of these products by 0·433.

TABLE OF LATENT HEAT OF VAPORS FOR EQUAL VOLUMES

Name.	Units of latent heat of vapor, for equal weight.	Spec. grav. of vapor. (Air=1.)	Product of latent heat with spec. gravity.	Units of latent heat of vapor for equal volume. (Water=1000.)
Water	962	0·45	433	1000
Alcohol	385	1·25	481	1111
Ether	162	2·26	365	840
Oil of Turpentine.	133	3·21	487	1125
Bisulphide of Carbon	210	2·60	546	1261
Ammonia	900	0·59	531	1226
Carbonic Acid	300	1·53	459	1060
Chymogene	140	4·00	560	1293

It is seen from this table that, in consequence of the fact that the vapors which possess the least latent heat are the heaviest, and therefore possess, for the same weight, the smallest bulk, the relative amounts of heat for equal bulk do not differ materially; or at least it is seen that the difference of the extremes, in place of one being more than seven times the other, as is the case with ether and water, are inconsiderable, when we compare equal volumes, differing less than one third part in the most extreme cases; in fact they are so small that some investigators have come to the conclusion that in all cases the same volume or bulk of vapor is produced by the same expenditure of latent heat, and consequently of fuel, whatever be the liquid which is evaporated, asserting that the differences in the figures of the last column are only due to the errors of observation consequent upon experiments of so delicate a nature as the determination of the specific gravity of gases and vapors, and of the latent heat absorbed by their evaporation—a conclusion of a cognate nature to that in regard to the same amount of specific heat, which the atoms of all elementary bodies appear to possess, and which was spoken of on page 389 of our last volume.

A liquid as volatile as the ether being thus almost uncontrollable over fire, in a steam boiler, the next question is: Can it not be heated in another way, say by means of the escaping steam of a high pressure engine? Or may it not be inclosed in a tubular boiler, through the tubes of which, in place of the flame and heat of coal, the exhaust steam is passed before going to the condenser? There is no doubt that in this way we may utilize the exhaust steam, without producing any back pressure, as has been the case with most other contrivances suggested for this purpose. As the exhaust steam may have a temperature of some 240°, and must have at least 212° (otherwise it can be no more steam), we may develop considerable pressure in a boiler containing ether, heated in this manner. According to Régnault, the pressure of the ether for different temperatures is as follows:

TABLE OF REGNAULT FOR THE PRESSURE OF ETHER AT DIFFERENT TEMPERATURES.

Degrees Fahrenheit.	Degrees Centigrade.	Pressure of ether in atmospheres.
240	116	9·25
230	110	8
212	100	6·50
194	90	5
176	80	4
185	70	3
140	60	2·5
122	50	2
104	40	1·33
86	30	0·8
68	20	0·6
50	10	0·33

It is seen from this table that the heat of exhaust steam is amply sufficient to develop considerable pressure by the intervention of ether in a separate condensing engine; but as ether is a quite expensive substance, being a product of chemical action on organic growth, the next question is: Can it not be superseded by another cheaper ingredient? And the answer is affirmative. We find in the table, on page 5 of this volume, bisulphide of carbon mentioned; this substance being simply a product of the combustion of charcoal in an atmosphere of sulphur vapor, CS_2, as carbonic acid is a product of charcoal in an atmosphere of oxygen, CO_2, can be, and is now manufactured very cheaply, while its boiling point (113° Fah.) is only 18° higher than that of ether. The above table, given for the pressure of ether, is approximately correct for that of bisulphide of carbon, if we add 18° Fah. or 10° Centigrade to the temperatures mentioned.

We are happy to find that the idea has been realized, and that at present, in the city of Boston, a steam engine* is successfully in operation, in which the heat of the exhaust steam heats bisulphide of carbon, and so originates a new pressure in another boiler even surpassing the first pressure, that of the steam in the boiler heated over the fire. Such a bisulphide of carbon engine may, of course, be separated from the steam engine, or may be so connected as to act on the same shaft and to form a single engine, in which the great problem, of changing as much of the heat as possible into power, will be much nearer to solution than was ever the case before.

THE INDIRECT INFLUENCE OF INVENTION UPON MANUFACTURES, ARTS, AND COMMERCE.

In a recent editorial, we spoke of the direct beneficial influence of patents upon general business. We propose now to notice some of the ways in which business is indirectly benefitted by invention, the latter having undeniably been greatly stimulated by our patent system.

In the first place, business is helped by the increased facilities for its transaction afforded by such inventions. Communication, transportation, printing, all of these have been

*This engine is fully described and illustrated on page 31 of the curren volume.

improved so much during the last fifty years that even we who live in the days of the telegraph, ocean steamers, railroads, and steam power presses, do not at all realize the magnitude of the change. Fifty years ago such a business as is transacted by more than one firm in New York could not have been created even by the greatest business capacity. In creating these immense concerns, the proprietors have had the aid of cheap printing to advertise them, of railroads to bring them customers from distances that fifty years ago would have occupied months to traverse, of the telegraph to transmit orders, and of a hundred of other improvements. The steam elevators, that raise their numerous customers to the acres of floors in the upper parts of their buildings, are patented machines. The bills and forms, which enable them to transact their business without confusion, are executed cheaply by patented machinery. The paraphernalia of their counting rooms include numerous patented helps to business. The very goods they sell are mostly manufactured by patented looms, driven by patented water wheels or steam engines.

Even the currency is so improved that the counterfeiter finds his deception more difficult and more easily detected.

But there is a still more indirect way in which general business is benefitted by the patent system. In this Yankee land, where the masses are constantly enlightened by the agency of the common schools and newspapers, every lad before he is fourteen knows something of the nature of patents, and has heard of money made and to be made in the invention or in the business manipulation of some patented improvement. The most ambitious often see, or think they see, that this way lies fortune. Many are thus induced to interest themselves in machinery, and to acquire some knowledge of mechanism. We thus have become a nation of mechanics, ready at the moment any exigency of agriculture, manufactures, commerce, or war, suggests a want, to act upon the suggestion, and the needed improvement shall be forthcoming. The farmer's boy invents his churn, his dog power, his washing machine, before he is twenty, and, by the time he reaches middle life, understands enough about machinery to run a saw mill, or even something more complicated, if necessary.

It is this universal, although partial, knowledge of mechanics that has rendered the introduction of agricultural machinery so successful in this country, and has so increased the production of the soil, that every commercial artery is now plethoric with the teeming harvests of our inland domain. Who, fifty years ago, would have thought of cultivating a thousand acres of wheat? The chances of harvesting without serious loss this amount, by any help attainable at that time by a single farmer, would not have been one in a hundred. The modern harvester, the threshing machine, has changed all that, and no one now thinks of impossibility in connection with harvesting a thousand acres.

What has caused the unprecedented growth of this great commercial center, New York? New York, as it now is, would have been an impossibility without the improvements we have named. Not a bushel of wheat from Illinois or Minnesota could ever have found its way to this port; not a tithe of the large business houses which now crowd the lower part of the city would have been heard of; the busy manufacturing towns that fill their establishments with wares would have been nothing but hamlets, and the vast prosperity, that has made America the wonder of the old world, would never have been one of the most brilliant chapters in history.

AGRICULTURAL CHEMISTRY AND CHEMICAL MANURES.

The researches of that veteran chemist, Baron Liebig, and others in the analysis of soils and the use of artificial manures did not result in such extensive progress in agriculture as was anticipated. As the effort to apply the knowledge gained by these researches was made throughout the world by intelligent agriculturists, it became evident that there was still some lack in agricultural chemistry, some mysterious circumstance, relation or element, that defeated this endeavor. As a consequence, the idea of chemical farming became a thing to be ridiculed, and fell into an ill repute which still attends it. The prejudice thus created will for a long time impede progress; but there cannot be a doubt that the missing link, which, if found in Liebig's researches, would have resulted in success instead of failure, has at last been discovered.

In the light of this revelation, the cause of the failure to apply chemical principles to agriculture is plain. We find it fully explained in the lectures of M. Ville, a translation of which, as delivered at the experimental farm of Vincennes, France, now lies before us.* These lectures are, we believe, the most important contribution to agricultural science that has appeared during the last half century. In our review of them, which we shall not attempt to make exhaustive, we shall extract some passages which will give a glimpse of their character to such as have not yet read them. In the third lecture, M. Ville remarks:

A priori, one would think that a chemical analysis which has been pushed so far in our day, and whose methods have acquired at the same time so much delicacy and certainty, ought at least to give us a means of estimating with certainty the richness of the soil, and so guiding us in the choice of the manure best suited to its nature. There is none, however, and I defy the most skillful chemist to say in advance what will be the return from earth submitted to him, and what manures are most appropriate.

A few words will explain the reason why chemistry is powerless to furnish us with these indications: you must recall the distinctions we have drawn between the different elements of which the soil is composed.

*Chemical Manures. Agricultural Lectures, delivered at the Experimental Farm at Vincennes, by George Ville. Translated by Miss E. L. Howard. Third Edition. Atlanta, Ga.: Plantation Publishing Co.

Let us suppose a soil containing both quartz sand and felspar sand among its mechanical elements. For vegetation these two sands are equivalent, although the first is from silica and nothing but silica, while the second is a silicate based upon lime, potash and soda, besides containing phosphate of lime in very feeble but appreciable quantities.

Here, then, are two bodies whose composition, in spite of similitude of exterior, have no analogy; and which, however, are equivalent in an agricultural point of view, because, the felspar being insoluble in water, its *rôle* in regard to vegetation descends to that of the quartz sand, that is to say, to a simple mechanical element. But for the chemist, there are no insoluble bodies, so he confounds in one whole the potash, lime and phosphate of lime that the felspar sand contains, though they are of no use in vegetation, with the products of the same nature which we have ranged under the class of active assimilable elements. Thus is explained the insufficiency of the signs with which chemistry can furnish us.

In order to understand fully the meaning of this quotation, it is necessary to say that M. Ville includes all the essential constituents, of soils in which plants can grow, in the category of fertilizers; but he divides them into two classes, the first of which is azotic or nitrogenous matter, and the second of which includes ten mineral substances, only three of which, phosphate of lime, potash, and lime, are so directly connected with the growth of plants that they need occupy the attention of the agriculturist in his attempt to restore to soils what has been drawn from them by the growth of crops. The other minerals act mechanically and are hence called mechanical fertilizers; but M. Ville maintains that they exist naturally in sufficient quantities, and that it is not necessary to provide them. So far as the mere growth of plants is concerned, this is probably correct, but there are doubtless many cases in which it is desirable to add some material not directly concerned in plant growth, for the purpose of modifying stiff soils, or tempering light ones.

The most favorable conditions of soil for plant growth being the presence of azotic matter, phosphate of lime, potash, and lime, M. Ville calls a mixture of these substances "the complete fertilizer." The non-assimilable elements are considered as purely mechanical in their effects.

The following experiments are given to illustrate these facts:

In burnt sand, free from all additions but moistened with distilled water, wheat acquires but a rudimentary development—the straw hardly attains the dimensions of a knitting needle. In this condition, however, vegetation follows its usual course; the plant blooms, bears grain, but in each head there are but one or two dwarfed, badly formed grains. Thus, without soil, the wheat finds in the water it receives and the carbonic acid of air, aided by the substance of its grain, resources sufficient—sorrowfully, it is true, but at last—to run through the entire cycle of its evolution.

From 22 grains of seed, weighing nearly 18 grains, we obtain 108 grains of harvest. Add the ten minerals (phosphorus, sulphur, chlorine, silicium, calcium, magnesium, potassium, sodium, iron and manganese) to the sand, excluding the azotic matter, and the result is but little more.

Under these new conditions, the wheat is a little more developed than in the preceding case, but the harvest is still more feeble; it reaches 144 grains. Suppress the minerals and add only azotic matter to the sand; the growth will still be mean and stunted, but the harvest will slightly increase, as it reaches 162 grains. Let us follow the changes. In pure burnt sand, 108 grains; with minerals without azotic matter, 144 grains; with azotic matter alone, 162 grains.

In this last case, a new system is shown. As long as we operate only with minerals the plants are diseased, the leaves show a yellowish-green color. As soon as we add azotic matter to the sand the leaves change their color, becoming ing a dark green. It seems as if vegetation would take its usual course, but the appearances are deceitful; the harvest is still feeble.

Let us attempt a third experiment, which will, in a measure, be a synthesis of the three preceding. Unite azotic matter and the minerals in the burnt sand. This time you will be tempted to believe in the intervention of a magician, the phenomenon so far surpasses those preceding it. Just now the growth was languishing, doubtful, diseased; now the plants shoot up as soon as they break the ground; the leaves are a beautiful green; the straight, firm stalk ends in a head filled with good grain; the harvest reaches from 396 to 450 grains.

You see, gentlemen, relying upon experience, which is our guide by choice, we have succeeded in artificially producing vegetation to the exclusion of manures and all unknown substances.

You will acknowledge that this is an important and fundamental point. No more mystery, no undetermined power; some chemical products of a known purity, distilled water perfectly pure in itself, one seed as a starting point, and the result, a harvest comparable in all points to the best obtained in good earth.

We are, therefore, justified in saying that the problem of vegetation here receives its solution, for we have not only defined the conditions necessary to the production of vegetation, but the degree of importance of each of the concurring agents.

Azotic matter in its decomposition furnishes ammonia, and nitrates; and the clay constitutes a receptacle which holds and gives out gradually as may be required these important ingredients. M. Ville divides plants into two classes, according as they draw their nitrogen from the air or the soil. Thus wheat is a type of plants which prefer their nitrogen in the form of salts of ammonia, and take it from the soil. Beets prefer it in the form of nitrate and take it from the soil. Peas and the other leguminous plants prefer to take it as a gas from the air. The consequence of this distinction is that plants which take nitrogen from the air will flourish in a soil containing only the other elements of the complete fertilizer, namely, phosphate of lime, potash and lime. Therefore, by planting in a soil one of each of the two classes of plants, it is possible to tell whether the soil contains the azotic and mineral matters or not. Thus, if peas and wheat be planted in the same soil, and the peas yield well while wheat yields little, the land has the mineral elements but lacks the azotic or nitrogenous matters.

At Vincennes, previous to the fertilization of the soil, the land produced nothing, and hence was proved deficient in all the elements of the complete fertilizer, by the addition of which it has been made extremely productive.

As chemical analysis of soils fails for reasons above stated the richness of the soil is determined as follows:

Suppose you institute seven cultures of the same plant—it may be of the beet or wheat, as you will.

To the first give the complete fertilizer; to the second, the same fertilizer excluding azotic matter; to the third, the complete fertilizer deprived of phosphate of lime; to the fourth, the complete fertilizer less the potash; to the fifth, less the lime; to the sixth, less all the minerals—that is to say, reduced to the azotic matter; the seventh not having received any manure.

It is very evident that if, in the complete fertilizer, the effect proper to each component is manifest but as it is associated with three others, the comparison of the returns obtained from the seven strips of the little field ought to indicate what the soil contains and in what it is wanting.

In this system of investigation, the culture with the complete fertilizer becomes, in a measure, the invariable standard of comparison to which are referred the returns of the other strips of ground; and, according as they approach or recede, we conclude that the earth contains or does not contain the element which has been voluntarily excluded from the fertilizer.

To put the value of this method beyond doubt, M. Ville reports the results given under three different conditions.

At the experimental farm at Vincennes were obtained, in 1864, the following proportional returns from wheat:

With the complete fertilizer	5644
" " " without lime	4333
" " " " potash	4044
" " " " phosphate	3466
" " " " azotic matter	1888
Without any fertilizer	1588

The conclusion is evident. At Vincennes, the complete fertilizer was necessary; the azotic matter was most deficient.

An eminent agriculturist of the department of the Somme furnished a second example, which is upon the beet:

With the complete fertilizer	4504
" " " without lime	4103
" " " potash	3703
" " " phosphate	3208
" " " azotic matter	3200
Without any fertilizer	2202

You see here, also, the earth is wanting in azotic matter, and, to put it under high culture, we must have recourse to the complete fertilizer.

The third example is from a culture of sugar cane, instituted by the Hon. M. de Zebrun, of Guadaloupe, a former delegate from that colony:

With the complete fertilizer	50666
" " " without lime	44444
" " " potash	32111
" " " phosphate	13333
" " " azote	49777
Without any fertilizer	2666

If I add that sugar cane particularly draws its azote from the air, you will conclude that the soil is particularly wanting in potash and phosphate of lime.

Here are, then, two methods of knowing the richness of the land. The first is founded on the culture of two different plants without any fertilizer, and the second, on the culture of the same plant with five different fertilizers. These two applications of the same principle lead to the same results, and verify and complete each other.

I need not add, that for each of these trials to have its full signification, the earth must not be used until the effect of each fertilizer has been spent.

By the aid of our experiments in burnt sand, and with only chemical products, we have realized a theoretic scale of culture whose progressive returns have shown us the laws which regulate vegetable productions. By the light of the collection of ideas, we were enabled to conceive and to realize practical processes of analysis accessible to all, whose testimony is of almost absolute certainty, and by means of which we can always say what a land contains, what it needs, and can consequently determine the nature of the agents to which we must have recourse to fertilize it.

In subsequent lectures, M. Ville gives tabulated statements of results from the use of what are ordinarily called chemical fertilizers, that is, such as are not directly of organic origin. These statements indicate that the chemistry of plant growth is destined to pass from under the odium of previous failures, and take its place in the sciences as a splendid collection of established facts, which will inaugurate a new era in agriculture.

We cannot extend our remarks and quotations further, but we will say that we have rarely examined a work more replete with interest, or perused a record of experiments in which the true scientific method has been more closely followed.

SHORT EXTRACTS FROM A FEW LETTERS.

An esteemed correspondent from Fort Concho, a remote spot in western Texas, forwards us a long list of subscribers, and states as follows: "This post is far west of any organized county, cultivated land, or signs of civilization of any kind. The citizens, if such they can be called, are mostly refugees from Mexico or outlaws from the States. Every one goes around armed to the teeth, homicides are common, and horrid shooting affrays are more so. Military law is the only law we have, and that has no control over these outside 'citizens.' When we reflect on the kind of men who recruit the army in time of peace, and what reckless men are willing to drive the mails, by stage, through these wild regions among hostile Indians and more dangerous 'citizens' (though the stage is always escorted by a soldier), we cannot wonder that there is no safety for money in the mails."

Another says: "I live in a small village, where there is more taste for whiskey than for science. It is hard to form a club of ten without cutting a club to break my own head. I have received five names by advancing the money for three, the fourth being a present to my brother in Nebraska; for the balance of the club, I am "going it alone. I hope

I won't lose more than my trouble. I will try to circulate them and get my money back if possible."

The following is gratifying to any who feel interested in the education and mental improvement of the young: "I cannot express to you what amusement your paper gives to my boys, nor what interest it awakens and fosters in them. The subscription is from their purses, and they prefer your weekly to any other they have received."

A Chicago friend writes as follows: "I have been burned out in the great fire (October 9, 1871), to the tune of ten thousand five hundred dollars, besides suffering many consequent inconveniences resulting from my losses, but I can go hungry a whole day and be merry; yet if I fail to get the SCIENTIFIC AMERICAN at its proper time, my equanimity is disturbed and I become a piece of broken machinery, "out of gear." I hope you will see to it that my paper is sent from your office as early as possible after it is printed."

SCIENTIFIC AND PRACTICAL INFORMATION.

THE RECENT ECLIPSE.

One section of the English expeditionary party in India chose Bekul, on the western coast of the Madras Presidency, as the point of observation. The chief results are published, and the existence of radial lines, well marked and distinct, in the corona is now established. These seem to demand our acknowledgdment of the existence of forces extending outwards from the center of the sun. Their exact position and narrowness, says Mr. Proctor, force this conclusion upon us.

PYROLIGNEOUS ACID.

Professor Cox, State geologist of Indiana, has recently experimented with pyroligneous acid, and claims that his results give us some new light on its nature and constituents. The acetic acid of the drug stores is usually derived from crude pyroligneous acid, and the latter has thus been erroneously spoken of as an impure acetic acid; but in the experiments of Professor Cox, acetic acid burned, steadily but not raipdly, with a reddish purple flame full of scintillations, while the pyroligneous acid of commerce boiled away without sparkling. In another experiment, the Professor found that the vapor of pyroligneous acid extinguished the flame of burning paper, while that of acetic acid left it undisturbed, but did not itself ignite.

These facts do not appear to us to show that the two acids are different in their natures, as it is well known that acetic acid will burn, and that when diluted with water, as in pyroligneous acid according to the usual theory, it will not.

A RESISTING MEDIUM IN SPACE.

The retardation of Encke's comet, amounting to about two and a half hours in its period of three and a half years, has been frequently cited as a proof of the existence of a medium in space, of sufficient weight to resist a body of such extreme tenuity as a comet. This explanation of the mystery of space has been objected to by Professor Asaph Hall, who gives his reasons in the following words: "So far as the motions of comets have been determined, the evidence is against the theory of a resisting medium in space. Thus far, the observations of the planets lead to the conclusion that their motions are in strict accord with the law of gravitation; and in the disputes about the acceleration of the mean motion of the moon, no one has thought to seek its cause in a resisting medium, but much more probable causes are at hand. Encke's comet, therefore, stands alone in the strange anomaly in its motion which the calculations have shown. If it be proved that the diminution of the periodic time actually exists, this anomaly must be considered as a peculiarity of Encke's comet, and its cause must be sought for in something which distinguishes this comet from all others. It was early pointed out, by Olbers, I think, that this comet moves through those regions where the zodiacal light is seen. Possibly, also, the numerous meteoric streams which are moving around the sun, and which are closely connected with the orbits of some of the comets, may exert an influence on their motions."

BALANCING SLIDE VALVES.

A correspondent states that it is the common practice, with western engineers, to calculate only the areas of ports, in estimating the pressure upon slide valves with a view to balance them. We can scarcely credit this statement, and think our correspondent must be mistaken. If the faces of valve and seat are fitted steam tight, the entire pressure will be the product of the entire area of bearing surface and ports, in inches, multiplied into the pressure per square inch maintained in the steam chest. This, multiplied into the coefficient of friction existing between the surfaces, will give the force required to move the valve under such pressure when unbalanced. Practically, there are few valves that are perfectly fitted, or that remain so if properly fitted at first. Any sure method of balancing slide valves for general use should therefore provide for experimental adjustment.

THE SUN'S EFFECT ON THE MAGNETIC NEEDLE.

It was observed by D. Müller that the variation of the magnetic needle pursued its regular course till the commencement of the recent eclipse. It then began to retrace its steps until it reached its minimum declination at 1 h. 58 m., which was the instant of totality. After that moment, the ascending motion towards the west recommenced, and continued until the needle regained the exact position it had occupied when the eclipse began.

LE GÉNIE INDUSTRIEL.

We regret to learn that the journal of the brothers Armengaud, published under the above title, is discontinued. Forty volumes have been issued during the twenty years of its existence, and it had till lately an extended circulation and a justly acquired celebrity; but the recent disastrous war on French soil has paralyzed so many industries and impoverished so many mechanics and manufacturers that its publication became no longer a source of profit to its esteemed proprietors and editors, who look hopefully for the resuscitation of mechanical and industrial science in France at no very distant date.

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Will subscribers to the SCIENTIFIC AMERICAN, who have duplicate copies of No. 1, 2, or 3, of this volume, or others who do not preserve their numbers for binding, re-mail back to this office what they are willing to spare?

At the commencement of the year, we printed several thousand more copies of each number than we had subscribers for, and as many as we anticipated a demand for; but subscriptions have come in so much faster than we expected that the first three numbers are nearly exhausted. The publishers will be obliged to any of their patrons if they return all or either of the above numbers. Address SCIENTIFIC AMERICAN, New York.

A GOOD MONTH'S WORK.

Since the first of last January up to February 5th inst.—a little over one month—201 United States patents have been issued to inventors whose specifications and drawings were prepared at the office of the SCIENTIFIC AMERICAN. This number, as large as it is, does not include a considerable number obtained through this office in foreign countries.

Death of Mr. Joseph B. Lyman.

Mr. Joseph B. Lyman, lately deceased, was for the last four years of his life agricultural editor of the New York *Tribune*, having previously filled a similar position on the New York *World*, and having edited at one time *Hearth and Home*. He had traveled much in many parts of the United States, and was thoroughly acquainted with agriculture in all the localities he had visited. Among the many friends who mourn his untimely death are most of the eminent men in journalism and agriculture on this continent.

THE submarine telegraph cable from Florida to Cuba, as we noted some time ago, was supposed to have been injured either by the bites of the sea turtles, or of some kinds of fish; and we now learn that in China a similar difficulty has been experienced in consequence of the attacks of a minute crustacean. This is so small as scarcely to be perceptible to the naked eye, but can be readily defined under the microscope. Various breaks have been satisfactorily referred to the agency of these animals, which had embedded themselves in the gutta percha. It has become necessary, therefore, to envelop the cables in certain localities with an external supplementary layer of metallic wire, in order to prevent injury in this manner.

PATENT INFRINGEMENT SUITS.—Francis and Loutrel *versus* Mellor and Rittenhouse, and the same *versus* Godfrey & Co., for infringement of plaintiffs' patents for making printing rollers of glue, glycerin and sugar. Judge McKennan, in the United States Circuit Court at Philadelphia, has rendered a decision adverse to the claims set up by Francis and Loutrel, and holds that they are not entitled to any broad claim as the first users of these ingredients, but are limited to the proportions substantially as described in their specifications.

MR. THADDEUS HYATT, formerly of this city, and the inventor of the glass covered gratings now so commonly used, has patented some new improvements connected with buildings, having for their object to render them fireproof. As a substitute for iron beams and brick arches for floors, he proposes wrought iron tubes, placed side by side. Other improvements consist of hollow bricks filled with plaster of Paris or alum, or other mixtures, which, like them, hold considerable water. Wire laths covered with similar compounds are also suggested, together with plasterings of the same materials.

THE experiments on beet root sugar made at the Amherst (Mass.) Agricultural college, during the past year, have been so successful that it is intended to ask the Legislature now in session to grant a charter to a company contemplating the manufacture on an extensive scale. They ask ten years immunity from taxation on account of the experimental nature and public importance of their enterprise. We hope the Legislature will grant the charter as asked for, and thus encourage a new industry in the old Bay State.

THE business address for the American Road Steam, George W. Fitts, inventor, illustrated in No. 6, is: American Road Steamer Company, 24 South Front street, Philadelphia, Pa.

Examples for the Ladies.

Mrs. Amelia Coutant, Brooklyn, N. Y., has had her Wheeler & Wilson Machine since June, 1869; has, besides other sewing, made 836 pairs of pantaloons, making as high as seven pairs a day, besides doing her own housework. She was self-taught, and has broken but two needles of the original dozen.

Miss Adelaide Perry, Bloomington, Ill., says: We have had our Wheeler & Wilson Machine in use eleven years without repairs, and it runs as well as the day it was bought. Last year I earned with it $485.85, besides doing the sewing for a family of eight persons, and considerable other work.

Business and Personal.

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

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Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

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Burnett's Cocoaine dresses the hair perfectly, without greasing, drying, or stiffening it.

Notes & Queries.

1.—PURIFICATION OF ZINC.—How can old zinc be made pure, or nearly so?—E. M. D.

2.—APPLICATION OF GUTTA PERCHA.—How is the gutta percha, which surrounds the helices in most telegraph instruments, put on?—E. M. D.

3.—GALVANOMETER.—How can I construct a cheap and effective galvanometer for galvanic electricity?—E. M. D.

4.—CLEANING BRONZE.—Will some of your readers give me a receipt for cleaning bronze chandeliers, etc?—T. E. L.

5.—SCENE PAINTING.—What kind of paint, that will not rub off, is the best to use for painting scenery?—Q. R.

6.—CEMENT FOR CAST IRON.—How can I make a cement or stopping cracks in cast iron pots, to make them water tight?—C. C.

7.—MEASURING ALTITUDE BY BOILING WATER.—Is there any way to tell the elevation above the sea, by the boiling point of water, with the aid of a thermometer?—F. A. C.

8.—GALVANIZING SMALL IRON CASTINGS.—I want to know the cheapest and simplest way of effecting this.—J. E.

9.—BREAKING UP OLD IRON.—I would like to know the best method, to be operated by one man, of breaking up old car wheels.—W. L.

10.—SPEED OF SHAFT.—How many revolutions per minute s it safe to run a shaft containing two cast iron arms, 20 inches long, and 4 inches square? As the work is to be done by the speed, it is a question as o how fast it is safe to run it.—W.

11.—POLISHING WOOD.—Will some one of your correspondents inform me how to construct a polishing wheel to polish boards of both hard and soft lumber?—W. M. H.

12.—STEAM ENGINE CONSTRUCTION.—If two engines are set quartering, so that they both work on one crank, will one eccentric do o work both valves, and do it as well as one eccentric to each valve?—M. H. A.

13.—VOLTAIC PILE.—Will some correspondent please inform me how to make a cheap voltaic pile?—T. F. G.

14.—GINGER BEER.—Will some one give me a receipt to make ginger beer, that will keep good for a month, and also, the best mode of fermenting, filling bottles, corking, tying, etc?—F. L. C.

15.—PRESSURE IN STEAM BOILER.—Which make the greater pressure on a steam boiler, steam of one hundred pounds to the square inch, or hydrostatic pressure of one hundred pounds to the square inch? Which strains the boiler most?—D. R. R.

16.—BORING CONICAL CYLINDER.—How can I bore out a hole in a cylinder 40 inches long, tapering truly from end to end, 12 inches in diameter at one end, and diminishing one eighth of an inch in the 40 inches? I am to do the job with ordinary tools of a machine shop, on a l athe with a boring bar 10 feet long.—J. F. W.

17.—VARIATION OF THE COMPASS.—Will some one please inform me, through the SCIENTIFIC AMERICAN, what the variation of the compass is, this year, at Portsmouth, N. H., and whether, and how much a year it is increasing or decreasing?—F. A. C.

18.—RINGING GOBLET.—Will some reader please inform me what is the cause of a goblet ringing when the wet finger ends are rubbed on the upper edge of the glass?—W. H. R.

19.—DIVIDING A CIRCLE BY RADII.—Is there any method, other than the tedious one by repeated trials, of dividing a circle into a given number of equal parts, when the number is a large prime number, say 6; or 73?—R. C. W.

20.—HARDENING IRON BY ROLLING.—Can thin—say one xteenth inch—iron be cold rolled as hard and elastic as if hammer hardened? And if so, what kind of rolls should be used? Would a roll of large diameter, and a flat, movable bed do?—W. S. H.

21.—HYDRAULIC CEMENT.—Will some one kindly furnish, through your columns, a formula for manufacturing hydraulic cement, and a description of the stone used for that purpose?—J. A. T.

22.—METALS UNDER STEAM PRESSURE.—Which of the metals, iron, steel, brass, copper, or any other, excepting gold, that will resist the action of steam, will expand most when immersed in steam, say at 100 pounds per inch?—J. A. T.

23.—GASOLINE.—Will some of your readers please answer the following questions? What are the chemical constituents of gas evaporated from gasoline? Is it explosive when mixed with common air, and, if so, in what proportion? What is the cost per 1000 feet, not counting interest etc., on machinery? An early answer will oblige.—J. A. G.

24.—SAND IN DRIVE WELL.—I have a four inch drive pipe well, 75 feet deep. There is a rock bottom at a depth of 81 feet. When opened, an abundance of water was freely pumped; but having no use for it he pump stood a week or so, at the end of which time pumping was resumed, but little water came. The cause was found to be no less than ten feet of solid sand in the bottom of the pipe. Will some of your readers tell me how to get the sand out?—W. L.

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 $1·00 a line, under the head of "Business and Personal."

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

S., of Tenn.—The largest steam hammer in the world is, we believe, the 100 ton hammer at Krupp's steel works in Prussia.

FRICTION PULLEY.—Will a friction pulley with six inches face have as much friction power as one twelve inches face with the same pressure? Answer: If similarly constructed, yes.

RUBBER PACKING TO PREVENT FRICTION.—The device described by J. W. S. is neither new nor patentable.

CEMENT FOR SHEET IRON AND RUBBER PACKING.—Let J. M., query 8, January 20, 1872, try a white lead paint on the iron. Leather or rubber can be glued on to an iron surface thus prepared.—D. B., of N. Y.

VOLUME OF HYDROGEN.—To W. W., query 1, February 3, 1872: One ounce of hydrogen measures 22,371 cubic inches.—D. B., of N. Y.

BENDING GAS PIPE.—This may be done by filling the pipe with molten resin. When the resin hardens, bend the pipe, and it will retain its round form. Remove the resin by heating.—W. H. R., of N. J.

WATERPROOFING COTTON CLOTH.—H. W. U., query 3, January 20, 1872, is evidently not a steady reader of your journal. Many recipes for this purpose have been given, and two new ones appear on page 105, current volume.—D. B., of N. Y.

A. D. N., of O.—Increasing the diameter of cylindrical boilers increases the strain resulting from steam pressure upon them, directly as the increase of diameters.

M. H. B., of Mass.—Your queries cannot be answered properly in any space we can give you in this column. You ought to obtain a good work on the steam engine, and read it for the information you seek.

SAW MILL GEARING.—To T. B., query 13, January 20, 1872: The weight of the saw has nothing to do with the question. You have to counterbalance the lower end of the pitman only. Therefore lay the pitman in a horizontal position and weigh the end which connects on the face plate, including the wrist pin; and you have the weight to counterbalance.—P. B.

FACING OIL STONES.—Your correspondents, who have written on this subject, have not yet described the best way of doing it. I go to a foundery and take any flat casting from which the scale has not been removed; by rubbing the stone on it, as on a board with emery, I can true an oil stone in one fourth the time needed for any other method, and I have tried them all.—J. E.

PRESERVING NATURAL FLOWERS.—R. A. L., query 1, February 10, 1872, should dip the flowers in melted paraffin, withdrawing them quickly. The liquid should be only just hot enough to maintain its fluidity, and the flowers should be dipped one at a time, held by the stalks and moved about for an instant to get rid of air bubbles. Fresh cut flowers, free from moisture, make excellent specimens in this way.—D. B., of N. Y.

COPPER DIP.—S. D. R., query 2, February 10, 1872, is informed that sulphate of copper is soluble in four times its weight of water at 60°, and that this proportion furnishes the strongest pickle. A coating of the required thickness may be produced by dipping the articles several times.—D. B., of N. Y.

R. M. C., of Mass., says: "I would like to inquire, through your paper, if there is any way to bleach ivory, and if so, how it is done?" Answer: Ivory is bleached by exposure to sunlight. For piano makers and others, it is prepared by first sawing it into thin sheets or plates. These are placed on suitable frames, under glass, and exposed to light for several months. The frames are of peculiar construction and patented. They are so arranged as to shift, thus reversing the exposure of the ivory, so that both sides may be duly acted upon by the light.

C. G., of N. J.—It is probable that the draft of your chimney is insufficient. The gases you detect, by smell, as escaping therefrom are certainly deleterious. It may be also that you use a damper between the fire chamber and chimney to regulate combustion. This would be wrong, and sure to result in the forcing of gases out into the room. The damping should be done at the throat of the stove, never in the uptake. If the stove is not made so that this can be done, it is not fit for use.

COLORING BAND FOR HOUSE'S TELEGRAPH.—Reply to R. I. H., query 6, page 90. The coloring band of the House printing telegraph is a common narrow silk ribbon, saturated with a mixture of lamp black, ivory black, sweet oil, and turpentine. The ink sold for hand stamps answers the purpose very well. Electro-chemical telegraphic paper may be prepared in several ways. Bain used a solution of yellow prussiate of potash in water, to which was added two parts nitric acid and two parts ammonia. With an iron style, this gives a dark blue mark on the passage of the electric current. Another formula consists of one part iodide of potassium, 20 parts starch paste, and 40 parts water. This gives a brown mark which, however, is not permanent fading out in a few hours.—F. L. P., of N. Y.

STEAM ENGINE FOR SAW MILL.—I would say to NEMO, query No. 16, of January 20th, that it is very doubtful if he can ever obtain "satisfactory results" in running a circular saw mill with a ten horse power thrasher engine. He might increase the size of his mandril pulley, and run his engine faster, but even then he would lack in steam making capacity. He had better not attempt it at all, but procure a portable muley mill. They are made especially for engines of that class; can be run with one half the expense, and are said to do nearly or quite as much as a stationary muley.—A. D. N., of O.

SAFETY GUNPOWDER.—Would it not be an infinite saving, to property holders in cities and to insurance companies, if a plan could be invented to make gunpowder perfectly safe from explosion, so that the merchant's house and stock and the surrounding neighborhood and human life would be perfectly protected?—INVENTOR. Answer: Any plan for making gunpowder inexplosive, while in stock, will meet with general approval.

AIR PRESSURE AND SUCTION.—P. D. asks how to prove that the pressure of the air, and not suction, raises the water in a pump. Let him take a straight lead pipe forty or more feet long, fill it with water, and plug both ends tight. Then, holding it perpendicularly, let him immerse the lower end in a pail of water and remove that plug. After all the water that will has drained from the pipe, let him replace the plug; and, on examination, he will find water enough remaining in the pipe to fill it to about thirty-two feet above the water in the pail. Then ask any unbeliever to explain why the water did not all run out. After he has done it satisfactorily on the suction theory, then ask him to explain why it would all run out if the upper plug were removed?—M., of Mass.

COMPOUND GEAR FOR SCREW CUTTING.—Some time ago R. H. S. asked for a simple rule for cutting threads by compound gearing. Since that time I have anxiously waited, and still wait, for such a rule. Many of your correspondents don't seem to know what compound gearing is, and give rules for simple gearing, and such rules as would be of very little use to a practical machinist. Imagine a machinist being ordered to cut a three eighth set screw two inches long for an engine ready to go out, and attempting to find his gear by the rule given by C. F., of N. Y., while, in reality, he need only multiply the number of threads in the leading screw and the number of threads to be cut by the same number. For instance, the screw is 6, and he wants to cut 8. Multiply by say 3, which gives 18 and 24, or by 3½=21 and 28, or by 4, which gives 24 and 32; any of these pairs will cut the required thread. By this method, you can see that in a few seconds many sets can be found to cut the required thread without the use of pencil or chalk. Even if he wants to cut 8½ threads, or any bastard thread, the rule holds good, and is what I call a practical rule for single gears.—L. —J. P. M. C.

SAW FILING.—In query 7, Jan. 27, C. M. B. wants to know how to file a cut off hand saw. I find by the practical use of said tool (which any one who pretends to file a saw should not be without) that the saw should be filed as follows: Put the saw into the clamp with the handle to the left hand always; run a file lightly across the teeth, as this will keep it straight, and give the filer a chance to see clearly the points of each tooth, which is necessary to a good job. Take the file and commence at the point of the saw, holding it (the file) at an angle of about 30° by lowering the right hand, and about 15° towards the handle of the saw. The file is to be so held as to file the front side of the tooth that is set from him and the back side of the one that is set towards him; and the point of the tooth should be but a trifle forward of the middle of the base. A saw to do nice work should have the least possible set in it, and must be a good tool in every respect. I have had over twenty years practical experience in the use of the saw, and have filed many saws in shops where I have worked; and I do not recollect ever having a fault found with one that was filed in this way. It is my experience that this is the only right way. When he has filed one side, he will see that he must reverse the saw in the clamp to file the other side. In filing in this way, the front edge of the tooth will be the thinnest.—A. D. W. of Mass.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

s 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 or 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.

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.

To Make an Application for a Patent.

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

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OFFICE IN WASHINGTON—**Corner F and 7th streets,** opposite Patent Office.

Recent American and Foreign Patents.

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

GOPHER TRAP.—William W. McKay, of Frankville, Iowa.—This invention consists in constructing a trap that may be inserted lengthwise into the burrow of the animal. In watching the habits of the gopher, it is observed that, in coming to the light or from his burrow, he always pushes earth before him, so that the common trap is sprung before he reaches it, or is prevented from springing by the earth which would be forced under the pan. This elongated trap prevents the first result, and the covering over the pan prevents the last. As the trap is carefully covered in the hole, the jaws are made to close past each other, so that earth will not be caught between them when the trap is sprung.

LAYING SHINGLES.—Sherman G. Castor, of Orwell, N. Y.—This invention relates to an improvement upon a method of laying shingles which was long since proposed, and which consists in securing the shingles by nails having enlarged heads, so that an air space shall be formed between the courses by reason of each course resting on the heads of the nails of the course below, or beneath it. This plan has, however, never been practically adopted, on account of the liability, evidently existing, of splitting or cracking the shingles in laying them, or by subsequent imposition of weight, in the form of snow or otherwise. Another important objection also exists in the want of any means of preventing snow, or even rain water, from penetrating upward between the courses of shingles, and thus finding access to or beneath the sheathing of the roof, and thus effecting more or less damage. To remedy these and other practical objections to said plan, the inventor employs strips of wood between the courses of shingles, and nails the latter thereto.

IMPROVEMENT IN CORN SHELLER TEETH.—Herman R. Rueter, of New Hope, Mo.—This invention relates to a new and useful improvement in teeth for corn shellers, whereby the ordinary corn sheller is, it is claimed, rendered more effective than heretofore. The tooth is made in two parts, one being the tooth proper, or part with which the corn comes in contact. This part is locked to the other, and the formation of the parts is such that a recess is left, within the lock, in which a spiral spring is placed. The tooth proper is made, by this arrangement, elastic, which allows it to give and conform to the size of the ear of corn. The teeth are placed in the machine so as to act together with inclined upper surfaces arranged to act as a screw to draw the cob through while taking off the kernels.

AIR BLOWER.—James W. Newcomb, of New York city.—This invention consists in a double acting blower of two flexible sides and ends, of leather or other like substance, two opposite rigid immovable sides, and a movable dividing plate or board at the center of the flexible part, moving back and forth between the immovable sides, alternately inflating and exhausting the spaces between it and the said immovable sides, the air being driven from both sides into branches leading to an exhaust pipe, which is alternately opened and closed to the respective sides by a valve moved by the shifting currents of air coming from the blower. It is claimed that this apparatus furnishes a very efficient blowing apparatus of great power. When the plate begins to move in one direction to exhaust one side and inflate the other, the valve is tilted over by the first part of the blast coming against it, opening the passage for the air arising from one side and closing the exhaust to the other.

PLOW.—Richard J. Miller, of Sherman, Iowa.—This invention consists of a vertically swinging arm at the end of the plow beam, to the swinging end of which the whiffletree is connected, which arm has an eccentric pulley or a segment thereof connected to its axis; and a chain extends from said pulley to another on a hand lever near the rear of the plow in such manner that, by pulling the lever backward, the arm to which the whiffletree is connected will be forced downward, which will cause the plow to run shallower, and, by allowing the lever to swing forward by the action of the draft, the said arm will be raised by the draft and the plow caused to run deeper. A graduated notched plate and a holding pawl are provided, in connection with the lever to hold the latter in the required position.

IRON TELEGRAPH POLE.—Richard D. McDonald, of Jersey City, N. J., and Edward M. Crandal, of Marshalltown, Iowa, assignors to Richard D. McDonald.—The lower section of the pole or the part which enters the ground is provided with a winged supporting socket. The end of this section may be pointed or made sharp in any manner, so that it may be driven into the ground; or the end may be split, with the parts turned out in either direction, where a hole is made to receive the pole. This section is supported upon the socket by shoulders. In "planting" the pole this lower section is either driven into or placed in the ground, with the supporting socket around it, the top of which socket is designed to be at or near the surface of the ground. The second section of the pole connects with the first section by a slip joint limited by shoulders. The third and fourth tubular sections of this pole are of diminishing diameter from the base section up, and each is connected by a slip joint limited by shoulders. In the upper end of each of the lower sections is a recess, and on the lower end is a lug, which fits into the recess. By this arrangement the sections are prevented from turning, and are held in proper position. There may be bands around the ends of each section, which will come in contact at each end of the joint, if desired. These tubular sections are made of gas or steam pipe, and are banded to form the shoulders or enlargements. Rounds pass through holes in the pole for convenience in ascending and descending the pole. Arms for supporting the wires, with insulators thereon, are provided. In the top of the upper section there may be an insulator, with provision for supporting a telegraph wire. The pole being a tube, a conducting wire (one or more) may be carried down through it to the ground, and thus be secured from injury, tranverse bars being arranged, with proper glass insulators, to guide the wire within the pole.

DRAWING KNIFE.—Albert M. Steele, of Danbury, Conn., assignor to himself and Frederick A. Hull, of same place.—The object of this invention is to render drawing knives more convenient for packing and carrying, not only for the manufacturer, but also for the mechanic in packing away his tools; and it consists in joints in the handle shanks and a mode of tightening the handles; the latter being arranged to fold over, to protect the blade, and admit of being packed in a small space.

RICE CLEANER.—David L. Geer, of Lake City, Fla., assignor of one third his right to Jesse Carter, of same place.—This invention has for its object to produce a machine whereby rice can be rapidly and thoroughly cleaned, after having been hulled in the ordinary manner. It consists in the employment of a shaft carrying projecting wings or friction blades within a stationary drum or cylinder, the motion of which causes the rice to circulate in the space around them, and by its own weight and pressure a friction is produced that cuts off the germs and membranous coatings or skin, producing what is called rice flour. When the process has been continued until the flour has been removed, the rice presents a flinty, white, smooth appearance. The breaking of the grain, so frequent with the use of the ordinary mortar and pestle, is prevented. The friction will also clear the rice of any hulls or chaff that may have adhered to it after the hulling process. In fact, it is claimed that the machine may, if proper time is allowed, be used for hulling as well as cleaning.

PUMP.—Robert T. Smart and Robert T. Smart, Jr., of Troy, N. Y.—This invention consists of a double acting pump with a hollow piston rod, through which the water is discharged, the cylinder being fixed below—or it may be above—the water, in which both of the valves are arranged on the upper side of a plate in a hollow piston, in such a manner that they both close downward self actingly, irrespective of the direction in which the piston moves, and they retain the water above them in such manner that it cannot pass back to either chamber of the pump barrel, thereby avoiding the necessity of a stuffing box to keep the discharge tube full, so that there is no loss while the pump is standing still. In case the pump is to be used horizontally, the relation of the plate and the chamber and passages with the horizontal piston will be so changed that the plate will still be horizontal to hold the valves so as to close by gravity.

CARRIAGE WHEEL.—Charles W. Fillmore, Marengo, Ill.—The invention consists in a peculiar construction of hub and clamp, by which the liability of wheels to give way at the junction of spoke and hub is entirely obviated and prevented.

TELEGRAPHY.—William C. Barney, Washington, D. C.—This invention consists in a discovery by which the ground current of a telegraphic circuit may be utilized and messages repeated at the point from which they were sent without any additional expenditure of fluid or money. It also discloses the unvarying uniformity of the earth as a conductor, and its adaptation to be used under all conditions of the atmosphere.

PLOW CARRIAGE.—Mark A. Melvin, Washington Court House, Ohio.—This invention pertains to improvement in the class of gang or wheel plows wherein a lever, rock shaft and connecting rod, are arranged to be operated from the driver's seat to cause the elevation or depression of the front end of the plow beam, for the purpose of governing the depth of furrow.

BELT TIGHTENER.—Louis Funke, of Champion Mills, near Belen, Territory of New Mexico.—This invention consists in a toothed segment for working the moving jaw of a clamp or belt tightener by gearing with a toothed bar, and being revolved by a hand lever or crank, so mounted in the said moving jaw that it can be readily lifted out of gear with the bar, to allow of moving the jaw away from the fixed one, and yet be properly maintained in gear with the said bar when required to force the movable jaw toward the fixed one for clamping anything between them, or drawing the ends of the belts together.

EXTENSION TABLE.—George H. Henkel, of Germantown, Ohio.—This is a new extension drop leaf table, which can be used either with a circular, oval, or extended top, as may be desired. The invention consists in the leaves so constructed that, when arranged at right angles with their position in an extension table, they combine with other leaves to form an oval table.

BLACKING BOX.—Hiram Smith, of Newton Mills, Haddonfield, N. J.—This invention has for its object to furnish an improved box for shoe blacking, so constructed that the blacking can all be removed with the brush, which will not cut the bristles of the brush when removing the blacking, and which will keep its place wherever it may be placed while being used, without its being necessary for the operator to keep it in his hand. The body of the box receives the blacking and is made hemispherical in form. With this construction there will be no angles or corners for the blacking to get into, and where it cannot be reached by the brush. With this construction also the sides of the brush cannot come in contact with the edges of the box while removing the blacking, thus preventing the bristles from being cut by said edges. To the edges of the hemispherical body is attached the upper edge of a cylindrical case band or rim. To the lower edge of the rim is attached a bottom which is perforated outwardly, so that the burs of said perforations may project outward, and thus serve as teeth to prevent the box from slipping around upon its support while being used. This same thing may be accomplished by forming teeth upon the lower edge of the rim. In this case the bottom need not be used. The cover is made and fits upon the top of the box in the ordinary manner.

INKSTAND.—John Charles Sparr, of Irondequoit, assignor to himself and Julius Schneider, of Rochester, N. Y.—When the inkstand, with its rack or without it, is overturned at right angles to its pivots, it will quickly right itself, being balanced to be vertically suspended. When the inkstand, with its rack, is turned in any other direction, the cover will slide down immediately and close the mouth of the bottle. When the latter is again in its normal position, the cover can be readily moved back to bring its circular aperture over the mouth of the bottle. The inkstand is balanced on pivots, and has a neck and is provided with the sliding cover above referred to.

ARTIFICIAL TEETH AND DENTAL PLATES.—Robert E. Burlan, Lewisburg, Pa.—In this case block teeth are first firmly secured to a platinum plate by a peculiar wire attachment, after which a porcelain body is packed over the wire and between the blocks, so that when properly packed there shall be a continuous although sectional block, presenting an artistic and natural appearance. This mode of mounting teeth is applicable in many kinds of work, or to various base plates.

ELECTROMAGNETIC RAILROAD SIGNAL AND SWITCH TENDER.—Hugh S. L. Bryan, Liberty, Mo.—This invention relates to an electromagnetic apparatus whereby the flags and lights of a signal stand or a railroad switch can be operated from a point at any distance therefrom, and whereby the flag, light, or switch in passing out automatically transmits to the operator the signal O K, and in passing in, the signal K O, by which signals the operator is informed that the flag, light, or switch is working properly.

FENCE.—Israel L. Landis, Lancaster, Pa.—The invention consists in a new way of putting up posts and rail or picket fences with wedge clamp metal, so that the panels may be detachable and used on different lines, the mortising of posts dispensed with and the cost of construction greatly reduced.

THILL COUPLING.—Clement St. James, of Pittsfield, Mass.—This invention has for its object to improve the construction of an improved thill coupling patented January 18, 1870, so as to make it simpler and less expensive in construction, more convenient in use, and more effective and reliable in operation; and it consists in the construction and combination of various parts of the coupling, as hereinafter more fully described. The combination, in a thill coupling, of the axle, with clips, and an U shaped bar with a one piece yoke plate, made up of two parts, constructed of different hights, so as to receive the said U shaped bar in a recess, formed by said yoke plate and the axle, are the features embraced in the claim.

WATCH CHAIN FASTENER.—William C. Edge, of Newark, N. J.—This invention provides a fastening for watch chains or guards, easy of attachment to and removal from the button hole of a vest or waistcoat and yet not liable to accidental detachment, and forming an ornamental termination or appendage of the watch guard, the means of fastening not being visible exteriorly. An S shaped or double hook, whose outer sections or arms are about half the length of the main inner section, is used. This hook is fastened to a curved bar secured in the under or flanged side of a button, which is ornamented on its top. The loop, for connecting the watch guard to the button, is swiveled to the hook. The hook is applied by first fitting the one end through the button hole or eyelet in the garment, then, by reversing the motion, carrying the central section, and, finally the inner end through the same. Secure fastening of the stud, button, or chain, to the garment is thus obtained. This invention does away with the necessity of using the short end of common chains now required in connection with the ordinary bar.

CAP FOR BOOTS AND SHOES.—Benjamin F. Sage, of Beverly, N. J.—This invention relates to a new toe protector or cap to be applied to the worn ends of boots or shoes. The invention consists in the use of a flexible detachable cap or toe piece, which can be prepared as an article of manufacture and supplied to the market to be supplied to the wearers of boots and shoes, who can easily apply the caps themselves. The cap or toe piece is made of leather, rubber, or equivalent fabric, and has backwardly projecting side pieces. The side pieces have eyes or hooks at their ends. The boot or shoe to be supplied with such a cap or toe piece is provided with a screw or eye bolt in the soles on both sides, so that the eye or hook at the end of the cap may be secured thereto; or else the side pieces have hooks that may be forced into the sole, or between sole and upper to hold in the leather stitching. To insure greater strength, the wire or metal, of which such hooks or eyes are formed, may be extended along the under side of the cap.

DEVICE FOR MOVING PIANOS.—Samuel D. Reynolds, Rochelle, Ill.—This is an improved device, the use of which will enable pianos to be conveniently moved. It consists of frames with wheels, which are used as follows: The piano to be moved is turned upon its rear edge upon the benches or horses in the ordinary manner, and the legs and treadles are removed. The frames are then passed over the ends of the piano and secured by screws passing through the bars and screwing into the bottom of the piano. Longitudinal bars are then secured to the frames, and the piano can be easily and readily moved wherever desired.

HORSE SHOE.—Silas Sloat, Morgan, Ohio.—This invention has for its object to improve the construction of an improved horse shoe patented October 22, 1867. It consists in the construction and combination of various parts of the shoe, by which the rear parts of the shoe are held against the rear part of the hoof by a lever pressure, so as to hold the shoe firmly to its place. This construction also enables the shoe to be conveniently tightened as may be required. This construction also enables the shoe to be attached to and removed from the hoof, and does not require the front part of the leather band referred to in the former patent, to be slit or made open.

CHURN.—Thomas J. Wilson, of New Lisbon, Ind.—A rectangular case holds the cream. It has a broad base, adapted to set on a table or bench, in which case is a dasher, consisting of a vertical stem, large horizontal arms, and smaller ones, and arranged perpendicular to each other, and a suitable distance apart vertically. The smaller arms are arranged at short distances from each other on the large ones, and perpendicular to each other, and have angular top and bottom sides, for dividing the cream readily in passing through it. These two sets of parallel arms, crossing each other in this manner, are adapted to agitate the cream in the most thorough manner, and alike throughout all parts of the case. The lower arms are notched at the ends and fitted with vertical guides, on the side of the case, to keep the dasher in proper position, and the stem is guided at the upper end by the cover, through which it passes. The cover is made in two parts, one of which covers about two thirds of the top, and is detachably fastened by a yoke, hook and beam. The other part of the cover simply rests on the top of the case, and is provided with a cover for lifting off readily, to note the progress of the work.

CIGAR MACHINE.—Frederic C. Miller, Cincinnati, Ohio.—This is a new machine for pressing the filling of cigars in molds prepared for their reception, and has for its object to facilitate the rapid manipulation of the molds in order to provide for an economical and perfect production of the cigars. The molds are arranged in a circular track in considerable numbers, and therein moved, by proper novel mechanism, so as to be brought in a line with a table for filling, emptying, and refilling, and then moved around and kept under pressure until again brought in line with the table. The invention consists in the new manner of arranging the molds, and in the new mechanism for moving and detaining the same, which seems well adapted to secure the objects intended.

THILL COUPLING.—J. Cugnier Racine, of Appleton, Wis., assignor to himself and M. H. Lyon, of same place.—This invention provides means for properly securing the bolts with which the shafts, thills, or poles of carriages, wagons, buggies, or other vehicles are held in place. Usually the coupling bolts are secured by nuts, pieces of leather, or similar devices. This invention consists in holding the bolt by a pivoted plate, which is drawn against the bolt by a spring, and has projecting lugs or spurs at the sides, whereby it is prevented from swinging out of place.

REED ORGAN.—George Woods, Cambridgeport, Mass.—This invention consists of an arrangement of an additional wind chest reed and sounding box, such as is described in a patent issued to the same inventor, September 13, 1870, relatively to the common wind chest, whereby the apparatus for working the valves of the said attachment is simplified and improved. The invention also consists of a combination, of a sheet or web of india rubber coated cloth or other equivalent substance, with the sounding board of the additional wind chest for varying and improving the tones.

LOW WATER ALARM FOR STEAM BOILER.—Linus Savage, Ashtabula, Ohio.—A lever is pivoted to some suitable support near its upper end, and, at its upper end, is connected with the feed pipe, or with a bar or plate, in contact with said feed pipe, by a connecting rod, which should be made adjustable to enable the alarm to be set as may be desired. To the side of the lower end of the lever is pivoted a small friction roller, upon which rests an arm or bar, pivoted at its lower end to some suitable support, and to which, near its upper end, is attached a hammer. The upper end of the arm rests upon a stop attached to or formed upon the side of the lever. A bell is suspended from some suitable support in such a position as to be struck by the hammer as it falls when the arm escapes from the stop. With this construction, while a supply of a water is passing through the pipe, the pipe will be cold; but should the supply of water from any cause cease, the pipe will become heated and expand, and will heat and expand the bar or plate connected with the said pipe. This expansion, by means of the connecting rod, will operate the lever, and cause the hammer arm to slip from the stop, sounding the alarm. When the supply of water is again started, the water will cool the pipe, which will contract, and, by its contraction, draw the arm back to its place upon the stop, ready to again sound the alarm. In substantially the same way the expansion of the supply pipe, upon the failure of the supply of water, may be used for blowing a whistle, causing an explosion, or giving other alarms.

SAFETY WATCH POCKET.—Hermann Fritsche, Newark, N. J.—The object of this invention is to produce a safety watch pocket, which will be entirely reliable and prevent the fraudulent abstraction of the watch. The invention will first be fully described, and then clearly pointed out in the claim. A pocket is made of leather, or other fabric, of suitable size and shape. It is closed on all sides except on top, where it has a swinging flap, which can be opened and closed. The edge of the flap is lined with wire, which forms a projecting loop in the middle. This loop, catching over a pin that projects through the wire lining of the pocket proper, serves to hold the flap closed. The pin projects directly from the end of a spring which is fastened to the under side of the wire. A knob also projects through the lining, rests with its lower end on the spring, and will, when pressed upon, carry the pin down out of the loop and open the flap. When it is desired to guard against even this mode of opening the pocket, a slide can be moved by a projecting knob and fitted with its end into a notch of the knob. The latter can then no longer be depressed, and the pocket consequently not opened until the slide has been withdrawn from the knob. The pocket is provided with two wings, formed of V shaped wires, inclosed in the leather or fabric. The wires have prongs at their outer parts, which, as they are held out by the springs of the wires, will enter the fabric of the vest pocket into which the pocket has been put. The inner ends of the wires bear against the watch. While the watch is in the safety pocket, this pocket cannot be removed from the vest pocket, since the wires cannot be contracted to clear the prongs from the vest.

CONSTRUCTING BUILDINGS.—Andrew Derrom, Paterson, N. J.—The object of this invention is to protect buildings that are in process of construction, or of thorough repair, and also the laborers, engaged at the work, from the inclemency of the weather. The invention consists in the use of a vertically adjustable cap or cover, which is placed over the walls to be erected, and gradually elevated as the walls go up, meanwhile keeping them, the flooring, material, and laborers always under roof. The advantages of this method of constructing buildings are manifold. Not only are the men kept in healthy condition, but also material is economized, and the application of artificial heat is made possible, whereby frost can be kept out and building in midwinter continued. The invention is equally applicable to the erection of new buildings as to the repair of such as are burned partly down.

GATE.—Garret S. Spragg and Gilbert Mott, Tabor, Iowa.—This invention consists of the combination of a rocking frame with a counterpoise and the gate, in that class of gates which are arranged to have the free end swing up vertically and be held so by a counterpoise to swing clear of ice and snow in the winter, the said rocking frame being pivoted on the top of the gate post, and operated in such manner as not to be obstructed by freezing in the winter, and so as not to acquire readjustment if the post leans, as the cord and weight heretofore used to do. The weight is suspended so far from the post that they will not interfere with each other in case the post is pulled out of the vertical line by the gate, as they do when the weight is suspended from the pulley close by the side of the post. This apparatus works much easier than the cord and pulley, and does not draw the post with as much force as they do.

COMBINED POCKET KNIFE AND ENVELOPE OPENER.—Aaron S. Pennington, Paterson, N. J.—This invention consists in forming a notch in the division plate, between the several blades or springs of a pocket knife, so as to convert such division plate into an envelope opener. The edge of this plate has a notch formed in it, which produces a point and cutting edge that can be used as an envelope opener, the notch being placed either between the blades or at the back of the knife, between the springs. In either case, it is claimed, the combined knife and envelope opener will constitute a convenient and desirable article of manufacture.

BELT TIGHTENER.—Josiah W. Batcheller, Oregon, Mo.—This invention consists of a tightening pulley mounted in the end of a bar, which is fitted in a place for holding it so that it can be adjusted forward and backward, and the plate is arranged to be fastened to any suitable support to hold the tightening pulley in front of the belt. The invention is more particularly adapted for sewing machines. The ends of the plate are adapted to be fastened to the under side of the sewing machine table or other support by screws or any equivalent.

[OFFICIAL.]

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DESIGNS PATENTED.

5,505.—PRINTED FABRIC.—F. Christie, Philadelphia, Pa.
5,506.—SHAWL.—H. Erbs, Philadelphia, Pa.
5,507.—TYPE.—A. Gilbert .Boston .Mass.
5,508.—LEECH JAR.—W. Neidlinger, New York city.
5,509.—SODA FOUNTAIN.—G. F. Meacham, Newton, Mass.

TRADE-MARKS.

641.—UMBRELLAS.—Dawes & Fanning, New York city.
645 to 647.—FERTILIZERS.—Maryland Fertilizing and Manufacturing Company, Baltimore, Md.
648.—SOAP.—J. Oakley, New York city.
649 to 651.—WHISKY.—James M. O'Donnell, Staten Island, N. Y.
652.—WHISKY.—C. H. Ross & Co., Baltimore, Md.

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:

20,091.—FLY TRAPS.—W. Riley, April 10, 1872.
20,564.—MANUFACTURE OF ROUND BELTING.—M. Jewell, May 30, 1872.
20,130.—HARVESTER.—L. Miller, April 17, 1872.
20,131.—HARVESTER.—L. Miller, April 17, 1872.
20,132.—HARVESTER.—L. Miller, April 17, 1872.
20,142.—WATER CLOSET.—W. S. Carr, April 17, 1872.
20,345.—CUTTER HEADS, ETC.—J. P. Grosvenor, Lowell, Mass.

EXTENSIONS GRANTED.

18,871.—HARVESTER.—T. I. Stealey.
19,191.—BLADE FOR PENCIL SHARPENER.—W. K. Foster.
19,222.—SEED PLANTER.—J. D. Willoughby.

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

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Inventions Patented in England by Americans.

From January 19 to January 18, 1872, inclusive.
[Compiled from the Commissioners of Patents' Journal.]

ARTIFICIAL TEETH.—C. H. Mack, Portland, Oregon.
BRONZING MACHINES.—E. F. Benton, Buffalo, N. Y.
CARTRIDGE BOX, ETC.—J. W. Frazier, New York city.
CASTING METAL, ETC.—W. Sellers, Philadelphia, Pa.
COMBINED TOOL.—J. Dixon, New York city.
COTTON GIN.—T. Bourne, New York city.
GAS AND WATER PIPES, ETC.—W. Radde, New York city.
GUANO BAG.—B. R. Croasdale, Philadelphia, Pa.
HORSE COLLAR.—Z. C. Robbins, Washington, D.C.
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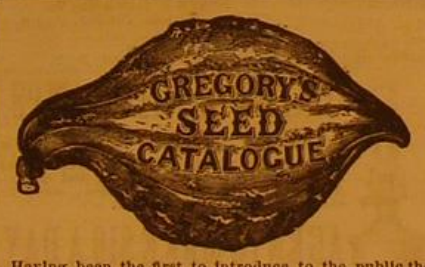
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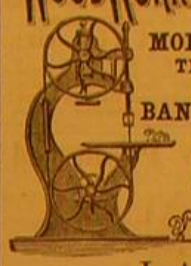
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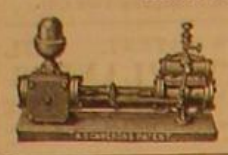
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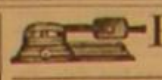
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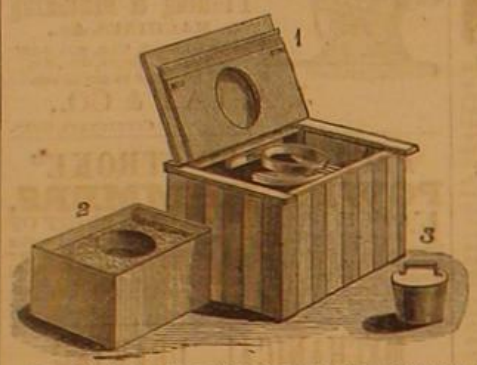
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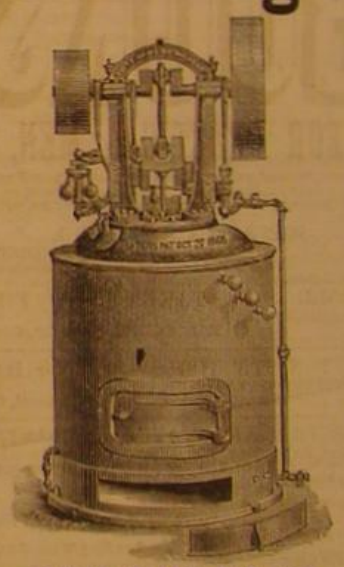
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