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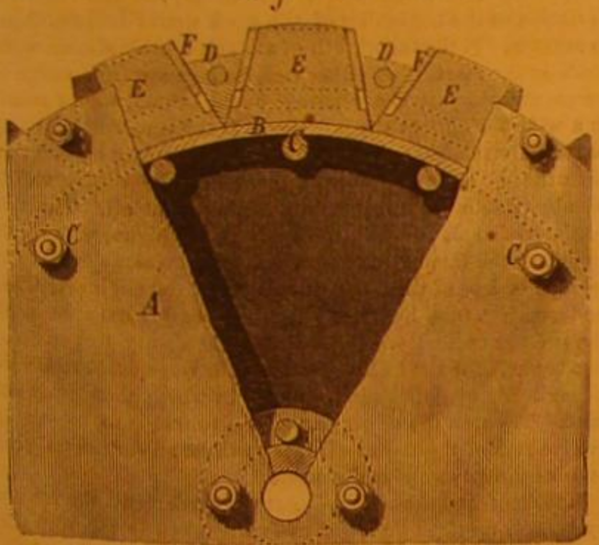
THE ROAD STEAMER "AMERICA."

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, is 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.

Fig 2



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.

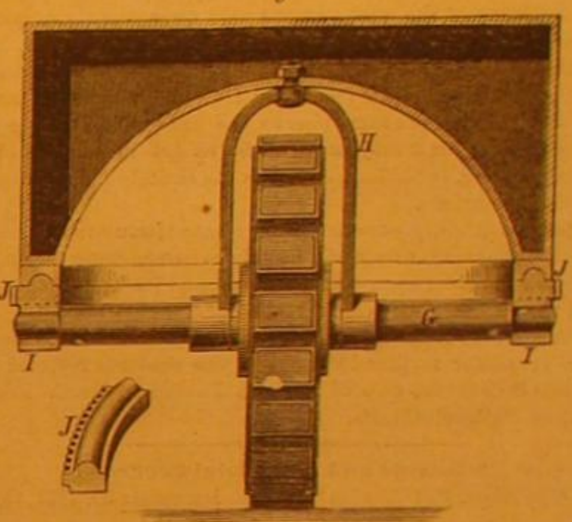
Fig. 2 is a side elevation of one of the driving wheels with a portion of the side plate broken away to show its construction.

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 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

Fig 3



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 1¼ 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. Da'e, 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 re place 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 somewhat interesting and decidedly novel work was as follows: The river, which was frozen between the bridge of Charleville and that of Mézieres 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 ½ 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.

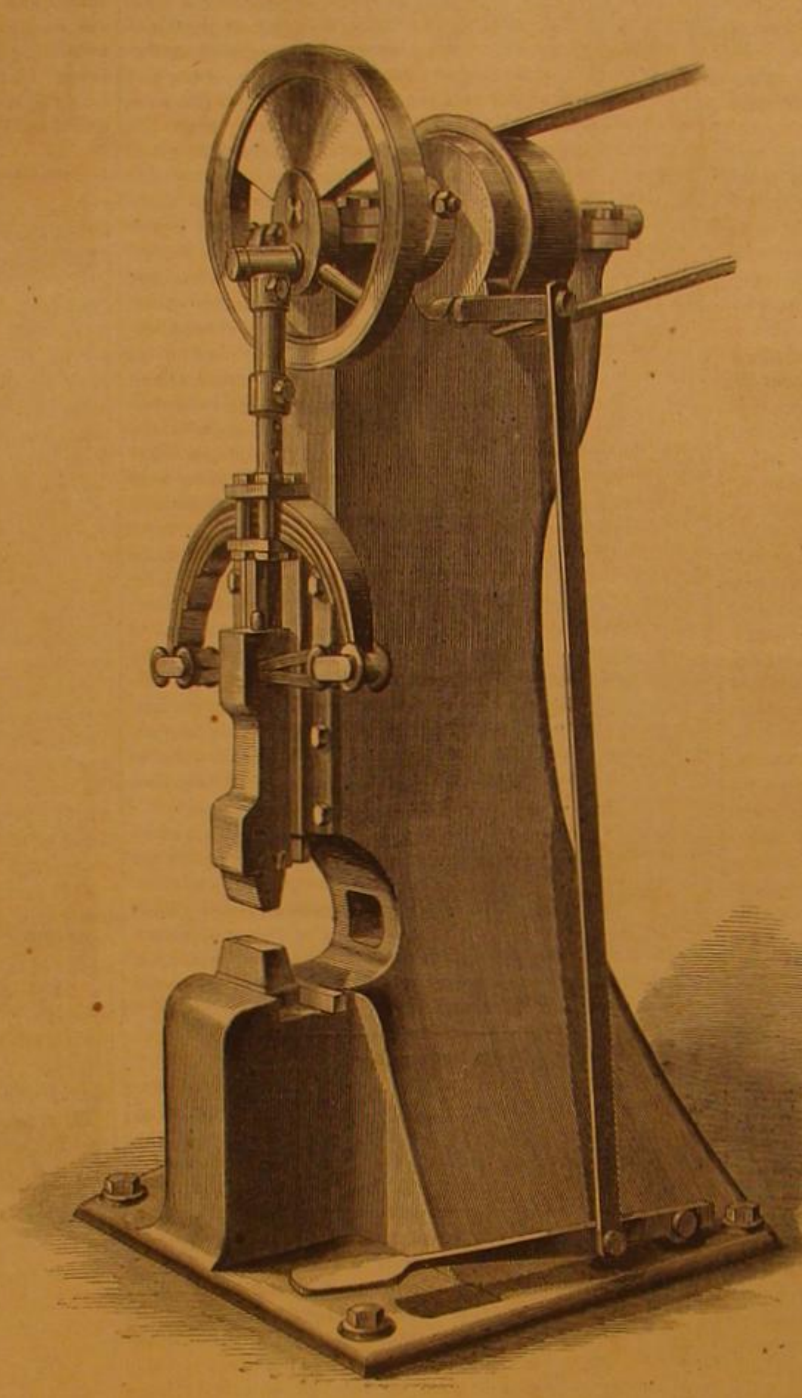
A small hammer, to be attached to walls, is the same in principle as that shown, but has advantages that the latter has not; as, *for* example, greater space between the anvil block and the back of the frame. This renders its useful *for* straightening saw plates or frames of any kind, planishing copper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

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

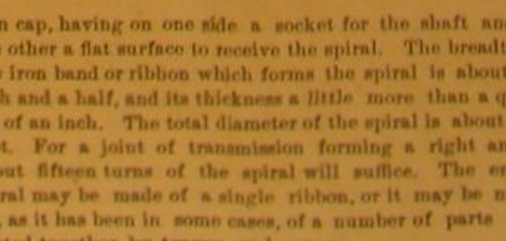


THE SHAW & JUSTICE DEAD STROKE POWER HAMMER.

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 appeats 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.

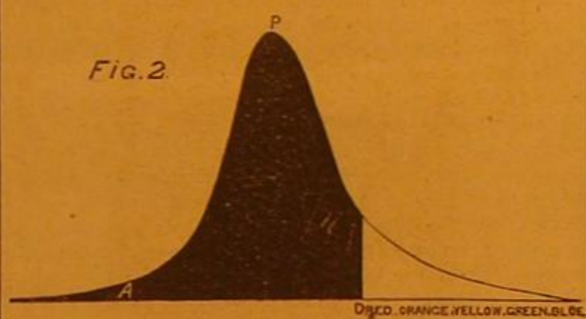
The flask A contains tepid water, over which a current of air is passed in the direction of the arrow, by means of a weighted gas bag; the dry air rapidly dissolves the invisible

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 iecturer 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.

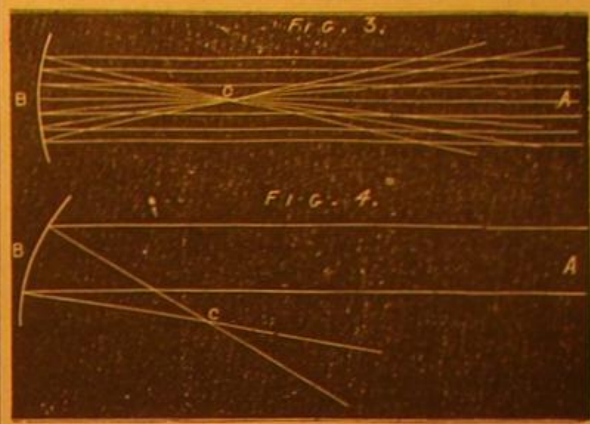
THE INVISIBLE RAYS.

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.

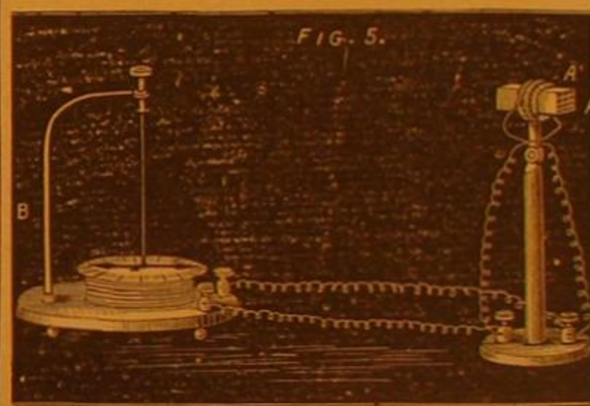
Dr. Tyndall then proved this statement by concentrating the rays of the electric beam by means of a concave mirror, Fig. 3, the parallel rays proceeding from the lamp placed at A, falling upon the mirror at B, and being brought to a focus at C. The particles of dust in the air of the lecture room made, 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 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-

*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.

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 others 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 s eam 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. Warburton, 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		13,033
Number of applications for extensions of patents		204
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		565
Number of trademarks registered		496
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	13	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	136	New York	2,954
Florida	10	North Carolina	31
Georgia	73	Ohio	905
Idaho Territory	2	Oregon	23
Illinois	871	Pennsylvania	1,542
Indiana	383	Rhode Island	184
Iowa	225	South Carolina	26
Kansas	40	Tennessee	104
Kentucky	125	Texas	52
Louisiana	85	Utah Territory	—
Maine	197	Vermont	111
Maryland	240	Virginia	108
Massachusetts	1,386	Washington Territory	1
Michigan	383	West Virginia	42
Minnesota	53	Wisconsin	227
Mississippi	48	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	$29,289·08	$33,506·98
1838	—	—	520	42,123·54	37,402·10
1839	—	—	425	37,260·00	34,543·51
1840	765	228	473	38,056·51	39,020·67
1841	847	312	495	40,413·01	52,666·87
1842	761	291	517	36,505·68	31,241·48
1843	819	315	531	35,315·81	30,776·96
1844	1,045	380	502	42,509·26	36,244·73
1845	1,246	452	502	51,076·14	39,395·65
1846	1,272	448	619	50,264·16	46,158·71
1847	1,531	553	572	63,111·19	41,878·35
1848	1,628	607	660	67,576·69	58,905·84
1849	1,955	595	1,070	80,752·78	77,716·44
1850	2,193	602	995	86,927·05	80,100·95
1851	2,258	760	869	95,738·61	86,916·93
1852	2,639	996	1,020	112,056·34	95,916·91
1853	2,673	901	958	121,527·45	132,869·83
1854	3,324	868	1,902	163,789·84	167,146·32
1855	4,435	906	2,024	216,459·35	179,540·33
1856	4,960	1,024	2,502	192,588·02	199,931·02
1857	4,771	1,010	2,910	196,132·01	211,582·09
1858	5,364	934	3,710	203,716·16	193,193·74
1859	6,225	1,097	4,538	245,942·15	210,278·41
1860	7,653	1,084	4,819	256,352·59	252,820·80
1861	4,643	700	3,340	137,354·44	221,491·91
1862	5,038	824	3,521	215,754·99	182,810·39
1863	6,014	787	4,170	195,593·29	189,414·14
1864	6,932	1,063	5,020	240,919·98	229,868·00
1865	10,664	1,937	6,616	348,791·84	274,199·34
1866	15,269	2,723	9,450	495,665·38	361,724·28
1867	21,276	3,597	13,015	646,581·92	639,263·32
1868	20,420	3,705	13,378	681,565·86	628,679·77
1869	19,271	3,624	13,986	693,145·81	486,430·78
1870	19,171	3,273	13,321	669,456·76	557,149·19
1871	19,472	3,366	13,033	678,716.46	560,595.08

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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Contents:

(Illustrated articles are marked with an asterisk.)

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 acquainted 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 $4,250 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 reweighing, 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.

WILL YOU FAVOR US?

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.

Examples for the Ladies.

Mr. George W. Nelson, (machinist,) Alleghany City, Pa., says the Wheeler & Wilson Machine in his family has been used for thirteen years without repairs; and he will warrant it for ten years more, and that any Wheeler & Wilson Machine will serve a family for a life-time—an important fact, particularly to girls who make their living by the needle.

Mrs. D. G. Eagerton, Madison, Ohio, has used her Wheeler & Wilson Machine 5 years; sometimes in competition with all kinds of "*woman killing*" machines; would not look at $2000 for it if she could not go another like it.

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.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

The most improved machinery for sewing machine needles, made by Hendey Bros., Wolcottville, Conn.

The best Cement in the world for steam, fire or water joints Address O. Graham, Peru, Ill.

Mechanics, ask for the Patent Star Bevel, and Try Square. The best Tools ever made. All qualities and sizes, and at low prices. Manufactured at the Star Tool Co.'s Works, West Meriden, Conn.

Star Combination, Bevel, Level, Try Square, Mitre Square, and graduated Blade. Each Tool perfect in itself, simple, practical, and economical. G. W. Hallett & Co., West Meriden, Conn.

Business in Boston wanted by an energetic young man with capital and first class references. Address F. Carlton, P. O. Box 1368.

Parties having Iron Water Wheels and Mi'l Machinery for sale, will send Circulars to Box 191, York, Pa.

Castings—Galvanized and plain. Malleable and Gray Iron Castings. Address Wilcox, Crittenden & Co., Middletown, Conn.

Practical Builders in Concrete and Artificial Stone, Send dress and references to Box 148, Port Chester, N. Y.

Grist Mills, New Patents. Edward Harrison, New Haven, Conn.

"Practical Suggestions on the Sale of Patents." Send for circulars. W. E. Simonds, Hartford, Conn.

Glass Signs—Wanted a Partner with capital to manufacture Glass Signs by machine. At work. Samples shown. Can be patented or not, to suit. Address T. Greenough, 406 Tenth Avenue, New York.

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.

Five Second Hand Lathes, of various sizes, for sale by Wm. E. Cass, 61 & 63 Hamilton Street, Newark, N. J.

L. & J. W. Feuchtwanger, 55 Cedar St., New York, Manufacturers of Silicates, Soda and Potash, Soluble Glass, Importers of Chemicals and Drugs for Manufacturers' use.

Walrus Leather, for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

A Correspondent wanted, who understands the erection of works for, and the manufacture of, Malleable Gas Fittings, with the view of an engagement. Address, Lock Box 1321, Titusville, Pa.

For 2 & 4 Horse Engines, address Twiss Bros., New Haven, Ct.

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Edson's Hygrodeik is the best Hygrometer in use. Send for circular. Geo. Raymond, Fitchburg, Mass., Gen'l Agent for United States.

Presses, Dies & all can tools. Ferracute Iron Wks, Bridgeton, N.J.

We will remove and prevent Scale in any Steam Boiler, or make no charge. Geo. W. Lord, 232 Arch street, Philadelphia, Pa.

Rubber Valves—Finest quality, cut at once for delivery; or moulded to order. Address, Gutta Percha & Rubber Mf'g Co., 9 & 11 Park Place, New York.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 470 Grand Street, New York.

Williamson's Road Steamer and Steam Plow, with Thomson's Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

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

For Hand Fire Engines, address Rumsey & Co., Seneca Falls, N.Y.

Over 800 different style Pumps for Tanners, Paper Makers, Fire Purposes, etc. Send for Catalogue. Rumsey & Co., Seneca, Falls, N.Y.

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.

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.

Diamond Carbon, of all sizes and shapes furnished for drilling rock, sawing and turning stone, conglomerates, or other hard substances also Glazier's Diamonds, by John Dickinson, 64 Nassau st., New York.

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

The Greenleaf Grate Bar saves fuel, and lasts much longer than the ordinary bar. Address Greenleaf Machine Works, Indianapolis, Ind.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

Best Oak Tanned Leather and Vulcanized Rubber Belting. Greene, Tweed & Co., 18 Park Place, New York.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies, see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 a year.

The qualities of *Burnett's Cocoaine*, as preventing the hair from falling, are remarkable.

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. L. 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 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 7, 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 chamois 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 SO_3 for the acid and FeO, ZnO, and Na_2O 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 Dack 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 beed 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 sliver than the latter can properly spin at any one stretch, the invention consisting in a mechanism whereby, when the proper length of sliver 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 dus 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 H. 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.

[OFFICIAL.]

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Lubricator for steam engines, Allen and Dewey	122,982
Mandrel, expanding, J. P. Simons	122,920
Marble polishing machine, M. Mallon	122,951
Matting, India rubber binding for, F. S. Beardsley	122,933
Matresses, material for filling, B. Harrington	123,016
Medical compound, R. G. Turner	122,975
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Moldings, machine for polishing and varnishing, C. and J. Gschwind	122,945
Movement and gas burner, mechanical, E. Omensetter	123,042
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Nuts, device for locking, K. H. Loomis	122,900
Nuts, device for locking, A. B. Davis	122,999
Nuts on bolts, machine for putting, B. L. Walker	122,927
Oiler, portable, G. W. Crossley	122,995
Organ, reed, G. Woods	122,979
Packing, piston, J. H. Strehll	122,923
Padlock, S. W. Budd	122,991
Paint for ships' bottoms, W. Jesty	122,949
Paper bag machine, G. Guild	123,013
Pianos, device for moving, S. D. Reynolds	122,966
Planter, hand, Y. F. Wright	122,980
Plow, N. Z. Glenn	122,885
Plow, R. J. Miller	122,956
Pocket safety watch, H. Fritsche	122,942
Power, animal, H. Bolton	122,987
Press, cotton, W. C. Banks	122,983
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Railway rails, roll for splitting, A. Howels	123,021
Rake, horse hay, S. P. Smith	123,053
Safe, burglar proof, D. Fitzgerald	122,883
Safes, etc., method of protecting, Rowell and Duncan	122,913
Sash holder, C. H. Eccleston	122,939
Sash holder, G. M. McConnel	123,034
Sausage filler, Edson and Bell	122,941
Saws, machine for filing, S. K. Wilsey	122,929
Screen, coal, B. L. Fetherolf	122,882
Screw, hand, A. O'Dell	122,905
Sewing machines, brake for, N. F. Palmer	123,043
Sewing machines, treadle for, T. A. Richards	122,910
Sewing machines, tension mechanism for, S. S. Spear	123,054
Sewing machines, thread tension device for, H. R. Newcomb	123,038
Sheller teeth, corn, H. H. Rueter	122,968
Shingle machine, J. H. Rice	123,048
Shingles, laying, S. G. Castor	122,935
Shoe binding, machine for slitting, C. E. Morrill	122,953
Shovels, manufacture of, Ellis and Ames	122,881
Signal, railway, D. F. Sweet	122,924
Spinning, mule for, W. Lees	123,029
Stove, heating, J. C. Chapman	122,993
Stove pipe supporter, R. Street	122,922
Stove, reservoir cooking, L. Hermance	122,888
Stud, shirt, E. Bredt	122,988
Sugar cane, preserving, F. O. Darby	122,936
Suspender, A. Salmon	122,915
Table, extension, G. H. Henkel	122,946
Tablet, writing, L. Pettigrew	123,045
Telegraph apparatus, T. A. Edison	123,006
Telegraph insulator, C. H. Pond	122,965
Telegraph, printing, T. A. Edison	123,001
Telegraph pole, iron, McDonald and Crandal	122,952
Telegraphs, insulating compound for, C. H. Pond	122,962
Tellurian, G. S. McKenzie	122,954
Thill coupling, C. St. James	122,974
Thill coupling, J. C. Racine	122,963
Tidal motor and air condenser combined, J. B. Atwater	122,930
Tobacco cutter, Schug and Alsover	123,050
Tobacco, preparing, E. Goodwin	123,011
Trap, gopher, W. W. McKay	122,953
Truck for loading wagons, J. W. Harmount	123,015
Truss, galvanic, M. Schuppert	122,917
Tubes and hollow cylinders, facing the ends of, N. P. Stevens	122,921
Varnish, rubber elastic, G. Hook	123,020
Ventilator, car, A. B. Sweetland	123,059
Wagon, grain, D. Warnock	123,065
Walls and ceilings, applying plaster to, A. Derrom	122,938
Washing machine, D. W. Norris	123,041
Washing machine, J. Scott	122,918
Washing machine, J. M. Clark (reissue)	4,717, 4,718
Washing and scouring machine, rotary, J. F. Holmes	123,019
Watch, C. Reinhardt	122,964
Wheel hub, O. B. Little	123,030
Whiffletree, G. G. Burgess	122,992
Wine and water cooler, D. O. Laws	123,028
Wire for wire guards, tool for twisting, J. McMurray	122,903
Wood, preserving, Faucett and McGowan	123,009
Wrench, P. Nichols	123,040
Wrench, ratchet, R. S. Sanborn	122,916

EXTENSIONS GRANTED.

19,023.—Shingle Machine.—R. Law, January 5, 1858.

19,012.—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.—Shawl.—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, Morrisania, N. Y.

5,483 to 5,490.—Carpets.—C. T. Meyer, Lyon's Farms, Elizabeth, N. J.

5,491 and 5,492.—Floor Oil Cloths.—C. T. Meyer, Lyon's Farms, Elizabeth, N. J.

5,493.—Type.—C. Schraubstadter, Brookline, Mass.

5,494.—Toy Safe.—A. M. Smith, Brooklyn, N. Y.

5,495.—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.

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, 1892.

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. Morss May 8, 1872.

20,086.—Cotton Gin.—S. B. Parkhurst. April 10, 1872.

20,313.—Device for Hand Saw.—H. Smith. May 1, 1872.

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.

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.

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 360 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 marvelous 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 it 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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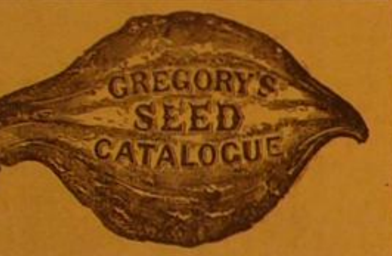

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