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Machine for Boarding, Pebbling and Glossing Leather.

Our engraving illustrates a machine designed to accomplish the above purposes, for which important claims are made, both as to the economy resulting from its use and the superior quality of the work turned out. A large amount of work is done with very little expenditure of power and very much less effort, on the part of the operator, than is required in the old way. The machine is adjustable to any thickness of leather and to give any requisite pressure. The precision with which the lines can be run at any angle in graining is a matter of much importance, this facility being derived from the action of the feed plate.

The machine can board the largest whole hide if necessary, taking its entire breadth, even to the points of the shanks, at one operation, producing a superior appearance which, with thin leather, is very notable as compared to that boarded by hand.

The pebbling and polishing appliances are especially claimed to be superior to anything yet devised for the purpose, and their advantages will, we think, be apparent to practical men upon examination. The pebbling roll can be quite small and of any length, as there is no strain on its bearings. The pressure is also perfectly controlled while the work is rapidly performed, and the leather is held in position by the machine itself.

Fig. 1 is a perspective view of the machine as it appears in the operation of boarding, the object of which is to raise the grain and to give the leather pliability. Fig. 2 is a section showing the operation of some of the parts of the machine during this process. Fig. 3 is a section which shows the application of the pebbling roller. A represents the upper roller, B, the under roller (these rollers being preferably made of cork), C, the steel feed plate, D, the treadle which operates the feed plate, E, a chain running over suitable pulleys, which chain connects the treadle and feed plate; F represents adjusting screws; G, the trough, which receives the leather as it passes over the edge of the feed plate; and H, Fig. 3, is a section of the pebbling roller.

In boarding, the hide is placed over the feed plate as shown in Fig. 1. This plate is carried by pivoted arms, so constructed that the edge of the plate may be brought to exact line with the line of conjunction of the upper and lower rollers, A and B. Its motion toward the rollers is adjusted and limited by set screws in the vibrating arms which carry the plate. By suitable gearing, the rollers, A and B, are caused to revolve in the same direction, as shown by the arrows in Figs. 2 and 3.

The machine being in motion, and the hide placed as shown in Fig. 1, the operator places his foot upon the treadle D, which carries the plate, C, up flush to the rollers and slightly between them as shown in Fig. 2. The action of the rollers then causes the hide to pass over the edge of the feed plate in the direction shown by the arrows. The trough, G, receives the hide as it passes through, and the operation is repeated as often as may be necessary.

For pebbling, a pebbling roller, H, Fig. 3, is placed in suitable bearings found at the ends of the front edge of the feed plate, and the leather is handled in precisely the same way as in boarding. Polishing or glossing, and creasing, are also

need tenderer care, and for them we have these directions from an experienced hand.

If you have no loam laid away for this purpose, take, any warm day, the upper surface of loam from your richest garden beds. Bake it in the oven in an old tin pan; when so dry as to crumble in your hands, add one third white sand. Now fill your pots, boxes, or pans with the mixture. The pots made for planting seed, with large holes for drainage, are the best; but salt, raisin, or cigar boxes will answer. Fill to the brim with heated soil, press down firmly, and, while milk warm, plant your seed. If large enough, place them in one at a time, about one inch apart; if very small, like petunias, sprinkle over the soil, press them in gently with the hand, then sprinkle on sand. Take a piece of any old flannel, double it, and lay on the seeds, pressing it down at the corners; then water with lukewarm water over the flannel. Put your pots or boxes in some warm place, on the shelf of a range, or on a mantel piece. The kitchen hob is the best place, for the steam from the kettles keeps the air moist.

Leave the boxes there until the seeds begin to push, giving lukewarm water over the flannel every day; then put in a sunny window, and, if the nights are chilly, return the boxes to the mantel shelf or back of the range. This way of planting rarely fails; the earth, being warmed through, starts the seeds as well as a hot bed, and the flannel prevents the caking of the top of the soil, and also keeps up a uniform heat.

Of course, the same treatment will be as effectual with seeds for the kitchen garden, though most of them do not need such careful nursing.—J. S.

COOGAN'S MACHINE FOR BOARDING, PEBBLING AND GLOSSING LEATHER.

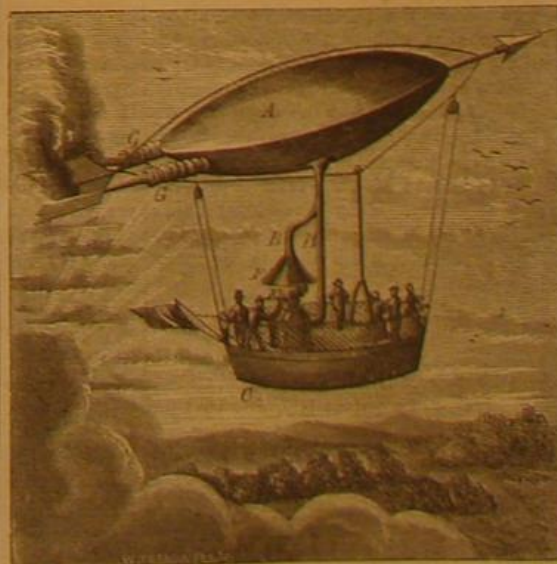
performed by suitable attachments carried by the feed plate, the general operation of which is analogous to that described for the pebbling roller.

fectual with seeds for the kitchen garden, though most of them do not need such careful nursing.—J. S.

STEAM FLYING SHIP.

As a contribution to the stock of lore on the subject of aerial navigation, we illustrate the following curious but impracticable machine, invented by a western correspondent:

This gentleman takes the ground that gas is too light, and has neither the elevating nor directing power essential to the proper guidance of a balloon. He thinks, however, that steam (although, as he says, hitherto employed with but lit-



tle success in ballooning) has a natural ascending power, which may also be used as a means of propulsion. The main objection to it was in the great weight of the apparatus employed; and this objection he intends to remove by using

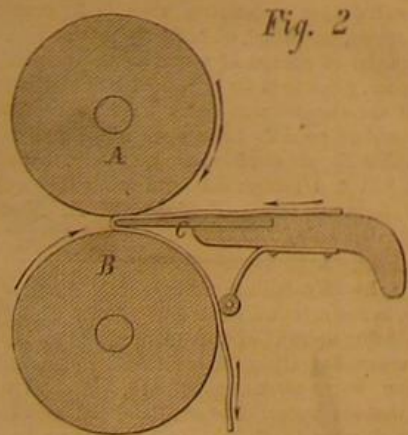


Fig. 2

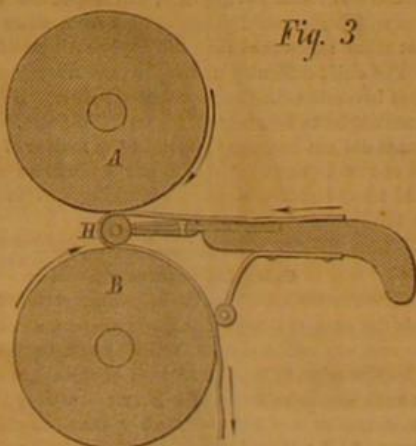


Fig. 3

This machine was patented through the Scientific American Patent Agency, Oct. 10, 1871, by Owen Coogan, of Pittsfield, Mass., who may be addressed for further information.

Starting Flower Seeds.

The sudden arrival of extremely hot weather, in New York and adjacent States, has taken everybody by surprise, and turned public attention to the country and horticulture. The following paragraph will be of interest, at this time, to all who have a garden:

There is nothing like loving them, to coax flowers to grow. Some old ladies seem to quicken the sap in drooping plants the moment their kind hands touch them. They give them their hearts, and so a thoughtful, quick-witted care, and their fuchsias are always the largest and their pinkas the sweetest. Beginners are often troubled at the outset to get seeds to germinate. Some will grow anywhere. Others

thin sheet metal vessels for its generation, and employing no cumbersome engine in applying its power. He proposes to carry out the idea by constructing an air ship, of sheet metal or of gummed rubber or other fabric made impervious to the action of steam, as delineated in the annexed cut; and the ship is thus described by him:

A is the body of the air ship for the reception of the elevating and propelling power—steam. B, B are two pipes leading to the car, C, below, one forming the chimney of the stove or furnace, D, and the other receiving through its funnel, F, the steam from the kettle or boiler, E; they both serve to conduct the smoke and steam into the body of the ship, A. As the body fills, the smoke and steam also enter into the circular bellows or expansive cylinders, G, G, which may be made of leather, or of rubber or other elastic material. The smoke and steam enter these cylinders through valves at the interior ends, and as they fill they are expanded outwardly. As soon as they reach their utmost outward limit, valves open and let out the steam and smoke. The outward expansion of the cylinders and the final escape of the steam and smoke are designed to propel the ship forward. As soon as the steam and smoke begin to escape, the inner valves close, thereby permitting the cylinders to contract, which they do by means of springs or elastic cords. These alternate expansions and contractions of the cylinders are the propelling power of the ship, and are equivalent to the operation of cylinder and piston in an ordinary steam engine. The other parts of the machine will fully be understood from the drawing, and consist of a metal rod surrounding the ship and supporting on its ends the arrow head and tail, which are made to turn on the rod to any required angle, and thus act as guides. There are, also, supporting rods, ropes and pulleys connecting the body, A, with the car, used for adjusting the relative position of each in such a manner that the required course shall be steered.

PATENT LAW REFORM IN ENGLAND.

The Committee of the House of Commons are now in session again on this subject, and are examining witnesses, *pro* and *con*, at great length, trying hard to satisfy themselves whether it is best to continue the patent laws in England or to abolish them. The lords and rich manufacturers want the abolition. But the active thinkers, workers, and go-ahead people are emphatic in their demands to have the system continued, and greater facilities given.

Mr. C. W. Siemens deposed that he was a Fellow of the Royal Society, a member of the Council of the Institution of Civil Engineers, and that he was by profession a telegraph engineer. He was not born in England, but had resided in it for twenty years. As a patentee, he had had considerable experience in patents. He had taken out some patents for successful inventions and some for failures; among the more successful of his inventions were a steam engine governor, a regenerative furnace, and a process for making steel and iron. He had also taken out patents relative to telegraphic apparatus and cables, thus covering a somewhat wide range of experience. He was an engineer possessing that order of mind which led him to make new applications of first principles. He considered his branch of the engineering profession to be much influenced by the existence or non-existence of a patent law; he was drawn to England in the first instance by the fact of a patent law existing there, and he went there from Germany directly after he finished his theoretical and practical studies. He made England his home in consequence of there being no properly understood and regulated patent law in Germany; England, therefore, had had the benefit of his inventions in the first instance. He had made a few applications for patents in Germany, but in most cases with unsuccessful results. He could not patent in Germany things which can be patented in England, and as a rule, patents are granted in Germany for small mechanical improvements, but very rarely for inventions including new applications of first principles. In Germany, they refused him a patent for his regenerative furnace because some people had hot stoves in their houses there to warm them. At the present time, the regenerative furnace is more widely adopted in England, where a royalty is payable, than in Germany, where it can be used without the payment of a royalty. His experience told him that without the protection of letters patent he should probably have not undertaken the long series of experiments and the great expense necessary to perfect that furnace; England had had the advantage of its use in the first instance, and at the present time it is more generally adopted there than on the Continent. Although the invention is in use in Germany, England is more benefited by it than Germany. Many inventions would never have seen the light of day at all without a patent law, and in England there are more inventions than in Germany, and they are more quickly adopted.

Mr. J. Skerrow Wright, of Birmingham, and formerly President of the Birmingham Chamber of Commerce, deposed to the Committee that he had had experience in the patenting of small articles. So far as he knew, manufacturers were to a man in favor of a patent law, and so were working men. The trade of Birmingham had been, without doubt, largely benefited by a patent law, and much of the prosperity of the town was due to patented inventions. Patents sometimes improve articles, and sometimes reduce the cost of manufacture, or they may promote economy in the use of materials. Elkington's electro-plating invention, for instance, he believed, would never have attained its present perfection without a patent law; as, in this case, that law has transformed a manufacture which was positively declining into one of the chief trades of Birmingham, giving employment and excellent wages to numbers of mechanics and artisans. The

old mercury gilding process was very unhealthy, but the present process is very healthy. The patent law accelerated this invention, if it did not actually form it; at all events, it would not have been perfected so soon without the protection of a patent law. He had considered the merits of various substitutes for a patent law, but thought that none of them were so satisfactory. A system of Government rewards, he thought to be utterly impossible, and sure to break down soon after it was established. His experience applied chiefly to inventions relating to small articles, some of which were of great importance, and he contended that patents should apply to these small inventions. For instance, the patent for a sleeve link might not have been thought worth \$25, and for several years, it produced no profit; the owner paid \$500 for it; during the last seven years, he made from \$75,000 to \$100,000 profit; nobody out of the trade could, at the outset, have assessed that invention at its true value. The public derive some benefit from it, otherwise they would not buy the links; no harm has been done to any individual, and it has stimulated other inventions, for he believed that other inventions had been brought out in consequence of that one. He had in his hand a watch, the result of an invention which might be assessed at a small sum; the watch was wound up by the act of opening, and could not be overwound. If it were not worth his while to buy that watch, he should not do it; it was, he believed, a Swiss invention which had been patented in England, and the extra cost of such a watch was perhaps two or three guineas. He himself had been interested in many patents, very few of which had succeeded. Operatives were in favor of a reduction of patent fees, and so were manufacturers. He held that the present law had worked satisfactorily; as compared with the old one, it was a very great advance indeed. The fees for patents should be reduced, there should be a preliminary examination, mainly as to novelty and not as to merit or utility; this is the opinion of Birmingham manufacturers generally. Half the patents taken out at present are taken out in ignorance of the invention having been previously patented. A person, when told by the Patent Office authorities that his invention was not new, would not be so foolish as to take out a patent, but if he wished to do so, he should be allowed to do so if he liked, but the verdict of the examiners should be put in the patent itself.

At present, the fees sometimes stand in the way of working men getting patents; if the fees were too low, there might be too many applications, but then each invention should be well examined. He thought that the first payment should be a very small one, and a higher one, perhaps, when the patent was sealed. He had never yet met an operative in favor of the abolition of the patent law. He thought the operatives could not sometimes pay the patent fees, but generally they found men willing to help them to carry out their inventions; no doubt they would be in a better position, to deal with those who aided them, if they could get protection cheaply. The French law is that a patentee must manufacture the article in France within a given time, but the law was evaded; he had worked two days in Paris to continue a patent. A foreigner who patents things in England should be compelled to make them here, and not to import them. England does nearly all the electro-plating business of the world, for very little of this kind of work is done on the continent outside of Paris. If foreign inventors patent things here, it gives a stimulus to inventions in England. If the patent law were abolished here, our best men would go to other countries, and we should lose our trade in novelties, whereby both British trade and British workmen would suffer. The idea of getting money is the thing which spurs on an inventor; men did not invent for the sake of inventing, but to make profit.

If England went without patents, and depended upon the inventions which she could pirate or filch from other nations, he did not think she would take the lead as a manufacturing people. The chief difficulty under the present system was to know what inventions had been patented before. He thought that patents ought to be granted for trivial objects, and that such patents did not hamper trade. In the matter of novelty, he would not make the decision of the examiners absolute, but should let the risk and *onus* of taking out the patent rest with the intending patentee.

Celestial Space.

When astronomers assure us that the diameters of the circles which the planets describe in their perpetual revolutions round the sun, are millions upon millions of miles—how is it possible for the mind to take in an idea of the space or room in which such globes as those of eighty and ninety thousand miles in diameter are running, thirty times more rapidly than a cannon ball, without the slightest interference with others?

Space—without limit! There is no boundary, no barrier, no precipitous termination, but space forever and ever, and there the intellect leaves the pursuit—the brain of man cannot grasp it.

But there is something more perplexing in the belief that interminable space is filled with billions, aye, with countless organized worlds, beyond all human computation, far exceeding our own in grandeur of proportions, physical resources and beauty, so immensely distant that no telescope can ever survey those on the nearest border of that celestial space which they occupy; and yet still beyond and beyond, so far that the light they send abroad, at the speed of one hundred and ninety-two millions of miles in one second, may not reach this earth for a hundred of millions of years to come, and there again and again there are globes infinitely multiplied. Space, then, is a field in which the Almighty displays the majesty of His supreme power.

One Primordial Form of Matter—One Primary Form of Force.

I. Matter exists certainly under two, and probably under three, varieties: namely, *ordinary* or *gross matter*, directly recognized by our senses; *universal* or *luminiferous ether*, filling all space, and pervading the interstitial spaces of all bodies of ordinary matter, the existence of which is inferred from optical phenomena; and *electric ether*, associated with all bodies of ordinary matter, whose existence is inferred from electrical phenomena.

These varieties of material substance may possibly not differ in their essential nature. It is at least conceivable that the atoms, so called, of ordinary matter, and of electric ether, are condensed groups of atoms of the universal ether; and hence that there is, essentially, but one form of matter in existence, namely, that which, as made up of single atoms homogeneously aggregated, forms the ether of space.

It may be that the electric ether, the supposed agent of electrical phenomena, may ultimately be shown to be identical with the luminiferous ether; but in the present state of physical science, it cannot be so regarded.

The existence of an electric ether has not been as conclusively established as that of the luminiferous, but all the phenomena give decided intimations of the operation of such an agent, and thus serve to confer upon the hypothesis of an electric ether a high probability.

Now that the ethereal is known to be one of the forms in which matter exists, and as we perceive that ordinary matter presents a great variety of substances, differing in density and other conditions, we may certainly just as reasonably refer electric phenomena to a special ethereal agent as to hypothetical atomic movements of ordinary bodies of matter. The comparative availability of the two hypotheses, in adequately representing the entire series of electrical phenomena, both formally and in their precise laws, is the only proper ground upon which we can decide to which the preference should be given.

II. All atoms of matter, when within a certain range of distance, attract or repel each other, either actually or virtually. In the normal condition of things, in the instance of each distinct body of matter, each of its constituent atoms is in a state of equilibrium, relatively to the rest, under the operation of all the forces, attractive or repulsive, exerted upon it by all other atoms within the range of sensible action. This is true of the universal ether, each atom of which is conceived to be at rest, so far as the natural action of other ethereal atoms upon it is concerned; and this action is supposed to consist in a force of repulsion. It is also true of bodies of ordinary matter; but each integrant atom is under the operation of attractive as well as repulsive forces, exerted by other contiguous atoms—or at least of forces which tend to urge it from or toward the atoms acting on it. It is by virtue of this statical condition, and the change in the intensities of the effective forces when the relative distance of the atoms is altered, that all existing collections of matter are *media*, through which extraneous forces applied to them at any point are propagated to other points.

III. All atomic forces, whether operating at small or great distances, are of the nature of *incessant forces*; that is, are made up of impulses which are renewed every instant. In the case, certainly, of the forces propagated in the waves of radiant heat and light, and taking effect upon the atoms of bodies, the number of impulses received per second is not infinitely great, but capable of determination though enormously great. It is conceivable that all the other incessant forces in operation (gravitation, molecular forces, electric forces) are of the same essential character: that is, consist of, or result from, *actual recurring impulses* propagated in ethereal waves. Upon this hypothesis, these forces should conform to the law of inverse squares, like the radiations of heat and light; as they in fact do, in every instance in which the law of variation of intensity with the distance has been determined. The *effective* molecular forces may furnish an exception; but we have no reason to suppose that the law does not hold good for the actual attractive and repulsive forces, from the antagonistic operation of which these effective forces result.

IV. In the light of these fundamental principles, we may assume, as the basis of an entire scheme of Nature, the hypothesis that all matter has but the one fundamental property of repulsion; and that the three great varieties of matter, and all the various substances known to us, differ essentially only in the mass, size, or perhaps in certain cases also the specific intensity of repulsion, of their atoms. We may reach a still deeper underlying principle by conceiving that all the atoms, so called, of ordinary matter and of electric ether, consist of groups of atoms of the one primary universal ether, condensed by reason of a diminished repulsive action of their constituent atoms. This conception brings us to the simplest possible basis upon which a physical theory of inanimate Nature can be erected, namely, that of the existence of but one primordial form of matter and but one primary form of force.—Professor W. A. Norton, in the *American Journal of Science*.

It is a healthy indication, says the *American Builder*, Chicago, to see artesian wells going down while new buildings are going up in the burnt district, and to know that, in the future conflagration, coming in consequence of tar roofs, when our water works again burn, we shall not be left wholly without water. Messrs. Hale, Emerson & Co. are to have an elevator in their new building, to be driven by water from the well, and they expect the well to save them from three to four thousand dollars a year. Messrs. J. V. Farwell & Co., have sunk a well very successfully on their premises.

Transferring Negative Films.

M. Gobert's method of transferring collodion images is a very simple one, and capable of application to obtain reversed negatives, or simple collodion prints.

The cliché upon glass is moistened with strong alcohol, and upon it is laid a sheet of albumenized paper, which has also been wetted with the spirit. Contact is easily brought about between the two surfaces as they are both covered with an excess of fluid; the spare alcohol is drained off, and the paper pressed into contact by means of a pad of blotting paper. After the lapse of a quarter of an hour, all the alcohol has been absorbed and the drying can be continued in the open air. The albumenized paper will then have become perfectly attached to the varnished or unvarnished collodion surface. To remove the sheet from the glass, the margins are cut round with a penknife, and the paper then moistened by means of a sponge dipped in water. After a few minutes a corner can be lifted up, and the paper gradually removed from the plate without trouble. Or, if desired, the plate can be put into a water bath and allowed to remain therein until the albumenized sheet floats from the glass, bearing with it the film.

In either case the sheet is allowed to dry, and is then rendered of a transparent nature by the use of wax in the ordinary way. In this manner, a reversed negative is obtained, which can, of course, be well employed for carbon printing and such like purposes. To obtain the image transferred in its proper position, it is necessary to employ gelatin paper, which is used in pretty well the same manner. The image is first obtained upon the gelatin paper, and afterwards this is pressed in contact with a sheet of albumenized paper moistened with alcohol, the two surfaces being pressed together in a printing frame. After perfect contact has been made, and the sheets have dried in one compact body, this is put into a bath of warm water; the image will then be found to be attached to the albumen film, which has been coagulated by alcohol and is, therefore, insoluble.

For detaching a cliché by means of the gelatin, Gobert recommends the use of a solution of 10 parts of gelatin in 100 parts of water, which is poured upon the negative. After the same has dried, there is poured upon the gelatin film a normal collodion, containing one per cent of pyroxilin; stronger collodion cannot be used, for the reason that it shrinks too much, and does not, therefore, answer the purpose. The addition of glycerin is not recommended, as by this means the film is rendered too hygroscopic. Gobert also warns the operator against employing very thick gelatin films, as the image, on leaving the glass, is very apt to become broken.—[*Photographic News*.]

Bitumen of Judea Paper.

At a recent meeting of the French Photographic Society, M. Despaquis exhibited some specimens of a new photographic material, being paper or sheets of mica sensitized by means of bitumen of Judea, prepared in several different ways according to the manner in which it is to be used. M. Despaquis, in calling attention to this novelty, made the following observations relating to it:—

The paper may be preserved for an indefinite period, if screened from light and protected from the effects of moisture, and yields prints of an unalterable nature. The manipulations necessary to its employment are of the most simple character, and are confined to placing the paper under a cliché, exposing the same to light, and washing subsequently in essence of turpentine.

The samples of paper are of various kinds. No. 1 is as transparent as glass, and is covered with a sensitive film of bitumen; it serves for the production of transparent positives, and for reproducing clichés, which may be put into the frame reversed if desired, according as the image is required for photo-engraving or carbon printing.

No. 2 material is also transparent, but possesses more the appearance of ground glass. It is suitable for making transparent prints for stereoscopes, transparencies, etc., at a low price. With prints of this kind, the stereoscope needs no glass, and is, therefore, very light and portable. This same material answers well for the preparation of so-called photominiatures, which are produced by means of two prints superposed, the lower one being vigorously colored; the tints, when viewed by transparency through the upper print, possess very fine gradations. The upper print is produced upon this No. 2 paper, which will doubtless be found to answer the purpose much better than albumenized silver paper rendered transparent by varnish.

No. 3 has a matt or opal white surface, formed by means of oxide of zinc and starch. It serves very well for the production of the second or lower print required for the object previously mentioned, and is also suitable for the preparation of transparencies.

All three papers may be attached or mounted upon cardboard like ordinary prints. To do this, the print is put upon a glass plate and covered with thin card slightly moistened; the two surfaces are then passed through a rolling press, and complete adhesion takes place.

There is yet a fourth material, which is likewise sensitized by means of bitumen, and is capable of important applications. It is prepared specially for the transfer of photographic prints, with all their half tones, to stone or zinc, for working up with fatty inks, and printing upon wood, glass, enamel, painter's canvas, etc.

In the last named material, there is a film of gum in between the mica and the bitumen, and as no washing in water is required for developing and fixing, it is attached while still wet, with essence. If already washed and dried, the print is again treated with the essence upon the stone, zinc, wood, etc.; then by the aid of a sheet of thick and

moist blotting paper, which is placed upon it and pressed down to chase away air bubbles, the print is allowed to dry under a slight pressure, as in carbon printing. The blotting paper should somewhat overlap the print. One or two dry sheets of the same kind are placed over the wet paper, and these are then covered with a few glass plates. After the lapse of a few hours, the dried sheets are removed by means of a sponge, water is applied to the last sheet of blotting paper, and the gelatin being softened, the gum is dissolved, and the film, consequently, comes away from the bitumen image.

The preparation of bitumen paper is, of course, no novelty, but it is the special employment of gelatin that is new. This renders the application of water unnecessary in development, and the film does not cockle or roll in washing; by the addition of starch, carbonate of baryta, oxide of zinc, and various colors, it is possible to impart to the film any degree of transparency desirable. The two principal points of importance are the application of bitumen of Judea to a support of gelatin, which, not being dissolved in the liquids used as solvents for the bitumen, is not modified or changed in any way during the process of washing; and the special preparation of the bitumen, whereby it is very adherent to its basis, and of so solid a nature that it will allow of the application of a layer of printer's ink by means of a roller. The employment of acids for etching may be employed with impunity, seeing the solidity of the film.

This is a very important matter for photo-engraving or photo-lithographic purposes. Maps and drawings have been prepared upon glass by M. Despaquis in the manner indicated, and in these cases not only is the etching of extraordinary depth, but the fineness of detail is perfect, proving beyond doubt that the hydrofluoric acid which had been employed for etching had in no way attacked the film. These same qualities are only to be seen upon metal engravings; and although M. Despaquis is himself but an indifferent operator, he has been enabled to obtain these results very easily.

As to the transparent pictures produced by means of this material, they are certainly very beautiful when mounted between two plates of glass, forming very charming illuminated designs. The manipulations are exceedingly simple: there is no sensitizing, no fixing, and no toning, inasmuch as the whole operation consists in placing the mica paper under a cliché, in exposing to light, and washing it in essence of turpentine.

Care of Lawns.

There is no season of the year when careful and persistent watchful attention and labor are more requisite to the perfection of a lawn than that of the early spring months. Nor is there any season during which the same amount of labor is better repaid by the future results. A severe rain, followed by a sharp frost, or a half dozen clear days, warm and bright, with cold, freezing nights, always result in throwing more or less of the turf and grass roots, which, if not at once and almost daily rolled and again pressed down, would by exposure at this time die out; besides, if the lawn be now left to take its own course without the use of the roller, there will ensue more or less of a rough uneven surface, caused by some lines of soil being finer and heavier than others, and therefore settling more rapidly and firmly.

If, by any previous neglect, the lawn has already got upon its surface small pit holes or undulations, varying from four to six inches across and half thereof in depth, now is the time to go over it with a barrow of fine soil and fill them up, at the same time filling the soil with a heavy seeding of pure lawn grass seed; then finish by rolling again and again.

If the lawn has become impoverished, make a mixture of pulverized hen manure or guano, two parts; two parts of fine, very fine, bone meal—not bone dust; one part of plaster (gypsum); together with two parts common salt (seven parts in all), and sow at the rate of eight bushels to the acre. Sow just before rain, and as soon as the rain is over roll thoroughly, and then follow with two bushels of clean lawn grass seed to the acre, and another, and another, and yet another rolling. Before doing any thing, however, rake the lawn thoroughly to clear it of chips, stones, etc.—*Addi*.

Particulars of the New Steamship "Adriatic."

The following are the interesting notes regarding tonnage, speed, engines, etc., of the new steamship *Adriatic*:

Tonnage, 4,200; maximum speed, 16.4 knots; length, 450 feet; breadth, 41 feet, draft, 23; weight of cargo, 2,800 tons. Her engines are compound, by Maudslays, Sons, and Field, 2 cylinders of 42 inches diameter, and 2 of 78 inches. The high pressure cylinders are on the top of the low; and all the pistons are of 5 feet stroke. The cranks make 50 revolutions per minute. The boiler pressure is 65 lbs., and the vacuum 27 inches. The temperature in the hot well is 120° Fahr. The engines have surface condensers and a centrifugal circulating pump driven by an independent engine. The air pump is 43 inches in diameter and has 2½ feet stroke. The maximum indicated horse power is 3,500; and the consumption of coal per horse power per hour is 2½ lbs.

The *Adriatic* has 12 boilers (cylindrical shells), with 2 furnaces each. The grate surface is 444 square feet, and the heating surface, 12,320 square feet, thus having a ratio of heating to grate surfaces of 28 to 1. She carries coal to the amount of 800 tons, consuming 65 tons per day. Her propeller is 22½ feet diameter and 31½ feet pitch. It has 4 blades, and is made of Vickers' steel; the slip is 8 per cent, and the area of the blades is 116 square feet. The coefficient of the power of her propeller, $MV^3 \div IHP$, is $992 \pm$.

Disinfectants.

A commission appointed by the French Academy, to investigate the relative merits of various disinfectants for use in hospitals where contagious diseases are treated, have made the following report as the result of their experiments:

HYPONITROUS ACID.

The members of the commission agree that the first place among agents for attacking and destroying infectious germs must be accorded to hyponitrous acid. Extraordinary precautions must, of course, be observed in making use of this dangerous gas; the doors and windows must be carefully sealed with gummed paper when disinfecting a room containing 40 or 50 cubic yards. The materials are taken in the following proportions: 2 quarts of water, 3½ pounds of ordinary commercial nitric acid, and ¼ pound of copper turnings or filings. A stoneware vessel is employed, holding two or three gallons. The exit doors are carefully pasted up, and the room left closed for 48 hours. The person opening the room at the expiration of the time should be protected in some way from breathing the gas, by a suitable respirator.

CARBOLIC ACID.

This is cheaper, more easily used, less dangerous, and has proved equally efficacious. It is best employed mixed with sand or sawdust—one pound of acid to three pounds of an indifferent substance. The mixture, placed in earthen vessels, was used for the same purpose as the hyponitrous acid. Carbolic acid, diluted with 15 or 20 parts by weight of water, was found useful for daily sprinkling of the floor and bed-clothes.

An interesting case is mentioned in the report where neither chlorine nor hypochlorous acid was able to destroy or render odorless the gases given off from the corpses in the Paris Morgue during the heat of summer. The object was attained by dissolving a quart of liquid carbolic acid in 500 gallons of fresh water, contained in the reservoir and used to sprinkle the bodies. Putrefaction was entirely stopped.

Devergie found that water containing only one to four thousand part of its weight of carbolic acid sufficed to disinfect a dead house, even in the hottest weather, when six to eight corpses were in it.

For fumigating linen, mattresses and other bedding with chlorine, Régnault's latest method was used, namely: One pound of chlorine of lime (bleaching powder) is sewn up in a strong bag of sail cloth, holding about a quart, and put in an earthen pot containing a quart of common muriatic acid (sp. gr. 1.15) and three quarts of water. As soon as the acid comes in contact with the chloride of lime the room is closed, and the things exposed to the action of chlorine gas for 24 hours; the room is then aired for 48 hours. Ten such earthen pots give off 500 litres of chlorine, sufficient to disinfect from 20 to 25, more or less, dirty mattresses.

Beet Sugar in Illinois.

The Freeport, Ill., Beet Sugar factory, a new institution, will commence grinding beets as soon as the vegetables are ready about the middle of the coming September. The Freeport Journal says that contracts have already been closed for the cultivation of nearly seven hundred acres of sugar beets. The contract price per ton is four dollars. The yield per acre is from fifteen to forty tons, a fair average being twenty-five tons. When in full operation, it will require two hundred and fifty hands to run the factory; and fifty tons of beets per day will be consumed.

It is expected that there will be paid out for beets no less than \$60,000, which would purchase 15,000 tons, enough for 50 tons per day for three hundred days, the full working time of a year.

The factory itself is a firm and thoroughly built brick structure, 300 feet long and 200 wide, being two stories high. The cost of the building and machinery is \$150,000. There will be in the factory 11 engines, ranging from 4 to 80 horse power. Thus it will be seen that the Freeport Beet Sugar Factory is a magnificent and important enterprise. Beets weighing two and a half pounds yield as much sugar as those that weigh five or six pounds, the latter being coarse and having a less percentage of saccharine matter. Farmers who raise beets for the factory will use the large, coarse ones to fatten stock.

Curculio on Plums.

A correspondent says that he wraps plum trees, below the lower limbs, with cotton, which he keeps wet with camphor and spirits of ammonia. He wets the cotton twice a week, and the result has been a good crop of plums and no curculio. A correspondent in another journal says:

"I have seen various methods for keeping these insects off plum trees, but none so simple or yet so effectual as the following: Soak corn cobs in sweetened water until thoroughly saturated, then suspend them to the limbs of the trees a little while after blossoming, being sure to burn the cobs after the fruit ripens, as they will be found full of the young insects. A good plan is to change the cobs every few weeks. My theory is this—that the insects deposit their eggs in the cobs in preference to doing so in the young plums. The first season I tried it upon one or two only, and in the summer was rewarded by a good crop of as fine plums as ever ripened, while those on the other trees fell off when about half grown. I have since tried it more thoroughly and have never known it to fail.

THE *Telegrapher* states that the Paine Electro-Magnetic Engine Company bubble, late of Newark, N. J., has gone up, that the inventor has left for the East, where the wise men came from, and that the stockholders have experienced a galvanic shock in the shape of a total loss of their interests.

Expansive Pivot for Sewing Machines, Cutter Bars for Harvesters, etc.

The wear of pivots in machinery is a frequent source of annoyance, and often of positive loss, as in case of the imperfect operation of the valve gear of steam engines. The object of the present invention is to provide means whereby this wear can be constantly taken up, and thus prevent the rattling of loosely connected joints and other evils attending imperfect fitting. The device is ingenious, yet simple and of easy application to many kinds of machinery.

Fig. 1 of the accompanying engravings shows the device attached to the cutter bar and pitman of a harvester or mowing machine. Fig. 2 represents the expansion pivot, attached to the frame or stand for carrying the driving wheel, of a sewing machine; and as this engraving shows every part of the invention, we shall refer by letters to it.

A represents the central pivot piece. It is prismatic in form, its cross section being triangular. The three sides of this piece are toothed after the manner of a ratchet. B represents a bushing used in the hole in the sewing machine stand, when this hole is larger than one half an inch in diameter. C, D, and E are washers.

Upon the sides of the central pivot piece are placed two plates having teeth corresponding to those of the triangular center piece, the outer sides of these plates being rounded, so that when applied to the central piece their united outward contour is cylindrical.

An external sleeve or split ring, F, is placed around the internally toothed and externally cylindrical plates described. Projecting ribs, on the part of the central pivot which enters the frame, fit corresponding grooves to prevent the pivot from turning on its longitudinal axis.

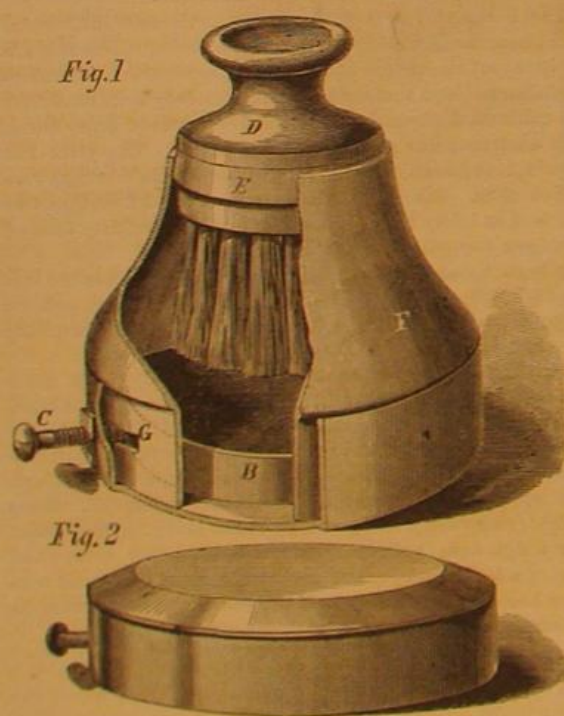
The inner ends of toothed plates which lie between the parts, A, and the sleeve, F, abut against the washer D. The outer ends of the plates do not quite reach the nut, H, or the washer, E, held by the nut, H, that bears against the split ring or sleeve, F. The latter furnishes the bearing surface. When the pivot wears smaller through use, the nut, G, is turned up, which draws the central pivot piece, A, along the reversed inclined planes on it and the plates lying between it and the sleeve, F, acting to expand the latter and take up the wear.

Patented through the Scientific American Patent Agency, February 13, 1872, by E. Motz.

For further information address Michael M. Motz, Woodward, Center county, Pa.

SWEETZER'S BLACKING AND BRUSH HOLDER.

This is one of those simple, practical, and cheap, yet useful inventions from which inventors often reap large rewards. The obvious utility and convenience of such a



blacking and brush holder, will, we think, secure for it a wide popularity. The object has been to form a convenient blacking and brush holder, so constructed that, while the blacking is fully covered and excluded from the action of the air, the knob of the brush shall form a handle for the entire apparatus.

Fig. 1 is a prospective view with a portion broken out to show the internal construction.

The external and lower part, A, is a receptacle for the blacking box, B, from which the cover is taken off when it is placed in A. One side of the blacking box rests against a lug soldered to the bottom of A, and the other side is engaged by the screw C, so that the box is firmly held in position. In this way the arrangement may be adopted to four sizes of blacking boxes, but it is preferred to employ two different sizes of holders, the smaller size forming a very neat and tasteful device for travelers' use.

D represents the daubing brush which is made slightly tapering at the part E, and has a suitable knot at the top. The part E engages and covers F, when the apparatus is not in use, in which case the parts are in the position shown in Fig. 1, a right angled slot, G, in the cover engaging the

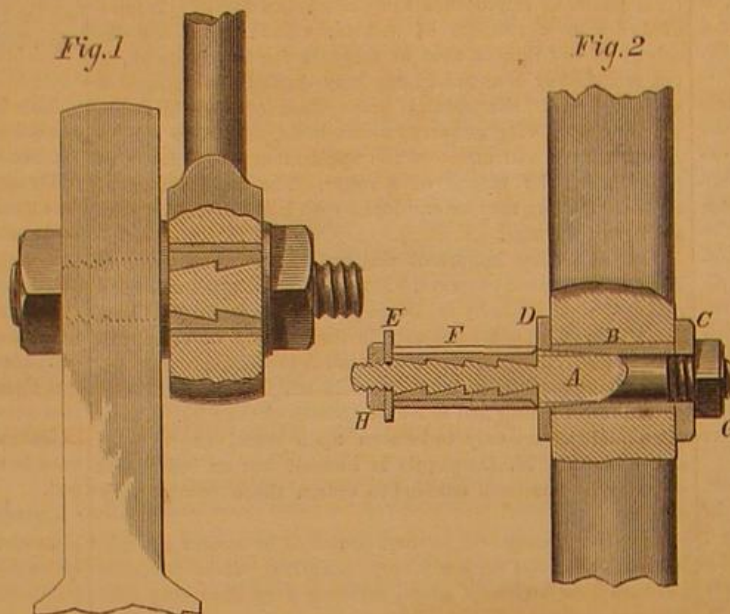
screw C, in the same way as a lantern top is sometimes made to engage lugs in the bottom. When it is desired to use the blacking, a smart tap on the knob of the brush releases it from its engagement with the cover, F. The latter is then slightly turned to release it from its engagement with the screw C, when it may be lifted off, and the brush is then left free.

When a brush combining a daubing brush with a polishing brush is preferred, a common cover for the blacking box and holder is employed, as shown in Fig. 2.

This invention was patented through the Scientific American Patent Agency, March 26th, 1872. For further information address E. H. Sweetzer, Box 317, Salem, Mass.

Jasper and Bloodstone.

Jasper, one of the many varieties of quartz, is very compact, and is found of various colors—dark green, red, brown, yellow, grayish, and sometimes bluish and black. It is very



MOTZ'S EXPANSIVE PIVOT.

hard and takes a fine polish. Occasionally it is found banded or in stripes of different colors, when it is termed ribbon jasper; the stripes are usually red and green alternating. Jasper alone is infusible before the blowpipe, but it will melt with the addition of carbonate of soda. It is sometimes found imbedded in trap rock, but more frequently in pebbles in the beds of rivers.

The yellow jasper is found near the bay of Smyrna, in Greece, and other places, the red in the plains of Argos; the variety known as ribbon jasper comes from Siberia and Saxony; and another kind, termed Egyptian jasper, is found on the banks of the Nile. This latter is of a fine brown on the exterior and clouded with brown of various shades, frequently spotted with black, the markings in this variety occasionally resembling natural objects. A specimen in the British Museum is thought to exhibit a likeness of the poet Chaucer. The yellow variety is used in the Florentine mosaic work called *pietra dura*.

The ancients were well acquainted with this stone, and prized it most highly. Onomakritos, 500 years before the Christian era, speaks of the "grass green jasper, which rejoices the eye of man, and is looked on with pleasure by the immortals." The emeralds spoken of by Roman and Greek authors were most probably green jasper, as we hear of pillars of temples cut out of one piece. Pliny, who describes no less than ten kinds of jasper, relates that it was worn by the natives of the East as an amulet or charm. This stone was much used for cameos; many specimens are extant, having several layers, and the objects represented are cut deep or shallow so as to bring the colors into contrast: for instance, in some specimens may be seen the head of a warrior in red jasper, the helmet green and the breast plate yellow. In the collection of the Vatican are two marvellous vases of this substance: one of red jasper with white stripes, the other of black jasper with yellow stripes.

This stone is cut on copper wheels with fine sand and emery, and polished on wooden or metal wheels with pumice and tripoli. The jasper, according to the authorized version of the Scriptures, was the twelfth stone in the breast plate of the High Priest; and as the Hebrew name is "yashpeh," which is strikingly similar to jasper, and almost all the translations agree, there can be little doubt as to its identity. Galen, among other sage advice, relates that, if a jasper be hung about the neck, it will strengthen the stomach.

The bloodstone is another jasper variety of quartz, of a dark green color, and having those minute blood red specks disseminated throughout which give its name.

The word heliotrope, from *heli* the sun and *trope* a turning, is derived from the notion that when immersed in water it changed the image of the sun into blood red. Pliny relates that the sun could be viewed in it as in a mirror, and that it made visible its eclipses. It is found in large quantities in India, Bokhara, Siberia, and Tartary, and also in the Isle of Rum in the Hebrides, occurring generally in masses of considerable size. It is translucent and susceptible of a beautiful polish; its commercial value, as in the case of other stones, varies with the quality of the specimen. The bloodstone is used for the same purpose as agate and onyx.

There is a tradition that at the Crucifixion the blood which followed the spear thrust fell upon a dark green jasper lying at the foot of the cross, and from this circumstance sprang

the variety. In the middle ages, the red specks alluded to were supposed to represent the blood of Christ; and this stone was thought to possess the same medicinal and magical virtues as the jasper.

The Future of Iron.

Unless the present scarcity and high prices of iron are the temporary effects of causes which may be speedily removed, they must operate as a serious check to the prosperity and progress of all civilized nations. The rapidly increasing demand for and consumption of this metal, in its various manufactured forms, has already been brought to a halt; and enterprises of great utility, and even of national importance, are now awaiting further developments upon this subject.

This enhanced cost falls with the most severe and paralyzing effect upon railroad building enterprises, and hence indirectly upon the general interests of commerce and production, so largely dependent upon transportation facilities.

Unfortunately, this large advance has come upon us at a time when the railroad system of the country is being extended at the rate of some seven or eight thousand miles a year, when new building projects were about to be entered upon in nearly every State and Territory in the Union, and when vast railroad schemes are being matured in South America, Russia, Egypt, India, China, and other non-producing countries, which have just begun to develop their material resources, and need iron to do it with, in immense quantities and in every possible utilized shape.

Where is all this iron coming from? And if the present demand so much exceeds the supply and forces up prices to so high a range, what may be expected of the prospective demand, which promises to be much larger in proportion than any prospective or even possible increase of production?

It is difficult to perceive how the increased supply, requisite to keep prices within bounds, can come from Europe. It is very evident that the cost of production there is not likely to be reduced, with mines growing deeper and more difficult to work, and operatives clamoring for more pay or deserting for other fields of labor.

It really seems that, with our abundant supply of coal and ore, lying close to the surface and so easily mined and brought together, we ought not only to be able to supply our own domestic wants but those of nearly all the world.—*Commercial Bulletin*.

WHITUS' ATTACHMENT FOR BIT BRACES.

This is a very simple invention, the application of which

to bit braces will add much to their utility while it does not greatly enhance their cost. We hardly need say that it is customary to keep on hand a number of wooden tubes or pods, of various lengths and sizes, to slip over bits to gage the depths of holes. This invention obviates the necessity of using such appliances.

A sliding gage, A, Fig. 2, is attached to the side of the bit stock and held in the desired position by the thumb screw, B, Fig. 1. C is the thumb screw which holds the bit in the stock. The gage bar has a ring shaped foot, which, meeting the surface of the material to be bored, limits the depth of the hole. The gage may be graduated in inches and fractions of an inch if desired.

This very practical and useful attachment is the invention of Mr. Charles Whitus, of Philadelphia, Pa., assignor to himself, Edward C. Smith, and William Martin, Jr., of the same place. It was patented April 9, 1872. For further particulars address William Martin, Jr., 1702 Gerard avenue, Philadelphia, Pa.

Nitrate of Ammonia in Respiration.

The formation of nitrate of ammonia in respiration may be shown by the following experiment: On breathing for a few moments from the chest into a large glass, the sides of which are moistened, and afterward rinsing out the glass into a test tube, the presence of free nitric acid is shown by the ordinary reagents (iodide of potassium and dilute sulphuric acid). The presence of ammonia is shown by the usual reagents. M. Struve has remarked that the formation of nitrate of ammonia, in the act of respiration, is more feeble in the morning before dinner than in the afternoon. He concludes from this that the nitrogen in the atmospheric air does not play an entirely passive role in respiration, which is evidently contrary to the experience of MM. Rénault and Reiset. It is natural to suppose that nitrate of ammonia present in saliva plays an important part in digestion.



Fig. 1.—HILL OF GUANO AT THE CHINCHA ISLANDS.

GUANO.

The Chincha islands, whence have come the immense supplies of the well known fertilizer termed "guano," consist of a group of three small islands, which rise from the sea at a distance of fourteen miles from the coast of Peru, to which government they belong. These islands vary in height from 150 to 300 feet, are about a mile in diameter, and the guano is found upon them in the form of a covering or deposit of varying depths, but in some cases 150 feet in thickness, the underlying rocks being of volcanic character.

Our engravings show the manner in which the valuable commodity is mined. The laborers employed are Chinese coolies, who are obliged, at the point of the bayonet, to submit to a servitude more galling than African slavery.

One of the views (Fig. 1) shows the largest remaining hill of guano, which is carted in dirt cars to the brink of the cliffs, and then dumped (Fig. 2) into cribs, from the lower corners of which it is made to slide down through strong canvas chutes into small boats, shown in Fig. 3.

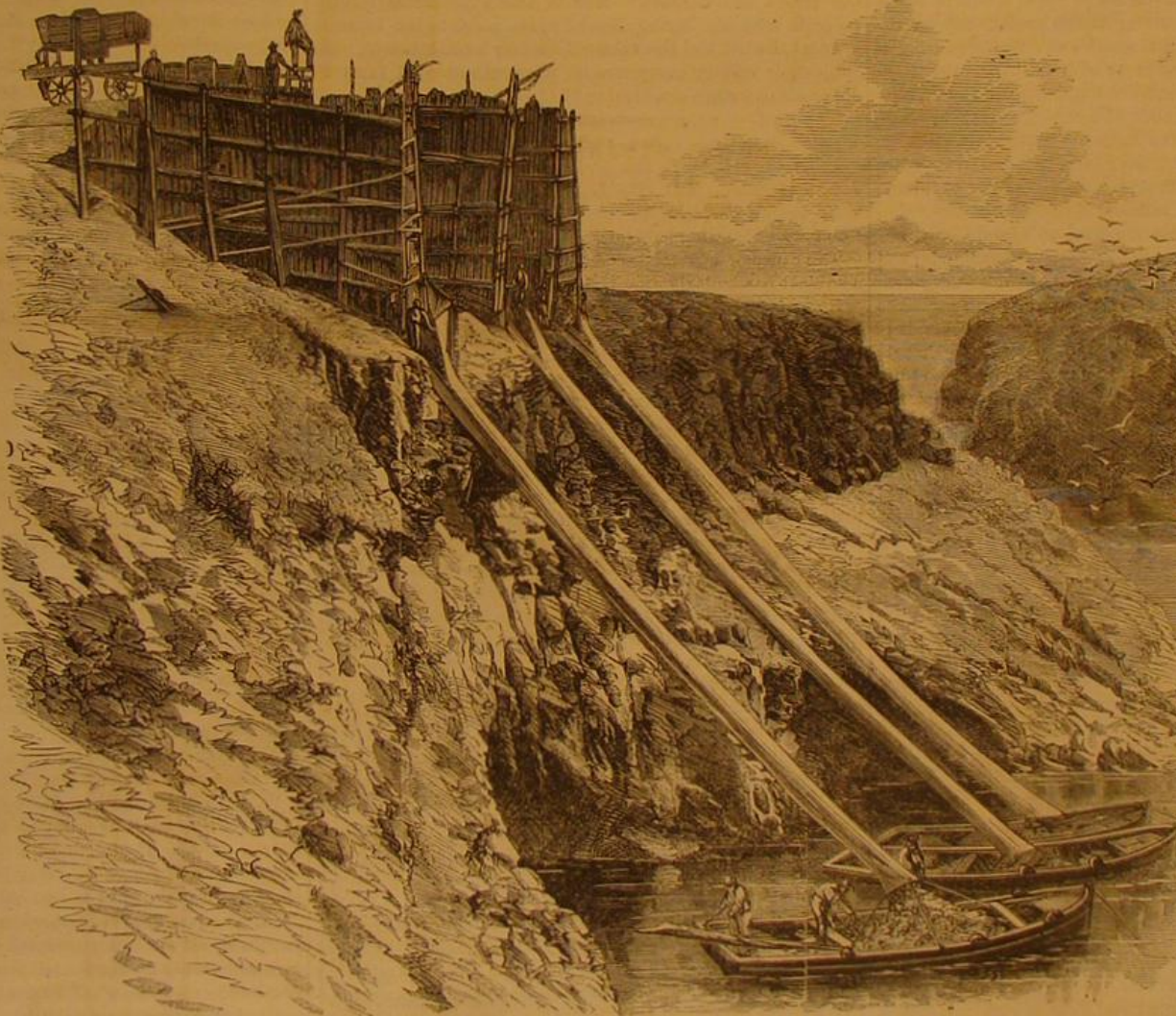


Fig. 3.—CHUTING THE GUANO INTO THE BOATS.

The mode of fastening the chutes to the boats, so as to prevent loss of the material, will be readily understood by a glance at the engraving. The small boats convey the guano to the ships which ride at anchor at some little distance from the islands. It is not uncommon to find over a hundred ships, of various nations, waiting to receive cargoes of the precious earth, which they convey to all parts of the civilized world. Many millions of tons of guano have been removed from these islands during the past thirty years, and their supply is now approaching exhaustion. There are twelve other guano islands on the Peruvian coast, which are now being worked; among them are the Guanape islands, which are north of the Chinchas. Other islands in the Pacific furnish guano, as, for example, Jarvis and Baker's islands.

It was formerly the popular belief that the guano deposits were wholly the excreta of wild birds, but careful investigations of geologists show that this is



Fig. 2.—DUMPING THE GUANO INTO THE CRIBS.

not correct, and that guano is the result of the accumulation of the bodies of animals and plants, and is in many cases associated with bitumen.

At a meeting of the Natural History Society in this city, Professor A. M. Edwards made the following instructive remarks upon the subject:

I am not prepared at the present time to enter fully into the consideration of this subject of the origin of guano, but I would merely mention that my views on the subject were first made public at a meeting of the American Microscopical Society, during the winter of 1868. Thereafter, on the 4th of January, 1869, I gave the results of my investigations and the deductions I drew therefrom at a meeting of the Essex Institute at Salem, Mass., and an abstract of what I then said was published in the bulletin of that association, Vol. I, page 11. The main points then brought forth, and which I desire to dwell upon now, are for the purpose more particularly of calling the attention of scientists to this interesting and important subject. I have spent several years in investigating this subject and have become acquainted with some facts of great moment as bearing upon several branches of science, more particularly geology, agriculture, biology, and chemistry, as well as commerce. I have also been, for the last fifteen years or more, studying the so-called infusorial deposits of marine origin; that is to say, those which are proved, by the character of the remains contained in them, to have been formed beneath salt water.

Among the specimens thus examined, are some of the rocks or shales making up the great mass of the mountains of the coast range which extend down the Pacific shore, from Washington Territory to the borders of Lower California and even perhaps down as far as the southernmost extremity of that peninsula. These shales are usually of a light cream color and mainly consist of the siliceous skeletons of *diatomacea* and *polycystina*, the former being commonly considered as plants, the latter as animals. These are of extremely minute size, and often require for their study the use of the highest magnifying powers. Many of them prove to be indistinguishable from forms living at the present day on the Californian coast. Exuding through and often appearing at the upper portion of these rocks, to which situation they have evidently been driven by heat, are found the petroleum, bitumen, and asphalt of California. Hence the survey has conferred upon these strata the name of bituminous shales. Along the Pacific coast, and lying generally parallel to it, are islands often bearing upon their summits deposits of guano of more or less commercial value.

We find that guano is not confined to islands only, but occurs in large quantities on the contiguous headlands; and many ravines extending into the interior of the country contain guano in smaller and larger quantities. With regard to the upheaval of such coasts, along which guano occurs, it is well known from Darwin's investigations that the whole Pacific coast of South America is in constant motion and upheaval, and that "on the mainland near Lima, and on the adjoining island of San Lorenzo, Mr. Darwin found proofs that the ancient bed of the sea had been raised to the height of more than eighty feet above water, within the human epoch, strata having been discovered at that altitude, containing pieces of cotton thread and plaited rush, together with sea weed and marine shells."

When the portion of guano which is insoluble in water and acids is examined by means of the microscope, it is found to be made up of the skeletons of *diatomacea*, *polycystina* and sponges, invariably of marine origin, and sometimes identical with those living in the adjoining ocean, and fossilized in the adjacent infusorial strata. Also we find that some of these forms occur in patches exactly as they grow in Nature, and as they would present themselves if they were deposited from water, and not as they would be if they had to pass through the alimentary canals of mollusca and similar small animals, then through the same organs of fish and birds, in turn, as they would have to do, to get into the guano in the manner commonly supposed.

I have stated that in California we have a deposit of infusoria, improperly so called, accompanied by bitumen, which bitumen the gentlemen of the State survey believe has been derived from those infusoria, and that contiguous thereto we have guano deposits. Now let us see if we have a similar association of facts anywhere else. At Payta in Peru, Dr. C. F. Winslow discovered an infusorial deposit, almost identical in character with the California one; near by are bitumen springs, and lying off the coast are the guano islands of Lobos, Chincha, Guanape and others; at Natanai, Japan, we have extensive infusorial strata and bitumen; it is not recorded whether guano occurs in that quarter. In the island of Barbadoes we have infusorial strata, bitumen, and near by the guano islands of the Caribbean sea; and I am informed that guano is abundant on the small islands and rocks nearly throughout the West Indian archipelago. In the island of Trinidad, we have infusorial strata and bitumen, and of course adjacent guano. At all of these localities volcanic action is evident, but we have some localities of guano without infusorial strata or bitumen as yet recorded, while we have the celebrated infusorial strata of Virginia, which by a little stretch of the imagination, may be supposed to be related in some way to the petroleum of West Virginia and Pennsylvania. In Algeria we have infusorial strata and bitumen, but I never heard of guano having been found near by. However, now that attention is called to this fact, it is to be hoped that more careful observations will be made connected with the subject, and I hereby call on all scientists and travellers to do all they can to assist in the elucidation of this interesting and important matter. From all of these facts, and others that I have collected of no less importance, derived from chemical and microscopical characters, I have come to

the conclusion that guano is not the excreta of birds, deposited upon the islands and main land after its upheaval, but that it is the result of the accumulation of the bodies of animals and plants, for the most part minute and belonging to the group which Haeckel has included in a new kingdom, separate from the animal as well as the vegetable, under the name of *protista*, and subsequently upheaved from the bottom of the ocean. Subsequent chemical changes have transformed it into guano, or heat and pressure have so acted upon it, that the organic matter has been transformed into bitumen, while the mineral constituents are preserved in the beautiful atomies that make up the mass of the extensive infusorial strata, found in various parts of the world.

In conclusion, I have to state that the Chincha islands have been visited by a competent geologist, Mr. Kinahan, of Dublin, and he has pointed out that they have been upheaved by volcanic action within a recent period, geologically considered, and that I have found a remarkable confirmation of my theory in a paper, read before the American Institute some years since by Mr. Alanson Nash, detailing the observations of a Mr. F. Nash, made during a residence on the Chincha islands, while engaged in the guano trade, for nearly six months. Therein I find it stated that Mr. Nash was of opinion that guano was formed in the way I have described; that the anchors of vessels in that locality bring up guano from the bottom of the ocean; that "the guano is (much of it) not composed of bird dung, but it is composed of the mud of the ocean." That "the composition taken from the islands, called guano, is stratified and lies in the same form it did before it was lifted up from the ocean; that the bottom of the ocean on the west coast of Peru, contains vast deposits of guano. An island, during an earthquake, rose up in the bay of Callao some years since from the sea, containing guano four feet deep, the formation the same as the Chincha islands."

In conclusion, he says "the day will come when the guano at these islands will be dredged up with boats like mud from our rivers and harbors." And in this expectation I fully coincide with Mr. Nash. Need I again point to the interest connected with, and the value of further knowledge of, this subject, or call on every one for a contribution of facts to aid in its thorough elucidation?

Sea Sickness.

From an article in the *British Medical Journal* by Sir James Alderson, M.D., D.C.L., F.R.S., consulting physician to St. Mary's Hospital, we make the following extracts on this very nauseating subject:

The cause of sea sickness and its possible amelioration is a subject particularly appropriate at the present time.

Referring to the experience of sufferers from sea sickness, it is admitted by all that they are most sensible of the miserable feeling at the moment of the descent of the ship. They are also conscious, at that particular time, of an instinctive effort to sigh or take a deep inspiration, the meaning of which is manifest. During deep inspiration, the chest is dilated for the reception of air, and its vessels become more open to admit blood, so that a return of blood from the head is then more free than at any other period of complete respiration; while on the contrary, by the act of expelling air from the lungs the ingress of blood is obstructed. This obstruction is proved by observation when the surface of the brain is exposed by the operation of trephining; a successive turbulence and subsidence of the brain is then seen in alternate motion with different states of the chest. A deep inspiration, therefore, at the time of the descent of the ship tends to counteract the turbulence of the brain.

Sickness is sometimes produced by waltzing. In this case, the same theory of pressure on the brain holds good; but during rapid gyration in waltzing, the blood is acted on differently; it is centrifugal force which causes the blood to rise in the vessels supplied to the brain. There is an additional cause of cerebral disturbance from the confusion of objects rapidly presented to the eye; from this comes giddiness.

In reference to sickness brought on by swinging, I cannot do better than quote Dr. Wollaston: "Sickness, by swinging, is evidently from the same cause as sea sickness, and that direction of the motion which occasions the most piercing sensation of uneasiness is conformable to the same explanation already given. It is in descending forward that this sensation is perceived, for then the blood has the greatest tendency to move from the feet towards the head, since the line joining them is in the direction of the motion; but when, in the descent backwards, the motion is transverse to the line of the body, it occasions but little inconvenience, because the tendency to propel the blood towards the head is then inconsiderable."

The last observation of Dr. Wollaston, quite accurate as to the result, plainly suggests the practical bearing of the subject. Knowing the mode in which the ship's movement acts on the brain, we are at once furnished with the only rational way of averting sea sickness.

The first point is wholly to avoid the upright posture. Every one knows that it is a common practice to lie down, and this is done almost instinctively, but it is also known that to do so, though frequently successful, is not invariably so. The way in which the motion in a swing affects the brain affords the proper explanation why lying down is not invariably successful, and shows that it is necessary, not only to take a recumbent position, but to lie in the right direction. A person lying down with the feet towards the bows of the ship is, while it descends in pitching, in the same position as a person in a swing descending forwards, in which case we have seen that sickness is produced by blood being forced upon the brain. On the contrary, a person lying down with

his head towards the bows is, during the descent of a ship, in the position of one descending backwards in a swing, in which case the pressure by the blood will be towards the feet, and, therefore, relief rather than inconvenience will be experienced, as the tendency will be to reduce the natural supply of blood to the brain. It is necessary, therefore, not only to lie down, but to do so with the head to the bows; and it is highly desirable that this position should be assumed before the ship begins to move. There is a secondary advantage to be gained by closing the eyes, and so shutting out the confusion arising from the movement of surrounding objects.

If the philosophical explanation here given be the correct one, which there is no reason to doubt, it adds one more to many unanswerable objections to the device of taking passengers in railway carriages on board gigantic vessels. No relief would be afforded by that plan to the miseries of sea sickness, since, except in a perfect calm, nothing can prevent the rising and falling of the ship and the consequent action of the blood upon the brain. The sitting posture would be equally unfavorable with the upright, and there would be, in addition, the common motion of a carriage, which alone, with some persons, produces sickness.

The Laws of Boat Racing.

A meeting, of the boating fraternities of Oxford and Cambridge Universities and the principal boat clubs of London, was recently held at Putney, at which the following laws to govern the racing of those clubs were agreed upon:

1. All the boat races shall be started in the following manner: The starter, on being satisfied that the competitors are ready, shall give the signal to start.

2. If the starter considers the start false, he shall at once recall the boats to their stations, and any boat refusing to start again shall be disqualified.

3. Any boat not at its post at the time specified shall be liable to be disqualified by the umpire.

4. The umpire may act as starter, if he thinks fit; where he does not so act, the starter shall be subject to the control of the umpire.

5. No fouling whatever shall be allowed; the boat committing a foul shall be disqualified.

6. Each boat shall keep its own water throughout the race, any boat departing from its own water will do so at its peril.

7. A boat's own water is its straight course, parallel with those of the other competing boats, from the station assigned to it at starting to the finish; and the umpire shall be sole judge of a boat's own water and proper course during the race.

8. The umpire, when appealed to, shall decide all questions as to foul.

9. A claim of foul must be made to the judge or to the umpire by the competitor himself before getting out of his boat.

10. It shall be considered a foul when, after the race has commenced, any competitor, by his oar, boat, or person, comes in contact with the boat, oar, or person of another competitor; unless, in the opinion of the umpire, such contact is so slight as not to influence the race.

11. In case of a foul, the umpire shall have the power—
(a.) To place the boats—except the boat committing the foul, which is disqualified—in the order in which they come in.

(b.) To order the boats engaged in the race, other than the boat committing the foul, to row over again on the same or another day.

(c.) To restart the qualified boats from the place where the foul was committed.

12. The umpire, may, during a race, caution any competitor in danger of committing a foul.

13. Every boat shall abide by its accidents.

14. No boat shall be allowed to accompany a competitor for the purpose of directing his course or affording him other assistance. The boat receiving such direction or assistance shall be disqualified at the discretion of the umpire.

15. The jurisdiction of the umpire shall extend over the race, and all matters connected with it, from the time the race is specified to start until its final termination; and his decision in all cases shall be final and without appeal.

16. Any competitor refusing to abide by the decision or to follow the direction of the umpire shall be disqualified.

17. The umpire, if he thinks proper, may reserve his decision, provided that such decision be given on the day of the race.

DR. PINCUS states that ozone is formed during the burning of hydrogen, and that if a flame of this gas is allowed to burn from a fine point, the smell of ozone can be distinctly recognized. This statement recalls to mind the announcement made some time since by Loew, of New York, that ozone might be obtained, in sufficient quantity for purposes of lecture demonstration, by simply blowing the heated air on the edge of an ordinary Bunsen flame, with the aid of a glass tube, into a glass receiver containing the ordinary reagent for testing an oxidizing agent—iodide of potassium, acetic acid and starch—when the blue coloration of the iodide of starch almost instantly makes its appearance. At the time, Loew's announcement met with some objectors who sought to explain the phenomenon by assuming that the oxidizing process originated with certain oxidized nitrogen compounds formed by the heat of the flame. From the fact, however, which is well known to chemists, that it is impossible to unite nitrogen and oxygen directly, by any means short of the electrical spark, the explanation of Loew would seem to be the correct one.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE COMBUSTIBILITY OF IRON.

The combustibility of iron is shown by any means that exposes a large surface to the action of the atmosphere. For that purpose, the late Professor Magnus, of Berlin, devised the method of using a magnet, to which iron filings readily attach themselves like a beard, all radiating from the poles in such a manner as to leave small interstices. On igniting these with an alcohol lamp or gas burner, they continue to burn most brilliantly; and if the experimenter stands on some elevation, like a step ladder, and waves the magnet, a most magnificent rain of fire is produced. When this experiment was first performed in Berlin, it was received with applause by the King and court of Prussia.

It is well known to physicists that a magnet of some strength may be made by placing a bar of iron or steel in the magnetic meridian, and striking it a few sharp blows with a hammer.

If no magnet can be procured for the experiment, a bunch of cotton wool is saturated with alcohol, placed on some support, and the alcohol ignited. Some fine iron filings, placed on a sheet of paper, are allowed to fall in a fine stream on the burning mass, when they burn with brilliant scintillations, showing that iron is combustible if only the supply of air is sufficient.

Still more remarkable is the experiment showing that iron is more combustible than gunpowder. A mixture of fine iron filings and coarse gunpowder is thrown on a small quantity of burning alcohol. As the iron falls through the flame, it takes fire and burns with its characteristic color and scintillations. The gunpowder falls through the flame without taking fire, and lies quietly in the bottom of the saucer until the alcohol is nearly consumed and the flame is brought into contact with it, when it flashes, showing that it was the powder, not the iron, that passed through the flame without taking fire.

The influences which the minute size of the particles, by which a large surface is exposed to the air, has on the combustibility of a substance is well illustrated in pyromorphic iron. If the oxide of iron be reduced, by passing over it a current of hydrogen, the heat employed being less than that of boiling mercury, the metallic iron is left in such a fine state of subdivision as to take fire spontaneously when allowed to fall through the air.

It may not be out of place here to refer to the fact that spontaneous combustion of greasy rags and oily cotton waste is due to rapid oxidation of the oil or grease, of which a very large surface is thus exposed.

REMEDIES FOR CANCER.

Our readers will remember that we published (on page 5 of the current volume) a recommendation of the use of wild tea as a cure for cancer. Mr. J. B. Williams, who wrote the letter, has since been accused of an attempt to impose on the public, some of our readers having tried in vain to obtain or hear of such a herb. Dr. W. W. Hall states that it is to be had in drug stores, that its names are various, *pisissawa*, *partridge berry*, *deer berry*, *tea berry*, *wintergreen*, and *mountain tea* being among them; and he gives its botanical name as *chimaphila umbellata*. There is, we believe, a little confusion in this description. *Pisissawa* is the *chimaphila umbellata*, and is known in the country as "spotted wintergreen." The real wintergreen is *gaultheria procumbens*, and "partridge berry" is a common name for it. Again, *Mitchella repens* is also called partridge berry. These three herbs are widely different in appearance as well as in their medicinal effects. It is probable that Mr. Williams meant the *Mitchella repens*, which is said to be in use among the Indian medicine men to facilitate parturition. No one would announce as a discovery that wintergreen (*gaultheria*) or *pisissawa* was a specific for cancer, the characteristics of these herbs being known to every tyro in pharmacy.

DYEING COTTON YARN WITH MAGENTA.

If cotton yarn be washed in pure water, heated to nearly boiling point, the material being supported on rods in the wash boiler and turned frequently during three quarters of an hour, then well rinsed in running cold water, and dyed according to the following directions, a mordant can be dispensed with. The color bath is prepared by using four ounces of the hydrochlorate of rosanilin (sometimes called diamond fuchsin) in ten gallons of boiling water. The yarn should be entered in parcels of about twenty pounds each, the color being also put in gradually. The heat of the water will impart a blue shade to the dye, and the yarn should be dried at a low temperature. This method is economical, and can easily be tried.

REGELATION.

This curious phenomenon can be exhibited by placing a block of ice on a netting of fine wire. The ice will be melted by the wire, and, passing down therethrough, will become frozen into a mass again below the wire. A single wire can, in a similar manner, be drawn slowly through a block of ice, the ice uniting again behind the wire and finally showing no sign of having been cut at all.

COLOR AND TEMPER OF STEEL.

In an interesting work entitled "The Metallurgy of Iron," we find some figures that will be useful to our very many readers who ask for particulars as to the tempering of steel for different purposes:

"The process of tempering steel consists in reheating hardened steel to a temperature varying with the degree of hardness required, and cooling it by immersion in the same manner. This proper temperature is indicated by the color

of the thin film of oxide formed on the surface of the heated metal, according to the following scale:

Color.	For
220° Pale yellow.....	Lancets.
230° Straw yellow.....	Razors and surgical instruments.
240° Golden yellow.....	Common razors and penknives.
250° Brown.....	Cold chisels, shears, scissors.
260° Brown, dappled with purple.....	Axes, planes, etc.
270° Purple.....	Table knives, large shears.
280° Bright blue.....	Swords, coiled springs.
290° Full blue.....	Fine saws, augurs, etc.
310° Dark blue.....	Hand and pit saws.

The reheating is generally effected in baths of molten metals, or metallic alloys having definite fusing points. Thus, alloys of tin and lead, in varying proportions, may be used up to a temperature of 300°; above which boiling linseed oil and pure lead are to be employed. The tenacity of steel is highly increased by tempering with oil instead of water."

Concentrated Ozone.

Professor A. Houzeau has devised a very simple electrical tube, by which he is enabled, by passing air through the tube, to produce ozone, so concentrated as to be from fifteen to twenty times stronger than has hitherto been obtained. He has thus been enabled to review many of the most important properties of this substance, and besides to determine the part it plays in Nature.

With the ozonizing tube, the following lecture experiments may be performed. The gas can be collected over water, in flasks of the capacity of half a liter (water dissolves about the 100,000th part of its weight of ozone.)

SILVER.—A bright leaf of silver is immediately blackened in most ozone (Schönbein). The oxide of silver formed is alkaline, and produces a strong blue with reddened litmus paper (A. H.) In spite of this absorption of ozone by the silver, the volume of the gas undergoes no visible diminution (A. H.)

IODIDE OF POTASSIUM.—A solution of iodide of potassium, poured into ozone, is decomposed and becomes of a reddish brown color, through the liberation of iodine (Schönbein). Free potassa is also formed (A. H.) The reaction is rendered more striking if, for a simple solution of iodide of potassium, we substitute a colorless mixture composed of four to six cubic centimeters of a neutral solution of iodide (6 to 100), and 2 c.c. of the dilute sulphuric acid containing 0.122 grammes SO₂, HO. The liquid colors slightly and nearly the whole of the iodine is precipitated.

HYDROCHLORIC ACID.—5 c.c. of pure colorless solution of hydrochloric acid in water, holding in suspension finely divided gold leaf, when agitated for two minutes with concentrated ozone, becomes of a yellow color; the metal is entirely dissolved, and at the same time a manifest odor of chlorine is produced (A. H.)

AMMONIA.—A few c.c. of the volatile alkali, turned into a half liter flask of ozone, emitted white vapors consisting of nitrate of ammonia (A. H.) A transparent mixture of ozone and dry gaseous ammonia nitrifies when water is introduced (A. H.)

SULPHURETTED HYDROGEN.—A strong reaction, sulphur deposited, and white vapors produced.

PHOSPHURETTED HYDROGEN.—(Ph H₂ of M. Thénard.) This gas, which is unaffected by ordinary oxygen, burns with a vivid light in contact with ozone. The experiment may be made without danger, if only one c.c. of gas is used over water in a tube several decimeters long. As each bubble of ozone is introduced, a brilliant flash of light appears (A. H.)

A mixture, composed of two volumes of phosphuretted hydrogen (not spontaneously inflammable), and one volume of oxygen, blown into a soap bubble, detonates with violence on contact with a globe of ozone (containing only 0.03 milligramme of ozone.) The ozone acts as though it were charged with electricity.

ORGANIC MATTERS.—Ozone rapidly corrodes caoutchouc, whether vulcanized or not (Frémy and Bécquerel.) A current of ozone, made to pass through a tube filled with fragments of caoutchouc, becomes charged with carbonic acid, and produces a precipitate with baryta water (A. H.) The alteration of caoutchouc by ozone is therefore the result of a combustion. Solution of anilin red is instantly bleached by ozone. A weak solution of indigo is likewise decolorized.

Chinese Plumagery.

Confucius informs us that in remote antiquity, ere the art of weaving silk or hemp was understood, mankind were clothed in the skins of beasts and feathers. How the latter were held together is not stated, but it must have been in a rude manner by cords or thread; at a later period, feathers were in general demand as ornaments to banners and articles of attire, and subsequently for the manufacture of door screens and caps. Tradition states that garments made of feathers and resembling fur dresses were presented to the Emperor Shan-shau, who reigned twenty-five centuries before our era. The earliest allusion to robes woven with feathers occurs in the history of the Tsin dynasty. In the year 272, A. D., Dr. Ching, the Court physician, presented the emperor with a gown made of feathers from the golden headed pheasant. His Majesty, being the founder of a new dynasty, was anxious to induce economical habits among his subjects; he therefore immediately ordered the splendid garment to be publicly burnt before the palace door, and issued, on the following day, stringent prohibitions against the presentation of articles of luxury.

The Emperor Wuti, who flourished in the latter part of the fifth century, had a son who was notorious for his extra-

gance, having among other costly articles a robe woven with peacocks' feathers.

The Chinese have lost the art of weaving feathers. Plumagery is still practiced, however, in the decoration of metallic ornaments worn by all classes of females, chiefly on the head. The mode of procedure is as follows:

"On the table at which the workman sits, he has a falence-lus of feathers, a small furnace with a few embers for keeping warm a cup of glue, a small cutting instrument like a screw driver, a pencil or brush, and the articles, either silver, gilt, copper, tinsel, or pasteboard, which are to be feathered.

"The thumb and index finger being smeared with glue, the feathers are gently drawn between them, which stiffens the barbs, causing them to adhere firmly together; and when dry, the perpendicular blade is drawn close to the shaft, dividing it from the barbed portion. Holding the cutting implement as in writing *a la Chinoise*, the artist, by pressing on the strips of barb with the knife, cuts them into the desired size and shape, which is a work of some delicacy, the pieces being very small, in the form of petals, scales, diamonds, squares, and the like, and requiring to be of same size as the particular spot on which they are to be laid. Besides fingering this tool in the manner described, he holds the pencil nearly as we do the pen, dips it into the glue, brushes the spot to be covered, then, expertly reversing it, touches with its opposite point a tiny bit of feather, which is thus lifted up and laid on the part for which it was fitted. Care is requisite also in giving a proper direction to this twilled work, for such, of course, is the appearance presented by the barbs.

The feathers most in demand for this purpose are from a beautiful species of *Alcedo*, brought from the tropical regions of Asia; they are employed for silver articles. Kingfishers, of coarser plumage and less brilliant hues, found throughout the country, are used for ornaments made of copper or pasteboard. Blue always greatly predominates over lighter or darker shades, relieved by purple, white or yellow.

A New Railroad Safety Signal.

The Boston and Maine road has ordered the construction on trial of a new safety signal, which bids fair to supply a very important want. The invention contains a dial about four feet in diameter, divided as to its circumference into ten parts. The sets of figures in this dial, from 1 to 10, inclusive, are each nine inches in length, and show white on a large ground of red glass. Back of the dial, and protected from the weather, is a clockwork, and also the light. This dial and the work attached thereto are mounted by the side of the tracks on a post sixteen feet high. Another part of the invention is a large signal arm presenting white with red spots.

The method of operation is as follows: When a train passes, a staple on the top of the engine cab strikes a trip rod depending from the signal, which sets the clock work in operation. The result is that the arm giving the danger signal at once falls, and remains in a horizontal position ten minutes. The dial also begins to revolve, and for ten minutes shows red to indicate danger, and at the same time presents the large figure or figures indicating how many minutes have elapsed since the train passed. Both the board and the illuminated dial can be seen a long way off, the latter being applicable particularly for night and the former for day trains.

THE way they boil rice in India is as follows: Into a saucepan of 2 quarts of water, when boiling, throw a tablespoonful of salt; then throw in one pint of rice, after it has been well washed in cold water; let it boil 20 minutes. Throw it out on a cullender, and drain off the water. When this has been done, put the rice back into the can or saucepan, dried by the fire, and let it stand near the fire for some minutes, or until required to be dished up; thus the grains appear separate and not mashed together.

FIRE KINDLINGS.—In France, a very convenient and economical kindling is made by dipping corn cobs for about one minute in a bath composed of 60 parts melted resin and 40 parts tar. They are next spread out to dry on metallic plates heated to the temperature of boiling water. They are then assorted, according to size, and tied up in bundles. They sell for one to two centimes ($\frac{1}{2}$ cent) apiece. The "Compagnie des Allumettes Landaises" employs 30 workmen and makes about \$40,000 worth a year.

M. C. Robin states that matters injected into the spongy tissues of the bones in the living subject are absorbed as rapidly as if they were introduced directly into the veins, from which he inferred that this spongy tissue is in direct connection with the veins, and must be regarded as forming a system of sinuses.

It is curious how great ideas will float about in the world. There is Mr. Darwin who, after extensive research and deep study, has hit upon the idea of the descent of man from animals. Now comes Mr. Poole, another Englishman, just from the Queen Charlotte Islands, who tells us that the natives claim their descent from the crow; they also give reverent form to the idea by protecting crow nests and never killing the birds.

A NEW Chinese temple was recently consecrated in San Francisco, with no less than seventy-five gods, two of which are twenty feet high and correspondingly large.

FOUR years ago, Lincoln, the capital of Nebraska, was "away out on the prairie," and was called "Young's Colony." Before the close of the present season, it will have six railroads, and will be lighted with gas.

Patent Pulley Bridle Bit.

This bit is used as a common bit, with the ordinary reins, and, it is claimed, gives the driver absolute control of his horse. A pulling horse is soon taught not to pull, and a vicious or frightened horse is easily managed.

It is argued by the inventor that control of a horse should be secured without extra reins or extra manipulation of them, and it is claimed this desideratum is, in this invention, secured for the first time. The driver can never be surprised or taken off his guard, for the reins are the ordinary reins, and he holds and handles them just as he has been accustomed to do. In this bit, in place of the ring in the ordinary bit, is a small pulley, A, Fig. 2, through which is passed a round strap to a buckle immediately under the blinder. A supplementary strap, attached to the same buckle, holds the bit in its proper place; or the bit may be supported by attaching two small rubber or leather balls to the reins under the pulleys.

Now, in pulling on the reins the bit is lifted into the corners of the horse's mouth; he cannot hold it in his teeth, nor receive the pull on his jaw, and therefore is compelled to yield and throw up his head; in this position he cannot kick or run.

At first, if the horse is a hard puller, it is necessary to drive him without martingale, as the length of the martingale regulates the force of the bit.

It is admitted that no man can hold or control a horse with the common bit, if the horse exercises his strength. A great deal of damage is done to life, limb, and property by horses becoming unmanageable and running away, which the old device made by our ancestors is inadequate to prevent.

No man wants a pulling horse. We drive for pleasure, and do not wish to "work our passage." By this bit, it is claimed, a horse may be taught never to pull, and a horse not so educated may be kept under full control until he has learnt the reason.

Patented, March 19, 1872, by G. W. Barnes, No. 12 First st., New York city.

Improved Brick Kiln.

This invention consists in applying to the top of a brick kiln a series of intersecting horizontal flues, with registers at the intersections of the flues, where, by the products of combustion can be directed in their course. Fig. 1 is a perspective view of the kiln, and Fig. 2 is a partial top view, and Fig. 3, a partial side elevation.

Upon a brick kiln of suitable size and shape, and built up of raw brick in the ordinary manner, with furnaces, eyes, and crevices for the proper distribution of the heat, is placed a course, A, of bricks, in such a manner as to leave horizontal, longitudinal, and transverse flues, D E, which intersect at C, the outermost flues being placed quite near the verge of the kiln. All these flues are in proper connection with the smoke crevices, so that all products of combustion enter them.

Upon the course, A, is laid another course, B, of bricks set on edge and close together, so as to cover the flues made in the first course. The bricks of the top course are preferably of burnt brick or fire brick, which will protect the kiln from injury by rain. Cement may be used to close the joints of the top course.

Each of the intersections of the flues has, placed over it, a register of cast iron or other suitable material, as shown in the center of Figs. 2 and 3.

In describing what led to this invention and the general operation and the advantages claimed for this cheap modification of ordinary brick kilns, we cannot do better than to copy the inventor's own statement:

"I have been engaged in making and burning brick for nearly the third of a century, and have, during that period, tried various experiments to discover a mode that should

produce better results than are usually seen throughout the southern country—a mode by which, with less fuel, a larger portion of well burnt brick might be produced. In this I have utterly failed until recently. Upon a paved foundation, twenty-four feet by forty-two feet, I constructed a kiln or clamp, with ten eyes through it (the short way), eleven feet six inches high, reduced by battering one foot on each side, making an upper base or surface twenty-two feet by forty feet. It was thirty-three courses high, with benches between the eyes four bricks thick. The eyes were two

feet of horizontal flues (three inches wide and four deep), the first flue passing along the sides and ends of the whole kiln, within three inches of the outer verge, with also ten flues of similar size crossing the kiln in the direction of the eyes, terminating in the long flues near the verge of the kiln. Each of these flues were, and should be, placed over the center of the eye below. There were also eight flues placed within three feet of each other, running lengthwise and terminating in the flues at the ends, thus making ninety-six intersections or flues. The courses of bricks forming all the flues were, and should be, half an inch apart. Upon this course I set another course of burnt brick edgewise, closely packed (with their joints broken in the length) except at the intersections of the flues below, where there should be left apertures nine inches square, to be closed with cast iron registers, made tight by fitting them in soft clay mortar. The whole upper surface should be flushed with soft clay mortar, and plastered smooth and tight so as to be impervious to smoke or flame.

"With the registers all open, I commenced a moderate fire, which was continued for fifty hours, when flame escaped from the central registers, which assumed a red heat. These

I then closed, and continued the fire and closed others as they became red hot. In 70 hours black smoke and flame issued freely from all of them, and the outer walls of the kiln showed considerable heat. I then increased the fuel, and so manipulated the registers as to keep up a good draft, giving the most draft where there seemed the least heat. At the end of 96 hours, the whole upper

surface shrank (with great uniformity, making no rent or break through which flame escaped) from four to six inches, when I supposed it was sufficiently burned and closed the eyes and awaited its cooling. I had on the ground eighty cords of wood, the quantity I had heretofore used in burning such a kiln; this I reduced to a little less than thirty

cords. The labor was performed by eight laborers instead of five. Seventy-five to eighty per cent of merchantable bricks was the best yield under the old system. On opening the kiln I found it burned to the surface as high as the earthen embankment (say six feet). From the embankment up, on one side and end, the bricks were thoroughly burned to the outside stretching course, which were themselves half burned. On the other side and end, owing to a continuous heavy wind blowing on them, the bricks were burnt to within the length of a brick of the outer surface. I stripped the kiln of all the salmon brick, which amounted to thirty-eight hundred, leaving ninety-eight per cent of merchantable brick, an advantage of eighteen per cent over the usual result, equal to thirty-six thousand bricks in the kiln, the increased value

being four dollars per thousand. The saving of twenty-eight cords of wood was equal to eighty-four dollars, and the saving in labor, thirty-two dollars.

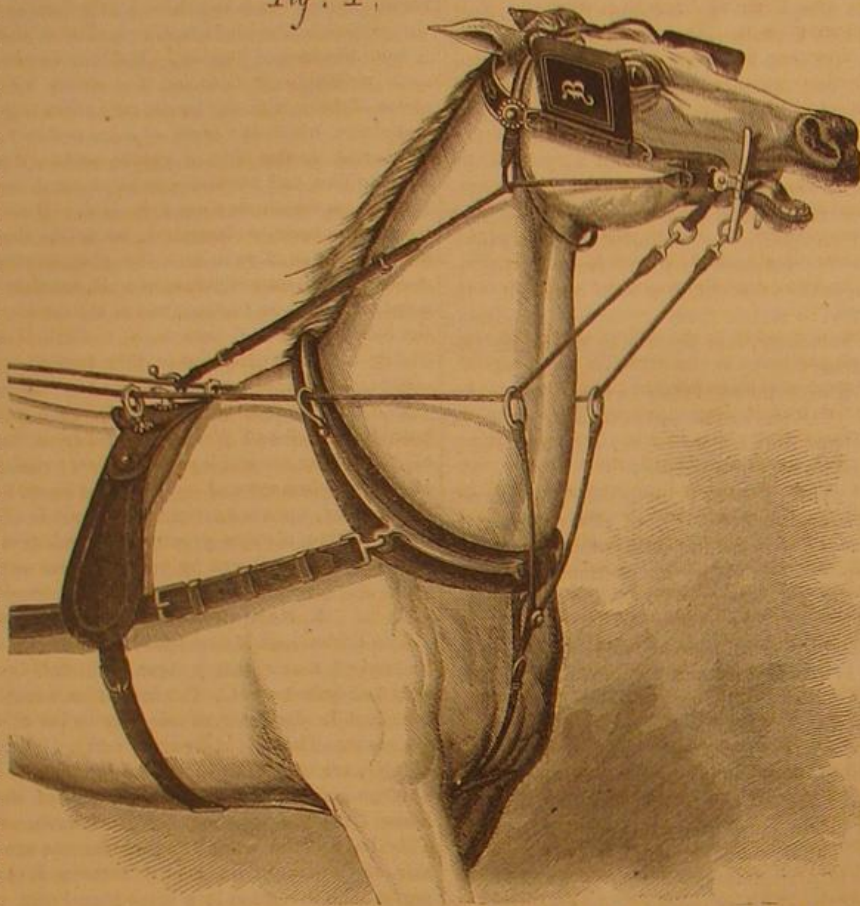
"The ninety-six registers cost seven cents per pound, which amounted to eighty-six dollars and sixty-four cents, and were not injured by the use, showing that they may be used over and over for an indefinite period."

The inventor and other credible witnesses say that the foregoing statement has been several times corroborated in actual practice, and from this it seems that the new kiln is a very valuable improvement, which can be employed at small cost.

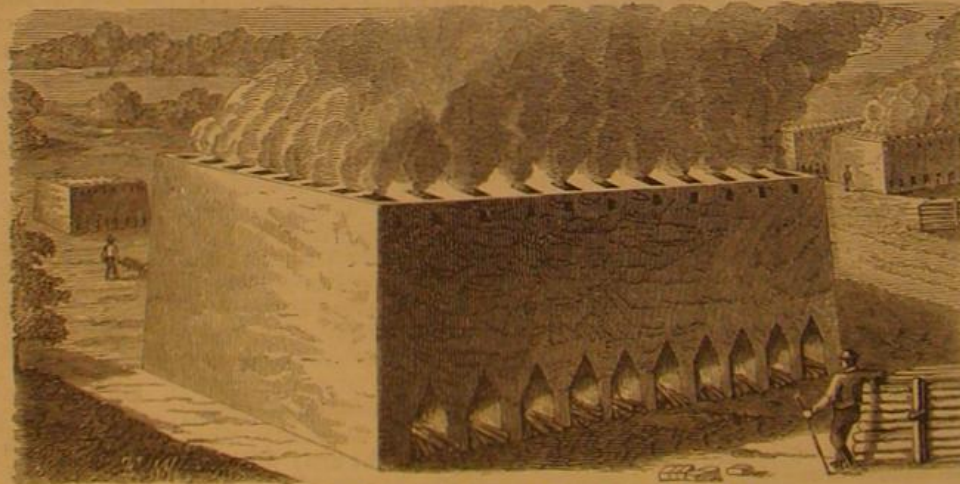
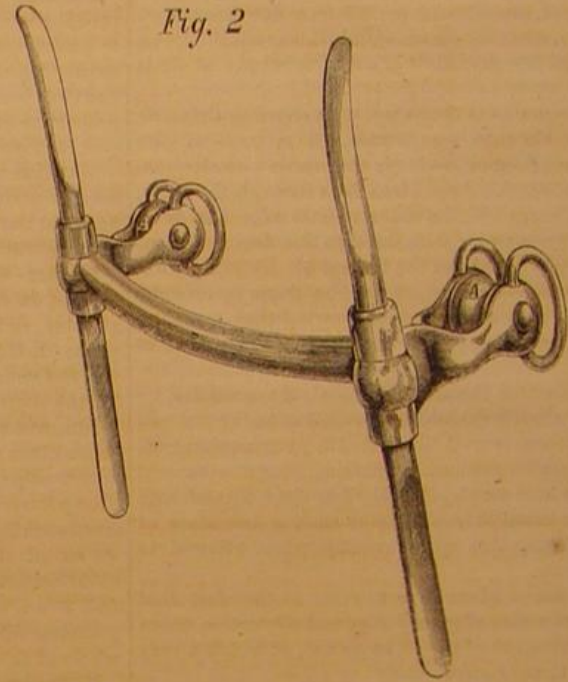
It was patented, through the Scientific American Patent Agency, June 20, 1871, by Samuel C. Brewer, of Water Valley, Miss., whom address for further information.

LEARN to do something, young man, and learn it well. Set it down that no man ever succeeded in this world without knowing how to do some particular thing better than his fellows. Whether it was in a store or a tinshop, in a bank or on the seat of an express wagon, excellence was shown, and made the beginning that is the foundation of a successful career. The doom of the sloth and the sluggard is told in the legend that appalled the Babylonian king: "Weighed in the balances and found wanting." Hard work is the price asked for success, and it can be purchased with no other kind of currency.

Fig. 1.



BARNES' IMPROVED PULLEY BRIDLE BIT.



BREWER'S IMPROVED BRICK KILN.

Fig. 2

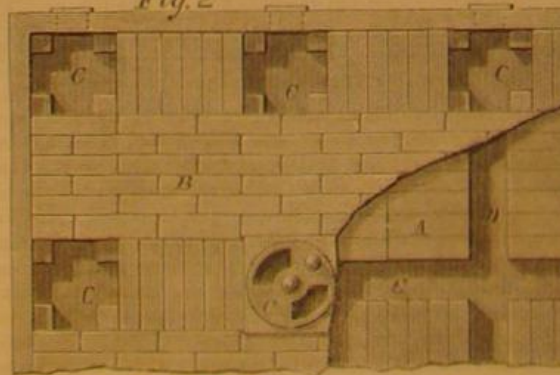


Fig. 3



so that, in every particular thus far, the kiln was just such as I and others have been putting up in this country for the last twenty years. Upon this structure, I placed an additional course of bricks upon the top of the kiln, so as to form a se-

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Importance of Advertising.

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

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

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

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

OUR OBLIGATIONS TO THE ARABIAN ALCHEMISTS.

It is well known that our modern chemistry, that wonderful science which, in this nineteenth century, is revolutionizing the industry of the world, is of recent growth. One century ago, it deserved hardly the name of a science; and only since the discoveries of Priestly and Lavoisier can it lay claim to be a systematic whole. And it has since grown in a twofold aspect: first, as a most practically useful pursuit; and, secondly, as one of the branches which ought to enter, more or less, into the curriculum of the studies of every man and even woman who lays claim to a civilized education, as it has a peculiar influence in the development of the human mind.

Still, notwithstanding the youth of this science as a systematic whole, it stands on a basis built ten centuries ago; in fact, our modern chemists may be considered to stand on the shoulders of the ancient alchemists, who, notwithstanding that they were always searching for unattainable results, have succeeded in discovering thousands of facts which have laid the foundation for that wonderful knowledge which gives us an insight into the secret recesses of the composition of matter. It is, therefore, highly interesting to trace the slow progress of that alchemistic science, chiefly nursed by the cupidity of men who wanted nothing but the increase of their personal possessions, and who, in place of that, increased the knowledge and well-being of the human race.

The *Divine Art*, as the ancient alchemists called their pursuit, appears to have been practiced first in Egypt, that cradle of knowledge; for historians tell us that the Emperor Diocletian, after the conquest of the rebellious Egyptians in the year 296, ordered that all the writings on the alchemy of gold should be burnt, in order that the people should not, by making gold, grow so rich as to commence a second rebellion. It was thus already known, at that time, that the success of revolutions and rebellions depends on the possession of money.

In the large European libraries, manuscripts on alchemy are preserved, many of them dating from Alexandria in the fifth century, and written by Greeks living in Egypt and practicing alchemy there. It appears, further, that when the Arabs invaded the north of Africa and the south of Europe, they learnt this art from the conquered nations; and the results of their labors and their wonderful advance are recorded in the archives of the Spanish Moors. So we find that Djafar, better known under the name of Geber, who lived in

the end of the eighth and the beginning of the ninth century, in Seville, Spain, and who was wise enough not to believe that any one had succeeded in making gold, discovered that a metal when calcined, which we now call oxidized, becomes heavier. It took 1,000 years to bring such facts to bear on the destruction of Stahl's theory of the Phlogiston, which taught that during this calcination, or burning of metals, something was driven out which had negative weight. Geber also was the first to make nitric acid by mixing blue vitriol, alum, and saltpeter, and distilling the mixture; he changed it into *aqua regia* by adding sal ammoniac; then he dissolved gold in the same, and obtained thus the solution of gold, so long searched for by other alchemists and supposed to be the elixir of life which would cure all diseases and even prevent death. The experiments undoubtedly made in this direction, however, failed, of course, and the results therefore have neither been recorded nor handed down. We know now that gold is one of the most dangerous elements to introduce into the human system, because its insolubility makes its removal afterward very difficult. Geber gives very clear instructions in many chemical operations, as sublimation, distillation, filtration, water and sand baths, cupels of bone earth to absorb the metals which become calcined (oxidized), etc.; and there is no wonder that, in the middle ages, he was called the master of all masters in alchemy.

Sulphuric acid was first made in the end of the ninth century by Rhazes, head physician to the great Bagdad hospital. He made it in the same way as at present practiced to make the Nordhausen vitriol, by distilling copperas. He also made absolute alcohol by distilling spirits of wine over quicklime, while phosphorus was made by Achill Bechil, who sublimated a mixture of urine, clay, lime and charcoal; he called it an artificial carbuncle, and said it shone in the dark like the moon. This was a lost discovery, when, in 1669, Brand in Hamburg made phosphorus in a similar manner. Geber had a clear conception of the evolution and combination of gases, which he called ghosts or spirits (whence our word "gas"). This is proved by his account which, translated, runs thus: "When spirits fix themselves in solid bodies, they lose their form and are in their nature no longer what they were before. When you compel them to be disengaged again, this is what happens: Either the spirit alone escapes in the air, and the solid body remains fixed in the alembic, or the spirit and the solid body escape (volatilize) at the same time."

As a few other eminent Arabian alchemists, must be mentioned El-Raii, Ebid-Durr, and Togbagré, who wrote an alchemical poem, and Djildegé, one of whose chemical works is called "The Lantern," a very significant title for such a subject. But the most astonishing fact of all is the definition which some of these authors give of the chemical science they practiced, and which is worthy of the nineteenth century. It is: "The science of combustion, the science of weight, the science of the balance."

PUDDLING IRON BY MACHINERY.—AN IMPORTANT IMPROVEMENT.

Many attempts have been made to supersede, by mechanism, the laborious and expensive hand processes, employed in making wrought iron, known as puddling. But until within the past four years, all efforts have failed. To Mr. Samuel Danks, of Cincinnati, Ohio, belongs the credit of having successfully solved the problem. He has invented improvements, now in successful operation, which promise to revolutionize the art, and which are recognized as indispensable to the trade by the leading iron puddlers of this country and England. Last year, Mr. Danks appeared before the Iron and Steel Institute in England, and read a very instructive paper, in which he described the practical workings of his inventions, as shown at Cincinnati, in such forcible terms, exhibiting, at the same time, such thorough knowledge of the whole subject, that the attention of the members was immediately called to its importance. They voted to appoint a committee to visit the United States, examine the practical operation of Mr. Danks' alleged improvements, and report in full to the Institute. The committee consisted of some of its most scientific as well as most practical members, and they came over here determined to make the most crucial tests possible. Every facility was granted them, and they went home fully satisfied that all that Mr. Danks had claimed had been realized in their presence, and even more, and they have so reported to the Institute. The invention is now being rapidly introduced in England, where hand puddling is declared to be doomed, and rotary puddling announced among the iron men as an accomplished fact. The saving effected by the use of the Danks machinery is placed at \$5 per ton of iron.

In puddling iron by the Danks process, a revolving furnace is employed in which the pig iron is melted down. This furnace is provided with a fire grate, and a blowing fan to urge the fire and supply the necessary gas. The revolving furnace rests on rollers, and its exterior has cog teeth by which motion is imparted. Mr. Danks gives the following particulars:

A suitable engine is attached to each machine, so that the furnace can be made to revolve at any speed that may be required according to the different stages of the operation. The most important feature in connection with the invention is the lining of the vessel. The foundation consists of what is termed the "initial" lining, which is composed of a mixture of pulverized iron ore and pure lime, worked with water into the consistency of a thick paste. The method of putting on this "initial" lining is fully described, and, when completed, the author says that upon it is placed the fettling

proper. A quantity of pulverized iron ore—about one fifth of the total amount required to fettle the apparatus—is thrown in, the furnace is heated and made to revolve slowly until the iron is found to be completely melted, and the apparatus is then stopped. That part of the molten iron, which has not been consumed by glazing of the "initial" lining surface, runs to the lowest level of the furnace, and there forms a pool, into which there are put a number of small and large lumps of iron ore of such dimensions as will be required to allow the said lumps to project over the surface of the liquid ore by from two to six inches. This part of the fettling is allowed to set, when a fresh quantity of pulverized ore is thrown in. The furnace is again made to rotate slightly until the newly added ore is liquefied, when the apparatus is again stopped, and the pool is filled with lumps as before. The operation is continued in this way until the whole of the vessel is properly fettled. From 2 to 2½ tons of iron ore are required to fettle a 700 pound furnace.

The iron is charged into the furnace either in a solid or molten condition. When charged in the shape of pig iron, the melting down occupies from thirty to thirty-five minutes, during which a partial rotation is given to the furnace, from time to time, in order to expose equally all sides of the charge to the flame. When the whole of this is thoroughly melted, the furnace is made to rotate once or twice per minute only during the first five or ten minutes, in order to obtain the most perfect action of the cinder upon the molten iron. A stream of water is injected through the stopper hole along and just above the line of contact between the floating cinder and the inner surface of the vessel on the descending side. A certain portion of uncontaminated cinder is thereby solidified on the metal surface, and is carried down into or below the bath of molten iron in a continuous stream, which, in rising up through the iron, combines with the impurities of the latter in a far more effectual and complete manner than any mode of puddling hitherto known can effect. On the expiration of the said five or ten minutes, the iron begins to thicken and the motion is stopped. The heat is then raised so that the cinder shall be perfectly liquefied, and the vessel is brought into such a position that the tap hole shall be just over the level of the iron, which by this time has become partly pasty. The puddler gently pushes back the iron and the cinder is made to run off. The heat is again raised, and the furnace is put in motion at a velocity of from six to eight revolutions per minute, by which means the charge is dashed about violently in the furnace. A high temperature being kept up, and the charge being continually turned over, the particles begin to adhere, when the velocity of the apparatus is lowered to from two to three revolutions per minute, upon which the ball then very speedily forms. The puddler then solidifies the front end of the ball by a few blows from a tool applied through the stopper hole. The props of the movable piece are then removed, and the flue hanging from the overhead rail is moved away. A large fork, suspended from a crane is put into the vessel along one side, and the ball, which by a turn of the vessel is rolled on to the fork, is then taken out by means of the crane. The ball is then worked in a squeezer. The flue is replaced after the requisite quantities of cinder and metal have been again charged, and the process is continued. From eight to ten charges are made before any refettling is required, and these heats are worked in a day of ten hours.

Mr. Danks claimed for the revolving furnace the following advantages: A great saving in the cost of labor and also in the consumption of coal, varying according to the size of the furnace; a superior and more regular quality of puddled iron from a given quantity of pig; a yield of puddled iron much in excess of the charge of pig metal, instead of the usual loss, the extra yield being obtained by the reduction of the rich fettling used in the machine; eight to ten heats, whether of from five to ten cwt., are made in a day of ten hours when suitable metal is used; the refining process is very complete, the whole of the phosphorus and silica, and the sulphur to a large extent, being removed by the chemical action of the lining mixture; the very heavy and exhaustive labor of puddling is performed by steam power, thereby enabling one skilled man to attend to the working of a large quantity of iron; the bringing to nature and balling of the iron is completed by the rotary action, without the use of rabbling, except when the heat has to be divided into smaller balls; and the capacity may be suited for heats of any weight from five cwt. upwards. The cost of the furnace, weight of product considered, is about the same as that of the usual hand puddling furnaces.

RESULT OF ILLUSTRATING A NEW INVENTION.

We have received a letter from Captain W. F. Goodwin, whose invention for the propulsion of canal boats was illustrated in these columns a few weeks ago, in which he alludes to the success he has attained in the introduction of his screw gear mower and reaper, which was illustrated in the SCIENTIFIC AMERICAN, November 25, 1871. After alluding in a complimentary manner to the great number of patents he has obtained through this office, he states that he has made some money out of his patents, but the amount would have been much larger had he earlier appreciated the advantages to be derived by placing his inventions before the public through the medium of the press. Immediately after the publication of the engraving and description of the mower and reaper in this paper, he states that he had so many letters of enquiry, from manufacturers and agriculturists for rights to build and for the purchase of machines, from every State in the Union and from Canada, that he was for a time exceedingly embar-

passed, not having the facilities for supplying the machines. "And much to my surprise and satisfaction," he says, "I found I had established, before I hardly knew it, a large business abroad; orders were received for machines from Europe, and applications for agencies as far north as Russia poured in upon me by every mail." The result has been the establishment of agencies in London, Edinburgh, Vienna, and St. Petersburg, and arrangements are about being consummated in Prussia. Captain Goodwin accords his success in the introduction of his harvester to the publication of it in the *SCIENTIFIC AMERICAN*, and closes his letter by stating that he hopes the same good result will follow the publication of his system of propelling canal boats that resulted from the publication of his mower.

ON ATMOSPHERIC AND PNEUMATIC PROPULSION.

The workings of the weather bureau have confirmed what was anticipated, namely, that the changes in barometric pressure are the causes of the winds, which, in their turn, become the causes of the different conditions of weather. If we trace the changes in the barometric pressure further back, we come finally to the solar heat which expands the air in some localities, and causes it to become specifically lighter than the cold air, and to the solar and lunar attractions which cause continual atmospheric tidal waves to run around our globe. In this way, our atmosphere is kept in a permanently agitated condition; and the colossal power expended in keeping up this agitation is something startling when we attempt to reduce it to our common measure of force, the foot pound. We have only to consider what an infinitely small portion of this force is utilized by sailing vessels, and what an enormous power is required to move about the sailing fleets of the world. Little Holland gives in its windmills an example of how this power may be further utilized; there are in that country (where the construction of windmills has been improved since more than 1,000 years, thanks to the study of the most profound mechanical thinkers) more than 12,000 windmills for the pumping of water alone, not like the mere toys we see in this country, but colossal structures of masonry 100 and more feet high, attended to by a regular crew, as is customary on shipboard, each mill lifting from ten millions to fifty millions gallons of water per day; there is an equal number of mills for sawing lumber, and at least an equal number for grinding corn. The total labor, performed by the utilization of the wind alone in that country of four million very industrious inhabitants, is estimated to equal that of four million horses.

In order to fix in the memory the relation between the velocity of the wind and the pressure exerted on a surface, it is best to remember that the velocity of a violent hurricane, of 100 miles per hour, exerts a pressure equivalent to 50 pounds on a vertical surface of one foot square, and that as the velocities decrease the pressures decrease as the squares of the velocities; so with half the velocity of the wind, or a storm of 50 miles per hour, the pressure is one fourth of 50 pounds or 12.5 pounds per foot; at one third the velocity, or a brisk wind of 33 miles per hour, the pressure is one ninth, or 7 pounds per square foot; at one quarter the velocity, 25 feet per hour, the pressure is one sixteenth of 50, or 3 pounds upon each square foot, etc. These rules hold for one square foot while the wind is in motion and can glide off all around the surface; when several square feet are united in one whole, so that the wind cannot glide off around each square foot, as in the case of the sails of a vessel, the pressures become considerably greater, and more still when the surface on which the pressure acts is enclosed in a tube or tunnel so that the wind or air is entirely prevented from gliding off or passing beyond the surface acted upon. The latter is practically the case with the system of pneumatic propulsion; and in order to see at once the great advantage of this mode of applying power, we have only to consider the effect of a difference of atmospheric pressure on both sides of the surface, acting as a piston in the tunnel of a pneumatic railroad, and separately attached to the car, or the effect on a well fitting car itself. Suppose the blowing machinery is able to raise the barometric column on one side of the car only one inch; this will be nearly one thirtieth of the whole mercurial column; and thus one thirtieth of the atmospheric pressure of 15 pounds, or half a pound per square inch, which is 72 pounds per square foot, will be exercised. If now the diameter of the tunnel is 8½ feet, the surface of the section will be nearly 55 square feet, and the total pressure, 55 × 72 or 3,960 pounds, almost two tons. This means that such a car will be propelled with an initial velocity equal to the effect of two tons suspended on a rope and the rope passed over a pulley to change the vertical traction into a horizontal one. As, now, on a level railroad, the friction resisting the propulsion is about one per cent of the total weight, the power thus obtained will be able to start any load less than 200 tons weight, and this load will move with increasing velocity, only limited by the capacity of the air blasts to supply more air as fast as the motion of the car diminishes the pressure.

Another consideration, greatly in favor of the system of pneumatic propulsion, is that a column of air enclosed in a tube or tunnel is in fact equivalent to an infinitely flexible and elastic rod, which may push a load forward through any number of curves and inclines; but what is most curious, it may be also used as a rope for pulling trains towards the source of power, by simply inverting the current and thus producing suction; or, in more correct scientific language, by diminishing the normal atmospheric pressure, it will propel the load by a simple excess of the ordinary pressure over the partial vacuum produced in front of the car. But the

most beautiful consideration of all this, is that this wonderful, infinitely flexible and elastic pushing rod and pulling rope costs nothing, never wears out, can never have a break or loss of connection; while, at the same time, we obtain the secondary but immensely important advantage of a most thorough ventilation in every part of the road, which is a necessity in localities so entirely excluded, from the atmospheric vicissitudes of hot and cold, rain and snow, as will be the case in the comfortable tunnel which, we flatter ourselves, will soon practically demonstrate its advantages to the population of our metropolis.

PROPOSED BOOK ON PATENTS.

There is a very general but erroneous opinion among a large class of people that patents are humbugs, and that more money is lost than made by them. Now the fact is that the greater part of the wealth acquired by manufacturers in every branch of industry has been acquired through some advantage, gained by inventive skill and secured by patent. There is hardly a successful manufacturing business in the country but owes its success in some way to patents. We do not say that all inventions are improvements, or that all patents are good; but we do say that nearly all valuable inventions are, or have been, patented.

We received a call a few days ago from a gentleman who is collecting facts and statistics for a book of successful inventions. We commend the idea as well calculated to remove the prejudice against patents, and as a matter of interest to all who are connected therewith. Instances enough have come under our own observation, of men who have made ample fortunes from patents, to fill a large volume had we written them down. But among the cares of business, many details have escaped our memory, while others are so dim that we cannot state them with the precision necessary for such a work. Nevertheless, we shall afford the author such facilities as are in our power, and in his behalf we cordially invite the co-operation of our readers. If they will send us statements of such instances as they may be acquainted with:

First. Where inventors have sold their patents in whole or in part for large sums.

Second. Where they have received or are receiving large sums as royalties.

Third. Where a large and successful business has been built up by manufacturing patented articles.

Fourth. Where articles are made cheaper by means of patented machinery.

Fifth. Where joint stock companies have been founded in part or wholly upon patents, and the stock has greatly advanced in value.

Names and figures and reliable information are wanted as far as possible. The book is designed to prove the actual benefit which has been derived from patents in the various branches of industry. If each one will contribute the facts within his knowledge, a work may be soon published which will be of inestimable value to inventors. Parties possessing such information will oblige by sending the facts to this office.

SUPPLEMENT TO THIS WEEK'S EDITION.

The attention of our readers is called to a supplement to this week's issue of the *SCIENTIFIC AMERICAN*, containing a full and exhaustive history of the discovery of petroleum, with complete descriptions of all the processes used in its refinement and manufacture. The works selected for illustrating this article are those of Charles Pratt's extensive manufactory. His establishment and appliances afford the best opportunities for describing the most recent and improved methods of treatment.

Subscribers are requested to see that their news agents deliver a supplement with each copy of our issue of May 18.

Balancing Slide Valves.

A correspondent, L. A. T., in commenting on the remark of a western engineer, published on page 121 of the current volume, states that "if a slide valve were relieved of all the pressure above and the cylinder filled with steam, the valve would of course be lifted from the seat."

When the engine is in motion and the steam chest filled with steam, the pressure on the slide valve is equal to that in any part of the chest; but then the valve gets considerable relief, although it is constantly increasing and decreasing as the valve slides to and fro upon its seat. For instance, when the valve opens a port, it instantly fills with steam, and at the time the valve cuts off that port, the pressure is equal above and below that edge of the valve; but as the piston travels back in the cylinder, the pressure in the port decreases until the valve exhausts that port; and then, from the time of the exhaust until the opposite port is opened, the cylinder is empty; and at this time the valve needs the most relief and gets none.

Now, if we relieve the valve of all its pressure, we commit an error. Why? Because it relieves itself, and the longer the steam follows the piston, the more we relieve the valve. For instance, we relieve it more when it is working at full stroke than when at half stroke, because we let a greater amount of steam into the cylinder at full stroke than we do at half stroke; and consequently we get a greater amount of pressure therefrom to relieve the valve just when it cuts off and before it exhausts.

To balance a slide valve successfully, we must take into consideration the relief as much as we do the pressure.

A MAN'S actions are effaced and vanish with him. But his intellect is immortal and bequeathed, unimpaired, to posterity. Words are the only things that last for ever.

American Ideas in China.

The Chinese government, influenced by the counsels of Yung Wing, an intelligent and enterprising native who enjoyed the advantages of a thorough college education in this country, has now determined to send over to us quite a number of young men for educational and professional training.

The plan, as it is now being carried out, is understood to be as follows:

1. The Chinese government to select thirty boys each year for five consecutive years, 150 in all, without distinction of rank and by competitive examination. They are not to exceed fourteen years of age when they enter the preparatory school at Shanghai or other schools that may hereafter be organized. Their education in Chinese is to be made as thorough as possible before they are sent to the United States.

2. The entire expense for their support and education in the preparatory schools and also while in the United States will be borne by the Chinese government.

3. An educated native of rank to be appointed as instructor to each yearly instalment, who is to accompany them to the United States and remain with them. He is charged with the instruction of the youths in the Chinese language and literature while in the United States, and is required to devote a portion of each week to that object.

4. The students are required to prosecute their studies for twelve years, and during that time each is expected to acquire one of the professions. They will not be allowed to remain in the United States beyond that period, nor to enter upon any private occupation.

5. Each student is regarded from the first as in the service of the Chinese government. A definite rank is assigned to him on the completion of his education, and he goes immediately into service on his return. In case the parents of any student are in narrow circumstances, a certain indemnity is to be paid them by the government.

6. The students will not be permitted to divest themselves of their Chinese nationality or become naturalized citizens of the United States.

From New York to New Orleans in Pneumatic Tubes.

A bill is now pending in Congress to incorporate the "National Pneumatic Tube Company," capital one hundred millions of dollars, with authority to lay pneumatic tubes between New York and New Orleans. The freight is to be carried in hollow balls, which are to be blown through the tubes, and this the projector thinks can be done at a high velocity and cheap cost. This plan of using "hollow spheres" in pneumatic tubes is very old. It was patented in England, by James in 1842, and again patented in this country, by Brisbane in 1869.

The idea of competing with long lines of ordinary railways by means of pneumatic tubes is chimerical. Pneumatics is well adapted for short routes in cities, where the traffic is large and the use of locomotives objectionable. But for extended lines through the country, the cost of construction, maintenance, and operation would be greatly in excess of an ordinary railway of same capacity and speed.

Measuring the Velocity of Railway Trains.

Several devices have been invented for registering the velocity of trains, but none of sufficient simplicity to come into general use have yet been suggested. Messrs Samman and von Weber's construction, a German invention, consists of a disk driven by clockwork and a recording pencil. While the train is halting, this describes a circle, but during the journey, a crooked line is produced by the vibration. In M. Cremer's apparatus, a strip of paper moves by clockwork. This paper is graduated and marked in minutes. A needle with an up and down movement, which is in connection with an axle, pricks the paper. The distance of the holes serves as a guide in ascertaining the speed. On French lines, an apparatus is met with in principle not unlike the centrifugal governor, the coupling box of which is in connection with and moves a pencil. In Schiff's apparatus, which is not unlike that of Cremer, the needle is moved by a battery, which renders its working more complicated and uncertain.

THE polarizing instrument, known as the Nicol prism, is composed of a prism of Iceland spar, divided at an angle into two halves, the angular surfaces polished and again united with Canada balsam. Professor H. F. Talbot finds that glass may be substituted for one of the halves of spar, and a good prism will be thus produced.

Nor long ago, the whole stock of the paraffin wax in the world did not exceed four ounces, which was carefully preserved in the laboratory of Professor Liebig as a chemical curiosity. There is now produced in Scotland alone a quantity of not less than 5,800 tons annually.

HERE is the business done by the Western Union Telegraph Company in one hour, by means of one wire, between New York and Boston, employing the Stearns instruments for sending messages both ways at the same time. From New York to Boston, 72 messages; from Boston to New York, 62 messages. Total, 134. This remarkable improvement in telegraph instruments doubles the capacity of every existing wire without increasing the cost of maintenance.

Edwin F. Johnson, one of the most eminent of American engineers, died on the 12th inst., and was buried at his home in Middleton, Conn. He was Engineer in Chief of the Northern Pacific Railroad until a little more than a year ago, and since has been Consulting Engineer of that company.

Fluorescence.

At a recent meeting of the American Institute, President Henry Morton, of the Stevens Institute of Technology, read a paper on "Fluorescence," or that action by which rays of the higher purple or even invisible light, such as produce photographic action most strongly, excite in certain bodies lower rates of vibration, resulting in the emission of light, generally of a red, green, or clear blue color. This paper was illustrated by a number of striking experiments. Thus, a flask of solution of chlorophyll (green coloring matter obtained from leaves), which is of an olive green color, being held in a beam of blue light proceeding from a "vertical lantern," appeared to be full of a blood red liquid. Various solutions, colorless in ordinary light, were then shown to exhibit the brightest hues, when illuminated by the violet rays of the lantern or those obtained from the electrical discharge of the Professor's large coil in rarefied gases. The speaker then announced that, in the course of the examination which he had been making of such substances, he had encountered one which he believed to be as yet unknown, and which possessed the property of developing light by fluorescence in a preëminent degree. This body was obtained from petroleum, and he would propose to take for it the name "viridin." The word viridin had been already applied as a synonym for chlorophyll, but was now practically obsolete, and too appropriate to the present substance to be thrown away. A large drawing of a flower, with leaves painted seemingly in light amber tints, was then shown and illuminated by electric discharges, when it appeared of the most vivid green. The peculiar fluorescent spectrum of this body and its relations to the spectra of other substances was explained, and many other illustrations were exhibited.

Experiments in a Compressed Atmosphere.

MM. Deville and Gernez are making a series of experiments in a chamber containing compressed air. In a cylindrical iron chamber of one hundred cubic feet contents, the sides of which have been proved to 165 pounds to the inch, these gentlemen have installed a complete set of apparatus. When the operators are shut in their cylinder, the air is compressed by means of a steam pump, when they proceed, as if in the open air, to ascertain the real condition of various substances, at the moment they combine in homogeneous flames, and the resulting temperatures. With certain precautions, the compression to which they are subjected presents no serious danger, and after a few moments, the difficulty of breathing disappears, even though the pressure amounts to nearly 45 lbs. to the square inch. At present the experiments are made only with the homogeneous flame of oxide of carbon and oxygen. With this and a pressure equal to one and seven tenths atmospheres, platinum melts, flying off in sparks with a facility that it never exhibits in the air; it melts in the elevated portions of the flame, which in the air would only heat it to redness. The temperature of these flames then augments with the pressure which they support, and, by consequence, the quantities of matter which combine are greater, and the dissociation diminished. Mr. Frankland's experiments have shown that the brilliancy of the flame of hydrogen gas increased considerably with the pressure, so that with a pressure of twenty atmospheres it surpasses that of a composition candle. In the same manner, when a mixture of oxygen and hydrogen is burned in an endometer, the flame is brilliant, while it would be nothing in the open air. M. Deville is of opinion that if you measure the quantity of heat disengaged by a substance which burns with brilliancy, the result would not be the same in operating with an opaque calorimeter as in one which allows the light and chemical rays to pass through it. This deserves noting for industrial applications.

Old Leather.

What becomes of all the old leather? We know that the scraps and trimmings that fall from the shoemaker's bench are collected and sold, and that these finally reach manufacturers of leather board, which, in cheap shoes, is used to give thickness to a sole which has but little real leather in it. But what becomes of worn out boots and shoes, and all other articles made of leather which have been cast aside as of no further use? It was in pursuit of this inquiry that we learned that worn out hose and belting are cut up into soles for boots, and that the "uppers" of boots and shoes whereof the soles have become demoralized, are carefully separated, subjected to various processes, which make them take on the semblance of newness, and then trimmed round, leaving them sufficiently large to make the "uppers" for smaller feet than they covered before. Thousands of such "uppers" are marketed annually, and it is not safe for those who buy their boots without regard to the standing of the dealers to assume that their understandings are new throughout.

A Mechanical Cat.

Leonard, of the Cleveland Leader, has invented a sheet iron cat, with cylindrical attachment and steel claws and teeth. It is worked by clockwork. A bellows inside swells up the tail at will to a belligerent size, and by a tremolo attachment, causes, at the same time, the patent cat to emit all noises of which the living bird is capable. When you want fun, you wind up your cat and place him on the roof. Every cat within half a mile hears him, girds on his armor and sallies forth. Frequently fifty or one hundred attack him at once. No sooner does the patent cat feel the weight of an assailant than his teeth and claws work with lightning rapidity. Adversaries within six feet of him are torn to shreds. Fresh battalions come on to meet a similar fate, and in an hour several bushels of hair, toe nails and fiddle strings alone remain.

Californian Estimates.

Californians are making estimates of the probable gross value of the products of the State during the present year. They give \$38,054,500 as the aggregate for wheat and barley; wool, \$12,000,000, or 30,000,000 pounds; fruit, \$8,000,000. The whole value of agricultural products is put down at \$50,000,000, of which, it is claimed, at least \$35,000,000 will be exported to Europe, Asia and the Eastern States. Add to this \$18,000,000 as the yield of the mines, and as much more for lumber, fish and live stock, and the total will reach \$80,000,000. A great many persons believe it will not fall short of \$100,000,000. Such an immense production and export, from a State comparatively so sparsely settled, shows that its producing powers are enormous.

The *American Builder*, Chicago, says, unsolicited, that: "Among the exchanges that come to our table we find none of greater value than the *SCIENTIFIC AMERICAN*, published by Munn & Co., New York; and if, during the three past years, we have quoted freely from its columns, our readers will bear witness that the matter has been well worth reproducing. It is not an easy task to conduct a journal devoted to industrial interests in such a manner that it shall be adapted to the tastes and capacity of the average reader, and yet command the respect and patronage of more thoughtful and scholarly minds. The *SCIENTIFIC AMERICAN*, while its contributors, many of them, rank among our most noted men of letters and science, is, nevertheless, most emphatically the people's paper. And there is not an artist or apprentice among our growing family of readers that would not be richer, in every true sense, at the end of every year, if he were to subscribe for it and take it regularly."

A CORRESPONDENT says: "The most deadly physical danger, threatening the whole community, in this country is the absorption of metallic poisons in water, food, medicines, washes, paints, dyes, enamels, etc., prepared and sold by the thoughtless and unprincipled; and the demand of every thoughtful patriot should be that no description of poisons should be sold under any other than its proper name. The public, in the sequester, is, and always will be, powerless to adequately protect itself against insidious poisons used in the many adulterations of the present day, and must perforce look for that protection to a government professing to guard the life and property of the citizen. Health is the most valuable property possessed by any one, and is life itself."

F. E. WILLIAMS, of Mount Washington, Md., writes as follows: "Sir: I have received the steel engraving in good order, and I am exceedingly pleased with it. I am well rewarded for my exertions in raising a club for your paper, and I shall use my influence to keep it up, and to get all I can to become subscribers to it."

THE annual meeting of the American Railway Master Mechanics' Association is to be held at the American House, Boston, Mass., June 11th, 1872.

The *Engineer* states that the oxyhydric light has not proved a success in Paris, and that it has been discontinued in the public lamps on the Boulevard des Italiens.

Facts for the Ladies.—Mrs. Sarah J. Fredericks, Toledo, Ohio, has used Sewing Machines for 17 years, the last 10 years Wheeler & Wilson's Lock-Stitch, and finds it far better than the other kinds; it runs lighter, with less fatigue, and holds a truer tension. She has used it for all kinds of dress-making and fancy work. See the new Improvements and Woods' Lock-Stitch Ripper.

Watch 1079, Stem Winder—bearing Trade Mark "Frederic Atherton & Co., Marlon, N. J."—manufactured by United States Watch Co., (Giles, Wales & Co.) has been carried by me two months; its total variation from mean time being half a second.—I. CALVIN SHAFER, 76 Cortlandt Street, New York.

Burnett's Cocaine dresses the hair perfectly, without greasing, drying, or stiffening 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.

Dry Steam, dries green lumber in 2 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patentee, Cleveland, Ohio.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$4 00 a year. Advertisements 10c a line.

For Sale or lease: Planing Mill with 30 horse Engine and return die boiler—one double surfacer and flooring machine—moulding machine—two circular saws with iron tables. All in first class order. Machinery sold separately if desired. L. Parker & Co., Gilmer st., Balt., Md.

Notice to Builders of Steam Fire Engines.—Gilmor st., Balt., Md. Descriptive Catalogue and Price List to Matt. Thornton, Master Mechanic, M. & B. R. E. Macos, Ga.

If you want a perfect motor, buy the Baxter Steam Engine.

Lyman's Gear Chart, with full directions for Laying out Teeth. Price fifty cents. Address, Edward Lyman, C. E., New Haven, Conn.

Grindstones for Edge Tool Manufacturers. Worthington & Sons, North Amherst, Ohio.

Glass Cutters' Wheels.—J. E. Mitchell, Philadelphia, Pa.

Grindstone Shafts and Pulleys.—J. E. Mitchell, Phila., Pa.

The Baxter Steam Engine is safe, and pays no extra Insurance.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro., 411 Water st., N. Y. Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside page.

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.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th 1869. Also, Glazier's Diamonds—John Dickinson, 64 Nassau st., N. Y.

Power Punching and Shearing Machines.

For car builders, smith shops, rail mills, boiler makers, etc. Greenleaf Machine Works, Indianapolis, Ind.

Everything for Cider Mills and Vinegar Factories. Address J. W. Mount, Medina, N. Y.

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

For Tri-nitroglycerin, insulated wire, exploders, with pamphlet, as used in the Hoosac Tunnel, send to Geo. M. Mowbray, North Adams, Mass.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 121 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Presses, Dies, and Tanners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

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.

Enamelled and Tinned Hollow-Ware and job work of all kinds. Warranted to give satisfaction, by A. G. Patton, Troy, N. Y.

Best and Cheapest—The Jones Scale Works, Binghamton N. Y.

A full set of dies, power-presses, etc., for making several kinds of dissectable tin hand lanterns for sale, to close an estate. Terms liberal. For particulars, apply to Clarence Sterling, P. O. Box 563, Bridgeport, Conn.

5,000 Tanners should Manufacture and Sell Wilcox Self-Sealing Fruit Cans, patented March 19, 1872. State and County Rights for Sale. For particulars, address A. A. Wilcox, 400 Chestnut St., Phila., Pa.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 18 Park Place, N. Y.

Hoisting and Pumping Engines (Locomotive principle); best and simplest, from 6 to 40 H. P. J. S. Mundy, 7 R. R. Av., Newark, N. J.

I want a Machine for rapidly trimming Printed Labels to a Round form. Address C. N. Morris, Cincinnati, Ohio.

Wanted—A Partner, with Capital to perfect and patent a new Hay Conveyor. Walter Smith, Weston, Mass.

Send for matter relating to the Hutton Governor. It will save its cost in three months, on heavily loaded engines. In use in the largest manufactories in America. It is not a ball regulator. J. Aug. Lynch & Co., Boston, Mass.

Wanted—Parties having Light Planers and Good Shingle Machines for Sale, will send Circulars and Price to D. B. Cade, Jr., Danburg, Wilkes Co., Ga.

Callow's New Patent Mode of Graining Wood. Makes Painters grain all woods first class who never grained before; Likewise makes Grainers lightening fast who thumbed it out before. Address, with stamp, J. J. Callow, Cleveland, Ohio.

See advertisement of Dederick's Self-adjusting Crank Box.

A competent Superintendent for the manufacture of Malleable Iron may hear of a situation on application to the Springfield Malleable Iron Works, Springfield, Ohio.

The most economical Engine, from 2 to 10 H. P., is the Baxter.

An experienced Patternmaker, has a good knowledge of Draughting, used to Steam Engine, Mill, and House Work, wants a situation as Foreman. Address Lock Box 59, Corry, Pa.

Partner or Purchaser wanted for an agricultural implement and wagon factory, at Kansas City, Mo. Machinery first class; business well established. Address O. C. & Co., Box 3977, Kansas City, Mo.

Wanted—To rent or lease, a building with good water power, suitable for woolen manufactures. Address W. K. N., Box 2099, N. Y. City.

Owners of patents for articles in general hardware trade can sell, or have made and introduced on royalty to advantage by Van Wagener and Williams, hardware manufacturers, 21 Park Row, New York.

Wanted—A Purchasing Agent in every city and county, to supply Nye's fine Sperm Sewing Machine Oil. Put up in Bottles, Cans, and Barrels, by W. F. Nye, New Bedford, Mass.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N. J. Also 3-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

The Patna Brand of Page's Patent Lacing is the best. Orders promptly filled by the Page Belting Co., No. 1 Federal St., Boston. Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

For Steam Whistles, address Exeter Machine Works, 75 Congress Street, Boston, Mass.

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

Lord's Patent Separator for Ores, or any dry material, built to order. State rights for Sale. 231 Arch St., Philadelphia, Pa.

Important—Scale in Steam Boilers—We will Remove and prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

"Anti Lamina" will clean and keep clean Steam Boilers. No injury to iron. Five years' use. J. J. Allen, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 22 Broadway, N. Y., or Box 1809.

Billiard Cushions—Manufacturers of Billiard Tables, use Murphy's Patent Cushions. The finest made. Send for sample set. Gatta Percha and Rubber Manufacturing Company, 9 & 11 Park Place, New York.

For the best Recording Steam and Indicating Gauges, address The Recording Steam Gauge Co., 91 Liberty Street, New York.

Farm Implements & Machines. R. H. Allen & Co., New York.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Amy, 331 and 333 Cherry Street, Philadelphia, Pa.

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, &c. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

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

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.—**POISONOUS COLLARS.**—What is the best test for discovery of lead in the enamel of paper collars?—S. K.

2.—**PARIS GREEN.**—What is the chemical composition of Paris green, which is much used to kill the potato bug? By what name is it known in works on chemistry?—J. C. K.

3.—**SEWAGE.**—Where can I find reliable information relative to the value and management of sewage?—F. T. F.

4.—**KILN-DRYING LUMBER.**—I wish to know how to construct a building for kiln-drying lumber, the length of time required for drying, and how such lumber compares with that seasoned out of doors.—O. C. H.

5.—**ANNEALING STEEL.**—What is the best and easiest way to anneal pieces of steel, say 3x3 square and about six inches long? I use them in lots of 100 and 200.—U. E.

6.—**POWER FOR BOAT PROPULSION.**—Will some correspondents tell us how large a boat can be driven by a boiler with twenty-one feet fire surface? What should be the power of the engine? Should the boat be a stern wheel, side wheel or screw propeller, in order to get the greatest speed and power?—F. & W.

7.—**DYEING OR STAINING HORN.**—Will some reader of the SCIENTIFIC AMERICAN inform me how I can dye or stain horn a jet black without injuring it? I would prefer something that will not stain the hands in applying it. I have read somewhere that the people of one of the eastern races dye their finger nails black. What do they use?—E. C. S.

8.—**WORMS IN HICKORY.**—Will some of your correspondents inform me what will stop the ravages of worms in the sap of hickory plank? The plank was cut in winter, put up under cover, and the bark taken off.—B. C.

9.—**PROTECTING SHEET IRON FROM CORROSION.**—How can I coat my sheet iron hood inside, to protect it from the corrosive effects of acid or chemical fumes, so that the coating will not be impaired by heat?—G. B. M.

10.—**ELECTRO-DEPOSIT OF STEEL.**—How may electrotypes be faced with steel?—G. B. M.

11.—**TRANSPARENT VARNISH.**—Can any of your readers inform me how to make a thin glaze or varnish that will not dim a pure white ground or pigment, but allow the white to shine through clearly and transparently? It must at the same time be capable of being cleaned with soap and tepid water, and not be sticky to the touch. The ordinary varnishes tend to make the white ground appear a pale yellow.—W. S.

12.—**DISSOLVING WOOL OUT OF MIXED FABRICS.**—Which is the best method of extracting wool from woollen and cotton rags? At present I use muriatic and sulphuric acid; but I have been given to understand that there is a much better process with vegetable and mineral matter combined.—J. S.

13.—**HYDROGEN LAMP.**—Will E. X., who gave directions for making a hydrogen lamp, or some one else, please inform me: First, how to tell when the air is expelled and it is safe to light the lamp? Second, when the materials are all in, if the lamp be corked tight and the vent closed, will the gas keep on forming until it forces out the cork or breaks the lamp, or does it only fill the space above the water and then cease forming until some is let out at the vent? Third, about how long would a lamp (of say about four or six ounces) keep in order without a renewal of the materials being required?—L.

14.—**REMOVING INK STAINS FROM PAPER.**—A valuable work of mine having been damaged by ink on the margins and the plates, I wish to remove it without defacing the paper. I have tried to remove it, but am unable to keep the paper from wrinkling and buckling. I have used oxalic acid and also salt of lemon, and I can partly succeed, but still it leaves a stain. What process is used to remove the ink from checks when they are altered? The process must work well, as I have seen checks from which the ink was so completely removed that it could not be found by acid or the microscope. There can hardly be any secret in it, as it is done so often.—R. W. A.

15.—**PAINT FOR IRON WORK.**—What is the best paint to put on iron railing, so that it will keep glossy and shining? I have used asphaltum and shellac, but the effect of the weather soon makes it look dead. I want something that will make the railing look as if just varnished.—J. O.

16.—**PRESERVING BIRD SKINS.**—Is there any preparation or preserving skins of birds, etc., that is not poisonous? Arsenic, strychnine, etc. are rather unsafe to handle and to have about the house.—G. C. T.

17.—**SMOOTH BRASS CASTINGS.**—Will some one please inform me how smooth brass castings, such as globe valves, etc., are produced? Has the composition of the brass anything to do with it?—P. P. Q.

18.—**CEMENT FOR TEXTILE FABRICS.**—Can any one tell me of a waterproof cement for textile fabrics, very adhesive on instant contact?—E. F.

19.—**FINISHING GAS FITTINGS.**—Will some one inform me, through your paper, how I may produce the bright brown finish we see on modern gas fixtures? The composition I use is spelter.—W. A. M.

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 10¢ a line, under the head of "Business and Personal."

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

A. D. T., of Mo.—The white specimens which you send are chalcodry; the translucent red is carnelian; the opaque red, jasper. The carnelian is the only one of any value.

S. H., of Pa.—The specimen you send consists of mica and quartz, of no use in the arts.

F. & W.—We publish your first query; the second is a business enquiry. See notice at the head of this column.

PREPARING SKELETON.—If G. L. F., query 10, page 200, will place his animal on an ant hill, the ants will make the skeleton as clean as a contribution box in dog days.—S. A. T., of Mass.

OZONE.—C. R. will find directions for the preparation of ozone on pages 214 and 225 of this issue of the SCIENTIFIC AMERICAN.

CONE PULLEY.—E. B. T., of Pa., is referred to pages 128, 129, 130 of Vol. XXV. of the SCIENTIFIC AMERICAN for a full discussion of this subject.

TELEGRAPH SOUNDER.—To C. P. P., query 17, page 281.—Your magnet is wound with No. 16 wire, which is too coarse. Use No. 20 or 22, and your sounders will work together perfectly.—S. G. S., of N. Y.

INFLAMMABLE LIQUID.—Is there any liquid sufficiently inflammable (retaining its inflammability) quality when exposed for any length of time to insure a cord or thread, that has been thoroughly saturated with it, being set in a blaze by the flash of a gun cap in its immediate vicinity?—A. B. C. Answer.—There is no liquid sufficiently inflammable for your purpose, except those which are too volatile to remain exposed for a short time without being evaporated. But there are pulverulent solids which you may make to a paste and then incorporate into your cord; such are duality, giant powder, dynamite, picrolin, etc.

RHUBARB IN TIN CANS.—Some rhubarb stalks were washed in cold water, boiled in an iron kettle, put into cans made of good charcoal lined plate, and then soldered down. In December last my family were all made sick by eating a pie made of this fruit. To be sure of the cause of the sickness, we tried the rhubarb again with the same result. The effects were vomiting and purging. Can any one give me an explanation?—C. H. G.—Answer. The acidity of rhubarb is caused by oxalic acid, and this has dissolved the alloy of tin and lead or your tin cans, forming an oxalate of tin and of lead; these metallic oxalates are poisons, producing vomiting, etc.

PROPORTIONS OF TELESCOPE.—To T. J., query 16, page 281. Your eyepiece is too strong for your object glass. Use a longer and larger eyepiece, say one 6 inches long, which will give you a power of about forty times. This is ample for a two inch object glass for terrestrial objects.—S. G. S., of N. Y.

BATS.—I would say, in answer to J. E. P.'s query, that if he will find the hole that the bats visit, and put some cayenne pepper in it and around the edges, he will never be troubled with bats. Bats also cannot stand it; they are sure to leave.—H. C. R.

DURABLE WHITEWASH.—To E. C. W., page 265.—The addition of one pound of sulphate of zinc in solution, to a pall of whitewash, will improve the color and prevent the wash from rubbing off.—E. H. H., of Mass.

MORTAR FOR DRYING OVENS.—To J. K. C., query 13, page 265.—I have used, for a similar purpose, a mortar made with common glycerin and litharge to a not very thick consistence. If the bricks are hard burned, the composition may be stiffer than if soft, as, in the latter case, more glycerin will be absorbed, and the joint will not be good if the cement is too dry. My success was quite what I desired; the mortar was hard and firm.—E. H. H., of Mass.

COATING IRON WITH EMERY.—To J. M., query 3, page 281.—First paint your cylinder with a good body of white paint, and when perfectly dry and hard, apply your glue and emery.—E. H. H., of Mass.

CLEANING COTTON WASTE.—Query 9, page 281.—S. R. F. will find the following plan to answer: Pack the waste in a tin cylinder with a perforated false bottom and tube with stopcock at bottom. Pour on the waste, bisulphide of carbon sufficient to cover, and allow to soak a few minutes, then add more of the bisulphide, and so on for a time or two, and then squeeze out. By simple distillation, the whole of the bisulphide, or nearly all, can easily be recovered and so be used over again. The cotton may remain soiled with fine metallic particles, but it will be free from grease.—E. H. H., of Mass.

SEPARATION OF MERCURY IN A THERMOMETER.—To F. D. H., query 1, page 281.—Fasten a string two or three feet long securely to the instrument, and then swing it vigorously round your head for a turn or two. The centrifugal force will be sufficient to cause the broken column to unite, provided neither tube nor bulb is cracked. An almost imperceptible crack in either is quite sufficient to utterly spoil a thermometer. A barometer tube may be carefully inverted, or sometimes gentle tapping will be sufficient so long as the vacuum is perfect. But, in the latter instrument, it can only occur in a very small tube, where capillary attraction, or friction from a soiled tube, overcomes the gravity of the metal.—E. H. H., of Mass.

TELEGRAPH SOUNDER.—To C. P. P., query 17, page 281.—If your magnet were wound with No. 30 silk covered wire, your instrument would probably work, but the armature would not even then give a very distinct sound. The resistance in the relay coil is too great; and in order to have your sounder work well, you must equalize this resistance. Therefore construct a magnet of the same size as the relay.—W. H.

ÆOLIAN HARP.—To J. F., query 4, page 297.—This instrument consists of a long narrow box, of very thin wood, about five inches deep. A circle is cut, in the middle of the upper side, an inch and a half in diameter. Stretch on this side, over bridges, seven or more strings of very fine catgut; these must all be tuned in unison. Place where a current of air will pass over the strings. A window just the width of the length of harp is a good place.—G. C. T.

Recent American and Foreign Patents.

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

GRAIN STEAMING APPARATUS.—Samuel W. Crampbell and James C. Evans, of Kansas City, Mo.—A new apparatus for steaming wheat or other grain preparatory to its introduction to a grind mill, with the object of thereby toughening the bran and preventing the flour from being specked by small particles of the bran constitutes the subject matter of this patent. The invention consists in the arrangement of a vessel containing a perforated inclined partition, over which the grain moves in its passage to the mill, and through which the steam reaches the grain.

RAILWAY SIGNAL.—Joseph F. Andrews, of Nashua, N. H.—This invention has for its object to provide an improved practical means of operating signals at railroad crossings by the trains that approach such crossings and at a suitable safe distance therefrom, to give timely warning to persons approaching the track when the trains are crossing. The invention consists in the arrangement of a vertically movable rail set on springs, which is crowded down by the weight of the train passing over it, and connected with the signal, moving the same when depressed.

LINK BLOCK FOR SLIDE VALVE.—Edward Marsland, of Sing Sing, N. Y.—To counteract the reduction in the size of a link block occasioned by wear is the object of this invention, which consists in making the block expandable and contractable—that is to say, making it in sections—so that it can be enlarged to fit the curved guides, or made to firmly embrace the pin that connects it with the valve. The invention seems well adapted to all link blocks for slide valve engines used on locomotives and other machinery.

WASHING MACHINE.—Newton C. Goodloe, of Okaloosa, Miss.—This invention relates to a new dashing apparatus of a washing machine, and consists in making the same in form of a hollow three sided prism, with perforated sides and a hinged door, and provided with projecting gudgeons, whereon it can be rapidly revolved within the suds box to insure efficient and expeditious results.

SAWING MACHINE.—Cornelius B. Morehouse, of Washington, Iowa.—This invention relates to a new and useful improvement in machines for sawing firewood and for other purposes; and it consists mainly in an automatic feeder, in combination with one or more saws.

PAINT COMPOUND.—Samuel F. Mathews, of Harrisburg, Pa.—This invention relates to paints for covering and preserving various substances.

BREACH LOADING FIRE ARM.—Orville M. Robinson, of Plattsburgh, N. Y., assignor in full to "The Robinson Arms Co.," same place.—This invention relates to an improvement in the loading, cartridge extracting, and adjusting mechanism of breach loading fire arms, and consists in a new arrangement of reciprocating carrier block, vibrating breech block, adjustable gate, and operating levers, whereby the necessary processes can be rapidly carried out.

PRAIRIE BREAKER.—Cornelius M. Clark, Seward, Neb.—This invention relates to a new plow for breaking prairie land, and consists in a new wire mold board for turning the sod with the least amount of friction, and in new arrangement of cutter, guide wheels, and handles for facilitating the operation.

MAP AND CHART RACKS.—Frank G. Johnson, Brooklyn, N. Y.—The object of this invention is to provide convenient means for exhibiting maps, charts, sheets of music, engravings, etc., designed more especially for school and lecture rooms, but applicable to all similar purposes; and it consists in lever brackets projecting from the wall or from a portable frame, and in suspending wires or rods, and in tension rods for straining the suspending wires, and in arranging the whole so that charts, maps, sheets of music, etc., may be allowed to slide laterally, and so that any single one may be exhibited in full or in part.

SPRING FOR RAILWAY CARS.—Henry Jeffrey and Henry Fisher, Aurora Station, Indiana.—This spring consists of a series of plates of square form, each supported on two diagonal corners by blocks in a cast iron shell or case, one above the other, two opposite diagonal corners being free. When weight is applied, each plate springs diagonally from corner to corner.

CART BODY CATCH.—Charles F. Chew, Swedesborough, N. J.—In this invention the cart body is hinged to the axle in the usual manner, and the front of the body is provided with a staple and hook of such length that the hook may pass down far enough to catch over the edge of a cross bar which extends across the shafts. When the hook is unfastened and thrown back, the body may be readily tilted and the load dumped. The body is again fastened on being simply raised, as the hook, by gravitation, secures itself upon the cross bar.

SEED DROPPER.—William C. Willey, Limerick, Ill.—This invention has for its object to furnish an improved seed dropping device, so constructed and arranged that it may be attached to any ordinary planter, and shall at the same time be simple in construction, easily and conveniently operated, and reliable and accurate in operation. It may be attached to any ordinary planter, and consists principally of the following parts: A vertical lever, giving reciprocating motion to a horizontal bar, and thereby oscillating the arms connected with horsehoe-like bars whose ends project upward into the seed chambers. These ends carry cups to take up the right quantity of seed; and, as the curved bar oscillates, the cups are alternately raised and discharged into a spout which conducts the seed to the ground.

FIRE PLACE.—Samuel D. Dearman, Rocky Hill, South Carolina.—This invention furnishes an improved cast iron fire place, so constructed as to serve as a security against fire and as a radiator of heat, and at the same time is simple in construction, easily applied, and durable. This fire place is constructed of three cast iron plates, standing and secured in the brick-work of the hearth. The back plate is bent forward until its top edge stands away from the rear brick work and crosses the mouth of the chimney about midway. The lower front of this plate is provided with projecting ribs to hold the wood forward, and to form a channel up which the heated air may pass to an opening in the upper front which leads to the space left between the back part of the plate and the brick work of the chimney. This arrangement produces a strong draft and prevents smoking. The opening is closed, when required, by shutting a damper hinged to its upper edge—which naturally, from the forward curve of the plate, hangs open. The chimney is also fitted with a damper, by which all draft may be shut off in case of fire.

CULTIVATOR.—Hugh Paxton Jordan, Victoria, Texas.—This improvement is intended to make this invention, patented January 10, 1871, more convenient and effective. To describe it in detail would occupy too much space. By this construction, the levers which guide the inner plows may be raised as required in driving, and yet leave the driver control of the plows by their lateral movement. By depressing these levers, the inner plow standards are raised from the ground, and may be kept so while turning, etc., by catching the lever ends on catches provided for them. To these inner standards are pivoted rods, which are hooked into holes in a plate attached to the outer standards; so that the outer standards are raised and lowered by corresponding motion given to the inner ones, and so that the outer plows may be set to work deeper or shallower than the inner, by adjusting the hooks in the plate.

FRUIT DRYER.—Charles A. Boynton, Vineland, N. J.—This invention relates to an improved apparatus for rapidly drying fruit and vegetables for preservation, and consists in the arrangement of a rotary rack that contains the fruit supporting shelves, with stationary top and bottom plates and conduits, whereby a series of up and down hot air passages through the several shelves is obtained, exposing all the fruit in the apparatus to varying degrees of heat, according to its distance from the place where it was put in. The invention also consists in the combination, with the apparatus, of a fan, by means of which air is drawn through it with desired effect.

COMBINED BUREAU AND WASH STAND.—Joseph Schneemann, New York City.—The object of this invention is to produce a convenient piece of furniture for hotel and private use, of pleasing exterior, and which will, though apparently a bureau, also fulfil the offices of a wash stand. The invention consists in the general arrangement of parts, and also in the combination, with a sliding wash bowl holder, of a vibrating soap cup.

CAR COUPLING.—George W. Loyd, Markleysburg, Pa.—This invention relates to a new car coupling, in which the system of detachable or removable coupling pins is dispensed with, and swinging hooks are substituted in their place. The entire mechanism seems to be extremely simple, not likely to get out of order, self coupling, and substantial, and for these and other reasons, better adapted to railroad cars than the couplings in common use.

FLOW.—William B. Bradford, Charlotte, North Carolina.—The object here is to construct a plow conveniently adjustable for use for subsoiling and other purposes. The rear end of the beam is curved downward and forward, so as to serve as a standard for the subsoil plow to be attached to. The handles are pivoted by their forward ends to the beam, a little in front of its downward curve. The upper plow standard is slotted or divided from its upper, to almost, its lower end. The arms formed by the division pass outside the beam and are pivoted together to the handles some distance behind their pivoted ends. The standard is secured to the beam by a bolt passing through its arms and the enclosed beam. Several holes being made in the beam, the shifting of the bolt from one to another of them effects the adjustment of the standard for its different uses. The draft strain upon this upper standard is sustained by a brace pivoted into its slot, which brace is also slotted, so as to slide over the lower standard, to which it is again pivoted.

BAND SAW MILL.—Henry Peterson, of East Germantown, Ind.—It would be impossible to give an adequate description of this invention without several drawings and a lengthy description. Its principal features are an arrangement for operating the carriage and knees, on and against which the timber rests while being sawed, by means of a toothed bar and gear wheels which give motion to screws connected with the knees, and a combination of levers, etc., for the purpose of throwing out of gear automatically the apparatus for setting the timber up to the saw. It is a simple and ingenious device.

POTATO AND PEANUT DIGGER.—James M. Lumbard, of Decatur, Mich.—The axle of the digger is bent four times at right angles, so as to bring the middle part nearly to the ground. The rear end of the tongue has four arms, which are severally connected with the angular bend of the axle, and form therewith a vertical rectangle. The rear end of the plow or scoop is so bent as to rest on the lower bar of the rectangle without slipping when the draft strain comes on it. The front part is supported at the required inclination by chains attached to the lower arms, and the back end is provided with two curved handles for its management.

OYSTER DREDGE.—Thomas W. Landon, of Fairmount, Md.—To a frame work of ordinary construction is attached the usual wire bag or net; and a tooth plate is pivoted by its ends to the lower ends of the bows of the frame. A trip bar extends along the lower side of the rear part of the tooth plate and its ends are bent inward and attached to it. The whole is so arranged that when thrown overboard the resistance encountered by the trip bar will bring the tooth plate into working position; and when the dredge is raised, the weight of the oysters in the bag will bring it back into line with the frame so as to pass readily over the roller.

LINING FOR FURNACES, SAFES, ETC.—Augustus C. Hamlin, of Bangor, Me.—This invention consists in the application of itsacolumite, as a lining for safes, furnaces, towers, to the manufacture of crucibles, and similar uses where its heat resisting qualities can be utilized. The material named is a laminated granular quartz rock, consisting mainly of quartz sand, but containing a little talc, and possessing a degree of flexibility when in the lamina. It is, at present, mostly found in the States of North Carolina, South Carolina, and Georgia. Its flexibility allows it to be easily worked into the lining of heat resisting articles specified, and permits thus the direct and inexpensive application to practical purposes of the valuable properties of quartz and quartzite. The peculiarity of structure or composition of the itsacolumite permits the expansion and contraction of heat and cold without destruction, and the material is therefore admirably adapted to all operations where the action of heat is to be resisted. It may be separated into sheets or slabs, and may also be pulverized and molded into crucibles.

OVERCOMING DEAD CENTERS AND PREVENTING BACK MOTION OF CRANE WHEELS.—John Coy, of Oswego, N. Y.—The invention consists in taking the pitman off the dead points by constructing it with a loose joint near end, also, in combining a flanged friction disk and cam on pitman to prevent back motion.

AWNING FRAME.—James W. Loane, of Baltimore, Md.—The invention consists in a frame and side pieces so constructed that the awning can be raised, thrown back, or lowered with great ease and celerity, while it can be quickly taken to pieces and packed in a small compass for transportation. This device has great advantages, and should be in the possession of every one who uses a tent or awning.

HAND CUTTING FORK.—David Arnold, of West Lodi, Ohio.—A fork which has an attachment for cutting the bands of grain sheaves, and other attachments for holding the cut band and the sheaf while the same are on the fork, has long been desired by farmers, as in feeding sheaves of wheat, etc., to thrashing machines it is important to have the bands cut promptly prior to the entry of the sheaf into the machine. This object is attained by the use, on the main fork, of a knife and a yielding fork, and also by a peculiar kind of main fork. When a fork of this kind is applied to a sheaf in a position to bring the knife at right angles across the band, wherewith such sheaf is tied, the knife will, after the prongs have entered the sheaf, commence to cut the band. The small fork will, at the same time, enter the band below the main fork and yield to the progress of the cutter.

FERTILIZER.—Joseph Ramsey Black, of Ninety-Six, S. C., has invented a new fertilizer compound, of such nature that by its use the most beneficial results on growing crops are intended to be obtained without impoverishing the soil or the owners thereof. The invention consists in a combination of stable manure with cheap chemicals, that thereby the elements of an excellent fertilizer are produced at comparatively little expense, and at a small outlay of labor. The chemicals are saltpeter, common salt, lime, and ashes.

DIE FOR SHAPING TEA KETTLE BAILS.—James Britton, of New York city, proposes the use of a new set of punches and dies for shaping tea kettle bails from flat sheet metal bands. The arrangement of projecting beads and receding grooves in the faces of said tools for the purpose of forming a bulge on the middle part of the bail constitutes the principal features of the invention.

DOOR SPRING.—Friedrich Stemmler, of East New York, N. Y.—This is a new means of connecting a door with a spring for closing it from both sides; and consists in a new combination of the door pivot with two spring contracting plates, and with the spring and drum, in such manner that when the door is swung open to either side the spring will be contracted for shutting as soon as the power opening the door is detached from the band.

MACHINE FOR MAKING CHAINS.—William C. Edge, of Newark, N. J.—This machine is intended for the manufacture of fine chains for jewelry, and consists principally in the use of reciprocating punches whereby the end of each chain link is expanded after it has been introduced to its place in the chain and previous to being bent.

[OFFICIAL.]

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DESIGNS PATENTED.

5,807.—CARPET.—W. De Hart, Amsterdam, N. Y.	
5,808.—BURNING CASKET.—G. Hasecoeter, Richmond, Ind.	
5,809.—BUTTER DISH.—J. Hill, West Meriden, Conn.	
5,810.—METALLIC GRATING.—J. K. Ingalls, Starkey, N. Y.	
5,811.—CARPET.—L. Jullien, Passy, France.	
5,812.—CARPET.—M. Robinson, Halifax, England.	
5,813.—RANGE STOVE.—G. Smith, H. Brown, Philadelphia, Pa.	
5,814.—BURNING CASKET.—F. Weseman, Brooklyn, N. Y.	
5,815.—GARDEN VASE.—R. Wood, Philadelphia, Pa.	

TRADE MARKS REGISTERED.

799.—TOYS.—Althoff, Bergmann & Co., New York city.	
800.—LINIMENT.—C. F. Brown Chemical Company, New York city.	
801.—LEATHER.—J. Davis & Son, Pawtucket, R. I.	
802.—MARQUETTES.—J. Dill, Boston, Mass.	
803.—COFFEE, ETC.—E. H. Garbutt & Co., New York city.	
804.—WRITING PAPER.—J. M. Goodall, London, England.	
805.—POLISHING BRICK.—T. T. Lacombe & Co., St. Louis, Mo.	
806.—MEDICINE.—W. Renne & Sons, Pittsfield, Mass.	
807.—PERFUME.—J. Rose, Dover, N. H.	
808.—MEDICINE.—Russell & Seabold, St. Louis, Mo.	
809.—SHIRTS, ETC.—Thalheimer & Hirsch, Philadelphia, Pa.	
810.—TOBACCO.—J. and L. Whorley, Nashville, Tenn.	

SCHEDULE OF PATENT FEES:

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On appeal to Commissioner of Patents.....	\$20
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On granting the Extension.....	\$30
On filing a Disclaimer.....	\$10
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On an application for Design (seven years).....	\$15
On an application for Design (fourteen years).....	\$20

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:
30,563.—ROCKING CHAIR.—I. P. Carrier. July 10, 1872.
25,635.—LABELS FOR PERIODICALS.—R. Dick. July 10, 1872.
21,329.—TELEGRAPHING.—M. G. Farmer. August 14, 1872.
21,099.—SLEEPING CAR.—E. Wheeler. July 17, 1872.
21,879.—SELF MOVING HOOK.—J. R. Henshaw. October 9, 1872.
21,122.—TREATMENT OF CAOUTCHOUC.—A. G. Day. July 24, 1872.

EXTENSIONS GRANTED.

20,051.—COTTON GIN.—J. De Bois.	
20,091.—FLY TRAP.—W. Riley.	
20,066.—PENCIL SHARPENER.—W. K. Foster.	
20,106.—REGISTER AND VENTILATOR.—E. A. Tuttle.	
20,111.—DAMPING APPARATUS.—C. A. Waterbury.	
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How Can I Obtain a Patent?

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

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To Make an Application for a Patent.

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

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It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first make the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first introducer, without regard to the rights of the real inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 21,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 42,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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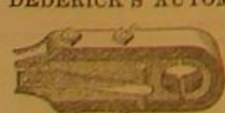
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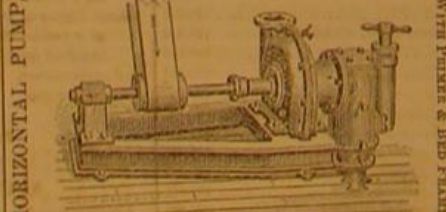
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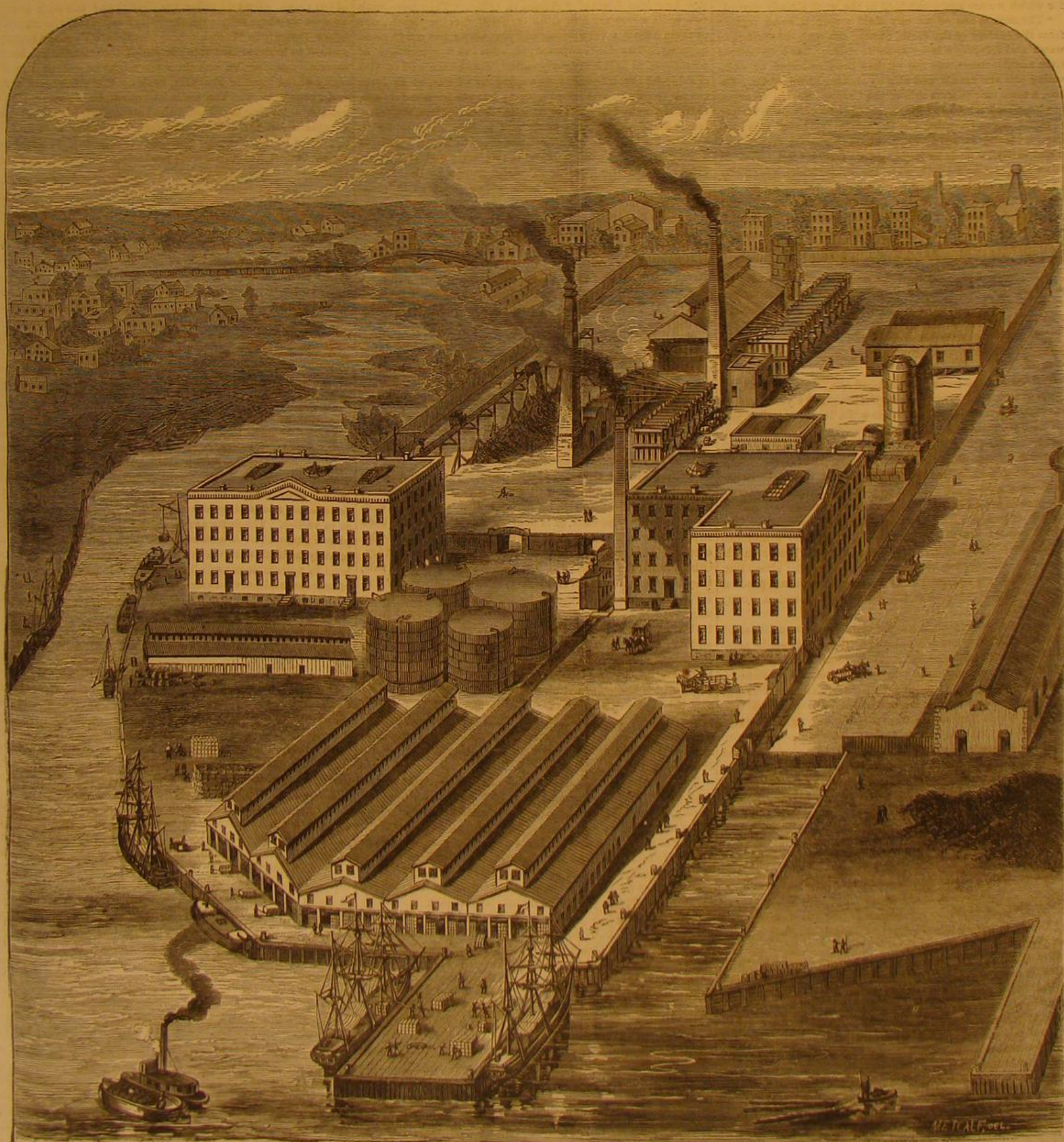
NEW YORK, MAY 18, 1872.

PETROLEUM AND ITS PRODUCTS.

The name of petroleum is derived from the Greek *πῆρος* a stone, and *λαϊον* oil; Latin, *petri oleum*. The substance to which this name has been given is otherwise called rock oil, and when rectified, mineral naphtha, to distinguish it from analogous compounds distilled from coal and wood, and which are respectively styled coal naphtha and wood naphtha.

Petroleum having, since its manifold uses were discovered, become one of the most important articles of American commerce, it is the purpose of this article to give, so far as space will permit, the leading points in its history, statistics of its production, the method of obtaining and refining it, and the uses to which the various products obtained from it can be applied, together with such other details of interest as may suggest themselves to the writer.

One of the most remarkable oversights that has occurred in the history of American manufactures is the fact that, although petroleum was known to exist in abundance and its analogy to coal oil was well recognized by chemists, the enormous natural supply of this useful material was ignored for years, while the distillation of coal was carried on quite extensively. It may not be amiss, in this connection, to make a brief reference to the coal oil manufacture.



BIRD'S EYE VIEW OF PRATT'S ASTRAL OIL WORKS, BROOKLYN, E.D.

COAL OIL MANUFACTURE.

In a work entitled "Eighty Years of Progress," Mr. James T. Hodge, geologist, writes as follows:

The following is a list of some of the factories which were in operation in 1861:

State.	Town or county.	Name of works.	No. of factories.	Daily capacity in 1861, Gall.
Maine.	Portland.	Portland Company.	1	400
Massachusetts.	Boston.	Dowser Kerosene Company.	1	400
"	"	Page & Co.	1	600
"	"	Suffolk Company.	1	300
"	East Cambridge.	East Cambridge Company.	1	300
Connecticut.	New Bedford.	New Bedford Company.	1	300
New York.	Hartford.	Hartford Company.	1	300
"	Newtown Creek, L. I.	Kerosene Oil Company.	1	400
"	Hunter's Point, L. I.	Luther Atwood.	1	300
"	"	Carbon Company.	1	300
"	South Brooklyn.	Empire State Company.	1	300
"	"	Franklin Company.	1	300
"	Williamsburgh.	Fountain Oil Company.	1	400
"	Harrison.	Belmont & Co.	1	300
Pennsylvania.	Pittsburgh.	Aladdin Company.	1	300
"	"	Lucisco Company.	1	300
"	"	North American Company.	1	300
"	"	New Galilee.	1	300
Ohio.	Newark, Licking Co.	Great Western.	1	500

Besides these, there were from sixty to a hundred more factories, of greater or less capacity; and the total product of coal oil was estimated as being nearly 10,000,000 gallons per annum at that time.

Petroleum had, however, at this time begun to be produced in large quantities, and to give promise of developing the immense trade that has since grown out of it. The origin of the American trade will be found in the following

HISTORY OF AMERICAN PETROLEUM

for which we are again indebted to the work already quoted:

"The occurrence of an oily fluid oozing in some regions from the surface of the earth, coming out with the springs of water and forming a layer upon its surface, has been noticed from ancient times, and the oil has been collected by excavating pits and canals, and also by sinking deep wells. Bakoo, a town on the west side of the Caspian Sea in Georgia, has long been celebrated for its springs of a very pure variety of petroleum or naphtha, and the annual value of this product, according to M. Abich, is about 3,000,000 francs, and might easily be made as large again. Over a tract about 25 miles long and half a mile wide, the strata, which are chiefly argillaceous sandstones of loose texture, belonging to the medial tertiary formation, are saturated with the oil, and hold it like a sponge. To collect it, large open wells are sunk to the depth of 16 to 20 feet, and in these the oil gathers and is occasionally taken out. That obtained near the center of the tract is clear, slightly yellow, like Sauterne wine, and as pure as distilled oil. Toward the margins of the tract the oil is more colored, first a yellowish green, then reddish brown. In the environs of Bakoo are hills of volcanic rocks through which bituminous springs flow out. Jets of carburetted hydrogen are common in the district, and salt, which is almost always found with petroleum springs, abounds in the neighborhood.

Another famous locality of natural oils is in Burmah, on the banks of the Irrawaddy, near Prome. Fifty years ago, it was reported there were about 520 wells in this region, and the oil from them was used for the supply of the whole empire and many parts of India. The town of Rainanghong is the center of the oil district, and its inhabitants are chiefly employed in manufacturing earthen jars for the oil, immense numbers of which are stacked in pyramids outside the town, like shot in an arsenal. The formation containing the oil consists of sandy clays resting on sandstones and slates. The lowest bed reached by the open wells, which are sometimes 60 feet deep, is a pale blue argillaceous slate. Under this is said to be coal (tertiary?). The oil drips from the slates into the wells, and is collected as at Bakoo. The annual product (1861) is variously stated at 412,000 hogsheads, and at 8,000,000 pounds.

The Burmese petroleum has recently (1861) been imported into Great Britain, and is employed at the great candle manufactory of Messrs. Price & Co., at Belmont and Sherwood. It is described as a semi-fluid naphtha, about the consistence of goose grease, of a greenish brown color, and a peculiar but not disagreeable odor. It is used by the natives, in the condition in which they obtain it, as a lamp fuel, as a preservative of timber against insects, and as a medicine. It is imported in hermetically closed metallic tanks, to prevent the loss of any of its constituents by evaporation. At the works, it is distilled first with steam under ordinary pressure, and then by steam at successively increasing temperatures, with the following results:

Temp. Fahr.	Proportional product.	Character of product.
Below 312°	11	Mixture of fluid hydrocarbons free from paraffin.
290° to 320°	10	" " " " containing a little paraffin.
290° to 320°	10	Distillate very small in quantity.
290° to 412°	20	Containing paraffin, but still fluid at 32°.
About 412°	31	Product which solidifies on cooling, and may be submitted to pressure.
Above 412°	21	Fluids with much paraffin.
	2	Pitchy matters.
	4	Residue of coke, and a little earthy matter in the still.

[This is therefore a much heavier petroleum than American.]—Ed.

Nearly all the paraffin may be separated from the distillates by exposing these to freezing mixtures; and the total product of this solid hydrocarbon is estimated at 10 o. 11 per cent.

Many other localities might be named which furnish the natural oils upon a less extensive scale, as in Italy, France, and Switzerland. In Cuba and in South America, impure varieties of bitumen are met with, flowing up through fissures in the rocks and spreading over the surface, in a tarry incrustation which sometimes solidifies on cooling. In the island of Trinidad, three fourths of a mile back from the coast, is a lake called the Tar Lake, a mile and a half in circumference, apparently filled with impure petroleum and asphaltum. The latter, more or less charged in its numerous cavities with liquid bitumen, forms a solid crust around the margin of the

lake, and in the center the materials appear to be in a liquid boiling condition. The varieties contain more or less oil, and methods have been devised of extracting this; but the chief useful application of the material seems to be for coating the timbers of ships to protect them from decay. By the patented process of Messrs. Atwood of New York, the crude tar of this locality, having been twice subjected to distillation and treated with sulphuric acid and afterward with an alkali, as in the method of purifying the coal oils, is then further purified by the use of permanganate of soda or of potash. Being again distilled, it yields an oil of specific gravity 0.900, which is fluid at 32° Fahr., and boils at 600° Fahr.

In the United States the existence of petroleum has long been known, and the article has been collected and sold for medicinal purposes, chiefly for an external application, though sometimes administered internally. It was formerly procured by the Seneca Indians in western New York and Pennsylvania, and was hence known as Seneca or Genesee oil. At various places, it was recognized along a belt of country passing from this portion of New York across the northwest part of Pennsylvania into Ohio. In the last named State, it was obtained in such quantity in the year 1819, by means of wells sunk for salt water, that it is a little remarkable the value of the material was not then appreciated, and the means perceived of obtaining it to any amount. The following description of the operations connected with the salt borings then in progress on the Little Muskingum, in the southwestern part of the State, written in 1819, was first published in the *American Journal of Science* in 1826: "They have sunk two wells which are now more than 400 feet in depth; one of them affords a very strong and pure water, but not in great quantity. The other discharges such vast quantities of petroleum, or as it is vulgarly called, 'Seneca oil,' and besides is subject to such tremendous explosions of gas, as to force out all the water and afford nothing but gas for several days, that they make but little or no salt. Nevertheless, the petroleum affords considerable profit, and is beginning to be in demand for lamps in workshops and manufactories. It affords a clear bright light, when burnt in this way, and will be a valuable article for lighting the street lamps in the future cities of Ohio." Several coal beds were penetrated in sinking these wells.

In northwestern Pennsylvania, the existence of oil in the soil along the valleys of some of the streams was known to the early settlers. One stream, in consequence of its appearance in the banks, was called Oil Creek. In other localities also it was noticed, and similar occurrences of oil were observed at some places in western Virginia and eastern Kentucky. At Tarentum, above Pittsburgh, oil was obtained by boring about the year 1845. Two springs were opened in boring for salt, and they have continued to yield small quantities of oil, sometimes a barrel a day. This has been used only for medicinal purposes. On Oil Creek, two localities were especially noted, one close to the northern line of Venango county, half a mile below the village of Titusville, and one fourteen miles further down the stream, a mile above its entrance into the Alleghany river. All the way below the upper locality through the narrow valley of the creek are ancient pits covering acres of ground, once dug and used for collecting oil after the method now practised in Asia. Cleared from the mud and rubbish with which they are mostly filled, some of them are found to be supported at the sides with logs notched at the ends, as if done by whites, and it has been supposed by some that this is the work of the French who occupied that region the first half of the last century. Others think the Indians dug the pits, and in proof of this, they cite the account given by Day, in his "History of Pennsylvania," of the use of the oil by the Seneca Indians as an unguent and in their religious worship. They mixed with it their paint with which they anointed themselves for war; and on occasions of their most important assemblages, as was graphically described by the commandant of Fort Duquesne in a letter to General Montcalm, they set fire to the scum of oil which had collected on the surface of the water, and at sight of the flames gave forth triumphant shouts which made the hills re-echo again. In this ceremony, the commandant thought he saw revived the ancient fire worship, such as was once practised in Bakoo, the sacred city of the Guebres or Fire Worshipers.

The old maps of this portion of Pennsylvania indicate several places in Venango and Crawford counties where oil springs had been noted by the early settlers. They made some use of the oil, collecting it by spreading a woolen cloth upon the pools of water below the springs, and when the cloth was saturated with the oil, wringing it out into vessels. The two springs referred to on Oil Creek furnished small quantities of oil as it was required, and from a third, twelve miles below Titusville, in the middle of the creek, the owner has procured twenty barrels or more of oil in a year.* In 1854, Messrs. Eveleth and Biessel of New York purchased the upper spring and leased mineral rights over a portion of the valley. They then obtained from Professor B. Silliman, Jr., of New Haven, a report upon the qualities of the oil, and in 1855 organized a company in New York, called the "Pennsylvania Rock Oil Company," to engage in its exploration. The same year a new company under the same name, formed in New Haven and organized under the laws of Connecticut, succeeded to the rights of the old company; but for two years they made no progress in developing the resources of the property they had acquired. In December, 1857, they concluded an agreement with Messrs. Bowditch and Drake of New Haven to undertake the search for oil. To the enterprise of Col. E. L. Drake, who removed to Titusville and prosecuted the business in the face of serious obstacles, the

region is indebted for the important results which followed. After a well had been sunk and curbed near the spring, ten feet square and sixteen feet deep, boring was commenced in the spring of 1859, and on the 26th of August, at the depth of seventy-one feet, the drill suddenly sunk four inches, and when taken out the oil rose within five inches of the surface. At first a small pump threw up about 400 gallons daily. By introducing a larger one, the flow was increased to 1,000 gallons in the same time. Though the pumping was continued by steam power for months, no diminution was experienced in the flow. The success of this enterprise produced great excitement, and the lands upon the creek were soon leased to parties who undertook to bore for oil for a certain share of the product, sometimes advancing besides a moderate sum to the owner.

The country was overrun by explorers for favorable sites for new wells, and borings were undertaken along the valley of the Alleghany river and up the French Creek above Franklin. The summer of 1860 witnessed unwonted activity and enterprise in this hitherto quiet portion of the State, where the population had before known no other pursuits than farming and lumbering. Every farm along the deep, narrow valleys suddenly acquired an extraordinary value, and in the vicinity of the most successful wells, villages sprung up as in California during the gold excitement, and new branches of manufacture were all at once introduced for supplying to the oil men the barrels required for the oil and the tools employed in boring the wells. From Titusville to the mouth of Oil Creek, about 15 miles, the derricks of the well borers were everywhere seen. On the Alleghany river, the number below Tidioute in Warren county, south into Venango county, seemed to indicate that this portion of the district would be especially productive, and the same might be said of the vicinity of the town of Franklin, both up the Alleghany river and French Creek. The wells had amounted to several hundred, or according to one published statement, to full 2,000 in number before the close of the year; and from an estimate published in the *Venango Spectator* (Franklin), 74 of these on the 21st of November were producing the following daily yield:—

	No. of wells.	Prod. bbls.
Oil Creek.	31	425
" Upper Alleghany river.	20	442
Franklin.	15	139
Two Mile Run.	5	64
French Creek.	5	35
Total.	76	1105

The last three named places did not, however, fulfil the expectations raised in regard to them.

The capacity of the barrel is 40 gallons. The depth of the wells is in a few instances less than 100 feet. The shallowest one reported, belonging to the Tidioute Island Oil Company, was 67 feet deep, and its product was 30 barrels a day. In general (1861) the depth is from 180 to 280 feet; one well in Franklin is 502 feet in depth, and one on Oil Creek 425 feet. At present from 500 to 1,200 feet are not unusual depths for wells.

LOCALITIES.

The selection of localities for boring was very much a matter of chance. Proximity to productive wells was the first desideratum; but this, when attainable, was not always attended with success. The early notions in regard to location have, however, all been reversed. The oil is now known to lie in belts, and borings are now made through hills as well as in valleys. The belts are in some places wide and in some places narrow, but in general their boundaries are so approximately defined that the element of chance in boring has been in a great measure eliminated. No doubt the system of crevices and pervious strata, through which the oil flows in its subterranean currents, is very irregular and interrupted.

Professor E. W. Evans, of Marietta College, gives in Vol. LII. of "Hunt's Merchant's Magazine," the following in regard to the

PHYSICAL FEATURES OF THE OIL REGIONS.

In what kinds of rock: The best deposits are found in the cavities of loose, brittle, much fractured sandstone or conglomerate. Sometimes the sandstone is quite argillaceous, approaching a shale in character. In some places, the most productive oil rock is a somewhat calciferous sandstone; but in pure limestone rock, the cavities are usually too extensive and afford too free passage to running water to hold good collections of oil imprisoned. The coriferous limestone (which is an ancient coral reef of the lower Devonian) contains petroleum in its minute cellules; but it has not yet, unless in Canada, yielded any in bulk. Strata of shale and slate often contain petroleum; but it is so generally diffused through the small fractures, and through the substance of the rock itself, that it cannot be obtained in large quantities. Indeed, it is a general fact that the rocks through which oil is universally diffused, and in which it may be conceived to have had its origin, are not those which contain it in collections large enough to be profitably pumped. Hard, compact sandstone is usually, for want of cavities, unproductive. This kind of rock, however, often serves as a cover to confine the oil in a looser rock underlying it. It is a common experience among borers to strike oil directly beneath such an impervious layer; for example, under the "third sandrock" of Oil Creek.

It is known that, beneath the oil bearing sandstones, at greater or less depths, there are different strata of bituminous shales containing vegetable impressions. This gives plausibility to the theory that the oil had its origin in the vegetation of the shales, and that by a slow process of distillation, caused by internal heat, it has worked its way up through the cracks and fissures and gradually accumulated in such cavities in the rocks above as do not admit of its escape to the surface. The most general source of petroleum may have been the

*See a pamphlet by Thomas A. Gale, published in Erie, Pa., 1860, entitled "Rock Oil in Pennsylvania and elsewhere."

so-called black slate, which is widely extended over the western States, and is considered identical with the Marcellus shales of New York; but on the western Appalachian slope, there are numerous strata of bituminous or carbonaceous shales above this, included in the carboniferous system.

At what depths: Other circumstances being equal, deep wells, as a class, are more productive than shallow ones. To speak more explicitly, supplies of petroleum found at a depth of two or three hundred feet or more are more copious and lasting than those found at a less depth. Wells not over a hundred feet in depth often give good promise at first; but they are soon exhausted. The best wells are, generally, not less than five hundred feet deep. Many of the most celebrated wells in Pennsylvania derive their supplies from a depth of seven or eight hundred feet, and have been producing for four or five years without complete exhaustion. In shallow wells, it is common to find a heavy lubricating oil, the commercial value of which is greater than that of the light illuminating oil; but what is thus gained in quality is, as a general fact, many times lost in quantity.

The idea of dislocation of the rocks being evidence of oil deposits is subject to a very great limitation. There is an extensive system of lines of upheaval running parallel to the Alleghany mountains, on both sides of them, as if all produced by the same force which slowly raised the mountain folds themselves, acting in a direction nearly at right angles to the Atlantic coast. It is important to observe that those which characterize the most productive oil regions, west of the mountains, are simple flexures. The slopes are curved or polygonal, and the axial lines not sharply defined. Open breaks and wide disruptions are unfavorable signs, since they admit of the free escape of oil to the surface. In places where such signs exist, no considerable deposits have been found. East of the mountains, where there is little or no oil, and even the coal has been debilitated, the dislocations are violent, exhibiting great disruptions and faults.

The somewhat popular idea of an oil basin, except so far as limited to a synclinal axis of disturbance, indicating cavities, is a delusion. It seems to be imagined that petroleum would descend along the strata from the sides of a natural basin toward the center. But being lighter than water, which is always found with it, its tendency is upward, not downward, even through the slight transverse crevices; and we could not conceive of it as running freely along the strata without supposing that it would be rapidly washed to the surface.

Metamorphism as a sign: In the uplifting and folding of the strata which took place in the so called period of the Appalachian revolution, heat (followed by great cooling and contraction) must have been an important agent, as shown by the somewhat metamorphic condition of the rocks in those places where the disturbance was greatest. In the region of great uplifts and faults, east of the mountains, this condition, though not complete, is exhibited in a much more marked degree than in the region of slight and wavy flexures west of the mountains. The absence of petroleum, as, also, the debilitated condition of the coal and shales, east of the mountains, is to be attributed not only to the more open fractures and clefs in that region, admitting to its escape, but in part, also, to the direct expulsive power of the higher degree of heat concerned in causing those fractures. It is certain that scarcely any petroleum has been found in regions where rocks of decidedly metamorphic character are seen. It is certain, also, that, even within the limits of the known oil regions, those places, where the disturbance has been greatest and the rocks approach nearest to that crystalline condition indicating metamorphism, have not been found rich in petroleum. Among the processes of metamorphism, may be enumerated the change of soft and brittle sandstones into those of a hard and crystalline character, and often from a pale color to red,—the change of the compact and colored limestones into bleached and granular ones,—the change of argillaceous shales into firm slates,—also, the partial or total obliteration of fossils. Another evidence of the heat which attended these processes is the frequent occurrence of lodes or transverse veins, of infiltrated metallic ores and other substances not soluble at low temperatures. The oil regions are characterized by loose sandstones and conglomerates, by the soft, shaly condition of the argillaceous rocks, by the absence of regular beds of granular limestone, by the rare occurrence of lodes, by the abundance and perfect condition of the fossils, as well as by the highly bituminous condition of the coal and shales.

Character of surface: Too much stress is often laid on the nature of the surface rocks. Practically, the main question to be determined is: What is the character of the strata at the depths where oil may be expected in remunerative quantities? and in order to determine this, the geologist observes the direction and grade of the dip and seeks the peculiarities in the configuration of the surface which characterize the Pennsylvania districts generally. The hills are abrupt and precipitous, the valleys narrow and deep, exhibiting in a very marked degree the effects of the process of degradation. Originally, the face of the country was higher than the tops of the present hills; but it has been worn down and cut deep by erosion, or the action of water. These effects are more marked than is common elsewhere; partly, because the rocks have been less hardened by metamorphism, and therefore wear away and crumble more easily. The surface rock would be most loosened along the anticlinal lines; hence these have oftenest determined the direction of narrow streams. Indeed, it is not uncommon to see the bottom of an original synclinal valley now crowning the top of a hill, while the original hills on either side of it have been worn down into deep gorges. But the mere fact of a deep valley or gorge is no proof of a line of disturbance of either kind.

It is necessary in every case to determine the inclination of the strata in order to form an intelligent judgment. Often, the dip is in the same direction on both sides; but this, if considerable in degree, is of itself an evidence of dislocation and fracturing; for rocks lying in the position in which they were originally deposited are, as a general fact, either horizontal or very nearly so. Many flexures are marked only by a change in the grade of the dip.

Surface oil: In every oil district, there is more or less "surface show," though not always very close to the sites of producing wells. It varies so much in quantity and quality, as well as in the circumstances under which it appears, that some discrimination is necessary in order to judge of its value as a sign. Considered independently of geological evidence, it affords, at best, no proof that there is oil beneath in collections large enough to be profitably pumped; for it may come up from beds of bituminous shale, or other strata that do not yield it in bulk. In the most productive districts, it is generally seen, on low grounds, in a thin scum on springs and streams, where it comes up with water through slight crevices in the underlying rocks.

Oil coming to the surface in bulk, so often prized as a good sign, is really nothing more than an indication of shallow supplies. In many places where "Seneca oil" used to be collected in gallons, and even in barrels, as it issued from the surface strata or oozed up through the sand, experiments in boring have resulted in finding only small collections at a slight depth. The oil, originally deep in the earth, has gradually worked its way up toward the surface, through the too open cracks and fissures, and is rapidly undergoing the process of exhaustion. If, as on Oil Creek, other oil bearing strata are found upon boring deeper, the kind of surface-show here described afforded, beforehand, no evidence of their existence, but only of that which lies near the surface or perhaps crops out in the hillside.

The thinnest scum of petroleum on water is bluish; a little thicker scum exhibits the colors of the rainbow, especially when agitated. Petroleum may also be distinguished by its dividing, when disturbed, and closing again with a perfectly even margin; while other scums, sometimes mistaken for it, break into pieces which do not perfectly re-unite. That which is oftenest mistaken for oil is a blue and somewhat iridescent scum, seen on waters holding carbonate of iron in solution, and precipitating a red ochreous substance (peroxide of iron) to the bottom. But it is not uncommon to find oil floating on the same pool with it.

Two or three drops of petroleum will cover a spring of ordinary size for half an hour with what would be recognized as fair surface-show. The present production of petroleum must be very slow if it does not exceed the natural drainage through springs, which perhaps would require a geological period to exhaust the supplies now in the earth. Indeed, it is not difficult to suppose that these supplies have mainly come down from a period of much greater heat, perhaps the close of the carboniferous era, when the folds and cavities now containing them were produced.

Connection with mineral waters: In the best oil districts there are numerous oil and gas springs in which the analysis of the water always reveals various minerals, such as common salt, chloride of lime, carbonates of lime, soda and iron, sulphates of soda and potash, and sometimes sulphuretted hydrogen. These are variously called salt licks, chalybeate springs, sulphur springs, oil springs, and so forth, according to the mineral predominating. If, on the common springs of pure water, whose source is usually near the surface, oil is not seen, but only on mineral springs, it affords good evidence that the source of supply is quite deep. It comes up, through slight cracks and fissures in the strata, from depths where the water has laid in contact with many substances and gathered its various mineral contents. The high temperature of these oil and mineral springs, as compared with the ordinary springs of pure water, is another fact indicating a deep source. But decidedly thermal springs (in the Pennsylvania region) are located on the axes of more violent upheavals than those which distinguish the oil districts.

The observed connection of petroleum with various soluble minerals, containing carbon and hydrogen, has led some to suppose that it is directly formed from these minerals, by some chemical interaction not proved or explained. This connection, however, may be satisfactorily accounted for without the aid of such an hypothesis. For aside from the fact, already adverted to, that mineral springs, as a class, come up from a great depth and are thus naturally rendered the common vents of various liquids and gases, it is evident that the same class of cavities, protected from running water, in which petroleum lurks, are also the best adapted to harbor water impregnated with salt and other minerals. The connection of the water in oil cavities with free currents is slight and indirect. The same is true of deposits of salt water and mineral waters generally, for the simple reason that, from cavities exposed to free currents, the minerals must, in the progress of ages, have been washed away. The history of salt wells presents various points of coincidence with that of oil wells. For example, the wells of the great Kanawha salines, in the neighborhood of Burning Spring, are located on a marked uplift. The salt water is found, according to Dr. Hildreth, in a "white calciferous sandstone, full of cavities and fissures." The water is stagnant, and contains, besides salt, various muriates and carbonates. The same wells have yielded large quantities of petroleum with carburetted hydrogen. Indeed, it is a general fact that the water on which collections of petroleum are found is either quite salt or brackish and nauseous with various minerals held in solution. Subterranean currents are almost always fresh, or nearly so; and experience has taught that, in fissures where pure water is found, no large deposits of oil are to be expected.

BORING FOR PETROLEUM.

From Cone and John's "Petrolia," published by D. Appleton & Co., in 1870, the substance of the following description of the process of boring is obtained:

We will suppose that the site for the well has been selected, and a suitable place made ready for the foundations of the derrick, engine house, etc. The first step generally taken, after securing and preparing the location, is to procure an engine, suitable in amount of horse power for the effectual prosecution of the work, and transport it to the location aforesaid. Next in order is the erection of an engine house, derrick, sumpson post, working beam, jack frame, and band wheels, and placing them in proper position. The engines in use in the Oil Region are of every conceivable style, portable, stationary, upright, and oscillating. Portable and stationary are the kinds now in general use. These are from eight to thirty horse power, principally the former. In former years it was the custom to operate several wells with one of these large engines, sometimes two; never over three. It is now considered more advantageous to have an engine to each well. The motion required to pump one well is generally different from what is required for another. Arranging motion for one well, where two are operated with one engine, disarranges it for the other, consuming more time and fuel than would pay for the extra one. Engine houses are built of rough boards, and are of sufficient capacity to protect the engine from the weather, contain a forge for dressing tools, bunks for workmen, a small amount of fuel, necessary tools, ropes, etc.

The derrick is a tall frame work, in the shape of a pyramid. They were formerly built of rough poles or hewn timber, the bottom being from ten to twelve feet square, the poles, four in number, being erected one at each corner, thirty feet in height, converging toward each other, forming a square at the top of two and a half feet, with girths and braces at suitable distances to make the structure sufficiently substantial for the purposes designated. Derricks are now built of sawn lumber or boards, two inches thick and from six to eight wide, the two edges being spiked together, forming a half square on each corner of the foundation, which is from fourteen to sixteen feet square and in some localities more. The derrick is now put up in sections, being braced transversely as it goes up, in order to secure the strength necessary, until it reaches the proper height, which for deep wells is about fifty-six feet; for shallow ones, less height and lighter derrick are required, and at the top it forms a square of from two to three feet.

On the top of the derrick is put a strong frame work for the reception of a pulley, over which the drill rope passes. The floor of the derrick is made strong by cross sleepers, covered with plank or boards. A roof, for the protection of the workmen, is laid with boards across the girths, some ten to twelve feet above the floor. In cold weather the sides are boarded up.

The bull wheel, as it is called, is a shaft of timber, six to eight feet long, fastened like the shaft of a common windlass, and six to eight inches in diameter; the ends of the shaft are banded with iron, and a journal of inch iron is driven into each end for it to revolve upon. Mortices are made through this shaft, eight or ten inches from each end for the arms of the wheel. The wheels are usually made from six to eight inches thick on the face, with strips of plank sunk into and spiked on the outer surface for the double purpose, of receiving the rope belt and connecting it with the band wheel for drawing up tools, tubing, etc. out of the well, and for the workmen to take hold of with their hands when working it without the help of the engine. The bull wheel is placed on the side of the derrick, next to or opposite the band wheel and engine as the workmen may desire. The drill rope is coiled on this shaft, between the wheels, one end passing from it over the pulley on the top of the derrick, and attached to the tools.

The sumpson post is of hewn timber, twelve to fifteen inches square and usually twelve feet in height, erected on heavy timbers, framed crossing each other, bedded firmly in the ground with a mortice to receive the tenon on bottom of post; also a brace on each side, reaching nearly to the top of the post. On the top of this are the irons fitted to receive the working beam, which is balanced on the top of the sumpson post, admitting of the rock motion required in drilling and pumping. The working beam is a stick of timber, from twenty to twenty-six feet long, eight to ten inches square at each end, eight by fourteen to sixteen inches in the middle, with iron attachment in the center, fitting to a similar one on the sumpson post. To the end over the well is an iron joint, for attaching the temper screw when drilling and sucker rods when pumping. On the other end of the working beam is an iron joint for attaching the pitman bar, which connects the same with the crank or band wheel shaft.

The band wheel is usually about six feet in diameter, with a six inch face, built in various styles according to the fancy of the builder, and is placed upon a strong frame, built for its reception, called the jack frame. The jack frame is secured in position by two heavy timbers, bedded into the ground, with gains sunk into them to receive the sills of the jack frame, to which they are keyed fast. The engine is usually placed from eight to twelve feet distant from the band wheel, and connected by rubber or other belting. The belting in general use is six inches in width.

When all this is completed, water supply for the engine procured, etc., we are ready to commence operations. The first thing in order is to drive the iron conductor or driving pipe, as it is generally termed, to the bed rock, which varies from six to seventy-five feet, generally from twenty to fifty feet. The pipe acts as a conductor, and prevents earth and stones from falling into the pit or hole while the drilling is going on. The driving pipe in general use is of cast iron,

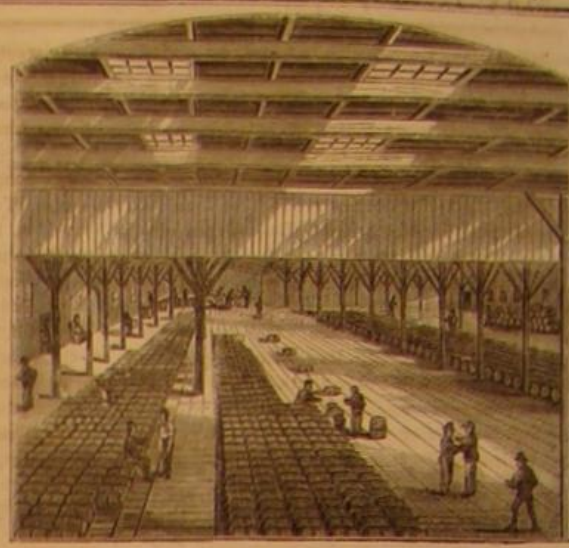


COOPER SHOP.

six to eight inches in diameter, having walls of about one inch in thickness, and is in joints nine or ten feet long. The driving of this pipe is a work of difficulty, requiring the utmost skill, since the pipe must be forced down through all obstructions to a great depth, while it must be perfectly vertical. The slightest deflection, from a straight perpendicular line, ruins the well, as the pipe acts as the conductor for the drilling tools. The process of driving is simple but effective. Two slide ways, made of plank, are erected in the center of the derrick to the height of twenty or more feet, twelve to fourteen inches apart, with edges in toward each other, and the whole made secure and plumb. Two wooden clamps or followers are made to fit around the pipe and slide up and down on the edges of the ways. The pipe is erected on end between the ways, and held perpendicular by these clamps and a driving cap of iron, fitted to the top. A battering ram is then suspended between the ways, so arranged as to drop perpendicularly upon the end of the pipe. The battering ram is of timber, six to eight feet long, and twelve to fourteen inches

drilled through the same. The pipe is then driven down, the edges of the obstacles being broken by the force applied, the fragments falling into the vacuum created by the passage of the bit. When this cannot be done, the whole machinery and derrick is moved to admit of the driving a new set of pipe, or the well is abandoned. It sometimes happens that the pipe is broken, or diverted from its vertical course by some obstacle; and the whole string of pipe driven has to be drawn up again and the work commenced anew. If this is not possible, a new location is sought.

After the pipe is driven, the work of drilling is commenced. The drilling rope, which is generally one and a quarter inch hawser laid cable, of the required length, from 500 to 1,000 feet, is coiled round the shaft of the bull wheel, the outer end passing over the pulley on the top of the derrick down to the tools, and attached to them by a rope socket. The tools consist of the centerbit, auger stem or drill bar, jars, sinker bar, and rope socket. When connected, these are from thirty to forty feet in length, and sometimes more, weighing from 800 to 1,600 pounds, according to depth required to reach the third sand rock. The process of drilling,



BARREL ROOM.

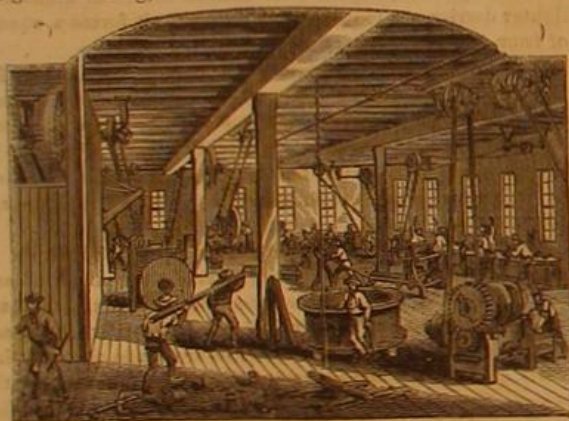
What are termed the "jars" by oil miners, attached to the auger stem, play a highly important part in the work of drilling. There are two long links or loops of iron or steel, sliding in each other. Drillers always have about from four to six inches play to the jars, which they call the "jar," and by this they can tell when to let down the temper screw. With the downward motion the upper jar slides several inches into the lower one; on the upward motion this is brought up, bringing the ends of the jars together with a blow as of a heavy hammer on an anvil, making a perceptible jar. Experienced drillers can, as soon as they take hold of the rope, tell how much "jar" they have on.

In drilling, the tools are alternately lifted and dropped by the action of the working beam in its rocking motion. One man is required constantly in the derrick to turn the tools, as they rise and fall, to prevent them from becoming wedged fast, and to let out the temper screw as required. This is one of the most important duties of the work, requiring constant attention to keep the hole round and smooth. The centerbit is run down the full



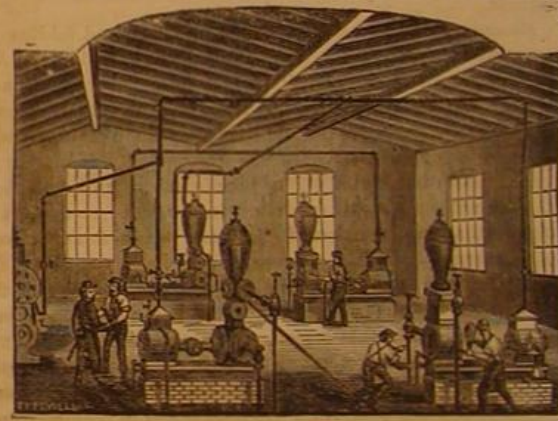
TAP FAUCET SHOP.

until the whole length of the tools is on and suspended by the cable, is slow. When the depth required to suspend the tools is obtained below the surface, the attachment between the working beam and drilling cable is made by means of a temper screw suspended from the end of the working beam, and attached to the rope by a clamp. The temper screw is from two to three feet in length, made with a coarse thread, and works in a thin iron frame, with a wheel at the lower end of the screw for the driller to let out the same as is required. As the drill sinks down into the rock, the screw is let down by a slight turn of the wheel by the driller, some allowing a full revolution every few blows of the bit, others once only in a few minutes, depending upon the hardness of the rock being drilled through.

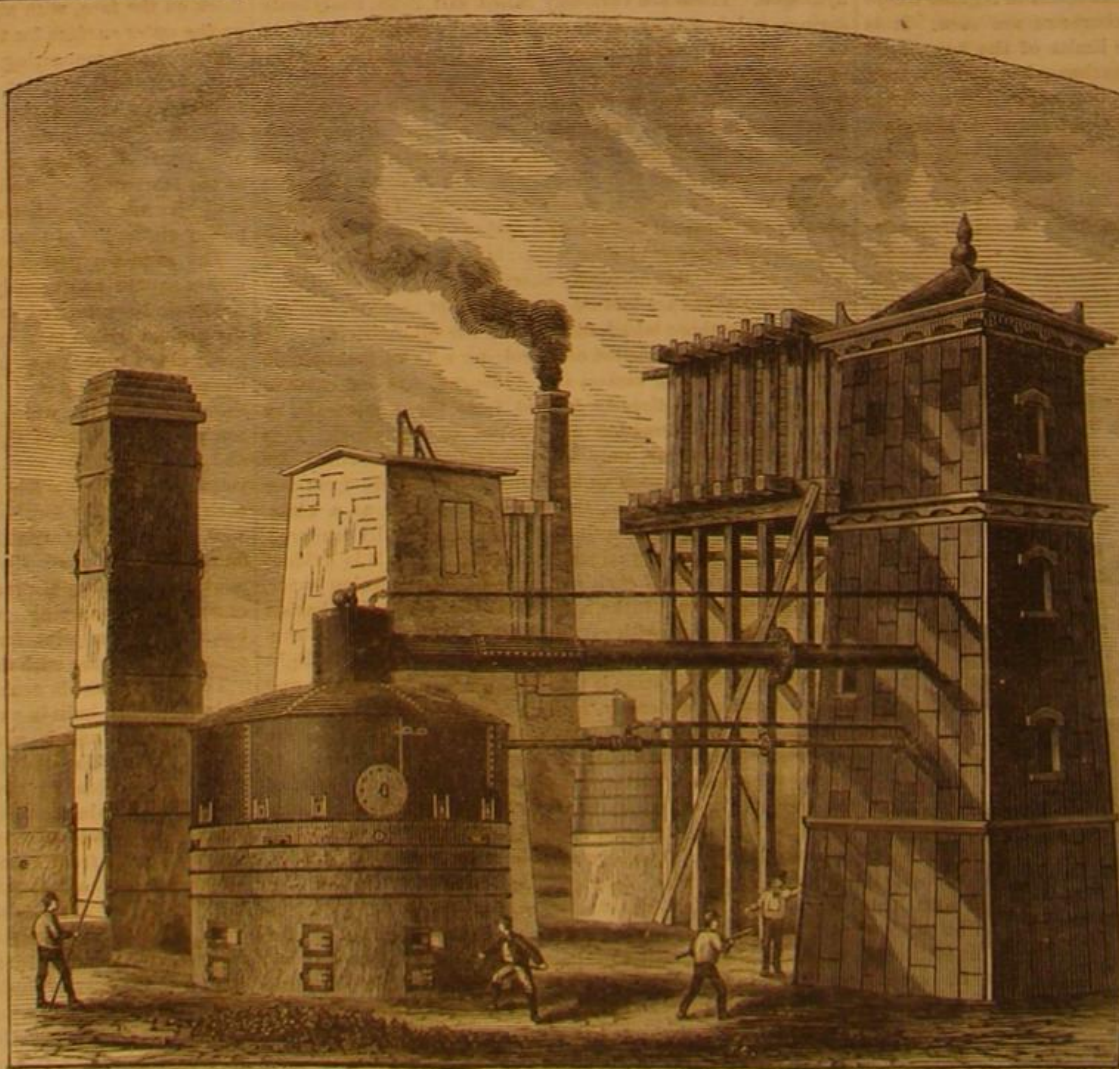


REPAIR SHOP.

square, banded with iron at the lower or battering end, with a hook in the upper end to receive a rope. When the whole is in position, a rope is attached to the hook in the upper end, passed over the pulley of the derrick, down to and around the shaft of the bull wheel. Everything is now in readiness to drive the pipe. The belt connecting the engine and band wheel, and the rope connecting the band wheel and bull wheel, called the bull wheel rope, being adjusted, the machinery is put in motion by the engineer, one man, standing behind the bull wheel shaft, grasping the rope attached to the ram and coiled around the bull wheel shaft, holds it fast and takes it up in his hands, thus raising the ram to its required elevation, when it is let fall upon the pipe, and by repeated blows it is driven to the requisite depth. When one joint of pipe is driven, another is placed upon it and the two ends secured by a strong iron band, and the process continued as before. The pipe has to be cleaned out frequently, both by drilling and sand pumping. Where obstacles, such as boulders, are met with, the centerbit is put in requisition, and a hole, two thirds the diameter of the pipe, is



PUMP ROOM.



GASOLINE STILL.

length of the temper screw. The centerbit is about three and a half feet in length, with a shaft two and a half inches in diameter and a cutting edge of steel, three and a half to four inches in width, with a thread on the upper end by which it is screwed on the end of the auger stem. The reamer is about two and a half feet in length, having a blunt instead of cutting edge, with a shank two and a half inches in diameter terminating in a blunt extremity, three and a half to four and a half inches in width by two inches in thickness, faced with steel. The weights of heavy centerbits and reamers average from fifty to seventy-five pounds each. The centerbit is followed by the reamer, to enlarge the hole and make it smooth and round. The sediment, or battered rock, is taken out after each centerbit, and again after each reamer, by means of a sand pump let down in the well for the purpose. The sand pump now in use is a cylinder of wrought iron, six to eight feet in length, with a valve at the bottom and a bail at the top, to which a half inch rope is attached, passing over a pulley suspended in the derrick some twenty feet above the floor, and back to the sand pump reel, attached

to the jack frame, and coiled upon the reel shaft. This shaft is propelled by means of a friction pulley, controlled by the driller in the derrick, by rope attached. The sand pump is usually about three inches in diameter. Some drillers use two, one after the centerbit and a larger one after the reamer, the two being preferable. When the sand pump is lowered to a requisite depth, it is filled by a churning process of the rope in the hand of the driller, and is then drawn up and emptied. This operation is repeated each time the tools are drawn up out of the well, the pump being let down and drawn up a sufficient number of times to remove all the drillings. The fall of the tools is from two to three feet. This labor goes on, first tools and then sand pump, until the well is drilled to the required depth. Abundance of water is found in the wells, both for rope and tools, from the commencement. It flows in from the surface veins, and from the larger ones below.

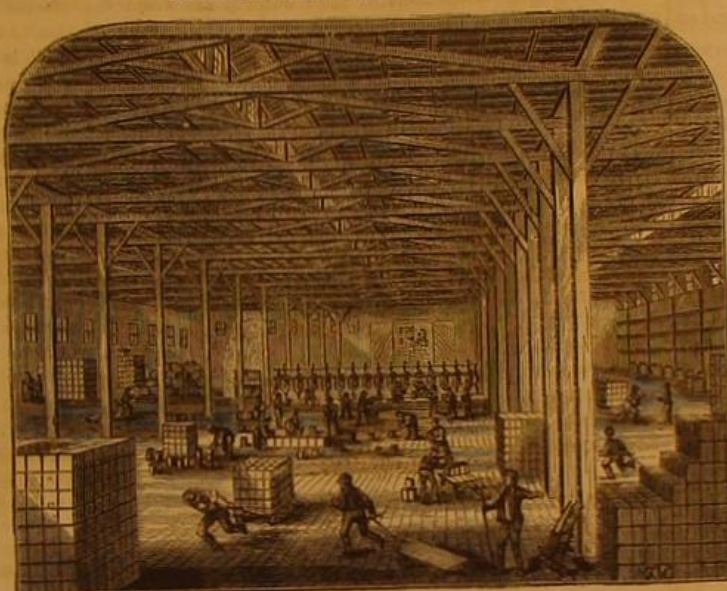
After the well is drilled, the process of tubing, to prepare for testing and pumping, is next in order. This is done generally with two inch wrought iron pipe, previously tested by hydraulic power. This tubing is in joints, from twelve to fifteen feet in length, screwed together by means of a thread on each of its ends, with a close fitting thimble.

The working or pump barrel is usually from five to six feet in length, made of brass, with a bore of from one and three quarters to one and seven eighths inches, always smaller than the bore of the tubing. In the lower end of this, is placed the lower valve, or standing box, as it is termed. The working barrel is then screwed to the first joint of pipe by means of a sleeve or thimble, such as attaches the sections of tubing together.

The swivel is now screwed into the other end of the joint of tubing, the tackle blocks being suspended in the derrick. The hook of the lower block is attached to the swivel, and by means of the rope, the whole is suspended over the well and let down into it until the derrick floor is reached. The clamps are placed across the mouth of the driving pipe under the thimble at the end of the joint, fitting closely and secured by a ring at the end of the handles. The swivel is then taken out by the pipe tongs, another joint or section of tubing is attached and lowered as at first. This process is repeated until the amount required is in the well, being held securely by the clamps, as before described. The tubing is put down various depths, usually to or near the bottom of the well. All



LOADING VESSELS WITH BARRELS.



PACKING ROOM.



CONDENSERS.

practical drillers keep a record, of the rock passed through (sand, pebble, or slate) which is done by preserving a portion of each sand-pumping, and of its thickness and relative hardness, shown by the drillings. This record is essentially necessary in order to determine the proper place for fastening the seed bag. The seed bag is placed upon the tubing so as to come at the depth necessary to cut off the surface water, as well as the heavier veins below from the oil veins further down. The depth generally required, being at the first sandrock, averages from 150 to 350 feet. This seed bag is of stout leather, made to about fit the bore of the well, and is from four to six feet in length. The tubing is passed through the seed bag, the lower end of which is fastened at the proper place on the tubing by lashing it with a stout cord. It is then filled with flax seed, pressed in, to a trifle less than the exact bore of the well,

lashed fast at the upper end, and lowered into the well to the desired depth with the tubing. The flax seed swells in a few hours, closing the hole effectually when properly arranged, so that water cannot pass down, nor the gas and oil up beyond it. This important appliance is used for the double purpose of shutting off the surface water from the oil veins below, when the well is pumping or flowing, and to force the current of oil and gas up through the tubing to the surface.

In pumping or testing a well, what are called sucker rods are used. These are of wood, about an inch in diameter, and twenty feet in length. Ash and hickory are the kind in general use. The sucker or working valve is attached to the end of one of these, each end of the rod being fitted with a screw thread and thimble alternating, the same fitting on in the form of a socket and lowered into the tubing. The rods are lowered one after another until the valve goes into the working barrel. The attachment is then made to the working beam by means of a rod passing through a stuffing box, fitted on the end of the tubing, above the driving pipe. When these arrangements have been completed, the pump is ready to operate, which is done by the machinery in the same

manner as in drilling. The process of "casing" the wells is now in general use. This is done by putting three and one quarter inch artesian tubing in the well to the first sand rock, and placing the seed bag at or near the same. The two inch tubing is then put on the inside of the casing without a seed bag, and can be taken up without danger of flooding out the well with the surface water, as in the old way, by turning the seed bag every time the tubing requires moving.

In early days, the conductor was made of heavy plank or a log of wood bored out like a pump log, the excavation having been made previously to the rock, or as far as the water would permit, by digging a well hole. The iron driving pipe now used is not only more economical, but insures greater accuracy in drilling. The tools and general machinery now in use are of a heavier description than those formerly used, in consequence of drilling deeper wells, insuring greater rapidity. The drilling of an oil well was formerly a labor of months. Now a well can be drilled and tested in from twenty to thirty days.

Very many improvements have been invented and applied to boring for oil, which have facilitated but have not superseded the old system which is, in its essential features, still retained as described above. Improvements have been made, some of which have proved very successful, in restoring the flow of oil from wells that had ceased to yield or from which the flow had become much reduced. These latter consist mainly of devices whereby powder, nitro-glycerin, or other explosives may be fired after their introduction into the wells, thus reopening obstructed crevices and forming new fissures.

STRIKING OIL.

In earlier years, when flowing wells were struck, the tools were thrown out of the well to a great height upon the penetration of the gas and oil crevice below, and a volume of gas and oil, the full size of the aperture, was forced up to a height of fifty or more feet, creating a shock, with its first escape, similar to an earthquake, bursting forth with a roar like the escape pipe of a steamer, covering whole acres with its greasy flood. This frequently continued for several days, and sometimes for weeks, the force of the gas being so great as to prevent the workmen from tubing the well. In such cases, trenches were frequently made for the oil to run into, and the oil dipped out of these into barrels, boats, or other suitable vessels. In many cases, the gas and oil give indication by bubbling up through



BLEACHING PANS.



RUNNING ROOM.

and out at the end of the conducting pipe; while many others, among which have been some of the best paying wells ever drilled, exhibited no sign until after they were tested. After the tubing is completed, in the manner before described, the pump is put down, a suitable tank or tanks for receiving the oil having been previously built within a convenient distance of the well. The size of these tanks, which are made of pine planks, cylindrical in shape and stoutly hooped with iron, varies, according to the necessity of the case, from 150 to 1,200 barrels. Connection is made with these by means of a pipe attached to the mouth of the stuffing box.

The well is generally full of water below the seed bag, from the surface water and veins above or the salt water below. The pump is set to work to pump this off, as also to clear out the well. This operation

is called "testing." When the water is thoroughly exhausted, oil generally makes its appearance, in large or small quantities according as fortune has favored the operator. The depth to which a well is drilled is generally regulated by the depth of the producing wells in the immediate vicinity, and sometimes by the "show," as it is called, of the oil in the well. It is usual to sink the well several feet below the oil vein, in order to prepare a suitable receptacle for sand, gravel, and particles of earthy matter that fall from the sides of the well, thus preventing the closing up or clogging the oil vein from such causes. The trite old saw, "all signs fail in dry weather," is amply verified by the frequent experience of the operator at this stage of the proceeding. The presence of oil and gas in fair quantity in the well does not necessarily insure a remunerative result. The veins may be small and soon exhausted. The lack of any such indication is not proof that success will not ensue. The oil may be held back by the dense column of water upon it; and when it is freed from this, it may respond liberally to the strokes of the pump, or even flow out abundantly without its aid. The testing process is continued until the water is exhausted, and the oil makes its appearance. Where wells are cased, as before described, and the seed bag perfectly tight, it may be a work of only a few hours or a few days. Where casing is not practised, the duration of the testing generally, though not invariably, occupies weeks and even months of incessant labor, and after all, perhaps, results in abandonment. But few operators continue to test beyond a month, unless the "show" of oil is very good. A few inches of rock, or other trifling obstacle, may intervene between the operator and princely affluence. If the oil gushes forth copiously, after due testing, the operator so fortunate becomes possessed of competence at least, and not unfrequently ample fortune. In case of failure, the reverse, financial loss or even ruin, is equally probable.

TRANSPORTATION OF PETROLEUM.

The crude petroleum is conveyed to the refineries, for the most part in large tanks placed on oil cars. As it reaches the refiners, it consists of a mixture of hydrocarbons, or chemical compounds of hydrogen and carbon, varying greatly in density and volatility, yet having many points of similarity. All are combustible, yet their igniting temperatures vary nearly or quite as much as their boiling points.

Constitution of American petroleum: Pelouze and Cahours have studied the Pennsylvania oil and find that it consists essentially of homologues of marsh gas, the lowest term of the series obtained being hydruret of butyl, C_4H_{10} , which boils at a little above $0^\circ C$, while the highest term yet studied is $C_{30}H_{62}$. The authors have obtained from these hydrurets the corresponding chlorides and in many cases the alcohols. They consider it probable that paraffin is a mixture of still higher terms in the series. Similar results have been obtained by Schorlemmer, who, however, finds benzol and toluol in the American oils, while Pelouze and Cahours explicitly deny the presence of these substances.

ORIGIN OF PETROLEUM.

In Silliman's "Journal," for July, 1866, is an article on "Petroleum and its Geological Relations," by Professor E. B. Andrews, of Marietta, Ohio, from which we make the following extracts: "Of the origin of petroleum, there are different opinions. All agree, however, that it must ultimately be traced to vegetable or animal substances, the primary combinations of hydrogen and carbon being the product of vital force. It is the opinion of Dr. J. S. Newberry and others that petroleum in its present form is the product of a slow distillation of bituminous strata. From this theory, Mr. T. S. Hunt, of the Canada Survey, in the 'Geology of Canada,' p. 526, dissents, and quotes approvingly the views of Mr. Wall, who investigated the bitumens of Trinidad, and who writes that the bitumen 'has undergone a special mineralization, producing a bituminous matter instead of coal or lignite. This operation is not attributable to heat nor of the nature of a distillation, but is due to chemical reactions at the ordinary temperature and under the normal conditions of climate.' It would appear to be Mr. Hunt's opinion that the bitumens, of which petroleum is the liquid form, are the product of chemical reactions changing the original organic materials directly into oil and kindred hydrocarbons. * * * There is no doubt that, at the original bituminization of organic matter, vast quantities of bitumen were formed. The greater portion of this was absorbed by the sediments which now constitute bituminous strata. For example, the black shales of the Ohio Devonian rocks are two hundred and fifty feet thick, and in them the bitumen is uniformly distributed throughout the whole mass. This distribution would imply that the bitumen was once in such a state of fluidity as to allow it to diffuse itself. * * * All the oil that I have ever seen, except very insignificant quantities in isolated cavities in fossiliferous limestones, has evidently strayed far from its place of origin. It is seldom, indeed, that we find any oil in juxtaposition with bituminous strata of any kind. It is more often found in fissures in sand rocks, rocks in which no oil could ever have been generated; for whatever organic matter they might have contained was too much exposed to atmospheric oxygen to admit of the possibility of any bituminization. It is not only impossible that the oil could have originated in these sand rocks, or in the arenaceous shales which underlie them in western Pennsylvania, but it is most probable that the oil ascended from the still lower rocks, in the form of vapor which condensed in the superior cavities. In other words, the oil which, according to the theory, was formed far below in the original bituminization of organic matter, must have undergone a process of distillation.

"In favor of the other theory, that petroleum, as now generally found, is the product of a distillation of bituminous

shales, etc., as suggested by Dr. Newberry and others, the following arguments may be urged: 1. Oil may be artificially produced by distilling such shales and other bituminous materials. * * * 2. The phenomena of oil and gas exhibited in our oil fields greatly resemble those observed in the artificial distillation of oil from bituminous materials. * * * It is believed that some petroleum has been actually produced in the earth by distillation. * * * 4. There is an abundance of oil-making material in the earth. * * * 5. A comparatively low temperature is believed to be adequate to set free the oil vapors. 6. By this theory, there might be produced an almost indefinite quantity of petroleum, since bituminous strata are found widely distributed. * * * Finally, the agency which would volatilize the liquid bitumen, or petroleum formed by direct bituminization, and bring it up and distribute it through the present oil horizons, would certainly be adequate to distill the bituminous shales, etc., and bring up the oil to the same elevations.

It may, however, be objected that, if this theory of distillation be true, we ought somewhere to find the residuum, or debilitated shales, etc., remaining after the oil had been extracted. Such discovery could not justly be expected in surface rocks, because, according to the theory, the heat agency would at best be small, and could be scarcely felt near the surface. The question, then, would be reduced to this, namely: Do the borings in deep wells ever show that the deep, bituminous strata have lost any of their original and normal quantity of bitumen?"

After presenting some facts bearing upon this point, he concludes as follows: "Such facts are not conclusive as to any positive loss of bitumen, but they are not without significance. Should I find many similar cases where strata which are highly bituminous at their outcrop are found to contain little bitumen at great depths, and, at the same time, the rocks above these buried strata containing in their fissures much oil, I think the inference, that the oil was derived from the bituminous shales, not unwarranted."

PRODUCTS OF PETROLEUM.

The products of petroleum which can be obtained by fractional distillation, in connection with other processes employed in rectification, are very numerous; but the more important are the heavy lubricating oils and kerosene oil. A lighter product, called gasoline, is used for illumination in various machines devised for the purpose. Naphtha is largely used, for the adulteration of kerosene oils, by unprincipled retailers. A product called chymogene, still lighter and more volatile than gasoline, has been utilized by Professor Vander Weyde in his ice machine. A great variety of names has been originated to characterize the products obtainable from petroleum, some of which are mentioned below, but their discussion in this place would not enlighten the general reader.

REFINING PETROLEUM, AND SEPARATION OF ITS PRODUCTS.

The crude petroleum is first put into stills and, the fires being started, a light product comes over, consisting of a mixture of substances, to which the general name of naphtha is given. The next product is called burning oil. Then follows a small quantity of paraffin oil, leaving a residuum of tar and coke in the stills. The distillates are next treated with sulphuric acid to bleach and deodorize them. The bulk of the acid is then washed out with cold water. What remains is neutralized with caustic soda, supplemented with a little ammonia.

This brief general description of the process of oil refining gives the reader but a meager idea of the magnitude of some of the works engaged in this business, or of the details of the operation. To give a just conception of the vastness of the petroleum industry in this country, we have prepared elaborate engravings of the celebrated

PRATT'S ASTRAL OIL WORKS

located in Williamsburg, N. Y., (Brooklyn, East District,) which is one of the largest of its kind in the United States, and which does an enormous export business in addition to its large domestic trade, in which the article known as Astral Oil figures largely and is justly esteemed as one of the safest and best kinds of kerosene sold in the American market. This establishment is a model in its way. Every appliance that the best engineering skill could supply has been made available to ensure economy, safety and convenience, in the prosecution of the business; and although it has been alleged that the works are obnoxious to the residents of the immediate vicinity, our observations lead us to believe that this allegation has no foundation in fact. Indeed, after a thorough investigation, the Board of Health of the City of Brooklyn dismissed this complaint as unwarranted. The odors which are perceptible are not in any way injurious, nor nearly as unpleasant as those emanating from the adjacent gas works; while in point of safety, it is scarcely conceivable that, with the perfect arrangements for the prevention and extinguishing of fires, any disastrous conflagration can take place.

The oil is brought from railroad termini in large barges constructed for the purpose, each of which is fitted with a large tank to hold 1,200 barrels. When it arrives at the docks, as shown in the bird's-eye view which is the first of our illustrations, it is pumped through pipes into the receiving tanks.

THE PIPES

are each eight inches internal diameter, and 450 feet in length. They are laid, as shown, in an open ditch, the principal reason for which is that, in case any leak should occur, it can be at once discovered and stopped.

THE RECEIVING TANKS,

which form the subject of one of our engravings, are enormous structures having a united capacity of 23,000 barrels. They are made of boiler iron and stand by themselves at a

distance from other parts of the works, but are connected with the latter by pipes. In this way, the crude petroleum is kept confined and prevented from giving off its odor, and the danger of ignition is obviated.

THE PUMP ROOM

contains five large steam pumps placed as shown in one of the engravings. There is one for water, one for crude oil, one for distillate and one for refined oil. The fifth is an air pump, used for agitating the oil during treatment. These pumps in their combined capacity are capable of throwing 3,000 barrels an hour. There is also another large pump on the dock for refined oil and general purposes. These pumps are arranged so as to act almost instantly as fire engines, and, through a system of piping, to flood any part of the works in which a fire may originate.

The office of the crude oil receivers is to separate the water from the petroleum before the latter is conveyed to

THE STILL.

Four of the stills are thirty feet long and fourteen feet in diameter. Six of them are ten feet long and six feet in diameter. The stills convert the oil into vapor which passes into a condensing apparatus, shown in the engraving entitled 'Condensers.' This apparatus consists of a box eighty feet long, sixteen feet wide and eight feet deep, filled with coiled pipe constantly cooled by running water. The object of this distillation is to separate the volatile constituents from all solid and foreign matters. The distillation is commenced at $120^\circ F$, which carries off all the products capable of evaporation at that temperature; the temperature is then steadily raised till it finally reaches about $1,000^\circ F$, which drives over all except the solid residuum. The distillate passes from the condensers to the

RUNNING ROOM

which is also shown in one of our engravings. The distillate, as it runs from the worm, appears by reflected light a beautiful French ultramarine color, but by transmitted light it has a slightly opalescent white tint. The running room is of much importance, as it is here that the progress of the work is noted, the specific gravity of the distillate is determined, and the separations are made.

There are four 500 barrel distillate tanks and two having a capacity of 1,000 barrels, to which the distillate flows from the running room. By proper connections, the stills can be connected with either of these tanks as may be necessary or convenient. From the distillate tanks, the distillate is pumped to the

AGITATOR.

In this apparatus, the oil is treated with one and one half per cent of sulphuric acid, by which it is bleached. It is then washed with a solution of caustic soda, followed by a little ammonia, by which the acid is neutralized; after which it is run into the

BLEACHING AND SETTLING PANS,

shown in one of the engravings, each of which contains 700 barrels. From the settling pans, the oil is pumped to a receiving tank having a capacity of 4,000 barrels. From this tank, it passes to the

PACKING HOUSE,

placed at some distance from the other buildings and near the shipping dock. An interior view of this building has been furnished by our artist. The oil is carried into this building in pipes, where it is measured out, through an ingenious filling apparatus, into the cans which are to receive it, the cans being filled nearly as fast as they can be passed along by the workmen. The filling apparatus is shown in the center of the background of the packing room; and, when fully employed, a dozen or more men can work at it, receiving empty cans from others as they are brought from the tin shop, and, when they are filled, passing them along to other workmen who as quickly seal them hermetically with solder. They are then packed in wooden cases, ordinarily two in a case. In such packages, the cans are passed to the

SHIPPING DOCK,

of which also our artist has provided an excellent view. At the time of our visit to the works, two large vessels lay there, taking in cargoes of oil. One of these vessels was destined to the Mediterranean, and the other was bound first to Odessa and thence to Beyrout.

The various shops connected with the works are supplied with power from two 60 horse power boilers, made at the West Point Foundry. Among these shops, we may mention first the

TIN SHOP

in which the cans are made with a rapidity truly astonishing. All the work, including the soldering, is done with improved machinery and appliances, by which the operation of can making proceeds with the utmost facility, the cans being sent as made on an endless belt directly to the packing room. The absolute time consumed in making a can, filling it with oil, and sealing, is two minutes, the cost of the labor not exceeding two cents.

There is also the

FAUCET SHOP,

where the patent taps and faucets, one of which is shown in one of our engravings, are made. This tap and faucet is an improvement for which all consumers may be thankful. When the center of the metallic seal is cut into, the consumer finds underneath it a small nozzle, which he adjusts to the tube of the faucet. At the time our artist was there, they were arranging to make a faucet possessing improvements on the one illustrated; which it is claimed will be (when finished) the most perfect appliance for emptying cans

ever known. The object aimed at is to produce a faucet that can be attached to the can without exposing it to breakage by rough handling, which will not require an enlarged case (which would increase the cost of transportation), and further to enable the consumer, having once used the can, to refill it with other fluids for use again. All this must, of course, be done at the least possible cost.

They were unwilling to offer it for illustration or description at this time, but, if our opinion is of any value, its efficiency for the use intended is perfect.

TESTING THE OIL.

The safety of illuminating oils and their commercial value are determined by what is called the fire test.

A portion of the oil is put into a glass cup, which is placed in a water bath, heated by a small lamp. From a bent standard a thermometer depends, so that its bulb is placed in the oil to be tested. As the temperature of the specimen rises, a lighted taper is frequently passed over and near to its surface, until vapor distills from the liquid and ignites. The temperature at which this takes place is carefully noted, and is termed the fire test. The oil is disposed of to the trader accordingly, and it is obvious that as the flashing point is higher, the safer is the oil. Oils which do not flash below 110° Fah. may, in general, be considered as safe for lighting purposes. The Astral oil, for which these works are celebrated, has a flashing point of about 150°.

WHY CANS ARE USED.

Cans are used to promote convenience in handling, to decrease fire risk in storage and transportation, and to insure



LOADING VESSELS WITH CANS.

Each seal has upon it the inscription "Pratt's Astral Oil." The

AMOUNT OF TIN PLATE USED.

In the manufacture of cans at these works, is forty thousand boxes per annum, yet the canned products are less than 50 per cent of the entire production. There is also consumed

establishment constantly employs about ten trucks, ten to twelve lighters, and two steam tugs, in moving goods to and from the works. The export trade is about three fourths the entire business of the works.

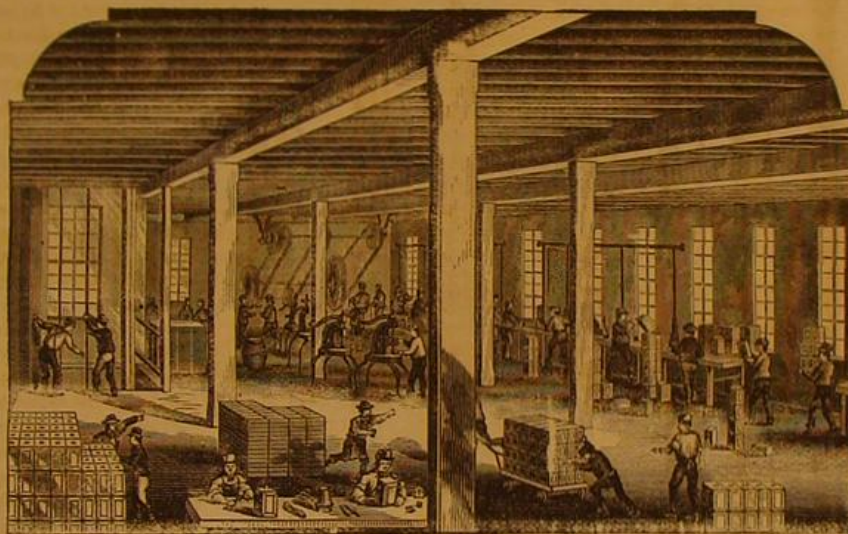
Among the safe oils we repeat that Pratt & Co.'s Astral oil ranks as one of the best in market. We have used it and experimented with it, and speak whereof we know. There are also other good oils in market, but the extent to which unsafe illuminating fluids are palmed off on a gullible public is a standing disgrace to the administration of justice in this country.

When we recall that, in 1861, this business had scarcely had its beginning, its enormous extension cannot fail to strike the mind of the reader with astonishment. The supplies being seemingly inexhaustible, a still larger growth may confidently be predicted. As it is, petroleum is one of the greatest sources of our mineral wealth, and its introduction as a lighting material has been an inestimable boon to mankind. Those who would wilfully lessen the benefits of this truly magnificent discovery by fraudulently selling unsafe oils to innocent buyers, ought to have the severest penalties meted out to them, while those who furnish only safe oils should be made known to the public.

THE SCIENTIFIC AMERICAN has frequently, during the last few months, published easily performed experimental tests for ascertaining the inflammability of kerosene oils, and by the adoption of these, every consumer is enabled either to justify the claims of the manufacturer of the oil, or to protect his life and his household from destruction. By using such tests, the dangers of many burning oils will be avoided, and the superiority of a



FAUCET.



TIN SHOP.



CAN.

the consumer in getting a safe article. The cans being sealed, he is enabled to determine whether the package has been tampered with or not. Every article put in the cans is warranted to be exactly as represented. The Astral oil, being de-

annually 125 tons of solder. The other products are put up in barrels prepared in

THE COOPERAGE,

which is shown in one of our engravings. The barrels are not made here, however, the work of the cooperage being to fit them for holding petroleum products. They are painted on the outside, a ton of paint per week being consumed for this purpose. To render the wood impervious, the barrels are coated interiorly with glue. A strong and hot glue size is poured into the barrels, and the bung is inserted. The barrels are then rolled about so as to bring the glue into contact with every portion. The air becoming heated generates pressure, so that, by tapping the bung loose, the latter is projected with considerable force. The barrels are then placed on long frames over troughs which collect the dripping glue. One half a ton of glue is thus weekly consumed.

This is the largest manufactory of gasoline in the world, and it makes a greater specialty of the light products of petroleum than any other. Gasoline is used in gas machines, for extracting oils from linseed cotton seed, and the extractive principle from hops, etc.

OTHER LIGHT PRODUCTS

are chymogene, for use in ice making, and rhigolene, for anæsthetic purposes in surgery. Benzine is prepared for varnish makers, japanners, patent leather and oil cloth manufacturers, special articles in the rubber manufacture, and also a refined deodorized and perfumed benzine for the extraction of grease from clothing, etc.

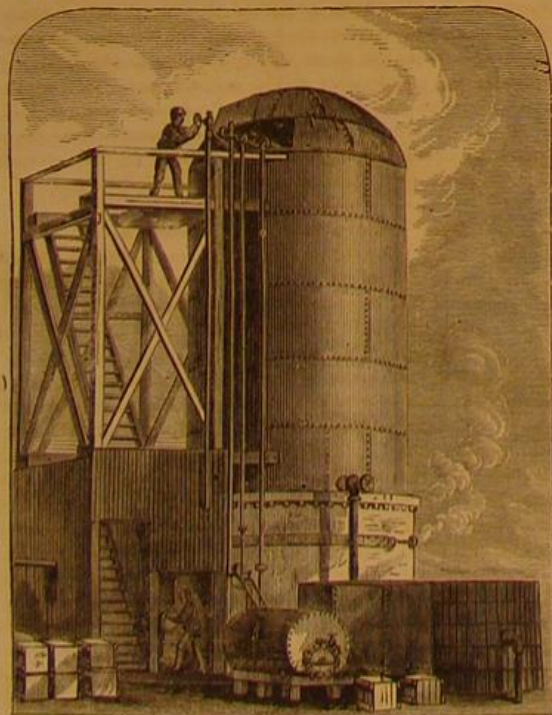
EXTENT OF THE WORKS, ETC.

The works occupy 110 city lots (2,500 feet in a lot), or from 6 to 7 acres, with about a quarter of a mile of water front.

Facilities are possessed for handling 25,000,000 gallons of petroleum products per annum. There are in the works about three miles of pipes. The amount of sulphuric acid employed is from 6,000 to 7,000 lbs. daily. The amount of soda and ammonia consumed is 1,000 pounds of the first and 2,000 of the second weekly. The number of men employed in all departments is between two and three hundred. The es-

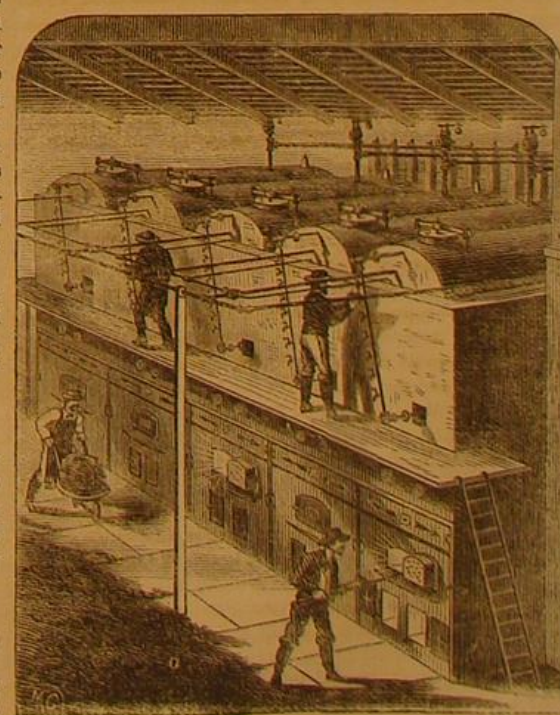
pure safe article, such as the Astral oil, will be made evident, to the satisfaction of the purchaser.

The daily journals are constantly giving accounts of lamentable accidents from the use of low quality oils which



AGITATOR.

signed for general lighting purposes, may be fully relied on as safe and good whenever the seals show that, they have not been meddled with.



STILLS.

ought never to have been sold; and the fact that these fluids are recklessly handled by careless and ignorant people gives additional importance and value to a safe and genuine article.

GENERAL STATISTICS.

To show the importance of the petroleum industry, we append a few statistics of the quantities of the oil shipped from New York, Boston, Philadelphia, Baltimore, Portland, and Cleveland, which are the cities whence foreign shipments are principally made.

FROM	CRUDE.	REFIN'D.	NAPHTHA.	TOTAL.		
				1870.	1869.	1868.
New York... galls.	7,904,418	74,805,397	4,717,484	87,427,299	65,833,600	52,803,202
Boston.....	25,177	1,559,479	306,605	1,790,271	2,117,929	2,410,114
Philadelphia.....	5,328,795	45,669,828	850,103	49,858,726	33,445,332	40,500,439
Baltimore.....	129,042	1,532,779	.....	1,731,321	1,551,423	2,387,702
Portland.....	.....	129,525	.....	129,525	.....	200,167
Cleveland.....	.....	.....	.....	.....	.....	270,000
Total..... galls.	11,238,232	123,596,321	5,773,292	141,208,135	102,748,664	99,281,758
Equal to bbls. of 42 galls.	284,439	2,977,412	144,821	3,230,204	2,568,715	2,842,044

The following shows, in barrels, the daily average product of the Pennsylvania oil district, during the year:

	1867.	1868.	1869.	1870.
January.....	9,700	10,152	12,624	12,624
February.....	9,300	9,967	11,917	11,917
March.....	8,621	9,801	12,285	12,285
April.....	8,537	11,067	12,574	12,574
May.....	9,790	10,153	14,163	14,163
June.....	10,192	11,334	14,817	14,817
July.....	10,698	11,607	15,969	15,969
August.....	11,981	12,157	17,474	17,474
September.....	9,700	11,833	12,645	12,645
October.....	9,600	10,133	12,071	12,071
November.....	9,800	10,275	13,012	13,012
December.....	10,400	9,524	12,844	12,844
Total production in December, 31 days, 1870.....	.....	.....	.....	471,657
Total production same month, 1869.....	.....	.....	.....	398,198

BORING FOR OIL.

The following description of tools and methods employed in boring for oil in Pennsylvania is extracted from Blake's "Notices of Mining Machinery":

The great advance has been in the construction of the tools, and in the adoption of simple apparatus for giving motion to the drill by means of steam power. For prospecting and for sinking to moderate depths, the spring pole, worked by hand, is frequently employed.

The constructions in common use in Pennsylvania at the oil wells, and used for a time during the oil excitement in California, consist of a derrick, ball wheel, band wheel, sampson post, and walking beam, and a portable steam engine.

The derricks are usually constructed of plank and boards, when they can be obtained, or of unhewn poles. They rise to a height of 50 or 60 feet, and taper upwards from a base about 15 feet square. The standards are of 2 inch plank, 8 inches wide, and the cross braces 8 inches wide and 1 inch thick. The tools are suspended by the cable, which, passing over the pulley at the top, descends at the side and is wound upon the drum of the bull wheel, the shaft of which rests on bearings in the standards. The drum of the bull wheel is about 10 inches in diameter.

The walking beam, of wood, 26 feet long, is supported at the center, upon the top of the sampson post. One end is connected, by a pitman, with a crank of 23 inches radius upon the end of a shaft, receiving motion by a belt from the engine; the other end, projecting within the derrick and directly over the well, carries suspended the temper screw to which is attached a clamp for seizing upon the rope. The rotation of the crank shaft gives a reciprocating motion to the end of the beam, and this is imparted to the rope, carrying the tools at its lower end.

The form of the temper screw is shown by the gure. By this, the drill may be lowered or "fed out" to a certain extent during the progress of boring. The rope is seized and held fast by the clamp, and when the whole length of the screw is fed out, the position of the clamp is changed.

The drilling tools consist of centerbits, reamers, an auger stem, sinker bar, and the "jar," besides a socket for attaching them to the lower end of the rope, and wrenches and other accessories to aid in attaching and unscrewing the bits. There are, besides, a variety of tools for recovering broken bits or other parts of the apparatus lost in the well, and sand pumps for removing the debris.

The bits are represented by the annexed cuts. They are 3½ inches broad on the face, and the reamers are 4½ inches. They are made, however, of various sizes, and all have strong, square shanks, so that they may be firmly screwed into the auger stem, made of 2½ inch iron and 20 feet long.

The "jar" is a contrivance by which the auger stem and bit are, in a measure, detached from the rope. By it a jerk may be given upwards, to loosen the bit in case it is wedged in the hole, while the same device serves to give a blow downwards upon the auger, after the bit strikes the bottom, thus doubling the efficiency of each stroke. It serves, also, to maintain the tension of the rope. These jaws are made of 1½ inch iron on the sides, with 12 inch heads and 18 inch stroke.

The sinker bar, 10 feet long, is attached by a screw to the upper end of the jar, and above this is the rope socket, securely united, by means of rivets, to the end of the rope.

The bits and other parts of the drilling tools are connected and disconnected by means of two large wrenches, 3 feet 9 inches long, with broad flat heads, shaped as shown in the figures.

The drilling ropes or cables vary from 1½ inch to 1½ inch diameter, and weigh from 48 pounds to 86 pounds per 100 feet.

The sand pumps, of sheet or galvanized iron, or of copper, are about five feet long and 3 or 4 inches in diameter, and are fitted with leather valves resting upon iron seats, as indicated at the lower end of the figure.

The steam engines in use are portable, and 8 or 10 horse power. A 900 feet well can be drilled with an 8 horse power engine. Rope for a well 900 feet deep, with the tools, will weigh about 800 pounds.

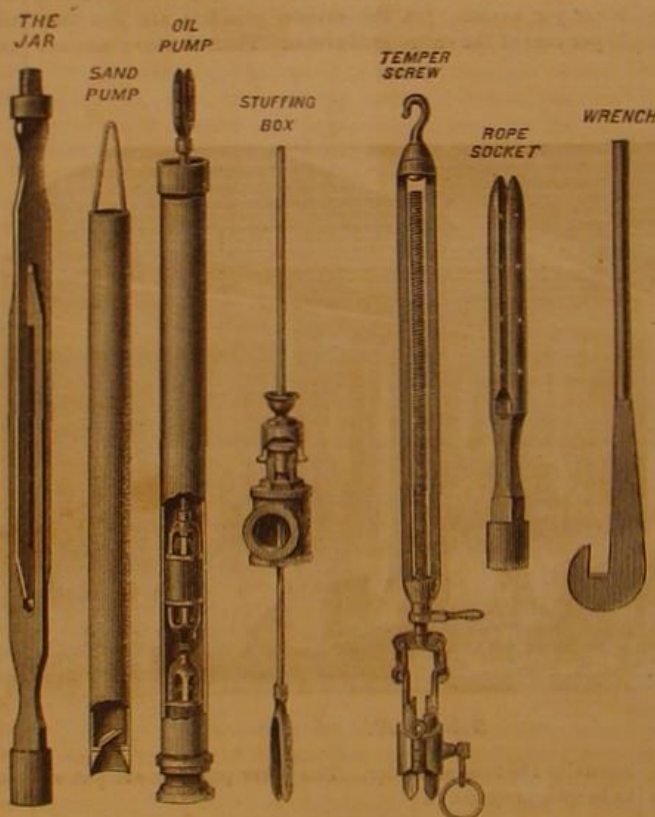
Before commencing to drill, it is usual to drive down a cast iron pipe through the loose soil until the firm bed rock is reached. These pipes are in lengths of 8 feet and 5 or 6 inches in diameter. They are joined together, end to end, by means of wrought iron bands, sized to shrink on to a shoulder turned upon each end of the pipe in a lathe, so that a flush joint is formed by the band. The lower end is made

BITS AND REAMER FOR DRILLING



sharp, and the band is edged with steel. The 5 inch lengths weigh 55 pounds per foot, or 440 pounds in all; and the 6 inch, 69 pounds per foot, or 552 pounds per length. For lining the wells, wrought iron tubing is used, made with screws and sockets, or with flush joints, but always smooth finished inside. The sizes vary for the light kinds from 1½ to 4 inches for the inside diameter, and from 1-66 pounds to 6 pounds per foot. The heavier tubing ranges from 1½ inches in diameter, and 2-70 pounds per foot, to 6 inches, weighing 18-7 pounds per foot. These large sizes are seldom used for oil wells.

Pumps are made of wrought iron pipe, lined with heavy seamless brass tubes bored perfectly true, or of heavy brass



tube alone. One of the last mentioned construction, 5 feet long, is shown by the annexed figure, in which a portion of the interior is seen with the two valves and boxes. These valves are made of gun metal, and are fitted with great care. The packing is made of the best oak-tanned leather. Ball valves are generally used.

At the top of the well a stuffing box and elbow pipe is fitted. The construction of this box and the form of the joint for attaching to the sucker rods is shown in the figure. The stuffing is kept in place, and is pressed firmly upon the plunger rod or piston by means of the follower, made of brass. The plunger rods are 5 feet long, are made of 1 inch diameter cold rolled iron, and are perfectly polished.

One other important adjunct of a complete oil well is the seed bag, the use of which is to form a water tight joint or packing around the tube or lining of the well, and thus shut off all communication between the water of the upper strata and the oil bearing crevices or chambers below.

This bag is made of leather, and is filled with flax seed. It is put around the tube, and is pushed down to the proper place, and soon becomes so much swollen by the absorption of water that it fills the space between the tube and the walls perfectly, and thus shuts off all communication around the tubing, for either water or oil from above or below.

Petroleum yields, by distillation, nine distinct commercial products.

Name.	Specific Gravity.	Boiling Point.	Boiling Point.
Rhigolene.....	62½	85	120° F.
Gasolene.....	66½	70	180°
C. Naphtha.....	706	67	220°
B. Naphtha.....	724	65	300°
A. Naphtha.....	743	45	350°
Kerosene Oil.....	804	36	425°
Mineral Sperm Oil.....	847	29	575°
Neutral Lubricating Oil.....	888	848(7)	

Naphtha in Gas Lighting.

Among the novel uses for naphtha, which is so successfully produced at the Pratt Oil Works, is the improvement of common gas light.

The history of this new system of lighting is as follows: About three years ago Dr. Leonard Gale and A. C. Rand, an extensive oil merchant and refiner, invented this process for at once utilizing the otherwise dangerous naphtha and supplying a cheaper and better gas. It has been in use for six months in South Brooklyn by the Citizens' Gas Light Company, who have had two "benches" (series of ovens containing retorts) in use with good success, and are getting more benches ready. The system has also been in operation for six months in Columbus, O., and is now being established in Detroit.

An interesting report concerning this gas has just been made by T. G. Wormley, State Gas Commissioner of Ohio, to the City Council of Columbus, O. The main points of his report are these: Examinations extending over a period of twelve days indicate that during that period the gas had an average illuminating power equal to 20-64 candles: that is, that the gas, when burned at the rate of five cubic feet per hour, gave on an average as much light as 20-64 sperm candles, each consuming 120 grains of sperm per hour. The statute relating to this subject fixes the illuminating power at twelve standard candles. The average of the sulphur found in the gas was 6-12. The averages in London, made at eight stations last year, ranged from 16-21 to 33-30 per 100 cubic feet of gas. The ammonia was scarcely noticeable at the Columbus works—8-100ths of a grain; carbonic acid gas, 60-100ths; vapor of water, 82-100ths; free oxygen gas, 90-100ths. These proportions of carbonic acid gas and vapor of water thus found were about the same or a little below the quantities usually present in illuminating gas, but the proportion of free oxygen was much above.

The works of the New York Mutual Gas Light Company, which gives promise of affecting very much for the better the interests of hundreds of thousands of our citizens, are well worthy of inspection. On the river side of the eight acres covered by the works are the coal sheds, capable of containing 30,000 tons of coal. On the Eleventh street side are the offices of the company and the coke yard. On the Avenue D side are the four great gas holders, already completed, and capable of containing 265,000 cubic feet each. On Thirtieth street are the foundations of three more gas holders and the naphtha reservoir. The latter is made of half inch boiler iron, fastened with hot rivets, and is steam proof. In the center are the purifying and retort houses.

The process by which naphtha, usually so dangerous, is converted into as harmless an illuminating gas as that produced directly from coal, is as follows: The liquid naphtha flows from the reservoir to the retort house, where it is received in four stills, within which steam pipes are run in all directions. The effect of the heat from the steam pipes is to vaporize the naphtha. These stills are supplied with safety valves. The vaporized naphtha passes next to a row of clay retorts, forty-eight in number, similar to those used for making ordinary coal gas, except that they are double. In the same building there are 240 retorts for making the coal gas that is to be mixed with the naphtha gas. The passage of the vaporized naphtha through and over the red hot retorts converts it into a permanent rich illuminating gas, the same as that from the best Australian cannel coal. It passes from the retorts to the building containing the condensers, thence to a large station meter in the office, and thence to the gas holders, where it first comes in contact and mixes with the common coal gas.

The gas contained in the coal has to pass through many more processes than that found in the naphtha; but as these processes have often been described, they need only be enumerated here. The coal is thrown into the retorts. The gas eliminated passes from these through a pipe to the building containing the condensers and a singular series of "scrubbers"—immense reservoirs wherein it comes in contact with falling water; thence to the purifiers—tanks where it is purified by chemical action—and thence to the station meter, preparatory to its mixture with the naphtha gas.

The Generation of Petroleum.

In the usually followed processes of manufacturing refined oil, the crude article yields three separate and different products—naphtha, kerosene, and residuum—a fact which certainly supports the belief that crude oil is the product of three different minerals. So far as concerns the contribution by coal of an integer in the chemical process, by which petroleum is produced in and from certain geological strata, it may be remarked that the "shale" oil produced from bituminous coal in England is very different from American petroleum, in that the American naphtha must be used in order that the latter may be burned in lamps. Another fact that favors the inference that petroleum is mainly produced from or generated through limestone, is that petroleum has been extracted from limestone found in the neighborhoods of Chicago and of Terre Haute, Ind. In regard to the reproductive powers recently developed, in the Pennsylvania territory believed to have been exhausted, it affords two favorable presumptions: First, as a partial assurance that the distillation of petroleum is a continuous process; and next, that the formerly abandoned territory was given up because the machinery for extracting petroleum from the earth exceeded, in its power of exhausting the fluid, the generative powers by which it is produced. These facts will be encouraging to the large number of persons whose livelihood is obtained by this important manufacture.

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Portable Drilling Machines.

In all machine construction, much time and labor are wasted in drilling holes by hand, for the want of a practical machine driven by power, which would do the work. Our illustration represents three sizes of portable drilling machines, manufactured by Thorne and De Haven, of Philadelphia, which fulfil the conditions required of a tool for this purpose. They can be bolted to the work to be drilled, as easily as a ratchet brace can be rigged up for hand drilling, and can be driven by power in any position, at any distance, and in any direction from the driving apparatus.

Tarred rope is used for transmitting the power, and is found to be preferable in every respect to a round leather belt.

The operation is as follows: The power is transmitted, to the fast and loose pulleys on the countershaft, by means of a flat belt from the line shaft, in the usual way. On the other end of the countershaft is a grooved pulley, which gives motion to the rope which drives the drilling machine. The pulling side of this rope passes under an idler pulley held in a frame which rotates on a hollow stud, through which the rope passes. The rotation of this frame permits the rope to be led in any direction to the drill. A weighted idler is hung on the slack side of the belt, maintaining the tension and permitting the distance of the drilling machine to be varied at will. A weight of only 25 pounds hung there will prevent the rope from slipping on the pulleys when drilling a two and a half inch hole, in the solid, with an ordinary feed. When the rise and fall of this weighted idler does not give sufficient distance, additional lengths of rope can be inserted by means of the couplings used.

All the features of the machine are shown in the engraving. The height of the post can be altered to suit different lengths of drills and chucks used in the spindle. The radial arm is traveled by a screw and rotated, on the post, by a worm and tangent wheel, giving great accuracy of adjustment and permitting this adjustment without the necessity of removing the rope from the cone pulley. The frame carrying the spindle, gears, and cone pulley can be rotated so as to bring this pulley in line for the rope, in whatever position the machine may be. By removing a collar from the bottom of this frame, as shown in the central figure, the spindle can be set to an angle, with the base of the machine, in any direction. By holding the post in the clamp bearing on the side of the base, the machine will drill parallel to the base.

Both the driving apparatus and the drilling machine have been patented in this country and abroad. Any further information can be had by addressing Thorne & De Haven, 23d and Cherry streets, Philadelphia, Pa., or J. Austin & Co, general agents, 168 Fulton street, New York.

Bone Dust as a Fertilizer.

The question is often asked whether boiled bones are worth less, and how much less valuable they are, than those containing the grease. Grease is of no value as a fertilizer, and its removal cannot diminish the cash value of the bones

The grease may even lessen their value, in so far as bones containing it are less rapidly decomposed.

There is a great difference in bone dust; the finer it is, the easier it becomes active. According to experiment, steamed and very finely ground bone dust is almost entirely decomposed in a few months, while coarse, raw bone dust has decomposed but slightly in years, so that it is in this respect very like wool and leather. On this account a very fine bone dust has a considerably higher cash value than the coarse.

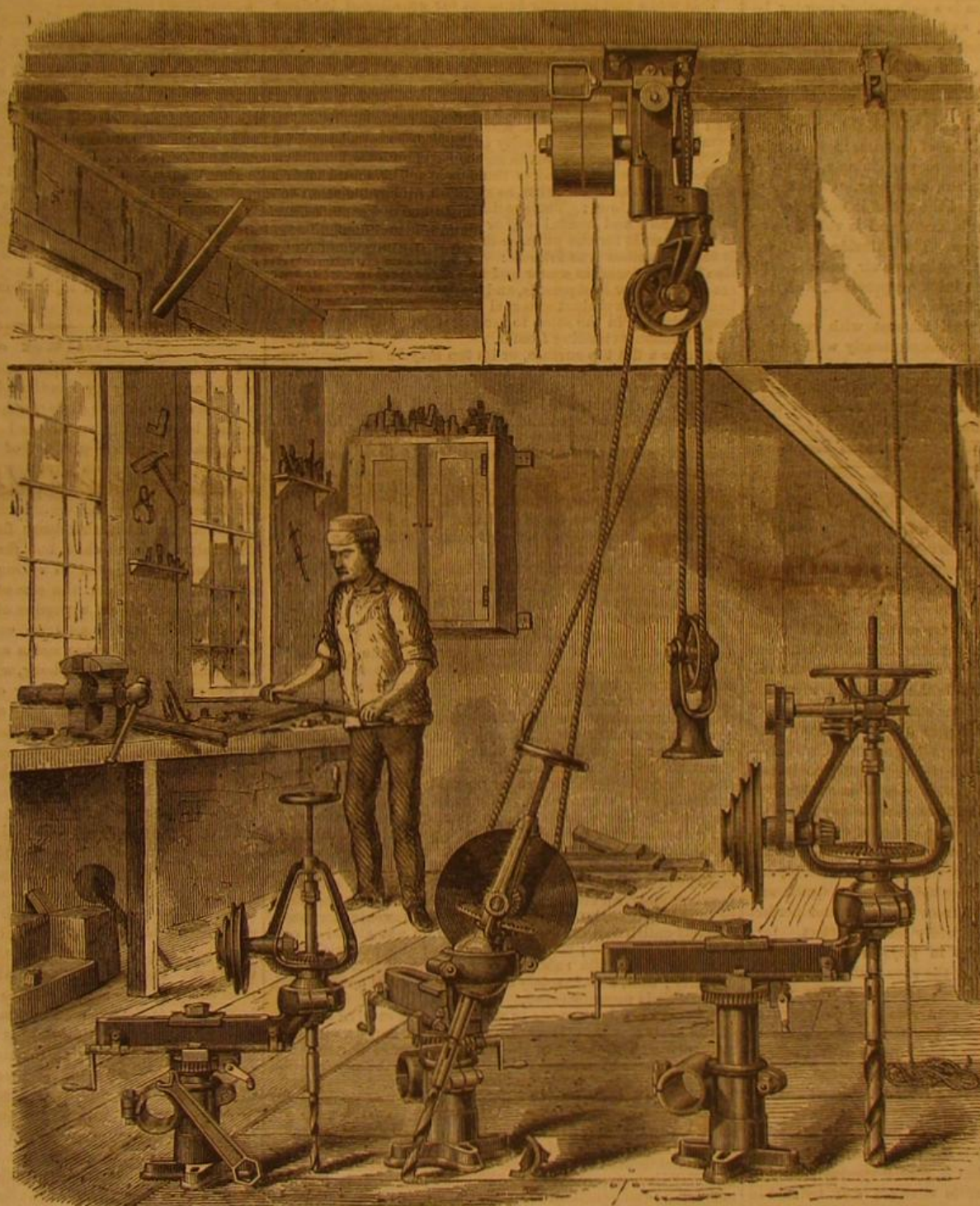
When to use bone dust depends not only on the plants but also on the soil. Bone dust contains phosphates and nitro-

In making the superphosphate, the bone dust is piled up in a heap, and 30 to 40 pounds of sulphuric acid added to each hundred weight. A hole is made in the top of the pile, and the acid mixed with its weight of water poured in from time to time, and the whole as thoroughly mixed as possible. The heap is then covered with earth and left until it is to be used, or at least for a few days, then mixed with earth and applied.—*Journal of Applied Chemistry.*

Indium, the Last New Metal.

Indium was first recognized in 1863, by Drs. Reich and Richter, in the zinc blende of Freiberg in Saxony, and by reason of the very characteristic spectrum afforded, which consisted of two bright blue or indigo bands, the brightest of them somewhat more refrangible than the blue line of strontium, and the other of them somewhat less refrangible than the indigo line of potassium. Since its first discovery, indium has been recognized in one or two varieties of wolfram, and as a not unfrequent constituent of zinc ores, and of the metal obtained therefrom, but always in a very minute proportion. Indeed, indium would appear to be an exceedingly rare element, far more rare than its immediate predecessors in period of discovery. Its chief source is metallic zinc—that of Freiberg, smelted from the ore in which indium was first discovered, containing very nearly one half part of indium per 1,000 parts of zinc. A considerable quantity of indium extracted from this zinc was shown in the Paris Exhibition of 1867; and an ingot from the Freiberg Museum, weighing 200 grammes, or over 7 ounces, has within the last few days been kindly forwarded by Dr. Richter himself, for inspection on the present occasion. To Dr. Schuchardt, of Goerlitz, also, the members of the Institution are indebted for his loan of nearly sixty grammes of metallic indium, and of fine specimens of other rare chemical products, prepared with his well known skill, in a state of great purity and beauty.

When zinc containing indium is dissolved, not quite completely, in dilute sulphuric or muriatic acid, the whole of the indium originally present in the zinc is left in the black spongy or flocculent residue of undissolved metal, with which every one who has prepared hydrogen gas by means of zinc and acid is so well acquainted. Besides some zinc, this black residue is found to contain lead, cadmium, iron, and arsenic, less frequently copper and thallium, and in some cases, as that of the Freiberg zinc, a small proportion of indium. From the solution of this residue in nitric acid, the indium is separated by ordinary analytical processes, based chiefly on the precipitability of its sulphide by sulphuretted hydrogen from solutions acidulated only with acetic acid, and on the precipitability of its hydrate both by ammonia and carbonate of barium. From its soluble salts, metallic indium is readily thrown down in the spongy state by means of zinc. The washed sponge of metal is then pressed together between filtering paper, by aid of a screw press, and finally melted under a flux of cyanide of potassium.



PORTABLE DRILLING MACHINES.

gen, both of which are necessary for the growth of all plants; so wherever these are wanting in soil, bone dust can be used to advantage. It is not judicious to employ bone dust or other insoluble organic substances in soils which already contain vegetable remains, as, for instance, in boggy and marshy ground, for we may safely assume that in such soils organic matter decomposes only very slowly, or not at all. In practice, bone dust is used on grain and on dry, not marshy, meadows, and especially on potatoes, since by manuring in the hill a smaller quantity of fertilizer accomplishes a more considerable result.

The method of applying bone dust is either to mix it with other manure, or sow it broadcast on the field and plow it (for grain), or manure in the hill (for potatoes, corn and beets); or it is mixed with sulphuric acid, and the superphosphate thus prepared is used in one of the above mentioned ways.

Thus obtained, indium is a metal of an almost silver white color, apt to become faintly bluish tinted. It tarnishes slowly on exposure to air, and thereby acquires very much the appearance of ordinary lead. Like lead, it is compact and seemingly devoid of crystalline structure. Moreover, like lead and thallium, it is exceedingly soft, and readily capable of furnishing wire, by the process of "squirting" or forcing. The specific gravity of indium, or 7.4, is very close to that of tin, or 7.2, and much above that of aluminium, 2.6, and below that of lead, 11.4, and that of thallium, 11.9. In the lowness of its melting point, namely, 176° C., indium occupies an extreme position among the metals permanent in air, the next most fusible of these metals, namely, tin and cadmium, melting at 232°; bismuth at 264°; thallium at 294°; and lead at 325°. Though so readily fusible, indium is not an especially volatile metal. It is appreciably less volatile than the zinc in which it occurs, and far less volatile than cadmium. Heated as far as practicable in a glass tube, it is incapable of being raised to a temperature sufficiently high to allow of its being vaporized, even in a current of hydrogen.

Indium resists oxidation up to a temperature somewhat beyond its melting point, but at much higher temperature it oxidizes freely; and at a red heat, it takes fire in the air, burning with a characteristic blue flame and abundant brownish smoke. It is readily attacked by nitric acid, and by strong sulphuric and muriatic acids. In diluted sulphuric and muriatic acids, however, it dissolves but slowly, with evolution of hydrogen. Oxide of indium is a pale yellow powder, becoming darker when heated, and dissolving in acids with evolution of heat. The hydrated oxide is thrown down from indium solutions by ammonia, as a white, gelatinous, alumina-like precipitate, drying up into a horny mass. The sulphide is thrown down by sulphuretted hydrogen as an orange yellow precipitate, insoluble in acetic but soluble in mineral acids. The hydrate and sulphide of indium, in their relations to fixed alkali solutions more particularly, seem to manifest a feebly marked acidulous character. Chloride of indium, obtained by combustion of the metal in chlorine gas, occurs as a white micaceous sublimate, and is volatile at a red heat, without previous fusion. The chloride itself undergoes decomposition when heated in free air, and the solution of the chloride does so upon brisk evaporation, with formation in both cases of an oxichloride.

But the chief point of chemical interest with regard to any newly discovered element, and consequently with regard to indium, is the establishment of its atomic weight; which, in the case of a metallic element, is based primarily upon the determination of the ratio in which it combines with oxygen and chlorine. In Cl_2 , the atomic weight of indium is 113.5.—*Lecture by Professor Odling, in Mechanics' Magazine.*

The Eye.

There is no optical instrument maker who does not succeed in constructing an apparatus much more perfect in many points than the eye—that marvellous organ, which we are inclined to regard as the masterpiece of vital and organic architecture, on account of the great service it renders to man.

This sense of sight, which is so far reaching that it gives us the power to penetrate infinite space and apprehend the universe, at the same time makes us familiar with the minutest objects; this sense, which is the freest and most unobscured in its actions—for our sense of touch is limited by the length of our arms, hearing to a few thousand feet, the senses of smell and taste having still greater limitations—this sense, I say, acts through an agent apparently so imperfectly adapted to its purpose, that recent investigations stand amazed at the idea how by it we receive any intelligible impressions. That we do is an evidence of the independence of the mind, and its power to make useful these necessary and imperfect means contact with the outer world, and proves the necessity of educating this sense to quick and precise perceptions in order to correct its faults and perfect the work which Nature has designedly left imperfect.

The eye has the defect of what in physics is called the "aberration of sphericity;" that is, the rays that pass through the center of a lens have a common focus, but rays which pass a certain distance from the center do not converge at the same point, but pass beyond. The nearer they come to the circumference, the greater the focal distance, if the lens is rigorously spherical. In good optical instruments, this defect is scarcely perceptible, the rays being centralized by flattening the lens. Again, the eye is not spherical, but has an elliptical curve. This was for some time thought to be an advantage, but the contrary is the truth. And this curve is not even well "centered," that is, placed symmetrically to the visual axis like a lens, but is changed and twisted in every direction. From this results what has been called the "astigmatism" of the eye, which consists in not being able to see at the same distance a vertical line with the same distinctness as one that is horizontal. This recently discovered phenomenon has attracted the attention of all oculists, as it sometimes constitutes a real disease of the eye. Again, the retina of the eye has spots where it is entirely blind to impressions of light. But is this eye, which is unsymmetrical, badly centered, blind in spots, at least perfectly translucent? Not at all. The cornea and crystalline lens of the eye are not absolutely limpid, as appears when examined through an intense blue or violet light, which renders it fluorescent. This phenomenon is due to the traces of a substance analogous to quinine, a body which possesses in the highest degree the property of fluorescence, that is, of emitting a light of its own, under the excitement of blue or violet lights. The crystalline lens, itself, is not of a homogeneous composition, but has a crystalline structure of six branches.

This is the cause of the stars appearing to us with rays. All attempts to explain this phenomenon were vain, until it was found to be in the visual organ itself. It is for this reason that the crescent of the moon, when it is very thin, seems to be double or triple to some persons.

These facts are enough to show to any one how prone the untrained eye must be to error and self-deception, and that seeing is not a physical but a mental act. In infancy, the eye is aided by the hands or touch to acquire experience of the nature and consistency of things; later in life, the eye asserts its superiority by instructing the hands to perform ingenious and cunning work. The two senses seem thus to continue mutually to assist and act upon each other. Touch lends to sight material aid and support. The eye refines and gives intelligence to the material sense of touch, so that, when sight is wanting, touch takes its place and performs its duties.

The eye in its direct and steady look embraces but a small compass of actual sight; in fact, we clearly see but a small point, which comes just in the focus of the eye; and it is owing to a quick vibratory movement of the eye that we are able to see large extents apparently at the same time.—*Professor John H. Niemeyer.*

PATENT INFRINGEMENT CASES.

United States Circuit Court—Southern District of New York.

Rubber Tip Pencil Company vs. S. D. Hovey et al.

This was a suit in equity brought for an alleged infringement of the patent granted to J. B. Blair, July 23, 1867, for rubber heads for pencils. The nature of the patent and the facts are fully set forth in the opinion of the court.

Benedict, Judge:

This action is founded upon a patent for rubber heads for lead pencils, issued to J. B. Blair, dated July 23, 1867, and numbered 66,938. The novelty of the invention and the validity of the patent are put in issue.

The proper construction of the patent is the question first presented. The description, as given in the specification and claim, is as follows: The specification states the invention to be a new and useful cap or rubber head to be applied to lead pencils for the purpose of rubbing out pencil marks. It then describes it as follows: "The nature of the invention is to be found in a new and useful improved rubber or erasive head for lead pencils, and consists in making the same head of any convenient external form, and forming a socket longitudinally in the same to receive one end of a lead pencil or a tenon extending from it. * * * The said head may have a flat top surface, or its top may be of a semicircular or conical shape, or any other that may be desirable. Within one end of the same head, I form a cylindrical or other proper shaped cavity. This socket I usually make about two thirds through the head and axially thereof; but, if desirable, the socket or bore may extend entirely through the said head. The diameter of the socket should be a very little smaller than that of the pencil to be inserted in it. The elastic erasive head so made is to fit upon a lead pencil at or near one end thereof, and to be made so as to surround the part on which it is to be placed, and to be held thereon by the inherent elasticity of the material of which the head is to be composed."

"The head is to be composed of india rubber, or india rubber and some other material which will increase the erasive properties, such as powdered emery for instance."

The article is further described by drawings, which, the specification states, "exhibit the elastic head so made as to cover the end as well as to extend around the cylindrical sides of the pencil; but it is evident that the contour of the said head may be varied to suit the fancy or taste of an artist or other person, and I do not limit my invention to the precise forms shown in the drawings, as it may have such or any other convenient for the purpose, so long as it is made so as to encompass the pencil and present any erasive surface about the sides of the same." The specification further states that the elastic or rubber pencil head, made as above set forth, may be applied not only to lead pencils, but to ink erasers and other articles of like character.

The claim is for "an elastic erasive pencil head made substantially in manner as described." In considering the effect of this language, it is to be noticed that the invention is not stated to be a combination, but a single article of manufacture—namely, an elastic erasive pencil head. The peculiarity in this article, by reason of which the inventor supposes himself entitled to secure it as his own, is not stated to consist in its elasticity; that is a quality of the material to be used, which is india rubber. Nor does it consist in erasive capacity; that, also, is solely due to the material out of which the article is manufactured.

An effort has been made to show that the erasive capacity of the Blair head is increased by means of certain swells or projections on the sides of the head, which are portrayed in the drawings and supposed to be indicated in the specification as a feature of the invention claimed; but I find no language which can fairly be said to convey the idea that such swells or projections form a part of this invention. On the contrary, the description states that the heads may be of any convenient external form, and expressly declares that the invention is not limited to the precise forms shown in the drawings, but may have any convenient form "so long as it is made to encompass the pencil and present an erasive surface about the sides of the same." The phrase last quoted from the specification discloses what is the real and only feature of the article in question upon which the right to it is based; and the characteristic is one of form, but not of what is called in the specification external form.

The characteristic form which the inventor claims to have invented is, broadly, any form which will enable the rubber to encompass a pencil, ink eraser, or other article of like character. The additional words "and present an erasive surface about the sides of the same" add nothing to the description, as it is impossible to have a piece of rubber encompass a pencil, ink eraser, or other article of similar character without presenting an erasive surface about the sides of the same. From this form which the inventor gives to a piece of rubber—otherwise to be of any convenient form—and from this form alone, does the article derive its value, as distinguished from rubber in any other form. By means of this form, any person is enabled easily to attach the rubber to a pencil, ink eraser, or other article of similar character, and the only useful result attained by the invention in question is that the head can be so easily attached to any pencil.

Now, what is it that accomplishes the useful result attained by the Blair pencil head? Simply the hole made in the rubber. There must be a piece of rubber with a cavity in it to constitute such a pencil head as Blair's specification describes, and there need be nothing more. The cavity may be round, square, or any other shape. It may go through or partly through the piece of rubber, and it may be of all sizes. The article sought to be secured by this patent, briefly and yet, as I think, fully described, consists, therefore, of a piece of india rubber with a hole in it. I am unable to fix any other limitation to the invention by any fair use of the language employed in the specification and claim.

Such an article cannot be the subject of a patent. The elastic and erasive properties of india rubber were known to all, and gave to that substance the names by which it is generally designated; and how to make a piece of rubber encompass and adhere to another article was known to every person who had ever seen a rubber shoe. No person knowing of the elastic quality of rubber could be wanting in the knowledge that a piece of rubber could be made to encompass and adhere to a pencil, ink eraser, or other article of similar character, by making a hole in it; nor could any one be deficient in the skill requisite to make such a hole.

I am of the opinion, therefore, that the patent in question cannot be upheld for want of invention.

This conviction, which I am unable to escape, renders it unnecessary for me to express any opinion upon the question of abandonment so largely discussed at the hearing, nor to determine whether the patent in question is for the same invention described by Joshua Gray in his application for a patent, and by others who have been relied on by the defence as showing prior invention.

A decree must be entered, dismissing the bill with costs.

United States Circuit Court—Northern District of New York.—Jacob E. Buerk vs. Dennis Valentine.

This was a suit in equity on two patents for watchmen's time detectors. Judge Woodruff decides that both complainant's patents are valid, and that both were infringed by defendant, who imported time detectors and sold them in this country. The patented improvements (sometimes called by the trade watch clocks and watch control), are largely used in factories and public buildings, and enable the officers to have a check on the watchman. The watchman carries the detector with him in his circuit to the rooms to be visited, and inserts a marking key fastened in the room, so as to mark a paper dial secured inside the detector. This is done at every room and station visited, a peculiar key being fastened at each place for that purpose. An inspection of the paper dial, at any time afterwards, will reveal the time and order of the visits.

Decree awarding an injunction and account, as prayed in the bill.

Insect Wax of China.

In China, prior to the thirteenth century, beeswax was employed as a coating for candles; but about that period the white wax insect was discovered, since which time that article has been wholly superseded by the more costly but incomparably superior product of this insect. The animal feeds on an evergreen shrub or tree (*Ligustrum Unidum*) which is found throughout Central China, from the Pacific to Thibet.

Sometimes the husbandman finds a tree which the insects themselves have reached, but the usual practice is to stock them, which is effected in spring with the nests of the insect. These are about the size of a fowl's head, and are removed by cutting off a portion of the branch by which they are attached, leaving an inch each side of the nest. The sticks with the adhering nests are soaked in unhusked rice water for a quarter of an hour, when they may be separated. When the weather is damp or cool, they may be preserved for a week; but, if warm, they are to be tied to the branches of the tree to be stocked without delay, being first folded between leaves. By some, the nests are probed out of their seats in the bark of the tree without removing the branches. At this period they are particularly exposed to the attacks of birds, and require watching.

In a few days after being tied to the tree, the nests swell, and innumerable white insects the size of mites emerge and spread themselves on the branches of the tree, but soon with one accord descend towards the ground, where, if they find any grass, they take up their quarters. To prevent this, the ground beneath it is kept bare, care being taken also that their implacable enemies, the ants, have no access to the tree. Finding no congenial resting place below, they reascend and fix themselves to the lower surface of the leaves, where they remain several days, when they repair to the branches, perforating the bark to feed on the fluid within. From mites, they attain the size of lice; and having compared it to this, the most familiar to them of all insects, our Chinese authors deem further description superfluous. Early in June, they give to the trees the appearance of hoar frost, being changed into wax. Soon after this, they are scraped off, being previously sprinkled with water. If the gathering be deferred till August, they adhere too firmly to be easily removed. Those which are suffered to remain to stock trees the ensuing year secrete a purplish envelope about the last of August, which at first is no larger than a grain of rice; but, as incubation proceeds, it expands and becomes as large as a fowl's head, when the nests are transferred, in Spring, to other trees, one or more of each, according to their size and vigor, in the manner already described. In being scraped from the trees, the crude material is freed from its impurities, probably the skeletons of the insects, by spreading it on a strainer, covering a cylindrical vessel, which is placed in a cauldron of boiling water; the wax is retained in the former vessel, and, on congealing, is ready for market. The *pel-lah* or white wax, in its chemical properties, is analogous to purified beeswax and also spermaceti, but differing from both, being in my opinion an article perfectly *sui generis*. It is perfectly white, translucent, shining, not unctuous to the touch, inodorous, insipid, crumbles into a dry, inadhesive powder between the teeth, with a fibrous texture resembling feldspar; melts at 100° Fahr.; insoluble in water; dissolves

in essential oil, and is scarcely affected by boiling alcohol, the acids or alkalis.

The aid of analytical chemistry is needed for the proper elucidation of this most beautiful material. There can be no doubt it would prove altogether superior in the arts to purified beeswax. On extraordinary occasions, the Chinese employ it for candles and tapers. It has been supposed to be identical with the white wax of Madras; but as the Indian has been found useless in the manufacture of candles, it cannot be the same. It far exceeds. It far exceeds, also, the vegetable wax of the United States (*Myrica Conifera*).

Is this substance a secretion? There are Chinese who regard it as such—some representing it to be the saliva and others as the excrement of the insect. European writers take nearly the same view; but the best native authorities expressly say that this opinion is incorrect, and that the animal is changed into wax. I am inclined to think that the insect undergoes what may be styled auraceous degeneration, its whole body being permeated by the peculiar product, in the same manner as the *coccus cacti* is by carmine. It costs at Ningpo from 22 cents to 35 cents per pound. The annual product of this humble creature in China cannot be far from 400,000 pounds, worth more than \$100,000.—*Dr. D. J. Macgowan*.

THE NEBULAR HYPOTHESIS.

Professor John Fiske, of Harvard University, recently delivered a very interesting lecture on the above subject at the Cooper Institute in this city, from which we derive the following:

The lecturer began by mentioning the planetary revolutions which have become so familiar to us that we commonly overlook them altogether through sheer inattentiveness, failing to realize their significance, though their harmonious relations, as Laplace has shown, prove that the various members of the solar system have had a common origin. The clue to that common origin may be sought in facts which are daily occurring before our very eyes. Every member of our planetary system is constantly parting with molecular motion in the shape of heat. Our earth is incessantly pouring out heat into surrounding space; and, although the loss is temporarily made good by solar radiation, it is not permanently made good, as is proved by the fact that during many millions of years the earth has been slowly cooling. The evidence is overwhelming which shows that the earth's surface was once hotter than the flame of an oxyhydrogen blow pipe. The moon also is cooler than formerly, as is shown by the fact that the stupendous forces which once upheaved its great volcanoes are now quiescent. The sun, too, is pouring away heat at such a rate that—according to Herschel—if a cylinder of ice 184,000 miles in length and 45 miles in diameter were darted into the sun every second, it would be melted as fast as it came.

PLANETARY GENESIS.

There is every reason for believing that sun, moon, and Earth, as well as the other members of our system, have been from time immemorial losing more heat than they have received in exchange. As in losing heat all bodies contract, it follows that the various members of the solar system must all be much smaller than they were at the outset. Though they have increased in mass by appropriating large quantities of meteoric dust, they must at the same time have greatly decreased in volume. Obviously, therefore, if we were to go back far enough, we should find the Earth filling the moon's orbit, so that the matter now composing the moon would then have formed a part of the equatorial region of the earth. At a period still more remote, the earth itself must have formed a tiny portion of the equatorial region of the sun, which then filled the Earth's orbit. At a still earlier date the solar system must have consisted simply of the sun, which, more than filling Neptune's orbit and consisting of widely diffused vapors, merited the name of nebula rather than of star. In the slow concentration of this solar nebula, the present peculiarities of the solar system may find their explanation. The incessant loss of heat radiated into the surrounding space caused a steady contraction of the solar mass; while, on the other hand, the increasing rapidity of its rotation impressed upon those parts of it nearest the surface a tendency to fly off into space, or at least to remain behind instead of accompanying the central portion of the body in its contraction. As in every rotating spheroid, this centrifugal force is greatest where the velocity is greatest—at the equator—a time came in the history of our vaporous sun when the bulging equatorial portion, no longer able to keep pace with the rest in its contraction, was left behind as a detached ring surrounding the central mass; which ring soon broke up into many fragments of unequal dimensions. At this stage, then, we have a host of satellites surrounding the solar equator, revolving in the direction of the solar rotation, following each other in the same orbit, and gradually becoming agglomerated, by gravitative force, into a spheroidal body, having a velocity compounded of the several velocities of the fragments, and a rotation made up of their several rotations. Meanwhile the central mass of the sun, cooling and contracting, left behind a second equatorial belt, which, breaking and consolidating after the same manner, became the planet Uranus. In like manner were formed all the planets and their satellites. Such is the grand theory of nebular genesis, in which, as Mill reminds us, "is no unknown substance, introduced on supposition, nor any unknown property or law ascribed to a known substance." It involves none but established mechanical and dynamical principles.

THE PHENOMENA OF PLANETARY HEAT.

Further evidence of the correctness of the theory is found in the present physical condition of the various planets. The

theory assumed that all the planets, having successively originated from the same nebulous mass of vapor, must be composed in the main of the same chemical elements; and this inference has been uniformly corroborated by the results of spectroscopic observation wherever there has been a chance to employ it. The contracting process through which the Earth has passed to its present dimensions has been or will be, under proper conditions, repeated to a certain extent upon all the other planets. Upon any planet there must eventually occur a solidification of the outer surface, and extensive evaporation and precipitation of water, an upheaval of mountains, an excavation of river beds, and a deposit of alluvium resulting in sedimentary strata. But obviously the time at which these phenomena occur must depend upon the rate at which the planet parts with its heat, as well as upon the age of the planet, and upon the stock of heat with which it started. Against the facts that the outer planets are immensely older than the inner ones, and have received during recent ages much less solar radiance, must be offset the consideration that they must have started with a much greater amount of heat than the inner ones. Manifestly when the solar mass filled the entire Neptunian orbit, it must have contained the heat of which the subsequent loss has shrunk the sun to his present dimensions. The earliest planets must therefore have possessed relatively enormous quantities of molecular motion; and the ratios of their volumes to their masses must have been very much greater than in the case of the inferior planets since formed from a cooler and denser sun. Just as the hot water in the boiler may remain warm through a winter's night, while the hot water in the tea kettle cools off in an hour, so a great planet like Jupiter may remain in a liquid molten condition long after a small planet like the Earth, though formed ages later, has acquired a thick, solid crust and a cool temperature. Hence we may expect to find the largest planets still showing signs of a heat like that which formerly kept the Earth molten, and the smallest planets in some cases showing signs of a cold more intense than any which has been known on the Earth. This series of inferences, constituting simply an elaborate corollary from the nebular theory, is fully confirmed by observation in the cases of Saturn, Jupiter, Mars, and the moon—the only planets whose surfaces have been studied with any considerable success. According to the nebular theory, Jupiter and Saturn ought to be prodigiously hot; and so they appear to be when carefully examined. The absence of any atmosphere from the surface of the moon, with the absence of any signs of liquid oceans and running water, shows a discrepancy which, however, disappears when we inquire into its past history as revealed by the present condition of its surface. That surface is almost entirely made up of huge masses of igneous rock, through which, at short intervals, there yawn enormous volcanic craters whose fires seem to be totally extinguished. This implies that the moon is a dead planet—that the tremendous forces which produced this state of things are radiated off into space. In the later ages of a planet's history, when the heat is nearly all radiated away, and the expansive force of the nucleus is consequently reduced to a minimum, the ever thickening and hardening envelope will have shrunk in upon the nucleus in such a way as to leave vast abysses capable of engulfing all the air and water which the planet possesses. Thus it is that in the chasms of the moon, all its oceans and atmosphere have disappeared. Mars, with his oceans, his atmosphere, his clouds and polar snows, is another strong supporter of our theory.

Facts which, on a superficial view, appear as obstacles to the nebular theory, turn out, on a closer examination, to be powerful arguments in its favor. The vexed question of "irresolvable nebulae" has been settled forever in favor of the theory, by the discovery of the bright lines, which are sure evidence of a gaseous condition. Henceforward, we add the weighty argument that masses of matter still exist in space in the very condition in which our system must be supposed to have originally existed. The distribution of nebulae is yet another significant argument. The parallelism between the positions of the planets and nebulae indicates a common mode of evolution of the whole starry system, and points to a gigantic process of concentration going on throughout the galaxy, analogous to the local process of concentration which has gone on in our own little planetary group.

Singular Break Down of an Engine.

A few mornings ago, the residents of the vicinity of Front street, Brooklyn, N. Y., were suddenly alarmed by a report like that of a cannon. It seems that a steam engine, which is located on the first floor of the Brooklyn Brass and Copper Foundry, was working as usual just before the accident occurred. There was no unusual strain upon it, when suddenly, and without any previous noise or signs of anything amiss, the trace at the bottom of the walking beam snapped, and although the engineer was on the spot, the whole engine was wrecked before he could shut off the steam. About one hundred and fifty hands are employed in the works. The damage cannot be fully estimated until the whole machinery has been examined, but it will amount to several thousand dollars, and the repairs will require probably three weeks time. Fortunately no person was injured.

MARVELS OF THE MICROSCOPE.—A beautiful and easily produced exhibition of crystal formation may be seen under the microscope as follows: Upon a slip of glass, place a drop of liquid chloride of gold or nitrate of silver, with a particle of zinc in the gold and copper in the silver. A growth of exquisite gold or silver ferns will vegetate under the observer's delighted eye.

Edge Tools.

Shear steel began to be made in Sheffield in 1800. The inventions of Mushet and Lucas in 1800 and 1804 further extended the manufacture. Forks and scissors were made by rolling in 1805. From this time, immense cutlery works sprang up in England, France, and Germany, and the competition between the three countries has been highly beneficial, for while England stands undoubtedly foremost, yet both France and Germany possess their own peculiar excellences. Amongst the imports connected with cutlery, there is in Sheffield an annual consumption of more than seventy tons of ivory for the handles of knives and forks, and about 3,000 operatives are employed in forging and grinding the blades. An equal number of workpeople are engaged on pen and pocket knives, made annually to the value of \$500,000. Very many are occupied in fabricating razors and scissors.

French cutlery is chiefly fabricated at St. Etienne and Thiers, where many hands are employed. Table cutlery is here produced at a rate almost incredibly cheap.

Germany, despite the superior natural advantages of England, exports knives and edged tools to a considerable amount. Solingen has received the appellation of the Sheffield of Germany, and has, since the middle ages, been celebrated for its cutlery, being especially famous for its swords, the blades of which sometimes sell for \$500.

In Austria, scythes, sickles, and table knives are made annually by millions, at an exceedingly small cost of production. It is computed that 80,000 Bavarian grindstones are consumed annually in the preparation of these implements.

With the rapid development of the mechanical arts, the manufacture of tools has correspondingly grown. At one time England possessed a monopoly, and the English trade mark was a guarantee of quality throughout the world. The efforts of European States, however, have been rewarded with a share in the manufacture, while the demand for cheaper tools has extended British trade, and yet allowed a considerable portion to fall to foreign cutlers. Operatives in wood work, as carpenters, joiners, builders, turners, and cabinet makers, employ a great variety of cutlery tools; sculptors, modellers, and pattern makers require steel tools of many kinds, and all their branches of industry and art are much increased. The demand, therefore, for planes, augers, chisels, saws, and gravers is continually increasing. In some instances, the French and Germans claim to have outstripped the English. English planes, however, are as yet unequalled. Paris, on the other hand, since the period when Dubois and Dupuytren advanced practical surgery to the high scientific position it now holds, has prepared the finest surgical instruments, particularly for dentistry. The most perfect steel work has now been enlisted in the service of science, and delicate balances and other philosophical apparatus have contributed to the investigations made by our chemists and astronomers.

Luminous Electrical Tubes.

At a recent *séance* of the *Société d'Encouragement*, M. Alvergnat, maker of physical instruments, exhibited several apparatus of his invention worthy of notice. They consist of rarefied tubes which can be easily rendered luminous by electricity. The tension of the vapor in the tubes is measured by a light of mercury varying from 196 to 314 of an inch. The vapor is the chloride or bromide of silicon, and by rubbing the outside of the tubes with any substance developing electricity, a bright light is produced within the tubes, formed of different colored filaments—rose colored for the chloride and yellowish green for the bromide. The tension of the vapor necessary to produce this phenomenon is greater than that for the Geissler tubes, and the electricity which illuminates these latter tubes does not pass through the new apparatus of M. Alvergnat. The ingenious arrangement which permits of the easy production of these phenomena is capable of application in the arts and sciences, and the *Comité des Arts Economiques* consider it well worthy of attention.

Antiquity of Birds.

Those most competent to give an opinion, supported by the disclosures of the rocks, which are records in the great volume of Nature more enduring than public libraries, are satisfied that the first birds on earth were waders, and not organized for flying. They were very large, too, and their legs long, fitting them for searching for food on the margins of muddy lakes and lacustrine shores. This is inferred from the foot marks of those monster bipeds found on the red sandstone in the Connecticut valley. The stride from one step to another shows they were tall, and known to geological science as *ornithichnites*. There may have been others on a smaller scale of construction. But they were extinct, probably, or disappearing with the advent of birds with wings. The ostrich, etc., are tolerable representatives of the non-flying birds of old red sandstone ages, both in their stilted legs, toes, resembling ornithichnite tracks, and their undeveloped pectoral stumps, which are merely the anatomical beginning of the wings exhibited in higher families, their successors.

When birds appeared that could soar in the air, an internal modification of structure came with expanded wings, and the weight and exterior form were essentially changed and diminished in size. The condor is probably a type of the most gigantic of flying birds whose appearance belongs to the tertiary formation of the globe.

At a late meeting of the Polytechnic Association of the American Institute, Professor Vander Weyde exhibited artificial musk, made by treating blood in a peculiar manner. By adding little hairs, such as are found in genuine musk, the deception is so complete that it cannot be detected even by the microscope.

CITY OF LONDON LIBRARY AND MUSEUM.

Our engraving gives a view of a handsome edifice adjoining Guildhall, London, recently erected by the corporation of that city as a depository of their very valuable library and museum.

The style is gothic, to accord with the Guildhall, and the external facing, stone. The museum is on the lower floor, and is over 83 feet long by 64 feet wide. The library is above it, and is 98 feet long and about the same width as the museum. Adjoining the library are a public reading room, 50 feet in length, and a commodious committee room. A flight of stairs leads from the library to a vestibule opening into the Guildhall. Below are strong rooms and apartments for muniments and archives.

This commodious and appropriate building has reflected credit upon all engaged in its erection, and we would like to draw to it the attention of our own architects of public buildings.

The city architect, Mr. Horace Jones, prepared the design, and the contract to complete the building, in accordance with it, was entered into for £21,360.

Improvements in Wheel Making.

One of the difficulties in making light carriage and buggy wheels has been to get a tight spoke and felly joint. One reason why this so often fails, and so many poor jobs are made, is, that if a round tenon fits very tight in a round hole, the driving on will often split the felly. This often occurs with the very best straight grained timber.

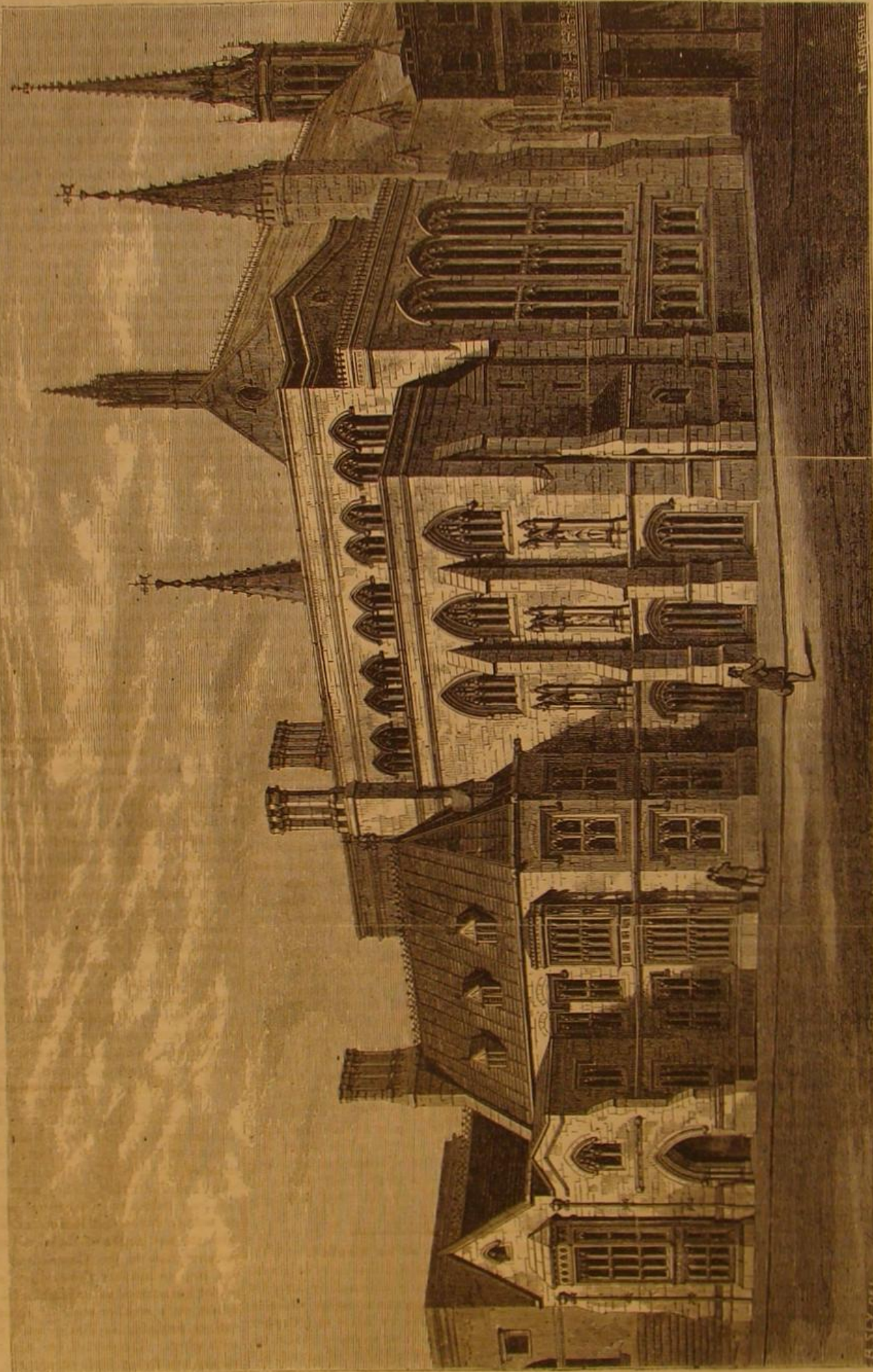
All wheelwrights know how very difficult it is to put on a light hickory felly tight and not split it. If, however, they are not split when put on, carriage makers know how often they give way afterward, and how many light carriages are disfigured by the bulging and swelling of the felly at the tenon of the spoke.

As a remedy for this difficulty, Mr. Jacob Woodburn, of Indianapolis, has applied to the Sarven wheel the following new principles, which are claimed to work very advantageously. Of the first he writes: "We make a tight joint, first, by making the tenon of the spoke oval; and, instead of doing this by filing and shaving, which is untrue and uncertain, we have a machine that turns the tenon perfectly smooth and true, and as oval as may be required. An intelligent mechanic at once sees the benefit of this. The hole is round, the tenon is oval; thus the wedging pressure of the tenon is upon the ends instead of upon the sides of the fiber of the wood, preventing, to a considerable extent, the swelling and splitting of the felly."

This idea, of making the tenons of spokes oval instead of round, appears to us to be a very practicable one, and it admits of wide application. Why would not every wheel be stronger with its spoke tenons ovoided? The points where the spokes connect, with the rim at one end and the hub at the other are the two weakest points in the wheel; but, in the Sarven wheel, this weakness is mostly transferred from the hub to the rim. This is why the oval tenon is particularly valuable in the Sarven wheel; but the same principle

applies to all wheels. The second invention of Mr. Woodburn will be best understood by the following description by himself. He says:

"Our long experience in making wheels has shown us that, while the oval tenon is a very great improvement upon the common method, yet it only partially removes the difficulty. The best timber, under the extraordinary pressure and strain brought upon it by rough roads, crossing the rails of street railroads, etc., will sometimes split, and, this giving way, the spoke becomes loose. This is a great annoyance and expense to the owner of the carriage, and mortification and damage



CITY OF LONDON LIBRARY AND MUSEUM.

Thread Cutting Tools.

Many carriage makers are in the habit of paying but little attention to their thread cutting tools; but the thread of a bolt or clip or nut will bear no more tampering with than the mainspring of a watch, and to attempt cutting threads upon bolts or clips with an imperfect screw plate, or to attempt cutting a nut with a worn out or useless tap, is nothing more than tampering with the thread. We would say to any correspondent on this subject, that he can himself repair his screw plates as well as any other person. To reproduce the thread in the dies, if they are heavy enough to

allow of it, first reduce the temper by annealing. A good and easy method of doing this is to place sawdust in a metallic box, heat the dies to the required heat and deposit them in the sawdust, and let them remain until they are perfectly cool. After the dies are annealed, we reduce the dies in width just sufficient to allow of the removal of all the old threads; after which we place them in the plate and commence cutting the thread by means of the plug tap. To cut with a taper tap would not be so effective, and would have a tendency to strain the dies and their bearing on the slide of the plates.

The following are the standard threads of this country: $\frac{1}{8}$ in. diameter, 24 threads to the inch; $\frac{3}{16}$ in. diameter, 20 threads to the inch; $\frac{1}{4}$ in. diameter, 18 threads to the inch; $\frac{5}{16}$ in. diameter, 16 threads to the inch; $\frac{3}{8}$ in. diameter, 14 threads to the inch; $\frac{7}{16}$ in. diameter, 12 threads to the inch; $\frac{1}{2}$ in. diameter, 10 threads to the inch; and so on until we arrive at $\frac{3}{4}$ in., after which the V shaped thread is unsafe, and the square thread is substituted.

It is better to have the plug tap with which the dies are cut a trifle larger than the diameter of the bolt desired to be cut. The concave on the dies must not be made so that they will be perfectly round, and allow the edges of the dies to meet while the tap is inserted. Unless the object is to have the bolts all the same size, there must be some space allowed for cutting them smaller, by a trifle, than the standard.

The tempering of the dies is a simple process. First heat and cool off; brighten a little with sandpaper or brick dust, and reduce to the required temper by placing on a bar of heated iron, and cooling off when the pro-

cess is arrived at. To temper taps, the wood or oil process is, in all probability, the best.—*The Hub.*

THE WONDERS OF THE TELEGRAPH.—A correspondent at St. Louis, Mo., gives us the particulars of the sending of telegrams from that city to Hong Kong in China, and the return of answer, the time each way being only 4 hours, the message being sent and reply received both during the same day.

EBONYING WOOD.—A simple method is to procure an ordinary slate and hold it over the gas, lamp, or candle, until it is well smoked at the bottom, scrape a sufficient quantity into French polish, and well mix; then polish your article in the ordinary way. If there are any lumps, gently rub them down with your finger, and apply another coat.

to the manufacturer of it. This difficulty has been met by our patent felly rivet, which makes it impossible for a felly to split. A tight fitting wood screw, with a sharp thread, is put through the felly, on each side of every spoke in the wheel, making over twelve feet of rivet in every set of wheels. This screw, after being tightly put in and firmly imbedded in the fiber of the wood, is cut off smooth on each side of the felly, so that when the wheel is painted it is not seen. This makes the joint more secure than the method of putting a bolt, with head and nut, to every spoke, and detracts nothing from the beauty of the wheel.—*The Hub.*

READING makes a full man, talking a ready man. The happy medium is reached when a man reads enough to give value to what he has to say.

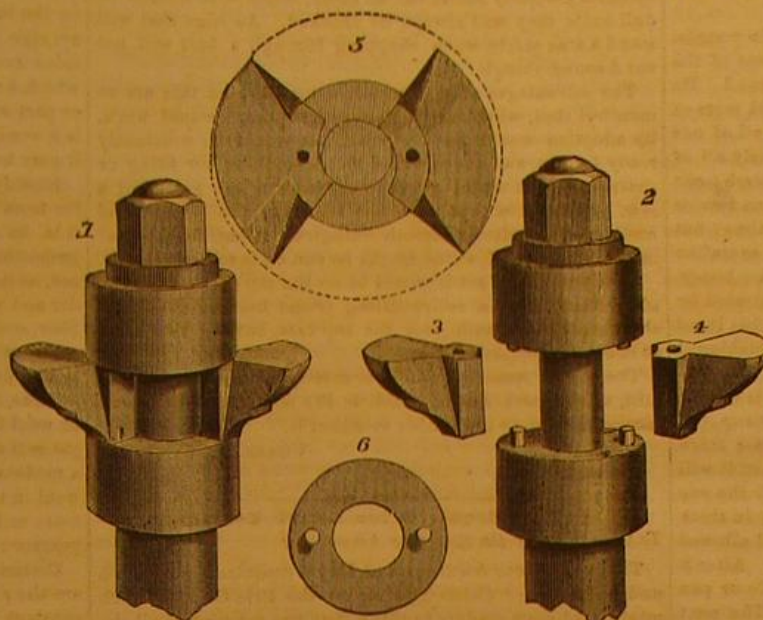
Molding Cutter Heads.

Our engraving illustrates an improvement in the construction of that class of "freezing bits," or rotary cutters for wood working machines, which are adapted to reverse, so as to present a cutting edge in either direction.

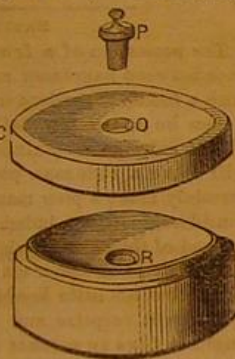
Fig. 1 is a perspective view of the improved cutter ready for work. Fig. 2 is a perspective view of the same, showing the collars ready to receive the bits. Figs. 3 and 4 represent bits removed from the collars. Fig. 5 is a cross section through the bits and spindle, the dotted lines showing the clearance. Fig. 6 shows the face of a collar, with the pins on which the bits are pivoted. Without further explanation, it will be seen how, by the peculiar shape of the bits and their connection with the collars, they are made to turn on the pivots, according to the direction of rotation, and stop (in either direction) when they present a clear cutting edge in front and clearance in the rear. When desired to reverse the action, the nut seen in the figures is slightly loosened, the bits are placed in proper position, and the nut again tightened.

For manufacturers of moldings, furniture and picture frames, this invention seems well adapted, and the inventor claims it to be equally important to all kinds of wood working. Patented April 16, 1872.

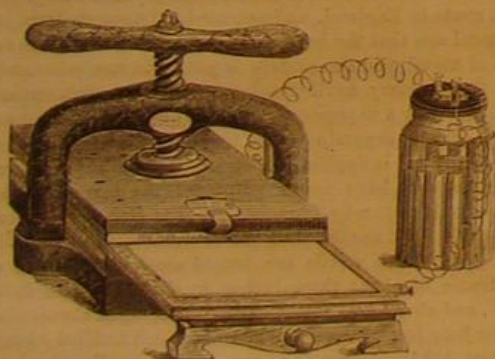
For further information, address Hope Machine Company, 181 West Second street, Cincinnati, Ohio. See advertisement in another column.

**CUTTER HEAD MOLDING MACHINE.****RESERVOIR PALETTE.**

It is well known to draftsmen that it is evaporation, rather than use, that so rapidly diminishes the liquid, color, or ink; and moreover, the material particles or sediment are prejudicial to high class work. The reservoir palette is designed to remedy these defects, which it does perfectly by simple means. The reservoir is shown at R, in the body of the palette B, and consists simply of a cylindrical cavity filled by a plug, P, so that any water previously poured into it is expelled and rises on to the surface of the palette, where, in the usual way, it is prepared for use by rubbing with the stick of Indian ink or cake of color requisite. After the desired depth of ink, tint, or color is obtained, if left to settle for a short time, the sediment precipitates on the palette, and when the plug is withdrawn, the clear ink or colored fluid flows readily into the reservoir, where it presents a very small proportion of evaporating surface, combined with depth for dipping pens, etc. The cover, C, being put over the palette, the plug may be used to close the orifice, O; or a common marble is dropped on to it, which readily recedes on the insertion of the pen, and settles in its place again on the withdrawal of the pen.

**ELECTRO CHEMICAL COPYING PRESS.**

This press, the invention of Signor Zuccato, of Padua, Italy, differs but little in appearance from an ordinary copying



press, and that difference lies mainly in the construction of the upper and lower beds or surfaces of the press, of which the former consists of a plate of copper, and the latter of a plate of copper tinned, both on mahogany beds—the upper one being attached by lugs or clips to the solid iron press plate, and the lower being made to slide out as shown. These plates are placed in the ordinary way in the circuit of a battery, so that when brought into close proximity by the action of the screw, the circuit is completed and a current established over the whole of the surfaces.

But, by the aid of an insulating medium—a varnish—applied to a steel plate and removable by the action of a "style" in writing, printing, drawing, etching, etc., the electric current is confined to those portions only which are so denuded of the insulating protection; and here it is made to leave record of its passage by its continued action on the steel plate and sheets of copying paper specially prepared and damped with a solution of prussiate of potash. The electrolytic action causes the formation of the ferro prussiate known as the "Prussian blue," producing a perfect facsimile of the original manuscript or design wrought on the varnished surface of the plate.

The battery employed consists of a single cell, with zinc and carbon elements in an actuating solution of bichromate

of potash and sulphuric acid; and its positive and negative poles are connected in the usual way, by spiral coils of insulated wire, with the upper and lower beds of the copying press. The moveable steel plates, on which the writing,

expensive. Compared with macadam, it is believed that where the traffic is heavy, asphalt would prove the cheaper of the two. The effect of temperature does not appear likely to prove injurious in London, unless it be in the case of asphaltes of an inferior character.

The steepest gradient for which asphalt has been used in the city appears to be 1 in 46. There is a pretty good prospect that the extensive trial now being given to various descriptions of paving will demonstrate the question whether we have practically any other choice than granite or macadam. The success of asphalt would be an enormous benefit to the metropolis in the cessation of the wearying roar which accompanies the passage of heavy traffic over paved roads, and in the comparative absence of dust and mud. Horseflesh is also to be considered. M. Leon Malo, a French engineer, has computed that, if all Paris were paved with the Val de Travers compressed asphalt, the saving in wear and tear to horses and carriages would be \$1,700,000 per annum. How far the calculation is correct may be difficult to say; but of the economy of asphalt in its effects on horses and vehicles there can be no question. Its general use is a consummation much to be desired, and the present competition will doubtless tend to reduce the cost of this luxurious improvement in the art of road making. Our only fear is whether it will stand the hard work demanded of it; though it must be remembered that granite often has to be patched and

mended, and what is called "relaying" is a formidable affair.

Remarkable Parasitic Fungus.

A correspondent, Mr. A. J. B., of Kansas, sends us a box of specimens and says: Please find herewith what to me is a wonder as well as curiosity, in the shape and character of what is, with us in Kansas, known and called a common grub worm. A bed of them was found and dug up recently while setting posts in this town. The grub when found was just as he now appears, having no life or animation whatever, while the sprout, *quec*, or whatever it is termed, growing from near the head of the grub, was in a growing condition, and full of vegetable life and greenness.

We give a drawing of the specimen sent by our correspondent. The grub is the larva of a brown beetle, which feeds upon the roots of grass, corn, wheat, etc. The long sprouts from the head are fungi (probably *Sphaeria* or *Isaria*) which grow at the expense of the nutritive fluids, and therefore of the life of the animal. They are generally found in the interior of the body (hence called *entophyta*) and near the posterior end. The dreaded disease of the silk worm (*Muscardini*) is caused by a fungus. Hosts of the seventeen year locusts are destroyed by a fungous disease. "It is probable," says Dr. Leidy, "that this disease is one of the means of maintaining the equilibrium in the aggregate of the life of the species under existing circumstances." These "vegetable grubs" are something of a mystery to the naturalist, and more light is wanted. Professor Orton noticed a like phenomenon on the western slope of the Andes, near Quito. The fact that all animals are liable to fungous diseases, that there is in fact a *flora* within man, ten different parasitic fungi having been found in him, the recent investigations of able naturalists

on both sides of the Atlantic, and the lectures of Huxley and Tyndall, invest this subject with deep interest and importance.

Proposed Government Boiler Experiments.

Judge Bradley, of the United States Supreme Court, has made a valuable suggestion in his late letter to the Secretary of the Treasury on the subject of steam boiler explosions. He points out the absolute necessity of making a trial of steam boilers, of the size and kind generally used, to find the laws governing explosions and the means of preventing them, and cites the few experiments made at Sandy Hook as showing there is much to be learned by this method of investigation. He recommends Congress to appropriate \$100,000 for the purpose, and to authorize the Government to have a system of experiments made under charge of a board of skillful engineers.

THE CURRANT WORM.—A small yellow fly, with brown wings, about the size of the common house fly, deposits its eggs about May 1st. The worms appear about the middle of May. Remedy: Hold a pan under the brush and jar the branches; the worms fall into the pan and are easily destroyed. Repeat the operation as often as necessary. The larvae are supposed to burrow in the earth.

Correspondence.

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

Maple Sugar.

To the Editor of the Scientific American:

There is a short article headed "Maple Sugar," in your issue of April 27, in which the writer gives an account of the process of the manufacture of that sweet compound. He says that nearly all of our hard wood trees will yield more or less sugar; this I doubt. I do not deny but what all of our hard wood trees will yield sap, but I deny that nearly all of them will yield sugar. Take, for instance, the birch; one birch tree of common size will yield more sap than two or three maple sugar trees will, in the same length of time; but the sap concentrated by boiling yields a compound as unlike sugar, in looks, taste, and smell, as tar is unlike honey. Again he says: "After the sap is drawn, it is concentrated by boiling it until it commences to crystallize." Now this is not so. Having had considerable experience in sugar making, I will give to your many readers the usual process of the manufacture of that desirable article. After the sap is drawn, it is concentrated by boiling to the consistency of sirup, but never until it crystallizes. When the sirup becomes thick enough to "apron" (as the farmers call it), or when it will drop from a dipper (which they always have to stir the sap with and to dip off the scum which rises to the top) in thick sheets, it is immediately removed from the fire, and allowed to cool or not as the maker of the sugar may desire. After it is removed from the fire, it is dipped from the kettle or pan in which it is boiled into wooden pails or barrels. The next operation is to strain or filter the sirup through woolen cloth. This done, it is set away, and the farmer can sugar it off at his convenience.

If the sap were allowed to boil until it commenced to crystallize, it would be impossible to filter the sirup; consequently it would be of no value, for the reason that it would be so full of dirt that it could not be used.

When the farmer comes to "sugar off" his sirup, as it is called, the kettle or pan is cleansed until it is perfectly clean. The sirup is then poured in and two or three eggs, according to the quantity, are well beaten and added to the sirup. This is to cleanse it from all impurities which rise to the top while boiling. Some use milk in the place of eggs; others, both. Farmers never boil the sap that runs after the trees commence to bud, for sugar made from such sap is unfit for use, because it is black and has a taste which is termed "buddy." I have known trees that have been tapped for fifty successive years, and then look as though they would last for as many more.

H. N. L.

The Cause of Earthquakes.

To the Editor of the Scientific American:

I do not know whether the theory I wish to advance about earthquakes is new or old. The phenomena are felt all over the world; and I ask, are they not caused by the shrinking of the earth's crust? Our mountain chains and river valleys are diagonal to the greatest diameter of this planet; and the volcanoes allow vent for the gases, the upheaved crust forming the mountains. The shells and other sea fossils which lie in the formation of these mountains indicate the salt plains; the deep soil through which the rivers plow furrows shows that the richness of the earth is washed into the sea, to be upheaved again when the land has become too poor to support life. When new streets are opened in Kansas City, Mo., the excavation is sometimes thirty or forty feet deep through alluvial deposits, uncovering water worn ledges of rock which are now 100 feet above the river. The tree growth of the Eastern portion of this continent denotes that the land does not show great antiquity.

I hope to learn, through your columns, what savans think of the causes of earthquakes.

J. W.

Elgin, Ill.

Making Shingles.

To the Editor of the Scientific American:

Some years ago I owned a manufactory for cutting and sawing pine shingles, and I tried the following experiment: I had an old thick 40 inch saw, from which I broke off the teeth, and then, by running it slowly in a mandrel and holding against it pieces of broken grindstone, ground down the edge upon one face till it was sharp all round like a circular knife. I then put it on my sawing machine, and by putting on a larger pulley and reducing the driver, made it revolve at about 60 revolutions per minute. Then by using well steamed blocks, I succeeded in cutting with it, before the edge turned too much, some scores of perfectly sound and smooth shingles. It required but little power to force the block on to it, and though it crowded or rubbed pretty hard, I do not think it would have heated injuriously if run constantly at that motion. The experiment convinced me that, above all others, this is the way to make shingles, or cut other thin and small sized boards. The difficulty lies in getting a proper and well tempered solid knife, of the kind, made; and after corresponding with several tool and saw makers on the subject, without getting any one to attempt the job, I gave it up. I believe now, however, that a knife made in sections, or plates of tempered steel riveted on to either a cast or wrought solid circular center of the right thickness, would answer the purpose. This might be an inch or more in thickness at the center, so as to give great rigidity. A knife of this kind need never be taken from its bearing to be sharpened, but could always be kept with the keenest edge by having a stone so fixed as to bear against it as it revolved. Owing to its drawing cut, it would pass through knots or other tough places in the timber much

more easily than a straight knife, and its edge might be made much thinner and yet stand. My experience in cutting pine shingles shows this to be a great advantage, for, out of good well steamed timber, with a sharp thin knife, shingles perfectly sound can be made, while with a thick or dull knife they will always be checked. An edge that will stand knots safely when chopping through a bolt will not cut a sound shingle.

The advantages of using such a machine as this are so manifest that, when once it were settled that it would work, its adoption would be universal. It would be constantly ready for use, and there would be no stopping for filing or sharpening. It would not take one fourth the power of a saw. It would save at least one fourth of the timber, and would make perfectly smooth shingles. If inclined to heat in use, a stream of water might be run on it to keep it cool.

The best way to set it would be on the top of a perpendicular shaft, with a reciprocating frame holding the bolts sliding back and forth over the top face, cutting two bolts at once from opposite sides.

The cost of steaming timber is merely nominal in a steam mill, using waste steam, which is the best, and it is a positive advantage to the timber to steam it.

CHARLES BOYNTON,

Memphis, Tenn.

Power Required for Canal Towing.

To the Editor of the Scientific American:

THE SCIENTIFIC AMERICAN of May 4 contains a paragraph under the title "Cable Towing on the Erie Canal," which might lead your readers to think that you sanctioned all the statements therein made, and in this way serve the interests of the Cable Towing Company, to the prejudice of many other inventors who are now engaged in working out different methods of accomplishing the same result. The portion of the paragraph alluded to, which I think requires your correction, is the statement of the comparative cost of towing loaded boats by horses, and the system by cable. By the former, it is stated, the aggregate cost of towing a boat the entire length of the canal, 350 miles, is \$122.50. By the steam cable system, "it is confidently believed" that one tug will haul six boats at a speed of three miles per hour, with an expenditure of two tons of coal for twenty-four hours, six days being allowed for making a trip. The cost of coal for towing the six boats will be \$6 per ton, or \$72. I am very anxious to know the facts. My own experience is that it takes three horse power to tow a boat with 200 tons freight at a speed of one mile and a half per hour, no matter what the motive power may be; and that, to tow the same boat at three miles an hour, will require about twenty-four horse power. This great difference in the power required—with but a small increase of speed—arises from a law which cannot be shirked by any mechanical contrivance. It will, therefore, take 144 horse power to tow the six boats at three miles per hour, and say 26 to propel the tug; in all, 170 horse power. Eight pounds of coal for each horse power per hour is as little as can be allowed; that is 1,360 pounds, equal to 16½ tons per day, or 97½ tons, which, at \$6 per ton, equals \$585, the cost of coal for the trip.

If the foregoing statement is about correct, it is safe to say that boats cannot be towed economically at a speed of three miles per hour. The best speed for towing by steam will be found to be two miles an hour, and this can be attained economically by any of several systems that have been invented.

A. B.

Rochester, N. Y.

[While the resistance to vessels in canals is much greater, especially in narrow canals, than in open water, still we think that our correspondent is in error in his estimates for the propulsion of a train of six boats. Some useful data upon the economies of steam power, as applied to propulsion, will be found on page 321 of our present volume, where it appears that 2½ lbs. of coal per horse power per hour are consumed on the steamer *Adriatic*, her maximum speed being 16½ knots per hour, and her burthen 4,200 tons.—EDS.]

NORTH CAROLINA FISHERIES.—Herring and shad are so abundant in North Carolina that the former are selling for \$1.50 per thousand, and the finest shad at from 10 to 25 cents each. The seines used are of immense size, and are worked by steam power. A seine worked at the mouth of the Chowan is said to be a mile and a half in length, and in it 300,000 herrings have been taken in one day. They also take from one to two thousand shad at a catch. Steamers are at the wharves, constantly loading with these fine fish, packed in ice, for the New York and other northern markets.

HOW TO WASH PRINTING ROLLERS.—Avoid all grit, sand, and dirt, simply use strong ley to loosen the ink; and quickly, with a soft sponge, wash off with water (in winter blood warm) the ley, squeezing the sponge dry, face up the roller, so that no moisture remain thereon. Let it then stand exposed to the air one hour, machine rollers two hours, before distributing ink on its surface. The time for exposure must be guided by the state of the weather, as shorter time will do in dry or windy weather. Be careful to ink the roller as soon as possible after exposure to keep it tacky.

CEMENT FOR FIXING GLASS LETTERS.—A thick solution of marine glue in wood naphtha will answer perfectly if color is no object. But the glass must be chemically clean, and this is not always easy. The least trace of soap or grease will spoil the adhesion of any cement. Try soda or ammonia, followed by whitening and water, clean cloths, and plenty of rubbing, and let the cement dry on the letters till the surface just begins to be "tacky" before you apply them.

The Uses of Old Rags.

Woolen rags, as they come in from the peddlers, comprise every variety of fabric that it is possible to produce from wool, from a coarse and harsh carpet to the finest and softest product of the loom. These are piled up in huge heaps upon the warehouse floor, and women and girls, whose wages average from four to five dollars a week, attack them on all sides and "sort" them into no less than ten grades, each of which has a special use and an established value. The greater part of these are manufactured into "shoddy," and, as this is a word concerning which a general misapprehension exists, it may be well to devote a paragraph to its consideration.

Shoddy is, perhaps, the best abused material in use. So far from being a mere sham and a poor substitute for wool, it is, in reality, a valuable material, and enters, in certain proportions, into the composition of nearly all cloth. It is not, as is generally supposed, woolen rags ground to a powder and worked into the cloth to give it weight, but wool fiber, combed out of wool fabrics by a peculiar process, and, mixed with new wool when the latter is carded, is spun with it, and finally becomes a component part of the cloth.

Thus, by mixing a due proportion of fine grade of shoddy or wool fiber with new wool of a coarse grade, a substantial yet soft and handsome fabric can be produced and sold at a moderate price; while the same thing, with fine high cost wool in the place of the much reviled shoddy, would cost far more and possess but little more value so far as wear and appearance are concerned.

Cotton and linen rags are sorted with equal care. They are the principal source of papermaking material, and are in constant demand. Used alone, they make the highest grade of paper, while, in combination with varying proportions of paper stock, they produce the various grades of paper to be found in the market. Paper material may be used over and over again, provided always that a given amount of new rag stock is used, but it deteriorates in value with each process, owing to the breaking and consequent shortening of the fiber; and, beginning, say in the form of writing paper of fine quality, it passes successively through the various grades, and eventually is found in the shape of a coarse article, possessing little strength and small value.

Saving Money.

The possession of a few dollars often makes all the difference between happiness and misery, and no man, especially with a family dependent upon him, can be truly independent unless he has a few dollars reserved for the time of need. While extreme carefulness as to the expenditure of money will make a rich man poor, a wise economy will almost as certainly make a poor man rich, or at least make him, to a considerable extent, independent of the caprices of employers and of the common vicissitudes of life. Nothing is more important to the poor man than the habit of saving something; but his little hoard will soon begin to grow at a rate which will surprise and gratify him. Every working man ought to have an account in some savings' bank, and should add to it every week during which he has full employment, even if the addition is but a dollar at a time. If he does this, he will soon find the dollars growing into tens, and these tens into hundreds, and in a little time will be in possession of a sum which is constantly yielding an addition to his income, which secures him a reserve fund whenever one is needed, and which will enable him to do many things, which, without a little money, he would be powerless to do.—*Pittsburgh Post*.

Anvils.

The best anvil in the market is, perhaps, the Peter Wright anvil, made in England, and patented. The peculiarities of this anvil are that the horn, bick, face, and arse are one solid piece of metal, and the surface is put on in one piece, while with the ordinary anvil the horn and bick are a separate piece, the body a separate piece, and the arse and four arms or legs are also separate pieces, making, in all, seven pieces before the steel is applied, which is put on in three pieces.

Persons that have never witnessed the manufacture of anvils would naturally suppose, says *The Hub*, that the same were made upon anvils. Such, however, is not the case. The anvil upon which anvils are forged consists of a large cast iron frame of about three inches in thickness, one foot in depth, and about four feet square, resting upon the earth, or having four feet of space either way, which is filled with the heaviest kinds of iron turnings, or the smaller grades of scrap iron, the former being preferable. When the anvil is removed from the fire, it is placed upon this bed of adjustable scrap iron, and after a few blows soon sets itself into the proper position to receive the remaining blows from the strong arms of the half-dozen men who stand about the frame. The small square holes in the ends of the anvil, at what is termed the waist, are called by anvil makers "port holes" or "porter holes," into which the iron porters are inserted when taking to and from the fire and changing the position while forging. The face is finished on the grindstone.

ENDEAVOR to take your work quietly. Anxiety and overaction are always the cause of sickness and restlessness. We must use our judgment to control our excitement, or our bodily strength will break down. We must remember that our battle is to be won by a strength not our own. It is a battle that does not depend upon the swift nor the strong.

ACCORDING to a recent report of the New York and New Haven Railroad Company, not a single loss of life or limb to any passenger, on any train on that road, has occurred during the past sixteen years. Two and a half millions of passengers are annually carried. Length of road, 76 miles. This is one of the safest and best managed roads in the country.

"Sorry He Did Not Learn a Trade."

A young man, well dressed and of prepossessing appearance, called at our office recently and inquired in great earnestness if we had employment of any kind to give him for but a few days, if no longer, as he was a stranger in the city out of money, and unable to pay for a few days' board and lodging. He further stated that he was a book-keeper, but after a diligent search, he had found no one who wanted any help in that line, nor could he obtain employment at anything that he felt competent to perform in a satisfactory manner. The positions of clerk and book-keeper, he remarked, were all filled, and applicants for them far in excess of the demand. "I am sorry," said he, "that I did not learn a trade."

The appeals of the young man excited our sympathy, but, requiring no farther assistance in the office, we were compelled to reply to his eager questioning that we could not employ him.

The door closed after him, and he again went out to continue what, in all probability, proved to be a fruitless search for employment. But his words lingered behind and, as we sat musing on them, recalled to mind the oft repeated expressions of the mechanic, in which he reproves himself for want of foresight in selecting an occupation. Here I am doomed, he says, to toil in a shop, at work which is hard, affording but poor pay. Like a dog, I must come at the call of a whistle, or like a servant, obey the summons of a bell; had I studied book-keeping or entered a store as a clerk, I might have been leading a much easier and more pleasurable life.

In the cases cited, we find each one dissatisfied with his selection, and wishing to exchange places. And the difficulty at once presents itself, as to how we shall decide for them and the classes they represent, so that the seeming mistakes in selection may be remedied. We acknowledge we are unequal to the task.

Food, clothing, tools, machinery, houses, ships, and an almost endless variety of other things are continually in demand, which require the labor of farmers and mechanics; while that class which makes exchanges (merchants) is of necessity comparatively few in number, and, therefore, needs but a small force of assistants. The necessities of the millions of earth require by far the largest number of persons to be employed in agriculture and manufactures. Whenever then, through pride or any other motive, parents disregard the law and encourage their sons in seeking after situations, as clerks, book-keepers, etc., rather than to engage in those pursuits for which there is always a natural demand, there must be a corresponding amount of suffering as a penalty. Hence we find the so called respectable occupations are glutted, while the mechanical branches are suffering through the lack of skilled laborers. An advertisement for a clerk will quickly bring to the office door a small army of applicants of all sizes and ages, while the want column may plead several days for a good mechanic, and fail to meet with a response.

"Sorry he did not learn a trade." Let apprentices and journeymen, who may be bewailing their lot, at once resolve to thus repine no longer, but by hard study and close application master their trades, and having done so, demand a fair compensation. Then by adding to skill, honesty, punctuality and economy in expenditures, there need be no fear that they shall be compelled at any time to beg for sufficient employment to pay for a day's board and lodging.—*Coach Maker's Journal.*

The Diamond in its Matrix.

Professor Gustav Rose, of Berlin, in a communication to the Chemical Society of the Prussian capital on the recent discovery of diamonds *in situ*, said that the diamonds were found loose and detached in alluvium, but actually enclosed in another mineral, and though of but microscopic size, had not on that account been less surely identified. They were found by Professor von Jereonjew, of St. Petersburg, in a mineral first described by Professor Rose during his journey through the Urals, and named by him xanthophyllite. This rock occurs in yellow tabular crystals, cleaving along the principal face, or radially segregated in rounded masses, and was found to be a silicate of alumina, lime, and magnesia, with some water. The spherular segregations often enclose a nucleus of the talcose schist. It is in these crystals of xanthophyllite that the crystals of diamonds are met with, lying in parallel positions in respect to each other and in a definite position as regards the crystals of their matrix, in a similar way to the minute crystals of iron mica in felspar or oligoclase; the diamond crystals, however, are smaller than these, and are not visible to the naked eye. On placing a thin plate of xanthophyllite under the microscope, the diamonds are recognized by their peculiar form, hexakistetrahedra, with somewhat rounded faces, and are seen to have their tetrahedral faces, which are also frequently visible, parallel to the cleavage face of the xanthophyllite. The diamonds are not in equal abundance in all parts of the xanthophyllite. In the yellow transparent crystals they are sparsely found, or not at all; the greenish, less transparent varieties contain them more plentifully, and are often filled to excess with them. In its bearing on the questions of the formation and origin of the diamond, the occurrence in the Urals is very interesting. There, as in Brazil, it occurs with crystalline schists, in the so called metamorphic rocks, which are supposed to be Neptunian rocks that have been deposited from water, and have subsequently undergone certain changes, amongst others that of taking crystalline characters, whereby all the organized constituents have been removed. Why carbon has separated in the itacolumite of Brazil as diamond, and at Strehlen, in

Silesia, as graphite, is a phenomenon demanding explanation. Professor Rose asks whether we may trace the cause to the far greater diffusion of itacolumite in Brazil than in Silesia, where it only occurs as beds in gneiss?

Japanese Metal Work.

The Japanese are very skillful in all that relates to the artistic treatment of the metals, and produce works in this branch of art as commendable as they are varied. They are expert in casting, carving, damascening, engraving, inlaying, weaving, and tempering; and in many of these departments produce specimens comparable to anything done in Europe. Perhaps the most characteristic of all their metallurgic works is that called by them *syakfido*. In this, numerous metals and alloys are associated, the designs being produced in colors through the agency of the various colored metals—white being represented by silver, yellow by gold, black by platinum, all shades of dull red by copper and its alloys, brown by bronze, and blue by steel. Gold, silver, and polished steel, of course, represent themselves in designs as well as abstract colors. A red garment, embroidered with gold and clasped with silver, would be executed in red colored copper, inlaid with gold, and furnished with a silver brooch; the sword in the hand of a warrior would be in polished steel, and if bloody, would have red copper inlaid on it. These instances will suffice to illustrate the general mode of producing colored designs by the exclusive use of metals. The Japanese have brought bronze casting to great perfection, as is proved by the superb incense burner which was presented to H.R.H. the Duke of Edinburgh by the Mikado, now on exhibition in the South Kensington Museum. They also produce a highly finished and polished bronze work, on which the relief ornamentation is produced by cutting the surrounding metal away. The relieved objects are then engraved, and richly damascened with gold and silver. Bell founding is carried on to a considerable extent, and art is never neglected in the designs. *Repoussé* work is well known to the Japanese metallurgists, but is not so largely adopted by them as it is by western artists. Flat silver wire, woven into diaper patterns, is a favorite material for covering uniform surfaces, and is frequently applied by the Japanese artists in an effective manner. In drawing the attention of the meeting to a group of storks, executed in gold, silver, bronze, and other metals, Mr. Audsley, in a paper recently read by him in England before the Architectural Association, said the audience would agree with him that the Japanese have been more successful than our silversmiths in appreciating the nature of their materials, and realizing the correct modes of working them. This group—where every feather is a thin plate of metal, carefully engraved; where the legs, tails, necks and heads of the birds are in their natural colors; where the rock they stand upon is modelled with accuracy, and its stunted vegetation truthfully rendered—would bear comparison with the best efforts of our silversmiths as displayed in presentation plate, of which the best that can be said is that it contains many pounds of "solid silver;" and the comparison would lead to the award being given in favor of the Japanese work.

Old Rubber.

A fortune awaits the happy inventor who shall teach manufacturers to restore old rubber to the condition in which it was before vulcanization, for, with that secret, there would be practically no consumption of this invaluable article. The thing has been done, and successfully, and we have ourselves, says the *Commercial Bulletin*, seen pieces of vulcanized rubber possessing great strength and elasticity which were made entirely from old car springs; but it has never been accomplished on a large scale, and awaits the enterprise and ingenuity of some new Goodyear to develop it.

Meantime, old rubber has its uses. By a system of steaming and passing between rollers, it is reduced to a semi-plastic state, and in this condition is used in combination with a coarse fabric for heel stiffening, a purpose for which it is admirably adapted, its waterproof qualities being of especial value. There is, in a neighboring city, a factory devoted entirely to this branch of manufacture, where several hundred tons of old rubber of all kinds are consumed annually.

Old rubber is also largely used to mix with new raw material in the manufacture of all kinds of rubber goods. It serves to give bulk and weight, and if it does not increase, it certainly does not lessen, the strength of the fabric. It may also be mentioned that powdered soapstone, white lead, *terra alba*, and other heavy substances enter largely into the composition of almost all rubber goods, the use of which becomes apparent when it is remembered that they are generally sold by weight.

Cure of Hydrophobia.

Dr. Alford, at Flint, Mich. has cured a case of hydrophobia. The disease did not make its appearance until eight months after the patient was bitten. The treatment was this: Sulphate of morphia, one grain, was injected subcutaneously every four hours, and half a dram of powdered castor given internally, in sirup, at the same time. Chloroform was also inhaled in small quantities. In about half an hour, sleep occurred, and continued over an hour. Convulsions then recurred, and continued, with intervals of variation, for about twelve hours, when they entirely ceased. Vomiting and great prostration followed, but the patient ultimately recovered. The excessive prostration was counteracted by wrapping the patient in a woolen blanket moistened with a warm solution of muriate of ammonia, twenty grains to the ounce.

Dr. Alford states that he had another successful case of cure of hydrophobia eight years ago.

A New Sensitive Singing Flame.

Philip Barry has recently described a very sensitive flame produced by placing a piece of ordinary wire gauze on the ring of a retort stand, about four inches above a Sugg's steatite pin hole burner, and lighting the gas above the gauze. "The flame is a slender cone about four inches high, the upper portion giving a bright yellow light, the base being a non-luminous blue flame. At the least noise this flame roars, sinking down to the surface of the gauze, becoming at the same time almost invisible. It is very active in its responses, and being rather a noisy flame, its sympathy is apparent to the ear as well as to the eye."

A simple addition to this apparatus has given me a flame, which, by slight regulation, may be made either: (1) a sensitive flame merely, that is, a flame which is depressed and rendered non-luminous by external noises, but which does not sing; (2) a continuously singing flame, not disturbed by outward noises; (3) a sensitive flame, which only sounds while disturbed; or (4) a flame that sings continuously except when agitated by external sounds. The last two results, so far as known to me, are novel.

To produce them, it is only necessary to cover Barry's flame with a moderately large tube, resting it loosely on the gauze. A luminous flame six to eight inches long is thus obtained, which is very sensitive, especially to high and sharp sounds. If now the gauze and tube be raised, the flame gradually shortens and appears less luminous, until at last it becomes violently agitated, and sings with a loud uniform tone, which may be maintained for any length of time. Under these conditions, external sounds have no effect upon it. The sensitive musical flame is produced by lowering the gauze until the singing just ceases. It is in this position that the flame is most remarkable. At the slightest sharp sound, it instantly sings, continuing to do so as long as the disturbing cause exists, but stopping at once with it. So quick are the responses that, by rapping the time of a tune, or whistling or playing it, provided the tones are high enough, the flame faithfully sounds at every note. By slightly raising or lowering the jet, the flame can be made less or more sensitive, so that a hiss in any part of the room, the rattling of keys, even in the pocket, turning on the water at the hydrant, folding up a piece of paper, or even moving the hand over the table, will excite the sound. On pronouncing the word "sensitive," it sings twice; and in general, it will interrupt the speaker at almost every "s" or other hissing sound.

The several parts of the apparatus need not be particularly refined. By the kindness of President Morton, I have used several sensitive jets of the ordinary kind made of brass; they all give excellent results. Glass tubes, however, drawn out until the internal diameter is between one sixteenth and one thirty-second of an inch, will do almost equally well. For producing merely the singing flame, even the inner jet of a good Bunsen burner will answer. The kind of gauze too is not important; I have generally used a piece which had been rounded for heating flasks; it contained about 28 meshes to the inch.

The experiments can be made under the ordinary pressure of street gas, three fourths of an inch of water being sufficient.—*W. E. Geyer, in the American Journal of Science.*

The Origin of Petroleum.

The recent development of the reproductive power, of petroleum wells that had been for some years abandoned because they were believed to be exhausted (says the *Petroleum Monthly*), is not alone a matter of value, to the owners of the territory that was until lately presumed to be incapable of further production, but it affords a more trustworthy basis than any the world has hitherto been able to obtain for forming an approximately correct opinion concerning the chemical process whereby petroleum is generated. Until within a few days, a popular opinion prevailed that petroleum, in spite of its name, was the product of coal; and so nearly was this idea general among a majority of people, that many foreign receivers of petroleum are still accustomed to order it as "coal oil." The belief, however, that the terrene oil of Pennsylvania and Canada is exclusively a product of bituminous coal may now safely be pronounced to be an error. There is certainly no evidence that coal is not one of the substances from which petroleum is distilled; but, at the same time, it is a somewhat strange fact, allowing a proper degree of credit to the belief that coal does enter into the composition of petroleum, that no coal beds susceptible of being worked are known to exist within fifty miles of the oil-producing territory. Again, it is a manifest and recognized fact that carbon does predominate as an integral essence of petroleum; and the other fact that the oil territory of Pennsylvania is surrounded by beds of bituminous coal, renders it eminently reasonable to believe that coal enters largely—if not, indeed, more largely than any other substance—into the process of distillation whereby petroleum is produced. Petroleum is certainly a mineral oil. But whatever may be the number and chemical variety of the minerals from which it is formed, the distillation of it is more intimately associated with limestone than with any other mineral. Sandstone is also found in boring oil wells, but it is from the pores of limestone that, in the chemical process of extracting oil from the minerals found in connection with its production, the greatest quantity of petroleum is taken. It is singular that, in boring for oil, no coal has ever been found, even in the smallest quantities, while sand, sandstone, and limestone abound. The inference, therefore, cannot be escaped that petroleum is the product of the distillation of at least two, and probably of more than three distinct mineral properties.

Improved Fire Shield.

It is the object of this invention to provide convenient and efficient means for preventing the spread of fires in cities and villages. It consists of a portable adjustable shield or screen, composed of fireproof plates or sheets, mounted on wheels, as indicated in our engraving, so that the machine can be transported from place to place without difficulty and with expedition.

A light frame or platform, A, is supported on the axles, B, of the wheels, C, but raised above and projecting over the wheels. Two pairs of stanchions, D, attached at the bottom to the platform, A, and connected at their top ends, have a pulley hanging from the center of each pair. There is an upright rod, G, at each corner, or one for each stanchion, rigidly connected to the platform and extending up about half way, more or less, to the top of each stanchion. The upper ends of these rods are curved and forked, and each contains a pulley, H. There is a brace for each of the rods, G, on which horizontal pulley shafts, J, are supported. A horizontal pulley shaft, K, at each corner of the platform, is supported by stands, L. Another horizontal pulley shaft, M, at each corner of the platform, is also used.

All these shafts are provided with cranks, by means of which they are revolved, and are also furnished with wheels and pawls, by which movement may be prevented.

Sheets or plates, O, of metal or other incombustible material, are suspended from the stanchions, and from the rods, C, by means of chains or wire ropes, P, and are raised or lowered by means of the crank pulley shafts.

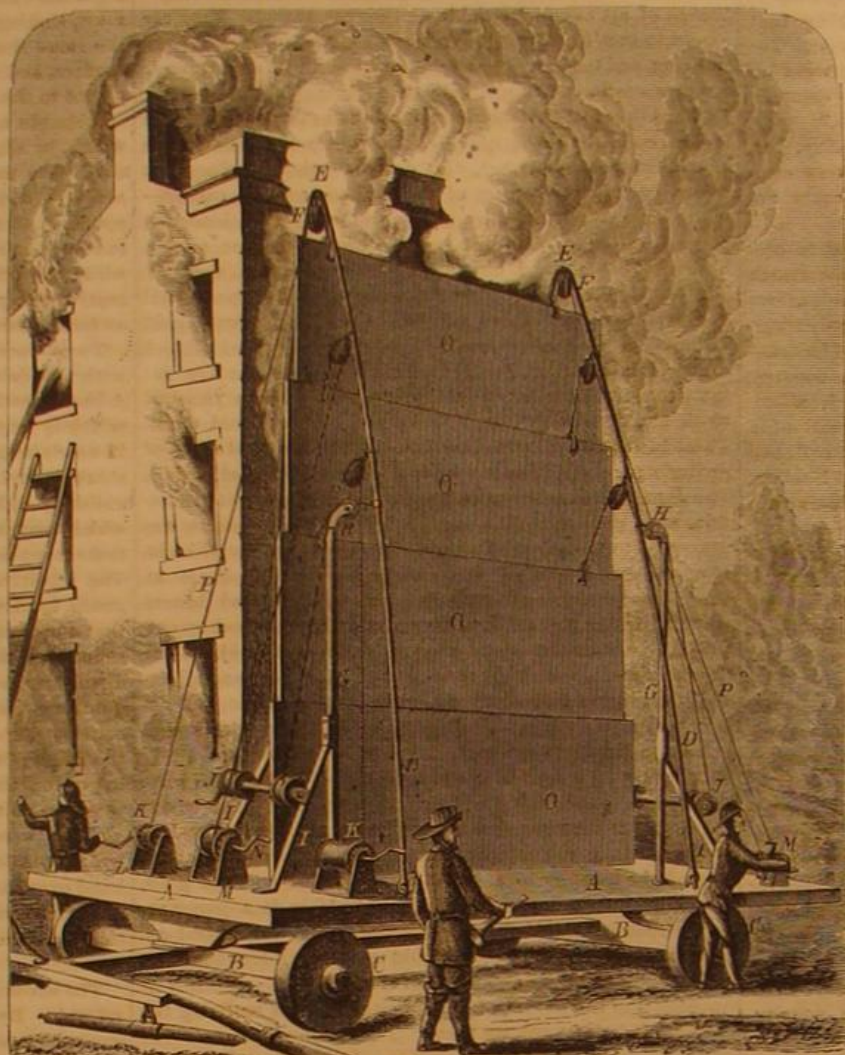
The plates may be of any size or thickness, and are so arranged that they work independently of each other; and they may be adjusted in a mass, or so as to present two or three thicknesses to the heat of a burning building.

It is claimed that, by interposing this shield between buildings, one of which is on fire, that the fire may be limited in extent and much property saved.

Patented through the Scientific American Patent Agency, Nov. 28, 1871, by Henry Rieger, whose address, Kansas City, Mo., for further information.

Q, which runs in a thread formed in the removable bar, R, this bar being taken out while the cover is raised or lowered. When the follower is actuated against the stuffing, the latter enters the tick, which, as fast as it is filled, slips off the chute very much as a filled case slips off the nozzle of a sausage stuffer.

With the use of this machine and that of a trifling machine by the same inventor, and on which a patent is now

**RIEGER'S FIRE SHIELD.****Improved Mattress Stuffing Machine.**

Our engraving illustrates a mattress stuffing machine, by which, it is claimed, the stuffing of mattresses can be effected with astonishing rapidity. The whole arrangement is simple, easily managed, and, we judge from examination of a model of the machine, constitutes a valuable and important addition to appliances of the upholsterer's art. It is adapted to all sizes and kinds of mattresses, and its use will, we think, effect a large saving in this branch of business.

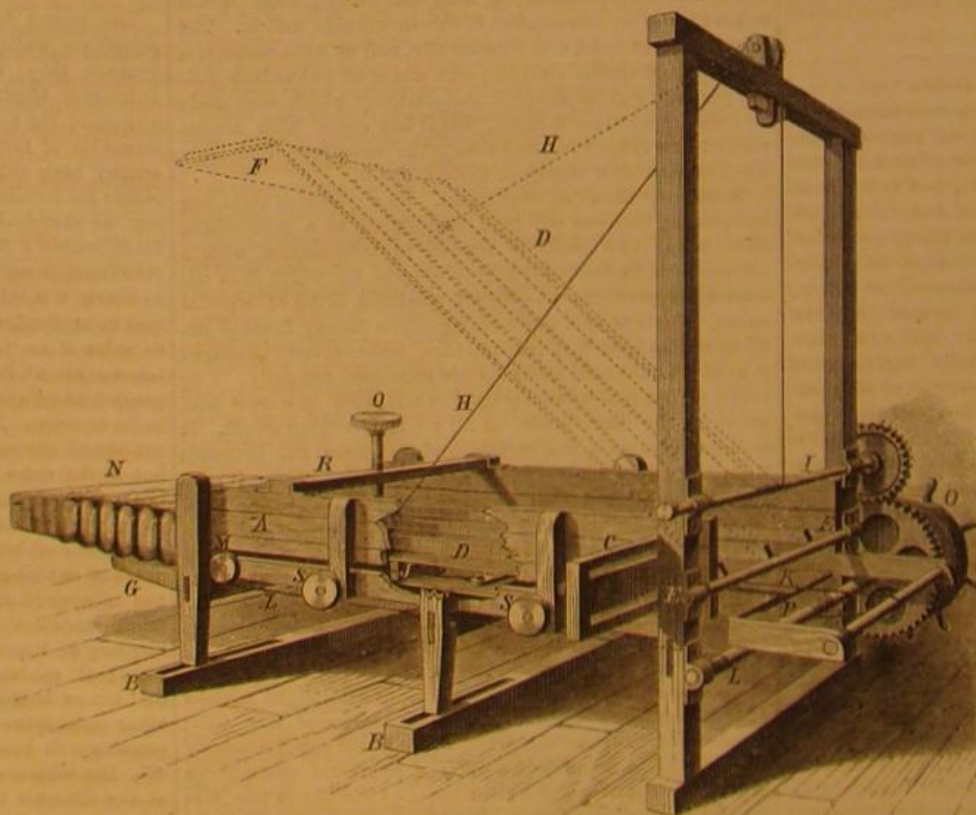
A box, as wide and as long as the largest sized mattress, has one side, A, laterally adjustable for any required width of mattress, the legs of that side sliding in slots formed in the sills, B. One end of the side, A, has attached a slotted board, C, which slides on bolts (not shown), and by which, and the screws, S, the side, A, may be adjusted and held in position when adjusted for width. A cover, D, ribbed longitudinally and pivoted at E, is raised, while placing the filling in the box, into the position shown by the dotted outline. That part of the cover shown in dotted outline, and lettered F, is pivoted to the other portion, and, when the cover is lowered, turns down to form a closed end of the box while the stuffing is being placed; but when the pressure is applied, it extends straight with the rest of the cover, so that, in connection with extensions of the sides and bottom of the box, it forms a chute, through which the filling is forced into the case or tick. The latter is placed for filling over this chute, being gathered into folds thereon, and is held from yielding and escaping too readily by laterally bent springs, G, which press against the tick and hold it against the bottom of the chute.

The cover, D, is raised by the rope, H, which runs over a pulley and is wound up by the shaft, I, at the same time that the compressing follower, J, is withdrawn by the action of the cord, K, the cords, L, running over the pulleys, M, actuating the follower, J, in the direction to force the filling into the tick, N, whenever the hand wheel, O, is turned to wind up the cord, L, on the shaft, P.

The shaft, I, has long bearings, which allow it to be thrust endwise to run its pinion out of gear and permit the cover to be lowered independently of the action of the hand wheel. When thus lowered, the cover is forced down to compress the filling by the action of a screw,

pending, a mattress can be filled and stitched in a remarkably short space of time. The machine has already elicited high praise from practical men, and has won prizes in all fairs where it has been exhibited. There is no doubt that it is a first class machine for the purpose intended; and we would recommend parties interested in this class of manufactures to make personal investigation into its merits.

The simplicity of its arrangements, and the ease with which it is managed, together with the time saved by its use, cannot fail to be considered points in its favor. It was

**WATSON'S MATTRESS STUFFING MACHINE.**

patented through the Scientific American Patent Agency, April 2, 1872, by Thomas A. Watson. For State, county, or other territorial rights, address Watson & Phillips, Brenham, Washington, Co., Texas.

Water ordinarily freezes at 32° Fah. But if it be confined in a strong vessel, so that its tendency to expansion is restrained, the freezing point may be lowered to 23° Fah.

Effects of Electricity on Milk.

The *Milk Journal* states that, in an address before the North Western Dairymen's Association, Mr. X. A. Willard repeats the following interesting facts:

Mr. Andrew Cross, the celebrated English experimenter, considered that the roots and leaves of plants were in opposite states of electricity; some of his experiments in this direction are very interesting. He cut two branches from a rose tree. They were as nearly alike as possible with the same number of buds, and both equally blown. An arrangement was made by which a negative current of electricity was passed through one, a positive current through the other. In a few hours the negative rose drooped and died, but the positive continued its freshness for nearly a fortnight; the rose itself became full blown and the buds expanded, and survived an unusual length of time. Again, he was able to keep milk sweet for three weeks in the hottest weather of summer, by the application of a current of positive electricity.

On one occasion, he kept fishes under the electric action for three months, and at the end of that time they were sent to a friend, whose domestic knew nothing of the experiment. Before the cook dressed them, her master asked her whether she thought they were fresh, as he had some doubts. She replied, that she was sure they were fresh, indeed, she said, she would swear they were alive yesterday. When served at table, they appeared like ordinary fish, but when the family attempted to eat them, they were found to be perfectly tasteless; the electrical action had taken away all the essential oil, leaving the fish unfit for food. However, the process is exceedingly useful for keeping fish, meats, etc., fresh and good for ten days or a fortnight. Now this is consistent with our observation and the facts known to every one in the habit of handling milk. When the condition of the atmosphere is in a negative electrical state, or shows a deficiency of positive electricity, a state of weather which we designate as sultry, close, muggy, and the like, there is always difficulty in keeping milk sound. Even in good, healthy milk, the fungus germs common to all milk increase and multiply with great rapidity, producing the common lactic acid fermentation or souring of the fluid; but in case fungi from decomposing animal or vegetable matter comes in contact with the milk,

rapid decomposition takes place, and we have rotten milk, putrid odors, and floating curds. The exposing of such curds to the atmosphere, as well as the aeration of milk to improve its condition, are both philosophical, because these minute organisms of fungi are affected by the oxygen of the air, which checks their development and multiplication.

The influence of electrical action is a question entirely new to the dairy public, but it is one concerning which I think some useful suggestions present themselves for our consideration. When the electrical equilibrium is disturbed,

or when the state of the atmosphere indicates a preponderance of negative electricity, we are all made aware of the fact by its depressing influences. At such times, it is important that we take more than ordinary care in the handling of milk; that it be kept out of harmful odors; that attention be given to its aeration, and such treatment be given it as shall be inimical to the growth and development of fungi. And again, the fact that milk may be kept sweet a long time in hot weather by electrical action will offer a very important suggestion to inventors in the preservation of milk, and perhaps in the improvement of cheese at the factories. I believe that we are only on the threshold of the cheese making art, and that as we become better acquainted with the laws of Nature and their application, great progress is yet to be made in every branch of dairy husbandry.

The best authorities estimate the entire world's wool product for 1871 at 1,620,000,000 lbs. Of this enormous quantity, Europe produced about 827,000,000 lbs.; Asia, 470,000,000 lbs.; Australia, 175,000,000 lbs.; the United States, 122,600,000 lbs., and South Africa, 34,000,000. Great Britain presents the largest market for wool in the world, her own annual production being estimated at 260,000,000 lbs., while her consumption is something over 250,000,000 lbs. The United States used of the raw material, in excess of the home production, about 68,000,000 lbs., imported at a cost of \$9,780,000. The value of the manufactured articles imported into the United States, in 1871, was about \$44,000,000.

The production of quicksilver in California amounts, on an average, to about 2,250 flasks per month.

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HOW TO CONDUCT NEW SCIENTIFIC INVESTIGATIONS.

Any one, inclined to use his leisure hours to enter a new field of scientific investigation, for the purpose of the promotion of science or for personal benefit, either reputation or profit, must first proceed to find out all that is known, respecting the subject chosen, before he commences his attempts to find something new. This is indeed the only way in which he may expect to be rewarded for his trouble; for what is the use of consuming our time and money to find in the end that we have only arrived at results which others before us have left behind long ago? That this statement is not exaggerated will be acknowledged by many who have either themselves made that mistake, or been the witnesses of the same mistake made by others.

The preparatory investigation suggested here will lead the explorer through many most fascinating paths of knowledge; and in order to conduct it rightly, we will give a few hints to all concerned.

The first information which we may obtain may be in a cyclopedia, found in almost every public library or in the possession of any well-to-do private citizen who loves books and ought to be willing to occasionally give others the benefit of his treasures when properly approached. If the cyclopedia is written in the right way, the article looked for will first give the general reader sufficiently full instructions in all he cares to know concerning the subject, and secondly, it will suggest to the student how and where to get further information. A good cyclopedia is similar to a finger post in the footpaths of science; it must point out the way, as it cannot be the whole way itself. It places the mere visitor on a hill, from which he may overlook the prospect, and gives the laborious traveler the guides necessary for his explorations. Those finger posts of the cyclopedia point to two kinds of roads, to special treatises on the different branches of science, mathematics, mechanics, physics, chemistry, etc., and to the transactions and memoirs of scientific associations. Of these two, we consider the latter as the most important, notwithstanding there is a general tendency to overlook them. It is argued that the truths they contain have been absorbed in the special treatises of science, while there are errors in them that have been rejected, and that therefore they are confusing and even dangerous to the student. There is some foundation for this opinion, and we agree that a totally ignorant person may thus be led astray; but any one having only a moderate knowledge of the present condition of science, as far as can be learned from the latest ordinary text books, is not subject to this danger, and only such are fit to enter at all in new scientific investigation. And these surely will find such documents, especially the old memoirs, instructive and even delightful reading. They have the great merit of being conscientiously written, with an admirable truthfulness and simplicity, and in this respect contrast very forcibly with many modern writings. They are earnest and condensed, true models of style, true models for practical investigators, and they describe the most admirable modes of research.

There is another reason why these scientific records should be consulted. The most valuable data were not often represented in such a way that the attention of subsequent compilers was sufficiently directed to them. Such a one takes no more than what strikes him, or what he wants, and the result is that second hand compilers, who abridge and sometimes even alter the abstract, misrepresent the results

of the original investigators. In this way, the most valuable incidental matter lays buried and neglected among the volumes of the memoirs, taking years to be unearthed; and even it is often not found there at all, but has been rediscovered by great labor and republished; and afterwards, some explorer of the old memoirs finds the original discovery and, by publishing the truth, robs the later discoverer of one of the gems in his crown.

We know that nobody will undertake the kind of labor we are speaking of except when he loves the subject so much as to be truly inspired with such an interest that, even when he doubts if pecuniary profit will accrue to him in consequence, he will not abandon his investigation. Scientific knowledge has its claims on us to be cultivated for its own sake, as well as literature, poetry, or music; we must not solely pursue it for the sake of money making, but first for its beauty and beneficial influence on our minds, and consider the profit, often the consequence of scientific investigation, as a secondary matter, but an important one at the same time, in which science has a decided advantage over literary and poetical pursuits, which can do nobody any material good, and never exerted the least influence of the improvement of the conditions of mankind.

All the great agents which have reformed the modern relation of man are due, not to literary and poetical, but to practical scientific pursuits. Is it a wonder, then, that the tendency of the most advanced minds is to modify our institutions of learning and to make them more scientific and less literary? Not only are physics and mechanics more pleasant studies than Latin, and chemistry more interesting than Greek grammar, but we assert that a man may make more money by applying a mere superficial knowledge of these sciences than by a much more profound knowledge of the dead languages. That these latter have not been more extensively superseded by more practically useful studies is a matter of surprise.

ENGINEERING IN BRUSSELS.

The recent completion of the public improvement works at Brussels affords a good illustration of the successful issue to which great engineering undertakings in large cities can be carried. These works have given to the city a beautiful boulevard extending (with its branch) over a mile and a half, and conveying, in its tunneled substructure, the contents of a river which had become a nuisance.

The Senne, which passes through the city, had there a very tortuous channel with very slight descent. Choked with the drift brought in from the outside country, and receiving all the refuse from the populous districts bordering it, it degenerated at last into an open sewer, which, swelled by the rains, occasionally inundated the adjacent parts of the town. The disastrous consequences to health and property induced much anxiety and deliberation, which resulted finally in the building of the present works. The leading features of the design consist in the construction of a large tunnel, and the diversion of the river waters into it on a straight course. Earth was filled in upon the tunnel even with the adjoining ground surface, and a new street formed upon the top of the tunnel. The latter is composed of a system of arches structurally connected, presenting, in cross section, four channels; the two middle arches, of twenty feet span and fourteen feet seven inches high, draining the river, and two side arches, thirteen feet one inch high, and, respectively, ten feet five inches and eight feet two and a half inches wide, collecting the city sewage. These channels can be made to communicate for the purpose of flushing; and ingenious provision has been made to accomplish this by utilizing the water from the city water works. The boulevard or street above the tunnel is ninety-two feet in width, wider than our Fifth Avenue, and runs nearly across the city. Besides sanitary considerations, the improvement has great importance. It opens a new and commodious thoroughfare between two distant railroads, and affords sites for public and other much needed buildings.

Great as is this achievement, it is far exceeded by the Thames Embankment in London, and the Metropolitan and other underground railroads in that city. In these, greater difficulties have been overcome. How successfully, is proved by a glance at the noble quay along the river, and at the constantly changing crowds in the handsome stations built many feet below the busy streets. We cannot but look upon them all as monuments of engineering skill exerted in the interests of the people; and it seems strange that in our own city we are so backward in admitting the practicability of minor efforts in the same direction.

THE COLORADO POTATO BEETLE.

In the last annual report of the State Entomologist of Missouri, Mr. Charles N. Riley, we are given some interesting additional facts regarding the Colorado potato beetle, its ravages, parasites, and enemies, and the means taken to counteract its work.

The insect showed numerously in the spring and summer of 1871, and there was a consequent falling off, of the potato crop in several States, of from 20 to 35 per cent, while new territory was being steadily invaded. Parts of the borders of New York and Pennsylvania and the interior of Canada were reached, and its continued march eastward is confidently predicted. The southern columns of the invader extend far more slowly than the northern, which is, no doubt, because the insect cannot thrive when the thermometer ranges near 100° F. It never entirely quits any district where it has once obtained a foothold, but in two or three years generally proves less injurious, because its natural enemies have multiplied sufficiently to keep it in check. These natural enemies are on the increase, and twenty-one cannibal or parasit-

ic insects are now known to attack it, in one State or another, while toads, crows, ducks, and chickens are learning to devour it also. It is believed the skunk likewise preys upon it. The Colorado potato beetle has in the past been found to flourish only on plants of the nightshade genus proper (*Solanum*), other members of the same family being but little to its liking, and it therefore is an interesting fact that last summer it was found feeding upon the cabbage, which is, botanically, so very distinct. Whether it will continue so to do seems a matter of considerable doubt.

Various have been the expedients tried to rid the potato of this pest, both chemical and mechanical. Of the former, Paris green has been found to be the most efficacious; but a good deal of objection has been made to the too general use of this poison on the ground of its dangerous nature, and it has been stated that the bugs could be subdued by determined handpicking. It has been thought that potatoes grown on land where Paris green has been used are often watery, rank, and of bad flavor, and that peas planted in soil mixed with the green rotted immediately, and that some, flourishing finely in unadulterated soil, died when transplanted into the mixed soil. Each cultivator must judge for himself how far these statements are to be relied on. It is certainly advisable to avoid as much as possible the use of the poison. Properly mixed, it has been used without the slightest injury to leaves or tubers, and what is wanted in the matter is a series of accurate and reliable experiments.

The green may be shaken over the vines in various ways, and some make use of an old sack attached to the end of a stick; it is most safely applied, however, by aid of a perforated tin box attached to the end of a stick three or four feet long. The least possible dusting suffices, and by taking the handle in one hand and then tapping the box with a stick held in the other, the amount sifted can be regulated as the rows are rapidly walked along. The green is most effective when mixed with flour, though plaster has the merit of cheapness. If the green be pure, it may be mixed with 25 to 30 times its weight of flour, though 12 to 14 parts are usually recommended; and a deep, bright green color should be chosen, as the paler colors are weaker. It does not appear to seriously endanger the animals around, except where left exposed in quantity sufficient to be eaten by them; but nothing can excuse the careless use of the poison, which must be especially guarded against during the heat of the day; it should always be dusted in the cool of the morning, while the dew is on the plants. The antidote for Paris green poison is hydrated sesquioxide of iron. Where it cannot be purchased, it may be prepared thus:—Dissolve copperas in hot water, keep warm, and add nitric acid until the solution becomes yellow; then pour in ammonia water—common hartshorn—or a solution of carbonate of ammonia, until a brown precipitate falls. Keep this precipitate moist and in a tightly corked bottle, and administer a few spoonfuls when a case of poisoning by Paris green or arsenic occurs. It might be supposed that as arsenic is one of the principal ingredients of Paris green, it could be used as an economical substitute. It has been tried, however, with no satisfactory result. It does not kill the bug with anything like the certainty of Paris green, and causes injury to the leaf of the plant.

Various mechanical contrivances for knocking the bugs off the vines are in use. One is a simple box six inches high, with wheels to which brooms are attached so as to sweep the bugs into the box. Another consists of a trap held under the vine to catch the bugs which are detached by means of a light, flat, and broad broom. The trap is afterward emptied through a sliding door and the bugs destroyed. The great difficulty with all such devices is that they can only be used when the vines are a considerable size, while it is necessary to fight the enemy from the moment the tuber breaks the ground. This is what makes the Paris green so valuable.

THE RUBBER TIP PATENT CASE.

For several years past, the stationers have supplied to the public a new and highly useful little article known as rubber tips for lead pencils. These consist of small blocks of rubber, molded into various fanciful forms and provided at the center with an orifice into which an end of the lead pencil is thrust. Small and simple as the article is, a very large business is carried on in its manufacture and sale.

Several conflicting patents and claims for patents at one time existed concerning the rubber tip; but the various parties finally consolidated their interests under the name of the Rubber Tip Pencil Company. One of the principal patents, held by the Company, was that of Blair, 1867, and on this patent the Company lately brought suit in the United States Court against Hovey and others for infringement. We publish the decision of the court in another column. It will be seen that Judge Benedict takes a very narrow view of the invention. He regards it as simply a piece of rubber with a hole in it; and, looking at it from this point of view, he thinks there is not enough invention about it to support a patent, and so dismisses the case.

This decision we believe to be erroneous. True, there was no great amount of invention exhibited in the article. In such a small affair, not much is to be expected. But enough of invention was manifested to produce a new article that everybody wants—enough to create a new and important branch of industry, and therefore sufficient to support a patent.

SLEDGE HAMMERS made from cast steel are superior to those made from iron and faced with steel. They cost about twice as much as the latter, but will perform fully four times the amount of work without requiring to be dressed.

NATURE AND ART.

One of the most interesting general subjects, with which a philosophically inclined mind can occupy itself, is the comparison of a natural object with a product of human art. An artificial object may indeed excite our admiration and even delight; but after some study, we comprehend all that it is intended to, and all which it possibly can, teach us. As it has been executed by the genius, skill, and perseverance of a man, it can be understood by another man, provided his intellectual development is not so low and his preparatory education not so defective that he cannot elevate himself to the standard required to appreciate the genius of his more advanced fellow man. By studying the products of such genius, he finds that, after all, they partake of many (and if not of many, at least of some) of the human imperfections. The finest human production represents, after all, nothing more than the state of scientific knowledge or artistic ability possessed at the time of its production; it silently admits of improvements, and confesses that probably it will be improved by advancing science, or, even worse, entirely set aside by the more perfect productions produced by later generations, and elaborated on a different type.

In studying a natural production, that is, an object made by Nature, alone, without human interference, we find that all the above remarks are totally inapplicable. We find that we never will be able to learn all that it can teach. Its place in the universal economy is such that we are compelled to confess that it was assigned by the most Supreme Wisdom, and while science comes, in its giant steps of progress, nearer and nearer to that wisdom, new perfections are discovered in it. Every natural production appears more and more elaborate, and more and more in harmony with the whole universe; it will never be superseded or set aside, but is steadily fulfilling its functions in the great mysterious evolution and differentiation of the material universe. At every step of our investigation, it admonishes us of the eternal laws of its being. A thought of the great German philosopher and poet Goethe, which flowed from his pen when his mind was turned to the study of botany, is worthy of attention; it is

"Suchst du das Höchste, das Größte?
Die Pflanze kann es dich lehren.
Was sie wissenlos ist.
Sei du es wollend,—das ist's."

We add the translation:

"Wouldst thou the highest, the greatest attain?
The plant may instruct thee.
What it unwittingly is,
Wittingly strive thou to be."

And this may be said of any natural object as well as of the plant, even of every part of a plant, of every part of the minutest animalcule; and if we recall the millions of organisms which the microscope is revealing in our time, in every grain of fossil earth, in every drop of stagnant water, even in the mud of the ocean bottom, at depths so great as to be formerly considered utterly inaccessible and devoid of life, we are dumbfounded at the infinity of the mysterious Power which presides over Nature's productions, and the comparative insignificance of man, notwithstanding all his pride.

CANADIAN PATENTS.

Our provincial neighbors have commenced their annual discussion of their Patent law. In the Canadian House of Commons, a few days ago, the Hon. Mr. Pope moved that the House go into committee on certain resolutions to amend the Patent law. He explained that in effect the measure was intended to assimilate the Canadian Patent law to that of England and the United States. The proposed amendment does away with the provision of the present law which requires a year's residence in Canada. The only other change proposed is that patented articles shall be manufactured in Canada. The House then went into committee, Colonel Gray in the chair, and adopted the resolutions and reported. The report was received. The resolutions were read a second time, and a bill founded on them was introduced.

We shall watch with interest the progress of the new bill, but have but little hope that the Canadians will so amend their Patent law as to permit their cousins in the States to secure protection for their inventions within the Provinces. The Canadians have so long practiced the habit of appropriating the inventions of our people that they will not readily give up the privilege; but at every Parliamentary session, a great deal of virtuous discussion takes place about Patent reform, which always ends without affording any protection to American inventors. We apprehend that the present discussion will terminate in the same manner.

EAST INDIAN IRON.

The *Indian Mail* is wondering why so little has been done to develop India's alleged wealth in iron, while the demand for that metal is so great as to divert British capital into foreign mines. It states that the steel now wrought in Cutch may vie in beauty of temper with the best productions of Sheffield and Glasgow, and that iron was lately turned out, from a rude furnace erected in the hills near Simla, superior to that obtained from Glasgow and Merthyr Tydvil at seventy shillings a ton. For sixty miles, along the base of the lower Himalayas, extends a rich iron bearing country, while the materials for smelting the ore lie close at hand in the shape of forests of hard timber. The iron bearing tract near Simla, covers two hundred square miles and yields a malleable ore very like that of Sweden. No doubt is entertained that plenty of iron may be found all over India, and that it may be brought into the market there cheaper than the English metal.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW BLUE COLOR.

If metallic antimony be dissolved in *aqua regia*, after filtering through granulated glass, a solution of prussiate of potash being added as long as any precipitate is produced, a beautiful and permanent blue color is exhibited which can scarcely be distinguished from ultramarine. With chrome or zinc yellow, it gives a green, almost equal in color to Schweinfurth green and far less poisonous.

ACOUSTIC TELEGRAPH.

Professor Weinhold, of Chemnitz, Germany, has invented a phonic telegraph, employing neither electricity, magnetism, light, nor heat. The wire, which must be very carefully insulated, is attached at both ends to sounding boxes. Words uttered near one sounding box are repeated by the other very distinctly. This telegraph has been found to work well on the short line (2,200 feet long) where the experiment was made.

THE MARSH TEST FOR ARSENIC.

In the Berlin laboratory, it was customary to pass the arsenuretted hydrogen gas through several wash bottles containing dilute solutions of nitrate of lead, before passing it into nitrate of silver. It was often noticed that, although using chemically pure acid and zinc, the lead solution always became quite black, a fact indicating the presence of sulphuretted hydrogen. If concentrated sulphuric acid were used, the smell of sulphuretted hydrogen is also noticed. Professor Kolbe, who has been studying this subject, concludes that the sulphuretted hydrogen is due to a reduction of the sulphuric acid by nascent hydrogen, the amount of heat generated favoring the decomposition. This reaction could perhaps be represented thus:



It seems probable that the sulphuretted hydrogen thus generated would precipitate a portion of the arsenic introduced and render the test less accurate. To avoid this, Professor Kolbe suggests the use of a very dilute acid.

ADULTERATION OF STEARIN WITH PARAFFIN.

To determine the amount of paraffin in stearic acid or in stearin candles, the following simple and practicable method may be employed: About five grammes of the substance is weighed out and treated with warm potash lye, not too concentrated. The stearic acid is, of course, converted into soap, while the paraffin remains suspended in the liquid in small drops which finally collect on the surface. By allowing it to cool, most of the paraffin could be taken from the top, but to avoid errors, caused by drops of paraffin which remain suspended in the liquid, a solution of common salt is added which throws down the soap from the solution. The solid soap and paraffin are brought on a filter and washed with cold water, or a very dilute alcoholic solution. After all the adhering salt solution is washed out, the soap itself dissolves and passes through the filter, leaving the paraffin alone on the filter. This is dried at a temperature below the melting point of the paraffin, say at about 35° to 40° C. The paraffin may still contain some water and excess of alkali, so that it is not yet ready to be weighed. It should be treated with ether on the filter, and the ethereal solution evaporated, in a weighed porcelain or glass capsule, at a low temperature on a water bath. This operation must be conducted with great care, for the solution is apt to foam and spatter. The weight of the evaporated residue gives the amount of paraffin present, while the difference is stearic acid.

THE FOREST FIRES.

The calamities of last autumn, which destroyed so much property in Michigan, Wisconsin, and other parts of the Northwest are now being supplemented in the States of New York and Pennsylvania. Fires are destroying the timber and brushwood on the mountains in Delaware county, N. Y. At Hancock, a steam sawmill and much other property, including over 1,000,000 feet of hemlock timber, have been destroyed. We are informed by a traveler on the Delaware, Lackawanna and Western road that a tremendous scene of devastation was visible from the train, the heat being such that the glass windows of the cars were uncomfortable to the touch.

SEXUALITY OF HEART DISEASE.

Dr. Richard Quain reports that enlargement of the heart, one of the most distressing and fatal diseases, is more than twice as frequent in males as in females, the precise proportion being 8 to 3. This remarkable liability to enlargement of men's hearts, as compared with those of women, is, he thinks, unquestionably due to the greater amount of work and anxiety which, under the present dispensation, falls upon man. Ladies may take this fact to heart, and reflect whether, in claiming the rights of women, they may not at the same time incur the risks of men, and with them a new and unexpected form of disability.

AN ANCIENT RECORD.

Mr. Henry Fox Talbot has recently read, before the Society of Biblical Archaeology, a paper on a "Curious Myth respecting the birth of Sargina." Sargina the First was an ancient king in Babylonia, his capital being at Agani, in that country, at a date so far distant that the site of the city has never been discovered. The remarkable discovery of Mr. Talbot is that the account of his birth and infancy, recorded on a tablet in the British Museum, has many strange points of similarity to the history of Moses recorded in the Pentateuch. The following is a literal translation of the hieroglyphical inscription: "In a secret place, my mother brought me forth. She placed me in an ark of bulrushes; with bitu-

men she closed up the door. She threw me into the river, which did not enter into the ark. The river bore me up and brought me to the dwelling of a kind hearted fisherman. He saved my life and brought me up as his own son," etc. The original inscription was doubtless a long one, but only the commencement has been preserved.

ABSORPTION OF SOLID MATTER BY ANIMAL TISSUES.

Dr. Auspitz, of Vienna, gives the following result of a number of experiments on the behavior of some insoluble matter in contact with the living tissues. In mammals, granules of starch are absorbed by the subcutaneous tissue, and are able to reach the lungs and thence the general circulation; and, moreover, they pass through the lymphatic system to win their way into the veins. The epidermis presents an obstacle, to this absorption, which doubtless varies in pertinacity with its condition and the varying state of the pores in different states of health and cleanliness. "Absorption," says Dr. Auspitz, "is essentially promoted by the assistance of fatty matters which enter the system much more readily than starch, and in the same manner."

INDUSTRIAL ACTIVITY IN VERMONT.

The Messrs. Remington, whose works at Ilion, N. Y., we recently described, have taken a large interest in an extensive rolling mill at St. Albans, Vt. The capability of the new works may be judged from the following figures: Three steam engines, of an aggregate of 1,200 horse power, will run the machinery, and twenty-six steam boilers will be required to supply them. The iron mill will employ twenty puddling furnaces, ten reheating furnaces, and two 21 inch trains. The works are estimated to be able to turn out 90 tons of rails per day, using 500 tons of coal, and will employ 400 men, working day and night.

ELECTROPLATED JEWELRY.

The great demand for jewelry of the more ornamented patterns has induced manufacturers to produce the most elaborate specimens in inferior metal, coated with gold by electric process.

STEAM TILLAGE.

Mr. William Smith, of Woolston, England, has long been a successful practitioner of cultivation by steam. He states that by thus thoroughly working the land, he has grown on two fields fifteen crops in succession, wheat after beans, without a fallow; and the yield of wheat last year was fully forty bushels per acre. On two other fields of heavy soil he has grown wheat after wheat, and estimates the crop this year at quite forty bushels per acre. "The produce of these four fields under horse culture was," he says, "about twenty bushels per acre on an average of years." And notwithstanding the heavy and continued cropping under steam tillage, the land is so clean "that the total cost of working the seed bed for each crop, from the smashing up of the previous stubble to the pulverization of the surface in readiness for the drill, is only \$1.60 per acre."

IMPROVEMENT IN PUMPS.

An effective and novel application of steam power to the raising of water is evidenced in the action of a Reynolds' atmospheric engine, at present engaged in pumping out the coffer dam surrounding the caisson which is being sunk, on the New York side, to support one of the towers of the East river Bridge. The engine, which is of an improved form, has two vertical cylinders of 7½ inches in diameter, and two cranks. Its stroke is 14 inches. The steam, at a pressure of about 50 pounds, is led from the boiler through a half inch pipe for a distance of 75 feet, and enters the engine through a valve half an inch in diameter. With this valve half open, the engine, working at a rate of 65 strokes per minute, and condensing all its steam, raises a six inch column of water 28 feet high without the interposition of any extra machinery whatever.

There is no question but that this is one of the best results yet obtained from any pumping engine, more especially as the raising of the water is rendered doubly difficult from the fact of its containing large quantities of mud and grit. Two steam pumps from a well known manufactory in Brooklyn are also engaged at the work, but it has been found that, although they use together nearly eight times as much steam, raise only a four inch stream, and are placed some ten feet below the Reynolds engine, the entire volume of water discharged by them is not more than half as great as that raised by the latter.

BUILDERS' HARDWARE.

The complaints of our correspondent F. G. W. at page 76 of the current volume, regarding the very inferior quality of builders' hardware, we find echoed in the correspondence of *The Ironmonger*. It seems they have in England equal cause with ourselves to demand better articles in that line. F. G. W. and others think that the fault lies with the manufacturer, who should supply the market with goods of better quality; but a Wolverhampton lock maker takes the ground that the purchaser is the party to be blamed. He deprecates the question of price taking so large a place in the purchase of useful articles, and thinks that if the buyer would only look to quality, and be willing to pay enough, the run of common goods would become unsalable. He states that manufacturers would rather send out a good article than a poor one, but so long as the public prefer quantity to quality, builders and cabinet makers will buy the cheapest they can.

There appears to be some force in these remarks. Whether they would apply to the relations existing between our own manufacturers and buyers is a question worthy of consideration.

TIMELY HINTS FOR PATENT OFFICE EXAMINERS.

The Commissioner of Patents, in a recent decision on a case appealed to him, gives expression to the following timely and common sense views respecting the duties of Patent Office examiners:

"Where two parts of a device co-act to produce a useful result, they should not be separated for the purpose of rejection. A legitimate combination must be met as such or the claim admitted."

To (1) a claim and reject it piecemeal is not admissible. The invention claimed in this case is for the double purpose of preventing the losing of the key that holds the standard and beam of a plow together, and of strengthening the beam at its point of greatest weakness.

The device consists of a notched key to pass through the standard and a wedge shaped plate having a slot to receive the standard, the slot being considerably longer than the width of the standard. The slotted plate is then dropped over the upper end of the standard and so adjusted as to bring the thinnest end of the wedge under the keyhole, when the notched key or gib is inserted and the wedge plate driven under it firmly and then fastened to the beam by a screw.

The application was rejected by a reference to Fowler's patent of March 26, 1867, which, it was thought, showed the wedge shaped slotted plate, and to various classes of machinery for the notched key. The key is not separately claimed, neither is the slotted plate, and if they co-act to produce a useful result they should not be separated for the purpose of rejection. A legitimate combination should be met as such or not at all. The practice of dissecting a machine and rejecting it by piecemeal is without the sanction of either reason or law. Under such practice, the Office might very soon close its doors, for the lever, the inclined plane, and the pulley are all very old and very well known, and might soon become sufficient references for every possible mechanical device; but in this case applicant's invention is not met even by the fragmentary mode in which it was examined. The wedge in Fowler's patent is a fork driven under a pin in the standard, for the purpose of regulating the pitch of the plow point and the draft of the plow. It has no other use, and is not designed or adapted to serve the end sought by the applicant. It has no influence whatever in retaining the key in its place more than the beam would have without the plate. It resembles the plate in this case in being wedge shaped, and in being fastened to the beam with a screw, but in no other respect. The key, when considered by itself, has no element of novelty, and the applicant sets up no claim to novelty in either the plate or key. His claim is for a novel combination of the two in such manner as to secure a single and desirable end. It is well known that the alternating strain and relaxation upon the beam of a plow while at work has a very troublesome tendency to loosen the pin that retains the standard and beam in their proper relative positions. If the pin drops from its place, the plow is in danger of being seriously damaged. To obviate this danger and trouble is the sole end of applicant's invention, and it was no part of the object of Fowler's invention; neither would nor could his invention accomplish such purpose.

The key and slotted plate in applicant's device clearly co-act in securing this end, and seem to be admirably adapted to the purpose. The notched key could not be successfully used except with a plate substantially in the form described, and the plate would be worthless for the desired purpose except with the notched key. When acting together, the end is attained. Hence the combination is legitimate, and is not answered by references that apply only to the parts when separated from each other.

The decision of the Board of Appeals is reversed."

DEATH OF AN INDIAN NOBLEMAN.

On the 11th of January last, died, at Poona, British India, Vensick Gungadur Shastree, commonly called Aba Sahib. The deceased was a Marátha nobleman who, unlike his class generally, chose a life of unobtrusive usefulness.

From his early youth he devoted his attention to science, and was in 1848 elected a member of the Royal Asiatic Society, which at that time did not number a dozen native members. He accomplished, unassisted, the correction of the ordinary Hindu calendar, which had remained for centuries in dispute, and is reputed to have been the first introducer of photography among the native communities of Western India.

Aba Sahib was for many years a subscriber to the SCIENTIFIC AMERICAN, and we are indebted to his son for a Bombay paper containing his obituary.

Aeronautics.

An ingenious instrument, for measuring the forces exerted by a horizontal current of air on planes in various positions, was lately exhibited before the Aeronautical Society of Great Britain. The plane is carried at one end of a horizontal arm passing through an eye at the upper end of a spindle, and can be fixed at any inclination by a clamp at the back. The direct pressure of the current is read off on a spring balance operated by the spindle, and the rising force due to the various inclines is shown on a vertical balance connected with the arm. The experiments show that, as the angle of inclination becomes more acute, the lifting force exceeds the horizontal (or power required to propel planes through the air) in an enormous ratio. At 20°, it is about three times more; while at 15°, the lift is four times greater than the thrust. More acute angles were not then tried, but it was deemed that further experiment would dissolve all mystery relative to the support of weights in flight.

Beecher on the Darwinian Theory.

Henry Ward Beecher, in the course of a recent sermon, thus expressed himself in regard to the Darwinian theory:

It is of little consequence to me where I came from; it is of a great deal of consequence to me to know where I am going. There are a great many men at the present day investigating the road which has brought man up to the present state, and I confess to a curiosity in the matter, and I do not say that these researches may not be of benefit. I regard the labors of Mr. Darwin with profound interest, believing that the world will in time accord him a great deal of credit. Although I am not prepared to accept all his speculations, I thank him for all his deductions of fact. I do not participate a particle with those who read the idea of man's having sprung from some lower form of existence; all that I ask is that you show me how I got clear from monkeys, and then I am quite satisfied to have had one for an ancestor fifty centuries ago. (Laughter.) Only make the difference great enough and I am content. I had just as leave spring from a monkey as from some men I know around here. (Renewed laughter.) I look upon the Patagonians or the miserable crawling Esquimaux, and I don't see much to choose between them and any latent animalhood. I don't care so much about that thing, for I have never been there. I had no early associations a great while ago. I have not the least recollection of what happened a million years ago. All my life is looking forward. I want to know where I am going; I don't care where I came from.

Halls and School Rooms.

While sulphurous acid, chloride of lime and carbolate of lime cannot be used without inconvenience, on account of their unpleasant odor, in frequented rooms, chemical science has recently brought out a disinfectant apparently more effective than either, which can be safely and conveniently used anywhere, since it is free from odor, and when properly diluted does no harm to the color or texture of carpets or furniture. This is bromo-chloralum. Would it not be worth while, as a sanitary measure, occasionally to sprinkle the floors of our school rooms, churches and other assembly rooms with it? If this were done at the close of a session, the air, instead of being kept in its foul condition until the next gathering, would be cleansed of its impurities. If the sprinkling were repeated just before the pupils assemble, there would be a tendency to lessen the accumulation of unhealthiness in the atmosphere of the room. No thoughtful person can doubt that the question: How may we secure the best sanitary condition of our school rooms and public halls? is worthy of more attention than it has generally received.—*Professor M. C. Stebbins.*

FIVE EIGHTH inch octagon steel is the best for making punches, cold chisels, or drills; one and a quarter inches square is the best size to use for making chisels. To make a good sized flattening hammer, you will require about six inches of one and a half inches square steel. This will also make you as heavy a hand hammer as any ordinary man ought to use. If you make but one hammer, let it be of the face and ball pattern.

THE first coal ever mined in the United States was dug near Richmond, Va. Bituminous coal was mined there as early as 1700, and in 1775 was extensively used in the vicinity. During the Revolution a Richmond foundry employed this coal in making shot and shell for the Continental forces.

Facts for the Ladies.—Mrs. J. P. Millard, New Hamburg, N. Y., has used her Wheeler & Wilson Lock-Stitch Machine since June, 1862, doing the family sewing for six persons, and making the bedding for a steamboat, without a cent for repairs; it now works as well as when first used. See the new improvements and Woods' Lock-Stitch Ripper.

"Barnett's Toilet Preparations will speak for themselves."—*Charleston Mercury.*

Business and Personal.

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

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$4 00 a year. Advertisements 10c a line. John Fairclough, St. Joseph, Mo., desires information about best bone mills.

T. Shaw's Blast Gauges, Ridge av. & Wood st., Phila., Pa.

Important to Iron workers.—A man, recently from England, having had twenty years' experience in the galvanizing of iron, wishes to obtain employment—would be willing to commence the business. Apply, by letter, to John Smith, 233 Court St., Buffalo, N. Y.

Shive's Patent Watchman's Time Detector—the most unerring detector extant. Price \$15. Shive Governor Co., 12th and Buttonwood Sts., Philadelphia, Pa.

T. Shaw's Hydraulic Gauges, Ridge av. & Wood st., Phila., Pa.

Kemmer's Patent Oil Frescoing—great improvement for frescoing Ceilings and Walls. Office, No. 4 Warren St., New York. Factory, East Newark, N. J.

Flouring Mill for Sale. See advertisement, on page 357.

Better than the Best—Davis' Patent Recording Steam Gauge Simple and Cheap. New York Steam Gauge Co., 48 Cortlandt St., N. Y.

For 2, 4, 6 & 8 H.P. Engines, address Twiss Bro., New Haven, Ct. Grindstones for File Cutters. Worthington & Sons, North Amherst, Ohio.

Wanted—A man that fully understands Engines and Machinery, to travel and sell same—also, to sell Stoves. Address, with reference, Great Western Manufacturing Co., Leavenworth, Kansas.

T. Hodgson, Amherst, N. S., wants some heavy spiral springs.

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 \$1.00 a year.

The Best Water Pipe, also the Cheapest, when strength and durability are considered, is the Tin-Lined Lead Pipe manufactured by the Colwell, Shaw & Willard Manufacturing Co., No. 218 Centre St., New York. Price, 15 cents a pound for all sizes. Send for circular.

T. Shaw's Steam Gauges, Ridge av. & Wood st., Phila., Pa. Dederick's Self-adjusting Crank Box, 79 Beach St., New York.

Wanted—A first class Machinist; he must thoroughly understand the Harrison Boiler. Address, with reference, Post Office Box 1228, New York.

Patents Sold by Moody & Co., 183 Broadway, New York. Parties wishing to buy or sell, send for "Patent Bulletin."

Crossley's Patent Lubricator, for Stationary, Marine, and Locomotive Engines, Steam Pumps, &c. Manufacturing, cor. Adams & John Streets, Brooklyn, N. Y.

If you want a perfect motor, buy the Baxter Steam Engine.

The Baxter Steam Engine is safe, and pays no extra Insurance.

Brown's Coal-yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W.D. Andrews & Bro., 414 Water St., N.Y. Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside page.

For Tri-nitro-glycerin, insulated wire, exploders, with pamphlet, as used in the Hoosac Tunnel, send to Geo. M. Mowbray, North Adams, Mass.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Presses, Dies, and Tinner's Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Day St., New York, for descriptive pamphlet.

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.

Best and Cheapest—The Jones Scale Works, Binghamton, N.Y.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 15 Park Place, N.Y.

Hoisting and Pumping Engines (Locomotive principle); best and simplest, from 6 to 40 H.P. J. S. Mundy, 7 H. R. Av., Newark, N. J.

Send for matter relating to the Hutton Governor. It will save its cost in three months, on heavily loaded engines. In use in the largest manufactories in America. It is not a ball regulator. J. Aug. Lynch & Co., Boston, Mass.

Seeds and Fertilizers. R. H. Allen & Co., New York.

For the best Galvanized Iron Cornice Machines in the United States, address Calvin Carr & Co., Cleveland, Ohio.

Diamonds and Carbon turned and shaped for Philosophical and Mechanical purposes, also Glazier's Diamonds, manufactured and reset by J. Dickinson, 44 Nassau st., New York.

Callow's New Patent Mode of Graining Wood. Makes Painters grain all woods first class who never grained before; Likewise makes Grainers lightning fast who thumbed it out before. Address, with stamp, J. J. Callow, Cleveland, Ohio.

A competent Superintendent for the manufacture of Malleable Iron may hear of a situation on application to the Springfield Malleable Iron Works, Springfield, Ohio.

The most economical Engine, from 2 to 10 H.P., is the Baxter.

Wanted—A Purchasing Agent in every city and county, to supply Nye's fine Sperm Sewing Machine Oil. Put up in Bottles, Cans, and Barrels, by W. F. Nye, New Bedford, Mass.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N.J. Also 2-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

The Patna Brand of Page's Patent Lacing is the best. Orders promptly filled by the Page Belting Co., No. 1 Federal St., Boston. Absolutely the best protection against Fire—Babcock Extinguisher. F. W. Farwell, Secretary, 407 Broadway, New York.

For Steam Whistles, address Exeter Machine Works, 75 Congress Street, Boston, Mass.

An inducement.—Free Rent for three months to tenants with good business, in commodious factory just built for encouragement manufacturing. Very light rooms, with steam, gas, and water pipes, power elevator, &c. &c. Manufacturers' Corporate Association, Westfield, Mass. Plans of Building, Room 22, Twenty One Park Row, N. Y.

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

The "Bellis Patent Governor," made by Sinker Davis & Co., of Indianapolis, Ind., is acknowledged to be the most perfect engine regulator now in use.

Persons in want of Portable or Stationary Steam Engines, or Circular Saw Mills combining the latest improvements, should correspond with Sinker Davis & Co., of Indianapolis, Ind.

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

Lord's Patent Separator for Ores, or any dry material, built to order. State rights for Sale. 232 Arch St., Philadelphia, Pa.

Important.—Scale in Steam Boilers—We will Remove and prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 232 Arch Street, Philadelphia, Pa.

"Anti Lamina" will clean and keep clean Steam Boilers. No injury to iron. Five years' use. J. J. Allen, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 33 Broadway, N. Y., or Box 1839.

Billiard Cushions—Manufacturers of Billiard Tables, use Murphy's Patent Cushions. The finest made. Send for sample set. Gutta Percha and Rubber Manufacturing Company, 9 & 11 Park Place, New York.

For the best Recording Steam and Indicating Gauges, address The Recording Steam Gauge Co., 91 Liberty Street, New York.

For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Army, 33 and 353 Cherry Street, Philadelphia, Pa.

Boynton's Lightning Saws. The genuine \$500 challenge. Will cut five times as fast as an A.L. A 6 foot cross cut and buck saw, \$4. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

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

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.—**SUPERHEATING STEAM.**—Can any of your readers inform me whether steam can be superheated to a red or higher heat, and how?—R. H. E.

2.—**REMOVING NITRIC ACID STAINS.**—Can some of your readers inform me if the yellow stains in cloth, caused by nitric acid, can be removed, and if so by what means?—S. H. F.

3.—**DEPOSITING TIN BY ELECTRICITY.**—Can thin sheet brass be galvanized on one side with tin? Can it be done without getting tin on both sides? Is there any preparation of tin that can be applied with a brush?—K. E. F.

4.—**ACIDULATION OF ALE.**—What is the cause, or what will prevent, ale in the process of brewing from running into the acetic acid state? In cleansing, should it be allowed to work until it is perfectly still, and then be bunged down?—W. H. C.

5.—**ELECTRODEPOSITION OF IRON.**—Can iron be deposited on brass or copper by the aid of a galvanic battery? Can any one give me a receipt to make a solution?—T. N. S.

6.—**MEASURING THE FLOW OF STEAM.**—How can I best ascertain the quantity of steam, in terms of horse power, passing through a given sized pipe, in a given time, the pressure in boiler averaging say 70 pounds per square inch? Do you know of a meter or other appliance which might be connected with the steam pipe which would indicate the amount of steam used in a given time?—J. W. G.

7.—**WIRE ROPE FOR BALING PRESS.**—I wish to know whether a wire rope would be suitable to use as a balance rope on a baling press, and what sized wire rope would be necessary where it has to hang on a foot roller and sustain 2,000 pounds attached to each end, each 2,000 pounds alternately passing up and down, and drawing the wire rope over the rollers? Would it weaken the rope to bend it over said roller?—A. J. B.

8.—**PROPORTIONS OF ENGINE.**—An engine, the cylinder of which is of eleven inches bore and three feet stroke, runs at forty revolutions per minute with fifty pounds pressure of steam, as shown by gage. Can I do the same work with an engine of seven inches bore and fourteen inches stroke, running at one hundred and fifty revolutions per minute, carrying eighty pounds of steam, or what part of the work per minute can I do?

9.—**FANNING AND FLY BRUSHING MACHINE.**—In our warm climate we need fanning and fly brushing machines, and the main trouble has always been the difficulty in securing some safe, light and steady power to run said machines. I think this difficulty can be overcome by constructing a wind mill which, night and day (whenever the wind is favorable) will force water up into an elevated tank. Said tank can be placed upon the roof of the house. This tank will supply water, by means of a pipe, to a turbine wheel placed over the well from which the water is first drawn, and will furnish, I think, ample and steady power for the purposes named, and will besides run the family sewing machine and supply the house throughout with all the water needed. Will some one get up the required machinery or else give us an idea of the sizes of the windmill, tank, turbine wheel, fans, etc?—S.

10.—**CUTTING STEEL.**—I wish to know the proper diameter and number of revolutions of a smooth-faced soft steel cutter, such as is used in cutting the screw point on augers.—A. V.

11.—**WOODEN TANK FOR WATER.**—Will some one inform me what is the most durable wood to use for a reservoir, to be placed on top of a house to hold water for domestic purposes? Of white poplar or pine, which would be preferable?—R. S. S. H.

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

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

SPECIMENS.—We are indebted to Mr. J. L. Rhodeback, of Norway, O., for specimens of petrified honey combs, a rare and beautiful petrification upon which we shall remark hereafter. Also for specimens of agate spear heads of aboriginal construction.

POUNDING OF PISTON.—To S. R., of Pa.—This question has been fully discussed in the current volume of the SCIENTIFIC AMERICAN. See pages 132, 155, 170, 217.

PROPORTIONS OF SAFETY VALVE.—To C. H. C., of N. Y.—We have frequently answered your question. You will find full particulars on page 106 of Vol. XXV. of the SCIENTIFIC AMERICAN.

E. K., of N. Y.—The mineral you send is anthracite coal. Thin seams of this coal occur in many places throughout the State of New York, but there are no workable beds.

N. B. D., of Ill.—The mineral you send is iron pyrites or "fool's gold," of no great value. It is used in the manufacture of copers and for the sulphur it contains.

C. R., of Va.—In the mineral you send there is a small percentage of iron, not enough to make it an ore of any value.

B. F. R., of Ala.—The mineral you send is not graphite, but a highly carbonaceous slate, which would make but a poor substitute for "black lead."

J. W. B., writing from Fayette, Miss. says: I send you here-with a large bug found on the bank of a creek in this vicinity. As no one here knows what it is, I take the liberty of sending it to you to find out the name of the "critter." Answer: We are much obliged for the specimen. It is one of the largest beetles occurring in the United States, the *Dynastes titivus* of Linnaeus. It is kindred to the sacred *Scarabaeus* of the Egyptians.

J. H. D., of Ohio, sends a mineral specimen which he states was taken from a wooden water conductor ten rods long, which drains a well on a descending grade. The water is used for watering stock. The red sediment collects in large quantities in the pipe and also in the trough. The water has the property of turning all vegetable matter, falling into it, black in a very short time. Answer: The mineral you send is hydrous oxide of iron, mixed with earthy matter, and contains no poison. The tannin in the vegetable matter unites with the iron, forming a black precipitate, resembling ink.

EYE STONE.—E. P. B. says: A difference of opinion having arisen between myself and a friend in regard to the nature of an eye stone, whether it is animate or not, we beg of you to enlighten us on the subject. Answer: The best form of eye stone is said to come from Venezuela, where it is found on the seashore. It is flat on one side, oval on the other. When introduced under the eyelid, the motion of the eye causes it to move about, and any particles of foreign matter in the eye adhere to the stone. The eye stone is as inert as any other pebble.

NEUTRAL NITRATE BATH IN PHOTOGRAPHY.—In photography, the most difficult thing is to preserve the nitrate bath completely neutral, as, at every dip of a plate, free nitric acid is liberated. If we allow a small piece of carbonate of lime or common marble to remain in the bath, will it not neutralize the acid without incurring the risk of making the bath alkaline? Iceland spar is said to be the purest form of carbonate of lime; where can it be procured? Answer: Photographers do not want the bath completely neutral; a slight acidity is the best preventive against fogging. A neutral bath requires a shorter exposure. We prefer to add a little carbonate of soda when our bath becomes too acid; but it is better to filter, boil down, and make a new bath. The use of lime, as you propose, would be an injury to the bath.

SIPHON.—To J. M. J.—It is not possible to raise water from a well by means of a siphon, unless the siphon discharges at a point lower in level than the water of the well. To draw water from a depth by means of a siphon would be making the water run up hill, which is proverbially impossible. The size of the pipe does not affect the efficiency of the siphon.

GREASING COGS OF REAPERS, ETC.—I would say, in answer to query 14, May 4, that I consider it best to oil cogs when there is no sand or grit to get into them. The grease lessens the wear; but if the sand gets to it, it will stick to the cogs and make the wear more rapid.—H. C. B., of O.

EXPANSION OF MERCURY BY HEAT.—Query 10, page 249.—If a given volume of mercury at 32° be taken as 1, when heated to 212° it will equal 1.02; that is, raising its temperature 180° increases its bulk .02 of itself. But the increase in the bulk is not uniform, for the ratio of expansion for liquids and solids increases with the temperature. Of the metals, zinc expands most. If the length of a bar of zinc be taken as 1 when the temperature is 32°, when heated to 212° it will equal 1.003942—an expansion of .003942 of its length for 180°. Lead is next and shows .0028425.—X. P. M., of O.

GREASING COGS.—Query 4, page 297.—Having had some experience in this with a reaper, I would advise C. A. A. to put his grease where it will do some good and no harm. For, if he puts it on the gearing of a reaper or mower, he will soon find that it catches and holds every grain of sand that drops on the wheels (and a good many will fall there in a day), and thus help to wear away the cogs faster than is necessary. I found this when I tried it, so I quit greasing and cleaned off the cogs, and the wheels were soon bright and smooth, and ran as light as ever and with much less wear.—X. P. M., of O.

BLACKBOARD.—Query 17, page 297.—I have known silicate slating (a liquid) to be used with much success.—G. L. F., of N. Y.

WILD BEES.—Query 5, page 297.—C. J. M. should go to where the bees abound, put a little honey on a log, and when a bee alights and is well loaded, take him by the middle of the back and attach a light piece of cotton to his legs. Then letting him go, he will take a straight line for home. Marking the direction with a compass, it can easily be traced by means of the cotton.—G. L. F., of N. Y.

WILD TEA.—In your paper of February 24, you advise a correspondent that Jersey tea (*ceanothus americanus*) is commonly known as wild tea, and was used during the Revolution of 1776 as a substitute for tea. I write to inform you that another plant called Labrador tea (*ledum latifolium*) was also used in New England and Nova Scotia as a substitute for tea by our forefathers. See Bigelow's "Plants of Boston and its Vicinity," page 183.—W. B. S., of Mass.

PAINTING THE INSIDE OF AN IRON WATER TANK.—Query 5, page 313.—I would recommend the coating of the inside of an iron tank with beeswax hardened by adding about one fourth part of rosin. Clean the tank and coat it well with the wax preparation, as hot as possible without burning your brush. A long experience convinces me that the above is the best possible coating for an iron water tank.—H. W. M., of Mass.

WILD BEES.—Query 5, May 4.—Take the bottom of an old sugar hoghead and keep it saturated with water; or place on it waste honeycomb. "Stink bait," however, will draw them much further from home. I have known bees to go two miles to this bait; some people say they will go three or four.—H. W. S.

MAGNETIZATION.—Query 9, page 297.—A circular piece of steel can be magnetized as well as any other form. In this case the poles must be on opposite sides of the circle, and at right angles to those points, there will be points that will manifest little or no magnetism. The steel must be tempered, else the force is lost as soon as the magnet is removed. The best way is to apply the steel to a powerful electromagnet; this might prove the only effective way for a piece as large as the one mentioned. But if this cannot be done, take two pieces of loadstone with their opposite poles towards each other. Place them upon the center of the piece of steel, and slowly draw them to the edge. Remove them, replace them at the center, and again draw them to the edge. Continue the process until the steel becomes magnetized. This method will not give as good results as the electromagnet.—L. R. F. G., of Mass.

BRITTLE SPIRAL SPRING.—Query 13, page 297.—The spiral spring of a pegging machine breaks after it has been run for some time because the continual jarring causes the particles to assume the crystalline form. Not only does iron crystallize in casting, but a continued jar will cause cold iron and steel to crystallize. I cannot say that the steel becomes harder by use, but it is more brittle. If W. A. S. will take a magnifying glass and look at his broken spring, he will plainly see the crystals. The remedy is to reheat and retemper the spring occasionally.—L. R. F. G., of Mass.

Recent American and Foreign Patents.

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

SOAP HOLDER.—Jacob A. Camp, of Sandusky, Ohio.—The invention consists in a perforated and handled soap cup by which all necessity for taking soap in the hands is removed, while a better lather, cleaner soap, and economy in use are all attained. All those who have used, and those who have omitted heretofore to use, soap will find it to their interest and convenience to have one of these soap holders.

CHURN AND BUTTER WORKER.—Wm. McKeever, of Staunton, Va.—The invention consists in a stop chamber, with stationary breaker thereunder, which is combined with a movable breaker, so that the milk or cream only moves backward and forward in a small area. This compels the production of butter in three or four minutes. Its shaft is also provided with paddles which beat and work the butter, so that there is no need whatever to touch it with the hand. This invention doubtless possesses more real utility and novelty, and is a greater improvement in churns than has been made in the present century.

WHEAT HOOLING MACHINE.—George B. Newman, of Liberty Mills, Va.—The invention consists in a grain scower which discharges the grain from the hopper around the shaft and upon a top cup, whence the centrifugal power forces the grain outward, over its concave sides, and rubs the pellicle with great friction. This detaches all or a large portion of the dirt. The grain is then conveyed down to the shaft and into one cup after another until the operation is completed.

MOLE TRAP.—Clark Polley, of McMinnville, Tenn.—The invention consists mainly in applying a spiral spring to a mole trap, so as not only to impel the bait, but to hold together all the parts, and thus render them easily detachable. This greatly simplifies, cheapens, and makes more useful the whole trap.

ointment.—Wm. C. Jones, of Henry County, Ala.—This ointment is a compound formed of beeswax, butter, honey, rosin, mutton suet, sugar, and verdigris, mixed in certain proportions and by certain successive manipulations. It is intended for cutaneous diseases, such as ulcer, tetter, scaldhead and sores of all kinds.

CULTIVATOR PLOW.—Cealy Billups, of Norfolk, Va.—The invention consists in providing a cultivator plow with wings, ratcheted on their shanks, and made fast, or adjusted by corresponding ratchets, on sides of shoe, and by having their front ends entered into the sockets of the shoe.

WASHING MACHINE.—John W. Hunt, of Liberty, Mo.—The box of the machine, the bottom of which is made inclined, contains a rack, the side bars of which are set in inclined grooves in the sides of the box toward its forward or deeper end. The rounds or rods of the rack are arranged at a little distance apart, so that the water forced forward by the plunger or beater and the water squeezed out of the clothes may pass through freely into a space between the rack and the forward end of the box. This space is covered by a platform or apron, which is slightly inclined to the rearward, and is attached to the sides and end of the box a little below their upper edges. The apron keeps the water from dashing out of the end of the tub. The plunger is inclined to correspond with the inclination of the rack, so that the clothes may be pressed squarely between the plunger and the rack. To the rear side of the plunger is rigidly attached the end of an arm, to the rear end of which is pivoted the lower end of a lever which is attached to the center of a cross bar, the ends of which are pivoted to the sides of the box. The lever is curved so that the power may be conveniently applied to it.

MACHINE FOR MAKING COP TUBES.—Robert Douglas, of Lowell, Mass., assignor to himself and James Douglass, of same place.—The liability of the paper tube formed in the usual way to collapse as it is passed from the mandrel, in consequence of a partial vacuum formed therein for want of air to resist the external atmospheric pressure, is remedied in this invention by providing a hollow mandrel, having an opening therein for the admission of air to the tube as it passes from the mandrel. From this mandrel the tube is received between a gripping pawl and a fixed gripping jaw on a bar, carried by an endless belt, to be drawn from the mandrel, cut into suitable lengths for drying, and carried to the apparatus for conveying to the dryer. There are preferably three of these grippers on the belt; also as many cutting shears just in advance of each gripper, between the jaws or blades of which the tubes are drawn by the grippers in advance of them, and these shears are automatically closed upon the tube and cut it off immediately after the grippers behind have taken hold of the said tube. At the same time that the tube is cut, the grippers in advance of the shears are opened and the piece of tube cut off falls upon a chute, by which it is conducted to endless carriers to be conducted into the heating chamber.

CIDER MILL.—William Aiken and William W. Drummond, of Louisville, Ky.—The bottom of the hopper is formed of two inclines, the lower one of which inclines more steeply, and between the inner edges of which is formed the space through which the apples pass down to the grinding cylinder, the journals of which revolve in bearings attached to the frame, and to which are attached teeth to break up the apples against the crusher plate. The crusher plate is pivoted at its upper edge to the sides of the hopper, in front of the opening between the inclined parts of the bottom of said hopper, so that it may be swung forward to crush the apples against the toothed cylinder to enable them to pass down between the said toothed cylinder and the toothed concave attached to the frame, where the crushing, grinding, or mashing process is completed. To the main shaft is attached an eccentric wheel which bears against a projection formed upon the rear side of the lower part of the crusher plate, so that at each revolution of the eccentric wheel the lower part of the said plate may be forced forward to crush the apples against the toothed cylinder.

WAGON TIRE TIGHTENER.—John Kafader, of Jacksonville, Oregon.—This invention has for its object to furnish a device for tightening and securing tires upon the felloes of wheels, both when first applied and when they may have become loose from use. The adjacent ends of the felloes upon the opposite sides of the wheel are cut away, or made a little short, so as to leave narrow spaces between said ends. Within the space and resting against the ends of the felloes are placed two plates. The sides of the plates that rest against the ends of the felloes are made flat to bear squarely against said ends. The other or inner sides of the plates incline in both directions from the center. In holes in the plates, at their angles, are placed small rollers, said holes being so formed that the sides of the rollers may project sufficiently to receive the wear. Between the plates is placed a wedge shaped block, with its smaller end toward the hub of the wheel. Through the center of the wedge block is formed a screw hole to receive a screw which passes in from the inner side of the rim through the casing, against which a collar formed upon the said screw rests, so that by turning the screw forward the wedge block will be drawn between the plates, expanding the rim of the wheel, and thus tightening and securing the tire. The tubular casing is made of the same form and size as the felloes, and is let into the ends of said felloes, so that the outer surface of the case may be flush with the outer surface of the felloes. With this construction, should the tire become loose from use or other cause, a turn or two of the screws will expand the rim of the wheel and tighten the tire securely.

WAGON BRAKE.—Henry J. Hadden, Jr., of Catskill, N. Y.—This invention relates to that class of wagon brakes which are applied whenever the horses are held back. To the rear part of the under side of the wagon tongue is rigidly attached a downwardly projecting arm about twelve inches in length. To the lower end of the arm are pivoted the forward ends of two rods, which incline from each other and pass back beneath the forward axle with their rear ends attached to the brake bar. The brake bar is supported by and moves forward and back in keepers attached to the sway bar and bounds, and which is kept from longitudinal movement by guide pins attached to it, which strike against keepers. To the ends of the brake bar are pivoted or otherwise attached brake shoes, which bear against the rims of the forward wheels and thus check the advance of the wagon.

CATTLE POKE.—Orville Sweet and Clarence B. Sweet, of South Glen's Falls, N. Y.—This consists of a block of wood, which may vary in size and weight with the size and strength of the animal that is to wear it. To the forward side of the block, toward its ends, are attached two pins or prongs which project forward and incline slightly upward, and which are designed to keep the animal wearing the poke from using its horns. To the middle and upper part of the block is attached a longer pin, which projects upward and forward, and which is designed to prevent the animal wearing the poke from getting its head through or under the fence and throwing it down. Sharp pointed spikes or pins are attached to the middle part of the block, with their points projecting at the rear side of said blocks in such positions as to come in contact with the head of the animal wearing the poke, should the poke be jolted or should any pressure be applied to it. To the rear side of the block is attached a spring which rests against the animal's head, and which should have sufficient strength to hold the spikes away from the animal's head when grazing or walking, but which will yield and allow them to prick the animal should it attempt to run, jump, or push. The ends of a wire are passed through the block and coiled to form rings to receive the animal's horns; and they are then hooked to each other. The fastening thus constructed cannot injure the animal, and cannot shrink when it becomes wet, while at the same time it holds the poke securely in place.

TREE AND PLANT PROTECTOR.—William F. Eaton, of Cape Elizabeth, Me.—This consists of a standard or stake, the lower end of which is sharpened so that it may be readily thrust into the soil. The length and size of the standard is proportioned in size and length to the size of the plant to be supported. The upper end has two longitudinal slots formed in it, dividing it into three prongs. The ends of the side prongs are cut off, leaving the central prong the longest. There is a metallic strap, the middle part of which is bent into circular form. The arms of the strap are parallel with each other to pass through the slots of the standard, and their ends are bent outward at right angles to rest against the rear side of the standard. In using the support, the strap is passed around the plant, shrub, or tree. The parallel arms of the strap are then slipped down into the slots of the standard, the upwardly projecting central prong guiding them readily into place. The edges of the middle or ring part of the strap are turned or flared outward so that they cannot chafe or rub the plant or tree.

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How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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To Make an Application for a Patent.

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

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BLINDER FOR HORSES.—Rudolph Lehmicks, of Stillwater, Minn.—This invention has for its object to furnish an improved horse blinder or blinker, which shall be so constructed that it may be readily and conveniently drawn forward and down over the horse's eyes when necessary to bring him under control; and consists of a plate sliding against coiled springs contained in the frame in which it runs, and pulled forward, when required, by blinder reins attached to eyes on its forward end.

PITMAN CONNECTION FOR HARVESTERS.—Willard Loucks, of Lowville, N. Y.—The lower part of the pitman is split and bifurcated, and carries at the ends inwardly projecting pins of conical form and with rounded points. A sleeve embraces the pitman, and is provided with a set screw, whereby it can be fastened at a suitable distance from the lower end. The upper bar has an eye formed at its end, and a box, of cylindrical form fitted therein, said box having conical recesses at the ends for the reception of the aforesaid pins. The split ends of the pitman are spread apart in order to admit the pins into the box, and are then held contracted by means of the sleeve. If, by wear, the recesses in the box should become enlarged, it is only necessary to move the sleeve further down, and thereby further contract the pins. When the box is entirely worn, it is readily replaced by another.

COTTON PRESS.—Gus. Falkner, of Warrenton, N. C.—This invention consists of a combination of notches, bars, and operating levers, and holding pawls therefor, with the follower of a press working from the bottom upward, all so arranged that the pressing of the bale may be readily effected by hand power applied to said levers. It also consists of a novel arrangement of the top cover and apparatus for lowering the follower.

WASH BOILER.—Nicholas L. Rigby, of Chetopah, Kansas.—This invention has for its object to furnish an improved wash boiler in which the washing shall be done by water forced from the lower part of the boiler upon the upper parts of the clothes by water and steam pressure; and it consists in adding, to the ordinary one, another boiler with an inclined slotted bottom, fitting loosely within it. This slot is covered by a bridge which supports a rack on which the clothes are placed. The steam pressure forces the water between the boiler bottoms up through channels formed at the ends of the inner boiler, and discharges it on the clothes, after passing through which, it returns through the slot.

CORN GRATER.—George C. Rickards, Jr., of Philadelphia, Pa. assignor to himself and William Allen, of same place.—The object of this invention is to furnish convenient means for reducing green corn to pulp or nearly to a pulp, and it consists in the construction and arrangement of the following parts: The stock is made of wood, in two parts, which are two inches, more or less, in width, and one inch, more or less, in thickness. These pieces are connected together end to end, by two serrated plates, one of which is coarser than the other, so that the corn may be grated coarse or fine, as may be desired. These plates are of about the thickness of saw plate steel, cut out on the upper edge to form semicircles, with the semicircles serrated, the circles being three inches, more or less, in diameter.

HOOF SHEARS.—Micalah C. Malone, of Palmyra, Ill.—The two handles of the shears are connected by a pivot pin. The one handle carries the cutter of the shears, while the other has a hook, over the face of which the blade moves to cut. From the blade projects outwardly a pointed lug, for marking on the outside of the hoof the line to which the same is to be cut. The hook carries an outwardly projecting arm, for clearing the seam and frog of the hoof. There is also an inwardly projecting lug, on the hook. It serves to steady the blade in cutting, and to hold the hook against the portion of the hoof to be cut.

ANDERSONS.—John T. Dee and Isaac Murray, of Fredericktown, Miss.—The forward ends of the horizontal bars of these andirons are bent downward to form the forward feet. The rear ends of the horizontal bars are attached to the vertical bars, the lower ends of which serve as feet for the andirons. The upper ends of the vertical bars are connected by a horizontal bar, or rather formed in one piece with said bar. This construction enables the andirons to be made with only four feet instead of six, as they must be when made separate.

ICE MACHINE.—William H. Johnston, of Sedalia, Mo., and William Whitelaw, of Memphis, assignors to themselves and John Johnson, of Memphis, Tenn.—This machine (which would need the aid of drawings to describe in detail) is intended to effect the proper utilization of sulphide of carbon and kindred substances in ice making, by eliminating the vapor of the agent employed from the air by passing it through oil. Also, to regulate the evaporation of the bisulphide by a concentrated solution of chloride of sodium floating on it; and to eliminate the aqueous vapor in the current by passing it over chloride of calcium before it enters the freezing chamber.

LOCK NUT.—James A. Morrison, of Parker's Landing, Pa., assignor to himself and George H. Morrison, of same place.—The object of this invention is to provide simple and efficient means for preventing the nuts of screw bolts from working off when in use. It consists in the employment of a grooved bolt with a ribbed collar, which can be slid to any part of the bolt without being at liberty to turn; this collar has suitable springs attached, which fall into recesses in the nut to be locked, and hold it securely to the collar, so that it, also, cannot turn.

SOLDERING TOOL.—John A. Tillery, and Samuel A. Ewalt, Baltimore, Md.—The invention relates to that class of soldering tools which are usually rotated about the cap by twirling or carrying them around with the hand, and consists in combining therewith a simple mechanism for operating them more rapidly and conveniently. The invention, however, mainly and more particularly consists in an arc shaped soldering tool, adapted to all the various sized cans and caps used.

PATTERN FOR CUTTING GARMENTS.—Mrs. Sarah A. Millwee, Greenwood, S. C.—The invention consists in a pattern chart for front and back of human form, with scales of figures and perforations, arranged for fitting plain and full waists, loose sacques, and basques of all sizes. It would seem to be an invention greatly calculated to economize the cost, to ladies, of their various garments, since, with one of these charts, they may both cut and readily fit as well as make them.

DOOR CHECK.—Simon Peters and Cyrus D. Eisaman, of Penn Station, Pa.—This consists of an oblong plate made of metal, wood, or any other suitable material, with holes through it, of slotted or other form, and recesses or rabbets on its under side, around or partly around the holes; a spring, of molded India rubber, with a flange or flanges on its under side, which are designed to fill the recess or recesses in the plate, while the body of the spring is designed to fill the hole and project above the plate, and a stop for the door, of rubber, made to fill one of the holes in the plate, and to project above it, with a flange to fill the recess around the hole. The plate, with the spring and the stop inserted from the under side, is screwed down to the floor near the wall in such a situation that, when the door is opened and swung back, the door will pass over the spring and be kept from striking the wall by the stop. By this arrangement it will be seen that the door will be securely kept in the desired open position and that all noise will be avoided.

CANAL BOAT.—Hartley J. Hatch, of Chicago, Ill.—This invention relates to a new canal boat, which is made in two sections in such manner that its pointed bow can be detached and brought alongside of the pointed stern whenever a lock is to be entered, and which is provided with a hinged and swiveled paddle box. When the boat is to enter the lock, the bow section is detached and fastened alongside the pointed stern. The boat is thereby made shorter, and with broad ends, to fill the lock like ordinary canal boats. By this arrangement of detachable triangular section, the boat is enabled to proceed rapidly through the water without creating unnecessary disturbance of the same, and still to fit the locks like an ordinary boat, all without reducing its carrying capacity beyond the weight and space of the additional sides required by the detachment of the section. The paddle box or frame is hinged to an arm, which is swiveled to the pointed stern of the boat, and which carries a toothed disk gearing into a pinion on the steering shaft. By means of the shaft, the arm and the paddle box can be turned to either side. The shaft of the paddle wheel has its bearings in the frame, and is provided with cranks that are connected with the operating engine by suitable rods or devices, said engine being situated on a platform or projection of the frame, and connected by jointed pipes with the boiler, which is placed in the stern portion of the main boat.

FLY TRAP.—Perry A. Burgess, of Butler, Mo.—This invention relates to a new and useful improvement in devices for catching flies; and consists in a flanged disk of wood or other suitable material, with a central hole and an interior recess on the under side filled with some absorbent material, as soft leather, felt, or sponge. The disk is placed on a tumbler or similar vessel, the vessel being nearly filled with soap suds or other liquid. The absorbent is filled or smeared with molasses or other substance for attracting the flies. The flies enter through the central hole, seek the bait, and drop into the liquid beneath.

CORN PLANTER.—Wm. H. Crosby, Parish, N. Y.—The invention consists in pivoting the two frames of a double planter, independently, to the axle and to a front beam, while they rest upon two castor wheels. They are then enabled to rise separately over obstacles and the planter to drop the seeds uniformly and at the proper intervals.

SAFETY VALVE.—Herbert S. Jewell and Ferdinand Steele, Brooklyn, N. Y.—This invention relates to improvements of the safety valve and alarm, for which letters patent were allowed to the same inventors on or about Jan. 6, 1872. It consists, first, in an adjustable plate, provided with a notched ring for graduating the steam inlet apertures; secondly, in a swinging weight applied to the sliding bolt of the valve; thirdly, in a weight sliding and adjustable on the stem of the valve by a set screw, and fourthly, in connecting a weighted lever, on which the valve rests, with a dial mechanism by an intermediate arbor.

GOLD FOR DENTAL PURPOSES.—Richard S. Williams, New York city.—The present invention relates to a new preparation of gold foil for dental purposes, by means of which the gold may be used for purposes for which it is not otherwise well adapted; and it consists in rolling the foil into cylinders, the length and diameter of which is governed by the size and number of sheets of the foil used, and then cutting the cylinders into pieces of proper size for use.

HARROW.—William J. Cordill, Blue Earth City, Minn.—The body or frame of the harrow is made in four parts, each of which is formed by rigidly connecting four, more or less, longitudinal bars by means of cross bars framed to them. The frames are arranged in pairs, the longitudinal bars of the frame of each pair being placed end to end and connected and hinged to each other by short bars, the ends of which are pivoted to the opposite sides of the adjacent ends of two or more of said longitudinal bars. Stop plates or bars are rigidly attached to the upper side of the inner ends of two or more of the longitudinal bars of one frame of each pair of frames, so as to overlap the upper side of the inner ends of the longitudinal bars of the other frame, so as to prevent the adjacent ends of the frames of each pair from sinking down below a certain fixed limit, while allowing their outer ends to drop down to conform to the surface of the ground.

REVERSIBLE FILTER.—John D. Parrot, Morristown, N. J., assignor to himself and Henry McCauley, of same place.—The object of this invention is to perfect a water filter for which letters patent, dated July 30, 1869, were granted the inventor, and to render it more useful than it has hitherto been; and for this purpose is attached to it a reversing apparatus, consisting of pipes and cocks, by means of which the flow of water may be reversed, and the filtering material and the chambers of the filter may be cleaned at any time.

COMBINED COOKING STOVE AND WATER HEATER.—Chester Comstock, New Canaan, Conn.—The invention consists, first, in providing the inner sides of the fire box of a stove with auxiliary and adjustable sides, to lessen the fire room and the radiation of heat therefrom on the sides; second, in suspending over the oven, between cover and fire box, and out of range with the holes therein, a water vessel, which is connected with cold water vessel on top, and has certain hollow arms and pipes to give a greater heating surface; and, thirdly, in combining these two devices with a water chamber around the fire box.

FLEXIBLE SIDES FOR BELLOWES.—Alfred F. Jones, New York city.—This invention relates to a new construction of the flexible sides of bellows, air pumps, and similar apparatus which are to be contracted and expanded; and consists in the combination of a woven or porous fabric, for strength, with an outer rubber fabric which is impervious to air. The two fabrics are not intimately connected, except, perhaps, at the edges, and the impervious material will, therefore, not be strained, the other fabric taking all strain. Heretofore, such flexible sides were made of single fabrics, which, under strain, would open their pores and let air in, thereby defeating the object of the entire instrument. By the use of the double fabric absolute air tight sides can be obtained.

MACHINE FOR CUTTING CLOTH.—Andrew Heller, New York city.—This invention relates to a new machine for cutting the cloth used in the manufacture of clothing and other fabrics into certain definite shapes, and consists, principally, in the employment of a vertically reciprocating continuous cutting blade; in the combination therewith of marking troughs and apertures in the plate to which said blade is attached; and in the arrangement of a clamp for feeding the fabric to be cut to its place under the cutter.

PREPARING MOSS FOR ORNAMENTAL BASKETS.—Jonathan W. Shiveley, 637 Broadway, New York.—The inventor proposes to improve natural moss for various ornamental purposes, by coloring it with bronze or other metal or mineral dust, sprinkled on a coating of mucilage or other gummy matter previously applied, or by dipping in a bath of gummy matter and powder, and then drying it, and either stripping or dressing it to impart a glossy appearance or not. He sometimes steeps or boils the moss in hot water, and then dips it in linseed oil preparatory to coloring it, as above described, to keep it soft and pliable.

PADDLE WHEEL.—George H. Cushman, North Bridgewater, Mass.—This invention has special reference to side wheel steamers employed on canals. The principal object of the invention is to prevent the washing and wearing away of the banks of a canal by the action of the swell or waves created by the passing of the boat through the water. Another object is to so construct the floats of the wheel as to enable them to enter the water easily, and thereby produce little or no vibration of the boat. With the outer side of the wheel closed and with its inner side open, much of the water displaced and forced outward by the prow will be arrested and deflected and discharged toward the stern.

EXTENSION TABLE.—James Plenkhar, Columbus, Ohio.—This invention is a marked improvement in extension or dining tables, the same being formed mainly of two parts, connected by slides and furnished with legs in the usual way, and of a third part consisting of a circular plate or disk, designed to form the top of the table when not extended and the middle thereof when extended. The table is compact, strong, simple in construction, and attractive in appearance.

WATER WHEEL.—Samuel P. and Oliver H. Castle, Urbana, Ohio.—The invention consists, first, in constructing water wheels with a cylindrical hub to receive the radial buckets, and a conical frustrum to receive the aprons, so that while the outer edges of buckets and aprons are equally distant from the center of motion, the outlet is increased and the dead water discharged with greater facility. It consists, secondly, in constructing the chutes with a gradual inclination, at the top, toward the axis, whereby a greater uniformity in the percussion of different strata of water is obtained. And it consists, thirdly, in making a circular gate that turns on a pivot and admits of openings of different sizes in front of the chutes, while it takes up no space wanted for other purposes.

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(Compiled from the Commissioners of Patents' Journal.)

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EXTRACTING PHOSPHATES.—G. T. Lewis, Philadelphia, Pa., S. A. Pratt, Charleston, S. C.

HORSE STOCKING.—W. Lewis, D. T. Way, Astoria, N. Y.

LOCK NUT, ETC.—G. Mallory, Mystic Bridge, Conn.

MANUFACTURE OF STEEL.—G. F. Wilson, Providence, R. I.

PILM CARPETS, ETC.—G. Crompton, Worcester, Mass.

PRINTING PRESS, ETC.—M. Gally, Rochester, N. Y.

WRAPPING MACHINE.—W. A. Wood, Hoosick Falls, N. Y.

ROOFING, ETC.—D. G. Conger, Chicago, Ill.

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5,859.—COOKING STOVE.—N. S. Vedder, Troy, and S. Heister, Lansingburgh, N. Y.	126,758

TRADE MARKS REGISTERED.

811.—HAMES.—Baker, Carr & Co., Andover, N. H.	126,799
812.—TEAS.—Castle Brothers, San Francisco, Cal.	126,632
813.—BARKING POWDER.—G. F. Gasle, New York city.	126,627
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SCHEDULE OF PATENT FEE:

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APPLICATIONS FOR EXTENSIONS.

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

21,213.—MACHINE FOR FORGING NAILS.—S. S. Putnam. July 31, 1872.	
21,275.—ICE STAND.—H. A. Roberts. August 7, 1872.	
21,311.—SECURING PLANE IRON.—L. Bailey. August 14, 1872.	

EXTENSIONS GRANTED.

30,243.—FINGER OR GUARD FOR HARVESTERS.—L. Miller.	
30,192.—EXPANSIVE BIT.—W. A. Clark.	
30,245.—SEWING MACHINE GUIDE.—L. W. Serrell.	

EXTENSIONS REFUSED.

Extension of Robert Wilson, of Milton, Pa., for fly nets. Patented May 11, 1853; refused May 10, 1872.	
Extension of G. W. Morse, of Greenville, S. C., for cartridge cases. Patented May 11, 1858; refused May 11, 1872.	
Extension of Jeroboam B. Creighton, of Akron, Ohio, for railroad cars for day and night service. Patented May 15, 1858; refused May 9, 1872.	

Value of Extended Patents.

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

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FOREIGN PATENTS—A HINT TO PATENTEEES.

It is generally much better to apply for foreign patents simultaneously with the application in the United States. If this cannot be conveniently done, as little time as possible should be lost after the patent is issued, as the laws in some foreign countries allow patents to any who first make the application, and in this way many inventors are deprived of valid patents for their own inventions. It should also be borne in mind that a patent is issued in England to the first introducer, without regard to the rights of the real inventor; therefore, it is important that all applications should be entrusted to responsible agents in this country, who can assure parties that their valuable inventions will not be misappropriated. The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Mechanical Improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address

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NEW BOOKS AND PUBLICATIONS.

SPECTRUM ANALYSIS EXPLAINED, illustrating its Uses to Science, and including the Theory of Sound, Heat, Light, and Color. Being No. 3 of "Half Hour Recreations in Popular Science." Price 25 cents. New York: Lee, Shepard, and Dillingham, and John Wiley and Son.

PRINCIPLES OF POLITICAL ECONOMY; with Some of their Applications to Social Philosophy. By John Stuart Mill. New York: Lee, Shepard, and Dillingham; Boston: Lee and Shepard.

A full and exhaustive criticism of this book will not be expected in this place. The renown of its author as a logician, the lucidity of his style, and the clearness of his reasoning are well known. Of his doctrines, it must be said, and their author would doubtless allow, that there are exceptional circumstances in various forms of human society that might render their application inadvisable. But the book is worthy of study by everybody who is interested in the welfare of the community in which he lives. Succinct, clear, and terse, without a superfluous paragraph in it, the book is full of mental "meat;" and any student, either of political economy, logic, or the language, will do well to master its contents.

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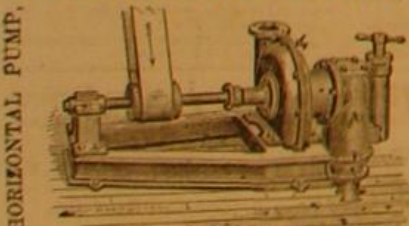
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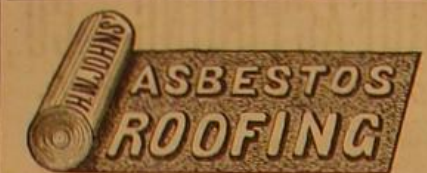
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Railroad Rail Straightener.

Our engraving illustrates what appears to be a useful invention for straightening railroad rails without taking them up or drawing the spikes. A is a truss bearing bound round with a metal band, through which passes a truss rod, the course of which is partly shown and partly indicated by dotted lines. The curved center of this truss rod bears against the rear end of the bearing, B, which is firmly secured to the truss bearing, A. C is a bearing made with a bulge to fit the rail. D D are clamps, which are placed the required distance apart, and wedged so as to hold the truss bearing to the rail. E is a lever with a cam shaped end. The whole operation will readily be understood from Fig. 2, which represents, in section, the relative positions of the working parts and the rail, just before the lever is depressed to straighten it. The inventor states that four or five men will take a crook out of a rail, with this machine, in one minute; to take it up, straighten, and replace it, would occupy them twenty-five or thirty minutes. Its efficiency was proved by straightening a portion of a rail on which rested the driving wheel of a thirty ton engine. Patented through the Scientific American Patent Agency, March 26, 1872. Further information may be obtained of the patentee, G. I. Kinzel, Knoxville, Tenn.

Fig. 2.



KINZEL'S RAILROAD RAIL STRAIGHTENER.

The Effect of Cold on Iron.

The effect of cold on iron, concerning which much diversity of opinion exists, is illustrated pretty forcibly by the experience of the Grand Trunk Railway of Canada, which is exposed to severe cold and a great deal of it. At the recent half yearly meeting of the company, in London, the President said that 3,500 to 4,000 rails on the line break every winter! But he found comfort in the fact that, in about 110 miles of steel track, only eight or ten rails have broken. It was feared when Bessemer rails were first introduced that their resistance to wear would be counterbalanced by unusual liability to break, and that they would be especially dangerous in severe climates, the impression being apparently that, having something of the hardness of cast iron, they had also something of its brittleness. This experience of the Grand Trunk, however, indicates that they are especially fitted for such climates.

BAILLAIRGE'S STEREOMETRICAL TABLEAU.

Our engraving is a perspective view of the above named educational device, which has been patented for its inventor, Mr. C. Baillairgé, of Quebec, in the United States, Canada

and Europe. It consists of a board, about six feet long and four feet wide, with some two hundred wooden models, comprising, so to say, all the elementary forms, their segments, and sections, and numerous other solids, simple and compound.

The tableau is set in an appropriate frame, with glass covering, so as to exhibit the models while excluding the dust. The front can be opened at pleasure so as to afford access to the models, each of which is merely supported on the board by a round nail or wire, which admits of its easy removal and replacement by teacher or pupil. The instruction conveyed by this tableau, appealing, as it does, to the uneducated eye

and mind, is, the inventor thinks, destined to be of great use in developing the intelligence of the untaught masses of mankind. He expects to introduce it into all the educational

institutions of the United States and elsewhere, as it is now being disseminated in Canada; and he has no doubt that the tableau will also find its place in the studio of the engineer and architect, to whom the models will be suggestive of various forms and relative proportions which cannot fail to aid them in their pursuits. The rapid success attained by a school in Quebec, in mensuration of all kinds of surfaces and yet higher mathematics, including conic sections, was attributed to the use of this tableau. Every tableau is inscribed with a rule for finding the solid contents of any body, called "the prismoidal formula." This formula has been shown, by Mr. Baillairgé in his treatise on geometry and mensuration published in 1856, to be less restrictive than supposed, and he has added to the known solids, measurable thereby, a long list of others discovered by him, the whole of which are given in the tableau. Each tableau is also accompanied by a printed treatise, explanatory of every use to which the models can be put. Mr. Baillairgé is in possession of a mass of testimonials, from high officials and other distinguished

Dr. Wilkie, of Quebec, thinks "the government would confer a boon on schools of the middle and higher classes by affording access to so suggestive a collection;" and Professor Newton, of Yale College, considers the tableau "of great use for showing the variety and extent of applications of the prismoidal formula."

Aniline Colors.

Professor C. F. Chandler recently delivered an interesting lecture on the above, before the Polytechnic Association of the American Institute, from which we take the following:

It is well understood that coal is an element of our national wealth, and that we derive from it our power. The combustion of 300 lbs. of coal under a steam boiler will produce a power equal to the mechanical force exerted by a man for a year. Another important application of bituminous coal is to the manufacture of illuminating gas. In this manufacture there are certain residual products, which were at first thrown away; and it is of these that I propose to speak to-night.

Coal tar is produced at the rate of about ten gallons to the ton of coal. Thousands of barrels of coal tar were at first thrown away; but the chemist turned his attention to this substance, and discovered so many products useful in the arts, which could be made from it, that coal tar now finds a ready market at \$1.50 per barrel. When coal tar is subjected to distillation, the liquid portion passes off, and there remains the heavy black pitch which is used for roofing and for pavements. The liquid portion, which comprises about one fourth of the original coal tar, produces first a light fluid called naphtha, and then a heavy liquid which is called dead oil. The light liquid is a mixture of carbon and hydrogen, of which benzole is the type. It is $C_{12}H_6$, that is, taking into account the difference of weight, 72 parts of carbon to 6 parts of hydrogen. Other substances are produced from this, differing by two atoms

of each, making $C_{14}H_8$, $C_{16}H_{10}$, $C_{18}H_{12}$, $C_{20}H_{14}$, etc.; but, until recently only the first two have had any practical importance in the arts. They were used simply as fuel, and as antiseptics, for preserving timber from decay. But lately one of them is claimed to be a specific for the small pox.

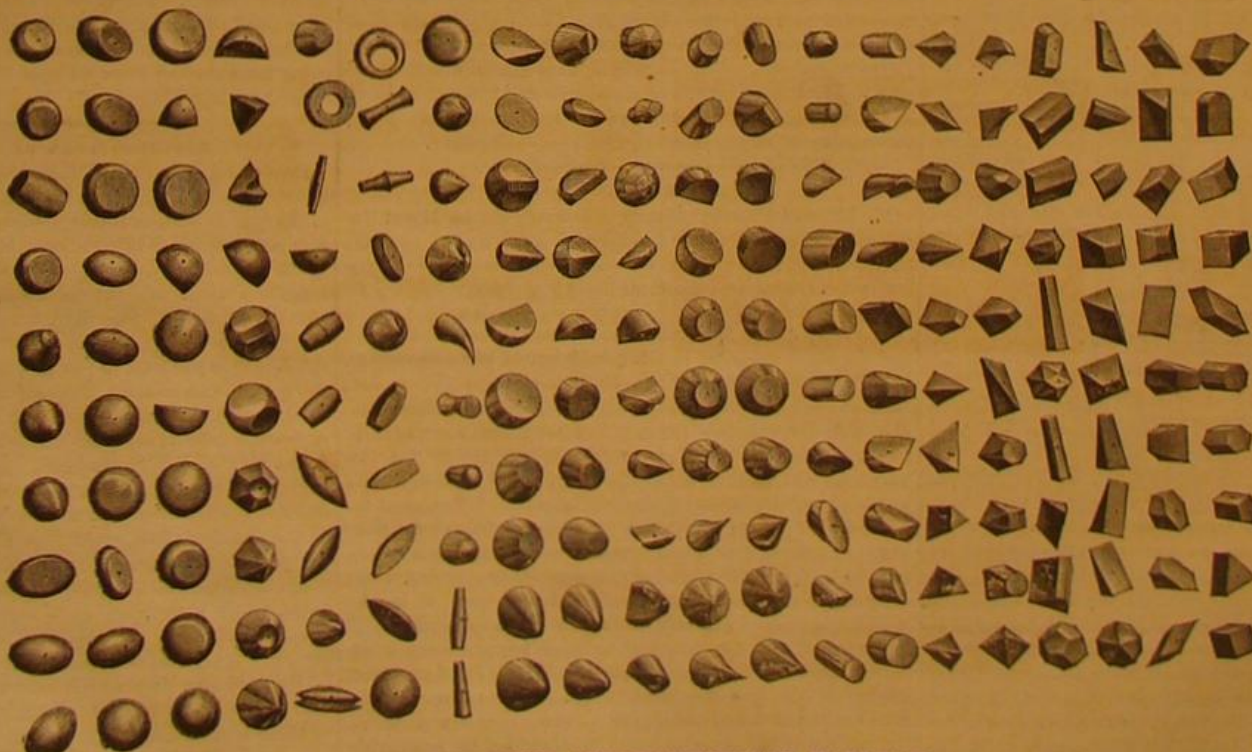
After the volatile portions have been removed, there remains this dead oil, which is heavier than water. This was for a long time used as a fuel in glass houses. It was then found that the carbolic acid it contains was a most powerful disinfectant and antiseptic. It was found that it would prevent the spread of the

cattle disease, that cattle having the disease in its worst form might be placed with others with safety, if they were protected by this acid. It was found, too, that the durability of timber was increased four or five fold by its application.

But I wish to-night to invite your special attention to the beautiful colors which have recently been obtained from refuse coal tar. They are naturally subdivided into three groups, the aniline colors, those derived from naphthaline, and the carbolic acid colors. I shall confine my attention wholly to the chemical phase of the subject.

Benzole is a hydrocarbon. Bringing that in contact with nitric acid, an atom of nitrogen carries off an atom of hydrogen; and we have

nitro-benzole, which is a very fragrant oil, an artificial oil of bitter almonds, used instead of that substance in the manufacture of soaps. When the nitro-benzole is made to give up



BAILLAIRGE'S STEREOMETRICAL TABLEAU.

men, both in Canada and Europe, together with reports of various educational and other institutions, all highly complimentary to him and his invention.

its oxygen and take up hydrogen, it becomes aniline. Nitrogen is a protean element which gives rise to a great variety of compounds. Ammonia is NH_3 ; and these three atoms of hydrogen can be replaced by a great variety of substances. Aniline is a similar substance. It is ammonia, replacing one atom of hydrogen by phenyl, which is C_6H_5 . There is no limit to the number of compounds that may be developed on this type; and it opens one of the most important fields of chemical investigation at the present day. All the aniline colors are derived from NH_3 , converted by the process of substitution into new compounds. The first investigation in this direction, which, however, did not result in any practical product, was that of a German chemist, who found that by treating aniline with chloride of lime, he produced a violet or purple tint. Perkins, who was the first successful manufacturer of color from coal tar, manufactured a substance to which he gave the name of mauve. Then came the discovery of the rose aniline, which is produced from commercial aniline, pure aniline not answering the purpose. Subjecting commercial aniline to the action of nitric acid, and then to the action of nascent hydrogen, we obtain rose aniline, which is $C_{10}H_9N_3$. The chloride, hydrochlorate, arseniate, acetate, nitrate, and other salts of this substance produce the beautiful tints of which I have specimens here. Hoffmann found that he could change this beautiful red tint of the rose aniline to various shades of violet, by simply boiling it with more aniline. This introduced more phenyl in the place of hydrogen. One atom made it purple, another more bluish, and a third atom of phenyl made it the most beautiful blue that has ever been manufactured.

Replacing the hydrogen with ethyl, C_2H_5 , or with methyl, CH_3 , we obtain still farther colors. In every case the beautiful rose red becomes more and more purple, until the substitution of the last atom of hydrogen converts it into a deep and perfect blue. On carrying the investigation further, it was found that by proper treatment the blue color could be converted into a green, by using ethyl and methyl. Subsequent treatment developed an entirely different base, having the form $C_{10}H_{11}N_3$, with yellow tints; and further treatment produced a brown and finally a black; so that the most durable black for calico printing is now obtained from aniline.

From the coal tar obtained from a ton of coal, three fourths of a pound of this beautiful color are produced. The coal, which is worth about \$3, produces the gas, the coke, the ammonia water, largely used for agricultural purposes, the carbolic acid, used for the preservation of timber and as a disinfectant, and finally this beautiful color, which alone is worth nearly as much as the coal originally cost. The amount of this industry has become so enormous that at present five tons of this raw aniline oil are manufactured daily on the continent alone, and 90,000 lbs. of iodine are used in effecting the substitution; and yet it is an industry which has started since 1860.

A word with regard to the carbolic acid colors. The carbolic acid is obtained by treating the dead oil with an alkali. This furnishes a number of coloring matters. Carbolic acid is $C_6H_5O_2$, or it is the oxide of benzole, which is $C_{12}H_{10}$. Treating carbolic acid with nitric acid, we produce $C_{12}H_3(NO_3)_3O_2$. Picric acid is a substantive dye for silk and wool, uniting with them without any mordant. Treating picric acid with the cyanide of potassium, an acid is produced which gives beautiful garnet colors on silk and wool. By treating carbolic acid with soda and the oxide of mercury, it is converted into rosolic acid, which produces various shades of orange, and is used for coloring house paper. Treating this with ammonia, it produces a scarlet tint. The intimate connection, existing between the rosolic acid and the aniline colors, is shown by the fact that, by treating rose aniline in anhydrous acid, the same result is obtained. From this orange red of rosolic acid, can be produced a deep blue color by the action of aniline.

There is a series of naphthalene colors, but they are not found to be fast, and I will therefore pass them by.

When coal oil is distilled, and 25 or 30 per cent of volatile products are removed, the result is solid, and is called anthracene. Recently, from this, there has been artificially produced the coloring matter of madder. The colors from aniline had proved brilliant and durable for silk and wool, but not for cotton fabrics. It is now a question whether the colors from anthracene will supply this want, and whether they will be found to be permanent.

QUICK STEAM LAUNCHES.

By F. J. BRAMWELL, Esq., C. E.

For some little time past, the interest of naval architects and engineers has been excited by the reports which have from time to time been given in the newspapers of the performances of steam launches built by Mr. Thornycroft, of Chiswick. From these reports, it has appeared that steam launches of about 50 ft. in length have attained speeds varying from seventeen to nineteen statute miles per hour, or 14.47 to 16.27 knots per hour speeds which even in this day would be considered very good for the finest sea going steamers, and speeds which have hitherto been regarded as impossible unless the vessel were at least 200 feet in length. The writer, having been much struck with these statements and with those made to him by engineers who had witnessed the performances of the launches, thought it might be interesting for the Institution to have a short paper upon the subject. He, therefore put himself in communication with Mr. Thornycroft, who kindly allowed him to make what experiments he thought fit. These experiments, which have taken place within the last few days, have been made

on the *Miranda*. The length of the *Miranda* over all is 50 feet; ditto, on water line, 45 feet 6 inches; the beam 6 feet 6 inches; ditto, on water line, 5 feet 9½ inches; the draft of water in running trim with six persons on board, and with 3 cwt. of coals, is 2 feet 6 inches, taking the extreme depth of the screw. She is built of steel, the general thickness of the plates being 1.8 inch to 1.16 inch. She has a pair of inverted direct acting engines having cylinders of 6 inches diameter by 8 inch stroke. These engines make up to as many as 600 revolutions or 800 feet of the piston per minute; their ordinary working speed, however is less than this. They drive a two bladed screw of 2 feet 6½ inches diameter and 3 feet 4 inches pitch. This screw is abaft the rudder, which is made in an upper and lower part joined by a bow, so as to pass the shaft which is placed out of the horizontal line to the extent of 1 in 28, the after end of course being the lower. The boiler is of steel, of the locomotive type, and has a total heating surface of 116 feet, and a total fire grate surface of 41½ feet; the barrel plates are 5.16 inch thick, the fire box external plates also 5.16 inch; and the internal, which are copper plates, are ½ inch thick; the stays of the fire box are ½ inch, and 4 inches apart. The fuel is coal. The boiler is fed by a three millimeter Giffard injector. The whole weight of the engines and boiler with water in it up to the working level, and of the propeller, is about 40 cwt. to 41 cwt., or 4,448 lbs. to 4,560 lbs.

A point which the writer thought it would be interesting to note was the gross indicated horse power at each of the speeds. So far as the writer has ever heard, no one has attempted to indicate engines at anything like 500 revolutions per minute. At 300 revolutions the horse power was 11.05, at 600 revolutions, 71.61, 490 revolutions, 23.45, and 500, 42.31. The next thing to be ascertained was what was the speed of the boat at these varying revolutions. For this purpose, it was determined to take the ordnance measurement from Barnes railway bridge to Putney old bridge; this appears by measurement to be three and a half statute miles and eighty-eight yards. A counter was kept in gear; the total number of revolutions was 6,131, giving a mean of 530 a minute. It was clear a greater speed could have been maintained so far as the engine and boiler were concerned; but it was feared that the injector was hardly large enough to supply the required quantity of feed water, and therefore the link was notched back.

The total number of revolutions was 6,756, giving just under 580 revolutions as the mean per minute. At the very last of the run, the engines were making 600 revolutions per minute. Mr. Thornycroft having found that he had water enough in his boiler, and being thereby enabled to give the engines full steam without risk. The mean speed was 18.36 miles per hour. Runs were then made upon the measured mile at varying revolutions; 555 revolutions give 18.65 speed; 500 give 16.15 speed; 400, 11.82 speed; 300, 11.05 speed; 200, 4.02 speed; 100 revolutions could not be taken, as it would not have given a rate sufficient to have stemmed the tide.

The slip of the screw was for 500 revolutions 14.7 per cent; for 400 hundred revolutions, 21.9 per cent; for 300 revolutions, 12.9 per cent; and 200, 7.1 per cent. The highest point of observation on which any measurement was taken was 555 revolutions, at which point the slip of the screw was 11.3. The displacement of the boat at the draft at which she was tried was 3.73 tons. If the speeds at the varying revolutions be reduced from statute miles into knots, and then the formula $V^3 \times D^2 \div 1$ H. P., be employed to ascertain the coefficient of steamship performance, the following results will be obtained: At 500 revolutions, the coefficient will be 150; at 400 revolutions, the coefficient will be 106; at 300 revolutions, the coefficient will be 131, etc.

In conclusion, the writer has to thank Mr. Thornycroft, and he thinks the Institution will also thank him, for the readiness with which he has allowed these experiments to be carried out; and more than that, for having made that which the writer believes to be a real step in the science of steam propulsion. And he trusts that these unusual and wholly unexpected results of speed will call the attention of naval architects and engineers to the subject of improving the velocity of large sea going steamers.—*Engineer*.

The Star Depths.

Mr. Richard Proctor recently delivered, at the Royal Institution, a lecture on star depths. He dwelt on the contrast between the ideas which we form from the aspect of the starry heavens, on a calm clear night

When all the stars shine
And the heavens break open to their highest,

and the scene disclosed to the mind's eye of the astronomer. Each star, amid the solemn depths, is in reality a sun, instinct with fiery energy and urging its way with inconceivable velocity through space. Nor are these suns exempt from mutation. Several among them are losing year by year a portion of their light and heat, equal to the requirements of our earth, or of the whole solar system even for hundreds of years; others are growing brighter; new stars have appeared, and stars known to the ancients have vanished. Thus the question arises whether our sun, a star like the rest, may not also be subject to changes. If so, the question is one of extreme interest to ourselves, not as directly affecting our wants, but as involving the very existence of more or less remote generations. To obtain a direct answer to the question would require observations of the sun continued with unflagging patience for many years. But indirectly the question may be answered by comparing the present aspect of the heavens with the scene presented to those who first studied the stars. The lecturer then proceeded to inquire whether any traces remain of those features of resemblance which first led the ancients to call certain

star groups by certain names. He showed that, though the constellations of the Great Bear and the Lion as at present figured do not in the least remind us of the animals they are supposed to represent, yet the figures of these animals may be fairly traced if we include larger regions of the heavens than the present constellation boundaries permit. For instance, if *Canes Venatici* be included with *Ursa Major* and the three stars at present regarded as the tail (of a tailless animal) be regarded as forming an outline of a part of the back, then we have a figure not unlike a bear. Again, if we regard the group of stars forming the northern claw of *Cancer* as marking the place of the lion's head, the stars in *Leo Minor* as forming the mane, and *Coma Berenices* as the tufted tail of the animal, then the space thus indicated will be found to include a very fair representation of a lion. In like manner the stern of the ship *Argo* is very fairly indicated if the stars forming the hind legs of *Canis Major* are included in the configuration. Hence the lecturer arrived at two conclusions—1st, that the ancients were not solicitous to occupy the heavens with constellations fitted in like the countries in a geographical map; and 2ndly, that the stars exhibit at present the same general configuration which existed when the most ancient constellations were formed. From the second of these conclusions, we may infer that probabilities are on the whole in favor of a satisfactory degree of steadfastness in the sun's luster.

The remainder of the lecture was occupied by an explanation of the general principles on which the determination of stellar distances depends. This introduced the consideration of the enormous extension of the stellar universe when, with distances from star to star so enormous as have been proved to exist, the number of stars is so vast as to be practically infinite. Amongst the illustrations of this part of the lecture was an illuminated diagram showing 324,198 stars; but the lecturer mentioned that the Herschels' 18 in. telescope would show 530 times as many stars and the great Rosse telescope, more than 2,000 times as many.—*Mechanics Magazine*.

Liebig on Lager.

A correspondent has interviewed Baron Liebig, the celebrated German chemist, at his home in Munich, and gleaned his views upon the lager question. "Beer," said the Baron, "is better than brandy. Man must have a stimulant of some sort. Brandy is a great evil. We find that the consumption of beer is making great headway even in wine districts—for instance, in Stuttgart. As a nourishment, beer takes a very subordinate place, not higher indeed, than potatoes; and we find that in no city is there such an amount of meat consumed as in Munich, where the greatest quantity of beer is also consumed. Beer must have meat or albumen. Before every beer cellar in Munich, you will find a cheese stand. Why? Because in cheese you will find that albumen which in beer is lacking. Therefore you see that beer and cheese go together by a law of Nature! But as an article of nourishment, beer is very subordinate. Schnapps is a great misfortune, and destroys the working power. Through our late war, we have won great respect for tobacco, tea, coffee, and extract of meat. A physician told me that, when the wounded would take nothing else, they have grasped at cigars; their eyes glistening—they felt a lifting up of the sinking nerves. Tobacco must have this effect. We could not do our wounded, frequently, a greater service than by giving them cigars. And we came to the conclusion that tobacco was valuable to us." Baron Liebig evidently looks to America for an improvement in beer and the perfection of beer drinking. Said he: "It is a peculiarity of Americans that they make everything better than we do. I am convinced that American beer will, in time, be better than German. With us everything remains as it was. The worst beer brewers are in Bavaria—though it was earlier the best. And why? Look into our brewery system. The brewers are only ignorant people, who brew good beer from routine alone. They are incapable of helping themselves. But as soon as the Americans get any thing from us they improve upon it, and we get it back again as an American discovery."

Arabian Mode of Perfuming.

How the Arab ladies perfume themselves is thus described by Sir Samuel Baker in his work on the Nile: "In the floor of the hut or tent, as it may chance to be, a small hole is excavated sufficiently large to contain a champagne bottle. A fire of charcoal or simply glowing embers is made within the hole, into which the woman about to be scented throws a handful of drugs. She then takes off the clothes, or robe which forms her dress, and crouches over the fumes, while she arranges her robe to fall as a mantle from her neck to the ground like a tent. She now begins to perspire freely in the hot air bath, and the pores of the skin being open and moist, the volatile oil from the smoke of the burning perfumes is immediately absorbed. By the time the fire has expired, the scenting process is completed, and both her person and her robe are redolent with incense, with which they are so thoroughly impregnated that I have frequently smelt a party of women strongly at full a hundred yards distance, when the wind has been blowing from their direction. The scent, which is supposed to be very attractive to gentlemen, is composed of ginger, cloves, cinnamon, frankincense, and myrrh, a species of sea weed brought from the Red Sea, and lastly the horny disc which covers the aperture when the shell fish withdraws itself within its shell. The proportions of these ingredients in this mixture are according to taste."

The support of one of the large tuns of ale in Coolidge, Pratt & Co.'s brewery, containing from 400 to 500 barrels of boiling beer, recently gave way all of a sudden, letting the vat fall and spilling the beer. Loss, \$4,000.

BEETLES.

That class of insects which naturalists term *coleoptera*, and in common parlance are known by the name of beetles, seem to have been studied with more interest and care than most other entomological species spread over the globe.

The individual species of *scarabaei* may be divided into seven principal classes; of which the first, that of the *cetoniidae*, comprehends a series of beautiful insects, which feed on the juices of flowers. The golden beetle is one of the most charming; the country people call it the king of the beetles. It is of a golden green, with white spots; when it flies in the sun, scarcely raising the elytra, its whole body sparkles like polished metal. During the summer months, it lives in gardens, always choosing the most brilliantly colored flowers on which to rest; it penetrates to the heart of the roses and peonies, or settles on the petals of the honeysuckle, which it eats, sucking the honeyed liquid. It is perfectly inoffensive, does no harm to vegetation, and has not the unpleasant smell which belongs to many of the tribe. The females lay their eggs at the foot of trees among decayed wood, or even in the nests of ants. Here the young larvae find their nourishment in woody morsels for three years, and then construct their cocoons, from which, in due time, the beetle emerges. One beautiful kind, found in the Philippine Islands, is so much admired by the ladies that they are kept as pets in small bamboo cages. The Brazilian species are of an immense size, and may be seen resting under the leaves of the maize plantations, or flying round the tops of the tallest trees. These, again, are surpassed in size by the Goliath, which is peculiar to tropical Africa. Collectors have been so anxious for specimens, and found them so difficult to obtain, that as much as fifty pounds has been given for one of these insects, which are the common food of the natives, when roasted.

The sacred beetle of the Egyptians belongs to the *coprini*; its singular instincts had, without doubt, much astonished them, for it is found on the most ancient monuments in the land of the Pharaohs, depicted on amulets, placed on sarcophagi, and treated with the greatest veneration by the dwellers on the banks of the Nile. They were an agricultural people, and valued these great black insects for their habit of clearing away noxious substances. An oily substance which they secrete keeps their skins bright and glossy, so that none of the dirty matter among which they live can adhere to them. The fore feet are armed with spines, whilst the hind ones are much longer and suited for the work they have to perform. The care which the female takes for the preservation of its eggs and the development of its larvae is very curious. Instead of simply hiding them, like other beetles, in a lump of mud or some little cavity where the egg is laid, she surrounds it with manure, and rolls it up into a little ball with her hind legs; soon it is a solid, well kneaded mass, with the egg in the center. Already a choice has been made of a suitable place where the larvae, when hatched, can find a living. Towards this point she sets out, rolling the ball before her; meeting with some obstacle, or a rough piece of ground, she places the lump on her broad head, and thus carries it over. But should it prove insurmountable, she flies off to seek other aid, and soon returns with five or six others, who assist her by pushing on all sides, and thus carry the precious burden to its destination. Then the hole must be dug in which to deposit it—the fore legs now come into play, being especially formed for spades,—and when it is deep enough, the ball is rolled in, the hind legs brush down the earth, and every trace of the hole disappears under the parent's indefatigable labor.

Among the class of the *melolonthidae*, the common cockchafer may be regarded as the type of the whole, and a very redoubtable enemy it can prove itself to be. In some years, it appears during the month of April in prodigious numbers; its life lasts until June; and during all this time it is preying on the leaves of various trees,—the maple, poplar, birch, beech, and oak. But it shows a marked preference for the elm, so that in France the peasants call the flowering and fruit buds "cockchafer's bread." It is not uncommon to see whole forests on the Continent entirely bare of leaves in the spring months, having been eaten up by these insects. But this is a slight evil compared with what they have already effected underground, by living on the roots of cereals. The various metamorphoses of the insect in its underground life last for three years, during all which time it displays a wonderful voracity. When the females are ready to lay their eggs, they choose a light, well cultivated soil, and, burying themselves in it, perform their task. There are generally about forty young ones, which burst the shell in thirty days. Nature has armed them with powerful mandibles and a forked tooth, so that they set to work at once.

After a warm day, when they have been tempted nearer the surface, whole fields, covered with green shoots, are at once changed into dried-up withered leaves and stems. The roots of the vegetables, grain, or colza, have been eaten and soon perish by the same means. For this reason, the habits of this kind of beetle have been made a peculiar study on the Continent, especially where their ravages are so much dreaded.

When the ground is in course of preparation for receiving the seed, in the months of September and October, almost all the larvae are near the surface; taking care not to plow the ground too deeply, they will, in most cases, be turned up, and the harrow, energetically used, will destroy the greater number; if, however, the plow is too deep, they will only be buried.

The Sexton beetles are well known throughout Europe, and are so called from their living on the bodies of any animal they can find. Should a dead mouse or mole be left in a

field, they collect in large numbers around it; and as their intention is to lay their eggs in it, and so provide suitable food for the larvae, they proceed to bury it, that it may not dry up or be eaten by other animals. Hollowing the ground beneath and throwing out the earth, the animal gradually sinks down and is covered with the surrounding soil. About twenty-four hours suffice to conceal a mouse. The eggs are speedily laid, and the larvae feed upon the putrid flesh until they are full grown, when they descend into the earth for three or four feet and undergo their metamorphoses. There is a very curious tribe found in Brazil, the body being immensely distended and lying on the top of the back. They are generally found in the nests of the white ants, and do not lay eggs, but produce living larvae. The Bombardier beetles derive their name from the apparatus of defence with which they are provided. Their habit is to hide under stones in large numbers, and when the stones are disturbed, they eject a quantity of vaporous fluid with a loud noise; it is pungent, acrid, and volatile, becoming a bluish vapor when mixed with the air. Chemical tests prove it to be a strong acid, which will produce a sense of burning on the skin.

It is to the family of beetles that the *cantharides* belong, which have been used by the medical profession from the days of Hippocrates and Aretæus. Not unlike them in appearance are the pretty glowworms, which light up the grassy banks of our southern hedgerows during the summer nights. It is the female only that possesses the phosphorescent light, which it can withdraw at pleasure; and it is not furnished with wings, so that its appearance is more like that of a larva than a beetle. Some species find their home in timber or planks, instead of the ground. Every one knows the small holes which are seen to be drilled through the wooden floors of old houses: these are made when the larvae change into beetles; and as they are nocturnal in their habits, they discover their whereabouts to their companions by striking their mandibles against the wood. From this simple noise has arisen the superstitious dread of invalids and nurses, who, in the dead of the night, hear the death watch, and consider it as a summons to another world. Elm trees suffer greatly from the attacks of a beetle of this class, whole forests being sometimes laid low under its insidious labors. The female makes a gallery beneath the bark, and, boring side alleys, lays an egg in each; when hatched, the young ones eat away in regular directions until the whole tree is pierced. In tropical countries, the larvae are of a much larger size, and their ravages are more serious. The Titan, which is found in Guiana, revels in the undergrowth of that hot, damp district, where vegetation is exuberant; and the mimosa trees in the West Indies have their young shoots destroyed by a *lamia*. M. Houliet, who once lived in the neighborhood of Rio Janeiro, heard the sound of falling branches of trees belonging to the *acacia* every night. On examination, he found they were sawn all round, but the pith was left untouched, so that they broke from their own weight when the wind blew upon them. It was supposed to arise from the mischief of the slaves; but on cutting into the branch, the larvae of the *oncideres* were found, and the beetle had, no doubt, cut round with its powerful jaws, to prevent the sap flowing in, which would interfere with the growth of its young.

In such a numerous family, only the most curious examples have been selected; but we may just mention the ladybirds as belonging to it, as they are such favorites with little children. These pretty insects are common in all quarters of the globe, and are very valuable in checking the swarms of insects which infest roses and other plants. It is not in the adult state that they eat much; but the gray larvae may be seen creeping up the stems, and swallowing the lice in regular order. During the last few years, immense numbers have appeared in the south of England, and have been described as extending in dense masses for miles. In conclusion it may be said that the uses and instincts of beetles are most wonderful. Plants grow too fast, and the larvae settle on them; with wonderful appetite, they eat incessantly, and make haste to reach their full size. They fertilize the soil by scattering decomposing matters, and thus prevent them from vitiating the air; while their gorgeous colors compete with those of the floral world and add to the charms which Nature offers to the observer.

Mineral Sperm Oil.

This is a burning heavy oil made from petroleum; and its valuable properties as a safe illuminating agent are such as to render this product one of very great importance. The following statement of its discovery and character is given by Mr. Joshua Merrill:

"In the summer of 1869, in connection with Mr. Rufus S. Merrill, I made an important discovery relating to burning heavy or paraffin oil in lamps, for illuminating purposes. Mr. R. S. Merrill is a skillful mechanic who has devoted himself for several years to perfecting the construction of lamps and burners for hydrocarbon oils. While experimenting upon an apparatus for burning paraffin wax, with a view to increase the light from this beautiful substance over that obtained from common candles—the only form in which paraffin is burned—he one day put some lubricating oil into the lamp, instead of the paraffin wax, and we were both much surprised at the good qualities of the light yielded by it. But, after experimenting some days, we found this heavy oil to be impracticable as an illuminating material in its present form, and that some modification would be necessary. It occurred to me that if this heavy paraffin oil was passed through a partially destructive distillation, cracking it enough to lessen its viscosity, but not enough to render it volatile, its increased mobility would cause it to ascend the wicks freely, and yet preserve its character as a fixed oil.

"After many trials, I obtained the product now called 'mineral sperm oil,' which is sufficiently thin to fill the wicks perfectly; but it is so far from being a volatile oil that it is comparatively inodorous, and will not take fire at any temperature below 300° Fahr., or nearly 100° hotter than boiling water. Flames of considerable size, such as a large ball of wicking yarn saturated with oil and ignited, when plunged beneath the surface of this oil, previously heated to the temperature of boiling water, are extinguished at once. It burns freely in the German student lamps, and with great brilliancy from the 'Dual' burner."

The manufacture of this oil is patented in this country and in Great Britain; and Mr. Merrill estimates the quantity that may be made as at least one quarter of the whole production of petroleum, or 160,000 gallons of the mineral sperm oil every day—a quantity more than twice that of the whale and sperm oils, obtained in the best days of the whale fishery of this country.

The present time, when government authorities and scientific men are so generally cautioning against the "dangers of kerosene," and just as French *savans* have discovered that certain heavy petroleum oils may be burned in lamps, seems peculiarly opportune for the introduction of this product of American skill and invention—namely, a hydrocarbon, or a mixture of hydrocarbons, which seems to fulfil all the requirements of an oil to be burned in lamps, yielding a steady, brilliant, and safe light. And practical indications of its appreciation may be found in the manufacturer's announcement that the demands for this mineral sperm oil are steadily increasing. It is used on ocean steamers plying between the United States and Europe, and also on several railroads.

Metal Coated Sheet Iron.

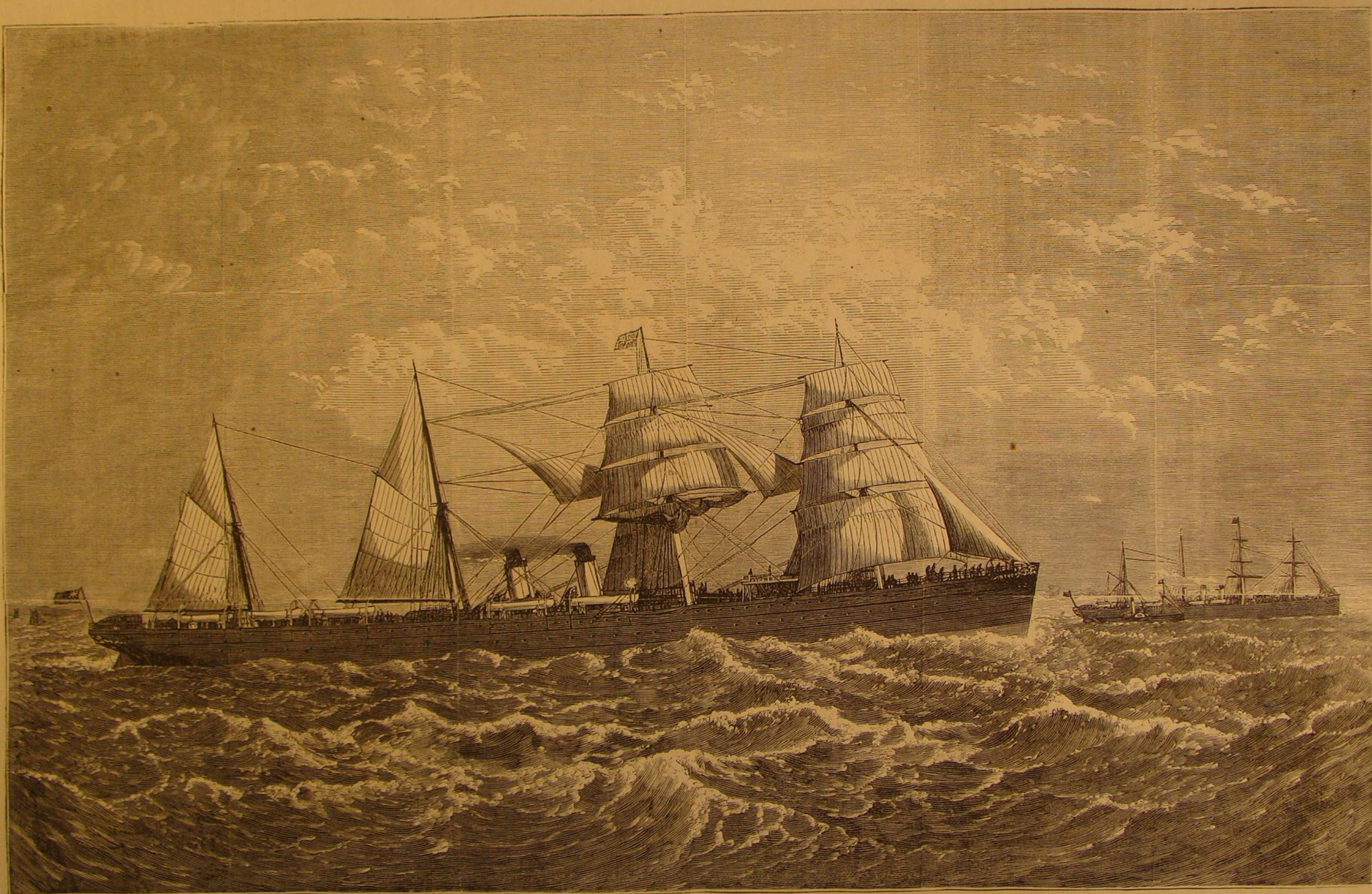
An improved method of protecting iron from injury and deterioration has been introduced by Mr. B. Morrison of Philadelphia, whose invention consists in deoxidizing the scale oxide adherent to sheet iron, and amalgamating, blending, or intimately uniting with it any of the softer and more fusible metals, so as to render such scale oxide more flexible, soft, adherent, and less liable to rust, and the sheet iron also more perfectly annealed and flexible. It is essential that the sheets be made of the best charcoal bloom iron, and that the scale oxide thereon be even, or of uniform thickness and unbroken; and in order to produce such a scale oxide, it is recommended that the usual rough and imperfect scale be removed—by means of a weak acid, in the usual manner practiced in the process of coating sheet iron with zinc by immersion—and that the sheets be then passed between a pair of smooth pressure rolls, and finally subjected to a sufficient heat to produce thereon a new and uniform scale of oxide.

Having prepared saturated or strong aqueous solutions (say) of sulphate of zinc, chloride of zinc, chloride of tin, acetate of zinc, acetate of lead, and of any other readily fusible metal that will amalgamate, unite, or combine with the deoxidized scale on the iron at a strong or bright red heat under the hydrogen or carburized hydrogen gas, immerse the deoxidized sheets in either one or a mixture of two or more of the said solutions for five or ten minutes, or apply the same by rubbing it on by means of a sponge or rough brush; let the excess of solution drain off, and the remainder crystallize or dry upon the surface of the sheets. Now place them in a box in the heated chamber of a furnace; then introduce the hydrogen gas, and slowly heat up to a scarcely visible red, maintaining the said low heat for (say) half an hour, more or less, to allow a perfect reduction of the oxide of the applied solution; after which the heat should be increased to a bright red, or heat a few degrees above that which may be required to fuse the now reduced softer metal and cause the same to amalgamate, blend, or unite with the deoxidized and, consequently, soft and porous scale on the sheet iron.

To obtain brightness of surface when desired, it is proposed to pass the sheets severally between and in contact with a pair of cylindrical rapidly rotating bristle brushes; and, if afterward intended to be put up in packs for storage or shipment, the sheets may, as a further protection against dampness, be dipped into any suitable hydrocarbon oil, and then the superfluous portion drained or wiped off. The solution of the sulphate or of the acetate of zinc forms, with the deoxidized scale on the iron, an excellent coating. About three parts of the solution of chloride of zinc mixed with two parts of the solution of chloride of tin make, with the deoxidized scale on the iron, an excellent flexible coating of a whiter color. Three parts of the solution of the acetate of zinc, mixed with two parts of the solution of the acetate of lead and one part of solution of the chloride of tin, make, with the deoxidized scale on the iron, a very suitable coating for sheet iron intended to be used in the construction of stoves, stove pipes, coal hods, etc.; but as the predominant metal in the coating is the deoxidized scale oxide of iron, the number and proportions of solutions of whatever metals are intended to be applied thereto may be increased and varied as the coating desired may require.

Germination—Its Relation to Light.

The theory of the germination of plants, which has been heretofore admitted, requires that the germinating seed be excluded from direct sunlight. Late experiments appear to establish the fact that, while exclusion from the luminous rays of the solar spectrum is necessary to the healthy germination of seeds, yet the chemical or actinic rays are indispensable to that process. These penetrate much deeper into the soil than do the luminous rays. The exclusion of the chemical rays, and not the absence of oxygen alone, is assumed to be the cause of seeds failing to grow when buried too deeply in the earth. Will our agricultural colleges settle this question by careful experiments? Let us have all that can be known of the mysteries of plant life.



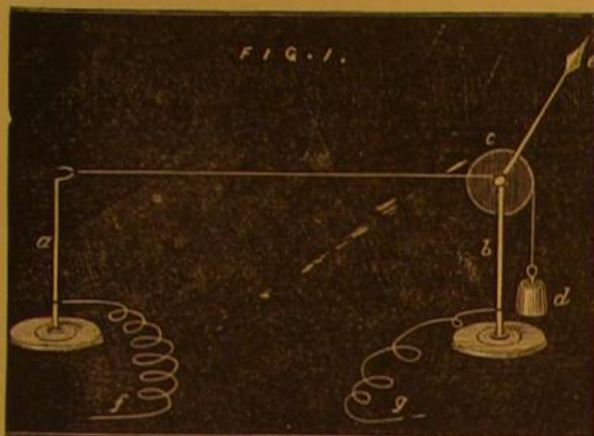
THE NATIONAL STEAMSHIP COMPANY'S STEAMER "EGYPT."—[See Page 364.]

HEAT AND LIGHT.

[Report of a recent lecture by Professor John Tyndall, before the Royal Institution.]

History shows us two different philosophical schools trying to account for the visible universe. The one school bases itself upon speculation, and the other on observation and experiments, the one trying, as it were, to develop a universe out of its own consciousness, the other seeking patiently after the outward facts of the universe, and through them after the principles that connect them. It is needless to say that in our day the school of experience has gained the upper hand. Indeed it is common, in philosophical books, to say that, in the investigation of Nature, you cannot go beyond experience. Take the idea of atoms, for example. No doubt this notion was first derived by the ancient philosophers from the observation of small sensible particles of matter. But in transmuting them to atoms, they so diminished the size of these particles as to place them entirely beyond the boundary of experience.

Most physical minds of the present day believe in atoms and molecules, or groups of atoms, though none of us have ever seen either atoms or molecules. In fact, you can have no explanation of the objects of experience without invoking the aid of objects lying beyond experience; we cannot possi-



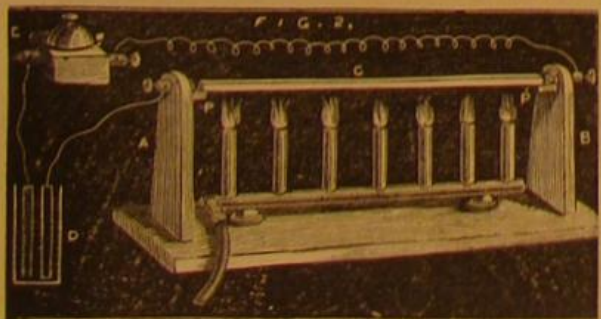
bly reach the roots of natural phenomena without the help of atoms and molecules. We figure them as the constituents of all bodies.

It is the play of the power we call heat among these atoms and molecules which is to occupy us during these lectures. In front of the table is stretched a platinum wire, which can be warmed by passing an electric current through it; the wire passes over a wheel, to which a straw index is attached, and a small weight is hung at the end of the wire. You are to figure that wire as an assemblage of atoms, held near each other by their mutual forces, but not in contact with each other. Heat forces them more widely apart.

The platinum wire stretched between the two stands, *a* *b* (Fig. 1), is lengthened when it is heated. This can be done by causing an electric current to pass through it. The wire is fastened to the hook at the top of the stand, *a*, and is carried round the axle of the small wheel, where it is made fast; over the periphery of the wheel is a cord from the weight, *d*, which keeps the wire in a state of tension; to the wheel itself is fixed the straw with a paper attached to it to act as an index, *c*. The platinum wire is pulling in one direction, and the weight is pulling in the other direction, but if the platinum wire is released the weight will instantly predominate, and the index will fall. That it does so is shown by pressing the top of the stand, *a*, towards *b*; now, making contact with the wires from a battery, at *f* and *g*, the wire becomes hot, and the index falls. Stopping the current, the wire contracts, and the index comes back again.

But here electricity might be supposed to have something to do with the effect.

Here are two wooden stands, *A* and *B* (Fig. 2), with plates



of brass, *P* *P'*, riveted against them. At present the bar of iron, *C*, is not long enough to stretch from one support to the other. I will support them on two little projections of wood attached to the stands at *P* *P'*. One of the plates of brass, *P*, is connected with one pole of a voltaic battery, *D*, and from the other, *P'*, a wire proceeds to the electric alarm bell, *E*; and again from that instrument a wire returns direct to the pole of the battery.

At the present moment the only break in the circuit is due to the insufficient length of the bar of iron to bridge the space from stand to stand. Underneath the bar is a row of gas jets, which I will now ignite; the bar is heated, the metal expands, and in a few moments will stretch completely across from plate to plate. When this occurs, the current passes and the signal bell rings, as you hear. Throwing a little water on the bar, after the gas is extinguished, the

bar shrinks, the circuit is broken, and the bell ceases to sound.

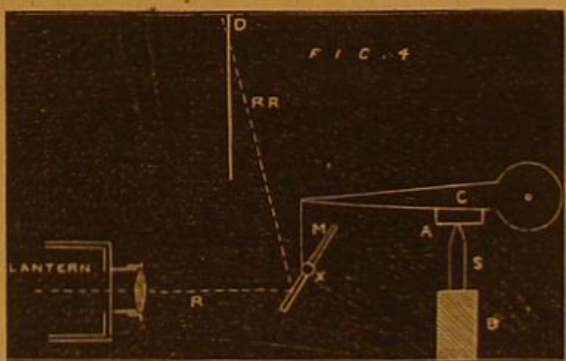
The contraction of a bar of metal, which has been heated, is a very powerful force. The contractile force of cooling has been applied by engineers to draw leaning walls into an upright position.

The bar of iron, *A* (Fig. 2), is red hot; it has a hole through it at *B*, through which the cold bar of steel, *C*, is inserted; it is then dropped into the *Y* shaped supports, *D* *E*, and screwed up tight by the thumb screw at *F*; the whole arrangement stands in a trough; and water being poured over the bar, *A*, it contracts, and does so with such an exertion of force that the bar at *B* is broken into two pieces.

But bodies expand in very different degrees, and it is necessary to devise instruments which are capable of measuring very small changes of volume. Among the most delicate of these is the apparatus before you. At the bottom of the sketch, Fig. 3, *B* represents the upper end of an upright bar of metal; on the top of this bar rests a little brass stem, *S*, the top of which acts as a fulcrum to the plate of agate, *A*. The arm, *C*, above the plate, moves on a pivot, which you see marked by a dot; a very little pushing of this arm causes it to move through a greater space than the body which pushes it. Attached to this arm is a piece of the hairspring of a watch, and that is carried round an axis, *X*, upon which is a mirror, *M*, upon which a beam of light, *H*, is made to impinge. Now, if you conceive the end of the bar to be lifted, and to push the arm upwards, it will cause the mirror to rotate, and the beam will travel with it, but with twice its velocity. Thus, in this experiment, instead of a straw, a ray of light is used as an index. It is exceedingly sensitive; clamping the bars of metal with both hands causes a sufficient elongation to bring the luminous index from the ceiling to the floor. Pouring a little alcohol upon it causes, by its evaporation, sufficient chilling to send the index back with great velocity; again clamping the bars, it is again brought downwards.

Putting tires on wheels, while they are still hot, is a familiar example of the way this contractile force is utilized.

Thus we make ourselves acquainted with the sensible fact of expansion. We are here in the domain of experience, but there is something within us which prevents us from resting there. What is the internal mechanism which produces this expansion? Here, again, we must help ourselves to conceptions by reference to the visible world. An experiment will make the matter clear.



On heating this flaccid bladder over a ring burner, turning it in the hand at the same time, it becomes smooth and tight.

In a very natural way, this fact of the expansion of atmospheric air was transferred from the region of experience into the region of atoms and molecules. It was assumed that the atoms were surrounded by atmospheres—atmospheres of heat or caloric; and the expansion of bodies by heat was supposed to be due to the swelling of these atmospheres. We have here that theory of heat which regarded heat as a free elastic matter, surrounding the atoms or molecules of bodies as the atmosphere surrounds the earth.

We can, as I have already said, make no attempt at explaining natural phenomena without resorting to a mental imagery of this kind. The first effort at explanation is an effort of the imagination. But having assumed a distinct and definite cause, it is a duty, which Science never neglects, to verify or confute the assumption by comparing its consequences with observed facts.

The notion of caloric atmospheres was thus tested and found wanting; and it was the founder of this Institution, whose life and doings have been recently sketched so admirably by Dr. Bence Jones, who offered the most striking experiments and the most powerful arguments against it.

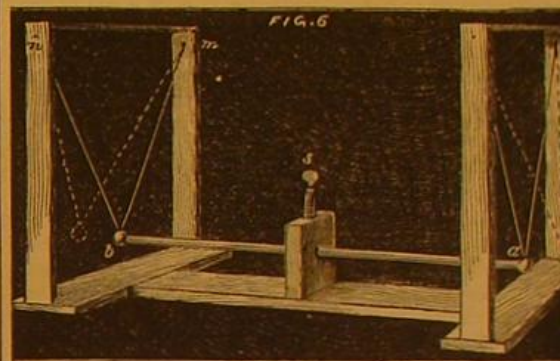
Count Rumford contended that heat could not be a kind of fine matter, because its supply by friction is inexhaustible—which matter is not. He contended that his experiments proved heat to be motion. And there was another great name, also associated with this Institution, who soon afterwards rendered it in the highest degree probable that the origin of light was a vibratory motion; and inasmuch as heat resembles light so closely, and in most cases preceded and accompanied it, the notion became irresistible that heat also was a kind of vibratory motion.

But how on this assumption is expansion of bodies by heat to be accounted for? Well, it requires no great effort of the imagination to see that when the atoms are oscillating to and fro, they require a greater amount of room than when they are at rest. In this one case the atom occupies a space

measured by its own diameter; in the other it virtually occupies the line along which it oscillates.

Though the amplitude of a vibration be very small, its intensity may be great; striking a tuning fork, it is set in vibration, but the vibrations are so minute that they are well nigh imperceptible. If, however, two cork balls are suspended, as at *a* *a'*, Fig. 5, about a quarter of an inch away from each limb of the tuning fork, *c*, the greater space required by the fork when in a state of vibration is shown by the violence with which the balls are thrown to *b* *b'*.

Another example is furnished by the brass rod, *a* *b*, Fig. 6. When rubbed with a piece of flannel, having some powdered resin sprinkled on it, it is thrown into longitudinal vibration. The center, *s*, is a node, and remains still; but the two free halves elongate and contract in rapid alternation. I apply the rubber more briskly, and the balls *a* and *b* are thrown off with violence every time they come in contact with the ends of the rod.



In this case the amplitude of the vibration is so small that no eye can detect it, and still it is capable of projecting the ivory balls violently into space.

But the energy of those small vibrations to which we give the name of heat is immensely greater.

Dip the hand into a finger glass until the water in it is warmed one degree. An amount of energy is withdrawn from that hand sufficient to project that water to a height of 772 feet, or if the degree be centigrade, to a height of 1390 feet above the earth's surface—three times the height of St. Paul's.

Let us follow this vibratory motion to its consequences. As the temperature of a solid body increases, its atoms oscillate more and more widely, the body in consequence expanding more and more. A point, or temperature, is at length attained when the hold which the atoms of the most refractory bodies exert upon each other is so loosened that the atoms are enabled to glide round each other with freedom. When this occurs, the liquid state sets in. You must not imagine cohesion destroyed in liquids, for very strong cohesive power may be associated with the power of free liquid sliding of the atoms over each other.

In the body of a liquid, each atom or molecule is surrounded on all sides by its neighbors, and thus prevented from flying away; but it requires no great stretch of imagination to see that at the surface, where on one side they are entirely uncontrolled, the molecules may be jerked away from the liquid altogether. This, in fact, is the conception of the vaporous or gaseous state of matter now prevalent. The temperature of gases—that, in fact, which keeps them in a state of gas—is supposed to be a motion of translation instead of a motion of vibration. The gaseous molecules fly through space; striking against the surfaces by which they are surrounded, striking against each other—and recoiling like little elastic balls. Here, for instance, is a vessel covered with india rubber, which is now quite flat. The air, according to this new conception, is hitting the opposite sides of the india rubber with equal force. It is, therefore, in *equilibrium*, and will remain so till the forces on the two sides become unequal.

Placed on the plate of an air pump, directly exhaustion of the air within the vessel commences, there is a loss of projectile energy on the part of the air in the interior, and the air on the exterior, retaining all its original power, drives the india rubber before it, forming a hollow within the bell glass of the air pump.

The pressure of the atmosphere being known, and the weight of the gases that compose it being known, it is easy to calculate the velocity with which the atoms must strike against a surface in order to produce the pressure. Of course the lighter the atoms, the greater must be their velocity.

The velocities of the following gaseous atoms at 32° Fah. are:

Oxygen.....	1514 feet a second.
Nitrogen.....	1616 " "
Hydrogen.....	6050 " "

If the gases be heated, their velocity is augmented and the pressure correspondingly increased.

Extreme care is necessary in determining the coefficients of expansion. Such constants are the foundation stones of science; and no higher sincerity was ever exercised by man than in determining them.

Examples of solid coefficients:

Copper	from 1,000,000 expands to 1,000,017
Lead	" 1,000,000 " 1,000,020
Iron	" 1,000,000 " 1,000,012
Zinc	" 1,000,000 " 1,000,030
Glass	" 1,000,000 " 1,000,0080
Platinum	" 1,000,000 " 1,000,0088

The last is almost the same as that of glass; hence the possibility of fusing platinum into wires with glass tubes for endiometric and other purposes. Were the coefficients different, the fracture of the glass would be inevitable during the contraction in cooling.—*Mechanics' Magazine.*

THE STEAMSHIP "EGYPT."

Our full page engraving represents the steamship *Egypt*, a splendid vessel lately built at Liverpool for the Atlantic National line of steamers.

She is 430 feet 6 inches in length, which is more than two thirds as long as the *Great Eastern*; her breadth of beam is 44 feet, and depth of hold 36 feet. She registers 5,150 tons gross. Her engines are on the compound principle, and are of 3,000 horse power. They are supplied with steam by six double boilers arranged in two sets of three each, which carry a pressure of 75 pounds to the square inch.

She is a complete four decker. Her spar deck is flush fore and aft, the cabin entrances and skylights being the only obstructions on it. This and the deck below are plated with steel and planked with pine. The two lower decks are plated with iron amidships, where the general strain of the machinery is felt, and are also planked with pine. She carries four masts and two funnels. Her ability to spread canvas equals that of any vessel afloat, while her rate of steaming is fourteen knots an hour. The lower masts are of iron, and the lower yards and lower topsail yards are made of steel. She has steering apparatus amidships as well as aft, and is provided with five steam winches, which work the pumps, hoist the sails, and load and discharge the cargo. The saloons, staterooms, and officers' rooms are heated by steam pipes. Between the spar and main decks are accommodations for all the first class passengers, officers, and crew, besides cooking galleys, ice houses, etc.; and the entire space between the main and next lower deck is left free for the storage passengers.

The workmanship throughout the vessel is of the highest class, and her construction is such that more than ordinary comforts are afforded to the steerage passengers.

Sensible Suggestions about Patents.

Mr. Wm. T. Hamilton, writing to the *Engineer*, gives expression to some very practical ideas on the Patent law question now before Parliament. His suggestions apply with equal force to the American Patent law, which is based on that of England. He says:

The simple system which I would propose would be that every inventor should have patent protection, as, of course, for certain proper periods, for every invention or alleged invention, no matter whence he may have taken the primary idea. I would give him protection, not only for his own original ideas, but for utilizing the abandoned ideas of others. Why not? It would hurt no one. This patent right should of course be defensible upon its being shown by any one else that he had had the same idea in practical operation prior to the date of the patent. Here commercial user would find its proper place. It would of course save to the public every useful invention now in operation; it would injure no one, while it would open a wide field for inventors.

Thus, then, the only patent question which would arise would be one of priority of practice. This would always be a simple one, even for the county court. The issue would be not whether perhaps abstract ideas were original, but whether palpable processes were identical, and which of them had been first used. Commercial usage is notorious and of easy proof. I would thus take commercial usage not as the basis of protection, but as the element by which to prove priority; such a system would have the great charm of being almost self acting. The mere existence of such a public counterpoise would keep inventors in the right path for their own sakes. What they now fear is not what is in the light, but what is in the dark. By all means let there be competent authorities to settle these questions of priority in the last resort. The judge of the county court might be stupid; or some cases might involve very nice distinctions as to the application of principles or as to identity, or as to what is or is not essential in a scientific point of view. Let there also be libraries and museums and open registries, carefully classified, with every other possible source of information, free to inventors upon their own seeking. Let our system be for affording, not for forcing instruction; for encouragement in every direction, not for prohibition in any. Do not let us degrade what has higher grounds upon which to rest into a mere notice board against trespassers, which any preliminary inquiry, if coupled with the condition of originality, could alone be.

Give inventors all possible information not now accessible; give them all possible liberty, but do not meddle with them until others complain that they have taken what previously belonged to those others. Let relative rights be adjusted as all other rights; self interest will do the rest.

If England expects to maintain her inventive superiority, she must boldly open up every possible source of thought, old or new. She must break up some of the old, worn grooves in which we are now too prone—or, perhaps, too much compelled—to move. Let her, above all, give back to the inventors of the future the vast stock of thought put upon a now useless record by the inventors of the past. It would be like shedding a new light over the scene of inventive exertion.

A New and Simple Continuous Battery.

Professor Bottomley, of the Glasgow University, thus describes a new battery in use in that institution:

A shallow wooden tray, square and with slightly slanting sides, is lined with sheet lead; and this, after being electrolytized with copper, forms both the containing vessel for the liquids and the copper plate of the cell. Copper trays were used at first, but they were soon eaten through by the solution. The lead is not attacked at all. The length of a side of the lead tray is 21 in., and its depth is 3½ in. In each corner is set a small block of wood 1½ in. high. The zinc plate, which is like a square gridiron, rests at its corners on these blocks. The zinc has parchment paper tied round its lower surface and sides. The cell is filled up with saturated solution of sulphate of zinc, and crystals of sulphate of copper are dropped in, when required, round the edges outside the parchment paper. For connecting these cells together in series, the lead lining is carried over the wooden tray at the corners and down the outside to the under sur-



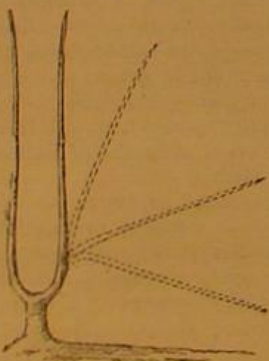
face of the bottom of it. Here it is soldered to a small square of thick sheet tin. The cells are piled up one on the top of the other, the tin plates of the second cell resting on the first, and so on. The tin connections—a suggestion of Mr. Varley—are most excellent. Two of these cells are shown in section, Fig. 5. The resistance of each of these cells is on an average 0.19 of an ohm. They are now used at all the telegraph stations where Sir William Thomson's siphon recorder is employed.

In using these batteries in a laboratory, where they are not perpetually at work, the best way of managing them may possibly be not to charge them with sulphate of copper except when they are about to be used, and only to put in as much as will do the work required. To calculate the quantity is easy; and any small excess might be worked off through a low resistance. We have been keeping them at work almost night and day. They require no attention except to be occasionally supplied with sulphate of copper crystals, and to have the sulphate of zinc that creeps up over their edges wiped away with a cloth.

At present our battery is tested very frequently, generally once in four or five days. The electromotive force and the internal resistance of each cell is determined. We have now had the greater number of the eighty cells in action for three months, and some of them for five or six months. During all that time they have been most satisfactory, the electromotive force of them having remained perfectly constant.

Increasing the Vigor of Growth in Plants.

It has been known for some time that if two branches of a fruit tree be selected, of about the same size and the same upward inclination to the horizontal plane, and one of these be bent downward toward this plane, it appears to lose its vigor, while the other gains in like ratio. It is now announced as the discovery of an ignorant peasant on the Danube, named Hooibrenk, that this law holds good only up to the horizontal position; and that if the branch is depressed still further, and below the horizontal, it becomes characterized by much greater vigor than before, and, in fact, will put out leaves and branches to an astonishing and unheard of degree. But this depends upon keeping the branches as nearly as possible in a



straight line, the effect being measurably lost with a considerable curvature. In this case, only the buds which occupy the top of the arc are developed completely, at the expense of the rest which remain in their original condition, contributing neither to the extension of foliage nor of fruit. (The successive positions of the branch are illustrated in the cut.) Duchesne-Toureaux, in communicating these facts to *Les Mondes*, attempts to show the causes which seem to determine so great a flow of sap to the branches inclined below the horizontal line, and thinks that the explanation is to be found in the establishment of a siphon arrangement, by means of which the juice is carried over the bend from the main stem in excessive flow. Be this as it may, the fact remains, as illustrated by an experiment prosecuted by this gentleman. In early spring, when the sap was running in the vines, he took four plants of about the same size, and trimmed them so as to leave one stem to each, these being arranged vertically and obliquely upward, and horizontally and obliquely downward. He then cut off the stems and collected and measured what exuded, and found the amount from the branch inclined downward was more than three times greater than that from the others.

CAR VENTILATION.—A correspondent of the *Car Builder* calls attention to the fact that the problem of car ventilation is still unsolved. Whoever can invent a simple and effective system for the ventilation of railway cars will be likely to reap a good reward.

Correspondence.

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

Testing Turbines.

To the Editor of the *Scientific American*:

I have read all the efforts to illuminate the turbine question that have appeared in the *SCIENTIFIC AMERICAN*.

In the last one there are some noticeable points, by R. H. A., on page 228 of the current volume, who puts forth some quite curious ideas in relation to the efficiency of turbines; with some of which I must beg to differ. These differences may not be very important; they are certainly entitled to some consideration as historical facts or well demonstrated theories. It is very true that all engineers concede a difference of percentage with extreme variations of head; but what that proportionate variation in head and percentage is has never been satisfactorily determined. Natural causes are known to modify the efficiency of the same turbine under extremely high or very low heads. The extent to which some of these causes affect the efficiency may be readily computed and proved by actual test. That some turbines work much better under low than under high heads is no doubt true. Whether there are some which work the better under high heads remains to be proved.

That a properly formed turbine will work equally well under considerable variations of head, is certain. The following extract, from the report of some carefully made experiments, proves this beyond a doubt:

Head in feet.	Relative speed.	Efficiency.
11-773	709 per cent.	803 per cent.
11-952	686 "	802 "
11-995	730 "	804 "
12-175	702 "	808 "
13-016	745 "	804 "
14-084	731 "	804 "
14-410	746 "	803 "

In these seven experiments, the variation in efficiency is six tenths of one per cent. The variation in head was 224 per cent, and the variation in relative speed was 087 per cent. "That more patents are yet to be obtained before the best effects can be had" is quite novel; the utility is less apparent, though by substituting "will" for "can," the truth would certainly be told. It is very doubtful, to say the least, if results higher than have already been obtained depend on patentable devices. It is quite safe to say, that no material progress has been made, in the efficiency of first class turbines, during the last half century. It is now nearly, or quite, fifty years since Fourneyron obtained 83 per cent from turbines "cast in one piece."

It is very true, in nine cases out of ten, that we "by no means" get what is claimed as the proportion of the whole power of the weight of the water. The philosophers have said that "action and reaction are equal." Many inventors, with more enthusiasm than common sense, have in consequence claimed that water has a double force, impulse and weight; and that it has really twice the power in it, under any given head, that it has ever been credited with. Hence the great variety of contrivances to use the impact, impulse, percussion, or blow of the stream of water upon one set of floats, calling it direct action; whilst upon another set in the same machine, they attempt to use the weight, backward pressure, or spurt of the water, calling it reaction. In this sense, not even 30 per cent of the sum of the forces has ever been utilized. All intelligent persons now concede that the total force of a stream of water is directly as the weight and the fall. It is believed that turbines do not act on the impact or the reaction principle; but that the action is simply a direct, gentle, and gradually increasing pressure upon the buckets of the turbine. How the results of tests can be called speculation, I am at a loss to know. We have all the evidence that any reasonable man ought to ask for. Overshot wheels have actually raised, from mines, 70 per cent of as much water as was required to drive them, the total loss in all of the machinery being 30 per cent. Certainly one third of this must have been in the pumping machinery. It has been equally well demonstrated that the overshot has utilized 86 per cent of the total power of the water used upon it. It is, however, no sign that all overshots utilize 86 per cent because one has done so. Nor is it any sign that all Fourneyron or all Jonval turbines utilize 80 per cent, from the fact that their inventors got that result. There are all grades of these famous machines, from 30 per cent ones to 80 per cent ones. Because a small turbine was "accurately and nicely constructed" is no evidence that it was accurately and properly designed for the purpose to which it was applied. The test proves, positively, that this feature was sadly wanting, or else the pumping machinery was defective. It is quite possible that both were ill adapted to the purpose, whereas an hydraulic engine is the most simple and effective method of utilizing the force of a stream of water, to force a portion of the same to a greater height than the fountain head. A turbine, with the necessary gearing, is quite the reverse of simple when applied to the raising of water.

The similarity between a rotary steam engine and a rotary hydraulic engine is quite discernible; and one is about as effective as the other; but between the turbine and any rotary engine yet before the public, there is a vast and a radical difference, from my point of view. Nor is it the aim of all inventors of turbines to imprison the water until no more work is left in it. In one turbine at least, the water is, as much as is possible, left to its own natural course after entering the turbine, except in regard to its velocity alone. The inventor, in this case, has always allowed at least 8 per cent of the total force to be left in the water, at the instant of leaving the edge of the bucket. His theory is the expansion one for all fluids. The water is received upon the bucket of the tur-

bine at the highest attainable velocity without shock; then it is retarded in an accelerated ratio, and expanded in volume in like manner, until the moment it reaches the edge of the bucket, as above, with 8 per cent of its living force yet remaining, the 92 per cent having been expended in reaching and urging forward the turbine. A reasonable allowance of 12 per cent, for loss in reaching the bucket and friction of the machine, leaves 80 per cent as the efficiency of the turbine.

To force back 90, or even 80 per cent of the water used, by any machine, is simply out of the question for the reasons shadowed forth in the foregoing. If 70 per cent can be forced back, it may be considered excellent work. A system of weight and measurement, by proper apparatus and competent persons, is, however, infinitely superior. It tells the whole story, "The truth, the whole truth, and nothing but the truth."

A. M. SWAIN.

Metallic Roofs in Thunder Storms.

To the Editor of the Scientific American:

A communication in the last SCIENTIFIC, signed John Wise, has the passage: "While I am not prepared to say positively that a metal roofed building cannot be injured by a stroke of lightning, I have never found one so roofed, in my fifteen years' investigation, that has been injured by a thunderbolt," etc.

Will you do your subscribers the favor to give your views as to whether a metallic roof is a protection against lightning?

Wilmington, N. C.

L. M.

[Answer: A metallic roof upon a building, if connected with the earth, is undoubtedly a protection against the injurious effects of lightning. Even when lightning rods are not used, a connection is generally established, between the roof and the earth during a thunderstorm, by the water spouts or the wet walls of the building. A metallic roof, if it were insulated from the earth would be a source of danger, and not a protection.—Eds.]

THE INTERNATIONAL EXHIBITION OF 1872.

The second of the series of international exhibitions at South Kensington (London) was opened on the 1st of May. The leading features of this year's exhibition are cotton fabrics and paper, and the machinery used in the manufacture of those goods.

The process of envelope manufacture is illustrated by a series of machines by Messrs. Dickinson & Co., of the Old Bailey. The first is a Tidcombe paper cutting machine, which cuts the continuous paper from reels into sheets of the required size. The apparatus will cut five or six thicknesses of paper from reels at the same time, by which means the necessity for collecting single sheets, and the employment of collectors during the night hours, is avoided. The paper, after having been cut into sheets 30x22 inches by the Tidcombe machine, is placed between plates of brass and submitted to a pressure of from twenty to thirty tons in an adjoining press. By this means it receives a glazed surface, and the sheets are then passed to the adjacent envelope cutting machine, which is one of Hughes and Kimber's. From this machine, the blanks are passed on to the next department, where they are gummed and placed to dry in a rack heated by a steam coil. When dried, the gummed blanks are passed to the relief stamping counter, where there are three machines and as many operators manipulating them. The folding is effected by means of three folding machines, moulding envelopes being previously black bordered in a machine by Mr. J. Parkins. Finally, the perfect envelopes are banded, labelled, and packed in card boxes, which are made at a stand close by.

Near Messrs. Dickinson's interesting series of exhibits is a handy little envelope folding machine by Messrs. R. Fenner & Co. The uppermost blank of a pile is raised by a pneumatic mouthpiece, working vertically, and the end is seized by a pair of tongs having a horizontal traverse, and by which the blank is drawn under a plunger, which, descending, carries it into the interior of the machine, where it is folded and embossed in relief, the edges being gummed just before the descent of the plunger. Messrs. Goodall & Son exhibit a neat machine for a similar purpose, in which a revolving table with three plungers is used. This machine gums the envelope and works two dies at one stroke, one with the maker's name and the other with the monogram or device on the outside of the envelope. The remaining apparatus in this gallery are those used in ruling account books, marbling paper and book edges, embossing and lettering in gold, etc., Messrs. Letts exhibiting all these processes.

On the ground floor of the eastern range, the ceramic display of last year is replaced by an array of musical instruments and jewelry, the latter being of a very costly character, the exhibits of one firm being, in one case, valued at \$400,000, and in another, at \$100,000.

In the eastern portion of the range of building are placed the stationary exhibits, which range from a sheet of brown paper to a gorgeously appointed valentine, and from a penny account book to a banker's ledger of gigantic proportions.

In the western portion of this building are several models of machines relating to the paper manufacture. Mr. T. H. Saunders, of Upper Thames street, sends a roll of continuous paper, as supplied to the Times for printing with the Walter machine. The paper is 2½ miles in length, and weighs 634 pounds. Mr. Saunders also exhibits a sheet of parchment paper, which is carrying a weight of 5 cwt., and is stated to be capable of sustaining 9 cwt.

This portion of the exhibition is devoted to those articles which come under the head of scientific inventions, of which

there are several deserving of notice. Amongst the most striking is a full size model section, taken transversely, of a gun, designed by Mr. Bessemer, to carry a 5 ton projectile. The bore has a diameter of 30 inches, the metal being only 8 inches in thickness. The gun is on Mr. Bessemer's continuous low pressure principle, and will be 60 feet in length. The inventor is having one made a quarter full size, with which he intends experimenting. Mr. Bessemer also exhibits a model of the projectile to be fired by his big gun, as well as models of the Woolwich 12 inch 35 ton gun, in transverse section, and its projectile.

At the northern end of the machinery annexe is a Walter printing machine, on which the Mail is printed three times a week. At this point, also, M. Charles Kastenheilm exhibits a set of type setting and distributing machines, as used in the Times office.—Engineering.

Wire Cut Bricks—An Interesting Patent Suit.

An improvement in brickmaking machinery, which is coming extensively into use both in this country and England, consists in forcing the clay from the machine in the form of a rectangular mass or block and then dividing the block by means of wires into bricks of the proper size. Bricks are thus more quickly made, and are found to be of better quality and truer shape than when separately pressed in moulds in the ordinary manner.

In this connection, we present the report of a recent patent suit in England, which contains some interesting information concerning wire cut bricks and machinery for their production.

MURRAY vs. CLAYTON.—By his specification the plaintiff claimed:—"Particularly cutting the clay into the form of bricks by forcing the clay forward by means of a pushing board or otherwise against a series of fixed wires, so arranged that the clay is pushed or forced past the wires on to a 'moveable board' provided with handles, so that 12 or any other convenient number of bricks may be removed at the same time." The defendants denied the validity of the plaintiff's patent mainly on the ground that the invention had been anticipated by a patent known as Dahlke's, which was founded on an invention made in Germany by one Sachsenberg, and by a machine which the defendants themselves made after Sachsenberg, with some variations. The Vice Chancellor was of opinion that the defendants had made out their case, and he dismissed the bill. The plaintiff appealed. Lord Justice James said that the case had occupied a long time, but when the real questions between the parties came to be eliminated from the mass of the evidence, they did not require any very long time for discussion nor present any great difficulty in determination. The plaintiff had given the usual *prima facie* evidence of his being the first inventor, and he had produced, in favor of the novelty and practical utility of his invention, a mass of evidence greater than his Lordship had ever witnessed in any similar case. There was the evidence of brickmakers, engineers, Government contractors, who had not been cross examined. One of these witnesses said that bricks made by the plaintiff's machine were worth 50 cts. per thousand more than other bricks. All this evidence was practically uncontradicted. Then came the question whether the invention was novel *de jure* as well as *de facto*—that is, whether it had been anticipated. His Lordship was of opinion that the plain meaning of the plaintiff's specification was that he claimed the machine, the combination which enabled him to effect the result, so that by one or more turns of the wrist he could cut a mass of clay into a number of bricks without their being touched by the hand of the operator. The question was whether that had been anticipated in any manner. The only things relied upon to show that it had been anticipated were Dahlke's patent and the machine made at the defendant's works, and known as the German machine. As to Dahlke's invention, it was for a thing so substantially different from the plaintiff's in principle and in all its details that, if it were made now, it could not be considered in any respect an infringement of the plaintiff's patent. The only thing common to the two was the division of the clay by a cutting wire. After leading a fruitless existence of three years, Dahlke's patent was suffered to expire. As to the machine made at the defendant's works, which they made in 1864 after the German description of Sachsenberg's machine, substituting a table for rollers, there was a mass of evidence. It appeared that this machine was made at the defendant's works, and was exhibited at work at their shop to a great number of engineers and brickmakers. It did not appear to have been made for sale, but it was a working specimen. Of all those witnesses who saw it at work, not one said that he thought it a machine of the slightest utility. The evidence on the other side showed that it was an entire failure, that it was useless for any practical purpose whatever; the labor in working it was too great. The merit of every invention of this kind was that it saved labor. His Lordship was aware of no case where the exhibition of a useless machine had been held to affect the rights of a patentee who had made a useful machine, though there might be some similarity between the two. If there were defects in the German machine which the plaintiff cured, though he did not know of that machine, he would be entitled to maintain his patent. His Lordship thought it impossible that stronger evidence should be produced than had been produced here of the novelty of the plaintiff's invention. It was so simple, and so well calculated to effect the object intended, that the only wonder was that people had gone on for thousands of years making bricks without hitting upon it. With regard to the question whether the defendants had infringed the plaintiff's patent, it appeared to his Lordship that the defendant's machine was a mere transposition; they moved the wires

against the clay instead of moving the clay against the wires, as the plaintiff did. There was nothing but a colorable variation, and it was plain that the alteration could only have been made for the purpose of evading the plaintiff's patent. The object was effected by means of a much larger expenditure of power. But as was said by Lord Hatherley, in the case of "Daw vs. Eley," a clumsy invention might be an infringement, though it would not have been an anticipation. On the whole, his Lordship was of opinion that the plaintiff had made out his case; that he was the first inventor of a new and very valuable invention; and that the defendants had failed to make out that there had been any anticipation of it. It was proved also that the defendants had committed an infringement, and there must be a decree for a perpetual injunction against them, and they must pay the costs of the suit.

Polarized Light.

We have all noticed that when the sun shines directly through a window hung with figured muslin curtains, the reflection of the pattern of the curtains in the window interferes with the prospect.

When this reflected image is viewed through a Nicol's prism, it disappears when the prism is rotated, leaving the prospect unobstructed; the experiment is very interesting, and can be performed by any one who has a polariscope attached to a microscope, and it is only necessary to observe that the image is viewed at the proper angle. The effect will possibly be best when the sun's rays make an angle with the curtains and the glass nearly coinciding with the polarizing angle. (In my case, the angle was 36° 53'.)

Tyndall has mentioned a case in which the haze obstructing the view of a mountain top was rendered transparent by the Nicol.

The readers of *Nature* have probably observed how completely the leaves of the ivy polarize light; viewed through the Nicol and a pink selenite, the plant appears covered with blossom.—R. S. Culley, in *Nature*.

Hunting Truffles.

As the annual gathering season comes round, the truffle hunters, who lease of the proprietors of the woods the right to dig for these delicacies, commence their operations. To discover the whereabouts of the truffles, small dogs, trained for the purpose, are used. The education of the dogs consists in hiding under the soil a wooden shoe filled with earth, and containing a piece of truffle and a piece of bacon. The smell of the latter attracts them, and causes them to scratch up the shoe to get at the morsel of food. By degrees they confound the two scents, and cannot perceive that of a truffle without thinking of the bacon, and digging up the earth.

Twenty dollars is about the price of a good truffle dog. Dogs of the sporting breeds are never trained for the purpose, as they would be liable to hunt game instead of truffles, if the former happened to fall in their way. When the trained dog comes on the scent, the truffle hunter proceeds to hoe up the ground pointed out by the animal as the bed of the truffles. In the south of France, a certain species of lank lean pigs are trained and employed in the same manner as the dogs in more northern districts.—Once a Week.

Improvement in Gig Saws.

Mr. Henry W. Bullard, of Poughkeepsie, N. Y., has lately patented an ingenious and useful improvement, applicable to gig saws and other mechanisms. It consists of a device to regulate the extent of throw or stroke of the saw, and is so arranged that, by merely pushing a lever, the stroke of the saw may, at any moment, be increased or diminished, at the will of the operator, without stopping or changing the driving belt. This result is accomplished by shifting the crank pin to which the saw is attached. The crank pin is so arranged that it can be made to slide in or out from the center of the head or pulley to which it is attached; and this movement of the crank pin may be made while the saw is in full operation. The invention has been in practical operation for more than a year past, and its excellence is fully established. No gig saw machine is complete without it.

Available Nitrogen.

P. P. Deherain (in *Comptes Rendus*) advances a somewhat novel theory of the reduction of atmospheric nitrogen to an available form for the support of plant life. He endeavors to prove that the free nitrogen of the atmosphere is brought into combination during the oxidation of organic matter in the soil. To demonstrate this, he dissolves glucose in a dilute solution of ammonia in water, placed in a large flask filled with a mixture of equal parts of nitrogen and oxygen. Having closed the flask, he heats the mixture gently for one hundred hours, at the end of which time the whole of the oxygen has disappeared, and 50 per cent of nitrogen has been taken up. The same process with humic acid and potash shows a loss of 7.2 of nitrogen. If these results are confirmed by subsequent experiments, they will throw light on the hitherto obscure subject of the production of nitric acid.

EVERY young man, after he has chosen his vocation, should stick to it. Don't leave it because hard blows are to be struck, or disagreeable work performed. Those who have worked their way, up to wealth and usefulness, do not belong to the shiftless and unstable class, but may be reckoned among such as took off their coats, rolled up their sleeves, conquered their prejudices against labor, and manfully bore the heat and burden of the day. Whether upon the old farm, in the machine shop or factory, or the thousand other business places that invite honest toil and skill, let the motto ever be: Perseverance and Industry.

Foot Power Buzz Saw.

The saw represented in our engraving is run by an application of the principle, involved in Mr. L. S. Fithian's vertical multiplier, which was described by that gentleman on page 251, Vol. XXII. of the SCIENTIFIC AMERICAN. The treadle, A, is supported, as shown, by lathe chain wound on the small drum, B. This drum is loose on the shaft, C, but is governed in its motions by a contained ratchet wheel, keyed to the shaft, and so arranged that when the treadle is depressed the drum, ratchet wheel, and shaft are made to revolve, and the chain is unwound. On releasing the treadle, a weight at its far end brings it again into position; and a weight attached to the drum reverses its motion and causes it to rewind the chain; but the ratchet, being now free, does not affect the motion set up in the shaft, which is continued by means of the balance wheel, D. This balance wheel has attached to it a small pinion on the one side and the driving pulley on the other (as seen in the engraving), which are all loose on the shaft and driven as described hereafter. E is an intermediate wheel revolving, in the position represented, on one of two arms projecting from and revolving with the shaft. This intermediate wheel, E, engages with the pinion of the balance wheel, D, and gives motion thereto. The wheel, F, also engages, on its opposite side, with the outer gearing of the reverse wheel, E, as shown. This wheel, F, is loose on the shaft, and is connected by its inner gearing at the side with a small intermediate wheel, which, in its turn, engages with the wheel, G. This last wheel, G, is keyed to the shaft, and is the conveyor of the power. The other parts of the machine can readily be understood from the engraving.

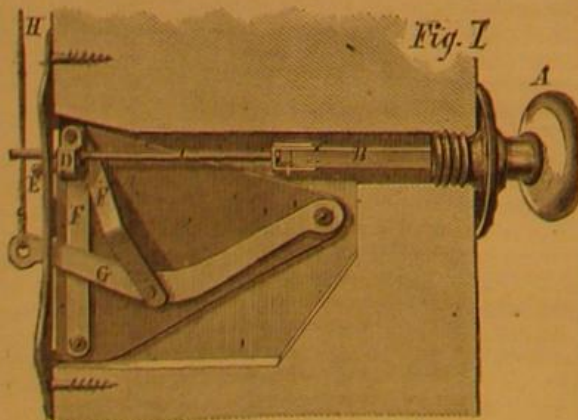
Without going into the principle of operation in this combination, we may state that, in the saw shown us, the balance wheel revolved seventeen times to one revolution of the shaft.

The inventor states that the revolutions in this machine are from one to one hundred and two, forty steps on the treadle per minute giving four thousand and eighty revolutions of the saw. The sawing is as smooth and true as fine planing; and to one who is accustomed to the treadle and remembers that he can do no more than put his weight upon it, the work is as easy as any manual labor can be.

Patented in the United States and Europe through the Scientific American Patent Agency. Address H. A. Miller, President, Room 9, 23 Dey street, New York, or Charles B. Fithian, 341 North Third street, Philadelphia, Pa.

BELL PULL AND BELL.

The bell pull, illustrated in Fig. 1 of our engraving, is designed to do away with the vexations attending the use of the ordinary street door pull. The engraving shows how the pull is attached to the door casing, and the whole arrangement will be understood from the following: By pulling the knob, A, motion is communicated through the shank, B, and

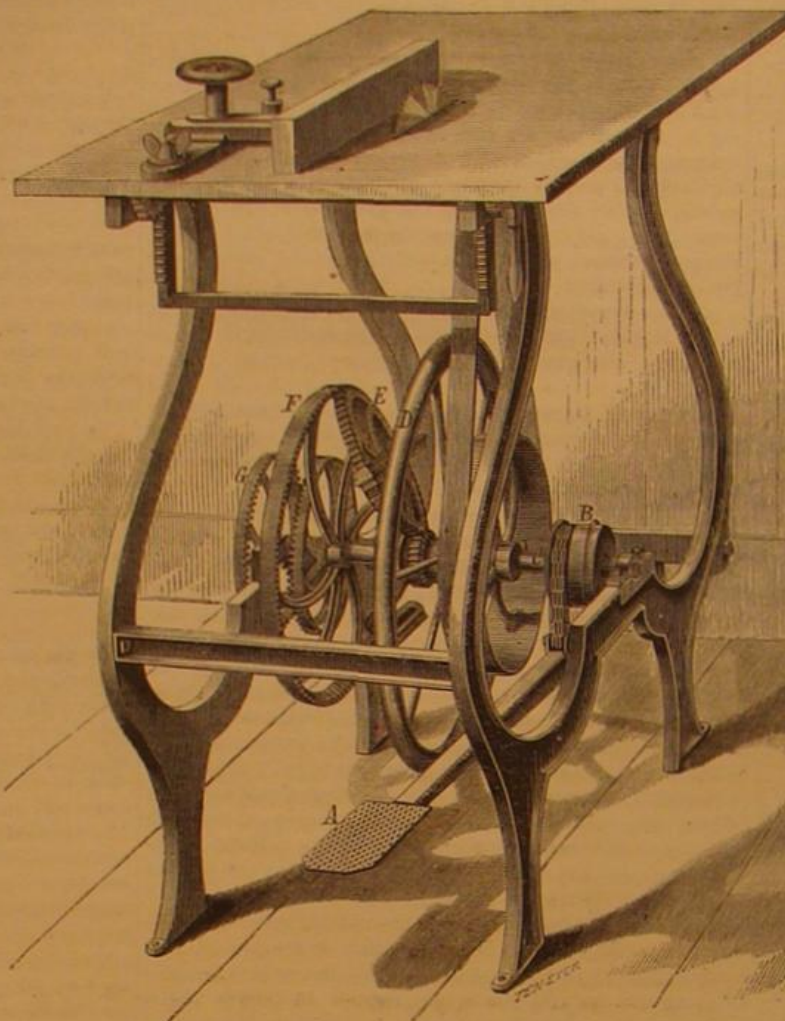


the extension wire, C, to the toggle, D, to which the wire, C, is made fast by the screw, E. This draws the top ends of the levers, F F, forward, and forces the lever, G, downward, thereby pulling the wire, H, which rings the bell. The wire, C, is cut off to the right length when adjusted. In the arrangement shown, the return of the knob to its original position is effected by the spring attached to the striking ap-

paratus of the bell; when required, it may be effected by an independent spring attached to the pull. This bell pull insures reliable action with a very short pull on the knob. It is applicable to all kinds of bells, is easily put on in place of the old pull, and does not require a new knob.

In Fig. 2, the improved bell, the working parts are partly concealed by the bell. Suffice it to say that the lever, I, by an ingenious arrangement of levers, operates upon the striker both in its descent and recoil. Consequently two strokes are insured for each pull. It is not liable to be strained or broken by hard or sudden pulls.

Patents on the foregoing were obtained through the Scientific American Patent Agency, Nov. 7 and Dec. 26, 1871. For

**FOOT POWER BUZZ SAW.**

further information address the inventor and manufacturer, A. L. Swan, Cherry Valley, N. Y., or E. J. Swan, Laporte, Ind.

Lead Pencils.

A lead pencil is in itself a small affair, but considered as a manufactured product, it rises into much importance. To start a first class factory, with improved machinery and stock of well seasoned wood, requires a capital of about \$100,000; ground covered is about half an acre, chiefly occupied by drying houses for the storage of red cedar. The Florida red cedar is mostly used in this country and in Europe—some "iben" wood, as the Germans call it, or English yew, is used in Germany—white pine is occasionally used for a common grade of a carpenter's pencil.

The "lead" of the pencils is the well known graphite or plumbago; the best of this is the natural, found in a pure state in masses large enough to cut into strips. Of this there is but one mine now up to the standard, which is in Asiatic Siberia, and pencils made from this graphite are all one grade, and pay here 50 cents per gross special, and 30 per cent *ad valorem* duty. The Cumberland mines in England were the first discovered, but are now almost exhausted. What was formerly refuse in cutting the graphite is now ground, cleaned and refined, and then mixed with a fine clay.

In mixing the clay and graphite, great care must be taken in selecting and cleaning the clay and getting the proper proportions; the mixture, with water, after being well kneaded, is placed in a large receiver and strongly compressed and forced out through a small groove at the bottom, in the shape of a thread of the thickness and style required—either square, octagon, or round. This thread, or lead wire, is cut in bars of the proper length (done by little girls), and then straightened, dried at a moderate heat, and packed in airtight crucibles and placed in the furnaces; the grade of the lead depends upon the amount of heat it is exposed to, the amount of clay used in mixing, and the quality of the plumbago. The coloring of the lead is by various pigments.

The wood, after being thoroughly seasoned, is cut in thin strips and dried again, then cut into strips pencil length. These strips are grooved by machinery, then carried on a belt to the glueing room, where the lead is glued in the groove, and then the other half of the pencil glued on. After being dried under pressure, they are sent to the turning room and rounded, squared, or made octagon, by a very ingenious little machine, which passes them through three sets of cutters and drops them ready for polishing or coloring—the former is done on lathes by boys, and the latter by a machine which holds the brush and turns the pencils fed to it

through a hopper. After the pencil is polished, it is cut the exact length by a circular saw, and the end is cut smooth by a drop knife, the pencil resting on an iron bed.

The stamping is done by a hollow die, which is heated; the gold or silver foil is then laid on the pencil which rests in an iron bed, and the die is then pressed on it by a screw lever. The pencils are then ready to go to the packing room, whence they find their way to all parts of the civilized world at prices ranging from two dollars to twenty dollars per gross.—*American Exchange and Review.*

New Carriage Mountings.

These mountings, such as shaft, whiffletree, and pole tips, the nuts and rivets for top props, hub bands, etc., are made, as is usual, of iron, brass, or white metal, and are coated with hard rubber or gutta percha, leaving exposed, to be plated with gold or silver, a small portion for ornament. A whiffletree tip, for instance, has the "dragon tongue" and the neat bead at the base plated with gold or silver, and the remainder is coated with the hard rubber. A beautiful contrast between the highly polished metal and the brilliant jet black surface of the hard rubber is produced. It has more the appearance of an article of jewelry than one intended for hard service on a carriage. In addition to their beauty, these articles combine the important feature of durability. The surface of the hard rubber will not become scratched or dented as readily as metal, even malleable iron. It will not easily chip off, indeed can hardly be broken off with a hammer; and we are informed that it does not tarnish by exposure to the weather, and will not lose its color from the same cause. They are as strong as the same articles now in use, the hard rubber coating being only a little thicker than the ordinary close plate. When the ornamental parts become tarnished, they can be cleaned or replated without injury to the rubber portion.

During the last few years, the public taste has been for showy gold and silver mountings, but there is a growing desire for something more quiet, which shall be at the same time rich and elegant; and our more prominent carriage builders are already using leather covered handles, prop nuts, etc. In Paris, rich gold and silver mountings, and the bright, gay inside linings of former years, have given way to things more sober, owing somewhat, no doubt, to the wide-spread affliction in that unfortunate nation. In the matter of price, we understand that the rubber mountings are of about the same expense as the best plated ones.—*The Hub.*

PROJECTILE FOR FIREARMS.

This improvement relates to that class of projectiles which are formed in sections. Hitherto the parts have been so constructed that, when fitted together, they were free to move one upon the other, and hence the slightest obstacle to the flight of the ball might cause separation of the sections and frustrate the purpose of the missile.

To remedy this defect, the inventor forms the sections as represented in our engraving, where Fig. 1 is a side view of the missile attached to a metallic cartridge case. Fig. 2 is a longitudinal section of Fig. 1, showing sections in perspective. Fig. 3 is a perspective view of one of the sections, and Fig. 4 is the top of the missile.

The missile, A, is thus composed of four parts, shown respectively at B, C, D and E, which are each provided with an angular projection and depression so that they will fit together and make a complete whole when in the gun barrel.

Fig. 1**Fig. 2****Fig. 3****Fig. 4**

In this way bands are dispensed with, and the ball can be handled, even carelessly, without displacing its parts.

Further information can be obtained of the inventor, Mr. Carlos Maduell, of New Orleans, by whom patents of January 9, 1872, and reissue of March 19, 1873, were obtained through the Scientific American Patent Agency. Post office address, lock box 893, New Orleans, La.

A. K. BRACH

NEW YORK, SATURDAY, JUNE 1, 1872.

(Illustrated articles are marked with an asterisk.)

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Libraries such as the Astor, American Institute, and several others in New York, Peabody in Baltimore, and many other public libraries, in Philadelphia, Boston, and, fortunately, now in almost every large city on this continent, supply the means for ascertaining the history of almost any subject of scientific research. When such a research is once commenced, the student will, while his material accumulates, be always surprised that so much is known respecting the subject under investigation. But, in place of being discouraged, the truly scientific mind will commence to feel not only a lively interest in it, but a sort of affection for it. It will occupy many of his thoughts, and, if the nature of the subject and his circumstances allow it, he will try experiments of his own. If, then, he is so happy as to discover

Before touching upon tin foil, our subject proper, we perhaps should mention a species of foil which, though almost identical in appearance with the former, is made entirely of lead. It constitutes the linings of those tea chests in which the poorest qualities of tea are imported. The metal of which it is made is carried to China from England in large quantities, averaging some 4,000 tons per year. The method of manufacture formerly in vogue among the Chinese was exceedingly primitive, as they merely pounded the lead until it attained the requisite tenuity, but in 1858 a rather ingenious invention was patented in England which we believe is

As AN accompaniment to the Grand Jubilee at Boston, Professor King, of that city, is manufacturing a gigantic balloon, capable of carrying fifteen or twenty passengers. This great flyer is to be called the "Coloasus."

THE INDUSTRIAL PROGRESS AND REQUIREMENTS OF NEW SOUTH WALES.

From the report of the Intercolonial Exhibition, held at Sydney, New South Wales, we extract the following information relative to the manufactures, requirements, and industrial progress of the colony. Prior to the discovery of gold in 1851, but few manufactures were established, and these few were confined to Sydney. Machinery was not then so generally used in every department of trade as now, and the greatest efforts at production were the manufacture of cooking stoves and other domestic articles, mill work and marine work. These, with the manufacture of soap and candles and the refining of sugar, formed the bulk of the native industries.

At the present time, although a steady progress has been made in the industrial arts, there is still room for enterprise; and the fact that imports of machinery and skilled labor from Great Britain and the United States are still large shows that the colony is as yet unable to develop completely its resources. There is a large demand for foundry and machine work for purposes of marine engineering, induced by the repairs which are constantly necessary for the steamers employed in the ocean postal service as well as in the coasting and intercolonial trade. The machinery and tools necessary for the various processes are all imported from England. Mechanical appliances on shore, flour mills, quartz mills, sugar mills, kerosene works, sheep washing apparatus, hydraulic wool presses, etc. etc., are all needed, and it has been found that they can be brought from England or America cheaper than they can be manufactured in the localities where required.

Among the minor articles of iron work, stoves occupy a prominent place. Large numbers from America find a ready market, though, as regards durability and economy, they are believed to be inferior to those of local manufacture.

Two sewing machines have been produced containing improvements invented in the colony; but these were rather curiosities than indications of a young trade. The import of machinery for 1869 was valued at £68,589, exclusive of weighing and sewing machines; the import of iron and steel for the same year amounted to 17,520 tons, exclusive of tanks, pipes, bridge work and old iron.

Galvanized iron, for various purposes, was introduced in 1863. The work of galvanizing for the whole colony is carried on in Sydney by a single manufactory.

Wood, particularly the softer kinds for indoor work, is obtained in large quantities from Europe and America. Most of the modern steam driven tools for wood working are also imported.

There is but one paper mill in the colony. A new material for paper is found in a sedge known as *cyprus vaginialis*, which grows in considerable abundance in the neighborhood of Sydney. It is said to be as suitable as the Spanish esparto grass. We notice that reference is made also to another useful vegetable termed the "colonial cabbage tree," which is employed as a substitute for straw in the manufacture of hats.

The list of new inventions made in the colony is rather small as compared with the number which would be produced by a population of equal size in the United States. The report, however, somewhat naively admits that the inventive genius of Australia has not yet developed like that of America, although the necessity for labor saving machines is as great in one country as in the other.

In minerals, New South Wales is particularly rich, new gold fields being constantly discovered. The yield to every man engaged in gold mining has been estimated to average about £72 4s. 6d. (nearly \$350) per annum. The largest amount of this metal received at the mint during a single year was 575,538 oz. in 1862. In 1869 but 224,383 oz., valued at £366,746, were received, the decrease being attributed more to lack of enterprise than to the mines becoming exhausted. Diamonds have been found in the wash dirt taken by the gold miner. The number found up to the present time is, at a rough estimate, about 5,500, the largest stone having been one of 5½ carats, and the smallest, one tenth of a grain. They are always accompanied by rubies, topazes, and other gems.

In view of the large amount of machinery imported, and the constant demand which must arise for new labor saving inventions, our conclusion, drawn from a perusal of the report before us, leads to the belief that a promising field is here presented for the inventor and the manufacturer. The resources of the colony are great and comparatively undeveloped, a fact to be accounted for by the greater part of the population entering largely into stock farming and gold mining, and depending upon England and America to furnish, ready made, the implements and machines which might easily be manufactured from abundant native material.

BUTTER.—The German *Agriculturist* says that a great portion of the fine flavor of fresh butter is destroyed by the usual mode of washing, and he recommends a thorough kneading for the removal of the buttermilk, and a subsequent pressing in a linen cloth. Butter thus prepared is pre-eminent for its sweetness of taste and flavor, qualities which are retained for a long time. To improve manufactured butter, we are advised by the same authority to work it thoroughly with fresh cold milk, and then to wash it in clear water; and it is said that even old and rancid butter may be rendered palatable by washing it in water to which a few drops of a solution of chloride of lime have been added.

THE total production of hops in the United States for the census year ending June 1, 1870, was 25,456,669 pounds,

SCIENTIFIC AND PRACTICAL INFORMATION.

TREE PLANTING.

The great consumption of lumber, which has so reduced the acreage of forest land in Maine, Michigan, and other States of the North and Northwest, and the consequent probable scarcity of timber at no very distant date has induced the Maine Legislature to pass an act to the effect that "any landholder who shall plant or set apart any cleared lands, for the growth and production of forest trees, within ten years after the passage of the act, and shall successfully grow and cultivate the same for three years, the trees being not less in number than 2,000 on each acre and well distributed over the same, then, on application of the owner or occupant of such lands to the assessors of the town in which the same is situate, . . . the same shall be exempt from taxation for twenty years thereafter."

HONEY DEW.

M. Boussingault has recently published in the *Comptes Rendus* a communication on the chemistry of honey dew, a saccharine matter found on the leaves of many species of trees. He noticed in 1869 the formation of considerable quantities of this substance, which formed a sort of varnish on the leaves in such quantities as to fall in viscid drops to the ground. He analyzed the substance, commencing by eliminating the albumen and mucilage by the use of the subacetate of lead; and he thus obtained a residuary sirup with distinct sugar crystals in it. The saccharine matter disappeared after fermenting the sirup with yeast, leaving dextrin, which has been proved by Berthelot to exist largely in the manna of Sinai and other parts of the East. M. Boussingault points out that the secretion cannot be the result of meteorological or atmospheric influences, and that the fact of one tree in a group being thus affected indicates the probability that it is a production of insect life. The manna of Sinai was attributed by Ehrenberg to a species of *coccus*, called by him *tamariz mannifera*.

COPPER IN COCOA AND CHOCOLATE.

Careful chemical analyses show that cocoa and chocolate always contain a small percentage of copper. The husks of the cocoa have been found to contain as high as 0.025 per cent of copper, while the kernel of the bean only contained 0.004. Samples of chocolate contained 0.0125 of copper. Substances containing copper, even in the smallest proportions, cannot be very desirable for the diet of invalids, for which the above articles are quite extensively used.

A CHEAP CONTINUOUS BATTERY.

The need for an inexpensive battery, created by the extended use of electric bells in hotels and other large establishments, has induced Herr L. Kohlurst to describe the following invention: The negative plate is formed of a truncated hollow cone of copper, closed at the top. The inside of the cone being protected with varnish, it is filled with sulphate of copper in crystals and inverted in a glass vessel deeper than itself. The cone is notched around the rim, and the apex is pierced with a small hole. For the positive element, a thick cake of zinc is used (suspended over the face of the cone); it has a hole in the center, through which is passed a covered wire connecting with the copper. The glass cylinder is then filled with water, and the sulphate of copper begins to melt, the rapidity of the deliquescence varying with the access of the water through the notches in the cone; and so long as this latter maintains a uniform rate, the current will be uniform in power. If common or Epsom salt be used in the water, the current will be intensified. The inventor states that 1½ pounds of the copper salt will continue the battery in operation for a year.

Beet Sugar.

There must now be over a thousand beet sugar factories in Europe.

While both the manufacture of beet sugar and the growing of the beets are seen to be profitable, it would seem, however, that the peculiar advantage of the industry to a country is its influence in diffusing a skillful practice of farming and of promoting agriculture in general. To show the appreciation in which it is held in France, Mr. Howard states that, at an agricultural meeting held a few years ago at Valenciennes, a triumphal arch was erected, on which appeared the following inscription: "The growth of wheat in this district, before the production of beet root sugar, was only 976,000 bushels; the number of oxen was 700. Since the introduction of the sugar manufacture, the growth of wheat has been 1,168,000 bushels, and the number of oxen, 11,500."

ARTIFICIAL WATER LIME.—It has been long known to chemists that water lime consists substantially of quick lime, burnt clay, and a small portion of the oxides of iron and magnesia, but scarcely any effort has been made to utilize this knowledge. All yellow or red clays contain iron, and most specimens of lime in use contain the required magnesia. If burnt clay or brick dust in the fine powder be mixed with an equal weight of fresh slacked lime, and twice this weight of clean, sharp sand be added, a compound will be formed which will harden under water equal to the best hydraulic cement.

CARBOLIC ACID AS A DISINFECTANT.—C. Homburg, of Berlin, proposes to use carbolie acid as a disinfectant, by saturating sheets of Bristol board, or any thick spongy paper, with a solution of carbolie acid in water. The paper, in pieces of any convenient size, may be hung up in the room to be disinfected, or may be placed in drawers or wardrobes, where it is desired to protect clothing from moths or other insects. This suggests a convenient method of using this excellent disinfectant and insect destroyer.

THE RECEPTION OF THE MINING ENGINEERS AT THE STEVENS INSTITUTE.

A very pleasant reception was recently tendered to the American Institute of Mining Engineers by the Trustees and Faculty of the Stevens Institute of Technology, at Hoboken, N. J. The visitors were received by the members of the Faculty, and by them escorted through the different departments of the college building. The various instruments of the physical laboratory were carefully explained both by professors and students, and their uses shown by actual experiment. A Hipp's chronoscope of exceedingly accurate construction is one of the latest additions to this already large collection; its delicacy is such that it measures time to the one thousandth of a second, and enables the laws of falling bodies to be demonstrated at a height of only eighteen inches. A large induction coil of over 100 miles in length, producing a spark of twenty-one inches, is another noticeable feature.

The workshop, containing a steam engine of twenty-five horse power, with link motion and Hutton regulator, planers, lathes, milling machine, and other mechanical apparatus, was next inspected, after which visits were made to the chemical laboratory, lecture room, and department of mechanical engineering. The latter contains a large collection of models of every description, together with a number of engineering relics in the shape of letters from Robert Fulton, Commodore Decatur, and other eminent men of times gone by. In the lecture room of the department of physics, a number of interesting experiments in magnetism were exhibited on a screen by means of the vertical lantern, and in the president's lecture room, numerous beautiful illustrations, showing by the aid of polarized light how strains are distributed in bodies under pressure, were shown in the same graphic manner.

After inspecting the departments in the upper portion of the building, the visitors met in the large lecture hall, where they remained for some time interested spectators of Professor Mayer's experiments with the huge electro-magnet belonging to the institution. A short address of welcome from President Morton followed, after which the party adjourned to the elegant mansion of Mrs. E. A. Stevens at Castle Point, where an excellent lunch was provided. Among those present were Peter Cooper, Ex Governor Ward of New Jersey, Generals Gillmore and Barnard, President Morton, Professors Silliman, Draper, Vander Weyde, Mayer, Thurston, and Leeds, and Drs. Torrey and Raymond, besides many other eminent scientific gentlemen.

The admirable arrangement of the various departments of the Institute and its superior facilities for instruction called forth the warmest commendations from every one. The college is yet in its infancy, being barely a year old, but if the same spirit of enterprise, by which the management of its affairs has been characterized in the past, be continued in the future, we can safely predict for it a foremost position among the scientific schools of the country.

Parchment Paper.

It has long been known that certain acids exercised a wonderful effect upon woody fiber. Early in the year 1857, Mr. Gaines described before the Royal Institution a method practiced by him of making artificial parchment. His process consisted in the mixing together of two parts of sulphuric acid and one of water, and, after it had become cool, immersing in it, for about one second, blotting or unsized paper, immediately washing it in several changes of water, after which it was allowed to dry spontaneously. This treatment conferred upon it new properties. No longer weak, it was now tough and strong, semi-transparent, and resembled parchment, being capable of use for the same purpose.

This treatment causes the lignin to undergo no chemical change. The weight is the same as before, and there is no indication of the presence of the acid. The paper no longer permits water to pass through it; it is, in fact, waterproof. Paper, however, is not the only form in which the lignin may be submitted to the action of the acid, for textile fabrics, such as calico, are affected in a similar manner and rendered tough in an extraordinary degree. Fishing nets, and fabrics of that kind, may also have their strength increased many degrees by the same cause.

Another method is to dip white unsized blotting paper for half a minute in strong sulphuric acid, sp. gr. 1.842, and afterwards in water containing a little ammonia. Another method is to plunge unsized paper for a few seconds into sulphuric acid diluted with a half to a quarter of its bulk of water, the solution being allowed to cool down to the temperature of the air before being used, and afterwards washing in water containing ammonia. The latter is said to be the method employed by Messrs. De la Rue and Co., who prepare parchment paper largely for various purposes.

We may here state that as blotting paper alone must be used for this process of conversion, common paper may in turn be converted into blotting paper by immersing it for a few seconds in hydrochloric acid. Some recommend for this purpose a mixture of hydrochloric acid and water; but, in the experiments that we have tried in this direction, we have immersed the paper in a bath of the ordinary undiluted acid, removing it, after a few seconds, to a vessel of water in which it was treated to several changes.—*British Journal of Photography*.

LAKE SUPERIOR TIN.—At a recent meeting of the New York Lyceum of Natural History, Professor Henry Wurtz exhibited some beautifully crystallized specimens of heavy tin stone or cassiterite, discovered a few months since on the most northerly shore of Lake Superior, near Neepigon Bay. The deposits are said to be extensive and valuable.

PATENT INFRINGEMENT CASES.

United States Circuit Court—Eastern District of Pennsylvania, in Equity.

Reeves vs. Keystone Bridge Company, J. H. Linville and others.

This was a suit for infringement of the complainant's patent of June 17, 1862. The patent is for an improvement in the construction of columns, shafts, braces, etc., and the invention consists in the use of three or four wrought iron bars of such shapes and dimensions that, when arranged together in the direction of their length and fastened by rivets or bolts through their flanges, they form a hollow shaft or column.

The respondents admitted the making and using of the column described in the patent, but denied its novelty on the following grounds:

1. That the invention was originally made by Jacob H. Linville and John H. Piper.

2. That it was described in the *Allgemeine Bauzeitung* for September, 1861.

3. That it was illustrated by a drawing in the *Dreyfuss Album* bearing the imprint of 1861.

We regret that our space will not permit us to give the opinion by McKennan, Circuit Judge, in full. Its essential features follow:

It appeared in regard to the first allegation that, on the 14th of January, 1862, a patent was granted to J. H. Linville for an improvement in iron truss bridges, which consists of a post composed of two rolled plates of wrought iron, semi-oval in form, secured by rivets passing through its diameter, or by bands shrunk around it, binding the plates firmly to distance pieces interposed between them at suitable distances to spring them apart at the middle, and terminating in cast iron bases and capitals. This was held by the judge to be essentially distinguishable from the complainant's post. It next appeared that in 1865 Linville, in conjunction with Piper, applied for and obtained a patent nominally for improvements in his post of 1862, but, really changing its fundamental organization, and seeking to fix its invention in 1860, and in fact describing and appropriating the distinctive features of Reeves' post, which had been patented three years before. It was shown in evidence that in 1860 Linville and Piper were engaged together in getting up plans for a proposed railroad bridge, and that sketches of various forms of posts, including those described in the patents of 1862 and 1865, were made; that the sketches of the post described in the 1865 patent were preserved for a time, but were lost, and, in fact, that nothing beyond making the sketches was done to embody or carry out the alleged invention until the patent of 1865 was applied for. After an exhaustive consideration of the question whether or not these sketches would carry back the date of the invention to the time when they were made, the Judge held that, whether they are to be considered as an incomplete invention not prosecuted with the required diligence, or as an experiment actually abandoned, they cannot impair the right of Reeves to be treated as the first inventor.

In regard to the second allegation, it was held that a column, constituted as described in the publication referred to, differs from Reeves' column in the necessary elements composing it and in its principles; and respecting the third reference, as it did not appear that the book was published before the patentee's invention, it was held, as evidence, to be altogether inconsequential.

The complainant is entitled to an allowance of the prayers of his bill, and a decree will therefore be entered for a perpetual injunction and an account, with costs.

George Harding and R. C. McMurtrie, Esqs., for the complainant.

C. B. Collier and Theodore Cuyler, Esqs., for respondents.

The Keystone Bridge Company vs. The Phoenix Iron Company.

This was a case of alleged infringements of Linville's and Linville and Piper's patents of 1862 and 1865, referred to in the preceding case.

In the opinion delivered by McKennan, Circuit Judge, his Honor did not deem it necessary to consider the alleged infringements of certain claims, in view of the decision just rendered in the case of *Reeves vs. The Keystone Bridge Company*, and after pointing out the essential difference between the bars claimed by the complainants and those made by the respondents, dismissed the patent of 1862 from further consideration. In regard to the third claim in the patent of 1865, which is for "the use, for the lower chords of truss frames, of wide and thin rolled bars, with enlarged ends formed by upsetting the iron, when heated, by compression into molds of the required shape," the respondents were proved to have only made round bars which were not employed or adapted to give vertical support to the roadway, which is an important function of the complainant's lower chords and the reason of their peculiar conformation. Further, it is not to be doubted that the patent is limited to the use of the chords in bridge structures. This is distinctly set forth in the specification where it is stated: "We do not claim the upsetting of bars in the manner described, nor any particular mode of performing the operation, but merely the use of chord bars," etc. Thus the exclusive right to make chord bars in any mode is disclaimed. In effect, they declare that any one may lawfully make the bars, and that no encroachment upon their rights is committed until the bars are used by being put into a bridge. Now, the respondents are iron manufacturers, and it was shown that the bridge in question was built by Kellogg & Clark, who obtained the iron for it from the respondents, and that the bottom chords used were like those claimed by the complainants. It was held that this proof of infringement fell far short of fixing any accountability upon the respondents, who made the bars, but did not use them. They only did what they had a legal right to do, and did not thereby assume any responsibility for the wrongful acts, or become involved in the unlawful purposes, of others. Bill dismissed, with costs.

C. B. Collier and Theodore Cuyler, Esqs., for complainants.

George Harding and R. C. McMurtrie, Esqs., for respondents.

United States Circuit Court.—Maine.—Miller vs. Androscoggin Pulp Company.

The defendants in this case were charged with an infringement of letters patent for a new and useful improvement in reducing wood to paper pulp, for which letters patent were issued, August 10, 1858, to Henry Voelter, assignor to Alberto Pagenstecher.

The Voelter patent is for an improvement in the art of reducing wood into pulp for use in paper, and also for certain improvements in machinery therefor.

In all the processes used prior to the present invention the wood has been acted upon by the stone in one of two ways: namely, either by causing the surface of the stone to act upon the ends of the fibers, the surface of the stone moving substantially in a plane perpendicular to the fibers of the wood; or, secondly, by acting upon the fibers in such a direction that they were severed diagonally, the surface of the stone moving diagonally across the fibers.

The first plan, in fact, made powder of the wood. The pulp had no practical length, and on trial proved worthless, or nearly so. The second plan was carried out by the use of a stone revolving like an ordinary grindstone, the wood being applied upon the cylindrical surface thereof, with the fibers perpendicular, or nearly so, to planes passing through the axis of the stone and the point or locality where the grinding was performed; and this plan also failed because the fibers were cut off in lines diagonal to their own length, and were consequently too short to make good pulp.

This improvement consists in grinding or rather tearing out the fibers from the bundle of fibers which makes up a piece of wood, by acting upon them by a grinding surface which moves substantially across the fibers and in the same plane with them without cutting or severing the fibers either perpendicularly or diagonally to their length as heretofore. The defense claimed that substantially the same process was shown in other patents. The invention is regarded as one of importance. Judge Shepley held the patent to be valid, and granted an injunction.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN NEWSPAPER DIRECTORY: Containing Accurate Lists of all the Newspapers and Periodicals published in the United States and Territories, and the Dominion of Canada and British Colonies of North America; together with a Description of the Towns and Cities in which they are Published. New York: Geo. P. Rowell & Co., Publishers and Newspaper Advertising Agents, No. 41 Park Row.

This book is already well known to the public, more especially to advertisers and publishers; and the new edition is corrected up to this date, and contains the full and accurate information claimed for it on the title page. Messrs. Rowell and Co. deserve credit, not only for compiling a trustworthy guide to the newspaper world, but also for the production of so handsomely printed a volume.

THE IMMIGRANT BUILDER; OR, PRACTICAL HINTS TO HANDY MEN: Showing clearly how to Plan and Construct Dwellings, in the Bush, on the Prairie, or elsewhere, Cheaply and Well, with Wood, Earth, or Gravel. Copiously Illustrated. By C. P. Dwyer, Architect, Editor of "Sloan's Architectural Review." Author of the "Economic Builder," etc. Price \$1.50. Philadelphia: Claxton, Remson, and Haffelfinger.

This book will be useful to thousands who are now pushing their fortunes on the western prairie, and to many of whom the question of a comfortable home is of chief importance, and its absence the greatest hardship. We shall probably make extracts from this volume in a future publication.

FOURTH ANNUAL REPORT ON THE NOXIOUS, BENEFICIAL, AND OTHER INSECTS OF THE STATE OF MISSOURI. By Charles V. Riley, State Entomologist. Regan & Edwards, Public Printers, Jefferson City, Mo.

This is an able and comprehensive report on the above subject, for the year 1871, made to the Missouri Board of Agriculture. It contains about 150 pages, with explanatory illustrations, and is indexed.

THE SIGN PAINTER'S GUIDE. By James T. Gardiner. Published by the Author. Cincinnati.

This little work is written with the view of helping sign painters in acquiring an adequate knowledge of their business, including glass gliding, pearl work, etc. It contains, besides, much general information, many valuable receipts, and instructions for using Callow's patent graining apparatus.

THE SCIENCE OF AESTHETICS; OR THE NATURE, KINDS, LAWS, AND USES OF BEAUTY. By Henry N. Day. Published by Charles C. Chatfield & Co., New Haven, Conn.

This treatise on the "general subject of beauty as perfect form" was specially prepared by the author in view of the demand for text books in this department of study. It is an elegant volume of over 400 pages, and is adorned with several fine engravings.

SELECTIONS FROM FAVORITE PRESCRIPTIONS OF LIVING AMERICAN PRACTITIONERS. By Horace Green, M.D., LL.D. New York: John Wiley & Son, 15 Astor Place.

This is a new and excellent edition of a valuable work, to which has been added a carefully prepared toxicological table which exhibits symptoms, antidotes and tests. Published at \$2.50.

THE HISTORY OF A GREAT ENTERPRISE.—In eighteen hundred and fifty-four, the original incorporators of the WILSON SEWING MACHINE COMPANY embarked in the manufacture of Sewing Machines, and from that time to the present, their time, talent, energy and capital have been employed in making First Class Sewing Machines, with varied success attending their efforts. It being their constant aim to produce a Shuttle or Lock-Stitch Machine that should be simple to handle, durable as steel and iron could make it, with unlimited capacity, unexcelled by any other machine, regardless of name or price, and withal to confine the price within the reach of all classes of people; and success has crowned their efforts in the production of the celebrated WILSON UNDER-FEED SHUTTLE SEWING MACHINES, which combine all the Elegance, Simplicity, Durability and Strength possible for any sewing machine to attain, and they are the First and Only First Class moderate priced machines put in the market. Salesrooms, 707 Broadway, New York; also for sale in all other Cities in the United States.

Facts for the Ladies.—Mrs. John Bogert, Jersey City, N. J., bought a \$25 Wheeler & Wilson Lock-Stitch Sewing Machine, and earned enough to pay for it in five weeks, stitching linen coats. See the new Improvements and Woods' Lock-Stitch Ripper.

Burnett's Cologne Water wins for itself a favorite place on the dressing table.

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.

Dry Steam, dries green lumber in 3 days; tobacco, in 3 hours; and is the best House Furnace. H. G. Bulkley, Patenteer, Cleveland, Ohio.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, \$4 00 a year. Advertisements 12c. a line.

Situation wanted as Assayer, for any or all branches, or as Analytical Chemist. Address S. P. C., 60 W. 22nd street, New York.

Dederick's Self-tightening Crank Box, 79 Beach St., New York.

Cutlery Grindstones, equal to the best foreign, made by Worthington & Sons, North Amherst, Ohio.

\$15,000.—I will give this for the right of a GOOD "Clothes Washer." Send drawings and stamp to J. C. Miller, Pittsburg, Pa.

Bliss' Gate and Door Spring is unequalled. Send \$1.00 for prepaid samples. Agents wanted. J. Bliss, Cleveland, Ohio.

For the best Foot Power Jig Saw, address Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Manufacturers of lamps, burners, lamp goods, illuminating oils and gasoline, please correspond with T. Tully & Co., Springfield, Ill.

Steel Measuring Tapes Manufactured and for Sale by W. H. Paine, Greenpoint, N. Y. (Send for Circular.)

An experienced Patternmaker, has a good knowledge of Draughting, used to Steam Engine, Mill, and House Work, wants a situation as Foreman. Address Lock Box 59, Corry, Pa.

Patent Right for Sale—A cheap and novel "Measuring Canister." Address E. E. S., Lock Box 62, Washington, D. C.

Hexagon Iron—superior quality for screws, &c., 9 16 in. 00½, ¾ in. 09, 1 1/16 in. 09, ¾ in. 08½, ¾ in. 08, 1 in. 08, per lb. The above is price per bundle; single bars 2 cts. higher. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Glass Work for Inventors. T. Degnan, 115 Milk St., Boston, Ms.

For hand fire engines, address Rumsey & Co., Seneca Falls, N.Y.

Small second hand or new Upright or Horizontal Boiler, requiring no Brick Work, wanted for Engine 6x6 Cyl., for cash. C. Kratz, Evansville, Ind.

T. Shaw's Steam Gauges, Ridge av. & Wood st., Phila., Pa.

If you want a perfect motor, buy the Baxter Steam Engine.

Brown's Coal Yard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W.D. Andrews & Bro., 414 Water st., N.Y. Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside part.

For Tri-nitroglycerin, insulated wire, exploders, with pamphlet, as used in the Heosac Tunnel, send to Geo. M. Mowbray, North Adams, Mass.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 115 to 122 Plymouth St., Brooklyn. Send for Catalogue.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Presses, Dies, and Tanners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

In the Wakefield Earth Closet are combined Health, Cleanliness and Comfort. Send to 36 Dey St., New York, for descriptive pamphlet.

Best and Cheapest—The Jones Scale Works, Binghamton, N.Y.

If you want to know all about the Baxter Engine, address Wm. D. Russell, office of the Baxter Steam Engine Co., 13 Park Place, N.Y.

Hoisting and Pumping Engines (Locomotive principle); best and simplest, from 6 to 40 H.P. J. S. Mundy, 7 R. R. Av., Newark, N.J.

Dickinson's Patent Shaped Diamond Carbon Points and Adjustable Holder for dressing emery wheels, grindstones, etc. See Scientific American, July 24 and Nov. 20, 1869. 64 Nassau st., New York.

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

T. Shaw's Blast Gauges, Ridge av. & Wood st., Phila., Pa.

Callow's New Patent Mode of Graining Wood, Makes Painters grain all woods first class who never grained before; Likewise makes Grainers lightning fast who thumbed it out before. Address, with stamp, J. J. Callow, Cleveland, Ohio.

The most economical Engine, from 2 to 10 H.P., is the Baxter.

Wanted—A Purchasing Agent in every city and county, to supply Nye's fine Sperm Sewing Machine Oil. Put up in Bottles, Cans, and Barrels, by W. F. Nye, New Bedford, Mass.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N.J. Also 2-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

The Patna Brand of Page's Patent Lacing is the best. Orders promptly filled by the Page Belting Co., No. 1 Federal St., Boston.

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

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

The Baxter Steam Engine is safe, and pays no extra Insurance.

Self acting Screen makes 6 grades Coal, ores, &c. A State right at a bargain. Geo. Lord, 222 Arch Street, Philadelphia, Pa.

Important.—Scale in Steam Boilers—We will Remove and prevent Scale in any Steam Boiler or make no charge. Geo. W. Lord, 222 Arch Street, Philadelphia, Pa.

"Anti Lamina" will clean and keep clean Steam Boilers. No injury to iron. Five years' use. J. J. Allen, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 33 Broadway, N. Y., or Box 1809.

Boiler and Pipe Covering manufactured by the Chalmers Spence Non-Conductor Co. In use in the principal mills and factories. Claims—Economy, Safety, and Durability. Offices and Manufactories, foot E. 9th street, New York, and 132 N. 2d street, St. Louis, Mo.

Derricks built by R. H. Allen & Co., New York and Brooklyn.

For the best Recording Steam and Indicating Gauges, address The Recording Steam Gauge Co., 91 Liberty Street, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Army, 301 and 303 Cherry Street, Philadelphia, Pa.

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, \$4. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Hydraulic Jacks and Presses, New or Second Hand, Bought and sold, send for circular to E. Lyon, 430 Grand street, New York.

Shive's Patent Watchman's Time Detector—the most unerring detector extant. Price \$13. Shive Governor Co., 12th and Buttonwood Sts., Philadelphia, Pa.

T. Shaw's Hydraulic Gauges, Ridge av. & Wood st., Phila., Pa.

Kemmer's Patent Oil Frescoing—great improvement for frescoing Ceilings and Walls. Office, No. 4 Warren St., New York. Factory, East Newark, N. J.

Better than the Best—Davis' Patent Recording Steam Gauge Simple and Cheap. New York Steam Gauge Co., 16 Cortlandt St., N. Y.

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 \$1.00 a year.

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.—INDIA RUBBER BELTS.—Can an endless gum belt be made uniform in thickness and strength throughout? A substantial belt 7 inches wide and 125 feet in length is wanted.—S. S.

2.—DIMENSIONS OF AIR PUMP.—How large an air pump do I want, and at what rate of speed should I run it, to produce a pressure of 100 pounds per inch, the air to be discharged through a three eighth inch pipe, and the discharge pipe to be open all the while? How large an air chamber or receiver should I want? How much power would it take to drive such a pump?—O. O. W.

3.—FUTURE HUNTING PROSPECTS.—Can any one tell me what the West will be fifty years hence? Will there be plenty of game out there and could a man make a living by his rifle? Also, if a person had a cartridge rifle, could he find plenty of that kind of ammunition out there now, or had he better get a rifle that would use both cartridge and loose ammunition?—O. K.

4.—WELDING STEEL.—What is the proper flux to use for this purpose?—L. A. C.

5.—OXYGEN IN SULPHURIC ACID.—What number of cubic feet of oxygen gas does it take to oxidize one ounce of sulphur to form sulphuric acid?—J. T.

6.—SLOWLY DRYING GLUE.—I am doing some joiner's work which requires the glue to set or dry very slowly. Can any of your correspondents tell me how to make it do so without injuring its strength?—J. H. P.

7.—TRANSFERRING PENCIL DRAWINGS.—How can I transfer a pencil drawing on paper to box wood or type metal for engraving?—J. H. K.

8.—ACETIC ACID.—Will some correspondent inform a subscriber how to make good acetic acid on a small scale?—F. O. B.

9.—FLAVORING EXTRACTS.—Will some one tell me how extracts of vanilla and lemon are made?—E. R. T.

10.—POWER OF HEAD OF WATER.—I have a fall of 19 or 20 feet water, only 12 by 2 inches; on a 20 foot wheel, what power will it give? Which will be cheapest and best, an overshot or turbine wheel? I want to build a stone dam; how thick should the wall be? The stones are small. Is there any mortar or cement that I can use at the foundation so as to prevent the escape of any water? Please tell me how to begin and finish the dam.—J. S. C.

11.—MOUNTING PRINTS.—I wish to know if wetting (as much as will be required for the purpose of backing in map style) will injure the color of a common lithographic print? If so, is there any other cheap method of preserving it? What is the most pliant and best material for backing? What is a good varnish for the face of the print? Will soaking blue common ink writing? If so, is there anything with which either it or a lithograph may be treated to fix the colors? I have two lithographs and another paper, with considerable writing on it, which I desire to back and mount in map style.—E. D. W.

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, taken paid for as advertisements at 100 a line, under the head of "Business and Personal."

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

TEMPERING MINERS' PICKS.—J. A. C. will find full directions on page 179 of Vol. XXV. of the SCIENTIFIC AMERICAN.

STAINING GUN BARRELS.—To S. G.—We have recently given full information on this subject. See pages 217 and 290 of the current volume.

TEMPERING STEEL SPRINGS.—To L. G.—Your question has been answered by several correspondents during the last few months. See pages 300, 349, and 313 of the current volume.

J. C., of W. Va.—The mineral you send is mica schist, of no value. No metal in it.

W. O. H., of Miss.—I enclose you an insect picked up in a room which had been for some time unopened. Please let me know what it is. Answer: The "insect" appears to be the puparium of a gray colored fly, whose "rat tailed" larva has a long respiratory tube. The species is *Merodon bardeus* (Say).

DIFFERENTIATION OF FOCI.—How should the lenses of a portrait camera tube be set so that the chemical focus and the light focus will be coincident? Can a tube that has these foci at different distances be remedied? And how? I noticed a few days since that, in taking a view of a house with a portrait lens, using a stop three inches in diameter, when the plate was developed there was a circle in the center of about three times the diameter of the stop, over which there was a greater deposit of silver than over the rest of the plate. How can this be prevented? Is there any combination of lenses that will present the image on the plate in the camera in its true position, that is, that will form a non-reversed picture? If so, what is the combination?—X. P. M. Answer: When the lenses of your portrait camera are truly achromatic, the chemical focus and the light focus will coincide; if they are not truly achromatic, or are so only in name, by the defective relations of the curves of the flint and crown glasses, they cannot possibly be made to coincide. This is entirely the business of the maker of the lenses; you cannot correct this by setting. All that you can do is to find out how far the chemical focus is in front of or behind the light focus, and when you have focused with the ground glass, to set your prepared plate so much forward or backward. In some cameras, the maker has done this by means of difference in the position of the ground glass and the plate holder, and you may correct your camera box in the same way. The new excellent landscape lenses of Lindmayer of Philadelphia, and many German lenses made in imitation of his, are not achromatic, and it is not claimed that the two foci coincide, but the picture is made in the chemical focus. The spot in the center of your picture, which you so admirably describe, is well known among photographers and called "the ghost;" it is a common defect in the lenses and cannot be prevented; all that you can do is to modify things so as to make your ghost as slight as possible. When the spot is between the lenses at the right place, the ghost is at its minimum. There are combinations for making a non-reversed picture, namely, a metallic reflector (in front of your lenses, placed at an angle of 45° with the axis of your camera tube), the so-called prism with total reflection, or a mirror inside the camera box, etc.

PARIS GREEN.—Query 2, page 330.—Paris green is known in chemistry as Scheele's green. It is an arsenite of copper, and is made by dissolving one part of common white arsenic (arsenious acid) and three parts of carbonate of potassium in fourteen parts of water and adding the mixture to a boiling solution of three parts of sulphate of copper (blue vitriol) in forty parts of water. The Paris green is precipitated.—L. L. F. G., of Mass.

CLEANING INSTRUMENTS.—To H. O. M., query 13, page 297.

—If the lacquering is badly spotted, clean it off with strong alcohol, and then polish the brass or German silver with the following paste by means of flannel and a little water, and polish off with clean chamomile leather or cotton cloth and a little whitening, after which you might revarnish with shellac dissolved in alcohol, colored with a little dragon's blood, which can be got from any apothecary: Soft soap, 3 ounces; sweet oil, 1/2 ounce; turpentine, 1/2 ounce; powdered rotten stone, 4 ounces; finest flour emery, 1 ounce; fine powdered crocus of antimony, 1/2 ounce. Melt the soap, oil, and turpentine together, add the powders, a little water to make a stiff paste, and mix well.—E. H. H., of Mass.

CONCRETE WALLS.—T. D. D., query 13, page 297.—Boil linseed oil over a fire for two or more hours until it forms on cooling a tough viscid mass. If while hot, or thinned a little with benzine, this is painted over the walls, I think you will find your trouble relieved, as the composition will form a perfect waterproof coating. In boiling the oil take care that the fumes do not catch fire; but if they do, put a sheet iron or tin or a thick wet mat or piece of carpet over your pot; so shut out the air and extinguish the flames. On no account throw in water. Be provided and ready for the emergency.—E. H. H., of Mass.

BENGAL SIGNAL LIGHT.—Query 2, page 313.—A white Bengal light, very powerful, is composed of saltpeter, 31 parts, sulphur, 10 parts, antimony, 3 parts, and slacked lime, 4 parts.—A. V., of Mass.

SULPHATE OF MERCURY.—F. G. V., query 1, page 297, may dissolve the metal in diluted nitric acid, and precipitate the sulphate from the solution by the addition of sulphuric acid.—E. H. H., of Mass.

GALVANIZED IRON VESSELS FOR MILK.—W. P. T., query 7, page 297, will find that the lactic acid in the soured milk or cream will act upon the zinc surface of the vessels, thus rendering the fluid poisonous. Earthen or enameled iron pans are every way better (excepting the liability to breakage) than zinc or tin. Polished iron is not so easily acted upon as the two former metals.—E. H. H., of Mass.

GALVANIZED IRON PIPES.—B., query 11, page 297, would be less liable to occasion zinc poisoning if the lead and brass connections were out of the way, for they in fact will act as the other element of a galvanic battery, the water forming the electrolyte and taking up the zinc. The amount of action of the water upon the zinc will depend partly on the salts it has in solution. Total prevention of the contamination of the water by the zinc will be almost impossible, but constant changing will lessen the evil. Antidote for zinc poisoning: Clear the stomach by an emetic, then use albuminous drinks, and the administration of tannin in ten grain doses.—E. H. H., of Mass.

PREPARING FABRICS FOR PAINT.—To F. O. L., query 21, page 308.—Paint the cloth with thin flour paste, and allow to dry. It need not render the cloth very stiff.—E. H. H., of Mass.

GROVE'S BATTERY.—Query 10, page 313.—The zinc cylinders of a Grove's battery should be amalgamated with mercury. All that is necessary is to clean them by immersing them in dilute sulphuric acid of the same proportion as that used in the battery (eight parts water and one of acid is good), and then pour over them mercury, keeping them constantly wet with the acid. Sometimes a little rubbing with a coarse rag will hasten the amalgamation. When once coated, a little mercury kept in the cup with the zinc will keep them bright. The zinc cylinder should have about twenty-four times the area of the platinum. J. C. G. will need for his arrangement a strip of platinum 8 inches long and 1/2 inch wide, if his acid touches only the inside of the zinc, and twice as wide if it touches both sides. To give needed strength, however, the platinum should be at least 1/2 inch wide, and should extend nearly to the bottom of the porous cup. The porous cup should be as large as can be put into the zinc cylinder readily.—L. L. F. G., of Mass.

PRESERVATION OF TELEGRAPH POLES.—H. R. R., query 9, page 313.—I have for some time been paying attention to this; and my opinion is that neither tarring nor charring them is done with satisfactory results. The best mode of preserving them is coating their ends with soluble glass. This method is not very expensive, and is proof against worms, as they cannot make their way through the glass; it is also proof against the decomposition of wood by moisture, as soluble glass does not melt at any ordinary temperature. If H. R. R. were to try this method, I think he would find it answer. Any chemist will tell him the mode of preparing soluble glass.—C. A. S., of O.

GROVE'S BATTERY.—Query 10, page 313.—J. C. G. is entirely wrong in supposing that the amalgamated zinc for a Grove battery is a mixture of zinc and mercury. The zinc is merely coated with mercury to prevent rapid and uneven action of the acid upon the zinc. Plunge the zinc in a bath of dilute sulphuric acid, dip it into a vessel containing mercury and water so that the mercury may cover the whole zinc; then, with a stiff brush remove all superfluous mercury. This is amalgamated zinc. His zinc cylinder should be open at both ends. The porous cup need not be larger than two inches in diameter for the size of zinc named. Platinum a quarter of an inch wide, thick as ordinary writing paper, is sufficient. He can buy a cell much cheaper than he can make it.—S. J. H., of Ala.

Recent American and Foreign Patents.

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

APPARATUS FOR SUPPLYING LOCOMOTIVE TENDERS WITH FUEL.—Henry C. Land, of Garlandville, Miss.—This consists of a platform or frame, on which the wood or coal is placed. To its lower side, at or near its central line, is pivoted the upper end of a frame, by which the platform is supported. The lower end of this frame is pivoted to a base frame or other suitable supports. Inclined rods are pivoted to the forward part of the lower side of the platform. The lower ends of the inclined rods are pivoted to the base frame, a little in the rear of the lower end of the pivoted frame, so as, when the frame and platform are swung forward, to tip or incline the platform and discharge the fuel into the tender. A strong upright frame is rigidly attached to the base frame just in the rear of the swinging frame, and by various appliances attached to the former the movements of the latter are controlled. The apparatus is designed to be placed at the side of the railroad track in such a position that the fuel may be discharged from the platform directly into the tender standing upon the track.

PICKLE AND CRUET STAND.—Thomas Leach, Taunton, Mass.—1st. The invention consists in a new pickle stand, provided with a hollow seat for pickle vessels, attached to and placed between two uprights, and provided also with a horizontal flange on which is fastened a vertical handle that straddles said hollow seat diametrically; 2dly, in extending the said horizontal flange, and recessing the extension so as to form a compound pickle and cruet stand; and 3dly, in combining, in one article of table furniture, a pickle and cruet stand.

WASHING MACHINE.—William G. Knowles, Jamestown, R. I.—This invention relates to a new washing machine in which a reciprocating slotted washboard is arranged to move on spring rails under and against friction rollers that hang in a spring frame. The goods pass down through the slot in the washboard into the suds, and are drawn through the washing apparatus by the friction exerted against the rollers by the reciprocating washboards.

WINDOW BLIND SLAT.—Alois Kohler, Williamsburg, N. Y.—This invention relates to the peculiar form of the slat. It may be made with any suitable molding upon its face. In cross section, the lower side of the slat presents a curved groove in front and a projection or heel in the rear; the upper side presents a tongue and a rear recess. These parts correspond, and will fit into each other when the slats are placed one over the other, forming a perfect joint.

APPARATUS FOR ELEVATING AND IMMERGING VESSELS.—Justin Jacobs, of West Salem, Wis.—This invention relates to a new device for application to river steamers, canal boats, and other vessels, and has for its object to prevent their sinking in case of a dangerous leak, and to cause their submersion in case of fire. It consists in the arrangement of vertical slides, which extend through the bottom of the vessel and are let down to serve as supports for the same on the ground whenever there is danger of the vessel sinking, also in the combination of these elevators with gates, which, when opened, let water into the vessel to sink it in case of fire.

ARMORED CAN.—William F. Thompson, of Toledo, Ohio.—This improvement consists, first, in armor sheet metal cans with wood to protect the thin metal from injury in handling and transporting, by fastening side, bottom, and top pieces, or boards to the can by means of clamp plates, soldered or otherwise fastened to the corners of the can, and the ends bent over the edges of the boards after they are applied, whereby much is saved in the cost of the wood case or protecting armor, which up to this time, has been first made into a box, into which the can was placed and inclosed by a cover; and, secondly, it consists of an arrangement of the nozzle in one corner of the can, which is sloped off to make room for arranging it so that the top will not rise higher than the top of the can, to admit of so applying the armor on the top.

TOBACCO DRYING HOUSE.—John C. Streeter, of Hinsdale, N. H.—This invention relates to the process of drying tobacco and other articles, and consists in the provision made for suspending the article to be dried, and in the use of metallic supports, connected with the building frame. The suspending wire is bent round the rod so as to enclose it in a loop, and the two ends of the wire are passed around the tobacco and again bent at an acute angle over the top of the rod. These metallic supports or rods are placed at proper distances apart, and are arranged at right angles with each other, so that they support the frame in each direction.

GRAIN SCREEN.—David D. Schamp, of Pleasant Run, N. J.—This invention has for its object to improve the construction of the delivery spouts of thrashers and grain separators, so as to more thoroughly clean the grain before it is delivered into the receiving box or half bushel, and which shall be simple in construction and convenient in use. The spout is made with flanges along the upper edges of its sides to adapt it to be slipped into a groove formed for it in the shoe of the machine, so that it may be shaken by and with the shoe. The bottom of the spout is made of wire cloth or perforated sheet metal, to form a screen through which the dust and fine seed may escape, while the grain passes down the screen and escapes from the outer end of the spout. If the spout were left open, the part of the grain that fell upon it near its lower end would scarcely be screened at all. To remedy this a plate is placed, in the upper part of the spout near its lower end, to receive the grain and guide it to the upper part of the screen, so that it may pass over a longer portion of the screen. The outer end of the spout is extended fourteen inches and has a screen formed in or attached to the inner part of its bottom, of such coarseness as to allow the grain to pass through, while the straws, heads, etc., which may be in the grain will slide over the screen and will drop from the outer end of the spout.

BALING PRESS.—Commodore J. Barney, of Rockport, Ind.—This invention has for its object to furnish an improved press for baling hay, straw, cotton, and other substances required to be put up in bales, and which shall be simple in construction, convenient in use, and effective in operation, enabling the work to be done much quicker and consequently much cheaper than when an ordinary baling press is used. The upright frames, which form the baling box, are securely connected by cross bars between which the doors for the removal of the bale are placed. Two followers work up and down toward and from each other in the baling box. To their outer sides are pivoted, respectively, the inner ends of bars, the outer ends of which are pivoted to levers. The outer ends of these levers are pivoted to the base frame and top frame near the outer vertical frame, and their inner ends are connected by a rope arranged with suitable machinery for compressing them. By this arrangement the levers operate upon the followers in the manner of a toggle joint, the bars coming nearer and nearer to a vertical position, and thus acting with more and more power as the bale becomes more and more compressed.

PUNCH AND DIE FOR FINISHING UMBRELLA STAFF COLLAR.—Robert Marshall, of Philadelphia, Pa.—The objects of this invention are to lessen the hand labor now required to finish umbrella staff collars in the lathe and to secure their being made to a standard size, which is accomplished by finishing the exterior of the casting in dies, and sizing the hole by means of a painted mandrel rising through the lower die.

SPADE.—Jeremy Lake and Andrew W. Elliott, of North Easton, Mass.—This invention relates to a new spade which will enter the ground with greater ease than those now in use. A notch is cut into the blade of the spade at the middle, and extends from the lower edge about half way up the length of the blade. The blade has thus the shape of an inverted letter U. Its lower cutting edges may be slightly rounded, or straight. A spade thus made will, with less difficulty, cut through the ground, and will crumble the soil with less effort than the full bladed spades, though it has sufficient surface not to break the clods while it supports the same.

SOLDERING TOOL.—John A. Tillery and Samuel A. Ewalt, Baltimore, Md.—The invention consists: 1st, in making a soldering tool adjustable radially from a hinge joint, in order to adapt the same tool to be used with caps of varying size; 2dly, in moving said tool out and in, and fixing it at the same time, at any point of adjustment, by means of a loop headed screw through which passes the holder. The advantages of this tool consist: 1st, in the arc shape by which it can be seen at a glance what point has been left unsoldered or imperfectly soldered. 2dly, in the facility with which such defects can be remedied without removing the tool; 3dly, in the option that it allows of using either wire solder, or the cheaper drop solder, thereby saving one half the expense.

ILLUMINATOR.—Chas. F. Jacobsen, New York city.—The invention consists in combining glass plates, a flanged metallic case, a flanged metallic rim, two concave reflectors and a pair of burners, so as to form a new double night sign. By this construction the name of the business man and his special occupation or class of goods are displayed with great clearness and the attention of the public unfailingly attracted.

PLANTER.—Weisel Beall, of Hainesville, W. Va.—This invention consists in introducing certain mechanical elements into the train of mechanism which connects the axle with the seed slide of a planter, by which the number of hills planted may be indicated on a dial with which it is combined. This implement is quite ingenious, but cannot be fully explained without an engraving and lengthy description.

COTTON PLANTER.—John A. Pope and William L. D. Pope, of Charlotte, N. C.—This invention has for its object to furnish an improved machine for planting cotton seed, distributing guano or other fine fertilizers, which shall be simple in construction, convenient in use, and effective in operation. Its principal features are the combination of a perforated platform, plates and feeder within the hopper, together with a stirrer, by which the seed or fertilizer is stirred up and made to pass through the holes in the plates on its way to the discharge spout. The seed is covered by adjustable covering plows.

REVERSIBLE SHADE FIXTURE.—William B. Hazard, of Philadelphia, Pa.—The object of this invention is to permit the adjustment of window shades in either direction, so that a shade can be placed opposite any one part of a window wherever it may be required. The invention is more particularly useful for photographic establishments, hothouses, etc., where the rays of light are to be controlled with great exactness. It consists in the arrangement of a sliding spring roller supported on wire tracks and connected with a cord, whereby it can be drawn up, while the lower end of the shade has another cord, whereby it can be drawn down.

CALENDAR.—Robert C. Ogden, of New York city.—This invention relates to calendars which have a sheet, leaf, or tablet for each month, hinged or fastened together and to the back, so that any one month may be exhibited to view by dropping that or another leaf, sheet, or tablet down; and it consists in forming the hinge or connecting device of a single wire, bent at the ends into loops of a peculiar form standing at right angles to the wire. By this construction, the calendar will rest daily against the wall when it is hung up, and the sheets can be attached and moved much easier than if plain rings were used.

BOOT FOR HORSES.—Patrick Murray and Frederick Koch, of Morrisania, N. Y.—This invention has for its object to provide a yielding but nevertheless powerful boot for horses, whereby the muscles and tendons in the lower limbs near the hoof will be protected. A strap is made of leather, or other suitable material, long enough to fit around the horse's leg, and as wide as the section to be protected is long. A cushion is formed in the strap, and a section of rubber or other equivalent elastic material also secured therein. The cushion, which is made of suitable soft material, projects on the inner side of the strap, and is, by means of the elastic, drawn against the portion of the horse's leg which is exposed to the strain. Being thus held in contact with the parts most exposed, the cushion serves to brace or sustain such parts and protect them from injury. The strap is, by buckle, buttons, or otherwise, fastened around the horse's leg. The elastic makes it also self-sustaining. The device can also be used as an "interfering boot," to prevent the animals from injuring their limbs by striking them against one another.

APPARATUS FOR TEMPORARILY INCREASING THE PRESSURE IN GAS PIPES.—George S. Dunbar, of Pittsfield, Mass.—This invention furnishes an improved device for attachment to the pipe leading from the gas holder to the street main, or from the street main to the building, to enable the pressure to be temporarily increased. The drip box or trap attached to the main pipe is provided with a valve and a compressing apparatus in the following manner: The end of the part of the pipe that leads to the gas holder is provided with a valve which opens into the drip box. With the top of the drip box is connected an open pipe which passes up the central part of a cup or receiver, in which is placed water or other liquid to serve as a seal to the open bottom of a gas holder placed in it. With this construction, when the holder is raised, it will be filled with gas at the same pressure as it has in the main holder and in the pipes. When the holder is forced down, the gas in the holder will be forced out, closing the valve and temporarily increasing the pressure in the pipes, so as to operate as a device for lighting and extinguishing street lamps and burners.

DOOR CHECK.—William Overton Clough, of Lexington, Ky.—This invention has for its object to furnish an improved device for checking a door when opened, and holding it while open, so that it cannot swing about and slam. The box or case of the device is made in two parts. One part is made thick, and is recessed to receive a catch bar. The other part is made thin, and is designed to cover and protect the catch bar. The inner end of the catch bar is rounded off, and fits into a round recess in the body of the thick part. Upon the forward side of the catch bar are formed two catches. The forward side of the forward catch is inclined, so that when the door strikes against it the catch bar may be pushed back, allowing the door to pass the catch. The other or rear projection is intended to stop the door after it has passed the first catch. Upon the forward end of the catch bar is formed a toe piece, which projects through a slot in the end of the case, so that the catch bar can be readily pushed back with the foot to release the door and allow it to be closed. The catch bar is held forward by a coiled wire spring. The case should have holes or lugs to receive the screws by which it is secured to the door. The door has a small metallic plate attached to it, projecting a quarter or half an inch, which is designed to operate upon the catch. This enables the holder to be made smaller, and consequently cheaper, than it could be if it had to operate upon the body of the door itself.

LAND ROLLER.—Holloway W. Matthews, of Frenchtown, N. J.—This invention relates to a new manner of connecting the back frame of the third roller to the main or front frame holding the two front cylinders of a land roller. The object is to permit the application of a limbered tongue, whereby much strain is taken from the horses' necks. An L shaped bar connects the front and back frames. This bar has a long horizontal arm which is swiveled in the middle of the front frame, and extends backward under the middle of the back frame. A short vertical arm projects upward from the same, and is swiveled in the front of the back frame. This arrangement permits the frame to swing to either side on the short arm, and to incline to either side on the long arm, while vertically it is rigidly connected with the front frame. Up and down the frames will swing as though the two were one, while in every other direction the back frame has independent play. The tongue can therefore be limbered to the frame.

LIFTING JACK.—R. T. Smart and R. T. Smart, Jr., of Troy, N. Y.—This invention consists of a stand, of any suitable kind, with a long vertical slot in the upper part, and a series of transverse notches in one side crossing the slot. A lifting bar, having one end fitted to work freely in the slot, is connected, by a pivot pin, with a pair of links, one on each side, which pin projects at each end beyond the links to lie in the notches. These links extend downward in the slot, and through to the other side, and have a lever suspended in the lower ends by a pin projecting at the ends to bear against the side of the stand, opposite the one having the notches, to hold the lever against being forced back by the weight. The short arm of the lever curves upward slightly, and is rounded and shod with a metal strap or plate to act against the lower side of the lifting bar, which lies upon it. The lifting bar has a notch on the under side, into which the end of the lever comes when the load has been lifted high enough, and by which the lever is locked self-actingly, to sustain the load without other fastenings, but so as not to prevent being unlocked or disconnected readily when the load is to be let down again by the raising of the long arm of the lever. The lifting bar and lever are readily adjusted to the height of the axle or other load to be lifted by shifting the pins to the different notches.

ASH SIFTER.—George F. Millard, of Pittsfield, Mass.—This invention consists of a wide flat bottomed sieve, with oval sides and open top, suspended on a cranked shaft, which drops, through slots, from the top of a case into bearings in two sides of the case, low enough for a cover of the case to close down and confine the dust while the sifting is going on. When the ashes are sifted out, the sieve is taken out of its case to empty the coal remaining in it. The ashes which accumulate in the bottom of the case are discharged through the top from time to time, as required, by turning the case over. The sieve is swung forward and back by the crank, and, by reason of its flat bottom and oval sides, gives a quick forward and back motion to the contents, and as quickly arrests the same by the oval sides in a manner well calculated to do the work quickly.

LAMP SNUFFER AND EXTINGUISHER.—Marcus L. Battle, of Bainbridge, Ga.—This invention consists of a snuffing blade, which is mounted on the top of the vertical portion of a cranked wire pivoted near one of the narrow sides of the wick tube. In the vertical plane of the largest diameter of said tube, and having a handle portion projecting outward from the base of the lamp top for swinging the blade over the top of the tube and back again for snuffing it when required; the wick being first drawn down slightly, so that only the completely burned portion will be snuffed off. The extinguisher consists of a little plate hinged to the rear of the snuffing plate, and curved on the other edge, so that when the snuffer plate is moved over the top of the tube it will swing upward, unobstructed by the cone of the burner, to the horizontal plane of the snuffer and be moved over the flame so as to extinguish it; and when the snuffer is moved back the said extinguisher will swing down again, so as not to strike against the cone or the supports thereof, and thereby obstruct the complete withdrawal of the snuffer.

BREAD CUTTER.—Samuel H. Martin and John S. Williams, of Mount Vernon, N. Y.—This invention has for its object to furnish an improved bread cutter, simple in construction and effective in operation, enabling the freshest and softest loaves to be easily and smoothly cut, and which may be also used to contain knives, forks, spoons, or other articles required about a table; it consists of a rectangular box, which is divided into three compartments by partitions. The rear partition extends up to the top of the box, and to its upper edge is attached a narrow board, to the edges of which are hinged the covers. To the front cover, near its rear or hinged edge, is attached a flange to rest the loaf of bread against while being cut. In one side of the box is formed a narrow compartment to receive the knife, the edge of which is concave. To the forward or free end of the knife is attached the handle by which it is operated. The rear end of the concave edge of the knife is made with a sharp angle, which may be forced through the crust in beginning the cut. The rear end of the knife is made wide, and to the opposite sides of its lower part are pivoted the lower ends of two short parallel bars, the upper ends of which are pivoted to the sides of the cranks that form the knife compartment or slot near their upper edges. This construction gives the knife a free movement, enabling it to operate

upon the bread with a drawing cut. The device may also be used for shaving dried beef, which may be cut readily and quickly by giving the knife a sawing movement.

CAR COUPLING.—Courney B. Servoss, of Wilmington, N. C.—This invention consists of a pair of jaws within the drawhead, closing together or nearly so behind their pivots by the action of springs to engage behind the shoulders of the coupling bar, which couples with them self-actingly when the head and shoulders are forced in beyond the end of said jaws. These jaws are so pivoted in cavities in the drawhead that the drawing force is expended on said cavities and not on the pivots of the jaws, and they are provided with arms projecting through slots in the sides of the drawhead, which are acted on to open the jaws and uncouple the car by inclines on vertical bars hanging one on each side of the drawhead from a cross bar, to which a lever is attached extending toward the side of the car, where it can be reached without entering between the cars; and this cross head rests by a vertical rod on the end of the coupler to hold it level to enter the drawhead of another car; also, to cause the uncoupling of the cars self-actingly in case one runs off.

BALANCED SLIDE VALVE.—Charles H. Hutchinson, of Concord, N. H.—This invention relates to that class of balanced valves which are made in two parts, one working on the valve seat and the other on the under side of the top of the steam chest, to prevent too much down pressure, and one of the parts working in and out of the other steam tight. The first part of the invention consists in having the parts of the valves thus working together of rectangular form, corresponding to the flanges, so that the down pressure will be alike throughout the valve from end to end. The second part consists of a novel arrangement of the packing for said parts, whereby it is adapted to such forms, and may be accurately fitted in a simple and economical manner; and the third part consists of the application of an exhaust valve, which opens to withdraw the steam from the interior space of said slide valve in case the packing leaks, but which closes when steam is shut off and the engine continues to run.

TOBACCO BOX.—Wilson C. Thomas and Edwin T. Pilkinton, Richmond, Va.—The invention consists of a tobacco box having body formed of a cylindrical sheet of isinglass, and bottom and top of stiff paper, flanged so as to embrace and support the body. It forms a box cheap, easily made, and yet strong enough to bear handling and transportation.

SOLDERING IRON.—Herrman S. Baroni, Cincinnati, Ohio.—The invention consists in providing a soldering iron with a hydrocarbon reservoir, a vaporizer, a combination socket, and means for expelling the fluid in the reservoir by elastic force.

SOLDERING IRON.—John A. Tillery, Baltimore, Md.—The invention consists in centering the soldering tool with a rod which has an end tube provided with a side aperture, so that while the soldering tool is itself enabled to move in a perfect circle, the air from within the can can still freely escape.

PREPARING HORSE RADISH.—Joseph D. Husbands, Jr., St. Louis, Mo.—This invention consists of a new article of manufacture for food, medicinal, and other purposes, the same being delicately and powdered horse radish, either alone or in combination with other condiments of salt, pepper, mustard, or spices, or other articles that will improve its flavor. The roots are desiccated in any approved way, and then ground or pulverized by any approved means, and packed together with the said condiments or not, as wanted.

WASH BASIN.—Jordan L. Mott, Mott Haven, N. Y.—This invention consists of a water closet and wash basin combined in one apparatus for use in prisons. The water closet basin and the wash basin are hinged together so that the wash basin rests on the top of the water closet basin and forms the cover thereof when in the position for washing; but when the water closet basin is to be used, the wash basin swings up and backward. This plan is calculated to economize considerably in the cost of plumbing, and simplifies the apparatus considerably, which is desirable for prisons and institutions.

PIPE WRENCH.—William C. Westerfield, Fairbury, Ill.—This invention relates to a new self-acting wrench for cylindrical bodies, and consists in the combination of serrated jointed jaws with a slotted shank in the operating lever, wherein the end of one of the jaws is allowed to slide and to thereby obtain the desired self adjustment. When the lever is moved upward it brings the serrated inner faces of the jaws nearer together, thereby grasping whatever object is between them, be the same cylindrical or of other form. The motion being continued, the object will be turned with the instrument, as intended. When the instrument is reversed, it will operate when the lever is swung downward. The invention is also applicable to the moving of railroad cars and other purposes.

BABY WALKER.—George Euell, Guttenburg, N. J.—This invention relates to a new construction of baby walker, and consists in making the same of two jointed annular frames connected by upright stays. Each of the rings is made in two equal parts, that are hinged together and locked at their opening ends by suitable spring catches. The lower ring is supported on legs which are rigidly connected with it, and which may also extend up to the upper ring. Caster wheels are applied to the lower ends of the legs. A handle, cushioned at the ends, is applied to the upper ring. A seat is connected with the lower ring, and made vertically adjustable, by means of a screw, to the size of the child. The rings are swung open whenever the child is to be inclosed, and are then locked together, confining the child, but allowing it full freedom of motion and action.

MARKING POT.—Jerome L. Tarbox, New York City.—This invention has for its object to furnish an improved marking cup, and is so constructed as to serve as a can for the ink and a cup for marking. Over the ink reservoir is a sponge compressed between two perforated metal plates. On this the brush may be rubbed when required, while the superfluous ink flows through into the reservoir. It is a convenient article.

FUSE.—George F. James, Manchester, England.—This invention relates to an improved fuse and a machine for making it, which cannot be explained in detail without the aid of a drawing. A machine similar to the ordinary circular braiding machine is employed, and is supplied with a hollow central spindle, above which is a self-acting feeder for placing the powder or other explosive compound in the interior of the braid. The work is drawn down the hollow spindle, instead of being passed upward as in ordinary braiding.

STEAM GENERATOR.—William V. McKenzie, Rahway, N. J.—This invention consists of a vertical cylinder boiler with vertical flues mounted in a sheet metal cylindrical shell with a furnace below; the cylinder is larger than the water boiler, so as to have an annular fire space surrounding it; the shell is jacketed on the sides above the surface and at the top, to economize the heat; the whole constitutes a simple, cheap, and efficient portable steam generator for cooking food for stock, and for other purposes.

HANDLE STRAP FOR TRAVELING BAGS.—Arthur Alexandre, New York City.—This invention has for its object to furnish an improved fastening for the handle strap for which letters patent were granted to the same inventor September 26, 1871. The strap is secured to the bag by rings, and is long enough to pass over the shoulder. In the center is a short length of strap to make the handle part thicker, and at each end of the thickened part is secured a short strap at right angles to it. The end parts of the long strap are doubled and carried through the rings up to the middle, forming a triple ply. The short straps are then passed round the long strap and fastened by eyelets to buttons on the long strap. To change the strap from a hand strap to a shoulder strap, all that is necessary is to unfasten the fastenings, when the weight of the bag will draw the folds of the strap through the rings, and expand it to its entire length.

RAILWAY TIE.—Edward J. Fenn, of Medina, Ohio.—This invention has for its object to furnish an improved railroad tie, which shall be so constructed as to form a continuous road bed, which shall be stronger and more durable than ordinary and form a smoother track; it consists in the construction following: Two inch planks of the length of ordinary ties are set on edge and arranged in pairs, the ends of the planks of each pair being securely bolted or spiked to the opposite sides of blocks twelve inches long. The outside planks of each adjacent pair are bolted or spiked to the opposite sides of blocks eighteen inches long, which are arranged upon the line of the rails, and are designed to have the rails bolted to them. This tie would have much more ground surface than the ordinary tie, and would consequently be much less liable to settle or get out of place.

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5,900.—CARPET.—J. Barrett, New York city.
5,901.—SEWING MACHINE BCD.—W. G. Beckwith, Newark, N. J.
5,902.—CARPET.—E. Demoussy, Paris, France.
5,903.—COOKING RANGE.—J. Magee, Chelsea, Mass.
5,904.—OIL CLOTH.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
5,905 to 5,912.—FLOOR CLOTHS.—C. T. and V. E. Meyer, Lyon's Farms, N. J.
5,913.—TEA SERVICE.—W. Parkin, Taunton, Mass.
5,914 and 5,915.—HITCHING POST.—R. Wood, Philadelphia, Pa.

TRADE MARKS REGISTERED.

821.—YEAST.—Fleischmann & Co., Riverside, O.
822.—TABLE SAUCE.—Halford Sance Company, Boston, Mass.
823.—SMALL BEER.—J. N. Hammond, Wayland, Mass.
824.—OILING APPARATUS.—S. Hutchinson, Jr., Salem, Mass.
825.—TEA.—S. A. King, New York city.
826.—PRINTING PRESSES.—V. E. Manger, New York city.
827.—OILS, ETC.—J. C. Moore & Co., Philadelphia, Pa.
828.—CLOTHING AND FURNISHING GOODS.—J. Seligman, Pontiac, Mich.
829.—SODA WATER.—S. F. Simes, Philadelphia, Pa.
831.—WHISKY.—E. Walters, Baltimore, Md.
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20,777.—CARTRIDGE.—G. W. Morse.....	June 12, 1872.
21,185.—STEAM HEATING.—H. G. Bulkeley.....	July 31, 1872.
21,194.—CUTTING MITERS.—S. W. Hall.....	July 31, 1872.
21,207.—REAPING MACHINE.—C. W. and W. W. Marsh.....	July 31, 1872.
21,233.—CARPET SWEEPER.—H. H. Herrick.....	July 31, 1872.
21,272.—METALLIC BALE TIE.—I. C. Plant.....	August 7, 1872.
21,286.—TEMPERING WIRE AND STEEL.—H. Waterman.....	August 7, 1872.
21,331.—BRACELETS.—F. M. Sweet.....	August 14, 1872.

EXTENSIONS GRANTED.

28,512.—CAR WHEEL.—S. P. Smith.....
20,238.—SASH FASTENER.—F. W. Brockseper and J. B. Sargent.....
20,235.—WORKING SHIPS' SAILS.—S. Very, Jr.....
20,227.—HARVESTER.—J. S. Troxel.....
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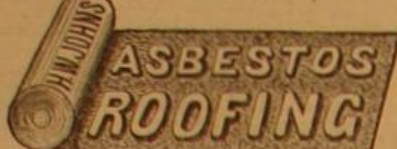
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