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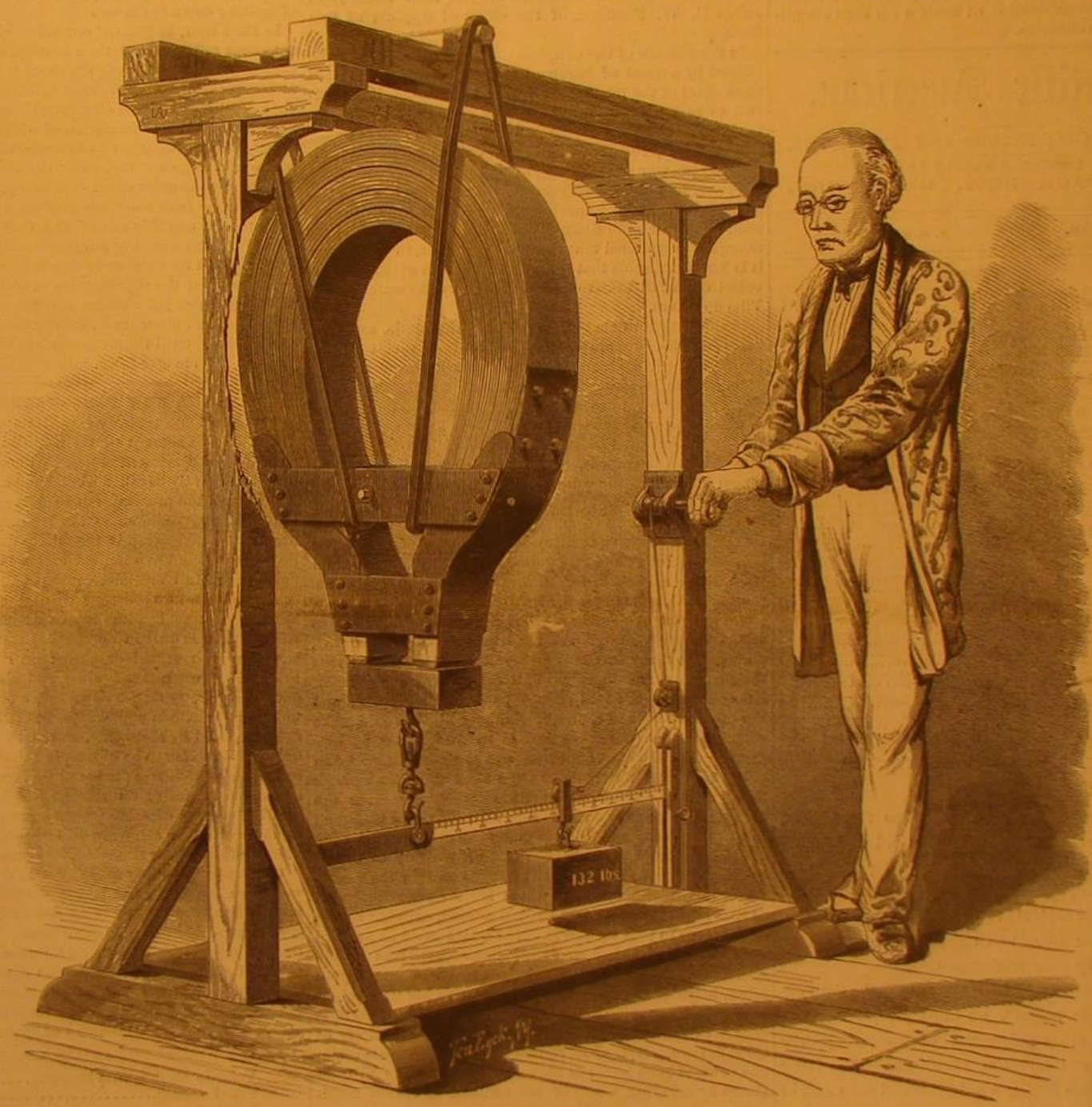
THE JAMIN MAGNET.

It is a well known fact that a compound magnet, formed of a number of plates or layers, each of which is separately magnetized, is possessed of a greater portative force, that is to say, will carry a heavier load than a simple homogeneous magnet of equal weight. Generally, however, it has been heretofore considered that this portative force is, as compared with the weight of the magnet, quite small, and Hacker has established a formula showing that the load carried is equal to a constant (depending upon the method of magnetization) multiplied by the cube root of the square of such weight. Thus, to illustrate, while a magnet weighing one pound will exercise a portative force of ten pounds, a second one, similarly magnetized, weighing eight pounds, will, according to the formula, only lift forty pounds.

Up to the present time the manufacture of magnets has been principally pursued at the city of Haarlem, in Holland, and to the Dutch workshops it has been customary for scientific men of all countries to repair, when powerful apparatus of this description became needed. In spite of the brilliant researches of Coulomb, of Biot, and others, but little has been definitely determined regarding the laws governing the construction of magnets, and notably in reference to their dimensions in order to attain a given power. The manufacture has been, in fact, more a matter of experience and individual skill than of established rule. For some time past, however, investigations have been in progress at the French Academy of Sciences, and M. Jamin has succeeded in not only providing magnets of most extraordinary powers, but also in deducing laws for their construction and for determination of their capabilities, thus adding data of the highest importance in elucidation of a department of physics regarding which, it may be safely stated, we know less than of any other branch.



THE JAMIN MAGNET.

Before entering upon a brief abstract of the principles governing M. Jamin's researches, there are two words which we shall employ, and which may need a previous explanation: first, by a "contact" we mean a piece of soft iron brought into juxtaposition with a magnet; and, second, by "dissimulation" is understood the temporary neutralization of the magnetism of one body by that of another when the same are together, so that, on their being drawn apart, the normal condition of each may be supposed to return.

I. When a steel plate is superposed upon a bundle of already magnetized iron (*faisceau*), the first effect is that two equivalent quantities of opposing magnetism separate in such a manner that the solenoids, which terminate at the surface of the bundle, appear to prolong themselves through the new layer, so that the magnetic power is referred to the new surface, and nothing is added to the primitive state of the magnet. But the latter produces two other actions: it repulses at its exterior the magnetism of the plate, and also determines in the plate a contrary magnetization increasing with its energy. The difference of these two actions represents the gain which the annexed layer brings to the bundle, and this at first considerably decreases with the addition of new layers, until the normal magnet results. The magnetization becomes, at a certain point, maximum, and a limit is reached, which, it may be here stated, is the inferior extreme of the portative force of the apparatus, and which, for the sake of future clearness, we shall call *f*.

II. Suppose that a contact be suitably fixed and supported, and a number of steel plates, magnetized to saturation, be separately applied in connection therewith. M. Jamin, at this point, finds that an indisputable analogy exists between the influence exercised by a magnet upon iron, and that of an electrified body upon an electrical condenser, as, for example, a Leyden jar.

The magnetisms normal to each body dissimulate each other, and the magnet and its contact constitute a true magnetic condenser. Now, in the case of the steel plates and a contact above noted, the magnetism of the first plate is dissimulated by the soft iron, so also of the second, third, and so on, until a point of equilibrium, so to speak, may be considered as reached, when, if more plates be added, a certain quantity of surplus magnetism becomes free. The plates react upon each other, lose polarity, and eventually a new limit is reached, which is the superior extreme of portative force. If, however, we remove the contact, the effect noted in the preceding paragraph takes place; the plates are subjected to their mutual influence, and the lower limit is regained. Replace the contact, remagnetize, and again the superior extreme is found. This we may term F, and it is clearly transitory and without utility, since it disappears on the first removal of the contact; and although the latter may be returned, unless re-magnetization of the plates be accomplished, the lower limit, *f*, remains constant.

III. Arranging two armatures in suitable position, M. Jamin connected his magnetized steel plates with them. If the former touched, he found that they dissimulated all the magnetism of a certain number of plates, but when separated, only a portion of this property became neutralized. In other words, the plates partially discharge each other, and lose a portion of the normal magnetism, but less than if the armatures did not exist, and still less than before they were separated. Now, by applying a contact to the armatures, a permanent portative force was determined, F_1, greater than ... and less than ... ample ... arrang... F, or th... limit ... secon... was f... 380 k... ...mes; on r... ...g the ...tact, F_1 then appeared equal to 260 kilogrammes; on displacing the armatures, *f* was reached, equal to 170 kilogrammes; on returning the armatures, F_1 was again reached, equal to 269 kilogrammes; and the difference between 170 and 260, in this example, roughly indicates the gain in permanent portative force resulting from M. Jamin's discoveries.

Lack of space forbids our entering in greater detail into the elaborate theories of the investigator. As regards the material composing his steel plates, he adduces the remarkable fact that the degree of temper, re-temper, and of annealing necessary is not uniform, and varies greatly with different kinds of steel, a circumstance which explains the hitherto great uncertainty in the construction of magnetic apparatus.

We present herewith an excellent engraving of the great magnet which M. Jamin recently exhibited before the French Academy of Sciences. The apparatus is arranged in a simple machine for testing the portative force, which consists essentially of a graduated lever, on which is suspended a weight of 132 lbs. The latter is gradually drawn toward the end of the lever by a cord, attached to a small ratchet wheel shown, in the hands of the operator, until contact is broken, when a very simple calculation determines the force. The magnet is constructed of two armatures placed opposite to each other, and each weighing 35 lbs. They are rigidly connected by heavy crosspieces of copper, and support a cubical contact of soft iron weighing 28 lbs. From their lower ends the armatures spread out and grow thinner, ending in sharp edges. Secured by screws to the exterior surfaces of both is a thin strip of steel, which takes a natural curve from one armature to the other. All the other plates previously magnetized are placed within and left to assume

a natural position, clinging to each other, as to the armatures, by their own elasticity. On using from 40 to 45 layers, it was found that the force, F, remained constant, and attained a limit of 1,100 lbs., which could not be exceeded with the conditions of armature, contact, and steel used in the experiments. Stopping at 45 plates, the total weight of the apparatus was determined to be 101·2 lbs., and its portative force 1,012 lbs., or ten times the weight. With a greater number of plates, these proportions rapidly diminished, and the power of the magnet no longer bore so high a relative value in comparison with its weight.

As to whether it will eventually be possible to obtain magnetized bars of even higher powers than thus reached, it remains yet to discover. Their utility may perhaps be questioned, or at least their direct and immediate application to scientific purposes; but the answer to this, as to every other interrogatory of the *cui bono* nature, is simply that even the most abstract of theories may, in the light of new investigation, lead to other ideas of considerable practical importance. Suffice it that M. Jamin has taught us how to construct, theoretically and practically, a magnet capable of producing the highest effect of which it is susceptible, and that it rests for inventors to apply these newly found principles toward the improvement or the origination of devices for their scientific and industrial utilization.

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Contents.

(Illustrated articles are marked with an asterisk.)

PUBLISHERS' CARD.

With the next issue of this paper, the time for which a large number of our subscribers have prepaid will expire. In order that our readers may experience no stoppage in the receipt of the journal, and that we may not miscalculate the quantity of the paper to print at the commencement of a new volume, we hope our friends will signify their intention to continue the paper by early remittances.

The plan of discontinuing the paper when the time expires for which it is prepaid, we think preferable to the course adopted by many publishers, of continuing their paper indefinitely and collecting afterwards. The latter course is too much like having a bill presented for a suit of clothes after it is worn out. We shall be gratified to have every old subscriber renew, and doubly grateful if each will send one or more new names with his own.

The safest way to send money is by postal orders, bank checks, express, or draft on New York, payable to the order of Munn & Co. Little risk is incurred in sending bank bills by mail, but the above methods are safe beyond any contingency.

THE LOSS OF THE VILLE DU HAVRE.

Another casualty at sea, which, in its terrible details, fairly rivals the horrors of the wreck of the Atlantic, has recently occurred in the sinking of the French steamer Ville du Havre while on her voyage from New York to Havre and Brest, France. She left this port on the 15th of November last, and at 2 o'clock on the morning of the 22d while in mid ocean, was run into by the British ship Loch Earn. All accounts agree in the fact that the steamer was struck amidships on the port side, the effect of the blow being to crush in her iron frame for a depth of at least thirty feet, and to cause her to plunge bow first under the waves twelve minutes afterward. Out of three hundred and thirteen people on board, but eighty-seven were picked up by the colliding vessel, and of this latter number, fifty-four were a portion of the crew, including the captain and some of the officers. A large number of the rescued went down with the ship and were subsequently found by the boats of the Loch Earn, after as long as one and even two hours drifting in the icy water, clinging to planks and spars. Several were killed outright by the crash of the collision, and others subsequently by the almost immediate falling of two of the masts. The Loch Earn experienced serious injuries about the bow, sufficient to excite apprehension as to her safety; and accordingly, on her falling in with the American ship Trimountain, the survivors were transferred to the latter vessel and by her carried into Cardiff, Wales. The Loch Earn, although spoken shortly after the disaster, has not since been heard from, and there is some fear of her loss.

The Ville du Havre, formerly known as the Napoleon III., belonged to the Compagnie Générale Transatlantique and was one of the largest ocean steamers afloat. Her length was 423 feet, beam 49 feet, depth of hold 40 feet, and tunnage 5,500. She was magnificently fitted up, and commanded by experienced officers, drawn from the regular French naval service.

The list of the lost includes a number of well known citizens of New York and Boston, several members of the Evangelical Alliance, who were returning to their homes, and Judge R. W. Peckham, of the Court of Appeals of this State.

In the absence of the complete details of the disaster, to be elicited by a court of inquiry now in progress, for which the arrival of the mails will have to be awaited, it is difficult to assign the immediate cause. That there is gross negligence and carelessness to be imputed to both vessels, there is hardly room for doubt. It was the steamer's business to give way to the sailing ship, but that the latter could not have, by proper management, lessened the shock of the collision seems very improbable. There are conflicting accounts regarding the sighting of the lights of the Loch Earn, though it is conceded that the night was clear, in which case it is hardly possible that the rapid approach of so large a vessel could fail to have been perceived by the watch of the Ville du Havre.

In this case as in that of the Atlantic, the Metis, and previous wrecks, we are again compelled to revert to that incomprehensible economy on the part of owners which sanctions the lavishing of large sums upon elegant upholstery, gorgeous furniture, and luxurious table at the expense of the provision of the simplest and best known appliances for the preservation of life. As a preventive of just such disasters as the present, there is the electric light, which, placed at an elevated position on the bow of the ship, can be seen at a distance of 15 miles, and which illuminates the surrounding space like a room. The apparatus could be driven by the main engine or donkey at an expense of four horse power. In cloudy and foggy weather or at night, the steam whistle, the ship's bell, fog horns, and the firing of guns, precautions which are never omitted on board of men of war, afford a means of signifying the position of one vessel to others in the vicinity. As for life-preserving apparatus, there are so many excellent and well tried inventions that their mere enumeration would fill columns of our journal. Every mattress on board should be stuffed with cork, and the cabin settees and chairs, if similarly filled, would make admirable supports, sure to float in the roughest sea. Life preservers of the most approved pattern should be placed in every berth, and distributed in the most prominent places throughout the vessel, in numbers largely exceeding the aggregate of people carried. Life rafts should be placed on the upper deck, and conspicuously marked so that they might be resorted to, in sudden danger, without confusion or delay. Buoys also might be arranged outside the vessel, and provided with chemicals which ignite on becoming wet, so that brilliant light might be shed around, enabling people in the boats to pick up others. The buoys could be fixed so as to be easily detached, or to disengage themselves on the sinking of the vessel. Similarly, a number of long copper tubes, hermetically closed and provided with life lines might be conveniently stowed in the chains; these would also float clear. In fact there should be, if anything, a superfluity of these devices. Every boat should be practically unsinkable; and to avoid such losses as were occasioned on the Ville du Havre by crushing, a nest of boats should be stowed amidships, and a part of the space now given up to deck houses be devoted to that purpose. There are also numerous inventions of folding and canvas boats, which could be placed around the decks, occupying little space, and which would also do good service in time of need.

The great desideratum, however, is an unsinkable ship, and to this need we desire particularly again to call the attention of inventors. The compartment plan, though it has been the saving of many vessels, has failed to counteract the effect of severe injuries, which rack the entire frame of the ship. What we require is a hull built with a double skin and honeycombed with air spaces, so that, no matter how big a hole is made, the fabric will still float: either this or some similar device which will keep the deck above water, no matter if the entire hold or lower works fill.

There is a need of compulsory legislation on this subject, which will reach not only our own vessels but those belonging to foreign owners sailing to and from our ports. A clearance might be refused to any passenger ship unless she could show a satisfactory certificate from proper officials that her life-preserving apparatus was adequate and in perfect order; or there might be such exemplary penalties attached to the loss of a vessel, which, upon investigation, it could be proved was not in every particular sufficiently provided, as would force her owners to look to the lives of their passengers with at least as much care as they now give to the insurance of their ships.

A STEAM SNOW MELTER.

A new machine for cleaning the tracks of street railways of snow, the invention of John Mullaly of this city, was lately tried here on the Lexington avenue railway. It consists of a car, on which is mounted a steam boiler and a superheater. Under the floor of the car, arranged between the wheels, is a steam chamber, three feet wide, seven feet long, from the bottom whereof project a large number of little pipes or openings. The steam issues from the superheater into the chamber, and is there discharged directly upon the snow beneath, which is instantly melted. The steam tank is surrounded by an apron or curtain, which encloses the escaping steam. On the trial mentioned, the machine worked with success, so far as the melting of the snow was concerned. In regard to the actual expense of its use, we have no data. But considering the large amount of heat theoretically required to melt ice, and the great waste of fuel in the practical heating of steam boilers, it would seem as if this must necessarily be an expensive method of clearing the streets. It would probably be cheaper to shovel up the snow and remove it in carts. But this sort of removal, prompt, economical and effective as it is, the railway companies take especial pains to avoid. Perhaps they will prefer the more expensive method of melting down the snow.

In Park Row, in front of our office, some half dozen different street railways have their *termini*, and the operations of their workmen in clearing the snow from the tracks, after a storm, are something ludicrous to behold. The street is occupied, for a distance of about one thousand feet, by the convergence of the various tracks, of which there are four. It might, perhaps, occupy two hours of time, if all the companies would unite and cart away the snow. But instead of this, they go to great expense in annoying each other by tossing the snow from one track over upon another, by means of snow plows; and this sort of fun they keep up sometimes for days. One company sends down a great snow plow and brush, drawn by eight or twelve horses, which throws aside the snow upon the adjoining track, and makes a clean sweep. Fifteen minutes later comes along a similar machine, running upon that other track, throws the said snow back again. So it goes on, until the air becomes milder, or the snow solidifies and is no longer loose.

A NEW FUEL---CARBONITE.

A new fuel has recently made its appearance in our market, which, on account of its intrinsic value as well as its novelty, is deserving of notice. Although a natural production it can hardly be called a coal: and although possessing to some extent the properties of coke, it is not produced by any of the methods common to the manufacture of coke. The proprietors have given it the appropriate name of "carbonite." It is found to a limited extent in the bituminous coal fields of Central Virginia, constituting a distinct vein by itself, which is now fairly developed and yielding a steady supply. It is sold in lumps like cannel coal. The surface when broken is dull in appearance instead of glossy, as is the case with cannel or anthracite coal. It burns with a bright flame when first ignited, and almost without smoke, and subsequently settles down into a bed of bright coals not unlike anthracite in appearance, but lacking the intensity of heat produced by anthracite, and at the same time more enduring. It seems to be especially suitable for open grates, and more particularly for parlor use, on account of its freedom from smoke or bituminous smell, and also from the small proportion of ashes (only 2¼ per cent) resulting from combustion. The ashes are also of such density that, in the process of stirring or removing, they do not rise into the room.

The analysis recently made by Dr. Wallace, of Glasgow, and given below, shows a larger proportion of combustible matter than is found in any known fuel, being 96 per cent that is available for producing heat. It has but a slight trace of sulphur, and is therefore free from the pungent odor and gas incident to anthracite coal. It is superior to any other fuel in the power of producing steam, and may prove especially desirable for steamships making long voyages, on account of its economy of space.

ANALYSIS.

Volatile combustible matter	14·26
Fixed carbon	81·61
Sulphur	·33
Ash	2·24
Water at 212° Fah	1·56
	100·00

This unique product of the earth is accounted for as follows: Originally a vein of bituminous coal, but lying upon and covered with a fine clay, it appears to have been subjected to heat by an overflow of trap rock on the surface, thereby expelling the gaseous and volatile properties of the coal. A process of nature has thus accomplished on a grand scale a more perfect result than is attainable by artificial means, and has delivered for human use a deposit of natural coke, so condensed, by the process under which it was formed, as to acquire a specific gravity nearly the same as bituminous coal, and possessing a heating power fully equal to our best anthracite.

THE COAL TAR INTEREST.

The traffic in coal tar is a comparatively new industry, and its growth has been very rapid. This is attributable to the many wonderful transmutations which have rewarded the chemical tests to which the substance has been subjected. From being considered but the worthless refuse resulting from the manufacture of gas, and of no commercial value whatever, it has within a few years attained an importance of no common order and the promise it affords of almost illimitable future development is evidenced by the

fact that it is at present undergoing a wider range of experiments than any other crude material now serving as the subject of the analytical operations or as an ingredient in the compounding processes of the laboratory. In one of its variations it has proved a positive blessing to humanity; and did carbolic acid alone represent the sum total of virtue derivable from coal tar, still would this isolated fruit of the crucible well repay the time and toil expended in its discovery, and hold its place as one of the greatest material gifts of modern days. But the bituminous distillation flowing from the gas house retorts assumes other marked forms in the chemist's hands; and although they may not so directly contribute to the physical welfare of mankind, yet for certain purposes of utility they are unapproachable. Creosote oil, for instance, is certainly unequaled in its peculiar preservative qualities, which are none the less valuable because the revelation of these special properties is of comparatively recent date. The United States government annually purchases thousands of barrels of this liquid, using it on all wood work exposed to the weather, especially on gun carriages; 120,000 gallons were employed in saturating the timber composing the bulkheads in the St. Clair Flats, Detroit river. It is extensively used by railroad companies for the preservation of railroad ties, bridge timbers, and piles, and also upon the blocks constituting the wooden pavements of Washington, Pittsburgh, and other cities. The artificial oil of bitter almonds (oil of myrbane), of superior fragrance and flavor, is also extracted from the same viscid base, and is exclusively an American invention and manufacture. But the most remarkable product obtained from coal tar is the new article called anthracene, from which is produced the coloring matter known as alizarine, the identical substance which for two hundred years has been found solely in madder. It is only in the United States that coal tar has been made to yield anthracene in large quantities, several hundred pounds of which are daily manufactured in this country and shipped to Europe on orders from the manufacturers of alizarine, which is not yet numbered among our domestic productions. This article constitutes the base of all the madder colors—Turkey red, black, pink, and purple. It was first discovered in coal tar by the distinguished chemists Grieb and Leibermann of Berlin in 1867. More than $10,000,000 is invested in its manufacture. In several foreign countries, the pitch from coal tar is combined with coal dust and pressed into the form of bricks, and an excellent fuel is thus produced, a given amount of which, it is said, will generate a greater heat than can be obtained from the same quantity of any other combustible material employed for utility or comfort; while at the same time, it can be stored more compactly and in better shape than either wood or coal. It is understood that negotiations are in progress in New York, looking to the utilization, in the manner described, of the 40,000,000 tuns of valueless coal dust now lying in the vicinity of the coal mines and depots of Pennsylvania.

RECENT ORDNANCE TRIALS.

Some remarkable results have been obtained during recent trials of naval ordnance, carried on under the supervision of Mr. Norman Wiard, at Nut Island, in Boston Harbor. Mr. Wiard's improvement consists in rifling an ordinary smooth bore gun with two grooves, having for a 15 inch cannon a twist of one turn in 50 feet, and cut in the sides of the bore so as not to cross the bottom. The object of this arrangement is primarily to allow the gun to be used as if it were a smooth bore and with ordinary spherical projectiles, which, were the upper and lower surfaces of the interior rifled, would in balloting destroy the grooves and strain and weaken the piece, while the firing would besides be greatly impaired in accuracy.

The trials above referred to have, however, proved an unusual gain of penetrating force, due to this system of rifling. Two ordinary smooth bore guns, of 15 inch bore, were selected, one of which was grooved according to Mr. Wiard's plan and provided with conical projectiles. The other was left in its normal condition, and ordinary round shot employed. The extremely large charge of 140 pounds of powder was used, and the projectiles weighed 460 pounds each. Two targets, of wrought iron plates 15 inches in thickness, were erected side by side, 160 feet distant. The rifle was fired first, when its bolt went clear through the target, tearing off a huge fragment and throwing the same for considerable distance and then burying itself in a sand bank. The smooth bore shot entered the target for six and a half inches and there stuck.

The experiments were of course designed merely to determine penetrative power, and hence were made at very short range, but we understand that further experiments are to be inaugurated for the purpose of estimating the comparative distance and rapidity with which projectiles can be thrown from guns rifled after the Wiard pattern and smooth bores. It will be seen, however, that the results thus far obtained are better than those reached in the celebrated Tegel tests of the Krupp guns in Germany. Two of the cannon employed in that case were respectively of 11 and 10 inches bore. The range was 164 yards. The 11 inch gun with 88 pounds of powder drove a shell through a 12 inch plate backed by 26 inches of wood, but the 10 inch projectile did not penetrate. The English 11 inch gun, at 200 yards, with 88 pounds of powder, has sent shot through 13 inches of iron, 12 inches of wood and 1¼ inches of skin, and *The Engineer* asserts that the shot of a 12 inch 25 tun piece, with 110 pounds of powder, at 330 feet, has entered, but not penetrated, 18¼ inches of iron backed by 12 inches of teak. In the Glatton experiments, the 600 pound projectile of a 12 inch English gun, weighing 25 tuns, with 85 pounds of powder, at 200 yards, pierced 14 inches of iron and 6½ inches of oak. Our American 15 inch naval gun, it may be noted by way of comparison, is of about 23 tuns in weight. Until we obtain data based on range in connection with penetrative power, it will be hardly possible to draw more than a general parallel between the performances of our improved ordnance and that of foreign nations. We may here state that the official reports of the naval officers, witnessing the Nut Island tests, have created considerable interest in government circles, and it is believed that there is every probability of future experiments developing even more remarkable results. There is one all important fact, however, which places our gun, from a certain point of view, far ahead of its foreign competitors, and that is that it is made of simple cast iron; while the English and German pieces are either, in the former case of wrought iron elaborately built up or else steel, or in the latter instance, as is well known, of the cast steel from the celebrated Krupp foundery. It is unnecessary to point out the vast difference in the cost of such ordnance or the high superiority of American iron thus indicated.

The ordinary spherical projectiles now in use are to be improved by the insertion of three brass pins in holes equidistant from each other on the surface, and hence in the form of a regular triangle. The pins are cut to support the shot exactly in the middle of the bore, so that the windage will be equal all around and the shot receive its impulse directly from the center of the exploding charge. The advantage gained is the prevention of the lodgments or indentation on the lower side of the bore, produced by the escape of the gas through the windage, before the ball has moved from its seat. The elasticity or crowding up of the metal causes the projectile to rebound, and, on its being carried forward by the charge to strike the upper surface of the bore, and there be reflected and re-reflected before it emerges. Of course these last three indentations, termed enlargements, become gradually deeper, and, besides rendering the firing inaccurate, eventually cause the gun to become unserviceable.

We understand that the Wiard improvement does not require the manufacture of new guns but simply a modification of those already in use. All the projectiles, equipments, etc., ordinarily employed are as available as ever, and in brief the idea is, merely by rifling the pieces, to give them the capabilities of both rifles and smooth bores, while besides materially adding to their range, penetrative power, and general efficiency.

SCIENTIFIC AND PRACTICAL INFORMATION.

TESTING STEAM BOILERS.

It is generally believed that steam boilers become weakened (for resistance to internal pressure) after continued use, from various known and unknown causes, so that the engineer cannot judge of the pressure to which his boiler can be worked with safety. But this he may determine by a very simple process and means which are always at his command. It is as follows: Let the boiler be filled entirely full of cold water even to the throttle and safety valves, and all closed tight to prevent any escape. Now, by lighting a fire under the boiler, the water will gradually expand and produce a pressure sufficient to even rupture the iron before the temperature of the water has reached the boiling point. While the pressure is increasing, let the steam gage or pressure indicator be watched; and when the test pressure (which may be twice or more as great as the working pressure) is reached, a portion of the water may be allowed to escape and the pressure reduced. The pressure results from the fact that water is expanded by heat more than iron. The process above given is attended with as much safety as the use of the hydrostatic press, unless the water be heated above 212°, which would not be required unless the boiler leaks. Below this temperature, no disastrous consequences would follow, even if the boiler should be torn asunder.

A GOOD FERTILIZER.

Farmers generally have to pay a high price for an article which, with a little skill, they could make themselves during the winter months or on rainy days, when they have little else to do. We give a recipe for a cheap, good fertilizer, which has been used successfully by farmers in Pennsylvania and Ohio. One recommends it especially for potatoes and wheat, and ends by saying that he has used it with success on corn and other products. It is as follows: Take 1,000 lbs. of good mold, sieve and screen it to get the gravel out and make it as fine as possible, then spread on a floor or some suitable place; add 100 lbs. sulphate of ammonia, 100 lbs. common salt, then mix with a rake. When thoroughly mixed, add 25 lbs. pearlash and 25 lbs. sulphate of soda, mix well, then add 400 lbs. ground bone, 25 lbs. best Peruvian guano, and 150 lbs. ground plaster. Mix the whole thoroughly, throw on a pile for forty-eight hours, and it is fit for use. If it is to be used for potatoes in districts where potato bugs are numerous, 5 gallons sulphuric acid may be sprinkled over the mass. Care must be taken not to use the acid in a confined place, as the fumes are bad for the health. If it is spilled on the floor, do not throw water on it, as it generates great heat when in contact with water. Sulphuric acid sprinkled on the ground will kill bugs of any kind, and its fumes are especially fatal to the potato bug.

REDUCTION OF GALENA AND OTHER LEAD ORES.

When in contact with metallic zinc, galena is readily decomposed by acids. Even oxalic, acetic, and dilute sulphuric acids are capable, when hot, of decomposing galena, metallic lead being deposited and sulphuretted hydrogen gas set free; while with chlorhydric acid, the decomposition is peculiarly rapid and complete. Galena is easily decomposed, also, even in the cold, by dilute nitric acid in presence of zinc, but the reaction differs in this case from that just described, not metallic lead but free sulphur being deposited, while nitrate of lead goes into solution. The reaction with zinc and chlorhydric acid may be employed with advantage for assaying galena, particularly the common American variety, which contains no heavy metal besides lead. The details of the process are as follows: Weigh out 30 or 40 grains or more of the finely powdered galena. Place the powder in a tall beaker, together with a smooth lump of pure metallic zinc. Pour upon the mixture 6 or 8 cubic inches of dilute chlorhydric acid which has been previously warmed to 40° or 50° C.; cover the beaker with a watch glass or broad funnel, and put it in a moderately warm place. Chlorhydric acid, fit for the purpose, may be prepared by diluting 1 volume of the ordinary commercial acid with 4 volumes of water. For the quantity of galena above indicated, the lumps of zinc should be one inch in diameter by a quarter of an inch thick; they may be readily obtained by dropping melted zinc upon a smooth surface of wood or metal. The zinc and acid should be allowed to act upon the mineral for fifteen or twenty minutes in order to insure complete decomposition. Any particle of galena which may be thrown up against the cover or sides of the beaker should, of course, be washed back into the liquid. It is well, moreover, to stir the mixture from time to time with a glass rod.

When all the galena has been decomposed, as may be determined by the facts that the liquid has become clear and that no more sulphuretted hydrogen is evolved, decant the liquid from the beaker into a tolerably large filter of smooth paper, in which a small piece of metallic zinc has been placed. Wash the lead and zinc in the beaker as quickly as possible with hot water, by decantation, until the liquid from the filter ceases to give an acid reaction with litmus paper; then transfer the lead from the beaker to a weighed porcelain crucible. In order to remove any portion of lead which may adhere to the lump of zinc, the latter may be rubbed gently with a glass rod, and afterwards with the fingers, if need be. Wash out the filter into an evaporating dish, remove the zinc, and add the particles of lead thus collected to the crucible. Finally dry the lead, at a moderate heat, in a current of ordinary illuminating gas, and weigh.

A THERMOMETER MOTOR.

M. de Paz, at a recent session of the French Academy of Sciences, proposed an odd though original idea, which it is needless to remark is hardly susceptible of any useful application. He places around the circumference of a wheel, the axle of which is horizontal, a series of precisely similar thermometers. Then he exposes one half the wheel to the sun, and shades the other half. The result, he says, is that the mercury in the exposed instruments dilates and carries their centers of gravity further from the center of suspension, consequently the effect, he believes, is as if the thermometers on one side became heavier, and hence the wheel turns around.

THE INFLUENCE OF GASES AND OF CARBOLIC ACID ON THE CONSERVATION OF EGGS.

According to M. Calvert, if an egg be placed in dry oxygen, no alteration takes place; but if the gas be moist, at the end of three weeks or a month, the egg becomes covered with white filaments, some 3 inches each in length. Its interior, however, shows no signs of decomposition. If, however, at the end of the egg a small needle hole be made, putrescence takes place in dry oxygen, attended with the disengagement of nitrogen and carbonic acid, and also the formation of great quantities of vibrions and microzymas. In damp nitrogen, eggs, whether pierced or not, may be kept perfectly for three months: and although a light deposit of *penicillium* appears on the exterior, the contents do not decompose. In hydrogen, the same effect is noticed. In carbonic acid, the conservation is perfect as above, but without a trace of *penicillium*, whether the gas be moist or dry. Similar results to the latter are obtained with ordinary illuminating gases.

New laid eggs were also plunged in weak solutions (1-500) of chlorine, of hypochlorite of lime, of sulphite of lime, and of carbolic acid; but the author gives no results except as relating to the latter substance, in the liquor containing which, the eggs kept perfectly for three months.

WET PLATING FOR BRASS, IRON, ZINC, ETC.

C. Paul says: Brass, copper, and German silver are tinned by boiling with granulated tin and cream of tartar. Iron must first be cleaned by a mixture of 1 part of sulphuric or nitric acid with 10 parts of water, and then coppered by adding a solution of some copper salt, moistening with a solution of 1 part of protochloride of tin in 2 parts of water and 2 parts muriatic acid, and subsequent immersion in a solution of ammonium copper sulphate. Brass, copper, and German silver, and iron or zinc, which have been coated with copper, can be silvered by rubbing with the following mixture; 14 grains of silver are dissolved in 26 grains of nitric acid and 120 grains of potassium cyanide in 4 cubic inches of water; the solutions are mixed and 24 grains of whiting added.

PROFESSOR JOSEPH HENRY, Secretary of the Smithsonian Institution, has received from the French Government a superb porcelain vase, as a testimonial of his services as the United States representative of the commission on the international standard meter.

THE first patent issued in the United States, of which there is any record, was granted to Samuel Hopkins, on July 31, 1790, for making pot and pearl ashes. The second was to James Stacey Sampson, on August 6, 1790, for making candles; and the third and last for the year 1790 was to Oliver Evans, for making flour and meal. The latter bears date December 18, 1790.

ALBINISM AMONG BIRDS.

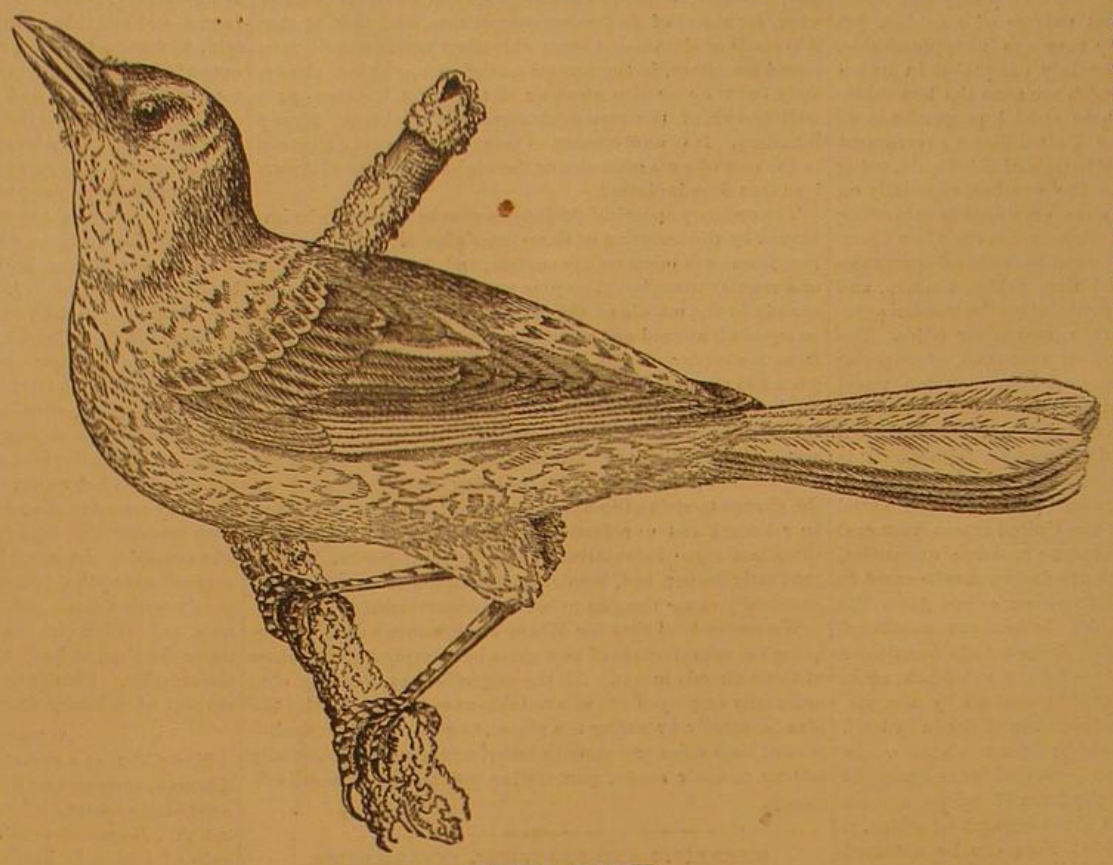
In the issue of the SCIENTIFIC AMERICAN bearing date October 25, 1873, a correspondent has given us the particulars of the finding of a nearly perfect albino starling, or blackbird.

Although this perversive mood of nature is by no means uncommon or unnoted, it is of sufficient importance and rarity to attract the attention of the most untutored observer, whenever an example of the kind presents itself. We hear mention, by eminent ornithologists, of albinism occurring among crows, some of the sparrows, starlings, and the shore lark, but the writer does not recollect finding note of this freak among the thrushes, and therefore presents, with the accompanying engraving, a description of the singular markings of plumage as exhibited by an adult female American robin (*turdus migratorius*).

For several successive days, in the opening spring of 1870, this specimen was observed frequenting the grounds of a citizen of Auburn, N. Y., on one of the principal streets. The remarkable markings of this robin, especially as seen in its flight, evoked expressions of surprise and comment from the most casual observers. At this time the bird under notice was busily engaged with its mate, a bird of perfect plumage, in building its nest in the branches of a tall and thrifty pear tree, and assiduously fulfilling its maternal instincts. Not willing that so rare a freak in feather should pass without an examination, a favorable opportunity was seized for bagging it, with the following results:

General color above, wherever occurring (see the shaded parts in the engraving), of a dull or faded umber, much lighter than the shade found in the perfect bird; the rest of the upper plumage, from frontlet to tail, pure white; breast, white, lightly and irregularly interspersed with a faint ferruginous color; bill, yellow; primaries, pale umber, edged with white; alula and scapulars, ashy brown: third tertials, pure white, with the outer webs loose and frayed in appearance; tail, two outer coverts wholly, and the remaining feathers irregularly, tipped and marked upon their outer vanes with white; iris, of the prevailing color of the species; legs and feet, lighter than in the perfect bird; dimensions, regular; specimen active, and note set clear to the predominant scale of the robins. Specimen shot at Auburn, N. Y., April 21, 1870.

A correspondent, E. H. F., sends us the following similar instance: The white blackbird mentioned in your journal of November 25, I have seen twice myself. One of them was in Maine some years ago, and was lost by being destroyed in a burned building. The other is, or was last May, in the possession of Mr. Charles Derninger, of Sauk City, Sauk county, Wis., who is a German naturalist of no mean acquirements, but of such retiring and modest disposition as to have allowed his light to be hidden from the world at large. He had a very fine collection of mounted birds, all done by his own hands, and among them many albinos: Two white quail (*ortyx Virginianus*), a white robin (*turdus migratorius*), white tree sparrow (*spizella monticola*), a white swamp or red winged blackbird (*agelaius phœniceus*), and a white duck, which I believe to be, as near as I could judge, a canvas back. The white blackbird was a young bird of a pure white color, with the exception of some few feathers which were tipped with a dull brown or drab. The wings distinctly showed the scarlet markings of the species. Mr. Derninger stated that his was the only one he had ever seen, in a twenty-five years' experience, in a country where blackbirds are so plentiful as to be an unmitigated nuisance, at least to the farmers.



ALBINO ROBIN.

Pinoline.

When heat is applied to the retorts a light oil, crude pinoline, passes over at first, and then ceases. The receivers are changed, and the fire augumented, when the heavy oils pass over, and colophonium is left in the retorts. The heavy oils are of a deep violet color. They are boiled for a day with water, and a part of the matter which passes off with the steam is collected. The next day the water is drawn off, and the residue saponified with caustic soda of 36° B. The almost solid product is then heated anew till no more oil distils over. The oil which has been distilled (single rectified) is submitted again to the same treatment, and that which finally passes into the receiver is called double rectified. It is used for adulterating fish oils. Crude pinoline contains acetic acid, from which acetate of lime may be prepared by neutralizing the crude product of distillation with chalk, and redistilling the oily liquid.

New Method for Chromic Acid.

The following method is based upon the decomposition of barium chromate by nitric acid, with the separation of the barium nitrate thus formed, by means of sulphuric acid. Precipitated barium chromate is added to boiling nitric acid (diluted with an equal bulk of water) till completely saturated; the whole is then allowed to cool, when the greater quantity of the barium nitrate crystallizes out. To the mother liquor a sufficiency of sulphuric acid is added, to precipitate the remainder of the barium; the barium sulphate settles readily to the bottom of the vessel. The supernatant liquor, containing chromic and nitric acids, is drawn off and evaporated to dryness on a water bath, when all the nitric acid is expelled, leaving a residue of nearly pure chromic acid, which may be purified by crystallization. By this method, nearly the theoretical quantity can be obtained from potassium chromate.—*J. McLellan, in Chemical News.*

IMPROVED COFFEE POT.

Very few persons know how to make good coffee. In the majority of cases, and especially in hotels and restaurants, the beverage is served in a reasonable state of clearness, but has an astringent and bitter flavor, while, if it be allowed to stand in the cup until cold, globules of oil may be noticed upon the surface. Coffee thus prepared has lost its caffein, which is the nutritive and valuable principle of the bean, and the infusion swallowed is merely a decoction of indigestible tannin. Good coffee, in small quantity, is deleterious to but very few organizations, and is healthy to most persons except those of extremely nervous temperament; but when badly cooked, it is productive of headache, nausea, and other disagreeable ailments.

In order to aid those who have not learned the art of making clear and aromatic coffee, we illustrate herewith a newly invented apparatus which, according to the inventress, will produce an excellent beverage. The outer part of the pot is of the usual form, and is provided with a tightly fitting lid. A is a cylindrical cover which rests upon the bottom, and has notches, as shown, at the lower open circumference. Two or more vertical pipes, B, of slightly conical shape, connect with the top of the steam cover, and carry, by means of elbows which fit closely over their upper ends, the cylindrical drum, C. The bottom of the latter is perforated, and below it is suspended a muslin bag, D, which is held by a ring that fits between the elbows and rests on suitable lugs. Boiling water is first put in until it covers the steam bottom, A. The pot is then placed on the fire, when the steam generated in A forces a continual flow of water up through pipes, B, into drum, C, thence through the perforations in the bottom of the latter to the coffee, which has previously been ground and placed in the muslin bag, D. This circulation is allowed to continue until the strength of the coffee is extracted, when the drum and bag are removed and the pot filled with hot water. No boiling over can take place, and the infusion is made very quickly, thus preventing the escape of the aroma and flavor of the coffee.

Patented through the Scientific American Patent Agency, September 23, 1873, by Margaret J. Stubbings, Lock Box 41, Youngstown, Mahoning county, Ohio, to whom letters for further information may be addressed.

Life in the South.

A correspondent in *Phillips' Southern Planter* thinks that the agriculturists at the South should make their homes more attractive, and advises that the farmers quit raising so much cotton and put in something to eat. He further says: "The Northern people have ten times as much amusement for themselves and children as we do. The fact is that the cotton planter works harder, lives harder, endures more trouble, has fewer comforts, rides poorer horses, sees less of the comforts or pleasures of life than any other people on the globe. The only excitement he has is in the spring: it is in making calculations for so many bales at one hundred dollars per bale, amounting to so many thousand dollars, and in the fall in finding out that it has cost him all his year's work, and all his crop came to, to pay the expenses of making it."

[We think, at the high price cotton fetches this year, the planter will find considerable profit above the cost of production, and we are in much doubt if any other crop he can produce will net him as good return. But it is desirable to make home as attractive as possible everywhere. We agree with the writer in this advice.—EDS.

Mennonites of Southern Russia.

The Secretary of the Interior, in his recent annual report says:

"I desire to invite the attention of Congress to a request from a colony of Mennonites, now and for several generations residing in Southern Russia, near the shores of the Black Sea and the Sea of Azov, for a modification of the existing land laws in certain particulars, to enable them to settle upon our public domain in a compact colony.

By a decree of the Russian government, this people, numbering between forty thousand and fifty thousand persons, have been deprived of certain immunities which they have enjoyed ever since their first settlement in Russia, and the granting of which had originally induced them to leave their former homes in Prussia and settle in their present place of abode.

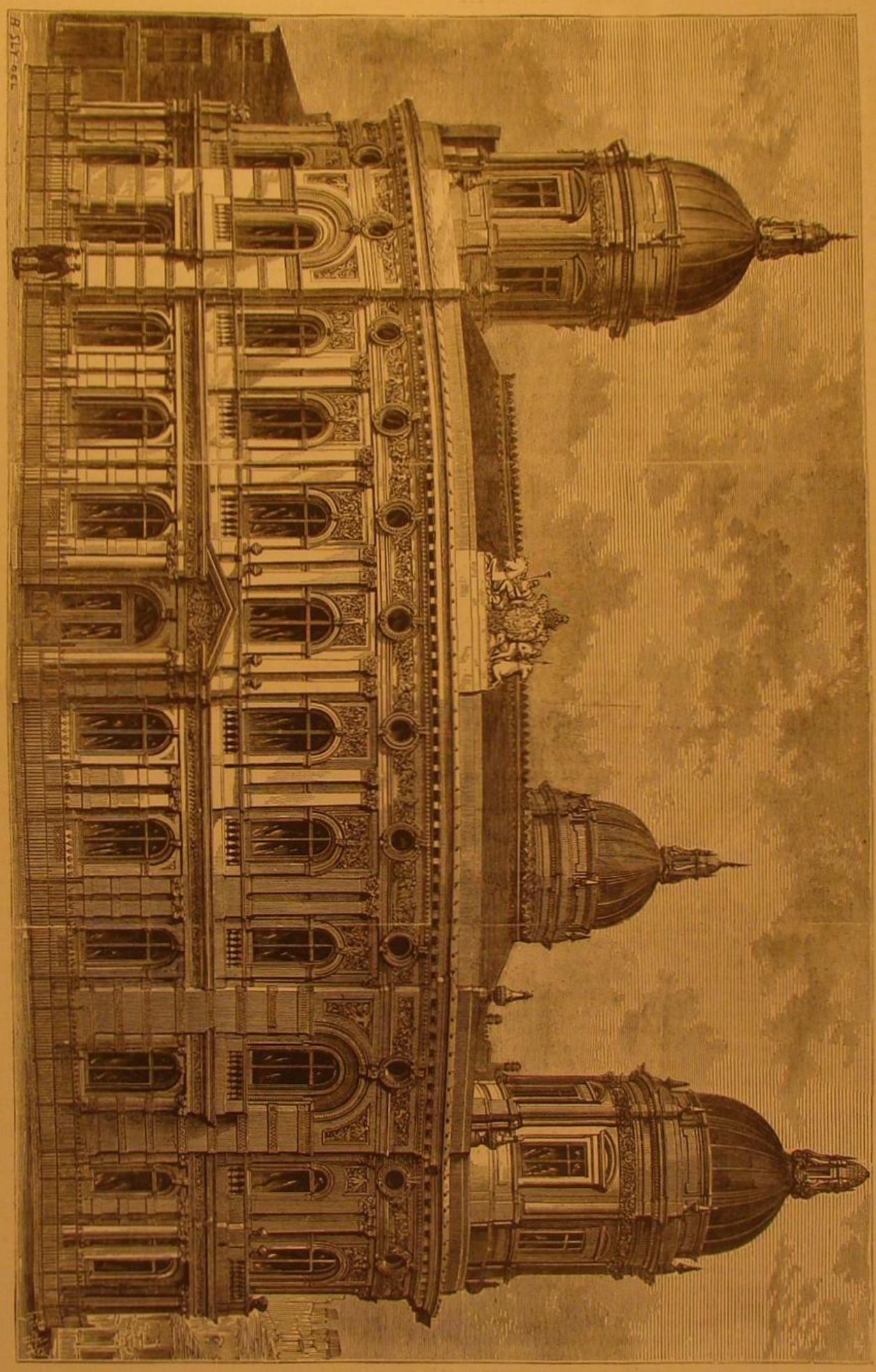
It is their desire to come to the United States and to occupy a portion of our public lands in a compact body, with no strangers to their religious faith within the exterior bounds of their possessions. Such exclusive occupancy they deem essential to enable them to carry out their peculiar system of farming, which to some extent involves a community of interest in and occupancy of the lands; and they also wish to avoid, as far as possible, the presence of any disturbing elements in their immediate neighborhood.

The deprivation of the immunities heretofore enjoyed by them does not take effect until the expiration of ten years from June, 1871, the date of the imperial decree. Within that it is their desire to dispose of their property in Russia, and remove to a country where they may enjoy civil and religious liberty; and they have selected the United States as a place where they can most fully realize such freedom.

In order, however, to enable them to obtain possession of lands in a compact body, some concessions must necessarily be made from the present requirements of the land laws. I would respectfully suggest that the Secretary of the Interior be authorized to withdraw from sale or entry such lands as they may desire to occupy, for a term of years long enough to enable them to emigrate to this country and settle thereon, and to dispose of such lands to those persons among the emigrants who shall make the proper entry or purchase thereof in accordance with existing laws. Should they desire to settle within railroad limits, the authority should enable the withdrawal, in like manner, of the alternate sections belonging to the Government. It is possible that the entire body of the emigrants may not desire to locate in one colony but would prefer the selection of two or more colonies or locations. It would be well, therefore, to confer such discretion on the Secretary of the Interior as would enable him to meet their views in that regard. The entire area they will probably require will be about 500,000 acres."

THE HULL DOCK COMPANY'S NEW OFFICES.

The wealthy corporation who own the extensive docks at Hull, in England, have recently erected a highly ornate building for their offices, of which we present an engraving. The structure stands on a triangular piece of ground, its plan consequently presenting much difficulty, especially as a maximum accommodation was required upon a comparative limited area. The architect, by designing the building to follow the outline of the complete site, has utilized the whole area, and obtained space for a central court for light and ventilation. There being much water in proximity to the site, the Italian style of architecture, of the Venetian type, has



NEW OFFICES FOR THE HULL DOCK COMPANY, ENGLAND

been adopted for the building, which is arranged with three façades, corresponding with the frontages. The main façades are connected with each angle by short circular façades, but having projecting porticoes, with detached Ionic columns, on the ground floor, which serve as buttresses to towers and cupolas surmounting these angles.

The entire building is faced with selected Ancaster stone, excepting the principal sculptures, which are of Portland, and the basement, which is of Bramley Fall. The roofs are covered with Westmoreland slates. The whole structure is surrounded by an iron railing, the uprights formed of ornamental tridents and harpoons placed alternately, with solid square standards at intervals, capped by escutcheons and crowns.

Within the building is an open court; this affords means for thorough ventilation and lighting. The warming and ventilating arrangements are effected by means of a fan, worked by a small steam engine.

Labor and Machinery.

The rapid introduction of steam power and machine labor into all branches of trades and industries shows how capital, availing itself of invention, science, and steam and animal power, is daily gaining an advantage over labor. When this aspect of the case was first presented, and the laborer by instinct, as it were, denounced the machine that excelled him both in quality and amount of labor, he was met by a sharp denial that machinery prejudiced his chances for a livelihood. It was asserted that the only effect would be to change his mode of employment, to relieve him from slavish drudgery, to quicken his intelligence by illustrating the triumphs of mind, and to elevate him from a mere beast of burden to the presiding spirit over the powers of nature. Within certain limits, all this is true. In that new and golden age, when all the relations of society are properly adjusted to the true standard, it may be that every man will be to some extent relieved from muscular toil and from need of it at the same time. But before that time comes, the process of re-adjustment must be attended with serious disturbance. Every day is changing the field of labor, putting more upon the machine and less upon the man. If, as is claimed, the expansion of industry and production shall make room for labor in a higher position, requiring more skill and returning a better reward, the final result will be only beneficial. How this is to be done without some convulsions remains to be seen.—*American Builder.*

Secondary Currents and their Applications.

BY M. G. PLANTE.

In pursuing the study of the phenomena presented by secondary couples with plates of lead, I have made the following observations: The chemical modification of the electrodes, which constitutes the source of the secondary current, is rendered more complete by alternate charge of the primary current in two directions, with repose between this double action. By the successive action of the primary current in two directions, the deposits of oxide are reduced, and the electrodes are modified in their molecular constitution not only at their surface but in their mass. By rest, the deposits formed on the surface of the plates, whether the deposits be of metallic oxides or of reduced metal, acquire a crystaline texture and strong adherence which contribute to protect the sub-adjacent deposits tending to form themselves under the continued action of the primary current. By following this course of operation, which I have termed the formation of secondary couples, deposits of great thickness may be obtained, admitting in the discharge of calorific effects more or less prolonged. A secondary couple, having less than five and a half square feet surface, charged under the foregoing conditions by two Bunsen elements, will redden a platinum wire of 0·02 inch diameter during twenty minutes, and a wire of 0·008 inch diameter for about an hour, without any communication with the primary source, even forty-eight hours after charging. A battery of 16·5 square feet surface, equally well charged, preserved sufficient of its charge to redden a platinum wire for some minutes a month after charging. Although the formation of the secondary couples necessitates the use of two Bunsen couples, of which we change the direction, with intervals of repose, in order to give the deposits time to take a crystalline aggregation, once this operation is effected, it is no longer necessary to change the direction of the current, and the secondary couples can then be charged by the aid of a very feeble primary current acting constantly in the same direction, such as that furnished by a sulphate of copper element, even mounted with water around the zinc. The chemical work produced by this feeble pile accumulates slowly, but nearly without loss, in the secondary couples, and there will be received, in the discharge, effects of an intensity infinitely superior to that of the primary source. These observations facilitated the several applications of the secondary currents that I have already mentioned, and have led me to construct the apparatus that I have the honor to submit to the Academy. It consists of a small couple perfectly prepared, or formed, contained in a box, of which the base and sides carry a system of connections arranged so as to redden a platinum wire, and to ignite, by simple pressure of a finger on a metallic touch, a wax candle, spirit lamp, or gas jet. The battery intended to put the apparatus in action consists of three elements of zinc and water, copper and sulphate of copper, and copper, and is placed at a distance or near the apparatus. It is not necessary to maintain the secondary couple constantly *en charge* under the action of the battery; for, once charged, we can produce a hundred consecutive ignitions. The ignition of a wax candle can be produced instantly, and such method of ignition is very economical and safe. The apparatus may be employed with electric bells in such a manner as to use only three cells of a sulphate of copper battery, being placed in a derived circuit from the primary and in direct communication with the two poles of the battery. It appears that, during the charge of a secondary couple under the action of a battery in whose circuit occur one of several bells, the couple absorbs all the current, and prevents the use of the bells; but, as the secondary couple acquires, under the influence of the battery, a high temporary intensity, it results that it does not act as an inert derived circuit, but itself contributes to the action of the bells. Further, if the battery

is rendered too feeble to work the bells, the secondary couple is capable, by the electricity which it accumulates, of putting them in action. By a combination of the apparatus, not only may sound be produced, but light may be obtained at the same time.—*Comptes Rendus.*

Correspondence.

The Treatment of Cancer by Pressure and Iron.

To the Editor of the Scientific American:

Pressure is supposed to act beneficially in cases of cancer by diminishing the supply of blood, and consequently of nourishment to the tumor, by preventing the growth of the cells by depriving them of the necessary space, by injuring them from direct violence, and by promoting absorption. The credit of this discovery is due to the writer of this. Although there were many who doubtless had some vague glimmerings of the truth, yet none ever put their ideas into practice. The number of cases subjected to the pressure system alone was nineteen. Of these, seventeen were cancer of the breast, and two, ulcers of the cheek and upper lip. Twelve cases terminated by cure, and five were considerably benefited, the two cutaneous ulcers being somewhat improved. The majority of the tumors were hard, irregular, tuberculated, and the seat of great pain. Six of them were ulcerated and discharged ichorous pus. Even in the worst cases, the tumor diminished in size, but the patients fell victims to the constitutional disorder.

So favorable results attracted but little attention, and almost all my resources were exhausted, and I was afraid that I would have to give up any farther experiments, when I attracted the attention of M. Récamier, of the Hotel Dieu, Paris, who consented to go on with my experiments. One hundred cancerous patients were selected, on whom the pressure system was employed; sixteen appeared incurable and underwent a palliative treatment. Thirty were completely cured by compression alone, and twenty received considerable benefit from it; fifteen were radically cured by extirpation and pressure combined, and six by compression and cauterization. The compress used was made by using strips of soap plaster and adhesive plaster. Since then, I have used soft rubber balls, three quarters full of air or water, binding them on the ulcer with a common form of bandage. The artery feeding the cancer must be compressed by a spring truss, and great care must be taken that no ulceration of the artery ensues. A caustic plaster may be used to advantage under the ball, where the cancer is small.

Give the patient carbonate of iron, of which the dose is from 6 to 12 grains. Keep the bowels open; and if suffering great pain, use hydrate of chloral. The diet must be carefully attended to, and stimulants may be freely employed. In every place where this treatment has been pursued, every case has been cured with but one exception. Iron has been cried down, and been as little used as possible of late years; but it exerts great influence on cancer, and kills the cancer cells that may exist in the blood and allows no other cells to gather. I have just received a letter, from a gentleman of high standing in medical circles, in which he assures me that he has used iron in the form of the carbonate, and that in every case it has effected a cure. GEO. W. BAILEY, M. D.

Two Wrinkles.

To the Editor of the Scientific American:

Mechanics who want small gig saw blades will find that the steel springs of which hoop skirts are formed will make capital ones of any lengths; and they vary in width so as to be suitable for a variety of uses. They can be jointed straight by brazing, and then they make capital band saws.

I would suggest the investigation of the practicability of weaving covers for umbrellas, of a circular form, with a selvage around. The invention of a loom to produce such work would furnish ample study for an ingenious man, and would probably lead to fortune. WM. P. HOPKINS.

Lawrence, Mass.

The Interplanetary Telegraph.

To the Editor of the Scientific American:

Officers of the United States Coast Survey have long been accustomed to converse together at stations over 100 miles apart, by long and short flashes of sunlight reflected from the surface of a mirror. Similar signal lights are occasionally used at sea.

1. Any cryptogram, hieroglyphic, or signal flag alphabet is readily solved by modern ingenuity, often without a key. We may safely assume that any race of beings, who have developed a superior civilization to our own, would be able to interpret Morse signals, if their attention was once attracted thereto. That such beings exist, we infer from the fact that our sun is only a second rate yellow star, of comparative insignificance.

2. Light is the only means of communication available or possible for traversing space.

3. It is therefore probable that light messages are even now passing around us in every direction, between the inhabitants of different stellar systems.

Let us assume, for example, that the huge planets which travel around Sirius or Procyon are peopled by intelligences slightly more advanced in science than ourselves, and that they communicate with Uranus or Neptune in the manner supposed. It is evident that we need only a large telescope wherewith to verify the existence of such a conversation, in order to join in it with manifest profit to ourselves. In such a case we should select the simplest telluric language, perhaps the "modified English" of Minister Arimori Mori. Our stellar correspondents would perceive a flash of light from each metallic element in turn, followed by its English name in Morse signals. Wherever in the universe these light rays might impinge upon the object glass of a telespectroscope, there the observer would become aware of the existence of an inquisitive humanity.

One objection to my project of an interstellar telegraph is the insufficient swiftness of light, only 186,000 miles per second. Thus no less than four hours are required to send a message to Neptune, and three years are necessary to send a signal from our earth to the planets of a neighboring star. The same length of time must elapse before receipt of an immediate reply. SAMUEL H. MEAD, JR.

New York city.

Scientific Prophets.

Under this heading the New Orleans *Picayune* very tersely gives the results of the labor of the learned scientific Americans who lately met in Portland, from which it would appear that the prospect of the denizens of this sublunary world is not of the most cheering character.

"Professor Young tells us that the sun is nothing but a gigantic spherical mass of gaseous matter, which is constantly being contracted by the gradual cooling of its outside circumference. The central kernel of this huge star will always, according to the learned Professor, finally be crusted over with a thick, impervious coating, through which neither light nor heat can possibly reach us. The result, as far as we are concerned, will be total darkness, intense cold, the end of animal life, and a return to primeval chaos.

"General Barnard—another scientific seer—compares the earth to a hollow india rubber ball filled with molten lead. The spherical shape of our globe being the result of its rapid rotary motion, any accident such as the bursting up of some great volcano, the shock of a comet or of a meteoric body, would open a vent through the thin rind upon which we live whereupon the incandescent matter would at once project expiring humanity into vacant space.

"Professor Walling denounces the sun as a spendthrift who wastes with stupendous folly his inheritance of heat and light, and who, thanks to his prodigal habits, is fast progressing towards that bourne whence no traveller returns—the bankruptcy court.

"Professor Franklin Hough draws it more mildly, as he only threatens us with the total disappearance of water, owing to the wanton destruction of trees and forests.

"Professor Le Comte has paid special attention to insects, and warns us that their frightful increase will ultimately lead to the total destruction of the vegetable world, after which man himself will become their prey. The earth will then be a gigantic parish of Plaquemines, in which the mosquito tribe will rule supreme, until some other equally noxious vermin shall arise and devour them."

This cheerful *resumé* of the labors of our American *savans* indicates, adds the *American Builder*, that the human race is decidedly in a tight place. If the sun is to go out like a snuffed candle and the earth to explode like an old steam boiler, we may as well overlook the lesser contingencies of rainless years and the universal prevalence of vermin. *De minimis non curat scientia*

Impure Water.

Public attention cannot be too often called to the danger of using impure water in households. The origin of typhoid fever, which so frequently runs through families in city and country, is oftener in wells and springs than is supposed. In cities it is easy to understand, when aqueduct water is not supplied, how wells may become contaminated, but for many it is not so easy to see how wells in the country, among the hills or in the green valleys, can become so impure as to be sources of disease.

Since the general introduction of aqueduct water into large cities, typhoid fever has become more common in the country than in the city, and this disease is certainly zymotic, or one which results from a poison introduced into the blood. Wells in the country are very liable to become contaminated with house sewage, as they are generally placed, for convenience, very near the dwelling, and the waste liquids thrown out upon the ground find easy access by percolation through the soil to the water. The instances of such contamination which have come to our notice, and which gave rise to fevers, are numerous. The gelatinous matter, which is often found covering the stones in wells affected by sewage, is a true fungoid growth, and highly poisonous when introduced into the system. It is undoubtedly concerned in the production of typhoid fever. How it acts it is difficult to determine, but it is at least conceivable that the spores of the fungus may get into the blood and bring about changes after the manner of yeast in beer. These spores, as is well known, develope rapidly by a kind of budding process, and but a little time passes before the whole circulation becomes filled with them, giving rise to abnormal heat and general derangement, called fever. These fungoid or confervoid growths are always present in waters rendered impure by house drainage, and great caution should be used in maintaining well waters free from all sources of pollution.—*Boston Journal of Chemistry.*

MOTH PREVENTIVE.—The following recipe for keeping moths out of clothing is a favorite in some families: Mix half a pint of alcohol, the same quantity of spirits of turpentine, and two ounces of camphor. Keep in a stone bottle, and shake before using. The clothes or furs are to be wrapped in linen, and crumpled up pieces of blotting paper dipped in the liquid are to be placed in the box with them, so that it smells strong. This requires renewing about once a year.

Electrical Metallurgy.

Specifications of the English patents of R. Werderman, C. E., have lately been published, which are interesting as presenting a new application of electricity to the arts. This new purpose, to which electricity lends its aid, is to the reduction of metals from their ores, and the refining and purifying of the reduced metals, without the ordinary chemical action of carbonaceous matter, the purifying and refining taking place at the same time and by the same process, during the reduction from the ore. The ores, that is to say, oxides, sulphides, carbonates, or other combinations in which the metals exist in Nature, are first crushed, and then heated in a suitable furnace or retort. After the whole charge is raised to a red heat, two pieces of carbon or platinum, or some other suitable material which conducts electricity, are plunged in the crushed ore. These two pieces are connected by platinum or other suitable wires or ribbons with the two poles of a galvanic battery or magneto-electric machine. The electrical action and chemical decomposition which then take place may be seen from the following equations, which are given for the purpose of illustration, and are arranged in the order for their elimination:

	Negative pole.	Positive pole.
Oxide of zinc.....ZnO	Zn	O
Red oxide of copper.....Cu_2O	2Cu	O
Plumbic oxide.....PbO	Pb	O
Sesquioxide of manganese..Mn_2O_3	2Mn	O+O+O
Loadstone.....$FeOFe_2O_3$	5Fe	SO_3, As_2O_5, Ph_2O_5
Hematite.....Fe_2O_3	2Fe	
Brown hematite.....$2Fe_2O_3 3H_2O$	3Fe	SiO_2, SiO_2, CO_2
Spathic iron.....$FeCO_3$	Fe	
Sulphide of zinc (blende)..ZnS	Zn	S
Subsulphide of copper....CuS	Cu, Cu	CuS
Sulphide of nickel.....Ni2S	2Ni	SO_2, SO_2
Bisulphide of iron (pyrites) FeS_2	Fe	$2SO_2$
Manganous carbonate.....$MnCO_3$	Mn	CO_2+O
Carbonate of zinc (calamine).$ZnCO_3$	Zn	CO_2+O

The reduction of iron ores may be effected either in the usual manner in the melting furnace with carbonaceous matter, or in a reverberatory furnace with some suitable flux only. The best ore for this purpose is the hematite, because it is a good conductor of electricity. As soon as the oxide begins to flow, the reduction takes place, and all noxious elements are eliminated in the following order, viz: sulphur, arsenicum, phosphorus, titanium, silicon, carbon.

By regulating in a suitable manner the electromotive force and the intensity of the electric current, and stopping it at the proper moment, cast iron, wrought iron, or steel can be produced directly from the furnace without any intermediate operations. This puddling by means of an electric current will occupy from 10 to 15 minutes only, instead of several hours as in the ordinary puddling by hand labor or machinery, and consequently a great saving of time will be effected.

The entire liberation of the electro negative elements is in some cases not effected immediately, but an intermediate transformation of the ore takes place. For instance, in treating the subsulphide of copper, this ore does not conduct electricity at the ordinary temperature, but at 230° Fahrenheit it becomes a very good conductor; copper is then produced at the negative electrode or pole, and at the positive pole sulphide of copper is formed, which, being a good conductor at a lower temperature, is now entirely decomposed and converted into metallic copper. A great difficulty in the reduction of plumbic oxide in the usual process consists in the formation of silicate of lead, due to the presence of silicates mixed with the ore. This difficulty is entirely overcome by the application of the electrical current for the formation of the silicate of lead, which is readily fusible and is no obstacle; and all ores rich in silicates, which could not be treated till the present time, can now be employed for the extraction of lead.

Instead of treating the sulphides and carbonates and other more complicated combinations directly by the electrical current, such ores may first be converted into oxides by roasting them in the usual manner for some time in contact with atmospheric air or oxygen.

While the metal is being reduced, all impurities and noxious elements mixed or combined with it are eliminated, so that finally the metal is collected perfectly purified and refined.

In purifying metals, the removal of the metals or metalloids which are to be eliminated is effected either in a melting furnace or in a crucible or converter or puddling furnace. Two pipes of fire clay are dipped in the molten metal. Two hollow cylinders of carbon or platinum or other suitable matter are fixed inside the clay pipes at the end immersed in the molten mass. To the carbon or platinum cylinders are attached two platinum wires or ribbons, which run up inside the clay pipes and are connected directly or by means of copper wires to the two poles of a galvanic battery or magneto electric machine. To prevent the development of heat in the battery or magneto-electric machine, the connecting wires pass through a cooling apparatus. Instead of hollow cylinders of carbon or platinum, solid cylinders or sheets, or any other suitably shaped pieces, of carbon or platinum or other suitable matter can be used; in the latter cases, space must be left between the said pieces and the fire clay envelope, to permit the eliminated metals or metalloids to be volatilized and to escape through the clay pipes, and to be collected in a suitable vessel, in which they are converted either into the liquid or solid state or into salts, in bringing them in this *statu nascendi* in contact with any suitable matter to which they have great affinity.

About Dyspepsia.

Sufferers from this horrible malady will find some of their own feelings described in the following article from the December number of the *Overland Monthly*:

Did you ever have the dyspepsia? Did you ever have—or ever imagine you had—a complication of all known, and several unknown diseases? If yes, then you have had the dyspepsia, or its full equivalent. Chronic dyspepsia may be defined as an epitome of every complaint wherewith transgressing mortality is scourged. It is as nice a thing to have about you as a trunkful of tarantulas, with the trunk lid always up An eminent English physician has said: "A man with a bad dyspepsia is a villain." He is, and worse. He is by turns a fiend, a moral monster, and a physical coward—and he cannot help it. He is his own bottomless pit, and his own demon at the bottom of it, which torments him continually with pangs indescribable.

When a worm of the business dust of this world has writhed with the dyspepsia until it has assumed a virulent chronic form, who shall find colors and abilities varied enough to paint his condition? His blood becomes first poverty-stricken, then impure, and, as "blood will tell," every part of his system is contaminated by the foul stream. The brain complains bitterly on its own account, and vehement complaints are being continually sent up to it from the famishing liver, bowels, spleen, heart, and lungs. Like "sweet bells jangled out of tune," the entire organization breathes discords. Even the remote toes telegraph up to the brain: "We are starving down here; send down some provender." The brain makes requisitions on the stomach, which are futile. The stomach is powerless to provide, and the brain cannot transmit. At times all the starving organs conspire together, suspend work and undertake to compass by riot what they fail to get by appeal. Then life trembles in the balance. Then the consolation—O, the consolation! —that is visited on the dyspeptic. Friends—when he is lifeless from lack of vitality—friends will exasperate him with taunts of being "lazy," "shiftless," "indolent," and "without ambition!" Nor can his friends be made to appreciate that it is as preposterous to expect one who is undergoing constant torture and consequent exhaustion to have "ambition" as it would be to expect a corpse to have an appetite, Remedy: everybody's advice—that is, ride everybody's hobby. Cure: death. Drugs are but aggravations, and "bitters" are bitter indeed we have heard of a chronic dyspeptic who took his cue from his chickens, and by swallowing daily a moderate handful of gravel stones of the size of a pea downward, finally succeeded in transforming "cue" into "cure." He claimed complete restoration. In the face of this evidence to the contrary, we re-assert that, for chronic dyspepsia in its worst form, there is but one certain cure—absolute rest. Preventive: take as good care of the coats of your stomachs as you do of the coats of your backs. Do you wish for faith in God, in human love, in earthly happiness, in the beneficence of Nature, and in immortality? Keep your digestion vigorous; on that hang all of these. Would you prefer an abiding faith in tortures unspeakable, in horrors inexpressible? Destroy your digestion. Would you live in the body for ever? Keep your digestion in full vigor; and although the end of the world may come, your end will not come—you will have to go after it. Old age is but the failure of nutrition. Nutrition is life; non-nutrition is death.

Spontaneous Combustion of Hydrocarbon Vapors.

During the years 1870, 1871 and a portion of 1872, at the Wood Preserving Works in San Francisco, Cal., several instances of spontaneous combustion occurred, accompanied by explosions of hydrocarbon vapors. Mr. I. C. Woods, manager of the works, at the last meeting of the California Academy of Sciences, gave the particulars of some of these accidents and a statement as to the remedy successfully applied. The hydrocarbon vapors used for the preservation of wood are obtained by the distillation of coal tar. A brick pit is attached to each two stills, to hold the hot pitch product as it runs from them. This pit has an opening in the side for access and a ventilating chimney through which the vapors from the pitch pass off into the atmosphere. The opening for access to the pit is closed by an iron door. The tar used is made at the gas works in that city. The stills used have a capacity of from 1,200 to 1,800 gallons.

In the progress of the work, the still containing the coal tar is run until the thermometer on the top, near the man hole, indicates a heat of 420° Fah., when they cease firing. The still and contents are then allowed to stand and cool until the thermometer indicates a heat of from 200° to 212° Fah. At this heat the liquid pitch is allowed to run from the still into the pitch pit; as it cools, it becomes solid. From the time the thermometer in the still indicates a heat of 420° Fah. until after the time of letting out the pitch, the corks remain open in the vapor pipe connecting the still with the wood-preserving tank.

Until April, 1872, this letting out of the hot pitch was attended with danger of fire, because of the tendency of its vapors to spontaneous combustion. If running the still daily, such accidents would occur three or four times a year. The vapors from the pitch in the pit, as they passed out of the ventilating chimney, were yellow, being the vapors of the naphthalin oils contained in the coal tar. The combustion would take place after the pitch had been running freely from the stills for some minutes. It was always accompanied by an explosion, loud enough to be heard across the street, and strong enough to force away the wooden braces placed against the iron door. Pieces of timbering in the pitch would take fire and burn until extinguished.

From the time the fire is extinguished under the stills to the time of letting out the pitch, there is always an interval of fourteen hours. The furnace of the still is always closed with an iron door and clayed up. There is a strong draft up the chimney of the still. The top of the ventilating chimney of the pitch pit is as high as that of the fire chimney of the still; and there is always a strong draft up this chimney through the crack between the iron door and the brick work of the pitch pit. A person standing at the iron door would not smell any of the vapor of the pitch. The distance from the outlet of the pitch pipe of the still to the furnace door of the still is not less than twenty-two feet. At the time of the last explosion, the furnace of the still had been carefully examined before the pitch was let out; no remains of fire were found there, nor was there any other fire in the building. The hour was 10 A. M., on Sunday, the works not being in operation.

This property of heated hydrocarbon vapors to spontaneously ignite after absorbing a certain quantity of atmospheric air is not generally known. The remedy devised by Mr. Woods is simple and complete. It consists in the introduction of a small quantity of water into the pitch pit while the pitch is running from the still. The hot pitch vaporizes the water, the yellow vapor from the chimney is changed to white vapor, and the desired safety is obtained. Too much water must not be put into the pit at one time, or the pitch will boil over: not a dangerous but a troublesome result.

Mr. Woods had noticed that the hydrocarbon vapors would eat away in holes the seat and valves of composition globe valves; and whenever this took place, steam was liable to leak into the wood-preserving tank during the process of vaporizing the wood. He noticed that, whenever the steam did so leak, the influence of the hydrocarbon on the wood was destroyed. This led him to try with success the experiment of the effect of steam on the vapors of the pitch. Since April 28, 1872, when the remedy described was first applied, not a single explosion has occurred at the works. The water is applied through a half inch iron pipe, connected with the city mains and regulated by a cock. Mr. Woods has reason to believe that the vapors from a combination of coal tar and petroleum are more liable to spontaneous combustion than the vapors from coal tar alone.—*Mining and Scientific Press.*

Magic Squares.

BY L. G. BARBOUR.

I will give three positions of a square of four figures to a side:

First position.				Second position.				Third position			
1	5	9	13	1	8	12	13	1	8	12	13
2	6	10	14	2	7	11	14	14	11	7	2
3	7	11	15	3	6	10	15	15	10	6	3
4	8	12	16	4	5	9	16	4	5	9	16

The second position is obtained from the first by inverting the two middle vertical columns, and the third from the second by inverting the two middle horizontal columns. It will be observed that, in the third position, each vertical column, each horizontal column, and each diagonal column sums up 34.

In a square of eight figures to a side, invert the four middle vertical columns, and then the four middle horizontal columns.

In general, invert the middle half of the vertical and horizontal columns.

After discovering this rule, I applied it to a square of twelve figures to a side, and so simple is the process that I wrote down not the first position or the second, but the third, at the very first dash, and without mistake. I subjoin one with eight figures to a side, so that the application of this principle may be seen:

Third position.

1	9	24	32	40	48	49	57
2	10	23	31	39	47	50	58
59	51	46	38	30	22	11	3
60	52	45	37	29	21	12	4
61	53	44	36	28	20	13	5
62	54	43	35	27	19	14	6
7	15	18	26	34	42	55	63
8	16	17	25	33	41	56	64

The sum of each row is 260.

The reader may try his ingenuity in constructing as many tables as he pleases. Ascertain beforehand what each column should sum up, by the usual method of arithmetical progression. Thus: the sum of the series 1, 2, 3, 4, 5, etc., to 64, is $\frac{65 \times 64}{2} = 2080$. Dividing by 8, the number of vertical or horizontal columns, we get 260 for the sum of each. For the series 1, 2, 3, on to 144, briefly, each vertical column $= \frac{145 \times 144}{2 \times 12} = 145 \times 6 = 870$.

I found a square of six numbers to a side rather harder, and one of five to a side quite troublesome. The reason was that the above method is not applicable. By approximating it, however, as nearly as practicable, and then using tentative means toward the close, I succeeded in both cases.

These tables are not useful in the ordinary sense of that term; they do not teach us how to measure corn cribs or survey farms; but they may interest pupils in arithmetic, and may cultivate the necessary but irksome art of adding up columns of figures. Let the teacher take an ordinary checker board some winter evening, cut out of card or leather sixty-four men, namely, round pieces of the size of a nickel; number them from 1 to 64, and set the boys and girls to work to construct a magic square. My word for it they will go at it with an interest such as the rule of three has failed to awaken.—*Home and School.*

Atmospheric Refraction.

At a recent meeting of the Manchester Literary and Philosophical Society, a paper on this subject was read by David Winstanley.

Mr. Baxendell has noticed the fact that at the moment of the departure of the sun below the horizon, the last glimpse is colored bluish green. Dr. Joule also observes that on two or three occasions he had himself noticed the phenomenon in question, and that, "just at the upper edge where bands of the sun's disk are separated one after the other by refraction, each band becomes colored blue just before it vanishes."

During the past eighteen months the writer, from his residence in Blackpool, has had frequent opportunities of observing the setting sun, and has noticed the phenomenon of the final colored ray certainly more than fifty times. To the naked eye its appearance has generally been that of a green spark of large size and great intensity, very similar to one of the effects seen when the sun shines upon a well cut diamond. The color, however, is by no means constant, being often, as in the case of Mr. Baxendell's observation, bluish green, and at times, as mentioned by Dr. Joule, quite blue. The period of its duration, too, is likewise variable. Sometimes it lasts but half a second, ordinarily perhaps a second and a quarter, and occasionally as much as two seconds and a half.

When examined with the assistance of a telescope, it becomes evident that the green ray results at a certain stage of the solar obscuration, for it begins at the points or cusps of the visible segment of the sun; and when the "setting" is nearly complete, extends from both cusps to the central space between, where it produces the momentary and intense spark of colored light visible to the unaided eye.

"Respecting the increased range of colors seen when the phenomenon is observed with telescopic aid, I may mention that, on the 28th of June, the sea was calm and the sky quite cloudless at the setting of the sun. Of the final colored rays, fifteen diameters showed the first to be a full and splendid yellow, which was speedily followed by the usual green, and then, for a second and a half, by a full and perfect blue. Respecting the increased duration of the color, I have found that, when the atmosphere is sufficiently favorable to allow a power of sixty diameters being employed, with a 3 inch object glass, the green effect is seen at that part of the sun's limb in contact with the horizon, even when one half the sun is still unset, and of course from then till final disappearance.

The different colors seen, together with the order of their appearance, are suggestive of the prismatic action of the atmosphere as the cause of their production, and the interception of the horizon or the cloud as the cause of their separation.

Assuming the correctness of this view, it becomes evident that an artificial horizon would prove equally efficacious in separating the colored bands, and also that, if employed during an inspection of the sun's lower limb, the least refrangible end of the spectrum would be disclosed. Accordingly, I introduced into an eyepiece of my telescope a blackened disk of metallic copper, having a slit cut in it of about the one hundred and fiftieth of an inch in width, and proceeded to make an observation, in July, when the sun was about one half of its meridian hight. The blinding glare, however, of that portion of the sun seen through the slit, rendered the observation futile. By projecting a large image of the sun into a darkened room, I was enabled to get the whole of the spectrum produced by the prismatic action of the atmosphere in a very satisfactory manner. In this case, a semicircular diaphragm was used, so placed that its straight edge divided the field of view into equal parts, from one of which it obscured the light. The diaphragm was placed as before in the focus of the eyepiece, and by rotating it every portion of the sun's limb could be in turn examined, and that too in the center of the field, so as to be equally subjected to the minimum of the peculiarities of the instrument. When the sun's lower limb was allowed to descend into the field of view, the first rays were intensely red. After a momentary duration, they gave place in succession to orange, yellow, and green, which were then lost in the ordinary refulgence of the sun. The upper limb gave green, blue, and finally purple, which latter color I have thus far never seen on the natural horizon. It should be remarked that the colors seen were vivid and unmistakable, and each one of them detained at will, or the whole phenomenon recalled, by the adjusting screws of the instrument. I apprehend that the results here given sufficiently prove that atmospheric refraction is the cause of the colored rays seen at the moment of the sun's departure below the horizon. I have, however, thought it worth while to examine the light proceeding from the moon's limb by the aid of the artificial horizon, and of course by direct observation. The results were decisive and satisfactory, the spectral colors being easily observed. The green effect I have also frequently seen on the departure of the moon beneath the edge of a dark and well defined bank of clouds. Telescopic aid has, however, in every instance been required.

The rapid changes in color observable in the case of almost any large fixed star at an elevation of twenty or thirty degrees above the horizon, and which changes vary between red, green, and blue, may I think be fairly attributed to the same cause as the color in the sun's final ray. Particles of dust floating in the air act, I apprehend, for the moment, in the capacity of diaphragm or horizon, and thus enable the eye to perceive, even in the light of the stars, the prismatic action of our atmosphere."

A TREE near a chimney will often cause a down draft of air.

THE UNIVERSAL BORING MACHINE.

Among the tools used in woodworking establishments, few have been more neglected than the wood boring machine. As a general rule, shops otherwise well supplied with labor-saving devices lack this important and useful tool, or, when its want becomes felt, seek to supply its place with an apparatus which, perhaps, partly answers for the special object sought, but which lacks the ingenious contrivance to make it advantageously used or even applicable to a great variety of work.

Our engraving represents the Universal Boring Machine, which, the manufacturers inform us, they have made a special study so as to effect the necessary improvements in order to enable it to meet the wants detailed in many inquiries which they have received relative to its adaptability for different uses. The machine is strongly built of iron and steel, and combines, in the small space it occupies, nearly all the facilities needed for boring large and small holes in any desired angle. It is cast with a heavy solid frame and body, and has two cone pulleys with three faces, for giving the mandrel the proper speeds for different sized bits. The mandrel, which is of steel, is made to traverse by a foot lever. The operator can adjust the leverage in a moment, so as to stop at any desired depth up to 11 inches. The adjustable table has a surface of 21 inches in width with 15 inches slide, and it can be raised or lowered 16 inches, enabling one to bore in the center of 32 inches. Adjustable rests upon the table render the work readily placed at any desired angle in the horizontal plane, while the table top itself can be set on an incline towards the bit to any angle not exceeding 45°, and the same can be raised or lowered, and slid forward or back, preserving the inclination given.

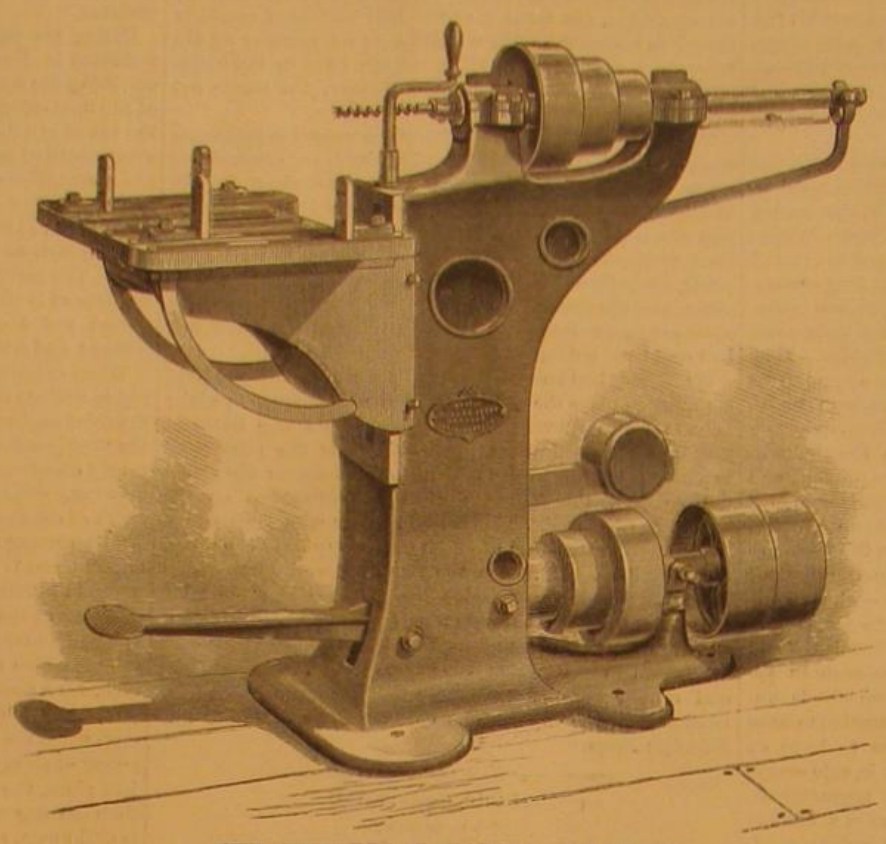
Augers and machine and pod bits of the various sizes can be employed, as an adjustable chuck is fitted to the mandrel for holding the same. The levers are in the inside of the machine, where they are protected, and where no dust and shavings can obstruct their movements. There is no spring connected with these parts to impart return motion, which requires a greater amount of pressure at this point of the operation than is needed to secure a smoothly finished hole.

It will be seen from the foregoing that the machine is [illegible] ready for doing either light or heavy boring at any angle desired, with ease and, it is claimed, with great rapidity.

It is claimed that, on machines or devices where the stuff has to be moved up to the auger, there is a liability of twisting, of making a crooked hole, and of breaking the bit, especially if knotty or crossgrained material be used; and that the expense of bits would, in a short time, amount to the cost of the present invention.

The countershaft attached to the machine rests in adjustable boxes, and has a tight and loose pulley of eight inches diameter and three and a half inches face, and should make 900 revolutions per minute.

Messrs. Bentel, Margedant & Co., of Hamilton, Ohio, the makers of a great variety of woodworking tools, descriptions and illustrations of which have already appeared in our columns, are also the manufacturers of this machine. Letters for further particulars may be directed to their address.



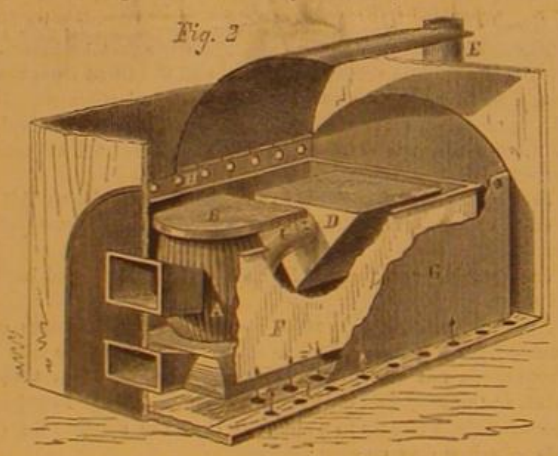
THE UNIVERSAL BORING MACHINE.

COMBINED COOKING, HEATING, AND DRYING APPARATUS.

The inventor of the device illustrated in the annexed engravings claims to have succeeded in producing a combination of useful apparatus relating to the operations of cooking, drying, house-warming, and ventilation. To families generally, and more especially to those residing in circumscribed quarters, notably French flats, this invention, it is believed, will prove of much utility, as it is practically a complete kitchen compressed into dimensions no larger than those of an ordinary good sized refrigerator. It serves as a range and, at the same time, as a heating furnace, while it exceeds the capabilities of both in its application to drying fruits, vegetables, or clothes. Paints and chemicals, we are told, may be similarly heated with success, and japanning, it may be added, is accomplished with great facility.

Fig. 1 represents the device with its attachments, and Fig. 2 the interior arrangements, portions of which are depicted as broken away. In the latter engraving, A is the fire box surmounted by an iron plate, B. The smoke and gases from the former pass through a tube, C, in which perforations are made, so that air is thus drawn in, which mingles with and insures the more complete combustion of the products within the hollow iron prism, D. With the latter communicates the chimney flue, E.

Surrounding the portions first described is a shield of sheet iron, F, and outside of this is another envelope, or, as it is termed, deflector, G. The upper part of the latter is arched and provided with suitable hinged covers. There is also a number of perforations, H, near its upper edge. At I are two sets of orifices in the bottom plate, the inner of which lies between the shield and deflector, and the exterior row without the latter. A double current of cold air is thus constantly drawn in from below (as indicated by the arrows) and between deflector and shield, which, while preventing the atmosphere from direct contact with the heated iron within, maintains a constant and even circulation. The warm current emerges at a suitable register in the top of the casing, and, if desired, may be conducted into another apartment by the flue shown. In weather during which it is not necessary to warm the room, the register and flue may be closed, when the current



will escape into the chimney flue by the pipe, J, Fig. 1. The vessel shown surrounding the chimney flue in the last mentioned engraving is a hot water receptacle, and the perforated tube, K, is designed to draw in the heavy and foul gases which sink to the floor of the room, thus, it is claimed, providing efficient and healthy ventilation.

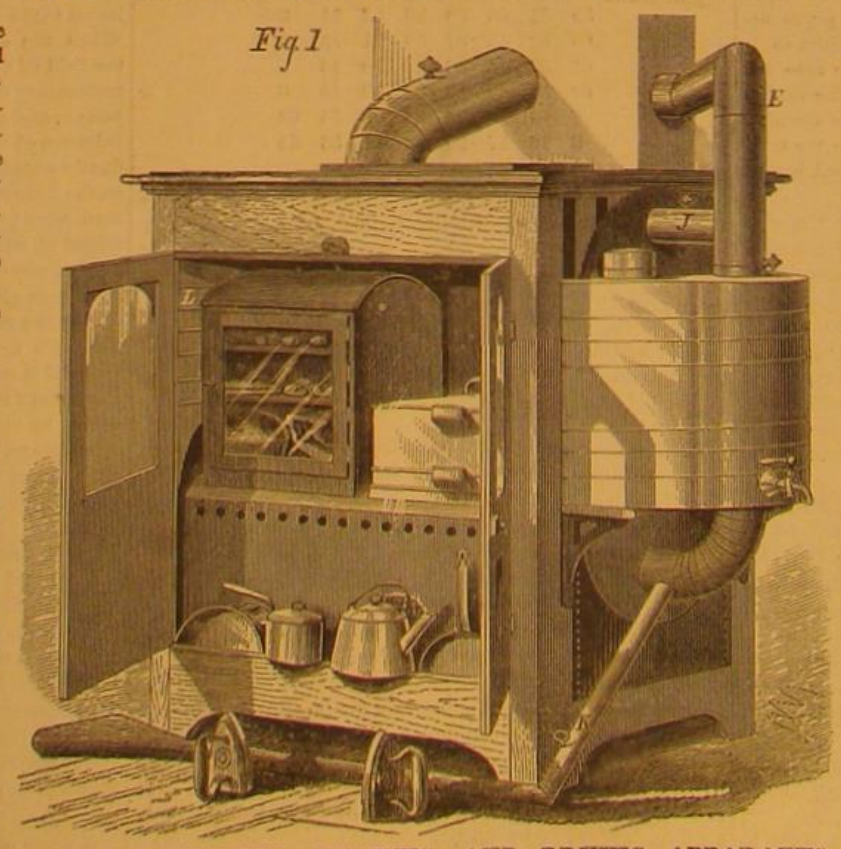
Within the case, which may be of wood, marble, or any other suitable material, and on the left is the oven, the bottom of which is so constructed as to deflect the warm air to its sides and top. It is provided with a glass door in order that the process of baking may be watched, and with suitable shelves for the reception of the articles. It is readily removable, and, when in place, rests above the arched portion of the deflector as shown. To the right is a boiler similarly located; on this being taken out and the cover below lifted, the upper surface of the prism is exposed. The latter, together with the plate, B, Fig. 2, serves to receive sadirons for heating, or may be used for any of the culinary operations usually carried on on top of an ordinary range.

For drying fruit, the oven and boiler are removed and iron rods are placed on the ledges, L, Fig. 1. These support suitable shelves on which the material is placed, and which, in the aggregate, give a large amount of heating surface. It is claimed that the ordinary family sized heater will solidify from three to four bushels of fruit in from eight to ten hours, and that the substance gains from 32 to 35 per cent in weight as well as greatly in appearance over common dried fruit. An economy is, besides, effected in the cost of cans, sugar, labor, etc., as it is stated that the flavor and nutriment of the article heated is perfectly preserved.

For clothes drying, rods are provided over which the garments are hung, inside the case. The operation, we are informed, is completed in one and a half hours, during which period the irons may be thoroughly heated, so that the laundress can proceed at once with the pressing as the garments are removed. In baking, the oven is stated to be economical and rapid.

During culinary operations producing smoke, the latter is confined in the casing and passes freely off through the flue. There are no range lids to lift, and breathing the heated fumes arising from an open coal fire is avoided. The device may be adapted to burn either coal, wood, or coke.

Invented by Mr. J. K. Boswell, of Ohio. Applications for territory or for further particulars should be addressed to S. R. Wells, publisher of the *Phrenological Journal*, 389 Broadway, New York city, or to Dr. R. T. Trall, 1,516 Chestnut street, Philadelphia, Pa.



COMBINED COOKING, HEATING, AND DRYING APPARATUS.

The Inter-Oceanic Canal.

The Secretary of the Navy in his annual report states that the expeditions authorized by Congress to survey the Isthmus of Darien, with a view toward the completion of a canal between the Atlantic and Pacific Oceans, have finished their labors. The preliminary operations to actual construction are therefore completed, and it now remains for Congress to determine whether the routes, indicated by the officers engaged for so long in this arduous duty, present sufficient advantages to warrant the undertaking by the Government of this very important enterprise.

Two surveys have been made. The Darien expedition, under Commander T. O. Selfridge, has selected a route including 100 miles of river navigation of the Atrato, which stream has been found to offer a sufficient depth of water for the heaviest class of vessels. Between this river and the Pacific a canal is necessary, 28 miles in length; 22 miles of this distance is over a plain having a gradual rise of 90 feet. Finally, there will be three miles further of open cut, and three miles of tunneling to reach the Pacific. It is estimated that the work will cost from $50,000,000 to $60,000,000, and could be completed within ten years.

Commander Lull, in charge of the Nicaragua expedition, has determined a practicable route for an interoceanic ship canal, having Lake Nicaragua as its summit level. It is proposed to connect this lake with the Pacific by a canal 16·33 miles in length, beginning at the mouth of the Rio del Medio, and terminating at Brito. The first 7·5 miles will require an excavation averaging 54 feet in depth, and will constitute the most expensive part of the work. Ten locks and one tide lock will be required, and there will be 56 miles of lake navigation.

The San Juan river will be navigated to the mouth of the San Carlos, and will be improved by four dams, in order to get around three of which short canals must be built. From the fourth dam to Greytown, an independent canal 41·9 miles in length is needed. The total length of the canal is 61·74 miles, of which 47·34 miles are an embankment and excavation. No tunneling is required, and it is believed that Lake Nicaragua will supply 38 times the maximum demand of water. The route surveyed by Commander Selfridge seems to be much more direct and easier to construct.

DESIGN FOR A CONSERVATORY.

We present herewith an engraving of a conservatory, called by its designer "a cool conservatory in the natural style." It is intended for the cultivation of such specimens (and they are very numerous and beautiful) as do not require stove heat to bring them to maturity, the protection by glass being generally sufficient. Very little artificial heat is enough to keep the temperature in winter at a minimum of three degrees above the freezing point, which is quite sufficient for the period of repose which is required for many of the plants from Australia, China, Japan, New Zealand, and mountainous tropical regions, etc. One can hardly believe what numbers of plants there are, often supposed to belong to tropical climates, with which a cool conservatory can be furnished. Numbers of our beautiful palms would yield to cool treatment; and hundreds of ferns require no better situation than the shelter of glass. The dracænas, agaves, acacias, dasylirions, ficus, aralias, banksias, tender conifers like the Norfolk Island pine, yuccas, grevilleas, rhopalas, and the cactuses, would certainly submit to the same treatment, without mentioning the smaller kinds, which only thrive under a low winter temperature.

The experience acquired of the natural style of arrangement in conservatories during fifteen years in Europe, says the *Garden*, enables us to recommend it with confidence.

More than thirty species of palm now flourish in cool houses. A great number grow in the cold regions of tropical mountains, such as the *ceroxylon andicola*, which is found at 10,000 feet and upwards. The *oreodoxa frigida*, and several kinds of *chamædorea*, rise up to the pine region; the *areca humilis* reaches to 8,000 feet in Java; the *chamærops martiana* to 7,800 feet in Nepaul; the *phœnix humilis* to 6 000 feet; without reckoning the *chamærops excelsa* of China, the *rhapis flabelliformis* of Japan, *corypha Australis*, etc. For a winter garden, palms ought to be kept in pots up to the period when their leaves divide and show their character, and their stems become at their base as thick as the arm. They must not be put in the ground before this, nor until they shall have been kept as much as possible in a warm greenhouse where the pots have been plunged in tan. They should be repotted twice a year, in spring and summer, when their growth is rapid, without cutting the roots, and in pots deep and narrow. A quiet and warm atmosphere, somewhat shady, but without stagnant moisture, is best suited to palms when young. Growing ferns have nothing to fear from the open air or the sun; it is only the stemless kinds which flourish in the shade and under other plants, their roots requiring nourishment. The *alsophila Australis* may be placed outside in the full sun without injury; if it be watered from time to time with liquid manure, it will acquire considerable dimensions in a short time, and be of unsurpassable beauty.

A COOL CONSERVATORY IN THE NATURAL STYLE.

A great number of the plants named will remain uninjured if protected from the frost; but it is better, as has been already said, to keep up the winter temperature a little over the freezing point; and even when the sun strikes upon the glass, raising the temperature, it will not be necessary to open the house at all during the winter. After February, however, when vegetation is getting active, it will be necessary to give air gradually, and to water in the evening. In March you must begin to shade with some light material up to the time that you can uncover the greater part of the conservatory, and at last place some of the plants in pots or boxes in the open air. As to the great palms and tree ferns, dracænas, aralias, etc., they will be better slightly shaded throughout the year, taking care to give plenty of air. Where it could be easily done, it would be desirable to remove the roof and allow the contents to be refreshed by the summer rains. Thus managed, with plenty of water and a proper amount of shade, it is very possible to develope splendid vegetation in such a structure.

DR. MONCHAUX recommends the use of cold infusion of green coffee in the treatment of gout.

Arsenic in Hydrophobia.

In a late number of the *Correspondenz-Blatt*, Dr. Guisan gives a number of cases showing the value of arsenic as a prophylactic in hydrophobia, and even as a remedy also after the symptoms are marked. He relates that a rabid dog, between the 7th and 9th of June, bit thirteen persons in various towns of the canton of Freiburg. All were recommended to be treated with one twentieth of a grain of arsenic morning and evening, as a prophylactic measure. Eight submitted to this and none were affected. Four declined, or were not allowed to take, the arsenic. Of those four, two remained unaffected, and two died. One began the arsenic treatment, but speedily left it off; she was attacked, but at a much later period, and died. Dr. Guisan recommends not only the internal employment of the arsenic, but that the wound should be dressed with it.

Screw Propulsion.

The subject of ship propulsion, which some years ago was one of the most frequented fields for the inventor, has now, for a long time, been comparatively quiet. After almost every conceivable form and arrangement of paddle wheels, screw blades, and jet propellers had been proposed, and many of them tried practically, the screw has obtained the mastery, and we now scarcely ever hear of a paddle wheel steamer being built, while the jet propeller has failed even to obtain a footing except in a few experimental vessels for the Government or for pleasure boats. It is scarcely too much to say that, among those who labored to improve the screw propeller, no one is better known, or has been more successful, than Mr. Griffiths, whose system has been almost universally adopted in the Government service, and to a large extent in the mercantile navy.

When, therefore, we hear of Mr. Griffiths again coming before the public with a new mode of applying the screw propeller to drive ships, the recollection of his former successes awakens an interest which would not attach to the experiments of one less experienced in the particular subject he has undertaken to improve, when further improvement in it seems to have been almost given up as hopeless.

Some time ago Mr. Griffiths read a paper before the United Service Institution, in which he proposed to supersede the present system of employing a screw outside the ship at the stern by a pair of screws, one in the bow and the other in the stern, both working in tunnels. It had often been proposed to fit propellers of different forms in tunnels extending through the ship from the bow to the stern, but these had all been abandoned on account of the enormous loss of power, due to friction, which such a system must necessarily entail. Mr. Griffith's tunnels were not proposed to extend fore and aft; in fact they amounted to two short tunnels, one at each end of the vessel, the fore one, after leaving the propeller, sloping downwards, and coming out with an easy curve at the ship's bottom some distance abaft the bow, and the after tunnel opening from the bottom of the vessel an equal distance on the fore side of the stern, and sloping upwards towards the after propeller until it emerges towards the stern in a direct fore and aft line.

In this proposal, of course, the objection on the score of increased friction could not be maintained to the same extent as if the tunnels were of great length; but what little experience had been gained of tunnels was not much in their favor, and it was incumbent on Mr. Griffiths to show that with his new system a certain power would propel the vessel faster than the same power applied on the usual system, of a screw on the fore side of the rudder post, would propel her. To do this a number of experiments have been carried out with models on the canal at the northwest corner of the Horticultural Gardens, at South Kensington, and a close scrutiny and study of these experiments have convinced us that very remarkable results are likely to arise from the adoption of the system, and that while opening up some curious and difficult questions on the theory of resistances and propulsion, the subject is full of practical importance, as affording every encouragement that economical results will be obtained of a character sufficiently striking to command support in these days of high priced coal.

That there is a pressing need for improvement in our steam mercantile marine is apparent to all engaged in shipping, and is shown by the increased number of orders which are being received by builders for new sailing ships, compared with the orders for steamers. This apparent tendency to return to sailing ships, which characterizes the present time, is no doubt due to two causes, namely, the expense of working steamers, and the great losses which have occurred among them. Both of these objections are proposed to be removed, to some extent, by Mr. Griffiths' plan, which combines the most desirable feature of separate engines at the bow and stern, with, as it is contended, an equal speed and less expenditure of power. On this latter point we have witnessed a large number of experiments, the details of which we hope shortly to publish, and shall therefore content ourselves, on the present occasion, with giving a brief outline of their results. They were made with a couple of models, so arranged that they could be propelled in the ordinary way or on the tunnel system, and every care and attention was paid to insure the power applied being accurately recorded, as well as the number of revolutions of the screws.

Experiments were made with the whole power concentrated on one screw at the stern, and afterwards with the power divided, placing half in a tunnel in the bow, and the other at the stern; and the increased speed, with the new system, was very striking indeed, amounting to about 30 per cent in some of the runs; but this, doubtless, was assisted by other causes, to which we shall hereafter refer.

The most curious results of the trials appear when the model is tested with the engine at one end only at work, and compared with the result obtained with the screw working at both ends, and with the power doubled. It is well known that in ordinary vessels when the power is doubled, the speed is increased by one fourth; but in these experiments, trial after trial appear to show that when the power is doubled by adding a screw in the bow working in a tunnel, the speed is increased by one half.

We regret that space prevents us dealing, on the present occasion, more fully with these valuable and interesting experiments, to which, however, we shall return, and discuss fully the bearing they are likely to have on the steam shipping of the future.—*Engineering*.

OIL OF CLOVES is effectual in protecting animals against flies and mosquitoes.

THE GERM THEORY AND ITS RELATIONS TO HYGIENE.

BY PRESIDENT F. A. P. BARNARD, LL.D., OF COLUMBIA COLLEGE.

[PART III.—Conclusion.]

PARASITIC GROWTHS.

In order that we may be able to judge of the probability that an infectious disease, of which the cause is unknown, is a result of the invasion of the blood of the viscera of the patient by a parasitic vegetation, it is important to consider first what has been already ascertained of the effects of such parasitic growth infesting the animal organism. A simple form of fungus, called the *sarcina ventriculi*, is often found in matters thrown up by persons laboring under disorder of the stomach. It has also been met with in other parts of the body when diseased. But it is likewise found, and not unfrequently, in the stomachs of persons in perfect health; and, as Dr. Carpenter says, may accumulate there in considerable quantities without causing inconvenience. This parasite, therefore, cannot be regarded as an inciting cause of disease. The stomachs of many worms and insects are found, moreover, to be frequently infested with fungi, which grow there in great luxuriance. Many of these have been examined and described by Dr. Leidy, of Philadelphia. In the West Indies, according to Dr. Carpenter, it is not at all uncommon to see individuals of a species of *polistes* (corresponding to our wasp) flying about with plants of their own length projecting from some part of their surface, the germs of which have been introduced through the breathing pores at their sides. This fungus growth, however, soon kills the insect, and a similar effect follows a similar cause in the case of certain caterpillars in New Zealand, Australia, and China, of which the bodies become so thoroughly interpenetrated and, as it may be said, replaced by the fungoid vegetation that when dried they have almost the density of wood. Our common house fly is a not unfrequent victim of a similar parasitic visitation. A fungus called the *empusa muscæ*, originating from the germination of a single spore brought in contact almost anywhere with the body of the insect, pervades after a time its whole interior, and, while leaving the surface uninjured, emphatically eats out its substance. When the animal's life is nearly exhausted he comes to rest, and fungoid shoots put forth from his body on all sides, clothing him apparently with a kind of fur, consisting of filaments each bearing a fructification of innumerable spores. The harvest of spores becomes very conspicuous when the unfortunate animal makes his last stand upon the window pane, forming a thin film over the glass to a considerable distance around him; and if by any chance a healthy individual of the same species comes within the limit of this infected area, the disease which has destroyed his fellow will be sure to attack him also.

The epidemic among cattle, called in England "the blood," is shown by the researches of Davaine to be occasioned by the presence in the blood of the diseased animals of innumerable living organisms resembling *vibrios*. This disease is communicable to many, producing what is called malignant pustule, and this is attended with the development of the same organisms in the pustules thus produced. Professor Lister, an eminent surgeon of Edinburgh, long ago observed that, when a chronic abscess is discharged by means of a *canula* and *trocar*, the subsequent accumulations of fluid are frequently attended with putrefaction, though none had existed before. The putrid mass is also found to be swarming with *vibrios*, though none had been present in the discharges. No explanation of this singular phenomenon, according to him, can be given except that the germs of these organisms were introduced in the original operations with the *canula* and *trocar*.

In plants, the smut in wheat, the rust in cotton, the *oidium* in grapes, and the *botrytis* in potatoes, are examples of fungi, constantly concomitant with disease, and presumably, almost certainly, in the last two instances, its cause. Neither in plants nor animals, however, is it to be supposed that the noxious effects observed are occasioned by the presence of these parasites mechanically interfering with and obstructing the vital functions, or by acting directly as poisons in the ordinary sense; but rather by their own vital activity decomposing the substance of the organisms they infest, and making them their food. The consequences of their extensive prevalence to the material interests of communities and peoples, and to their means of subsistence, have been occasionally of the gravest character. The *oidium* may be said to have exterminated the vine from the island of Madeira; the *panhistophyton* cut down the product of silk in France from 130,000,000 of francs per annum to 30,000,000; and the *botrytis* threatened to depopulate Ireland, by destroying the vegetable which constituted, for the common people, the staple article of their food.

EVIDENCE IN FAVOR OF THE GERM THEORY.

Putting together these well known facts regarding this subject, before proceeding to more doubtful cases, we may say that the germ theory has an amount of *prima facie* evidence in its favor which entitles it to careful consideration. In certain instances, and in a certain sense, the evidence is complete that the germ theory is true. But when we come to apply it to infectious diseases in general, we find the analogies which they present, with the limited class of examples above enumerated, to be unexpectedly feeble, while the points of dissimilarity are numerous and marked. It is not even enough to discover that in such diseases there are actually present, in the blood, or in the tissues, or in the secretions, or in the dejections, of the suffering individuals, living forms of microscopic cryptogams, since the evidence is rarely conclusive either that these minute bodies are injurious to the patient or that they were present antecedently to the attack. And if, as to the first of these points, the evidence in some cases is satisfactory, as to the second it can hardly be pronounced to be so in any.

As to the frequent presence of vegetable organisms in the blood of men or animals suffering under infectious diseases, it is impossible to entertain a doubt. The testimony of all the observers who have occupied themselves with this subject is concurrent to this effect. Coze and Feltz, Klebs, Burdon-Sanderson, Klein, and many others, have found *bacteria* invariably in the blood of patients suffering under typhoid fever, small pox, scarlet fever, puerperal fever, pyæmia, and septicæmia. Dr. J. H. Salisbury, of Cleveland, Ohio, affirms, as the result of his own observations, that in healthy as well as in diseased blood there are always present two species of cryptogams, the one algoid and the other fungoid. In the pustules of small pox, Dr. Salisbury has observed a cryptogam described by him as having both a fungoid and an algoid development, and the spores of this he has also found in the blood. In cow pox, or in the disease produced in the cow by inoculation from a small pox subject, only the algoid form appears. This the discoverer has named *ios vacciola*, while the entire plant in its double form is called *ios variolosa vacciola*. In typhoid fever, the same writer has detected a peculiar algoid vegetation developing itself upon the external surface of the entire body and upon the mucous membrane of the interior cavities. This he regards as the efficient cause of the disease, the means by which it is propagated.

The disease which appeared in 1868 among the beef cattle brought to this city from the West, and which is known as the Texas cattle disease, was investigated at the time by Dr. Harris and Stiles of the New York Health Department, who found the spores of a peculiar species of fungus both in the blood and the bile of the diseased animals. Specimens of these cryptogams were sent by these gentlemen to Professor Hallier, by whom they were successfully cultivated, and who succeeded in deriving from them three distinct forms of the fungus. The epizootic which attacked all the horses of the country twelve months ago was also marked by the presence of the fungi in the blood and the urine of the animals affected, which were described by Dr. Endemann, and by Dr. Charles Am Ende of Hoboken.

About forty years ago, the yeast plant was discovered by Cagniard de la Tour, and almost simultaneously by Schwann. Till that discovery, the chemical theory of disease had a strong support in the imagined analogy of fermentation. To the suggestion, after the discovery, that fermentation is probably a consequence of the rapid growth of the plant, there was at first a very general and natural dissent; but when, in 1843, Helmholtz made a direct experimental test of the question by placing a fermenting liquid side by side with one of the same kind not fermenting, both being contained in the same vessel but separated by a membrane which permitted the mingling of the liquids, but prevented the passage of the plant, that analogy lost its force; for the fermenting liquid continued to ferment, while the quiescent liquid remained quiescent. The case of fermentation assumes now a significance quite the contrary of that which it had before seemed to possess, and it began to be claimed quite as conclusive in favor of the germ theory, as it had been before in favor of the chemical. This theory, however, though among its advocates have been, and continue to be, counted many of the most distinguished physicians and physiologists of the past and the present generation, has never met with universal acceptance.

DISEASED CONDITIONS THE PABULUM FOR FUNGI.

What account shall we give, therefore, of the multiplication of fungi and algæ in diseased blood, if these organisms are not the cause of the disease? Simply, that the diseased condition furnishes to the organisms their pabulum, which is not present in the healthy state. For the cause of the disease we must, on this supposition, look elsewhere, and we shall be compelled, perhaps, to fall back upon the chemical doctrine of sympathetic decomposition. Many causes, in fact, produce profound changes in the blood with which parasites have nothing to do. This is true of the venom of the serpents, and of prussic acid, both of which produce fatal effects with singular rapidity. Of "the black death," which raged in the fifteenth century, Bastian quotes Hecker as saying that "many were struck as if by lightning, and died on the spot," and he cites the testimony of Dr. Aitken to the fact that, when the cholera reached Muscat, instances occurred in which only ten minutes elapsed from the first apparent seizure till life was extinct. These are cases for which the germ theory affords no solution.

On the other hand, we have the numerous observations and experiments of Coze and Feltz, of Burdon-Sanderson and Klein, of Klebs, of Davaine, of Zahn and Tiegel, and others, in which rabbits and guinea pigs were inoculated with bacterious blood drawn from patients laboring under a great variety of infectious diseases, including pyæmia, septicæmia, small pox, measles, scarlet fever, typhoid fever, etc., observations and experiments which seem to leave little room for doubt that these organisms are, in fact, in these cases, the vehicles of the infection and the causes of these several diseases.

In view of the conflicting character of the evidence surrounding the vexed problem under consideration, the conclusion to which the present speaker has been led, if it may be permitted to one so moderately versed in physiological science to have a conclusion at all, is that neither the germ theory of contagious disease, nor the chemical theory, is exclusively true, but that each of these morbific influences has a range of action of its own, and that in some cases it is eminently probable that the disease in its inception is attributable to one of these causes, and that is the chemical: but owes its subsequent virulence mainly to the other, that is, to the presence of rapidly multiplying vegetable organisms.

Such has been the success of modern measures for closing up all the insidious approaches, by which disease has hitherto effected its entrance into the family, the community, or the individual organism, as to encourage a hope, even so seemingly wild and visionary, as that a time is coming in which disease itself shall be utterly extirpated, and men shall begin to live out the days which Heaven intended for them. When that time arrives, if it ever shall, your honorable and learned profession may find, like Othello, its occupation gone; but it will be itself which will have destroyed it, and which will have established, in doing so, a nobler title to the gratitude of mankind than all its untiring labors for the relief of suffering humanity through centuries of self-sacrificing devotion hitherto have already won.

The Emotions.

Professor Tyndall, while in this country last year, visited the Falls of Niagara, when, reaching the Cave of the Winds by descending Biddle's stairs, he conceived the idea of attempting to pass under the blue waters of Horse Shoe Falls from that point. He found a guide who was willing to make the attempt with him, and together, the next day, they passed through the mist and foam of the roaring cataract, reached the desired point, and returned in safety. In describing his emotions at one point in his perilous journey, he remarks as follows:

"Here my guide sheltered me again, and desired me to look up; I did so, and could see, as before, the green gleam of the mighty curve sweeping over the upper ledge, and the fitful plunge of the water as the spray between us and it alternately gathered and disappeared. An eminent friend of mine often speaks to me of the mistake of those physicians who regard man's ailments as purely chemical, to be met by chemical remedies only. He contends for the psychological element or cure. By agreeable emotions, he says, nervous currents are liberated which stimulate blood, brain, and viscera. The influence rained from ladies' eyes enables my friend to thrive on dishes which would kill him if eaten alone. A sanative effect of the same order I experienced amid the spray and thunder of Niagara. Quickened by the emotions there aroused, the blood sped healthily through the arteries, abolishing introspection, clearing the heart of all bitterness, and enabling one to think with toleranse, if not with tenderness, of the most relentless and unreasonable foe. Apart from its scientific value, and purely as a moral agent, the play, I submit, is worth the candle. My companion knew no more of me than that I enjoyed the wildness; but as I bent in the shelter of his large frame, he said, 'I should like to see you attempting to describe all this.' He rightly thought it indescribable. The name of this gallant fellow was Thomas Conroy."

There is, in this graphic statement of the eminent *savan*, a hint at some truths which, physiologically considered, may be of supreme importance. "By agreeable emotions, nervous currents are liberated which stimulate blood, brain, and viscera." The "emotions" of every living person are unquestionably of more importance to his health, happiness, and well being than most physicians suppose. Agreeable emotions are curative in their influence, when coming to the relief of suffering invalids. Disagreeable emotions produce disease in individuals who, uninfluenced by them, would be in sound health. A dyspeptic who, at his own table, under the influence of depressing emotions, is unable to partake of an ounce of food without subsequent distress and pain, is able, at the table of a friend, under different circumstances, to eat a hearty meal without discomfort. It is a mistake to regard most diseases as resulting from chemical derangements of the system, and it is a mistake to meet a majority of diseases with chemical remedies. We have known physicians who exerted a moral influence over their patients, which gave them a success more gratifying and positive than ever resulted from the administration of any drug. The mind in its connection with the body exerts a controlling influence; and one of the great secrets in regard to securing health and longevity is to train the emotions so as to keep them outside of the cloud which hangs ever ready to darken our mental and moral horizon.—*Boston Journal of Chemistry.*

MOSQUITO NETTING AS A SURGICAL DRESSING.—The *Medical Record* remarks that in all those cases where it is desirable to keep up support and pressure, and at the same time permit the free escape of all discharges from the wound, or ulcer, or whatever it may be, the ordinary mosquito netting, used for a bandage, meets all the indications. Bundling dressings are avoided in this way, the parts are kept cool, the discharge goes on unrestrained, and at the same time support is maintained. If the discharge is considerable, a pad of oakum may be placed beneath the parts to secure the discharge, thus insuring perfect cleanliness. This netting serves an admirable purpose in dressing large abscesses; for instance, when compression and free discharges are to be associated.

LIQUID NOURISHMENT FOR SICK STOMACHS.—The *Dublin Medical Journal* commends the following: An egg, well beaten up, to which add one pint of good milk, and one pint of cold water, and salt to make it palatable; let it then be boiled, and when cold any quantity of it may be taken. If it turns into curds and whey, it is useless.

An Obscure Phenomenon in Psychology.

A few months ago a writer in this journal gave us a collection of facts illustrating the existence of what he called a "mental atmosphere." Such facts are of much more psychological importance than they are usually deemed. Indeed, most scientific writers fear to speak of them, lest censure for too great credulity be their reward.

This was long the case with mesmerism, until it was investigated by Dr. Carpenter, and then it proved a valuable means of furthering the study of mental phenomena, and led to the discovery, or at least the correct understanding, of the automatic cerebral action. This interesting function of the mind is closely connected with more recondite powers by which the brain, or rather the action of the brain, its rhythmical workings, become in some yet unknown manner in accord with workings of other brains, so as to lead to the rise of the same idea in two minds. If, with Fechner (still the best authority on all psycho-physical questions), we regard thought action as the manifestation of a series of vibrations subject to mathematical laws akin to those which govern the senses of sight and hearing, then the explanation which suggests itself to these instances of persons *en rapport*, or *clairvoyant*, is that the thought vibrations are detected by the consciousness as isochronous with those in a another mind, somewhat as a musical ear will detect concord between the pitch of two sounds, when ordinary persons cannot.

But we care less just now to substantiate this theory than to illustrate the facts for which we are seeking explanations. Two remarkable and well attested instances have been laid before the profession in the last few months, in the pages of the *Chicago Medical Journal*, in the numbers for June and September.

The first is related by Dr. George W. Kittell, of Shabbona, Ill. A young lady cut her head severely with a pane of glass, imbedding a number of small fragments in the wound. It was not attended to properly at first, and in a few months "the pieces of glass actually removed, from the crown of her head to the soles of her feet, were numbered by thousands." This looks very much like one of those aggravated cases of hysterical dementia which, in their love of self-inflicted suffering, have always been the puzzle of the wise and the wonder of the vulgar. In this wretched condition she survived from 1865 to December 1872, when death from exhaustion supervened.

The part of Dr. Kittell's description we wish to call attention to is the following:

"One curious phase in her history should be noticed. I refer to clairvoyance.

"In this case it was not produced by mesmerism, but by chloroform, and she became more and more susceptible to its influence. In the latter stages of the case, this state came on occasionally from over excitement.

"Before the accident which introduced the case, she was given chloroform for the purpose of having a tooth extracted. The doctor who administered it had not always kept that moral rectitude, in some particulars, which becometh a physician. Shortly after the inhalation commenced, she began to upbraid him for his conduct. The doctor was frightened, and accused a man, the only one beside himself who knew the circumstance, of telling. The man protested he was innocent, for he really was. When Miss Low returned to consciousness she knew nothing of what she had said, or of the occurrence she had related.

"My first knowledge of this effect of chloroform on her came in this way: After removing some glass one day, and while she was still under the influence of the anæsthetic, I was called out for a private interview. The weather being pleasant, we stepped into the orchard and sat down under a tree. When I returned she remarked 'you thought yourself very 'cute when you went into the orchard to talk; but I heard it all.' I then asked her to tell what she heard, and she related our conversation correctly. She had not left the bed in my absence, and could not see the orchard, as it was on the other side of the house. In fact, she was apparently unconscious the whole time; and when she had fully recovered from the influence of the chloroform, she knew nothing of what had been done or said. I had known her to say strange things while anæsthetized, but till now had not understood it.

"Sometimes, after having taken chloroform, she would rise in her sleep and go miles, in her night clothes, to find articles that had been lost. She never had any knowledge of these nocturnal expeditions in her waking state, except the proof afforded by the presence of missing articles, and the condition of the bed in the morning.

"Her clairvoyant state was another existence to her. When in this state she would tell anything that had transpired at other times, while in the same condition. I have given her chloroform in enable her to find lost articles, which she could always do. Some little thefts, and sometimes bigger ones, were made known in the same way.

"When very sick she was often delirious, sometimes for hours, which led many people to suppose she was insane, and some said she was possessed of the devil. It was from this fact that the horse thieves escaped punishment; many would take oath in court against her sanity. She was the principal witness; and popular prejudice, backed by some physicians for no laudable purpose, carried the day.

"To relate all that she said and did, while clairvoyant, would make a long and interesting chapter. The most interesting occurrences of this kind must be omitted because of their length. If any doubt is entertained as to the truth of these statements, any further proof desired will be gladly furnished by the author."

An example, not dissimilar in kind, but furnished by a young man in perfect health, is given in the number for September, by Dr. Henry M. Lyman, Professor of Chemistry in Rush Medical College, Chicago. The person was Mr. Brown, known as the "mind reader," twenty-one years of age, sound in body and mind. He exhibited his peculiar power by finding, blindfolded, any object which Dr. Lyman secreted in an adjoining room. To do this, he was obliged to be in physical contact with the person who had secreted it. He did not pass into a condition of trance, but claimed to be guided by a sort of subjective appearance of light. His power varied with the temperature and with his own feelings. It depended also on a distinct knowledge of the whereabouts of the article, on the part of the person who conducted him.

Though neither of these examples present novel features, they are valuable because carefully established by competent observers. The deductions from them clearly include the position that the function of cerebration can be stimulated and directed by other means than those ordinarily considered exhaustive. The thought vibrations are not bounded by the superficies of the body, nor by the peripheral extremities of the nerves, but are continued beyond in space, doubtless under some law of decreasing intensity, until, perhaps, they are metamorphosed into some other form of motion, or else become extinguished.

Certain brains, usually but not always in abnormal conditions, are impressed by these vibrations with sufficient force to cause the cerebral action to rise to the level of conscious thought, and hence this singular power of "reading the thoughts of others." The physiological laws which are here involved are those especially which explain the phenomenon of consciousness; and as these are of very extended bearing in other branches of psychology, we shall defer entering upon them until some future occasion.—*Medical and Surgical Journal.*

The New Daily Newspaper.

Inter Ocean, of Chicago, congratulates itself on its already large daily circulation, having increased 25,000 copies during the past ten months, and adds that its regular edition fills eighty large mail sacks. Our contemporary modestly disclaims the honor of its success and virtually ascribes it to the favor of the people; but it seems to us, at least so far as our own experience extends, that the people are not in the habit of converting journalistic enterprises into success unless there be overwhelming reasons, which in fact prevent their doing anything else. Hence, even at the risk of offending its modesty, we are obliged to take issue with *Inter Ocean*, and to assert that, unless it had been edited and managed in the very admirable manner which has characterized it in the past and at present, its popularity might still be an affair of the future. At all events, we congratulate our contemporary upon its prosperity, and cordially wish it the brilliant career to which, from its excellence as a journal, it is fairly entitled.

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

RUBBER WRINGER PATENT.—*JAMES B. FORSYTH* vs. *CHARLES M. CLAPP et al.*

SHEPLEY, *J.*:

Without at this time stating the conclusions to which the court arrived in relation to several questions presented in this case, it will be sufficient for the disposition of the cause to state the decision of the court upon the question of infringement. For a proper consideration of this question, it is necessary to consider the state of the art at the time of the alleged invention of Forsyth.

Rubber rolls for wringers were first made in the form of tubes or hollow cylinders, and expanded on to a plain shaft. Then attempts were made to secure the roll more firmly to the shaft, first by winding the shaft with wire and afterward with twine. An effort was made to secure a more lasting union to the shaft by forcing the tube upon a heated shaft. Next followed a mode of making the shaft itself of two or more parallel rods. The rubber rolls first made with a number of holes corresponding to the number of rods were forced on to these rods which were then connected at their extremities. Canvas was also interposed between the shaft and the roll and cemented to both. Various other devices appear to have been resorted to for the purpose of fastening more firmly the tube to the shaft. The purpose of all of these inventions was to make a more perfect connection of the elastic roll with the metallic shaft.

The difficulty which Forsyth thought he saw, and which he claimed had not been obviated by any of the other devices, was not so much the separation of the roll from the shaft, at the lines or points of connection, as the tendency of the strain on the rolls when in use to a destruction of the body of the roll itself. His theory was that, while the connection, of the shaft with the homogeneous body of the roll constricted on to the shaft, was sufficient for all practical purposes in the use of a wringing machine, the real difficulty to be overcome was that the particles of rubber in contact with the shaft separate and tear away from the rest of the rubber composing the body of the roll. He acted upon the hypothesis that, while the various connections of the roll with the shaft were sufficient to withstand the strain, a portion of the body of the roll would break away from the portion retaining its connection with the shaft by a process of disruption or rending asunder of the body of the roll itself. He commenced, thereupon, a series of experiments, the object of which was to substitute for the homogeneous rolls in use a roll with a tougher, stronger, and less elastic substance in the interior than in the exterior portion of the roll. After trying various methods to accomplish this result by the addition of fiberous or other non-elastic material to the stock of which the interior of the roll was composed, he finally constructed a roll with fiberous material arranged in the interior portion of the tubular roll in a manner which, in an expression proximately descriptive, he calls radially. A sheet of cloth, with a thin layer of vulcanizable compound on each side of it, is first cut into long strips, "bias" or diagonally across the threads or fibers of the cloth. Several of these long strips are placed upon each other and pressed together until the surfaces of rubber or vulcanizable compound are cemented and permanently united. The sheets thus formed are cut into strips or bands of suitable width to admit of their being easily wound on a mandrel, or the shaft of a roll, in such a manner that the fibers of the cloth will radiate from the mandrel or shaft. As shown by the drawing accompanying his specification, it is obvious that each thread would thus extend from the interior to the exterior of the fiberous portion of the roll in a curved radial line, the threads crossing each other, and such threads being nearer together at the core or axis, and separated further from each other as the distance from the core or axis increases. The roll is then made up to the desired size by winding rubber sheets around it coated with cement, when it is placed in molds and subjected to the vulcanizing process, the rubber in its soft and plastic state filling up all crevices around and between the layers and incorporating the parts together. In this way it is claimed that "*the tenacity of the roll and the degree of adhesion of the parts are much increased*, and the position of the fiber is better adapted to resist any tendency of the roll to become loose and turn on its shaft when subjected to a strain."

Charles McBurney had invented and manufactured at the works of the Boston Belting Company a tube substantially, if not precisely, like the tube of Forsyth. No appreciable material distinction can be discovered between the modes of making the McBurney and the Forsyth tube, or in the tubes themselves when made on a mandrel. McBurney's tubes and their mode of manufacture are represented by exhibits ten to fourteen, inclusive. These tubes were made of all sizes, from three quarters of an inch to an inch and a half thickness of tubing, and sold in tubes to consumers. The purchasers cut them in sections or rings for stuffing boxes. Such a tube constricted on to a shaft would be Forsyth's roll. Forsyth does not describe any particular mode of connecting the tube with the shaft. He leaves that to be effected by any of the old and well known processes in use. All that can with any show of reason be claimed for his roll is the combination of an old tube with an old shaft in a mode which was old to accomplish a new and useful result.

Treating it as a valid patent for this new combination of an old shaft with an old tube by old means of connection, for the purpose of considering the question of infringement in the light of the state of the art as existing when he made his roll, we now proceed to examine the construction of the Moulton roll as actually made and relied upon as an infringing device.

The Moulton roll, as manufactured by the respondents, was made by applying transversely to a sheet, or between two sheets of vulcanized rubber, a layer or range of strands of fiberous material and cutting this sheet into ribbons of the desired width at right angles to the length of the strands. These ribbons are folded in the center, and a metallic wire is inclosed in the fold and wound spirally about the shaft, under great torsion, from end to end between the journals, the wire being fastened to the shaft at each extremity. A cylinder or sleeve of rubber is applied over the surface, and the whole is subjected to a vulcanizing process until the whole mass of the roll is thoroughly compacted together. The wire is so tightly wound under pressure that it, in fact, becomes a part of the shaft. The fiberous threads are, in fact, loops which pass into one orifice and out at another in the metallic shaft, their ends extending strictly radially into the body of the roll.

There is a radical and obvious difference in the function of the fibers in the two rolls. Their similarity consists in the fact that the fibers in one are arranged in curves radial diverging lines, extending in a direction toward the periphery of the roll, and in the other in radial lines extending in the same direction. In both of them the effect of the fibers is more or less to diminish the elasticity of the interior portion of the resilient roll; but in the Moulton roll, as made by the respondents, not to any material or scarcely appreciable extent. Their difference consists in the function they perform. The inner ends of the fibers in the Forsyth tube touch or nearly touch the shaft. They do not fasten the rubber compound to the shaft, or aid in fastening it. The ends of the fibers themselves are not fastened to the shaft except so far as they are cemented by the vulcanizable material. The vulcanizable material holds the ends of the fibers up to the shaft instead of the fibers performing that function for the vulcanizable compound. The inner ends of the fibers in the Forsyth roll were attached to the rigid portion of the roll resting upon the shaft, and the outer ends extended from this rigid portion toward the circumference of the roll, thus tending to secure the "adhesion of the parts" of the roll to each other, at which he aimed, as well as to limit the mobility of the rubber into which they extend. If McBurney's tube, or Forsyth's, be constricted upon a shaft which is too small, or insufficiently cemented or connected to the shaft by any of the then existing modes of connection in an imperfect manner, so that the shaft turns in the tube, that result would not be owing to the fact that the fibers of Forsyth failed to perform perfectly their function of confining the rigid portions of the roll to the more elastic portions of it, and of limiting the mobility of the rubber in which they are buried. So, when the roll is subjected to strain by the passage of the silver of cloth between the rolls of a wringer, causing the outer surface to be compressed in one place and expanded in others, the fibers in the inner portion of the Forsyth roll do undoubtedly tend to prevent the body of the roll from being separated from the shaft; but they do not effect this result by reason of their attachment to the shaft preserving the connection between the shaft and the rubber, but by reason of their acting at the same time to preserve the form of the inner and more rigid portion of the tube, and keep up the adhesion of such parts with the outer portions where the mobility and resiliency is greater. But perfectly as the fibers may perform this function, a tube imperfectly cemented to the shaft may still, for that reason alone, turn on the shaft in the Forsyth roll. Now, the loops or bows in the Moulton fibers enter the shaft, and the ends of the fibers extend like "staples" (which they resemble in form) into the body of the roll, for the purpose of securing the interior of the resilient body to the shaft. The fiberous loop is to be taken as a whole. The parts of the fibers which extend from the interior toward the exterior of the rubber roll would not operate to confine the rubber to the shaft without the loops. By none of the methods in use at the date of Forsyth's patent, of making the connection between the shaft and the rubber, was the connection made any more tenacious by presenting the ends of the fiber to the surface of the shaft. In some of them the presence of the ends of the fibers lessen the adhesion by as much as it displaced the rubber. The principal function of the fibers in the Forsyth tube, as before stated, is to make the inner portion of the tube more rigid, and to tie the more rigid to the more elastic portion of the tube. Now, in the Moulton roll, as manufactured by the respondents, the principal function of the fiberous loops is to tie the rubber to the shaft, and they do *not create any material rigidity* in the interior portion of the tube. The method of fastening in the Moulton roll is an inseparable part of the roll itself, being necessarily constructed and built up with the roll and constituting the inner portion of the roll. It is not adaptable to Forsyth's tube, nor is Forsyth's tube capable of having Moulton's fastening applied to it. Because Forsyth borrowed from McBurney his method of constructing the interior of a tube with fibers of cloth arranged in radial curves, it would be the hight of injustice to allow him to monopolize any use of fibers for any purpose whatever in a wringer roll, if the ends of the fibers extended in a radial direction into the body of the roll. His reissued patent, examined in the light of the invention described in the original patent, if valid, must be limited to such a mode of introducing the fibers of a woven texture radially into the tube for the purpose indicated, without regard to the mode of fastening to the shaft.

The court will look beyond the mere form of words in the claim of a reissued patent; and even if, on the face of the reissued patent, it does not embrace anything not described or suggested in the original, nevertheless, the court will ascertain whether there is any substantive invention adequate to support a claim ingeniously worded, not so much for the purpose of describing what the patentee really invented as of grasping within its terms some contrivance not within the knowledge or contemplation of the patentee, and for that reason, not by reason of inadvertency or mistake, not embraced in the claims of the original patent.

Comparing the two rolls, as we have done in some more essential particulars, and without recapitulating other points of difference, enough has already been stated to show that, so radically different is the structure of the rolls, and the function of the fiberous material, and its mode of operation, that the Moulton roll, as manufactured by the respondents, is clearly no infringement upon anything secured to Forsyth by his reissued patent, even giving to the invention claimed in that patent the fullest scope claimed for it in the evidence of Forsyth himself and the expert testimony introduced by him.

Bill dismissed.

[*William Whiting* and *James B. Forsyth*, for complainant. *Benjamin R. Curtis* and *George L. Roberts*, for defendants.]

Recent American and Foreign Patents.

Improved Cigarette Machine.

Joseph De S. Ruiseco, Paris, France.—In using this machine, the tobacco is placed in a receiver above a distributing apparatus, which causes a gaged quantity of tobacco required for a cigarette to drop down to a compressor beneath, by the compressing action of which the tobacco, being rolled up, is inserted afterward into a paper tube ready to receive it, by means of a peculiar device. The paper sheets are laid into a rectangular box of the like section to the surface of the cigarette paper. A piston is constantly acting on the heap of sheets, and compels them to lean against a plate, which is called "a hand," forming one end of the box, and intended to catch them one by one, and carry them to the rolling rod, whereby the same are formed into tubes. The paper sheet is rolled up within a cylindrical tube or mold, split through one of its generating lines, which split one edge of said sheet enters, and is caught by the rolling rod, that is set rotating within the said mold. The lower end of the rolled up sheet is, together with the mold, carried up to the compressor containing a roll of tobacco, which is then, by another rod, driven into the paper tube. The mold moves anew and presents the rolled sheet containing its tobacco, and having its lower end folded up, to the action of the upper end folders, when the cigarette is completed, and the mold returned to its starting point, or under the rolling rod. On its entering the mold, the rod drives out the made cigarette, and gets hold of a new sheet, which undergoes the very same operations as the foregoing one. From what has been said, the making of a cigarette consists of three different operations, effected simultaneously with three different molds, so as to obtain a threefold speedy manufacturing action. The first operation consists in taking a sheet, rolling it, and folding the lower end thereof. The second operation consists in introducing the tobacco into the paper tube thus formed, and the third and last operation consists in folding the upper end.

Improved Spring for Chairs.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for use upon articles of furniture, which shall be readily adjusted to give it any desired tension. The invention consists in an improved spring, formed by the combination with each other of the two rubber blocks, between which is placed the middle part of a U-shaped bar. Another U-shaped bar is passed between the arms of the bar above mentioned, and thus passes around both the rubber blocks. A yoke passes along the upper side of the upper block, and the various parts of the spring are connected and held in place by two bolts which pass through the yoke through notches in the ends of the rubber blocks and through the middle part of the U bar. By this construction, by tightening and loosening the nuts of the bolts, the tension of the spring may be regulated as required. Suitable construction adapts the spring for use in connecting a chair seat to its pedestal.

Improved Harrow.

Silas K. Young, Glen Haven, Wis.—This invention consists of a couple of pulverizing bars in front, four, more or less, bars with knives or teeth behind them, and a wide pulverizing bar behind the toothed bars, all connected together a few inches apart by chains, to be drawn sidewise over the surface. The toothed bars are arranged obliquely to each other to give a side draft to the teeth or cutters, to some extent. The knives incline from the front backward so as to rise upon the clods, etc., and cut them by pressing downward; but they can be made to point forward and downward to be used like a colter by reversing the bars.

Improved Means for Propelling Vessels.

John O'Neil, New York city.—This invention relates to improvements in the class of propellers formed of oscillating paddles; and it consists, chiefly, in the arrangement of the upper pivot for the slotted stems of the paddles to shift forward or backward of the vertical plane of the crank, so as to hold the paddles in such manner that they dip vertically into the water and thus save the loss of power due to beating it obliquely.

Improved Governor for Steam Engines.

Carl Robert Rangvist, Stockholm, Sweden.—This invention consists, more particularly, in the use of an oscillating ring or plate, or of a combination of several parts, which are more or less symmetrically placed around a common center of support and gravity. This plate or ring is kept in continuous oscillation, so that any point on a line drawn from the center of gravity, at right angles with the plane of this plate or ring, will describe a circle in space. Various applications are made of this principle, the following of which appears to be the simplest: The disk is mounted by a universal joint upon a hollow support, through which a shaft carrying the three arms and buttons is fitted, a spring crowding said pins against the plate, and serving as equivalent for a weight. A pinion hung loose upon the shaft, meshes into a toothed segment, that is mounted upon a weighted crank lever from which the connecting rod extends to the valve. When the speed of the engine is increased, the increased friction on the buttons causes the loose pinions to act upon a lever in such manner as to move it to more or less shut the valve.

Improved Trimmings.

Welwood Murray, New York, city.—This inventor has patented three inventions of similar nature. The first consists of a trimming for dresses and other articles of wearing apparel for ladies, composed of a strip of muslin, lace, silk, or any other suitable textile fabric, with cross plaits arranged in groups of, say, four or five (more or less) plaits in a group, and plain portions between the plaits of about the same width as the groups thereof. The second invention consists of a reverse box-plaited and puffed trimming for dresses, etc., in which, by reason of the plaits of one side being made midway between those of the other side, they have the form of an ordinary box plait at one margin of the trimming, separated into two members at the other margin, and merged into the two adjacent box plaits thereat. The machine which is used for making this trimming consists of a pair of plaiting rollers with puffing teeth or formers in one, and sockets or dies in the other, and four plaiting blades for plaiting the cloth and pressing the plaits between the rollers. The third invention consists of a reverse side plaited trimming in which the plaits are folded in opposite directions at the margins, and, when desired, a puff is formed between the plaits at the edge. To make this trimming a pair of intermittingly rotating rollers is used, with puffing cogs or teeth, when the trimming is to be puffed, combined with a pair of folding blades or knives and a feeding guide.

Improved Car Coupling.

Warren B. Snedaker, Syracuse, N. Y.—A coupling hook is pivoted in the drawhead, so that it turns freely on a pivot rod. The long limb of this hook forms the coupling pin, and when the car is uncoupled is in nearly a horizontal position. When the cars come together, the end of the link strikes the center of the hook, which throws the long limb to an upright position. Before reaching this position, its end strikes the underside of a hinged cover and raises it so as to pass a shoulder. The cover drops by its own gravity, and confines the hook, so that the shoulder forms the abutment against which the link pulls. To uncouple the cars, the cover is raised by means of a chain. A forked weight bar is pivoted at its rear end, and its weight is brought to bear upon the short limb of the hook, by means of pins, to keep the hook and bar steady, and in position before coupling, or when the hook is turned down. The forks of this bar also drop upon the end of the link, and hold the link in a horizontal position, so that it is unnecessary to go between the cars to guide the link when coupling the cars together.

Improved Milk Cooler.

James Pearl, Lawrenceville, N. Y.—A water chamber is arranged on a frame by covering it with a layer of sheet metal, painted on both sides to resist the action of the water thereon. The water course is produced by longitudinal partitions, which connect by apertures at alternate ends, so that the water is compelled to take a circuitous course through said chamber. The cold water passes around the partitions, and is conducted off through an exit pipe. Another sheet of metal, painted on both sides, is placed on top of the water chamber, and attached to the main frame. The milk pan is placed on the cover, being cooled as readily as by being directly in contact with the water, zinc especially keeping the water cooler, and preventing the corrosion of the bottom of the milk pan. The milk pans are thereby kept dry, and last a great deal longer than when placed directly on the water. The top cover forms, also, a table, which allows the use of smaller pans, according to the quantity of milk obtained, keeping also butter and other articles cool, as they may be set thereon in any vessel.

Improved Automatic Hatchway Guard.

George E. Berry and Frank C. Pingree, Detroit, Mich.—This invention consists of a gate arranged to slide up and down in the posts or doorway of the elevator, and connected by cords running over guide pulleys with a tilting lever. The latter is moved by a pin on the upper end of the elevator carriage, and caused to raise the gate out of the way when the carriage comes up to the place for unloading and loading. When, by the passage of the carriage to a higher floor, the gate is allowed to fall, the descent is regulated by a pin on the lower end of the carriage, which passes above the lower end of the lever just before the upper pin escapes from the upper end. If the carriage descends without the upper pin passing above the lever, said pin regulates the descent. The gates closed below the carriage are opened by the lower pin on the carriage, and their closing is regulated by the upper pin.

Improved Curling Iron.

Joseph S. Morgan, Brooklyn, N. Y.—The object of this invention is to produce an improved curling iron, which is adapted to be conveniently used on every gas or other flame, keeping its polish and surface uninjured, and perfectly clean for use, and being easily handled with one hand, while the other curls the hair on the iron and manipulates it in the proper manner. This invention consists of a hollow metal tube, with a double elbowed handle applied to its larger conical base, which is provided with air channels for carrying up the flame to the full length of the iron, and also with diametrical side recesses having vertical openings, by which the extinguishment of the flame on the burner is prevented.

Improved Box Clamp for Tobacco Presses.

Thomas L. Robertson, Madison, N. C.—This invention consists of a clamp formed of two blocks, made of hard wood, notched across the grain upon their inner sides, and held together by two or more bolts. The ends of the blocks at their inner edges are rabbeted to form grooves to receive the screw posts. To the outer forward corner of the upper side of the rear part are secured plates, and suitable arrangements are provided so that the rear part will not be pushed back out of place while the clamp is being manipulated. The straps are arranged to prevent the parts from being worn by the heads of the bolts.

Improved Foot Warmer and Improved Artificial Stem for Cut Flowers.

John B. Craig, Perrysville, Pa.—This invention is an improvement in the class of portable heaters consisting of a metal case containing a block of soapstone or other material, which is removed when required to be heated. The invention consists in an arrangement of ribs and pins for supporting the block and holding it in place on the cover of the case. The pins prevent the block moving about in the box when the latter is being handled, and the ribs keep it from coming in contact with the cover, and thus unduly heating the same, thereby causing injury to the floor. The same inventor has also devised an artificial stem for cut flowers. It is the present practice of florists to stem flowers by attaching them to wooden splints by means of wire or thread. The improved device is formed of a wire, shaped spirally into the form of a hollow inverted cone, which is provided with a shank. To attach the device to a flower, the stem is drawn down through the coil until the latter embraces the base of the calyx, when the cone is compressed by slight pressure between the thumb and finger.

Improved Wheel Plow.

Fred Hasbrook, Stokes' Mound, Mo.—This invention has for its object to improve the construction of the wheel plow for which letters patent No 111323 were granted April 30, 1873. The invention relates to an arrangement of a rocking bar and pivoted rod in connection with the tongue and beam of the machine, for the purpose of adjusting them at certain angles to each other. By this construction the chain braces, in drawing the sulky, tend to press the forward end of the plow beam downward, and thus cause the plow to run deeper in the ground.

Improved Cutting Attachment for Sewing Machines.

William H. Sample, Albany, N. Y.—The object of this invention is to furnish an improved cutter attachment for sewing machines, by which fabrics of all kinds may be cut simultaneously with the stitching, and at suitable distances from the line of stitches, by the action of the machine. The instrument may, with slight variation, be attached to nearly every sewing machine, and consists of two upright arms, one of which is attached to the guide casing of the needle bar, and the other is connected loosely with the main arm of the sewing machine. The stationary arm carries at its lower end a cutter blade, which, together with a pivoted cutter blade operated by the reciprocating arm, cuts the fabric as the same is fed by the machine to it and the needle.

Improved Propulsion of Vessels.

George N. Jones, Philadelphia, Pa.—This improvement consists in propelling vessels by the alternate action of steam pressure and a vacuum, respectively operating and formed in a cylinder having a single orifice which is in communication with the water wherein the vessel floats, whereby the quantity of water in the cylinder is expelled and the same or an equivalent quantity readmitted in continuous succession through the aforesaid orifice. Thus no supplementary tube or passage is required to supply the steam and vacuum cylinder with the water to be expelled, but the inflow and outflow occur at the same point. The invention further consists in a valve and float mechanism connected with the cylinder, whereby the admission of steam is automatically regulated, as the water is expelled and admitted, thereby securing a proper and efficient action and allowing the steam pressure to be constantly applied.

Improved Automatic Lubricator for Car Axle Journal.

James Edward Bering, Newburgh, N. Y.—This invention consists in a method of automatically supplying the hot journals of a car axle with lubricating material by interposing, between the journal and a superposed lubricant holding-chamber, plugs fusible below that degree of temperature which will generate combustion.

Improved Implement for Capping Cartridges.

Henry M. Bronson, Sandusky, Ohio.—The object of this invention is to provide a convenient little instrument for capping the brass and paper shells used in the Parker and other breechloading shot guns, by which the operation can be performed in a quick, neat, and perfect manner. It consists of a tubular casing shown, which fakes hold of the cups and transfers them to the countersunk base of the shell by striking sharply the knob of a bolt with spiral spring sliding in the clamp.

Improved Accordion, etc.

Frederick Goetze and Donat Müller, New York city.—This invention consists essentially of the application of two "unisono" tuned reeds to every key of both key boards of a wind instrument in which the key boards form the sides of the bellows, as in an accordion, whereby one reed will sound by expanding and the other by contracting the bellows, and thus give the same note continuously as long as may be required. The invention also consists of sliding holders, in combination with the key board of such instruments, by which the bellows can be worked by the wrists of the player, thus leaving all the fingers free to work the keys, and allowing the hands to slide along the key boards, the instrument being supported at one end on the knees. The instrument thus improved is called an "aeoliodikon."

Improved Slide Valve Mechanism.

Ebenezer E. Gilbert, Montreal, Canada.—The main slide valve has end tubes that slide upon closely fitting guide rods. These guide rods have rear flanges that hold them movably between guide brackets. When the friction between the valve and its seat creates wear, the valve is thus enabled to lower itself and automatically take up the wear. A clapping and disagreeable noise is prevented by the use of an auxiliary valve, peculiarly constructed, and arranged in the steam chest and over the main valve. This valve has two subjacent cavities which alternately connect with the exhaust by a vertical passage, and are separated by a partition. The steam passes through ports into and out of the tubes, to alternately force the main valve in opposite directions, and recesses, over which pass the ends of the valve, to admit steam into chambers and thence to the tubes. The object of this arrangement is to cut off the egress of steam from these cylinders in time to form a cushion to prevent their percussive impact upon the rods. In order to render the valve self-adjusting, to take up its own wear, and also to drop according to the wear that takes place on the main valve below it, an auxiliary valve is provided, which becomes automatically adjustable by its own gravity, both as respects its own wear and that of the main valve.

Improved Link Guide for Car Couplings.

William Warinner and William L. D. Johnson, Creelsborough, Ky.—The bumper heads of the cars are constructed in the ordinary manner, except that their cavities are deepened, and have blocks inserted in them. The blocks have stems formed upon their inner ends which enter holes in the inner parts of the bumpers, and around which are coiled the springs by which the blocks are held forward. Upon the forward end of the blocks are formed flanges to support the pin when withdrawn. A curved frame, upon the inner sides of the side bars of which are formed grooves, receives the side bars of an inner frame. The rear end of the curved frame is hinged to the rear part of the bumper head, and its forward part is supported by a yoke, the side bars of which pass through guides attached to the bumper head. The frame can be raised and lowered, according to the hight of the adjacent car, by simply turning a screw. To the outer end of the inner sliding frame is attached a plate which, as the said frame is drawn outward, comes into such a position as to support the link in a horizontal position. A weight and cord of sufficient size are arranged to draw the frame forward as soon as released. The weight is supported by a small coiled spring, arranged to relieve the jar when the cars are run together, and the weight is drawn upward. The sliding frame is held when pushed inward by a lever pawl pivoted to the frame and held to its place by a spring. The forward end of the lever pawl projects at the side of the bumper, so that it can be readily operated to release the frame and allow it to be drawn forward by the weight.

Improved Toy Blocks for Object Teaching.

Nicholas Muller, New York city.—This invention relates to apparatus designed to facilitate the study of geometry, in the formation of geometrical figures, and to familiarize the minds of both the young and old with such figures, and also to afford recreation and amusement; and it consists in two triangular shaped blocks, made of any material and of any size, by the use of which (and no other) various figures are formed by laying them together.

Improved Standard for Stools, Tables, etc.

Samuel H. Newcomb, Port Williams, Nova Scotia.—The invention consists in an improved stand adapted to support different articles of furniture. The supporting stand consists of four curved legs, of which one is firmly connected to the central shaft. The other legs are hinged sidewise to each other, so as to fold nearly parallel to the stationary leg, and they are arranged to close accurately around the shaft. They are also provided with recesses around the shaft, and projecting lugs at their outer top ends. These lugs enter recesses of a round support which rests on the legs and binds them strongly together. A central circular aperture of the support, together with the recesses around the shaft, allow the insertion of the sockets of the different parts which are to be connected to this supporting stand. A hook of the outer folding leg closes into an eye at the lower side of the support, and prevents thereby the lifting off or otherwise disconnecting of the same.

Improved Plow.

Andrews Riviere, Barnesville, Ga.—The standard bars are set into recesses of the beam, pivoted to it by a strong cross bolt, and are connected rigidly at their lower ends so as to form a strong, rounded off support for the under side of the plowshare. A curved brace is rigidly attached to these bars, passing up between them and through a recess of the beam, above which it is provided with perforations and locked, according to the angle of inclination under which the plowshare is set. An adjusting rod passes between standard bars along the rear of the brace and up through the beam, and is raised or lowered by a crank. Different shares may, in this manner, be attached to the plow, as necessitated by the various requirements of farming, and their angles of elevation and depression be determined by simply adjusting the fore end of the brace.

Improved Slide Valve.

William Stephens, Pittston, Pa.—The valve is truncated and wedge-shaped. The walls between which it is arranged constitute a double seat with double induction ports and exhaust. The steam enters ports at the ends of the valve, which moves far enough to open them in that way. At the lower edge the valve rests on a flat seat, and at the top it may or may not be provided with flanges to bear on the top of the seat. It is fitted on these parts so that it just wedges into the cavity between the seats steam tight. Channels are in the corners of the valve at the lower edges, and in the corners of the seat at the top, to admit steam as a check, which prevents the leaking of the valve to some extent. Such channels can also be employed limit or balance the down pressure. It is believed that the pressure on the top will be governed by the area of the cross section of the ports at the line and it can be reduced to the requisite amount for keeping the valve steam tight by such channels, admitting the steam under it. The double seats afford greater length of ports with a valve and cylinder of a given size than can be had with the ordinary arrangement. The double ports will unite in one passage in any suitable way.

Improved Packages of Powder Charges for Blasting.

Henry M. Boies, Scranton, Pa.—This invention consists in packing the powder, in convenient quantities, in long tubes of paper or any fabric or material of sufficient strength, rendered waterproof if necessary, of a proper shape and size to be used as a cartridge, and of such a length in excess of the powder inside as shall allow of its being folded into a compact form, and divided for use into cartridges of any desired length or weight. Each cartridge tube or package may be easily marked with the size, and quantity, and brand of its contents; and when it comes to the consumer, he can measure off from either end the quantity desired for a blast, slide the powder away from this point, divide the tube, fold back the ends, and the cartridge is ready for use, proceeding in the same way until the whole package has been used. Thus the danger of preparing the cartridge over the open keg and the liability to damage of the exposed powder are avoided, and the time and labor of making the cartridge, as well as the materials of which it is composed, are saved.

Improved Mold for Fancy Buttons.

Frederick Maass, Newark, N. J.—This invention has for its object to furnish an improved fancy button, the mold of which shall be so formed that the cover may be put on, held in place, and ornamented with cord or thread without sewing. The invention consists in the grooves formed in the outer surface of the molds, and in cords or threads in combination with the grooves of the molds, for securing the cover in place upon said molds.

Improved Drill for Well Boring.

Timothy Phillips and Joseph Gollietz, Leavenworth, Kansas.—The drill is made tubular and somewhat flaring, so as to cut a hole a little larger than its body. The lower edge is serrated so as to cut a ring groove into the stratum through which it is boring, the core or central part of the cut passing up through the cavity of the drill. The upper end is rabbeted, and on it is screwed the lower end of a tube, in the sides of which are formed a number of holes to allow the water to flow out, and thus lessen the weight. In the upper end of the tube is screwed a section of pipe, and other sections may be added as the hole increases in depth. To the upper end of the drill is hinged a valve, opening upward into the tube, so as, when the drill is raised, to carry the contents of the tube and pipe with it. With this drill, it is stated, a hole may be sunk by hand to the depth of two hundred feet, and with a lever to any desired depth. This drill also enables the operator to know exactly the kind and depth of stratums through which a hole is being sunk.

Improved End Gate for Wagons.

Joseph C. Baird and Merritt Miller, Heaton, Ill.—This invention is an improvement in devices for securing end boards or gates of wagon boxes and consists, chiefly, in a lever pivoted to the gate by a link or bar, and having, at one end, claws or hooks for taking into notches in one of the side boards, and at the other end a slot to receive a staple which projects from the gate.

Improved Soap Cutting Machine.

Joseph Seibert, New York city.—The object of this invention is to furnish to soap factories and dealers in soap an improved machine for cutting the soap blocks into pieces of any required size. The invention consists of a feeding frame provided with adjustable block carriers for forcing the soap against a suitable cutting frame, on which the cutting wires are rigidly applied by a stretching device, which consists of a supporting piece which carries a crank shaft. The wire is wound upon the shaft by turning it with a small crank, and retained in stretched position by a ratchet and pawl.

Improved Churn Dasher.

George Ridler, Rickardsville, Iowa.—This invention consists in an improved form of churn dasher formed of bars crossing each other, which are made V-shaped with V grooves in their under side. It was fully illustrated and described on page 388 of the current volume of this journal.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From November 8 to November 15, 1873, inclusive.

CONDENSING MILK, ETC.—G. Borden, White Plains, N. Y., *et al.*

GAME.—G. S. Lee (of Worcester, Mass.), London, England.

GAS.—G. W. Morris *et al.*, Baltimore, Md.

LOOM.—E. Oldfield, Norwich, Conn.

PAPER BAG MACHINE.—L. C. Crowell, Boston, Mass.

PRESERVING MILK, ETC.—G. Borden, White Plains, N. Y., *et al.*

RAILROAD BRAKE.—W. M. Henderson, Philadelphia, Pa.

SPADE BAYONET, ETC.—F. Chillingworth, Springfield, Mass.

NEW BOOKS AND PUBLICATIONS.

ORIGIN AND METAMORPHOSES OF INSECTS. By Sir John Lubbock, M.P., F.R.S., Vice Chancellor of the University of London. With numerous illustrations. Price $1.25. London and New York: Macmillan & Co.

The author of this book is the head of a large London banking firm, and chairman of the Committee of the Bankers' Clearing House, besides fulfilling the duties of the positions mentioned in the title; and he yet finds time to pursue, to its uttermost details, one of the most complicated and voluminous branches of natural history. His numerous contributions to the literature of entomology have been read before the Royal Society, the British Association, the Ray Society, and many other learned bodies. This treatise, now issued in an elegant form, with numerous engravings, was originally published in the pages of *Nature*.

HOW TO MAKE MONEY BY PATENTS. By Charles Barlow Third Edition. London: E. Marlborough & Co., 14 Warwick Lane.

It is not necessary to give a detailed description of this excellent little treatise, as we published a resumé of its contents on page 366 of our volume XXVII. The demand for two further editions is an indication of its continued utility.

NOTES OF A METALLURGICAL JOURNEY IN EUROPE. By John A. Church, Engineer of Mines. With Illustrations. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

The author here reviews the systems in use in Germany and Italy, especially in the Hartz, at Freiberg, and at Agordo. The notes were first published in the *Engineering and Mining Journal*.

MATHEMATICAL AND PHILOSOPHICAL MANIFESTO, concerning a Lacking Link in the Demonstration of the Pythagorean Problem, Disproving its Absolute Truth, etc. By Theodore Faber. New York: E. S. Dodge & Co., 84 John Street.

We have carefully looked through this pamphlet for the disproof of the Pythagorean argument, and we must admit that the also is still a "lacking link." But as the matter is in the hands of the Royal Society of England, we will await the discussion of the subject by that learned body before venturing a final opinion.

ANSWERS TO CORRESPONDENTS

G. W. L. can anneal his lamp chimneys by the process described on p. 42, vol. 26.—C. F. E. will find the directions for transferring pictures to glass on p. 223, vol. 26.—H. C. M. will find a recipe for fireproof paint on p. 331, vol. 29.—F. W. E. can stop the leak in his pipe by the process described on p. 364, vol. 29.—R. A. D. will find a recipe for black ink on p. 106, vol. 27. For violet ink, use a decoction of logwood, to which a little alum or chloride of tin has been added.

S. C. H. says: I have a ¼ inch pipe, 2 miles in length; and at one end there is an atmospheric pressure of 10 lbs on the square inch. What amount of time would be required, to produce a pressure of 5 lbs. at the other end of pipe? A. A question of this kind could only be determined by experiment. Formulas have been established for the velocity of discharge of air through long tubes, but the constants have not been determined with sufficient precision to apply to this case. You will find the flow of air through tubes discussed in Weisbach's "Mechanics and Engineering."

W. E. M. asks: How many pounds will a steel screw 2 inches in diameter with ¼ inch thread be capable of raising? A. If you mean that the thread is cut half an inch deep, the screw will lift about 60,000 lbs.

G. W. J. asks: 1. How many revolutions does the screw of an ocean propeller make in a minute? 2. How is the screw made to revolve with the desired rapidity? A. 1. In the case of large ocean steamers, the number of revolutions per minute is generally between 50 and 65. 2. By having sufficient power in the engines. Governors are commonly fitted, to correct a tendency to change the speed.

F. J. S. asks: How can I prepare mustard with vinegar, for table use? A. The common practice of preparing mustard for the table with vinegar, or still more with boiling water, checks the development of the peculiar principles on which its strength almost entirely depends. Prepare as follows: Mustard (ground) 3½ lbs., water sufficient to form a stiff paste. In half an hour, add common salt, rubbed very fine, 1 lb. Then reduce to a proper consistency with vinegar, grape juice, lemon juice or white wine. A little soluble cayenne pepper, or essence of cayenne, may be added.

L. & H. say: We have a tubular boiler 12 feet long, 31 inches diameter, with 30 three inch tubes. We would like to know how to set it so as to economize fuel. We find our shavings and waste insufficient to run it. It has been suggested to set the grates on a level with the floor, without a front, or at least with a door of full size, so that the furnace may be easily and quickly fed; with the ash pit connnecting with a passage leading outside of building to supply draft. A. We think the plan proposed will answer very well. In regard to grate bars, you had better order them from some manufacturer who makes a specialty of building boilers for places where sawdust and shavings are to be used as fuel.

G. Q. asks: 1. How can I find out when sand contains gold, and how is the gold separated from the sand? 2. What is whiting? 3. What are the proportions of alcohol and chloride of lime used in making chloroform? 4. Is there such a thing as gold wash? If so, how is it made? 5. How can I make lemon soda water, in bottles? 6. Can you give me a recipe for making bronze ink? 7. Can I make alcohol from rotten potatoes? If so, how? 9. What are cornices made of? A. 1. You can see the fine glittering grains of gold, if they exist in the sand, and you can separate them by washing in a pan. This pan is best made with sloping sides, and a circular depression in the center, into which the grains of gold settle, while the sand and earth are washed along on the edge. 2. Whiting is elutorated chalk. 3. Chloroform can be prepared as follows: Chloride of lime in powder 4 lbs., water 12 lbs.; mix in a capacious retort or still, and add 12 fluid ozs. of rectified spirit (strong alcohol). Continuously distil the mixture as long as a dense liquid, which sinks in the water which passes over with it, is produced. Separate this dense liquid, which is chloroform, from the water, agitate with a little sulphuric acid, and lastly rectify from carbonate of baryta. 4. A gold wash can be made by agitating ether with a solution of terchloride of gold for some time. Allow it to repose and pour off the supernatant liquid. When this liquid dries, it leaves a coating of gold. 5. By using a carbonic acid gas generator and a bottling machine, with receptacles for sirup. Soda water is only put up conveniently in this way on the large scale. 7. Grind up bisulphide of tin, or bronze powder, with a little gum water. 9. Not from those portions of the potatoes which have undergone putrefactive fermentation. The sound portions left can be used. 9. Cornices are generally molded in plaster of Paris.

R. T. M. asks: Is there anything that will remove the tattoo marks, made in the flesh with common Indian ink, without leaving a scar? I have heard that they could be made to disappear by first rubbing the marks with a salve of pure acetic acid and lard, then with a strong solution of potash, and finally with hydrochloric acid. Is this so? A. There is little doubt that tattoo marks could be made to disappear by the application of the chemicals you name, but the entire cuticle and something more would undoubtedly be sacrificed in the operation, and we therefore advise you by no means to be imposed on by applying corrosive chemicals to the skin. The difficulty of removing the carbon which lies buried under the outer or scarf skin, without removing the skin at the same time seems unsurmountable, but perhaps some correspondent may be able to suggest a practical and painless method.

A. K. says: I have two upright (external tubes) boilers, connected at steam and feed water. Each boiler is provided with a stop valve on steam pipe, so that either or both can be shut off. I find that, when both valves are closed, the water will fall in the one and rise in the other and run out of safety valve, when the pressure on steam gages indicates the same for each boiler, with no fire under either of them. Can you explain this? 2. Should the bottom of a circulating boiler, such as is used in connection with a cook stove or range, be set higher than the highest part of the water back exposed to heat of the fire; or is it only necessary to have the pipe, that carries the hot water into boiler, higher where it enters boiler than highest part of water back? A. 1. You do not send enough particulars to enable us to answer this question. 2. The boiler should always be kept full of water; and provided there is sufficient pressure in the tank or main to secure this, it probably makes no difference at what point the connections are made.

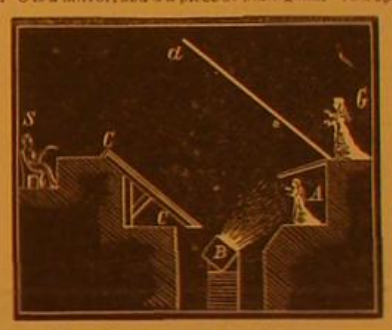
J. W. asks: 1. What are the relative strength and freedom from vibration of two husk frames to carry machinery (especially the burr husks of flouring mills), one built with timbers all standing perpendicular to the base, and the other with the sides vertical? 2. What is the best work for a millwright's guide? A. 1. From your statement it seems to us that you desire to compare two identical arrangements. 2. "Machinery and Mill Work," by Professor Rankine, and "Mills and Mill Work," by Sir William Fairbairn, are both excellent books. Byrne's "Practical Model Calculator" is also a useful work.

H. W. asks: 1. What is the philosophy of soap taking grease spots out of cloth? 2. Is there any profit in manufacturing lemon extract on a small scale, and how is it made? 3. Can you give me a recipe for making an oil for light machinery? A. 1. There is an excess of alkali in the soap. This mixes with the grease on the cloth, and forms more soap. 2. You can readily try it. For an account of the method, see page 331, current volume. 2. It would probably be cheaper and more satisfactory for you to buy it.

L. R. asks: Can you explain the working of a steam trap? A. Steam traps are frequently arranged with floats, so that when they become filled with water to a certain hight, a valve is opened below the water line. Thus the water escapes, but the steam is not permitted to do so; and when the water level is lowered to a given point, the float is not sustained, and the valve closes.

G. J. asks: How can I find the radius of a wheel to make any number of turns, when worked by a worm or a screw, the pitch being given? A. To find the radius of the wheel to make any desired number of revolutions in a given time, knowing the number of revolutions and the pitch of the screw: Multiply the number of revolutions of the screw by the pitch in inches, and divide the product by 6·2832 times the number of revolutions made by the wheel. Example: Suppose a screw with one inch pitch makes 140 revolutions per minute, what should be the radius of the wheel so that it shall make 2 revolutions per minute? Radius = 140 × 1 ÷ 6·2832 × 2 = 11·141 inches, nearly.

J. J. P. asks: How is Pepper's ghost produced? Can I perform the experiment with a common magic lantern? A. The real figure is situated below the stage, at A, and has a strong light thrown on it, from B. C is a mirror, and is a piece of plate glass. To a spectator in front of the stage, as at S, the figure appears to proceed from a point G, behind the glass. Really, the figure would appear to be back of the glass as far as the image formed in the mirror was in front of it, and thus the spectator does not perceive the plate glass.



T. thinks that, in the manufacture of shot, the melted lead, when it drops from the top of the shot tower, ought to assume an elongated form, and asks what prevents, or what makes the shot so round. A. The spherical form is due to the addition to the lead of a small amount of arsenic, which hardens the lead and causes it to assume the spherical form when poured through the strainer. The air chills the shot, which falls into the vessel of water below.

O. A. F. asks: 1. How can photographs be taken on another piece of paper without injury to the original photograph? 2. I have a small engine, 1 inch bore x 1½ inch stroke; it makes 400 or 500 revolutions per minute with 60 lbs. steam when loaded. The fly wheel is 9½ inches diameter. What is the actual power of it? A. 1. We have seen several recipes for this purpose, but are not sure that they are reliable. 2. The engine, at 500 revolutions, probably develeopes about one fourth of a horse power. In answer to your steam gage question: It would be possible to test them by such an apparatus as you describe, but great care would be required in the experiments, and it would probably be necessary to apply several corrections for differences of temperature, and variations in the bore of the tubes. A column of mercury, having one inch area of base, and a hight of 2·0753 inches, weighs one pound, at a temperature of 62° Fahrenheit. Every change of temperature will affect the hight of this column, since mercury expands about 0·0010085 of its volume for each degree that its temperature is increased.

W. J. S. asks: 1. What degree of heat is required to hatch eggs? 2. How can I construct an oven for this purpose? A. 1. 103° or 104° Fah. 2. See Science Record for 1873.

J. E. H. asks: How is lard oil made? A. By subjecting lard to pressure. In answer to your other query, enquire for employment in a machine shop, and study Bourne's works on the steam engine.

J. W. F.—Your general design of guide pulleys is correct, except that, unless the connection is very long, it will not answer to have their shafts vertical; but they must be placed at such an angle that the belt will not have a tendency to change its plane of action and thus run off.

T. Y. S. asks: Can a fly wheel be too large for an engine? I have an eighty horse engine which I have been using at only twelve or fifteen horse power. Since it has been doing so little, it has broken the bed plate, loosened the foundation, and otherwise damaged the engine. I use about 80 lbs. of steam. My idea is that the momentum of the wheel is so great that it wants to get ahead of its work, which the steam will not allow, thereby keeping the engine moving on the foundation. A. We have an idea that the trouble arises from improper setting of the engine, or from the fact that you use such a high grade of expansion as to strain the engine seriously.

P. S. asks: Is it dangerous to make oxygen gas (for a stereopticon light) from chlorate of potash and black oxide of manganese? A. If the pipes from the retort and washer are all of liberal dimensions, we think there is little danger. We call to mind a few explosions, one of a very serious nature, due to clogging of the pipes owing to their small dimensions.

M. D. asks: How is it possible that a grindstone can wear away into angles, so that as many as thirteen corners are seen in it? A. There are probably soft and hard places alternately in the stone from which it was cut.

J. E. S. W. asks: 1. How can I dissolve gum so that I can spread it on the soles of leather shoes, and what kind of gum shall I use? 2. What will take ink blots off paper? 3. How can I make a blackboard? 4. What can I make a mold of, to mold a leaden piece to set tyre in, with a level surface and without flaw? A. 1. You can dissolve India rubber in bisulphuret of carbon, and use it in the way you suggest. 2. Dip a camel's hair brush in dilute oxalic acid and paint the blots over with it. 3. See p. 799, vol. 28. 4. Lead is apt to form flaws in casting. Cast your plate on a smooth piece of iron, with a border of putty or clay.

A. A. B. asks: If a stove has no air to its furnace except what is delivered through an airtight pipe, the other end of which runs into water in a barrel, with a smaller barrel turned bottom up on the water, in the manner of a gas holder: Will the fire in the stove draw air from the barrel and burn it, and thereby allow the smaller barrel to fall down entirely inside of the larger? A. If the air in the chimney is heated, it will be lighter than the surrounding atmosphere; hence the stove will draw air from the barrel, or the barrel will draw air from the chimney, until the weight in each is the same.

C. R. asks: When and where did a race between the Niagara (American) and the Agamemnon (British) war vessels take place? A. We do not find any account of this race, but suppose it took place when the Niagara and Agamemnon were engaged in laying the Atlantic cable. Captain William L. Hudson commanded the Niagara at that time. Possibly some reader may have the particulars.

J. A. E. asks: Can a steam engine give more horse power than its nominal duty? Some persons claim that a 10 horse engine can be geared up to 20 horse power. A. The engines of reputable builders will generally do the work at which they are rated, with a given steam pressure and piston speed. Hence by increasing one or both of these elements of the power developed, the engine could do more.

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

R. R. R.—No. 1, barytes and fluor spar. No. 2, celestine No. 3, analsime. No. 4, limonite. No. 5, magnesite. No. 6, serpentine.

F. H.—Your specimens are crystals of quartz. Quartz is pure native silica, and is an important constituent of granite and other rocks, and of ordinary sand. The transparent variety, like the two larger specimens, is called rock crystal.

J. R. G. asks: Can you give a simple practical rule for finding the exact position of the wrist in the shaft of a nail machine?—C. F. S. asks how to make a blue stamping ink for marking knitted goods.

COMMUNICATIONS RECEIVED.

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

On the Science of Iron and Steel. By C. C. Jr.

On the Currency. By J. W. H.

On Reconstructing the Navy. By W. Y.

Also enquiries from the following:

J. B. H.—C. G. E.—J. C.—McG. & H.—S. H. A. F.—G. R. & B.—S. P.—F. G.—R. H. M.—W. A. B.—J. O.—H. A. M.—E. H.—H. R.—C. E. H.—W. L. R.

Correspondents in different parts of the country ask: Who makes life boats from willow and cork? Whose is the best shingle machine? Who builds lime kilns? Where can I get stave machinery? Where is oil well boring machinery sold? Whose is the best cement for making corundum wheels? Who makes a hand willow peeler? Who makes a good velocipede, or a similar machine to be worked by the hands? Who makes platinum plates for Smee's batteries? Who makes steel runners for ice boats? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal" which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patens of the United States

WERE GRANTED IN THE WEEK ENDING

November 18, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Valve, C. F. Murdock 144,692
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Vegetable slicer, N. Botsford 144,596
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Whiffletree, J. Parker 144,786
Windmill, Atwood & Bodwell (r) 5,656
Window fastening, storm, A. J. Lovejoy 144,684
Wood joining, R. McChesney 144,626

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:

27,341.—PHOTOGRAPH CAMERA.—A. Semmendinger. Feb. 4
27,291.—SEED PLANTER.—J. S. Huggins. Feb. 11.
27,406.—CULTIVATOR.—R. Craig. Feb. 18.

EXTENSIONS GRANTED.

26,177.—MAKING RUBBER BELTING.—D. C. Gately.
26,178.—RUBBER BELTING.—D. C. Gately.

DESIGNS PATENTED.

6,996.—LOCK CASE.—W. H. Andrews, New Haven, Conn.
6,997.—WHEEL HUBS.—J. R. Locke, Amesbury, Mass.
6,998 to 7,001.—C. T. & V. E. Meyer, Bergen, N. J.

TRADE MARKS REGISTERED.

1,527.—ICE PITCHERS.—Adams & Co., Brooklyn, N. Y.
1,528.—SOAP POWDERS.—B. T. Babbitt, New York city.
1,529.—BAKING POWDER.—B. T. Babbitt, New York city.
1,530.—COMPOUND SPICE.—E. R. Durkee & Co., N. Y. city.
1,531.—MEDICINE.—W. H. Gregg & Co., Elmira, N. Y.
1,532.—KID GLOVES.—F. Hegle, New York city.
1,533.—CUTLERY.—I. T. Meyer & Co., New York city.
1,534.—GOLD AND SILVER SOLUTIONS.—A. B. Morrison, Portland, Me.
1,535.—AGRICULTURAL IMPLEMENTS.—Rumsey & Co., St. Louis, Mo.
1,536.—DRYERS, ETC.—G. C. Liszka, Williamsburgh, N. Y.

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[Specially reported for the Scientific American.]

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA FROM NOVEMBER 18 TO NOVEMBER 24, 1873.

2,841.—J. M. Killin, Pittsburgh, Pa., U. S. Improvement on molder's gates or sprues, called "Killin's Molders' Gate." Dated Nov. 13, 1873.

2,842.—O. Sherwood, Jr., Brome township, P. Q. Machine for coupling railway cars, called "Sherwood's Self Railway Car Coupler." Nov. 13, 1873.

2,843.—D. DeCastro, of Mortlake, Surrey county, Eng., and R. Burton, Camden town, Middlesex county, Eng. Improvement on gas meters, called "The Imperial Compensating Wet Gas Meter." Nov. 13, 1873.

2,844.—W. A. Telling and Samuel Johnson, Wood Green, Middlesex county, Eng. Improvement on gas meters, called "The Imperial Dry Gas Meter." Nov. 15, 1873.

2,845.—J. Brunet and L. Bellefeuille, Montreal, P. Q. *Machine a presser la tourbe*, called "*Machine a Presser La Tourbe de Brunet et Bellefeuille.*" "Machine for pressing peat." Nov. 13, 1873.

2,846.—J. K. Home, Almonte, Lanark county P. Q. Improvements on patterns for pipe elbows, describing the swift to form miter joints of elbow pipes at various angles, called "J. H. Holmes' Patterns for Pipe Elbows." Nov. 13, 1873.

2,847.—D. C. Baker, Fulton, N. Y., U. S. Improvement on cultivators, called "Baker's Cultivator." Nov. 13, 1873.

2,848.—D. C. Baker, Fulton, N. Y., U. S. Bolt holders for railroad rails, called "Baker's Railroad Bolt Holder." Nov. 13, 1873.

2,849.—S. Rue, Philadelphia, U. S. Improvements on injectors for steam generators, called "Rue's Little Giant Injector." Nov. 13, 1873.

2,850.—J. W. Stockwell, Portland, U. S. Machine for the manufacture of cement pipe, called "Stockwell's Cement Pipe Machine." Nov. 13, 1873.

2,851.—J. W. Stockwell, Portland, U. S. Improvements in mixing machines, called "Stockwell's Improved Mixing Machine." Nov. 13, 1873.

2,852.—S. B. Munson, Jr., Chicago, U. S. Improvements on fireproof shutters, called "Munson's Fireproof Shutter." Nov. 13, 1873.

2,853.—G. W. Cottingham, St. Mary's, Texas, U. S. Machine for ironing clothes, called "Cottingham's Ironing Machine." Nov. 13, 1873.

2,854.—H. Bolton, Brantford, Ontario. Improvements on piano stools, called "Improved Double Adjustable Piano Stool Back." Nov. 13, 1873.

2,855.—H. Spear, Elizabeth, Cumberland county, Maine, U. S. Improvements on pumps, called "Spear's Pump." Nov. 13, 1873.

2,856.—N. C. Locke, Salem, Mass., U. S. Improvements on pressure regulators for steam or water, called "Locke's Pressure Regulator for Steam or Water." Nov. 13, 1873.

2,857.—M. Merrick, Oswego, U. S., assignee of H. Tilden, Philadelphia, U. S. Improvements on gas machine, called "Tilden's Improved Gas Machine." Nov. 14, 1873.

2,858.—Ed. Beanes, Toronto, Ontario. Extension of Patent No. 541, for improvements in brewing. Nov. 14, 1873.

2,859.—G. Borden, White Plains, N. Y., U. S., and J. G. Borden, South East, Putnam county, N. Y., U. S. Improvements on the manufacture or product of condensed milk, called "Borden's Manufacture or Product of Condensed Milk." Nov. 14, 1873.

2,860.—G. Borden, White Plains, N. Y., U. S., and J. G. Borden, South East, Putnam county, N. Y., U. S. Process of preserving and condensing milk, called "Borden's Process for Preserving and Condensing Milk." Nov. 14, 1873.

2,861.—W. G. Dunn, Hamilton, Ontario. Movable self feed attachment for coal cooking stoves, called "Dunn's Removable Self-feeding Attachment for Cooking Stoves." Nov. 14, 1873.

2,862.—T. O. Kemp, Clinton, Lincoln county, Ontario. A boiler attachment for removing scum and other impurities from boilers of steam engines, and also for preventing scale attaching to boilers and their tubes, called "Kemp's Patent Boiler Attachment." Nov. 15, 1873.

2,863.—E. C. Flint, Belleville, Ontario, assignee of E. P. Needham, New York city, U. S. Key for musical instrument, called "Needham's Improved Key for Musical Instruments." Nov. 15, 1873.

2,864.—J. R. Finley, Delphi, Ind., U. S. Improvements on gates, called "Finley's Improved Gate." Nov. 15, 1873.

2,865.—C. Kendall, Beloit, Wis., U. S. Machine for renovating and drying feathers, called "Kendall's Paragon Feather Renovator." Nov. 15, 1873.

2,866.—R. Burdett, Erie City, Pa., U. S. Improvement in reed organs, called "Burdett's Improved Reed Organ." Nov. 15, 1873.

2,867.—J. C. Ford and A. D. Cable, Montreal. Improvement on attachment for securing horses, called "Ford's Adjustable Leg Halter." Nov. 15, 1873.

2,868.—A. Pelletier, Washington, U. S., Rev. J. B. A. Brouillet, Walla Walla, Washington Territory, U. S., and H. Lafleur, Yamaska, P. Q. Composition of matter for the manufacture of artificial stone and for other purposes, called "Pelletier's Artificial Stone and Cement." Nov. 18, 1873.

2,869.—M. Henry, Parkhill, Ontario, and J. B. Steele, Montreal. Composition of matter for lighting fires, called "Henry's Fire Kindler." Nov. 21, 1873.

2,870.—J. West, Maidstone, Kent county, Eng. Method of manufacturing gas and the apparatus to be employed therewith, called "West's Improved Gas Manufacturing Apparatus." Nov. 21, 1873.

2,871.—C. Vandandaigne, dit Sabois, Baltic, Conn., U. S. Improvement on washing machines, called "The Baltic Washing Machine." Nov. 21, 1873.

2,872.—A. Wilson and E. M. Law, Bell Ewart, Simcoe county, Ontario. Improvement on sash fasteners, called "Wilson and Law's Improved Sash Fastener. Nov. 21, 1873.

2,873.—E. B. Sims, Antwerp, Jefferson county, N. Y., U. S. Improved door bells, called "Sims' Improved Door Bell." Nov. 21, 1873.

2,874.—W. Vincent, Arborfield, Berkshire, Eng. Apparatus for manufacturing gas, called "Vincent's Gas Apparatus." Nov. 21, 1873.

2,875.—H. Brewer, East Parsonfield, York county, U. S. Improvement on wagon brakes, called "The Brewer Wagon Brake." Nov. 21, 1873.

2,876.—A. J. Sorenson, Erie, Pa., U. S. Improvement on cases for cabinet organs, called "Sorenson's Improved Case and Sliding Fall." Nov. 21, 1873.

2,877.—W. R. Peck, Chatham, Kent county, Ontario. Machine for molding the frame work of vessels, ships and other material, called "Peck's Adjustable Frame Mold." Nov. 21, 1873.

2,878.—C. B. Hunt, Springville, Susquehanna county, Pa., U. S. Improvement in drills, called "Hunt's Hammer Twist Drill." Nov. 24, 1873.

2,879.—H. Gregory, Rockland, Maine, U. S. Improvement on elastic friction bands for booms of vessels, called "Gregory's Elastic Friction Band for Booms of Vessels." Nov. 24, 1873.

2,880.—H. Hinds, Ottawa, Ontario, assignee of H. Johnson of same place. Improvement on drum heaters for stoves and pipes, called "Johnson's Improved Stove Drum Heater." Nov. 24, 1873.

2,881.—J. Lewis, Manchester, Eng. Improvement on locomotive engine, called "Lewis' Improved Locomotive." Nov. 24, 1873.

2,882.—C. Carpenter, Hamilton, Wentworth county, Ontario. Attachments for door knobs and spindles, called "Carpenter's Door Knob and Spindle Attachments." Nov. 24, 1873.

2,883.—L. O. Thayer, Montreal, assignee of J. Duval, St. Joseph, Laprairie county, Quebec. Improvement on breech loading fire arms, called "Duval Thayer Breech Loading Rifle." Nov. 24, 1873.

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