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THE EDISON EXHIBIT AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

The accompanying engraving, made from a sketch taken by our artist at the International Electrical Exhibition at Philadelphia, is a faithful representation of the Edison exhibit, than which nothing in the great hall has attracted more attention. The Edison Company sought to represent a miniature counterpart of every detail of their system with a mechanical and artistic finish that should render it worthy the name it bears. How well they have succeeded every one who visited the Exposition is aware. To those who have not, this brief sketch may, perhaps, give a general idea of its most salient features, and the thoroughness which distinguished it.

Facing the main entrance, a circular structure of artistic workmanship marks the general headquarters. Within the dazzling glow of incandescence bursts from a circle of calla lilies jutting outward from a mass of roses, and japonica, and chrysanthemum, and gladioli hanging from the ceiling, and—

> "From the arched roof,
> Pendent by subtle magic, many a row
> Of starry lamps and blazing cressets fed,"

not with naphtha and asphaltum, as were the lamps in Milton's pandemonium, but with an invisible current, which, generated by dynamos at the other end of the great hall, is led by devious routes through subterranean passages. Near by a towering cylinder, glazed with mica, blazes with incandescence lamps, while colored lamps, fed by the same current, hang in festoons around it.

The various and ingeniously contrived parts which go to make up the Edison system are here displayed, not as models the practical workings of which must be explained, but at work in their several capacities.

Here is the plant fed from a central station, intended for cities or sections thereof, such as that one in successful operation in New York city; and there the isolated plant intended for great manufactories and the like. The dynamos occupy a section of their own at the northern end of the building, and notwithstanding the great currents they are generating, which feed several thousand lamps scattered throughout the building, their movements are so noiseless that the average visitor, though he be in their vicinity, would scarce suspect they were in active operation; a low rumble being all that can be heard even when close to them.

Opposite the Edison headquarters, and on the other side of

THE EDISON ELECTRICAL DARKY.

the common thoroughfare, is placed a section of the much talked about and little understood underground apparatus of the Edison system. It is intended for and has served to make incandescent lighting, not a possibility, but a practicability.

By it the current may be efficiently distributed for lighting and for power. For the most part it is constructed of wrought iron piping, in which are laid the copper electric mains through which the current is transmitted. These conducters are insulated with species of tape devised purposely for them, and to still further guard against contact they have here and there a serving of rope. Around the mains and inside the pipes is poured an insulating material which possesses the double advantage of hardening without cracking. The three wire system devised by Edison for his underground apparatus is a fair exponent of his genius in simplifying complicated and expensive mechanisms. Instead of the four wires which heretofore were thought necessary to carry the current from two dynamos of equal power, he uses only three. The central wire of the three is run from the connection which is made between the positive pole of one dynamo and the negative pole of the other dynamo; the two outside wires representing the remaining positive and negative poles.

There is no current through the central main while the dynamos are working evenly, the opposing currents having a neutralizing effect, the one upon the other. Instead of the 100 volt current which the outside mains should carry, they would, if joined together, carry nearly 200 volts. This is presented in the three wire system by means of the connection that is made with the central main from the mains on either side of it. In the three main system, the wires need not be of as large diameter as where four mains are used, and hence, as may readily be seen, still another saving of copper is effected.

The apparatus by which the Edison lamps are freed of air before being sealed is fashioned after the style of the Sprengel air pump—a column of mercury while falling driving the air before it. The life of the Edison lamp often extends beyond one thousand hours, which, if used on an average of five hours per diem, would insure its successful operation for more than half a year. This does much to sustain Mr. Edison's assertion that by means of his apparatus he can reduce the vacuum in his lamps to one one-hundred-thousandth of an atmosphere. After his pumps have done their work, a current of electricity is sent through the filament of the lamp to eliminate what air, if there be any, may have become mechanically entangled.

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THE PHILADELPHIA ELECTRICAL EXHIBITION.—THE EDISON EXHIBIT.

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No. 459,

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RECENT DECISIONS OF THE COMMISSIONER OF PATENTS CONCERNING TRADE MARKS AND LABELS.

The *Official Gazette* of the United States Patent Office, of September 30, 1884, contains a decision rendered September 22, 1884, on the vexed label and trade mark question by the Commissioner of Patents. In rendering his decision the Commissioner gives very lengthy reasons, the text filling nearly two full pages of the *Gazette*. The question is the old one whether the Commissioner canse fuse to register as a label what in his judgment constitutes a trade mark, and whether, if not a trade mark in all characteristics, it then can be registered as a label. Whoever as an applicant has had labels subjected to Patent Office rulings on the above question, will know what the decision was. The Commissioner held that the words "*not a trade mark*" occurring in the statute gave him full power to refuse label registration to a label containing subject matter for a trade mark.

We take decided issue with this decision. In former articles we have stated pretty fully what our views are, and have fortified them by appropriate quotations from authorities. The great court decision in these matters was rendered September 30, 1881; it is in the case entitled the Willcox and Gibbs Sewing Machine Company against E. M. Marble, Commissioner. This was a case before the Supreme Court of the District of Columbia, and in it a peremptory mandamus was issued, enforcing just such a registration as is now refused.

In his decision Mr. Butterworth disposes rather briefly of the opinion in the sewing machine case. He does not agree with it, and so concludes that it was not fully argued, and asserts that it was practically an *ex parte* case. Now the truth is that the case in question did not go by default in any sense. In Mackey's Reports, vol. i., page 285 *et seq.*, Mr. Marble's answer in the case will be found. If the decision, published also in the *Official Gazette* of October 17, 1882, be examined, it will be found unusually long and full. The court strikes at the root of the matter by going back to the original registration of labels with the Librarian of Congress under the copyright laws, and by deducing therefrom the powers of the Commissioner of Patents. But this opinion of so high a court is disposed of as given in "practically an *ex parte* proceeding,". . . . and as one rendered in a case that "did not have careful consideration" from the court. Now, no one can impartially examine the decision so shortly disposed of, without forming exactly the opposite opinion. It is certainly a bold criticism on the methods of so high a court to say that it decided a case and issued a peremptory mandamus without "careful consideration."

The Supreme Court of the District of Columbia is the successor of the old Circuit Court of the District. By the act of February 27, 1801, the original tribunal was established, one of whose functions was to issue writs of mandamus to compel public officers to do acts required of them by law in performance of their duties. The Supreme Court of the District was established by the act of March 3, 1863, whereby the old Circuit Court was abolished, and the new court made its successor. Cases from the Supreme Court of the District may be appealed to the Supreme Court of the United States. Thus the court we are considering possesses very high powers, exceeding in some respects those of the circuit courts. It is, to all intents and purposes, in the mandamus proceedings a United States Court. Several judges, one chief and five associates, compose it. Yet a carefully rendered decision of such a court, given after full deliberation, is disposed of by the Commissioner of Patents in a single sentence.

Three divisions of label and trade mark matter are created by the Commissioner's decision. There is, first, the label, which must be descriptive; secondly, the trade mark, which must be arbitrary or non-descriptive, and in use in commerce with some foreign nation or Indian tribe; and thirdly, the subject matter for a trade mark, but not in the prescribed commercial use. Of these three the first two are registrable, the last the Commissioner decides is non-registrable. All this distinction is purely a Patent Office creation. The old registration under the Copyright Laws with the Librarian of Congress was subject to no such rulings. The inherited power of registration belonging to the Commissioner of Patents should not be either. The point overlooked by this official is that he registers labels under one clause of the Constitution and trade marks under another. To define trade marks in addition to the special act of March 3, 1881, he has a multitude of court decisions. To define labels he is obliged to have recourse to Worcester's dictionary. His predecessor used Webster. He does not take the point that the greater includes the less, and that the term label includes trade marks. Labels are registered under the copyright law. Can any one conceive of an engraving being refused registration by the Librarian of Congress because it is arbitrary? Yet this is precisely what the Commissioner upholds as proper practice in the Patent Office.

The misfortune of the whole business is, that these cases are usually not of sufficient importance to be brought before the court. The applicant, on finding registration refused him, usually prefers to submit to the loss so unjustly incurred rather than go to the expense of an application for a mandamus. The predecessor of the present Commissioner of Patents incurred such a proceeding, however, in the case we have cited. It served to change the practice of the office during his term. Under such amended ruling the business of label and trade mark registration went on with perfect smoothness and satisfaction. It is a great pity that any change has been inaugurated. The status of affairs now is that the Supreme Court decision is set aside, and that rulings are made that would unquestionably incur a mandamus from that tribunal were one applied for. But owing to the somewhat minor importance of this class of privileges, such proceedings will not often be inaugurated.

The Commissioner's arguments in the case in question as affecting labels are derived from these words of the statute: "not a trade-mark," and from Worcester's dictionary. This is but a small basis for a decision. The true way to treat such a case is to go to the root of the matter, and examine the origin of the powers whose limitations are under discussion. Had the latter method been adopted, and not the more superficial plan, a different result would probably have been reached. But taking the issue as presented, we find that the Commissioner quotes Upton's definition of a trade mark, and Worcester's of a label. The trade mark according to Upton is "the name-symbol," etc. . . . adopted by a manufacturer or merchant "to designate the goods that he manufactures or sells." . . . Worcester says a label is "a small piece of paper or other material containing a name, title, or description, and affixed to anything to indicate its nature or contents." Certainly these two definitions quoted by the Commissioner in his decision come very close to each other, considering that they describe things that he considers so radically different. Even in Worcester's definition of a label absolute descriptiveness is not insisted on, as nature and contents may be indicated arbitrarily as well as descriptively. It is in such arbitrary indication that the commercial value of a trade mark consists.

We can only hope for the satisfaction as well of the Commissioner as of the public that some of these cases will again be brought before the Supreme Court of the District of Columbia. Mr. Butterworth, we are convinced, desires such an issue no less than the prospective registrants of labels and trade marks. When such a case does arise, the Commissioner, to borrow his own expressions, will have a good chance to fully argue the case and see that it receives careful consideration from the judges of the court.

SHOP SAVINGS.

A very suggestive sight was witnessed a short time ago in a visit to a large manufactory of machinery and tools. The outlet to the sink had been been closed, and the large drain pipes had to be removed and cleansed. The result of that cleaning was a surprise to the proprietors, although it was not so to at least some of the workmen. If a list of the articles found in the drain pipes and at their outlet into the tail race was made it would be almost like an inventory of the small parts used in the manufactures of the establishment. There were hundreds of pieces of broken files, taps, reamers, drills, parts of machines and tools spoiled in the working, and a wagon load of cotton waste. The water closets had been used as convenient "catchalls," "scrap heaps," and "glory holes." How much the establishment had lost in this way could not readily be estimated, as much of it must have been swept away by the stream and much of it buried out of sight.

It is surprising how much may be saved in the shop by judicious attention to little things and by handy appliances for saving. An establishment that works up brass and iron in about equal proportions for more than a year, mixed the drillings, turnings, and filings of both metals indiscriminately, and dumped them out of doors as useless rubbish to be got rid of. A separating machine was suggested, and now one of the proprietors declares that it paid for its cost within three weeks. It is self-operating, requiring only the occasional supply of the chips and the removal of those already separated. The mixed chips pass through a trough in a thin stream before a revolving cylinder composed of horseshoe magnets; the brass chips drop in front into a box, and the iron and steel chips are carried on the magnets to the under side, and are brushed off by fixed brushes into another box. Before being separated, these mixed chips were worthless; after being separated the iron chips had a marketable value, and the brass chips a value ten times as great.

In a large manufactory of machine screws, where two barrels of oil a day is not an uncommon amount to use, if all the machines were supplied afresh, three-fifths of this amount—sometimes more—is saved for further use. This is done by a small centrifugal machine. The chips, soaking in oil, are dipped into the little cup shaped receiver, the cover closed, the belt started, and the oil comes in an almost invisible horizontal sheet against the sides of the enveloping pan and runs into a tank ready for use. The chips are cleaned so nearly that they barely soil the hands.

In a certain machine shop worn out and broken files are placed in a transverse holder on the grindstone frame, held against the face of the stone by springs, given a traverse by a belt and a spiral cam, and the result is bits of smooth steel just adapted for forging to boring bar cutters and keys, with a further result of keeping the stone trued.

In brass manufactories there is unavoidable waste of the metals in the scoriæ of the melting furnaces, in the rolling mill department, and the wire drawing. Whatever of this waste, with the sweepings, can be gathered is put into large mortars and subjected to the impact of pivoted pestles until the whole is pounded to a dust. Then it is floated in a running stream of water through a chute over riffles, which catch the heavy metallic particles and allow the lighter trash to pass off. The metallic residuum, packed in crucibles with luted covers, gives back a profitable percentage of solid brass to be reused.

A PROJECT FOR THE REORGANIZATION OF THE ARMY.

The intelligent observer from the other side of the ocean has often, upon his return home, recorded his surprise that a nation of fifty millions of people should suffer its seacoast defenses to fall into decay, its army to sink into insignificance, and its fleet to lapse into the proportions of that of a power of the fourth class. To the European mind, wedded as it is to the theory that peace is only secure when sustained by the power to make war, the idea that there is safety in disarmament is incomprehensible.

The superficial observer, as we know, ascribes the lamentable condition of both our military arms to the temperament of the people themselves, who, to his mind, are too much absorbed in the race for wealth to guard against disaster when it shall have been acquired.

This is, there is reason to believe, only in part true. Recent events have shown that, when the matter is set before the people in its true colors, when the necessity for certain military precautions is shown and the reason for armament explained, they are quick to realize it. Hence it was that the scheme to improve the naval service and, above all, to manufacture heavy rifled steel guns for coast defense, was recently set afloat. Little, however, has been said about the army, notwithstanding the words of warning uttered by its late retiring chief. With a view of obtaining plans for the thorough reorganization of the military arm, the Military Service Institute recently offered a prize. The successful essay was contributed by Lieut. Arthur L. Wagner, Sixth U. S. Infantry. It is a concise statement of the military necessities of the United States, and, since it has been sanctioned by the best military authorities, may be looked upon as a correct estimate of our requirements.

The general plan outlined by Lieut. Wagner is the organization of what might be called the nucleus of an effective army, which, in time of war, could be readily expanded into a much larger body of trained fighting men, supported by a militia organization practically trained in the most minute details of the school of the soldier. He would have the peace establishment at 27,501 officers and enlisted men, which on a war footing should be raised to 56,356. First and primarily he would have each arm of the service—artillery, cavalry, and infantry—armed and equipped with the most efficient weapons and accouterments. The field artillery should be provided with Gatling and rifled guns, and so drilled that they could work quickly enough to operate at a moment's notice, even on an advance skirmish line; the gunners being protected by shields from the attacks of sharpshooters. He is sustained by the best modern authorities when he claims that cavalry, to be most effective, should fight afoot save upon those rare occasions when a sudden dash on an exposed flank or the like should be required of them. The saber, he thinks, ought not be discarded, but the principal weapon of the trooper should be an improved magazine rifle.

One of the most interesting features of Lieut. Wagner's paper will be found to be the description of a model national reserve, composed of a battalion from each congressional district in the country. This reserve, composed of the same material as the present militia, should be partly equipped by the Government, and be instructed under the personal supervision of army officers detailed for the purpose. It would consist entirely of infantry and heavy artillery, the latter being limited to companies and battalions in the seacoast cities, drilling usually as infantry, but at times serving the great guns mounted in the neighboring fortifications.

As a whole, this paper of Lieut. Wagner's will commend itself not only to the soldier, but to the people themselves; for, while providing for a powerful military organization, by far the greater portion of the power is arranged to be wielded by the people themselves, who are sovereign.

SHAFTS AND BELTS.

In many cases the shafting is too light for the weight put upon it and the strain to which it is subjected. In many cases the bearings are too far apart to properly sustain the load when in motion. In many cases the directions of the belts are either absolutely improper or relatively wrong.

Recently much trouble was caused by the heating and rapid wearing out of the boxes on the receiving length of a main countershaft in an establishment which occupied a four story building. The length of shaft, which was only two inches diameter, was replaced by one of two inches and three-eighths, but the trouble still continued. Between two hangers, a little over eight feet apart, were hung pulleys, the aggregate weight of which could not have been less than six hundred pounds. The main driving belt, twelve inches wide on a six foot pulley, ran directly up and down—vertically—and every other belt pulled in one direction. The main belt that ran vertically weighed about two hundred pounds. With these data the intelligent millwright or other mechanic can readily see that economical running was impossible.

Objection is made to shafting, stiff enough to bear the load and strain, on account of its weight. This might be remedied in a great measure by substituting hollow for solid shafting. This subject was treated definitely in the SCIENTIFIC AMERICAN of May 12, 1883, under the heading "The Load of Shafting," showing that the change was entirely feasible.

Part of this objection might be removed, also, by sufficiently supporting the shaft, as it is evident that a shaft will run with less friction when running perfectly straight and level than when running on the "double wabble" principle: at least no deflection out of a direct line should be permitted on a shaft at any place in its entire length. Even if this deflection is not apparent to the eye, it can be detected by holding the finger against a shaft in motion.

The direction of belts is a subject that is not usually sufficiently considered. If a belt is hung to run vertically its entire weight is upon the upper shaft, and it must be kept so tight as to take up the sag of its weight, which causes it to fall off from the bottom of the lower pulley. If a belt must run vertically, let the lower pulley be as much larger than the upper one as possible, so that the belt can have a bearing on its sides. Under no circumstances allow the lower pulley to be smaller than the upper one; it is best always in leading from a lower to an upper shaft, or *vice versa*, to give the belt an angle; the best running belts are those which run horizontally.

Never have the pull of the belts all on one side of the shaft; it is unnecessary to point out the reasons why. The pull of belts should be as equally distributed relatively as possible.

It is an easy matter to ascertain the proper position of the bearings of a shaft relative to its weight before the hangers are placed and the shaft hung. Place the bare shaft on boxes on movable horses, the bearings being at the desired distance apart. Then load the length of shaft with the weighed or estimated load of pulleys, and notice any deflection. The load test need not be the actual weight, but only a relative portion. Rig a lever over the shaft midway between the bearings on the horses, one end of the lever to be held by a rod bolted to the floor and the other end loaded. By estimating the difference (relative) between the fulcrum and the shaft and the shaft and the weight at the end of the lever, a comparatively easily handled weight can represent the total weight of the shaft, on the principle of the ordinary steam boiler safety valve lever. After testing the shaft by the actual weight of the pulleys and belts it has to carry, add fifty per cent more for the sagging, swaying, and vibration of the belts in motion, and when this total weight can be sustained without deflection, the position of your bearings is determined.

POISONING FROM GALVANIZED IRON.

No questions can by possibility be of more intense interest than those which relate to the means of supplying pure water for use in our cities and towns. All the drift of modern research has been to show that diseases of various types are spread through the agency of drinking water more energetically than in any other mode. But of what use is it to search with diligence for a pure source of supply, if in the process of transmission to the consumer the water is to absorb that which shall carry with it death, or at least the seeds of ill health? The mode of distribution becomes therefore of equal importance with the source of supply.

With the primary conduits, channels of brick or stone, and street mains of iron, there seems to be no occasion to find fault. Pure watering entering them will be delivered pure. The practical danger must come, if it comes at all, in the smaller distributing pipes, the house service. For this purpose three metals are in use in all our cities—lead, iron, and galvanized iron, the latter being really zinc. With the two former we do not propose at present to deal; but inasmuch as recently attention has been publicly drawn to cases of supposed poisoning from drinking water which has passed through pipes of galvanized iron, it is worth while to look to the matter closely. We have been accustomed to believe that galvanized iron was a perfectly safe material; if it is not so, the public ought certainly to be advised of the fact.

The first question for us is, What are the chemical *possibilities* involved? We are to take the case only of water which is supposed to be sufficiently pure for drinking, thus necessarily excluding that which is to any perceptible degree brackish. We have not, therefore, to suspect the presence of chlorine or of alkalies in sufficient proportion to have any appreciable effect. Neither can we have to deal with any organic acids. The water, of course, carries with it free air, whose oxygen is a powerful agent, and we have thus the means of forming zinc oxide constantly present. But the oxide of zinc is as insoluble in water as the metal itself, and as an oxide we may discard it from the question. And it would seem then that a galvanized iron pipe of any length ought to deliver the water as pure as it receives it. And chemically speaking this is no doubt true. But another factor is involved, which can by no means be neglected; this is mechanical attrition.

That the galvanized pipes are constantly wasted by the water is certain; the zinc surface is destroyed, and accumulations in the pipes occur sometimes, almost choking them, but this is done apparently only by the force of the current cutting off and carrying with it either metallic zinc or the coating of oxide, two inert and innocuous substances.

Now if we could stop here our chemistry would surely carry us safe; but the very object for which we are bringing the water is that it may go into the stomachs of consumers, and here we encounter a new series of conditions.

The gastric follicles, called into special activity at every act of digestion, develop an acid secretion. The precise nature of this is still a matter of dispute among physiologists, though all agree that it is either lactic acid or hydrochloric. Either one of these would at once dissolve zinc oxide or metallic zinc. Of the physiological action produced by zinc lactate we have no knowledge; but inasmuch as the two acids are so closely allied as to be distinguished with difficulty, it is reasonable to infer that their salts would have a corresponding resemblance, and the chloride we know abundantly as a violent poison; we may doubtless fear the lactate.

Here then seems a real source of danger from water flowing through galvanized iron pipes, and if really any injury has ever been produced by such water, it is doubtless in this manner that it has been done. But the remedy is plain and sure. The metal and the oxide are both insoluble, and can surely be filtered out. If, therefore, the water could always be filtered no danger would ever occur, but unfortunately this is done in so few instances that the practical bearing of it is small. And we come then to the question, Is this evil, thus shown to be chemically possible, anything more than a mere matter of theory? Have we any proof that poisoning has ever been produced by the use of the so-called *galvanized*, that is, zinc coated pipes?

We have examined with very great care all the accounts available, and so far we can find nothing to convince us that injury has ever occurred. Various reports have appeared of injurious effects, but none of them have been substantiated by satisfactory proofs. So many other causes of ill health, even of sudden attacks simulating the effects of poison, are liable to be intervolved in almost every case, that newspaper statements are to be received with extreme caution. And considering the small numbers of even these which have appeared in comparison with the countless myriads of those who are constantly using the water from zinc pipes, we are fairly entitled to believe that practically no danger can be attributed to them, and that the public may rest satisfied to hold them safe and harmless, the amount of material presented for the chemical action in the stomach to which we have referred being in fact too insignificantly small to produce any result.

The McCormick Observatory.

At the recent meeting of the American Association, Professor Ormond Stone, director of the Leander McCormick observatory of the University of Virginia, gave an elaborate description of that observatory, now approaching completion, and to be devoted entirely to original research. The telescope, which will soon be mounted, is the twin in size of the Washington twenty-six inch, and like it in most of its details, except the driving clock, which is like that of the Princeton twenty-three inch, with an auxiliary control by an outside clock, and that it has Burnham's micrometer illumination. The observatory has a permanent fund of seventy-six thousand dollars as a beginning; and eighteen thousand dollars have been expended in observatory buildings, and eight thousand dollars for the house of the director. Situated eight hundred and fifty feet above the sea, and on a hill three hundred feet above surroundings, the main building, circular in shape, is surmounted by a hemispherical dome forty-five feet in diameter. The brick walls have a hollow air space, with inward ventilation at bottom and outward at top.

Mr. Warner, the builder of the dome, gave an interesting description of the ingenious method of adjusting the conical surfaces of the bearing wheels, so that they would, without guidance, follow the exact circumference of the tracks; and then of the adjustment of the guide wheels, so that the axis of this cone should be exactly normal to the circular track. The framework of the dome consists of thirty-six light steel girders, the two central parallel ones allowing an opening six feet wide. The covering is of galvanized iron, each piece fitted *in situ*, and the strength of the frame is designed to stand a wind pressure of a hundred pounds per square foot. There are three equal openings with independent shutters, the first extending to the horizon, the second beyond the zenith, and the third so far that its center is opposite the division between the first and second. The shutters are in double halves, opening on horizontal tracks, and connected by endless chain with compulsory parallel motion of the ends. The dome weighs twelve tons and a half, and the live ring one ton and a half; and a tangential pressure of about forty pounds, or eight pounds on the endless rope, suffices to start it. If this ease of motion continues as the dome grows old, it is certainly a remarkable piece of engineering work.

Wells and Cholera.

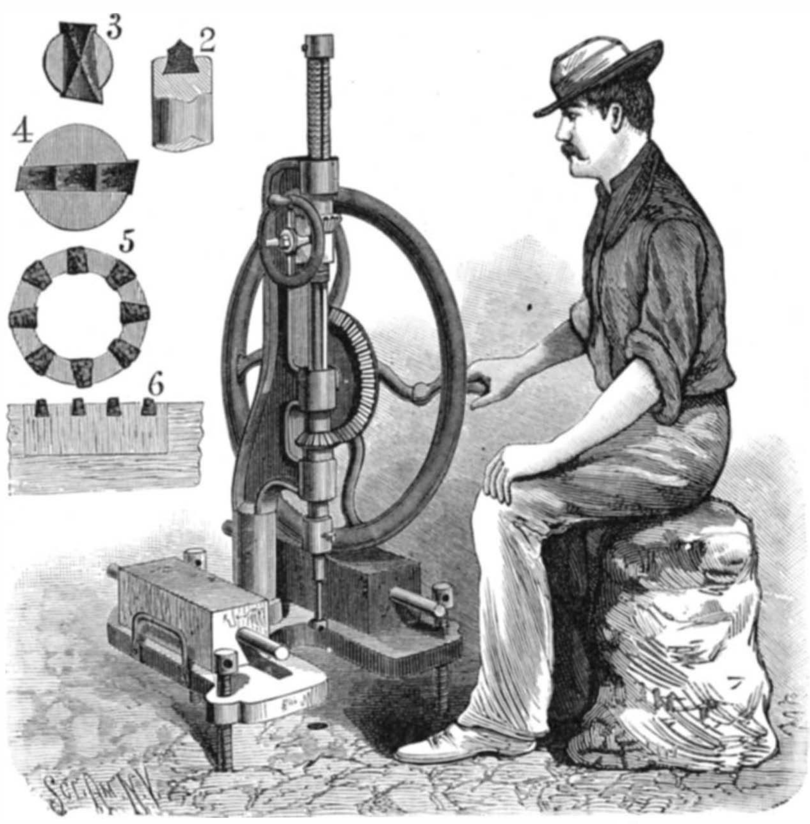
The New York Board of Health condemns the use of water obtained from the artesian wells of the city, maintaining that it is unfit for human use, and recommending that all the wells be immediately closed. Dr. Cyrus Edson, of the Board, says he does not believe there is one well in New York city that is safe, for the reason that the substrata beneath the city are contaminated in some degree by leakages from the sewers and other drainage. Paris can have good wells, because the watershed is 182 miles away, and London has a like advantage. But the watershed of New York is the city itself situated right over the wells. The chief reason urged for the closing of the wells is of course protection against disease, and especially against cholera. Dr. Edson is certain that in ninety-nine cases out of a hundred cholera gets into the human system through the germs in water used. The judgment of the intelligent gentlemen composing the Board of Health that the wells are really dangerous will justly carry great weight, especially in view of the possible advent of cholera here. Those who have expended large sums in sinking wells for the supply of their buildings, the *Insurance Critic* thinks, will naturally be reluctant to yield to these conclusions. But all will admit that public health and safety should be the governing consideration.

SETTING DIAMONDS IN TOOLS.

The engraving shows an improved method of inserting diamonds into the teeth of boring, drilling, sawing, grinding, and other tools, by which the diamonds are rigidly and permanently secured in position without bracing or soldering and without any possibility of their getting detached. The large cut shows the tool mounted for drilling; Fig. 2 is a vertical transverse section of a boring tool; Fig. 3 is a top view of the same; Fig. 4 is a top view of a tool of larger size; Fig. 5, top view of a hollow drill; and Fig. 6 is a side view of a tooth for stone cutting saws. The stock of the tool is provided with one or more transverse recesses of dovetailed shape, the sides of which converge slightly toward the longitudinal axis of the recess.

Inserted in the recesses are the diamonds, which are shaped at two opposite sides so as to correspond exactly to the shape and size of the recess. To obtain diamonds of the proper size required for the different tools, the raw diamonds are broken up, which is accomplished by making a slight incision with a diamond cutting tool at the point where the diamond should be separated, and then cleaving the stone in the line of the incision by a suitable tool. The diamonds are then cut into shape, and inserted with the narrower end foremost into the bit by aid of a few light blows. The double wedge action of the recess holds the tapering base of the diamond rigidly in place. The diamond projects at both sides of the bit, and is also pointed at its center when required for boring purposes. For larger sizes of boring tools, several diamonds of smaller size, shaped as described, are driven close to each other into the recess, as indicated in Fig. 4. When used for stone cutting saws, or for rock drills, the stones are so inserted that the longitudinal inclination of one transverse recess is in the opposite direction to that of the next adjoining recess, thereby exposing the stock to the same strain on both sides. By this method the diamonds can be inserted at the place of use by an average mechanic, so that the necessity of returning the bits for setting is obviated; and when they become worn off they can be exchanged, and used with bits of smaller size until they are entirely used up.

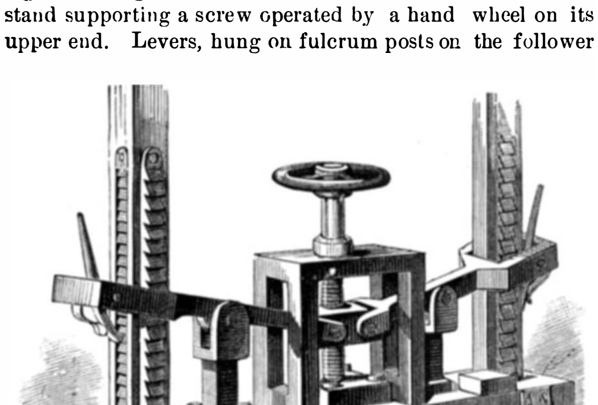
This invention has been patented by Mr. Anthony Hessels, who may be addressed care Messrs. Geopels & Raegener, Tryon Row, New York city.



HESSELS' METHOD OF SETTING DIAMONDS IN TOOLS.

IMPROVED PRESS.

Our engraving shows a press designed for the use of book binders, printers, metal workers, and for purposes where a compact and powerful apparatus is desirable. The follower is mortised to allow the passage of two standards that rise from the ends of the bed. The sides of the standards are fitted with ratchets, and in grooves on the platen are sliding dogs that are forced into contact with the ratchets by springs so as to prevent the rise of the follower. The dogs are drawn out to allow adjustment of the follower to or from the bed, according to the height of the material to be pressed, and suitable levers may be provided for moving all the dogs at once. At the middle of the follower is a stand supporting a screw operated by a hand wheel on its upper end. Levers, hung on fulcrum posts on the follower



DE NOBILI'S IMPROVED PRESS.

and having their outer ends forked to stride the standards, are jointed to a nut on the screw. Hook ended pawls hung on the outer ends of the levers engage ratchets on the standards in such a way as to permit the levers to descend but not to rise. In operating the press the material is placed on the bed and the follower adjusted on the standards. Then by turning the screw the platen is forced down by direct pressure of the screw and also by the downward movement of the nut acting through the levers. This constitutes a simple and compact device, which exerts great pressure.

This invention has been patented by Mr. A. De Nobili, and additional information may be obtained from Mr. Emil Zucca, of 250 Washington Street, New York city.

Curious Rock Formation in Orange Mountains, N. J.

The work on the quarry near Mt. Pleasant Ave., near the top of the mountain, which has been carried on for many years, has recently revealed a very curious formation of rock and has attracted much attention. So much interest has become centered in this discovery that Prof. Geo. H. Cook, of Geological Bureau, New Jersey, made a recent visit to Orange with the special object of making an examination of this geological formation; and his report reveals the curious fact that the formation there, and at the famous Giant's Causeway, Ireland, are almost identical. The rock is basaltic trap, and is deposited in columns from 15 ft. to 40 ft. high, as perfectly cut as if moulded in forms, and owing to their hexagonal or pentagonal shape offer the suggestion that their formation was crystalline. At the two extremities of the quarry the columns are vertical, while in the middle they diverge in every direction, from a point at top of clearing perhaps a hundred feet above the base of the quarry. The columns at the northern end are the largest, some of them being 4 ft. across a single side, while the smaller columns present faces not over one foot across.

Prof. Cook states in a letter to the Orange *Journal* that "it belongs to the same class of rocks, both in material and structure, with the Giant's Causeway in Ireland, but it is on a much larger scale, as will be seen by comparing the dimensions (which are given above), with the following taken from a description of the noted curiosity of Ireland, which says: 'In diameter the pillars vary from 15 to 20 inches, and in height some are as much as 20 feet.'"

These basaltic columns are undoubtedly of igneous origin, and the curious feature of them is that they seem to rest upon a platform of red sandstone, of which the mountain is principally composed, and which is a rock of earlier formation than the trap itself. The explanation is that the trap, while in a molten condition, was forced through openings or fissures in the sandstone during some period of volcanic upheaval. It is believed further that there must have been more than one eruption of matter, as the peculiar inclination of the layers would so indicate. The matter of working the rock is very simple, from the fact that the columns are so distinctly cut that without very much effort on the part of the workmen they can be dislodged from beds and rolled to the base of the quarry, almost in their complete integrity. Although there are numerous quarries and formations of trap in the mountain, this is the only one, so far as discovered, which presents the peculiarities observed above.

Lectures by Sir William Thomson on Molecular Dynamics.

By invitation of the authorities of the Johns Hopkins University, Sir William Thomson, D.C.L., F.R.S.L. and E., etc., Professor of Physics in the University of Glasgow, will deliver in October next a course of eighteen lectures on "Molecular Dynamics," before the Physical Section of the Johns Hopkins University, Baltimore, Md.

The opening lecture will be given on Wednesday, October 1, at 5 P.M. The other lectures will follow on consecutive days at the same hour. Professors and students of physics are invited to attend, and arrangements will be made by which they may easily obtain temporary lodgings, provided an early intimation is received of their intention to come.

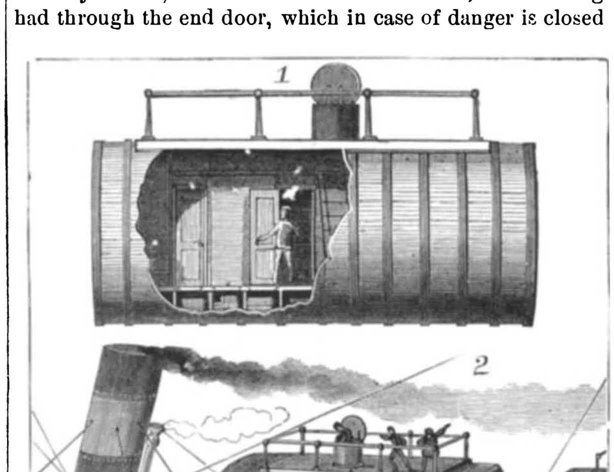
The Value of Trade Marks.

About a year ago what is styled the New York Cab Company began to run cheaper cabs in the city than the hackmen had theretofore afforded. Their vehicles were so distinctive as to be at once readily recognized, the lower panels being painted yellow and the upper ones having the device of a crown with three feathers issuing from it, encircled with a garter of gold. These cabs at once became favorites, and a prominent hack owner immediately painted over a number of his vehicles in pretty close imitation of the same style, so that the public generally would easily be deceived thereby. The original company then began suit for infringement of trade mark, which Justice Lawrence has just decided in the Supreme Court.

In his opinion Justice Lawrence says that the cabs of the company were painted in a novel and peculiar manner, and that the infringer's cabs were painted and lettered to create the impression that they belonged to the same company. The Justice says: "The true doctrine in cases of this character is, I think, that no one should be permitted to so dress his goods or wares as to enable him to induce purchasers to believe that they are the goods of another." He cites a large number of cases, and goes on to declare that an exact imitation of a trade mark is not necessary in order to convey a false impression. A partial one may be equally effective in misleading one. He does not mean to say that the cab company has an exclusive property in color or words, but that "it has established a trade mark in the color, words, and device as combined, which entitle it to call on a court of equity for protection against an imitation designed to mislead the public and deprive the plaintiff of its profits."

LIFE RAFT.

Since the life boats, life rafts, etc., used at present on steamers and sailing vessels do not present sufficient facilities for saving the lives of persons on the vessel in case of accident, Mr. John R. Adams, of Houston, Texas, has invented a life raft so constructed that it can be used as a stateroom ordinarily and as a raft in case of danger. This life raft is provided with two oval end pieces, on the edges of which are placed staves held in position by heavy bands drawn together by nuts and bolts. On top is a platform surrounded by a railing. A ladder leads from the hollow shaft on the platform down to the floor of the raft. Between the floor and the shell are formed compartments in which water, food, and other necessaries are placed. The raft is divided by a longitudinal central hallway, extending from end to end, and by transverse partitions forming a series of staterooms. Doors lead from the hallway into the staterooms and into a toilet room formed at one end. Access to the compartments beneath the floor is had by trap doors. In each stateroom are bunks, which are hinged to the side walls and provided with suitable means for holding them in place. At the end of the raft opposite the toilet room is a door opening to the hallway. The raft is held on deck by chains, and the staterooms are used, access being had through the end door, which in case of danger is closed



ADAMS' LIFE RAFT.

and securely bolted, the entrance then being made through the shaft. In case the vessel sinks, the raft, being disconnected from the deck, is washed off and floats like a huge cask or barrel, and as it is closed on the sides and ends it can be thrown about by the waves without injury to the occupants. As all the staterooms on deck can be constructed in this manner, it is evident that a steamer can carry sufficient rafts for a large number of persons without wasting any room.

THE INDUSTRIAL PRODUCTION OF OXYGEN AND NITROGEN.

Since the times of Priestley and Lavoisier, chemists have ever been trying to find some industrial and cheap method of producing oxygen; and many persons, whose names we shall not mention, have vainly endeavored to extract this gas from the air, since this is the most abundant source of it that is naturally at the disposal of experimenters. We have passed in review the works of the best authorities, and have found therein no practical method of obtaining this gas regularly and in an industrial way. Mr. Boussingault, in his researches on the absorbing power of caustic barytes, declares, in a report made to the Academy of Sciences in 1850, that this substance loses all its properties, in its functions of absorption and production, at the end of eight or ten operations.

We likewise find in Mr. Wurtz's works a passage touching the operations and experiments of Mr. Gondolot. But neither Mr. Boussingault nor Mr. Gondolot appears to have been encouraged by the results that he obtained. We have seriously sought the causes of the want of success that has existed to our day, and have especially studied both the chemical and physical conditions of caustic barytes with respect to its use in the extraction of oxygen from the atmosphere.

Our researches, and the multiple experiments that they necessitated, put us upon the real track of a product which we now possess, and which not only does not diminish in its powers of absorption and production, but has always given us proof to the contrary in the indefinite duration of its operation. For example: 1 kilogramme of caustic barytes made by our process will render at the first operation 25 liters of oxygen, and the production will increase from day to day, and, after eight days of continuous work, the yield of this same kilogramme will be 68 liters.

We assert, then, that a regular rate of production will permit of counting upon a yield of 50 liters of pure oxygen per kilogramme of caustic barytes, and per operation. We say 50 liters because it is not necessary to carry the deoxidation further.

We now come to the description of our process for separating the oxygen from the nitrogen in the atmospheric air.

The caustic barytes which we produce is placed in iron retorts arranged in horizontal series. These retorts have metallic friction joints at each extremity. For the perfect demonstration of our system we have constructed two coupled furnaces, each having 15 retorts 2·8 meters in length and 16 centimeters in internal diameter (Fig. 1). Two force and suction pumps are in communication with these series of retorts (Fig. 2). One of the pumps forces air into the retorts, where, in contact with the barytes, its gives up its oxygen. This is what we call peroxidation. The other pump effects a vacuum in the retorts and sucks up the oxygen that has combined with the barytes. This is what we call deoxidation.

But the air, before entering the retorts, is freed from its carbonic acid by passing it through the chambers of an apparatus containing lime and caustic soda.

The coupling of these two furnaces has permitted us to transfer the peroxidation or deoxidation to either one of them at will through piping and cocks.

The peroxidation of the barytes is effected at a temperature of between 500 and 600 degrees, but the deoxidation takes place well at about 800 degrees. As it was necessary to regulate these differences in temperature absolutely and automatically, we devised pyrometric bars, which, through their expansion or contraction, allow us to obtain exactly the temperatures necessary for the peroxidation or deoxidation.

These bars are shown to the right of Fig. 1. The pyrometric bar receives at its extremity a lever which holds in balance a disk that is designed to accurately proportion the mixture of air and carbonic oxide that serves for heating. Now this bar, in expanding, causes the disk or air valve to rest upon the corresponding disk, and from this there at once results a lowering of the temperature to 500 degrees; then the bar that is regulated to permit of an elevation to 800 degrees contracts, and brings about an entrance of the air again, and consequently another rise in the temperature.

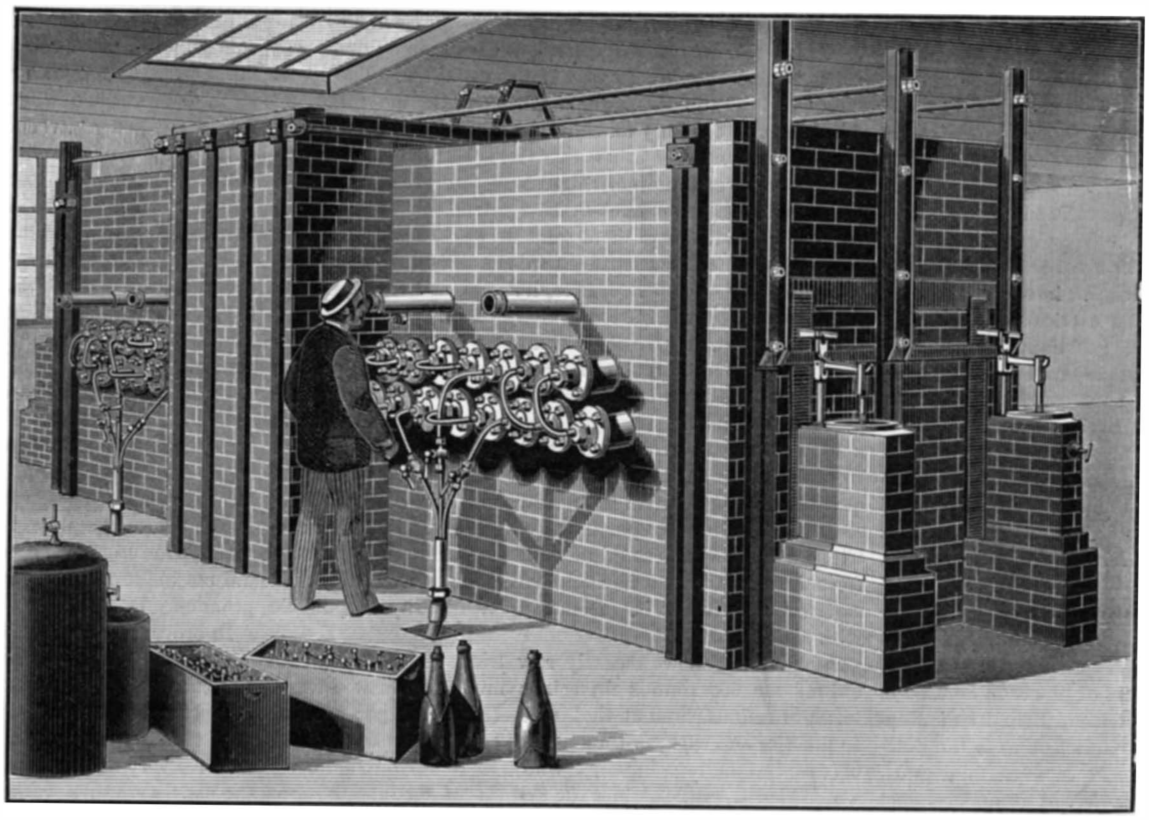


Fig. 1.—BRIN'S PLANT FOR THE PRODUCTION OF OXYGEN.

In this way we have obtained a regularity in the heating that guarantees a long duration of our material, and that also secures a perfect working without the needs of relying upon a personal surveillance. The running of our apparatus is therefore automatic and precise, since but one valve is to be closed in order to produce the peroxidation. This valve is opened for the deoxidation, and then the pyrometric bar is left free to play.

Our experimental plant is capable of producing 100 cubic meters of pure oxygen per day; and it is therefore not a *laboratory* matter that we are describing to our readers.

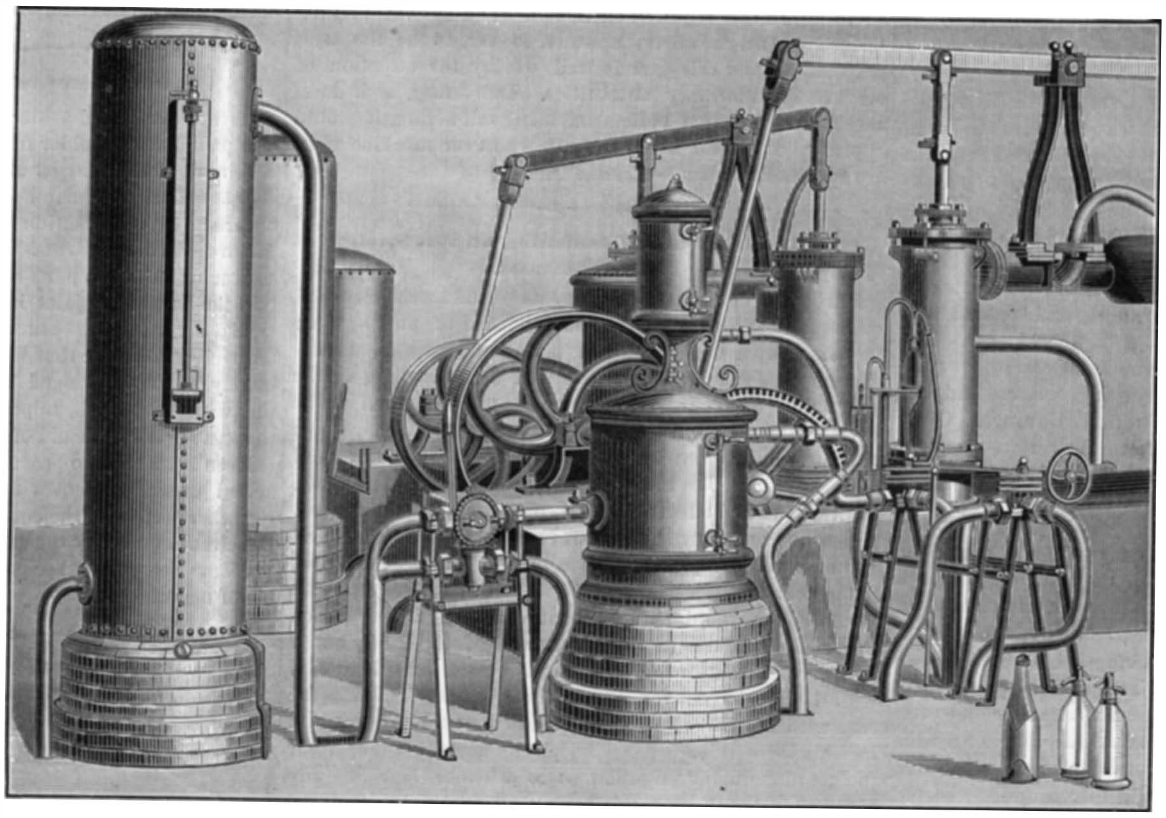


Fig. 2.—FORCE AND SUCTION PUMPS OF BRIN'S OXYGEN APPARATUS.

The oxygen that has been produced by all the processes known up to the present time has always cost so much that it has been impossible to deliver it for consumption, seeing that a sufficient production and reasonable price could not be guaranteed. Besides, the gas which is usually extracted from chlorate of potash remains, in spite of all modes of washing, charged with chlorine vapors that render it absolutely unfitted for medical applications. Ours, on the contrary, is absolutely pure, and consequently inodorous and tasteless.

We shall now speak of the applications of oxygen.

It occurred to us that by forcing pure oxygen under a high pressure into water we would obtain a solution of a certain quantity of the gas, that the volume in excess that could not dissolve would remain divided and confined in the water, and that we would then have a very light, tonic, and digestible gaseous beverage. The experiments that have just been made with this by several physicians are very conclusive. Carbonic acid, which for a long time has been daily consumed under the form of Seltzer water, is nevertheless placed among violent poisons, while our oxygen is an aliment which is indispensable to all organized beings.

Inhalations of oxygen are, by physicians, deemed necessary in certain diseases. One can therefore now count upon an absolutely pure gas for arresting all kinds of decompositions, since it is *the* antiseptic *par excellence.*

Acting as a combustive, it gives rise to a new metallurgy through the facility with which the highest temperatures may be obtained by its aid. There is no need of dwelling upon the economy that results from its use in the manufacture of all metallic oxides. The advantages of our system will be apparent, too, as regards the production of the Drummond light.

Finally, we must say a few words regarding the electrification of oxygen. Several chemists have given their attention to this subject, but have met with difficulties that proved insurmountable. In fact, before manufacturing ozone industrially and applying it economically, it was necessary to obtain oxygen in profusion. Ozone, moreover, is only the reduction of three volumes of oxygen to one—a reduction operated by electricity.

We shall submit a very simple and practical means of producing it. The oxygen is electrified in its passage against the sides of two test glasses, one within the other, and so arranged that the electric effluvia shall easily pass from one glass to the other. The interior glass holds a conducting liquid into which an electrode dips. The external vessel is surrounded with the same liquid, into which dips another electrode. These two electrodes are connected with the two poles of a Ruhmkorff coil actuated either by pile elements or a dynamo. As soon as the current passes, the characteristic odor of the ozone gas permits of at once knowing that the reduction is being effected. The energy of the ozone, then, depends upon the sum of electricity of which it is a carrier, and consequently upon its reduction. Ozone will soon be the subject of medical experiments, which we have left to some scientific men who have been specially requested to examine the question.

The industrial manufacture of oxygen by the reduction of peroxide of barium, followed by successive reoxidations and deoxidations, *ad infinitum*, can be just as well considered a production of nitrogen as of oxygen. In fact, the process is based upon the property possessed by barium of fixing the oxygen of the atmosphere and of setting nitrogen free, when a current of air is passed over barytes heated to a dull red. Now just as the transformations of the material alternate, so do the production of the gases likewise, that is to say, during deoxidation the retorts disengage oxygen, and, during peroxidation, nitrogen. A simple change of cock permits each of these gases being sent into its respective gasometer.

Nitrogen, then, is isolated just as well as oxygen during the operation of the plant. It may even be said that the production of the first-named gas is much greater than that of the second, since the atmospheric air contains about four volumes of nitrogen to one of oxygen, and consequently that for each cubic meter of the latter produced we invariably obtain four cubic meters of the former.

Up to the present we have confined ourselves to collecting only the oxygen, as being the more fertile in industrial applications and capable of more numerous and diverse combinations. Yet nitrogen, which is usually considered as merely the medium of oxygen, is likewise adapted to numerous special applications. For example, artificial fertilizers, most of them ammoniacal, are valued according to the proportion of nitrogen that they contain. The possibility of manufacturing ammonia by the immense source of nitrogen resulting from the production of oxygen is therefore one of the most valuable features of our plant. We need not be surprised that no one has as yet tried to perform such a synthesis of ammonia, that is to say, to bring about a direct combination of its elements, nitrogen and hydrogen, for the reason is very simple, and it is because it is first necessary to obtain these two elements. This obstacle disappears when we have at our disposal an absolutely gratuitous source of nitrogen, as is the case with us.

Without entering into a series of chemical considerations upon the reciprocal affinities of nitrogen and hydrogen, it will be seen that it is possible to create conditions that are sufficiently favorable to bring about a combination of these two elements.

The intermedium that we have chosen is an intimate mixture of carbon and caustic barytes. We place this mixture in retorts that are arranged either in a vertical or horizontal direction. A pipe leads the nitrogen into a quantity of water, which divides it, and it thus carries along a certain quantity of aqueous vapor. The gas thus charged with humidity is led into a retort heated to about 150°. Then the aqueous vapor decomposes on contact with the barytes and carbon, and the oxygen fixes itself upon these latter, while the hydrogen and nitrogen, alone remaining in presence, combine and form ammonia. The production of ammonia salts proceeds, then, from the easy combination of the ammonia gas and the acids into whose presence it is brought.—*Brin Brothers, in La Nature.*

The Maxim Machine Gun.

However opinions may differ as to the desirability of arming our troops individually with a quick fire or repeating rifle, so as to give each man a reserve of power to be used in the hour of need and when hotly pressed, there does not appear to have been from the first any question as to the practical value of that class of weapons known as machine guns. Hence they quickly found favor with the authorities, and have been introduced into both branches of the service. The essence of these guns is rapidity of fire, and a smart shower of bullets can be projected from them by the simple turning of a handle. The fire from these guns is exceedingly rapid, reaching some 150 to 200 rounds per minute, the operator turning a handle with one hand, and, for a traversing fire, imparting to his gun a horizontal reciprocating motion with the other. Remarkable as these results are, they are eclipsed by a machine gun which we have recently inspected in operation, and which by simply pulling a trigger once will feed itself and fire away continuously at the rate of 600 rounds per minute, if desired, the operator only having to impart the traversing motion to the gun as required. This remarkable gun is the invention of an American gentleman, Mr. Hiram S. Maxim, who is likewise the inventor of the system of electric lighting bearing his name, which was introduced into England about three years since. The gun has a single barrel, and is arranged in such a way that the force of the recoil from one round at the moment of firing is utilized and forms the motive power for loading and firing the next round, and so on round after round in succession. In fact, one recoil performs all the functions of bringing the next cartridge into position, forcing it into the barrel, cocking the hammer, pulling the trigger, extracting the empty shell, and ejecting it from the gun. To effect this the barrel is so mounted in its case that at the moment of firing, the recoil drives it backward about three-quarters of an inch, and it is this movement of the barrel alone that actuates the mechanism of the gun and enables it to keep up a continuous fire.

The gun we saw fired at Mr. Maxim's works, 57d, Hatton-garden, London, has a barrel of the ordinary service regulation caliber of 0·450 in. and weighs with its tripod stand 126 lb. It stands about 3 ft. high, and is about 4 ft. 9 in. long from muzzle to rear of firing mechanism. The training arrangements enable the gun to be elevated or depressed and set at any angle by adjusting screws, and traversed radially over any desired horizontal range. Or it may be instantaneously detached from the screws so as to be moved freely in every direction by hand. As the gun is self-firing, the operator can train it just as required while it is being discharged.

The cartridges are placed in a canvas belt in a manner somewhat similar to that in which they are carried in a sportsman's belt. The Maxim belt, however, is some seven yards long and holds 333 cartridges, and length can be attached to length as each becomes emptied, so that the fire can be maintained continuously. This belt is placed in a box immediately below the gun, and the leading end of it is inserted in the gun to start with. As the gun is fired the belt is drawn into it on one side, and one after another the cartridges are drawn out of the belt, forced into the barrel, fired, and the empty belt and cartridge cases ejected from the opposite side of the gun. By this arrangement the cartridges and the gunner are both below the level of the gun, and are only exposed to fire in a *minimum* degree. The external firing arrangement consists of a trigger or lever, which is placed against a graduated quadrant at the side of the gun, and the rapidity of firing is regulated by the distance to which this lever is pulled over. If this trigger be pulled over toward the gunner about an inch, and until the pointer indicates the figure 1 on the quadrant scale, the gun will then fire at the rate of one round per minute. By pulling the trigger over a little further the rate of fire is increased to about five rounds per minute, and the rate is gradually increased as the trigger is pulled further over until it reaches the rear end of the scale, when the fire is maintained at the unprecedented rate of 600 rounds per minute.

It is thus possible to fire either single shots, volleys of 10, 20, or 100, and to maintain a continuous fire either fast or slow. When the gun is once adjusted for a certain speed, it maintains the fire at that speed independently of human agency until all the cartridges have been discharged. Should the man working the gun be killed, the gun will still continue firing so long as any cartridges remain to be fired, provided no hitch occurs from a faulty cartridge. The great rapidity of fire in this gun is attributed to the following cause: In the ordinary machine gun it is stated that a very great speed is not possible with a single barrel, because a certain percentage of the cartridges hang fire—that is, they do not explode at the moment of being struck by the hammer, and therefore, if one of these guns be worked with too great rapidity, some of the cartridges will be drawn from the barrel before they explode. Hence, it is said that in all machine guns worked by hand it is necessary to have the movement sufficiently slow to give these comparatively slow cartridges time to explode before they are removed from the barrel. In fact, the action must be sufficiently slow to meet the requirements of the slowest cartridge of the series. With the Maxim automatic gun, however, a cartridge cannot be withdrawn from the barrel until after it has been exploded. It fires the quick-exploding cartridges rapidly, and if a slow one presents itself, it fires that particular one slowly. Should a cartridge hang fire for five minutes, it would not be withdrawn from the barrel until it had exploded; the gun, in fact, must and would wait for it. Hence great rapidity is possible with a single barrel.

Such is the gun we recently saw tried, and, although we did not see 600 rounds fired in a minute, we saw several series of rounds fired at that rate—that is, 10 per second. In practice and with continuous rapid firing the barrel would become heated, to counteract which it is surrounded by a water jacket. But besides the system of feeding the gun we have described, Mr. Maxim has another, in which the cartridges, to the number of 96, are placed in a flat brass drum on the top of the gun, and the movement of the barrel rotates the drum, draws the cartridges from it, and forces them into the barrel to be fired. When empty, the drum is removed and another one substituted for it without stopping the operation of the gun. A small reservoir attached to the gun furnishes the necessary supply of cartridges to keep the weapon in action during the brief interval of time required to remove an empty case and replace it by a charged one. The belt system of automatic firing has been applied by Mr. Maxim, not only to machine guns such as we have described, but also to rifles to be fired from the shoulder. In one instance he altered a Winchester rifle in such a way that the recoil performed all the necessary functions except pulling the trigger. An ordinary Martini-Henry rifle has been arranged by Mr. Maxim so that the recoil extracted the empty cartridge case and cocked the hammer, while the act of placing a new cartridge closed the breech action. Mr. Maxim has also made a third gun, in which all the functions are performed by means of a slight elongation of the cartridge case at the moment of firing, the case being corrugated to afford the required extension. The system first described by us, however, appears, so far, to be the most practicable, and this gun is well worthy the attention of our naval and military authorities. Delivering, as it does, such a perfect hail of bullets and being self-acting, it would appear to commend itself for use wherever machine guns are applicable in war.—*London Times.*

On the Influence of Punching on Soft Steel.*

BY W. BECK-GERHARD.

During the course of experiments made at the Poutiloff works at St. Petersburg, on the influence of punching on the strength of soft steel fish plates, the results, already well known, were arrived at, namely, that punching in the cold weakens perceptibly, and reduces the elongation of the steel; that steel annealed after cold punching, and when punched hot, is not injured; that annealing, when well done, even increases the tenacity of the punched specimen, and that the evil effects of cold punching are in a great measure removed by subsequent reamering out of the hole.

On bending samples of soft steel which had been punched in the cold through the holes, it was invariably found that the specimen would bend without cracking, if the punch side of the hole was on the convex side of the bend; but if the bar were bent in the opposite direction, that is to say, with the die side convex, the specimen broke. This was the case with all cast metal; while puddled or scrap iron could be bent without injury. This phenomenon led the author to institute an investigation as to whether there was any foundation for the very generally received opinion that the edges of a punched hole on the die side are injured by a ring of minute incipient radiating cracks. For this purpose a large number of specimens, 5 in. by 3 in. by ½ in., of all kinds of steel were prepared. The edges were planed, the surfaces polished, holes were pierced in various ways, and the metal surrounding them was carefully examined with a microscope, but no trace whatever of cracks could be found, though the nature of the steel ranged from 0·1 to 0·6 per cent of carbon.

* Translated from *Gorni Journal*. St. Petersburg, March, 1884, and published in London *Iron Trade Exchange*.

Although the search for incipient cracks proved fruitless, Mr. Beck-Gerhard observed and has described, he believes for the first time, certain markings on the polished surfaces of the plates around the cold punched holes, which seem to possess very great interest. Visible to the naked eye, and surrounding the holes, were sheaves or bunches of lines starting tangentially to the holes, and curving slightly toward them. These lines branch out in opposite directions, and intersect with some degree of regularity. They do not appear in the vicinity of drilled holes, but are distinct in cold punched holes reamered out. In forged iron they did not appear, although they were most distinct in the softest steel, and vanished when the metal reached the hardness due to 0·6 per cent of carbon. An increase of thickness in the plate caused a corresponding increase in the number and clearness of the lines, upon which the shape of the hole was also found to have an effect. In all the 5 in. by 3 in. specimens the lines were distinctly sunk, while in two of the 10 in. by 10 in. specimens the lines were prominent, sinking gradually to the level of the plate toward their ends. At the points of intersection near the holes the continuity of the lines was interrupted; dots or nodes represented their course.

In the 3 in. specimens with planed edges the lines terminated abruptly at the edges, but in natural bars, such as fish plates, the more pronounced rays turned round the edges, and actually appeared on the opposite side. In all the samples the lines were less developed in the upper or punch side of the plate, and even at times degenerated into a mere frosted appearance. Heating the plates to redness did not obliterate the rays, though it rendered them less pronounced.

In order to determine how far the rays extended around a cold punched hole, a 10 in. square sample was cut out of a ⅝ in. steel plate, the surfaces were polished, and a 1 in. hole was punched in the center. The curved rays appeared very strongly marked on the die side, and less pronounced, but still very distinct, on the punch side. The surfaces of the plate were then washed with aqua regia, when the rays disappeared, but the surfaces became streaked with elongated bubbles and hair lines arranged in the direction in which the plate had last passed through the rolls. The sample was then cut into eight test pieces, four on each side of the central hole, and subjected to rupture by tension. The result was an average ultimate strength of about 27 tons per square inch, with an elongation of 20 per cent. All the fractures took place at one of the elongated bubbles, and the polished surfaces of the specimens developed ridges and indentations, which could not only be seen, but felt. On placing the specimens together in their original relative positions as a 10 in. square plate, it was at once seen that the markings on the strips formed together a system of curved rays around the central hole, precisely analogous to those which the solid plate had exhibited, only the rays extended much further over the surface. Test bars cut from a similar ⅝ in. plate 10 in. square, which had not been punched, exhibited none of the marks above described, hence it must be concluded that the effect or influence of the 1 in. cold punched hole had extended all over the 10 in. plate. The observations made so far, the author considers, are insufficient for the foundation of a theory, and regrets that his occupations do not admit of further investigation.

Infringement of Combination Claims.

In the case of Schneider *vs.* Pountney, for infringement of a patent shade holder for lamps, Judge Nixon, of the U. S. Circuit Court, district of New Jersey, ruled as follows:

Where one party manufactures one portion of the device covered by a combination claim, and another party manufactures the other part of the combination, and it does not appear that the two parts are capable of separate use, *held* that the parties are joint infringers.

And the defendants cannot protect themselves by invoking the well-settled rule that where a patent is for a combination merely it is not infringed by one who uses one or more of the parts, but not all, to produce the same results, either by themselves or by the aid of other devices.

Even if there is no proof that the defendant had made an actual prearrangement with any particular person to supply the other portion of the combination, it will be inferred from the circumstances of the case that it is the intent of the defendants that such other portion shall be added to their article of manufacture.

The New Comet.

The new comet discovered by Dr. Wolf on the 17th inst has been observed by me. Its position at discovery was right ascension 21 hours 16 minutes; declination north, 22 degrees 23 minutes, which brings it near the western limit of the constellation Pegasus. As observed by me with the 9-inch reflecting telescope, it is an easy telescopic object in moderate moonlight. The coma is somewhat elongated in outline, and the nucleus is small but bright and star-like. The comet is moving southward at the rate of about half a degree daily along the western edge of the constellation Pegasus toward the star Epsilon. About the middle of October it will be in the head of Pegasus.

The comet may be readily picked up by telescopes of moderate aperture, as it is slowly growing brighter.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., Sept. 27, 1884.

Correspondence.

Copper for Roofing.

To the Editor of the Scientific American:

At page 193 of your last issue I see a few words relating to copper for roofing.

In the year 1833, fifty-one years ago, I built a house near here for my mother, and I covered the roof with 18-oz. copper. It is still there, and good for another fifty years, more or less. Several years ago the roof was raised 4 or 5 feet, when some repairs were made. The only disadvantage of copper after the first cost is found in the water caught from that roof being slightly impregnated with the copper, so that it becomes in a slight degree green, and possibly might be injurious to health if used for drinking.

The conductors for the rain are of copper, so that I have never felt at all anxious in storms of thunder and lightning, as the copper roof is an excellent conductor.

R. B. FORBES.

Milton, Mass., Sept. 26, 1884.

An Effective and Easily Made Oil Filter.

To the Editor of the Scientific American:

In your issue of Sept. 20, Mr. Geo. Boxley gives a method of filtering oil such as is used for lubricating purposes, etc.; his method may answer the purpose very well, but I have a device, which I have used for a number of years, that I think very much superior to his. I use a shallow pan about three inches deep, and square in form and flaring, or wider at the top than at the bottom; this I locate in any convenient place where it may not be disturbed, so placed as to have one side a little the lowest, say about ¼ of inch; over this edge of the pan I place a piece of heavy woolen cloth of sufficient length to reach to the bottom of the pan, and to hang over the outside and extend a little below the bottom of the inner end; this wick forms a capillary siphon, and filters the oil in the most perfect manner. A piece of sheet zinc or tin with the corners turned up on one side as far as nearly to the center serves as a guide to the dropping oil into a vessel to receive it. The pan can easily be cleaned, and is on the whole better and cheaper than any method I have seen or heard of.

ALVIN LAWRENCE.

Lowell, Mass., Oct. 6, 1884.

Disinfectants.*

It has been proved by experience that the best means of checking the progress of cholera and other such diseases is by the proper use of disinfectants, and on that account a few words about them will not be inopportune.

The use of disinfectants has of late years greatly extended; few private houses are without them; in fact, none should be. Their value as a means of preventing the extension of infectious diseases is attested by the fact that the municipal authorities of many large towns made arrangements, when cholera was last threatening us, for distributing to every householder in the district a free supply of disinfectants if the disease should appear therein.

This plan was adopted in Bristol during the last outbreak of cholera, and was attended with most satisfactory results —results which were certainly no less due to the energy and promptitude of those whose duty it was to prevent the disease spreading than to the efficacy of the disinfectants. Indeed, by the free and proper use of disinfectants cholera has been reduced from the very terrible position it had attained in the eyes of our forefathers, to a much lower—to a reachable—level.

There are many kinds of disinfectants known, and sold to the public at varying prices, some valuable, others entirely worthless, as disinfectants. Every one is familiar with bleaching powder, which was formerly (and is still to a considerable extent) so much used. It is very effectual, owing to the chlorine gas which it freely gives off when exposed to the atmosphere, or moistened with dilute acids, such as vinegar. Charcoal, too, is well known as a disinfectant, and as a powerful deodorant. We may here remark that a deodorant simply disguises the bad smell without destroying the poison which it may contain, and in this respect differs from a true disinfectant. Of all known disinfectants. carbolic acid is now generally admitted to be the most efficacious, and it is the basis of most of the disinfecting agents now sold. The acid is too powerful to be used alone, and is therefore generally mixed with eighty or ninety per cent of some other substance not possessed of disinfecting properties. Sometimes the bisulphites of lime and magnesia are added, and these substances are themselves possessed of disinfecting properties; but more generally chalk or sand is used; or the acid is simply diluted with water. A small portion of the mixture sprinkled in water closets and other places where decomposing matter is allowed to remain will diminish, if not entirely remove, the chances of contagion, and sweeten and purify the atmosphere.

Although carbolic acid is so efficacious, there are some who object to its use. It smells rather strongly, and many persons are thereby prevented from using it. It is a pity on this account to be robbed of its advantages; and such persons would do well to try and educate themselves to the smell. Moreover, it is better to breathe an unpleasant and pure atmosphere than a pleasant but unhealthy and dangerous one. The smell of pure carbolic is much more easily borne than that of crude carbolic; and we would recommend the use of the purest carbolic procurable, diluted with eighty or ninety per cent of water, or mixed with the same percentage of precipitated chalk. It is difficult for the chemist, trained and accustomed to the offensive and unwholesome smells in the laboratory, to understand how any person can retain a strong dislike to the comparatively sweet smell of carbolic acid.

There are some reasonable objections to the use of carbolic acid as a disinfectant in a concentrated form. In the first place, it is a powerful poison, and if taken internally, is almost certainly fatal. The liquid carbolic acid varies in color, as the crudeness of the product increases, from pale straw to dark brown, approaching almost to black in the very impure kinds. This darkening is due to the presence of tarry substances, which add considerably to the offensiveness of the smell. This changing color renders it liable to be mistaken for other liquids, but in the form of powders the chances of such mistakes occurring are few, if any; and if kept in the diluted form the danger is very greatly diminished.

The smell of carbolic acid is very characteristic, and can be readily distinguished.

When it has been accidentally taken internally, castor oil and sweet oil should be freely administered, and a doctor obtained without delay.

It is very painful when externally applied, as it rapidly cauterizes the fleshy tissues. In the concentrated form it should be very cautiously handled. Oil or carbonate of soda rubbed on the parts are the best remedies for external injury and pain. Water may be applied externally, but should not be taken internally.

Another objection to the use of carbolic acid in the concentrated form is that it is apt to be wasted, for many persons are ignorant of or incredulous as to its powerfully destructive effects on animal life, and are sometimes so forgetful of principles of economy in this matter as to use carbolic acid in an undiluted form, and in quantities far in excess of what is required.

To prevent waste, the acid is used to form the basis of what are known as "carbolic disinfecting powders," which consist simply of chalk, or some other cheap substance, in a finely divided state, to which from ten to twenty per cent of carbolic acid has been added, and sometimes from five to twenty per cent of the bisulphites of lime and magnesia, together with some coloring matter, to give a pleasing effect to the eye.

Powders are an expensive form of disinfecting by carbolic acid; and a considerable saving might be effected by persons who use it largely if the mixing were done by themselves instead of by the manufacturers, and the same tins used over again, while the article so made would have many advantages. It could, in the first place, be made as strong as the necessities of any particular occasion might require, and in the next place, the pure acid may be used for house disinfection, and so lessen the disagreeableness of the smell, while the commoner kinds may be employed for yards, stables, fowl houses, etc. The method of making powders is very simple. About four ounces of the acid, by weight or measure, should be added to one pound of precipitated chalk, or fine sand, or mould, or any other harmless substance in a finely subdivided state, and thoroughly mixed in a large bowl. This powder will be suitable for all ordinary purposes, and will be far superior to many of the disinfecting powders sold at twice the cost.

Why, it may be asked, cannot our chemists discover some pleasant and non-poisonous disinfectant? Why are we under the necessity of substituting an intolerable smell for a bad one? The answer is that nothing but poisonous substances can be good general disinfectants, as the dangerous matter which it is the aim of disinfectants to destroy is chiefly organic, of which too, though of course in a far higher degree, the vital parts of the human being consist. Of disinfectants, charcoal is perhaps the least objectionable; it is neither dangerous nor mal-ordorous; but though extremely valuable as a deodorant, its usefulness as a disinfectant is very limited. A disinfectant must be capable of destroying the lower forms of organic life, some of which constitute disease; and the province of the chemist is to find out that substance which is most destructive to these lower organisms, and least dangerous and objectionable to man. Carbolic acid best answers these requirements, and on this account has recently come into extensive use.

*By an analytical chemist in *Cassell's Family Magazine.*

Progress in Dyeing.

A new pigment, to which the discoverer, O. Miller, has given the name canarine, is destined to replace many of the colors employed at present in dyeing and printing, being the only dye which like aniline black in dyeing silk can be applied without the intervention of a mordant to vegetable fiber. An alkaline solution of this color is used as dye bath. The tissues dyed with this color are neither affected by light nor by washing with soap. In view of the cheapness and simplicity of dyeing textile fiber, the importance of canarine in calico printing is equaled only by that of aniline black. The recipe used for the manufacture of this chromogene is the following:

One part of potassium sulphocyanate is dissolved in an equal weight of water, and 0·1 part of potassium chlorate and 1 part muriatic acid added; the mixture soon becomes hot, evolves gases, and deposits a colored substance. When the reaction has slackened, the vessel is placed in cold water, and another portion of 0·4 part potassium chlorate and 1 part muriatic acid is introduced; the orange colored subsidence is filtered, and exhausted with water. During the operation the temperature of the mixture should not fall below 80° C., as a lower temperature gives rise to the formation of by-products, which are inferior in purity and intensity of color. Pure canarine is obtained from the above precipitate on dissolving in a hot aqueous solution of potassium caustic, cooling down of the liquid to 40° C., and precipitating, on addition of 20 parts of alcohol, the potassium compound. It is strained after standing for 12 hours, thoroughly washed out, and dried at 100° C. The pigment represents a red-brown powder of high luster, and is dissolved by sulphuric acid into persulphocyanogen and sulphurous acid; it is soluble in ether, alcohol, and alkaline solutions.

A dye solution of this color is prepared in the following manner: 1 part canarine is mixed with 20 parts of water, the mixture is heated to ebullition and kept boiling for some time, and 1 part potassium caustic added; after the color is dissolved and the liquid appears brown, a quantity of 7 to 10 per cent of soap is introduced, and the liquid allowed to cool. Potassium caustic cannot be replaced by caustic soda, as the sodium derivatives of the pigment are insoluble in cold water; lime and magnesia salts also precipitate the color from its solution. The color suffers by boiling with caustic potash decomposition; its solution therefore is to be effected within the shortest time.

The dye-beck employed for working consists of 60 liters canarine solution and 80 liters of water; it is worked cold, and dyes 800 yards of woven tissue; when partly exhausted, it serves for dyeing of light shades. This process has been modified by Koechling, who dissolves 100 grammes of canarine and 100 grammes borax in 1 liter water, heats the mixture to ebullition, and then employs the hot solution for dyeing; the temperature of the dye bath is maintained by the application of the method employed in dyeing with alizarine. Schmid has shown that canarine can be used as mordant for aniline colors, the shades which it produces with methyl blue, malachite green, and Poirrier's violet resist the action of a hot soap solution. The alkaline solution of canarine, being of a yellowish or orange-brown color, according to concentration, dyes calico without the application of a mordant. Canarine has been produced upon the fiber by printing on to the tissue a mixture of aluminum sulphocyanate and aluminum chlorate, with traces of vanadium; the fabric being stretched on a frame, was submitted for one day at a temperature of 28° to 30° C. to oxidation. When potassium sulphocyanate is used for the respective aluminum salt in printing, the mixture absorbs with avidity aniline vapors and assumes an emerald color, which is gradually changed to black. In dyeing yarn a bath is prepared by dissolving potassium sulphocyanate, potassium chlorate, and muriatic acid in an adequate measure of water; the fiber is passed through this solution, and then further treated according to known methods.—*Erfindungen.*

Prevention of Hydrophobia.

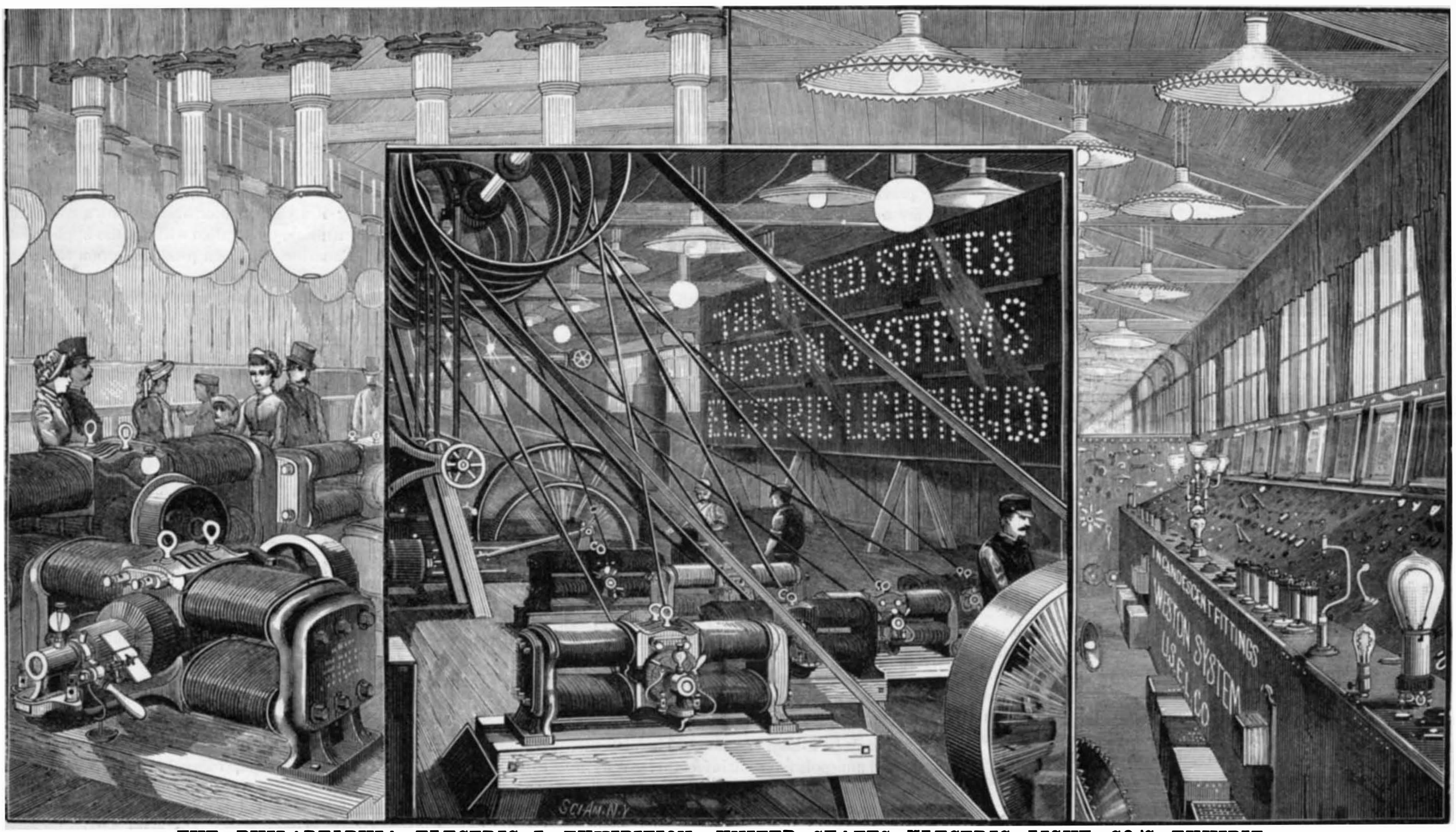
French science may indeed claim a new title to the gratitude of humanity. While granting this, we do not wish to rush to the hasty conclusion that hydrophobia is to be banished from our midst; only, if we can believe our eyes and ears, it seems that we are within measurable distance of this glad state. What has Pasteur done? He has—if our information be accurate, and we have no reason to doubt it —done something to twenty-three dogs, thereby rendering them, at any rate for a time, incapable of suffering from rabies. Side by side with the free animals he has placed others which may be regarded as servile to the yoke of hydrophobia. Of the latter series, six were bitten by mad dogs, three of them becoming mad; eight were subjected to intravenous inoculation, all becoming mad; and five to inoculation by trepanning, all likewise becoming mad. On this showing, sixteen out of nineteen dogs died when a dose of the virus of rabies was sown in them; whereas, of twenty-three protected dogs, none succumbed, although the virus was brought in the most effectual manner into the tissues of each animal. It is a well known fact that many more persons are bitten by rabid animals than suffer from hydrophobia. What the exact proportion may be is not satisfactorily known, but in dogs it would appear that about half the number bitten become rabid. There are two explanations of the escape. The first is expressed by saying that no virus gets into the tissues of the body. The second suggestion, though possible, is less plain. It is to the effect that some organisms are unsuitable for the development of the rabid poison. There is analogy for this contention. Some individuals are believed to be insusceptible to the poison of scarlet fever, and this statement also applies to other acute specific diseases. The questioner of nature may ask how these facts are to be explained? And although we are on very unsafe ground, still science does afford some clew to a possible explanation. If we remember rightly, Sir James Paget has asserted his belief that a severe attack of typhoid fever may do away with the protection afforded by a previous attack of smallpox. Typhoid fever so modifies the constitution that the protoplasmic organism once again becomes favorable to the growth and development of the germs of smallpox. Inoculation with the attenuated virus of hydrophobia gives a dog immunity from the disease, just as similar treatment preserves a sheep from charbon; in other words, the physical basis of the canine organism is so altered that it no longer affords nourishment for the evolution of the poison of rabies.—*Lancet.*

(*Continued from first page.*)

The Edison electric meter, by which the amount of electric light used in any dwelling or office may be determined, is shown and explained at the Exposition. Before entering a building, the current is transmitted through a resistance already known. A shunt circuit leads into the jar of a battery, the plates of which are zinc and the charging fluid the sulphate of the same. The same amount of current which enters the building is transmitted *via* the shunt circuit to the depositing jar, the amount of zinc deposited on one pole and taken from the other being a measure of the current which has entered. The weighing of the plates completes the operation, and enables the Edison Company to ascertain the amount of electricity they have furnished the consumer.

Upon a series of tables ranged along one side of the Edison exhibit are shown the various discoveries made by the wizard affecting telegraphy. These are so varied and so well known throughout the civilized world as to make any attempt at further description unnecessary.

One of the electrical comicalities of the Exhibition was the illuminated colored gentlemen who politely distributed cards to astonished visitors. The Edison Company conceived the idea of so locating one of their lamps that it could be seen by all, and to do this most effectually they placed it upon a helmet surmounting the head of the colored party. Two wires led from the lamp under his jacket, down each leg, and terminated in copper disks fastened to his boot heels. Squares of copper of a suitable size for him to stand naturally upon were placed at intervals in the floor, and were electrically connected with the dynamo. So with each heel in contact with a plate he was enabled to make and break the circuit leading to his lamp, the movement required being so slight as not to attract attention, and his hands being free to handle the cards. Many nervous persons were startled by the sudden flashing of the light, and so great were the crowds that continually surrounded this individual that he was frequently obliged to change his quarters in order to keep the passages open. As a further improvement it was the intention to place copper strips under a carpet and provide the heels with sharp points, so that each step would be illuminated. This simple exhibition led many folks from the rural districts to inquire as to the cost of such an appliance, as it was just the thing they wanted "to carry around the house."



THE PHILADELPHIA ELECTRICAL EXHIBITION.—UNITED STATES ELECTRIC LIGHT CO.'S EXHIBIT.

THE UNITED STATES ELECTRIC LIGHT CO.'S EXHIBIT AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

Those who have visited the Exposition and not seen the exhibit of the United States Company missed at the same time one of the most important as well as most interesting apparatus to be found in either of the halls or any of the corridors or galleries therein. It was, however, not difficult to find, for, as a matter of fact, parts of it pervaded almost every nook and cranny of the great hall. No expense was spared by the projectors to make an effective showing, and not content with exhibiting the more salient points of their system, they caused to be established a complete plant, wherein even the details of filament manufacture and the mercury process of exhausting the air from their lamps were practically demonstrated.

There are some companies that sell plant and not light, others that sell light and not plant, while still others there be that sell arc lights without pretending to sell incandescent. The United States Company, however, as shown by their exhibit, are prepared to supply everything in the way of electric lighting, arc and incandescent.

Around their headquarters were to be seen hundreds of small and large incandescent lights, whose soft, mellow light bid defiance to the night, while a multitude of the United States arc lights, fastened to the overhanging arches of the roof, cast down their powerful rays upon the surrounding exhibits.

At the headquarters of the United States Company, near the main entrance, five dynamos belonging to their system were placed. These were inactive, so as to permit of inspection.

Over at the north end of the building ten of these dynamo machines were kept constantly at work, in order to supply current to the almost innumerable lamps of all descriptions this company kept aglow on the floors and arches of the Exposition buildings. The character of the current generated by these machines is one of the peculiarities and advantages of the system. The current is continuous and free from pulsations which, when the mains are properly insulated, renders it comparatively harmless. In both the arc and incandescent systems, as exhibited, the regulation of the machine is wholly automatic. The lights may be turned off when no longer required, and a corresponding change is immediately apparent in the current generated, and in the amount of power required for driving the dynamo.

The large incandescent lights shown in the company's exhibit attracted much attention by reason of their novelty. They were from sixty to one hundred candle power, and, unlike arc lights, cast no shadows. Being vacuum lamps, like the smaller incandescent lamps, they require no attention. There is no pulling up and down every day and renewing of carbons, as in the arc light systems; it being only necessary to switch on the current to light them, and switch it off to extinguish them.

The Weston arc light system is used by the United States Company, and the Maxim incandescent system as improved by Weston. Each of the three forms of electric lighting requires a greater or lesser modification of the dynamo, though all are constructed on the same general principle.

The arc lights of the exhibit were generated by five dynamos each having a capacity of from five to fifty lights. The current from these machines showed an electro-motive force of 1,500 volts, while that from the dynamos furnishing the large incandescent lights showed an E.M.F. of 160 volts.

One of the most interesting features of the exhibit was the making of the incandescent lamps, or rather the vacuum making and the sealing.

The delicate carbon loops are attached on either side to platinum and placed within a vacuum, where a mercury pump is made to withdraw the air, and in its place is forced the vapor of gasoline, which leaves a slight deposit of carbon upon those parts of the loop which offer the greatest resistance, and thus the resistance is made equal all around. After this it is placed in its lamp, which is sealed after the air has been exhausted.

All this was publicly demonstrated at the United States Company's exhibit.

The Weston switchboard, as exhibited, is a model of simplicity. The circuits from the dynamos being brought to this switchboard, they can be coupled together. By means of this switchboard any of the outside circuits can be coupled to any of the dynamos, and readily changed from one battery of dynamos to another without, to an important degree, interfering with the others. Again, at the will of the operator, the dynamos can be put on any particular engine, and should certain shafting meet with an accident, other shafting can be connected by the aid of a series of clutches. By means of this switchboard, whatever combinations of circuits with combinations of machines are required can readily be made. A series of cables connect the circuits with the machines. At the extremities of the cables plugs are affixed, one extremity connecting with the circuits, the other with the machines. The dynamos are carefully guarded against the assault of lightning by being furnished with lightning arresters. The lamps are adjusted to each circuit by means of an extension of the circuits from the switchboard in regular order, and the lamps can be removed or returned without injury to the outside circuit.

The testing of lamps upon the circuit where they are to be employed also proved an interesting feature of the exhibit. As a whole, the United States system is very complete, and their friends may well feel proud of the interesting display which they have made, and the prominent position they have held in the exhibition.

Salmon Canning in British Columbia.

The Delta Cannery is the largest in British Columbia. Commencing operations only five years ago, its business has assumed such proportions that it now employs a force of over 400 men—280 Chinese and 160 Indians—and a fishing outfit consisting in part of 38 boats and nets, 2 seines, 1 steam tug, and 4 scows. The cannery covers a space of 160 by 120 feet, is two stories high, and in some respects is the best furnished on the Pacific Coast. It is provided with a boiler 16 feet long and 4 feet in diameter, 12 tanks, 2 retorts of 3,360 cans capacity each, filling and soldering machines, 4 lacquer baths, and every convenience for the rapid and thorough performance of the various operations necessary to secure the highest degree of perfection in the preparation of this most excellent article of food. Chinamen, under the supervision of experienced white foremen, are employed for the canning process and Indians for catching the fish, receiving from $1.25 to $2 per day, the net tenders the latter amount.

The daily catch per boat ranges from fifty to three hundred salmon, the fleet sometimes bringing in twelve or fifteen thousand. This season (1882?) the run has been so extraordinary that the Delta Cannery put up 1,280 cases in a single day, and 6,600 cases in six days. Messrs. Page and Ladner, the managing partners of the firm, showed me their product for the last month, amounting to the enormous quantity of 25,000 cases, or 1,152,000 cans, covering every available space of the immense lower floor to the height of over five feet, the largest number ever packed by any one establishment during the same period of time. Two hundred and fifty barrels of salmon, or about 13,000, were also salted within the month. The company ship their goods direct to London and Liverpool through the firm of Welch, Rithet & Co., of Victoria.—*Newton H. Chittenden, in Guide to British Columbia.*

BOTANIZING UPON A COIN.

Who has not remarked those small blackish masses which, as a consequence of too long a circulation, form incrustations (Fig. 1) upon the surface of coins, in the depressions between the images and letters? These have been studied by Mr. Reinsch, of Erlangen, whose investigations have embraced the coins—copper, silver, and gold—of all the states of Europe, and who has everywhere found micro-organisms—algæ and bacteria.

Upon scraping off with a needle the incrustation that had formed in the depressions of coins, and then placing it in distilled water and examining it under a magnification of from 200 to 300 diameters, Mr. Reinsch has detected the presence of the following bodies: fragments of textile fibers (Fig. 2, *c*), numerous granules of starch (Fig. 2, *d*), especially that of wheat, globules of fat, and a few unicellular algæ, etc. But, upon increasing the magnification, there are seen, amid all such detritus, bacteria in active motion (Fig. 2, *b*). Sometimes it is the rod-shaped sorts (oscillaroid bacteria), having an oscillatory motion (*Vibrio*, Fig. 3, *d*), or a spiral one (*Spirillum*), and sometimes the globular forms (micrococcoid bacteria). Sometimes all these forms are collected upon one and the same piece of money; but in most cases one form or another is met with isolatedly.

The globular bacteria are most frequent; the *Spirilla* (Fig. 3, *c'*) are much more rarely met with. As for *Bacilli*, these are almost always found upon copper, gold, and silver coins, under the form of from 4 to 12 jointed rods about 0·0055 or 0·0077 mm. in diameter. The terminal joints of these rods are swollen into a globular form. All these bacteria cease motion as soon as a drop of iodine or glycerine is introduced into the preparation. As for algæ (Fig. 2, *a*), the two species oftenest met with on coins are a very small *Chroococcus* (of the family Phytochromaceæ) and a unicellular species (Fig. 3, *b'*) that approaches the Palmelleæ. The *Chroococci* are hardly 0.00095 mm. in diameter, and are found collected, in 4s, 8s, and 12s, in spherical colonies that form small masses 0·02 mm. in diameter (Fig. 3, *a'*). The second form of alga (the one that approaches the Palmelleæ) is much larger, and consists of thick-walled cells having dark colored contents. In form they are related to the *Pleurococci*. Their diameter is from 0·009 to 0·01 mm., and the thickness of their walls is about a tenth of these figures. Several of these cells are found in segmentation, but not, however, so regularly as the typical *Pleurococcus*. The algæ are met with only upon old coins; the new pieces contain bacteria merely. Aside from algæ and bacteria, the incrustations upon coins contain undeveloped hyphæ, and spores of fungi analogous to those found in mould.

The fact ascertained by Mr. Reinsch is of great importance as regards public hygiene. We all know to what a degree the bacteria are propagators of contagious diseases, and certainly they could not choose a better vehicle for their dissemination than cash—that "object of circulation" *par excellence*. It would perhaps be prudent in times of epidemic to wash in a boiling alkaline solution such coins as have become coated by too long a circulation.—*Science et Nature.*

In connection with this subject, we present the following article, contributed by the editor of the *Hungarian Journal of Botany* to the September number of the *Bulletin of the Torrey Botanical Club*, of this city:

THE MICROVEGETATION OF BANK NOTES.

The recent researches of Paul Reinsch in Erlangen have revealed the occurrence, on the surfaces of the coins of many nations, of different bacteria and two minute algæ (*Chroococcus monetarum* and *Pleurococcus monetarum*, P. Reinsch), living in a thin incrustation of organic detritus composed especially of starch grains, fibers, etc., deposited upon their surfaces during the course of long circulation. This thin incrustation renders the coins very suitable for this microvegetation, but the same phenomenon is exhibited by paper money, and, indeed, by notes of clean and, to the naked eye, unaltered surface.

I have scraped off some of these minute incrustations with hollowed out scalpels and needles, and divided them into fragments in distilled water that had been boiled shortly before, and, upon examining them with lenses of high power (R. T. Beck's one-tenth inch), have seen the various schizomycetes distinctly.

I can now proceed to give a brief account of the results I have obtained from the investigation of the paper money. I have investigated the Hungarian bank and state notes, recent and old (from the years 1848–49), also Russian ruble notes, and have found bacteria upon all of them, even upon the cleanest.

On the surface of all the paper money is always to be found the special bacterium of putrefaction, viz., *Bacterium termo*, Dujardin.

In the thin incrustations on the paper money I ascertained

Fig. 1.—Coin with incrustations at *a b c*. Fig. 2.—A portion of the mass magnified × 200–250: *a*, algæ; *b*, bacteria; *c*, fibers of cotton; *d*, starch grains. Fig. 3.—The same more highly magnified: *a'*, algæ (chroococcus); *b'*, unicellular algæ; *c'*, Bacillus; *d'*, Vibrio; *e'*, Spirillum.

the occurrence of starch grains (especially those of wheat), linen and cotton fibers, and animal hairs, and, in this deposit upon the forint state notes, the blastomycete *Saccharomyces cerevisiæ* in full vegetation.

Various *Micrococci*, *Leptotriches* (many with club shaped, swollen ends), and *Bacilli* are also the most frequent plants in the deposit of the paper money.

The two new species of algæ described by Paul Reinsch are very rare on paper money. The green *Pleurococcus* cells have been observed in some cases on 1 and 5 forint state notes, and the bluish-green minute *Chroococcus* on the border of the 5 forint state notes.

The vegetation of the paper money is, according to my researches, composed of the following minute plants:

1. *Micrococcus* (various forms); 2. *Bacterium termo;* 3. *Bacillus* (various forms); 4. *Leptothrix* (species?); 5. *Saccharomyces cerevisiæ;* 6. *Chroococcus monetarum;* 7. *Pleurococcus monetarum.* From a hygienic point of view an investigation of the commonest household objects, and especially of books etc., used by students, may not be superfluous.

YOUNG CHIMPANZEES.

Valerian for Superficial Wounds.

At a recent meeting of the Societe de Biologie, M. Arragon brought forward a new method of dressing wounds, by which, he declared, their healing was hastened and the pain was made to disappear at once. The method consisted in the application of compresses wet with a decoction of thirty parts of valerian root in one thousand parts of water. Of fifty patients treated in this way, with only two had benefit failed to result, whether the wounds were lacerated or contused, but it is expressly stated that the treatment is of no avail in deep wounds. In one instance, warm injections of the decoction were used for otitis media. The anodyne effect is attributed to the action of the valerianic acid on the terminal nerves, and an antiseptic influence also is credited to the remedy.

Gas Tight India Rubber Tubing.

An elastic rubber tubing perfectly gas tight and free from smell has been urgently needed for many years; in fact, the impossibility of making satisfactory gas connection for gas apparatus which requires to be movable has rendered the use of gas as a fuel in many cases a most objectionable nuisance. A tubing by Mr. Fletcher, of Warrington, Eng., is made of two layers of rubber, with pure soft tin foil vulcanized between. It is said to be perfectly and permanently gas tight under any pressure, and free from smell after long continued use, while it retains the flexibility and elasticity of an ordinary rubber tube.

YOUNG CHIMPANZEES.

The chimpanzee is generally admitted to be the highest species of the apes, because its anatomy compares more favorably with that of man than any other of the monkey family. The adult measures nearly five feet in height. Its body is covered with long blackish-brown hair, which is thick upon the back, but scant upon the fore part of the body; at the sides of the head the hair is very long, and hangs down in the form of whiskers; the eyes are rather small; the lips are thick, and admit of great protrusion. The hands and feet are nearly naked, and the hairs of the forearm are directed toward the elbow.

The chimpanzee is a native of the Guinea region of West Africa. It has only been within the last few years that living specimens have been exhibited in this country. Our Zoological Gardens, Philadelphia, have now two interesting individuals of this species. Although they are comparatively young, perhaps not older than six years, yet they have an extremely antiquated appearance. I heard a countryman say to a bystander that he "guessed they were 70 years old, easy." One of them has such a great fondness for an old blanket, that he earries or drags it with him wherever he goes. Even if he desires to climb to the extreme top of his cage, the blanket must go along, although it greatly retards his progress. He knows its use, but does not always use it judiciously. Thus, on an oppressively hot day in July, I have seen him reclining for twenty minutes or more, entirely envelopod in the blanket, with the exception of his face, looking at the spectators with a comical and pouting expression. I saw one, when teased and disappointed by its keeper, throw itself upon the floor, and roll and scream vehemently, very like a naughty child in a tantrum. A board shelf was placed across their cage for them to climb upon. This they soon found could be used as a spring board, and nothing seems to give them more pleasure than, when there is a good audience, to steal gently to the center of the board, grasp it tightly with all fours, and spring violently up and down, causing the board with themselves to vibrate rapidly, and producing at the same time a loud, jarring noise. They then seem to greatly enjoy the startled and amused looks of the spectators. Perhaps one of their most human actions is languidly to recline, and holding a straw in one hand, listlessly to chew at its tip, while the eyes are rolled vacantly around. It may be that they are then building "castles in Spain." A lady observing a chimpanzee thus engaged, said he was thinking of liberty and his sunny home. But I do not for a moment suppose he was dreaming of and longing for his native home—the luxuriant and balmy forests beside the calm-gliding Gambia—but rather saying to himself, "Isn't it most time for that bossy and consequential cousin of mine to bring me my boiled rice and milk?" C. FEW SEISS.

The Length of the Meter.

The result of the latest investigations by Prof. William A. Rogers, gives the length of the meter as 39·37027 inches.

Concrete vs. Brick Floors.

The designer of a certain warehouse in Germany, unable to find definite data of the resistance of such floors, resolved to make trials for his own information, and incidentally for that of his professional brethren. The warehouse was of immense size, covering nearly an acre of ground, and was intended for the storage, among other things, of heavy pieces of metal, the handling of which often involved considerable shocks to the floors. The whole building was fireproof, part of the flooring being of brick arches in cement, between iron beams, and part of concrete slabs supported in the same way. Five trial floor arches were built, each 44 inches in span, of which the first consisted of concrete, made with one part Portland cement to five parts of gravel, while the second was of hard bricks in Portland cement mixed with three parts of sand, and was covered with a coat of asphalt three-quarters of an inch thick; the third was of softer brick, in mortar containing one-half as much lime as cement, and four parts sand; the fourth was of the same brick, in equal parts of lime and cement, and five parts sand; and the fifth was of the same brick, in cement alone, mixed with four parts sand. These last floors were finished with a coat of cement, three-quarters of an inch thick or more.

Fifty-four days after their completion, each floor was loaded with pig iron to the amount of 200 pounds to the square foot. This weight had no effect, and two days later the concrete arch was tested by letting fall upon it an iron ball of 60 pounds weight. This, dropped from a height of five feet, did no harm, and another ball, of 135 pounds weight, was let fall from the same height. The first blow produced no effect, but by dropping the ball repeatedly on the same spot a crack was started at the fourth blow, and the eighth broke a hole entirely through the floor, the opening being 4 inches in diameter at the top and 24 inches at the under side.

Thirty days later the same test was applied to another part of the floor, and a hole of the same size and shape was broken through at the ninth blow of the ball. The thickness of the concrete in the middle of the span was 4 inches. Trials were made of the brick floors in the same way. The first, of hard brick in strong cement mortar, stood forty-eight blows of the heavy ball before it was pierced; the second, of softer brick, with lime added to the mortar, gave way at the tenth blow; the third, at the seventh blow; and the last, of soft brick in sandy cement mortar, without lime, at the tenth. In all these cases the hole broken through was much larger at the intrados than at the extrados. A new floor was then built of soft brick, in mortar made with two parts lime to three of cement and ten of sand, and covered with a layer of concrete, of equal parts of cement and sand, 2 inches thick. After this had set, the floor required seventy-one blows of the 135 pound weight to break it through. This protective effect of the thick layer of concrete over bricks is very curious, but aside from this, the result of the tests was decidedly in favor of the brick arching.—*American Architect.*

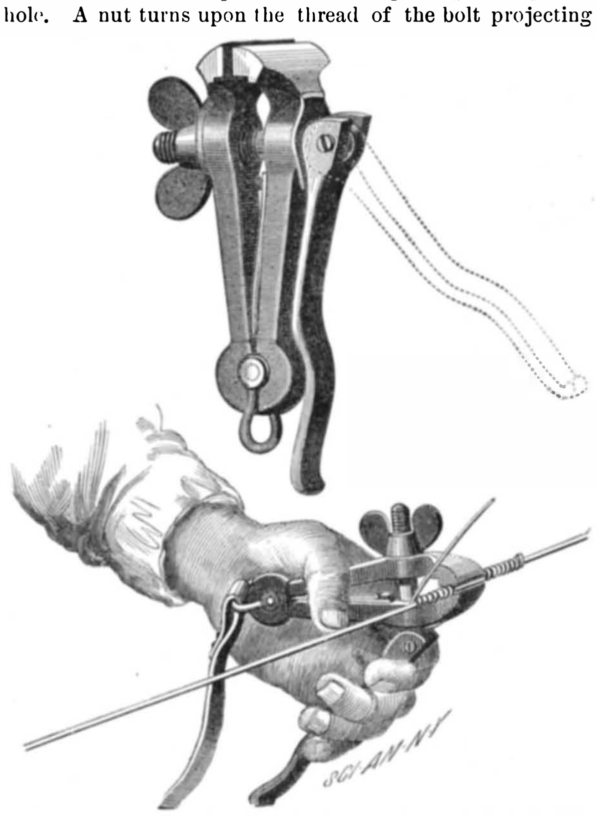
Exemption of a Physician's Property from Debt.

A New Hampshire physician was unfortunate enough to fall into debt and have judgments entered against him. The creditors naturally tried to obtain payment by issuing execution, and among the articles levied on by the sheriff were the physician's wagon and harness. The New Hampshire law says that such articles as are "tools of a person's occupation" cannot be seized and sold under an execution. The physician maintained that his wagon and harness came under this designation, and tried to recover them from the sheriff. The court, in deciding the question, which is an important one, does not settle the particular case, but refers it to a jury. The legal principles involved are of interest, and we quote from the decision as follows:

"The court cannot say, as a matter of law, that a wagon or a harness is a tool of a physician's calling, and so exempt to all physicians; nor can they say that it is not such a tool. The most that can be said, as a matter of law, is that it may be a tool of his profession if, in the particular case, it is reasonably necessary for him to use it as a tool. If it should appear that his practice was confined to his office, or that he was a physician or surgeon in a hospital, attending to no cases outside of the institution, or that he was a surgeon on shipboard, or that he went on foot or horseback, or on the cars, to visit his patients, a wagon and harness would not be exempt under our statute, because they would be of no use to him as tools in his practice. They might be of use to him in other respects, as in going to church, or in carrying his children to school, or in visiting friends, or as a means of recreation and pleasure; but these uses are manifestly not within the legitimate scope of the technical duty of a physician. Not coming within the strict definition of the term tools, and not being reasonably necessary as tools for him in his practice of his profession, they would not be tools within the meaning of the statute, and so would not be exempt as such. But if it should be found that the physician claiming the exemption could not practice his profession with reasonable success without a team with which to visit his patients; that he was located in a country town, for example, where it was necessary for him to ride a large part of the time in order to accomplish anything professionally, a wagon and harness might properly be found to be reasonably necessary for him as tools of his occupation. But the finding would be one of fact, so far as the reasonableness of the use is concerned; and it could not be said that these articles are exempt to every physician, or to physicians generally, but only to the debtor in the particular case. If there is any doubt whether an article claimed to be exempt from attachment is a tool under the statute, the question should be submitted to the jury whether its use as a tool by the debtor in his business is reasonably necessary. If it is, it is exempt; otherwise, it is not exempt."

IMPROVED VISE.

The object of an invention recently patented by Mr. William M. Whiting, of Elizabeth, N. J., is to construct a vise for grasping and securely holding articles of various sizes in such a manner that the pressure exerted by the pivoted jaws may be increased at will by a device acting independently of the screw and nut usually employed for forcing them together. The jaws of the vise are of the usual form. A screw threaded bolt extends through holes in the jaws, and at one end is pivoted to a cam lever, which also serves as a head for the bolt and prevents it from passing through the hole. A nut turns upon the thread of the bolt projecting



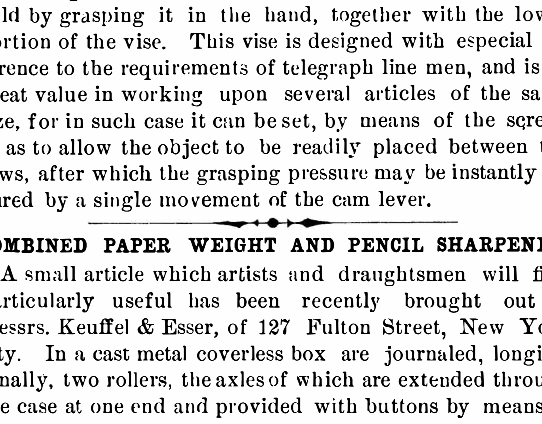
WHITING'S IMPROVED VISE.

from the opposite side of the vise. By means of this nut the jaws may be forced together, but where a greater pressure is desired than can be obtained in this way, the cam lever is raised so that the narrowest portion of its eccentric is interposed between the jaw and pivot of the lever.

After the jaws have been brought sufficiently together by the nut, the final pressure for grasping the object is obtained by forcing the lever downward, when it may be conveniently held by grasping it in the hand, together with the lower portion of the vise. This vise is designed with especial reference to the requirements of telegraph line men, and is of great value in working upon several articles of the same size, for in such case it can be set, by means of the screw, so as to allow the object to be readily placed between the jaws, after which the grasping pressure may be instantly secured by a single movement of the cam lever.

COMBINED PAPER WEIGHT AND PENCIL SHARPENER.

A small article which artists and draughtsmen will find particularly useful has been recently brought out by Messrs. Keuffel & Esser, of 127 Fulton Street, New York city. In a cast metal coverless box are journaled, longitudinally, two rollers, the axles of which are extended through the case at one end and provided with buttons by means of which they may be turned. Each roller is formed with a longitudinal slot just wide enough to admit the edge of a piece of fine sand or emery paper, which is of such a length



COMBINED PAPER WEIGHT AND PENCIL SHARPENER.

as to admit of its being wound several times around the rollers. The paper passes over a bar placed across the top of the box parallel to and between the rollers, and thus presents a wide surface upon which the pencil may be conveniently sharpened. When the exposed part of the paper becomes worn, a clean portion may be brought up by simply turning one of the rollers. All the dirt is collected at the bottom of the box. The device also forms a very handy paper weight.

DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Northern District of Illinois.

THE BROWN MANUFACTURING COMPANY *vs.* DEERE & CO.

Blodgett, J.:

The first claim of letters patent No. 190,816, granted to William P. Brown, May 15, 1877, for an improvement in couplings for cultivators, examined, sustained, and the defendant held to infringe.

The phrase in the claim "against or with the weight of the rear cultivators or plows" should not be read, as defendant contends, "against and with the weight," etc. There is no uncertainty or ambiguity in this claim. The claim is comprehensive enough to cover both the arm, M (by which a spring power is applied), and the arm, M' (by which the draught power can be applied), for the purposes to which the inventor proposed to apply them.

The objection that the specification describes and the claim covers a useless form or construction, as well as a useful one, is of no avail where the infringer uses the latter. The well known maxim applies, "*Utile per inutile non vitiatur*"—that which is serviceable is not to be rendered invalid by that which is useless.

Transferring the point of applying the lifting force of a spring from a point behind the forward end of the beam to an arm on the coupling, to which the beam is pivoted, *held* to involve patentable invention.

The fact that not only the defendants in this case, but other large manufacturers of cultivators, have at once adopted substantially the same auxiliary lifting devices shown in complainant's patent is evidence of the popular acceptance of this as a practical solution of many of the difficulties which had been encountered in the attempt to use the older devices, and is such a change and improvement as required more than mere mechanical skill, and brings this device fairly within the domain of the patent laws.

The fact that these older devices—Stover of 1870 and Brown of 1872—which it is now claimed were susceptible of being modified by mere mechanical skill into a machine in its operation and effect like that shown by the complainant's patent, rested without any such modification until the present patent was promulgated, held to be quite conclusive proof that it required something more than mechanical skill to produce what is shown in this patent.

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

HOLMES ELECTRIC PROTECTIVE COMPANY *vs.* METROPOLITAN BURGLAR ALARM COMPANY.

Wheeler, J.:

Patent No. 120,874, granted to Edwin Holmes and Henry C. Roome, November 14, 1871, construed to be for an electrical covering fitting the outside of safes, as distinguished from an electrical protection applied to houses and other buildings and to rooms. The patent sustained, and a preliminary injunction granted.

The provision of the statutes that a United States patent for an invention previously patented abroad shall be so limited as to expire at the same time with the foreign patent seems to mean that the term of the patent here shall be as long as the remainder of the term for which the patent was granted there, without reference to incidents occurring after the grant. It refers to fixing the term, not to keeping the foreign patent in force.

Rifle Caliber Machine Guns.

Lieut. Sleeman, in an article in the *N. A. Review* for October upon the development of machine guns, says:

The use of rifle caliber machine guns offers to a general the simplest and most effective means whereby to intensify rifle fire at any point of his position, without causing the offensive or defensive power of any other part to be weakened for this purpose.

Rapid firing single barreled shell guns possess some exceedingly important features for the military service, whether used in the field, as mountain guns, or for the armament of fortifications and earthworks. The properties that most strongly recommend these guns for service in the field are rapid fire, little or no recoil of gun carriage, mobility, simplicity of mechanism and manipulation, and, lastly, the use of made-up or self-contained cartridges. It is difficult to conceive of more suitable guns for light horse artillery. Take, for instance, a battery of six rapid firing three-pounder shell guns, each capable of discharging eight projectiles in half a minute, with deliberate aim between each shot. A battery of this nature could in this short period of time deliver forty-eight projectiles, equivalent to 144 pounds of metal, and if common shells were used, with 1,440 splinters, or for shrapnel shells, with 2,016 lead bullets. Such a rain of bursting shells would create terrible confusion, and have a most demoralizing and destructive effect, if thrown among a body of troops, while if directed against earthworks or houses, the continuous fire of shell after shell would soon produce considerable damage. The comparative lightness of these weapons would permit of their being provided with an effective shield protection without reducing to any serious extent their property of mobility; besides, the additional weight of this shield would permit of a larger powder charge being used, with a corresponding increase in initial velocity, accuracy, and power. Three-pounder guns have been referred to, but six-pounders are also adapted for field service, by allowing them to recoil and automatically return to their original positions without causing their carriages to run back.

Vermilion.—Its Manufacture in China.

The Chinaman has no knowledge whatever of chemistry, and of the principles of natural philosophy and statics generally his notions are of the most rudimentary and primitive description. How then, in the face of these obvious disadvantages, have the Chinese contrived to place themselves in the front rank among nations in the matter of certain chemical manufactures, one of the most important of which is the subject of this article—vermilion? In our last article we have seen with what ingenuity and pertinacity in carrying out his ends the Chinaman has succeeded in making perhaps the most delicate and perfect iron castings in the world.

He has succeeded in that instance not by any deep researches into the hidden mysteries of nature, by no process of thought involving an inquiry into the "reason why;" to this the Chinaman is averse, the whole tendency of his education, such as it is, tends to made him satisfied with observing effects; it is sufficient to him to know that things are so, without going into troublesome or elaborate investigations into those changeless laws of nature into which his philosophy teaches him that, as he cannot alter or control research, is fruitless; but that he has in his own small, ingenious, patient way observed effects to very good purpose the unrivaled excellence of some of his manufactures testifies. We will now enter a vermilion manufactory, and watch the process from the first stage of mixing its two ingredients—mercury and sulphur—to the final process of weighing and packing this costly and beautiful pigment for the market.

The first objects to attract the visitor's attention on entering the yard attached to the works will probably be large piles or stacks of charcoal, crates or baskets of broken crockery ware, and numerous rusty old iron pans of somewhat similar shape to the rice pans previously described, but considerably thicker and heavier. There will also probably be a few broken and disused cast iron mortars. All these articles are the cast off or worn out implements of the manufacture, and will be described in their proper order. On entering the factory proper, scores of little stone mills, each being turned by one man, and other long rows of workmen weighing out and wrapping up the vermilion, will be seen.

The furnaces are then arrived at; these may be a score or more in number and may be ten or twelve in each furnace room, five or six on each side. After passing these the stores of quicksilver, sulphur, alum, glue, new spare iron pans, serviceable crockery ware, and sieves, and other utensils used in the factory are arrived at, and this completes the view of the works. The iron pans in which the vermilion is sublimed are those referred to above; they are circular and semi-spherical in shape; all are of the same size and weight; they are cast upside down, and in the casting, a runner or lump of iron, two and three-eighths inch in diameter by from six-eighths to one inch in depth, is purposely left on every pan, in order to enable the workman the more readily to handle the pan when stirring up its contents. The size of the pans proved by actual measurement to be twenty-nine and a quarter inches in diameter, by eight and seven-eighths inches deep, and the weight forty catties, or say about fifty-three pounds. These pans are set in rows of five or six on each side of a small rectangular room, in size some twelve feet by fifteen feet; the door of this room is of wood, and contains an aperture a few inches square in order to enable the workman to watch the progress of his operation, from time to time, without the necessity of lowering the temperature of the apartment by opening the door. The pans are set in brickwork, each pan having beneath it a grate to hold the charcoal used as fuel. There is no communication between the grates or furnaces under each pan, and no chimney, the flames and products of combustion finding exit from the front of the grate, which is left wholly open at all stages of the operation.

The process of manufacture is as follows: Taking an iron pan, which is of four inches smaller diameter than those described, and also in all other respects proportionately less, except the runner, which is the same size, a skilled workman proceeds to weigh out seventeen and one-third pounds of sulphur. This he places in the pan, and adds about half the contents of a bottle of quicksilver. The pan with its contents is then put upon a small earthen brazier or portable furnace, the fuel used in which is charcoal. When the sulphur is sufficiently melted, the workman, taking an iron spatula or stirrer, rapidly stirs up the quicksilver with the sulphur, and gradually adds the remaining contents of the bottle of quicksilver, stirring the two ingredients together meanwhile until the mercury has wholly disappeared, or "been killed," as the Chinese put it. When this takes place the pan is removed from the fire, a small quantity of water is added, and rapidly stirred up with the contents of the pan, which have now assumed a dark blood-red appearance and semi-crystalline structure.

This mass is then turned out of the pan into an iron mortar, and then broken up into a coarse powder. This forms a charge for one of the large pans previously described, and when sufficient material has been prepared to charge all the pans in one furnace chamber the sublimation is proceeded with as follows: All the pans having received their quantum of crude vermilion, this is covered with a number of crockery or porcelain ware plates of tough, strong manufacture, each about eight inches in diameter; some of these plates, however, are broken up, and are in a more or less fragmentary condition. When these plates have been piled up into a dome-shaped heap of the same shape as the bottom of the upper pan, to which they should extend, the whole is covered with one of the smaller pans previously described. Now, it will be remembered than the smaller pan was of four inches less diameter than the larger one; there will consequently be a circular space of two inches all round between the circumference of each pan.

Consequently the rim of the upper or covering pan will be about two inches lower than the rim of the lower pan; there will also be some four inches space horizontally between the rim of the larger lower pan and that portion of the smaller pan which is at the same height as the rim of the larger one. This space is carefully filled with a clay luting into which some holes, generally about four in number, are pierced, extending down to the rim of the smaller pan or cover; this is done in order to allow the heated air and other matters to escape. All the pans in one furnace chamber being thus charged and covered, the fires are lighted. The flames from the charcoal should occasionally play several feet above the mouths of the furnaces. The door of the chamber is kept closed, except when it is opened for a moment in order to enable the workman to replenish the fires, which must be kept up at a fierce heat for eighteen hours. During the process a blue lambent flame is seen to play above each of the four holes which are pierced through the clay luting of the pans, so it is evident that a considerable quantity of either one or probably both the ingredients is wasted.

After eighteen hours the fires are allowed to go out, and the contents of the pan cool down. When this is accomplished, the greater portion of the vermilion will be found adhering to the lower surface of the broken up porcelain plates with which the crude product is covered. The vermilion is then carefully removed from the porcelain by means of chisels, and is now ready for the elutriating mills. Another portion of vermilion of not so good quality is found adhering to the upper iron pan and that obtained by washing the clay luting in a cradle, as diggers wash dirt for gold. This together with the wipings and scrapings generally is mixed up with alum and glue water into cakes, and, after drying on a brick surface heated beneath by means of wood or charcoal, is powdered up on a mortar, and resublimed when a sufficient quantity has accumulated.

The vermilion which was removed from the porcelain plates is of a blood red color and crystalline structure. This is then powdered up in a mortar and removed to the levigating mills; these are the ordinary little horizontal stone mills used by Chinese and other natives of the East to grind rice and other grain into flour or pulp, as the case may be. Each stone is about two and a half feet in diameter; the lower stone is stationary, the upper is turned by a direct-acting piece of wood having a hole in it, which works a wooden peg affixed to the upper stone, which is made to revolve by a backward and forward movement of the piece of wood, or handle, some three or four feet long, previously mentioned. One man turns each mill. The upper stone has a small hole in it near its center, down which the workman from time to time pours a little spoonful of the powdered vermilion, which he washes down into the mill with water; as he turns the mill the workman keeps continually ladling little spoonfuls of water down the aperture or hole in the upper stone; the ground and thus elutriated vermilion, as it escapes from between the stones, is washed down by the water into a vessel placed beneath to receive it.

When work is suspended for the evening, the ground vermilion is carefully stirred up with a solution of glue and alum in water, in the proportion of about an ounce of each to the gallon. The glue has been made to mix with the water by previously heating it with a small quantity of water; the earthen pots in which this process is effected each hold about six gallons. The mixture is then left to settle. In the following morning the mixture of glue and alum is poured off the vermilion, and the upper portion of the cake of vermilion at the bottom of the vessel—that is, the portion which remained longest suspended in the liquid—will be found to be in a much finer state of subdivision than the lower portion, which requires to be again elutriated as on the previous day; this separation of the more finely divided vermilion from that which was coarser by suspension in a dense medium, is a really most ingenious process, for which we should give the Chinamen every credit.

The process of grinding, elutriation, and separation of the coarsely ground from the fine vermilion sometimes requires to be several times repeated, in order to fully bring out the color. As a final process the damp cake of finely ground vermilion is stirred up with clean water, and allowed to settle down until the next morning, when the water is carefully poured off into large wooden vats to still further deposit a small quantity of vermilion still remaining in suspension, and the vermilion dried in the open air on the roof of the premises. When quite dried the cakes of now full colored pigment are carefully powdered and sifted by means of square muslin bottomed sieves, contained in a covered box some two feet high by two and a half wide, in which the sieves, which slide on a framework inside the box, are jerked backward and forward by means of a handle on the outside of the box or case containing them.

The now fully prepared vermilion is removed to the packing house, where may be seen rows of workmen, men and boys, seated before a series of tables. Between every two workmen is a third, with a small pair of scales, which he holds in his left hand; and as the workmen on either side place before him the little pieces of paper in which the vermilion is to be wrapped up, he weighs into each paper one tael (about an ounce and a third avoirdupois) weight of vermilion; the papers are two in number, the inner a black or prepared paper and the outer a piece of ordinary white paper. After being wrapped up the packets are placed in rows before another workman, who stamps them with a seal containing in Chinese characters the name and address of the manufactory in which the article has been made, and the quantity and quality of vermilion contained in the packet.

The rapidity and deftness of the Chinese workmen at this employment is really surprising; the stamping, for instance, is effected at the average rate of sixty impressions per minute, and the wrapping up is carried on with proportionate rapidity. The mixture of alum, which is the ordinary aluminum potassium sulphate, with the vermilion, in one of its stages of manufacture as described above, is not added, as at first sight we thought it might be, merely to assist in clarifying or purifying the water by causing it to deposit its sediment, but seems to have some peculiar effect upon the color. Although what may be the *rationale* of the process, or how it acts, we cannot quite clearly see; the glue is added as described above merely to favor separation of the finely elutriated vermilion by holding it longer in suspension than the coarser particles, which sink first, and may therefore be separated in their order of stratification.

The actual composition of vermilion is one hundred parts of mercury to sixteen of sulphur, when both these ingredients are in a perfectly pure state; the excess of five and one-third pounds of sulphur added by the Chinese is probably volatilized and lost in the process of sublimation, or as the sulphur used is generally not quite pure, a part may go for foreign matter contained in the sulphur; the balance being probably the *raison d'etre* of the blue lambent flame seen playing over the apertures in the luting during the sublimation process. For a people, having like the Chinese no acquaintance with even the first rudiments of chemistry, the proportion of ingredients taken—fifty-six and one-quarter catties to 13 catties, or say 75 pounds to 17 and one-third pounds—shows wonderfully accurate powers of observation and a knowledge of combining proportions only to be gained by much experience and a long extended series of careful observations highly creditable to the manufacturers. The entire process is one of the most ingenious and interesting to be seen in any part of the world.

Hong Kong, March 29, 1884.

—*T. I. B., Chem. News.*

Mounting Prints on Muslin.

At a recent meeting of the Rochester Photographic Society, Mr. J. M. Fox gave the following account of his method of mounting prints on cloth. He said:

"After trying many experiments in double mounting on muslin I have adopted the following method: I prepare several yards of cloth at a time by sizing with starch, and always keep a roll of it on hand ready for use. While damp the cloth is stretched not too tightly on a frame, and sized plentifully with warm starch paste made rather thin, and spread on evenly. Where large quantities of muslin are used, perhaps tenter bars might be employed to advantage for stretching. When dry cloth is cut to the size required before mounting, allowance being made for the expansion of the prints, if the starch for mounting be used while warm (which I think is preferable), it should be as stiff as can be conveniently spread on the print, for the reason that it will expand the cloth less and dry quicker. From the moment the first print touches the cloth dispatch is important; therefore both prints are first pasted, one being laid aside ready to be picked up quickly. The first print is rubbed down with a hand roller, which can be done more expeditiously than with the hands. When the second print is properly laid on the side there is less occasion for haste, and rubbing down by hand is preferable; because, although the roller does the work perfectly on the first print mounted, it is liable to leave air bubbles in rolling down the second one. To avoid bubbles in the hand rubbing, the strokes should be toward the middle of the print, and not in every direction from the center. When the mounting is completed, the prints are placed between papers and covered immediately with several folds of cloth of sufficient weight to keep them in place. To facilitate drying they may be aired after an hour or two and placed between dry papers and again covered with the cloth."

A Mischievous Toy.

On each side of 108th St., between Third and Lexington Avenues, this city, is a row of new flats. The row on the south side is almost completed, but a very large number of the whole glass windows have been shattered. The hole in the glass is generally small and round, with fractures extending in all directions.

"The boys do it with what is just now the most popular toy Harlem ever saw," said a policeman in Lexington Avenue. "The toy is made like the stock of a gun. A short, hollow, wooden cylinder fits into the channel of the gun stock and is secured near the muzzle of the stock by a stout rubber cord. When this cylinder is pulled back to the position a gun lock would occupy, it is caught on a trigger. The boys put a lead bullet into the little cylinder, aim at a window a square away, and pull the trigger. A jingle follows every time. Sparrows and cats even have been killed by the bullets. It has been impossible so far to catch the boys in the mischief, because there is nothing to tell where the shot comes from. Unless we are lucky enough to see some of them in the act, we will probably not be able to stop the destruction."

MECHANICAL INVENTIONS.

A bearing for spindles of spinning machines has been patented by Mr. Albert R. Sherman, of Pawtucket, R. I. This invention combines with the spinning bolster and case a ball or detachable stiff vertical supporting pin with free lateral movement, the pin or ball stepped at its lower end in the bottom of the bolster case, and the oil cushion between the bolster case and the bolster being preserved in the plane of the whirl.

AGRICULTURAL INVENTIONS.

A combined corn planter and fertilizer distributer has been patented by Mr. William Cassill, of Hamden Junction, Ohio. This invention covers improvements on a former patented invention of the same inventor, making the machine more convenient in use and more reliable in operation.

A check row corn planter has been patented by Mr. Stephen E. Williams, of Rockport, Mo. The frame is mounted on a stationary axle with rotating wheels, and hinged to it is a frame with rotating axle and fixed drive wheels, so the drive wheels can be raised from the ground; there are also hinged marker bars which can be readily raised and lowered.

A corn harvester has been patented by Mr. John E. Smith, of Wilmington, Del. The cutters are arranged to cut two rows of corn at one passage across the field, the outer cutter, or the one most remote from the team, being in advance of the inner one, there being also an evener chain for bringing the butt ends of the two rows of stalks together to be bound as fast as they are cut.

A harrow attachment for plows forms the subject of a patent issued to Mr. Enoch Calvin Eaton, of Pinckneyville, Ill. An obtuse angled bar carrying teeth on its outer arm is so combined with a turn plow, another bar bent at both ends having teeth adapted to work rearwardly, as to form a harrow rigidly attached to the plow beam, to pulverize and level the soil, cutting down the high parts of the furrow slice and filling the low places.

MISCELLANEOUS INVENTIONS.

An oil filter has been patented by Mr. Daniel S. Neiman, of Fargo, Dakota Ter. It is a tank with a funnel at its upper end and a series of shelves with layers of charcoal, lime, and woolen cloth, with a steam coil surrounding the lower end of the funnel.

A hair spring regulating pin for watches has been patented by Mr. George F. Johnson, of Aurora, Ill. In combination with the regulator and its pins is a spring, so attached and arranged as to close by its tension on or against the under or exposed ends of the regulator pins.

A paper box machine has been patented by Mr. Maurice Marques, of New York city. There are male and female cutting dies, with expanding plates, and means for operating them, so the paper box may be formed of a single blank cut from a sheet of pasteboard or other suitable material.

A pump has been patented by Mr. Luis G. Careaga y Saenz, of Puebla, Mexico. It is a double piston pump, with rigid piston disk and rod arranged eccentrically, with a segmental plate attached to the disk and rod, a flanged imperforate rubber plate, and various other novel features.

A clock striking mechanism has been patented by Mr. Lucien Diacon, of Chaska, Minn. The object of this invention is to simplify the construction and reduce the cost of clocks intended to strike the hours and their subdivisions, as well as prevent their becoming easily disarranged.

A horse detacher has been patented by Messrs. John E. Stevenson and Joseph Forsyth, of Brighton, Tenn. This is an improved contrivance of trace hooks and means for unhooking the traces therefrom, to provide simple and efficient means of escape from the horses when they become uncontrollable.

A line throwing gun has been patented by Mr. Jeremiah Williams, of Hartford, Ky. There are side openings in the barrel about the middle of its length, and there is a cone held to turn on the barrel on which the line secured to the dart is held, the dart having a wad held on its butt end by a screw.

A distributing roller for mucilage, gum, etc., has been patented by Mr. Joseph A. Conwell, of Vineland, N. J. This invention consists of a roller with an annular groove at each end inclined inward from the rim toward the central axis, making pockets for the mucilage flowing down the ends of the roller.

A plumb bob has been patented by Mr. George Morrison, of Elmira, N. Y. In its upper hollow portion is a spring barrel gearing with a pinion on a shaft, a reel being mounted on the shaft with its periphery notched for the engagement or a spring pawl for holding the reel at any desired point.

A nut for carriage axles has been patented by Mr. Robert M. Pierson, of Mayesville, S. C. The nut is hollow, with adjustable covers for taking up the endwise wear of the axle box in the hubs of carriage wheels, and it has a locking device for maintaining the hollow nut and core in any given relation to each other.

A paperhanger's table has been patented by Mr. Lewis A. Young, of Stanstead, Quebec, Canada. This invention combines, with a frame, means for trimming the edges of the paper, for distributing the paste, and an endless conveyer belt upon which the paper is conducted after having been supplied with paste.

A chain pump has been patented by Mr. George W. Derrick, of Centerville, Ore. This invention covers a special combination of parts to lessen the friction and wear upon rubber buckets, and also to allow the well pipe to be easily cleared of sediment and the water to be easily discharged from its upper part to prevent freezing.

A circular saw lifter has been patented by Mr. William G. Baumgardner, of Filer City, Mich. It is a yoke with a handle pivoted on each of its parallel bars, with a cam lug on one side of the pivot adapting the two handles to form gripping bars, between which the toothed edge of the saw may be inserted, so as to be gripped and held firmly.

A hand truck has been patented by Mr. Joseph Annin, of Brooklyn, N. Y. The truck frame is of cast iron, with jaws cast in one piece therewith, and having parallel extensions for receiving clamping bolts, the handles having sockets or clamping jaws for securing them tightly, and so they may be conveniently attached and removed.

An automatic safety brake for horse powers has been patented by Mr. William L. Remington, of Meriden, Conn. This invention consists principally of a system of levers applied to the ordinary brake lever in such manner that a downward movement of the main horizontal lever of the system will shove forward the brake lever and apply the brake.

A safe has been patented by Messrs. John W. Johnston, of Richmond, Va., and J. H. Rogers, of Washington, D. C. An envelope is made to cover the entire safe, the envelope being wholly or partially adjustable, with means for adjusting, and an electro magnetic locking device for precluding the movement of the envelope except within certain intervals of time.

A carpet fastener has been patented by Mr. James A. Waters, of New York city. A hooked clamp plate is employed, journaled in suitable blocks or standards, and acted upon by springs, for grasping and holding the edge of the carpet, so the carpets may be held without injury and easily taken up and replaced, avoiding the use of tacks, hooks, etc.

A rope supporter for hay and other carriers has been patented by Mr. Richard Tennant, Jr., of Woodland, Wis. It is made with a pulley to receive the rope, bars, and wheels to carry the pulley, and spring catches to engage with the carrier, preventing the rope from sagging, and lessening the space traveled by the horse at each trip.

A mowing machine knife has been patented by Mr. John M. Hamblin, of South Union, Ky. This invention provides a light, strong serviceable knife bar and knives, which may be worked a long time without excessive gumming and with little power, and which will allow of a quick, easy, and accurate sharpening of the knives when dulled.

A door hanger has been patented by Mr. George H. Burrows, of Somerville, Mass. It is made with a traveling bar with a longitudinal slot to receive the wheel, and long rabbets in its lower side to receive and travel upon the journals of the wheel, the improvement being especially applicable to car doors, though useful for other purposes.

A boot or shoe polishing machine has been patented by Mr. Arthur A. Sparks, of Trenton, N. J. It consists of a frame mounted loosely on a shaft and carrying revolving brushes, which may be swung around to the work by turning the frame in vertical plane, the brushes being revolved by belts leading from a fixed pulley on the shaft.

A spoon bowl has been patented by Mr. Henry Nickolds, Sr., of Taunton, Mass. The bowl of this spoon by this construction, instead of having a sharp edge, has its margin bent outward or extended in the manner of a flange, or made with what is styled a returned edge, so it will present a more smooth and agreeable surface to the upper lip.

A pole attachment for wagons has been patented by Messrs. Alfred T. Hawk and Joseph W. Scott, of Preston, Ohio. It is made with a socket bar secured to the hounds at the forward side of the axle by clips, and a socket bar secured to the forward part of the bounds by a keeper, and properly strengthened by brace rods, so two poles can be readily applied to the wagon.

A washing machine has been patented by Mr. Merritt W. Palmer, of Holland, Mich. This invention covers certain improvements in clothes washers where the water is forced through the clothes by air being compressed in the vessel, a valve admitting air but preventing its escape, the up and down movement of the washer effectively acting to force soapy water through the clothes.

A belt clamp has been patented by Mr. Eleazer Ainsworth, of Wilmington, Del. Clamp bars are provided with convex sides facing each other, the bars having grooves in the ends increasing in depth from the outer to the inner edges, to permit inclining the clamp bars to the screw rods, the invention being an improvement on a former patented invention of the same inventor.

A marker for weather boards, flooring, and jambs has been patented by Mr. John Hamm, of Memphis, Kansas. It consists of a rule formed of two strips of wood, connected together at one end by a hinge and at the opposite end by a transverse screw, each strip having a short arm, and each side of the rule a standard with a shouldered projection, with other novel features.

A saw mill head block has been patented by Mr. Robison W. Shelbourne, of Blandville, Ky. There is a wheel with shaft gearing with the log setting shaft, a rising and falling rail adapted for contact with the wheel, an apparatus for actuating an endwise movable bar, and other novel features, to effect in an improved way the manipulation of the log in presenting it to the saw.

A cotton gin breast has been patented by Messrs. William F. Smith and William W. Adams, of Ozark, Ark. There is a suitably supported flexible breast back comprising one or more belts armed with strips upon the exterior sides, and driving wheels encompassed by the belts, with other novel features, to facilitate the passage of the cotton to the saws, prevent breaking or stopping the roll, and afford increased facility for ginning wet cotton.

A folding skeleton gun stock has been patented by Mr. Frederick Schwatka, of Vancouver Barracks, Washington Ter. The skeleton extension is pivoted to swing upon a smaller stock of gun or pistol, and arranged so that when closed it fits underneath the stock; there is also a spiral articulated construction of the skeleton stock, with fastenings for it closed and extended, securing great compactness and providing for a large extension of the stock.

A numbering attachment for printing presses forms the subject of four patents issued to Mr. Albert R. Baker, of Indianapolis, Ind. The press has an additional cylinder, with numbering heads properly mounted therein, and appropriate mechanism for operating them, the cylinder being in such relation to the regular cylinder that the numbers in the numbering heads will come in contact with the paper thereon as the cylinders revolve, with various other novel features.

A wheelbarrow has been patented by Mr. Joseph Annin, of Brooklyn, N. Y. The body can, by means of clamps, be secured to the handles at any desired distance from the wheel, and a stiff flanged brace sustains the tray in its normal shape, so the barrow can be used in carrying burning coals about gas works, melted refuse about iron works, etc. The same inventor has also obtained another patent covering an improved metal wheelbarrow tray, with two angular side and end pieces, forming a flaring body, riveted together with the bottom.

A belt fastener forms the subject of two patents issued to Mr. George W. Southwick, of Southwick, Mass. It consists of a rigid plate with prongs and eyes on both edges, the longitudinal axes being parallel with the edges from which the prongs project, so the strain is distributed over the plate in all its positions; also, if the belt begins to rip, an additional plate may be fastened on the belt, and the loops connected with the other, the object being to unite the ends of driving belts, so they need not be adjusted and tightened as often as with the usual lacing.

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This a handsome octavo of nearly a thousand pages, containing a full list of all newspapers in the United States and Canada; it also has classified lists of those devoted to special subjects, as religion, agriculture, trade, science, etc., making it an extremely valuable and convenient reference book. From these lists we see that there are in 1884, 12,713 newspapers and periodicals published in the United States, as compared with 11,966 in 1883—a gain of 747; while Canada shows a loss of 9. The book may in part be styled a co-operative publication, in which the various newspapers join with the Messrs. Ayer & Son in getting out a volume which will give the greatest amount of information about their business.

DYNAMO-ELECTRIC MACHINERY. By Silvanus P. Thompson. E. & F. N. Spon, London and New York.

This volume is based on the Cantor lectures of the author before the Society of Arts, in 1882, but affords a good deal more than a mere reprint of those papers, which were at once republished and widely circulated in America and throughout Europe. The present work is a review of what has been done, down to the present time, in converting the energy of mechanical motion into that of electric currents, and *vice versa*, a subject in the investigation of which the writer has been prominent for some years past. His papers have been read, and his judgment is highly valued, by all thorough investigators in this field.

WONDERS AND CURIOSITIES OF THE RAILWAY. By William S. Kennedy. S. C. Griggs & Co., Chicago.

This is a pleasant book for a traveler on a journey by rail, with which to while away an hour. There are few matters in it with which an ordinary engineer or an intelligent mechanic is not already conversant, but it is sometimes agreeable to refresh the memory with a book of this kind, which interests without taxing the mind.

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Notes & Queries

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Name and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or mail, each must take his turn.

Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter**, should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. H. B. B. asks: How can I determine the velocity of water in a pipe? I have an artesian well, and it is suspected that there is a loss of water by percolation through the joints of the pipe. If there is some simple device which I could let down 250 feet and ascertain the velocity there, and then get it at the top, I could of course settle the question of loss, and ascertain the amount of water. A. We know of no method of accomplishing what you want by getting the difference of velocities; if you could run down a self-packing plug to the bottom of the pipe, you could then discover if there are any leaks by the subsidence of the water in the pipe.

(2) J. A. R. asks: 1. Would it do to attach the engine shaft direct to the saw shaft by a coupling? A. With a slow saw and fast feed the saw would wedge and heat. Do not think it advisable to attach engine shaft to saw shaft under any circumstance. 2. I had a dispute with several persons about the length of belt used on common steam thrashing machine. I claim after the belt has all the grip the pulleys will allow, then any more length of belt is lost weight and harder on the machinery. How is it? A. There is no advantage in extremely long belts.

(3) A. D. writes: Is it necessary to oil well fitted bearings (light work) as often as customary? I know of a case where a shaft, through neglect of an employe, was allowed to run three months on one oiling at 10,000 revolutions per hour. Not the slightest damage was done to the "Babbitt" or to the shaft, nor was there noise or heat. A. This looks rather extravagant. There is a patent for dry journal boxes. As far as known to us, they have been failures. Probably the shaft in question did not bear upon the journal box.

(4) L. D. B. asks what Bessemer steel is, and if nails made of it are as good or any better than the common iron nail. A. Bessemer steel is a low grade of steel made by blowing air through molten iron in a converter. It is tough and strong, and is the very best material for nails if you can afford it.

(5) J. A. L. asks: 1. What is compound spirits of ammonia? Can I compound it? A. For compound spirits of ammonia, the aromatic spirits of ammonia are usually dispensed by druggists. Its preparation is simple to those familiar with pharmaceutical manipulations, and its formula according to the United States Pharmacopœia, which describes its manufacture, is:

Carbonate of ammonium	40 parts.
Water of ammonia	100 "
Oil of lemon	12 "
Oil of lavender flowers	1 "
Alcohol	700 "
Distilled water sufficient to make	1000 "

2. Are spirits of turpentine and oil the same? A. They are. 3. Will the sun draw the temper from saws and other edged tools? A. It is generally considered that such is the case.

(6) W. R. G. asks: What will cure a dog of the mange? A. Any of the following can be used as lotions for the mange:

Corrosive sublimate	¼ ounce.
Hydrochloric acid	½ "
Water	1 quart.

or:

Corrosive sublimate	1 drachm.
Ammonium chloride	½ ounce.
Water	1 pint.

or, to the last add a strong decoction of white hellebore, half a pint.

(7) J. H. G. asks: Is the cause of the potato "scab" known, and what is the cause and remedy? A. Potato "scab" and "skin crack," though not identical diseases, ought to be considered together, for their causes are apparently the same. They proceed from an irregular supply of moisture to the growing root and plant. Where the growth has been vigorous and rapid, and has been then checked by drought, the skin of the potato becomes firm and strong; if now a sudden and rapid growth starts, this firm skin is cracked by distention, and the cracks extend down into the starchy substance; this is "skin crack." In another case, where the new and rapid growth is perhaps not quite so sudden in its start, the skin instead of cracking becomes rough and thickened in patches and scales; this is "scab," and results from excessive development of the cork cells forming the inner surface of the skin. In either case, "scab" or "skin crack," the tissues beneath become diseased and die to the depth of half an inch more or less, of course injuring the value of the crop. In this decayed tissue, various mites barely visible, and others too small to be detected without the help of a microscope, make their home, and have been erroneously supposed to be the cause of the injury. These forms of disease were first described by Dr. Herman Schacht in his report to the Prussian Board of Agriculture, in 1858.

(8) S. D. R. writes: We want to make some cider jelly. Will you please inform me how much gelatine to use to a gallon of cider? A. To make cider jelly, 2 ounces of gelatine are dissolved in a pint of cold water, and when dissolved, 1 pint of hot water and 1 quart of cider are added, that is, 8 ounces to the gallon.

(9) C. B. H. writes: I wish to decolorize red wine vinegar. I think of leaching it through animal charcoal. Will the commercial variety of that article answer my purpose, or would the vinegar be too much contaminated by dissolving the phosphates, carbonates, etc., in the coal? If so, how could the coal be prepared so as to be fit for the purpose? Would wood coal answer? A. To take away the color of vinegar, 2 pints red wine vinegar are mixed with 1½ ounces bone charcoal, or bone black, in a glass vessel. Shake this mixture from time to time, and in two or three days the color completely disappears. When the process is to be performed in the large way, throw the bone black into the cask of vinegar, shaking it from time to time. Wood charcoal if ground fine would answer, and the impurities contained in it are so slight in quantity that they can be entirely disregarded.

(10) J. B. asks what kind of cement to use to fix a glass eye with. A. Dissolve fine glue in strong acetic acid to form a thin paste, or use Canada balsam or clear glue (gelatine) to which has been added a small quantity (one fiftieth) of potassium bichromate. The latter soon loses its yellow tint, and becomes unaffected by dampness when exposed to daylight.

(11) J. F. S. asks how near a complete vacuum can be produced by an exhaust fan. Or in other words, how low can the mercury in a barometer be reduced in an air tight chamber or vessel, from which the fan is exhausting the air? A. An exhaust fan will produce a draught, but not an appreciable vacuum, only about equal to one or two ounces negative pressure, say about one-quarter inch on the barometer. 2. I wish to produce a partial vacuum in an air tight cylinder 2x10 feet, and with either a rotary pump or fan instead of the regular air pump. Which would be preferable? A. A rotary pump or any air pump.

(12) W. P. W. writes: I have a steam pump used for raising water. Pump 3¼ and 5x7 inches, I run this pump continuously 10 hours, and pump say 9,000 gallons during that time. The lift from the surface of the well to top of tank is 55 feet distance, of well from the pump is 68 feet; suction pipe 2¼ inches; delivery pipe, 1½ inches; I throttle the valve so as to run slow. The boiler pressure averages 60 pounds, the boiler furnishing steam to run an engine and for other purposes. I wish to find out some method of getting at the cost of raising this amount of water to the tank on a basis of coal price say at three mills per pound. I also would like to know the method used to obtain the result. A. The computed lift of the pump in volume of water is about 18,500 pounds 1 foot high per minute. The computed work of the pump at the pressure you name is about 40,000 pounds 1 foot high per minute. So you must lose over 100 per cent in friction. The indication by steam is 1¼ horse power, which, considered with the uncertain economy of boiler, you may safely assign at 8 pounds per horse power, or say 100 pounds coal per day, or 30 cents for coal alone. Oil, attendance, and interest must be added to this for obtaining a proper value of the cost of pumping. For the detail of these computations we refer you to Haswell's Engineer's Pocket Book.

(13) G. W. F. asks the process for cleaning and polishing steer horns. A. Rough down the horn with a rasp or file to make the surface even. Then scrape with broken glass or a steel scraper, such as cabinet makers use for finishing hard woods. Then finish with a buff of felt (wheel or hand) with tripoli and water. Gloss with whiting and water on a soft buff, finishing the gloss with a cloth and dry whiting.

(14) H. L. R. asks for the best glue or substitute for glue of a waterproof nature, to use in gluing the white kid leather to the pine ribs of an organ bellows, where the bellows is situated in a damp room, under which circumstances ordinary glue softens, and allows the leather to come off from the wood. A. The addition of a small quantity of bichromate of potash to your glue and the subsequent exposure of the glued material to light would probably secure the desired results.

(15) E. L. desires a receipt for making a good stove polish or paste. A. Black lead pulverized, 1 pound; turpentine, 1 gill; water, 1 gill; sugar, 1 ounce; mix.

(16) Z. D. asks: How many gallons of water per minute should a 3¼ inch pipe one foot long with a head of 103 feet discharge? A. 6,930 gallons per minute, free from other friction than the one foot nozzle.

(17) B. J. B. writes: I am digging quite a large cistern (13 feet diameter and 10 feet depth); would be glad to know if it will be safe to put the cement directly over the clay sides, or whether a brick wall must be introduced. The cistern is circular. Is there any good recent work on the construction of cisterns? A. You may make a good cistern wall with a concrete of equal parts Portland cement, sharp clean sand, and broken stone. But to make it thoroughly substantial the concrete should be rammed between a crib and the clay wall, so as to have a solid outside bearing suitable for the arch or cover. If you make a cover of concrete, make the arch nearly hemispherical, or half a sphere, for safety, although experienced persons could make it much flatter. For the arch use 50 per cent more Portland cement than noted above. Build the support with scantling and boards nearly to the form required, and cover with sand to give it a true form, and tamp the concrete around the outside first, filling in solid against the earth bearing for supporting the arch; finish at the hole in the center last. Make the arch at least 8 inches thick at center and 12 inches at the outside bearings. We know of no book on this subject.

(18) A. L. P. asks: 1. How do astronomers calculate the distance to the sun or any heavenly body? I am at a loss to see where the starting point is, to obtain the angle. A. By making a triangle of which a part of the earth is the base; observing the zenith distance of the sun's center at simultaneous moments, the chord of the arc between the places of observation being computed from measurements actually made upon the surface of the earth for the purpose of establishing its diameter, upon which is based this method of computation. The transit of the inner planets, particularly Venus, has given a more refined method of triangulation, which is somewhat complicated. You may obtain a clearer insight into this subject by reading any technical work upon astronomy. 2. A vessel moving at the rate of 10 or 15 knots an hour. Does it leave a vacuum or hollow in the water at the stern of the vessel, or does the water follow up the vessel, so as to keep in constant contact with the stern? A. The motion of vessels through the water produces a slight depression under the stern from the inertia of the water, or inability to acquire the momentum necessary to instantly fill the cavity.

(19) E. L. M. writes: 1. Do you know of any machine shops where they take apprentices? If so, please give their addresses. A. Taking apprentices in machine shops is always dependent somewhat on the appearance of the applicant, and is largely a matter of personal judgment with the employer; the opportunities they have been often better than they are just at present, but any young and intelligent man earnestly desiring such an engagement, and applying in any considerable manufacturing locality, would not, we presume, have long to wait for an engagement, though we do not know where there are any vacancies. 2. Would two cylinders 3x5 inches develop more power than one 6x6 inches? Which is most economical and lightest, also horse power of first? A. The 6 inches by 6 inches would be more than double, the power of two 3 inches by 5 inches. We cannot estimate the power, as you give neither the pressure of steam nor velocity. 3. Give best size of ports, pipes, and thickness of cylinder, cylinder heads, etc., for high speed two cylinder 3x5. A. Steam openings, five-sixteenths inch by 2¼ inches, exhaust openings ⅝ inch by 2¼ inches. Your cylinders, heads, etc., may be made about as light as they can be cast, bored, and turned. 4. Would the boiler described in SUPPLEMENT, No. 182, furnish abundance of steam for the above engine? A. No, not half large enough for the two engines; boiler should have 130 feet fire surface. 5. Would above engine and boiler furnish enough power to run a boat 35x6 14 miles per hour; if not, what size boat? A. No; but little more than 7½ miles with a boat 28 to 30 feet by 6 feet. You may get with good model 9½ to 10½ miles per hour. 6. Could sails be applied to above steam yacht at the same time profitably? A. Sails would be a detriment generally.

(20) W. D. writes: Will you let me know how many miles an hour a catamaran boat ought to go when propelled by six paddles? The face of each paddle is two feet six inches by two feet; three paddles dip at a time and as they pass out the other three enter. They enter the water vertically, and leave it the same; there is one yard of space between each paddle, and each paddle revolves in its own circle; and to run at seven hundred revolutions per minute, and have a dip the full length of the paddle, namely, two feet six inches; the two hulls fifty feet long by three feet wide and four feet depth, to draw two feet six inches of water when in sailing trim; width of boat twelve feet, paddles in middle of boat, three and three, parallel to each other. It is my opinion I can make the run from Philadelphia to Wilmington in one hour, and it is thirty-five miles; the grip of the paddles is good for one hundred revolutions more, if need be. Can I do it with a boat and paddles as I have described to you? A. There is no data upon which your question can be answered, but we do not hesitate to say that you cannot accomplish what you propose, and advise you not to expend time and money upon the expectation.

(21) J. D. B. writes: Referring to SCIENTIFIC AMERICAN, August 23, 1884, Notes and Queries, No. 31, what size screw, number of blades, and pitch of same would work best for engine mentioned in this number, also size of boat, and probable speed of boat? I have an engine and boiler 2x4, 3 inches stroke, but my boiler is a little bigger, it is 14x28, including firebox, 14x9; 12 1-inch flues, but have much trouble with flues getting stopped up; what would you advise to use for fuel, except wood? I have used soft chunk coal; broke them to size of walnut. A. Propeller about 17 inches diameter and 26 inches pitch, three blades. Boat 15 to 16 feet long, and 36 inches to 40 inches wide. Speed 5 to 5½ miles per hour. Your boiler is too small; it should be about 18 inches diameter, and 32 inches high. Furnace not less than 12 inches deep, and should have 28 to 30 feet fire surface. Use coke or anthracite coal, chestnut size.

(22) E. P. S. asks for some formula for soap powders. A. Use any suitable kind of hard soap, baked and ground.

(23) Upsilon wants to know recipe for an acid mixture that will restore files and other cutting tools, when blunt from use. A. Thoroughly clean from grease or oil by alkali, soda, or potash. Then dip in solution made with 1 part nitric acid, 3 parts sulphuric acid, 7 parts water by weight, 5 seconds to 5 minutes according to fineness of cut. Then wash in hot water, dip in milk of lime, dry, and oil.

(24) B. S. writes: I have a bunch of small chains entirely coated with rust. I have used coal oil to clear the chains of rust, but to no avail. Could you recommend a better method? A. Shake them in a bag of fine sand or emery.

(25) D. T., Jr., asks: 1. When is "24 o'clock" by the twenty-four hour system—at 12 M., or 12 midnight? A. Midnight, civil time; at meridian, astronomical time. 2. Does the astronomical day begin at 12 M. or 12 midnight? At 12 M.

(26) C. B. B. writes: With engine 2x4 inches for a very small, light launch or canoe, say 15 feet by 2½ feet sharpie, why would not a plain cylindrical vertical boiler without tubes or flues run it at a moderate rate of speed? What should be height and diameter of smallest boiler that would answer? If tubular, what should be height and diameter of shell, length, size, and number of tubes, and distance of boiler above grate? Object being to have boiler as small and light as possible. A. A plain vertical boiler without tubes would be too heavy. Your boiler should be about 18 inches diameter and 32 inches high, with tubes, so as to give say 28 to 30 feet fire surface. Use coke or anthracite coal, chestnut size. You should make a drawing of boiler to see what tubes you can get in. The furnace should not be less than 12 inches deep.

(27) J. H. B. asks: How many horse power engine would be required to drive a single paddle wheel 5 feet in diameter, face 2 feet 6 inches, buckets 6 inches deep? The boat is a light draught catamaran 30 feet in length. Please state the size and stroke of cylinder and the number of square feet of heating surface of boiler. Would it be as economical to have a long stroke engine with direct connection with crank shaft, and thus avoid the noise of the gear wheels, or a short stroke geared? How many turns should she be geared up? How many revolutions should the paddle wheel make to insure a fair speed to the boat? A. One engine 4 inches cylinder by 10 or 12 inches stroke, direct connection to shaft. Boiler to have about 60 feet fire surface; 40 to 45 revolutions per minute.

(28) J. R. C. asks: Will you please let me know in the next number of your paper the heating power of crude petroleum as compared with the best bituminous coal, that is to say, how much petroleum will equal one ton of coal? A. Two-thirds of a ton of petroleum equals one ton of the coal. Heat of combustion, 20,240 units. Evaporative power at 212°, 20·33 pounds water to 1 pound petroleum. Best coal, ¾ of these amounts.

(29) H. B. S. writes: I want something to stick paper labels on to wood or glass that will stand being wet or put into water. It need not stand hot water. A. In order to render glue insoluble in water, even hot water, it is only necessary when dissolving the glue for use to add a little potassium bichromate to the water, and to expose the glued part to the light. The proportion of bichromate will vary with circumstances, but for most purposes about one-fiftieth of the amount of glue will suffice.

(30) N. B. H. writes: 1. What would be the cost of machinery including engine, boiler, propeller, and shaft, with all fixtures, such as is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 81 (July 21, 1877), on the boat Flirt? A. Probably $280 to $300. 2. Would it be suitable for one of the Sharpie model boats described in SUPPLEMENT, No. 177? We want the boat to run on the St. John River, N. B., where in the lowest water there is not more than 18 or 20 inches. Smooth, gravelly bottom. If that machinery would not be suitable for such a boat, could you suggest any that would answer the purpose, with cost? A. Yes, but would suggest that you make the "Sharpie" 5 or 6 feet longer than that shown in No. 177. The machinery would do very well for such a boat, giving her a speed of about 6 miles per hour.

(31) C. A. P. asks: Will you please be kind enough to state why and when the kaolin should be added to a hektograph; whether the glue, glycerine, etc., should be boiled? If so, how long, and how to prevent bubbles from forming on the surface of the hektograph? A. The kaolin should be added when the solution of the glue and glycerine is complete. It is added simply to give the pad a light color. For the other information consult article on copying process in SUPPLEMENT, No. 374.

(32) E. K. E. asks: 1. What is the benefit to be derived by searching for the north pole? A. The practical benefit is doubtful, but scientists hope information so obtained may guide us in researches on magnetism and electricity; also teach us more of the history of this planet, give us a better knowledge of ocean currents, and throw light on many other obscure points of geology and physical investigation, though it must be confessed a great many people doubt whether the probable benefits are worth the cost. 2. How would the explorers know when they would reach that that point? A. The explorers know their latitude by observations there, the same as on any other part of the earth.

(33) J. N. B. writes: I am troubled to coat cast iron perfectly with tin, having it roll off in places as though the work was greasy. Have tried boiling it in strong potash water after it was pickled in dilute oil of vitriol, and then rinsed in water, passed through dilute muriate of zinc, but have never been able to coat cast iron with the same perfect coat and gloss that I can wrought or malleable iron. I have seen some lots of malleable iron that were imperfectly annealed that the tin would act in the same manner as with cast iron. What is the cause of it? A. Your trouble in tinning cast iron is not yours alone. The carbon in the cast iron is repellent to tin. The inventor of a perfect tinning process that is not expensive for cast iron will make a fortune if he can secure the process for his own benefit.

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Campaign light, Masten & Wells 11,530
Cartridges for breech loading firearms, Winchester Repeating Arms Company 11,540
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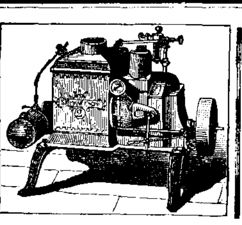

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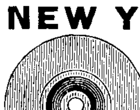

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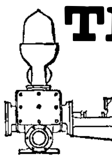

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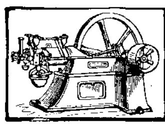

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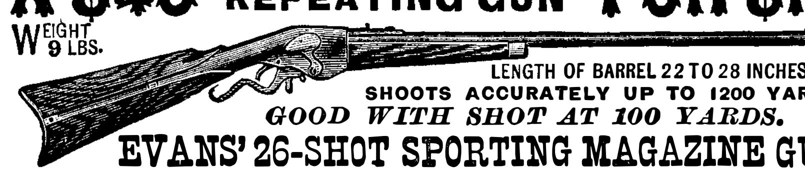

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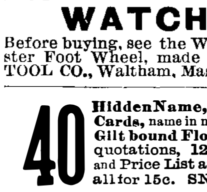

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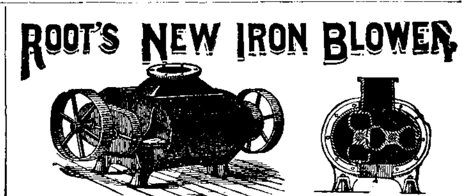

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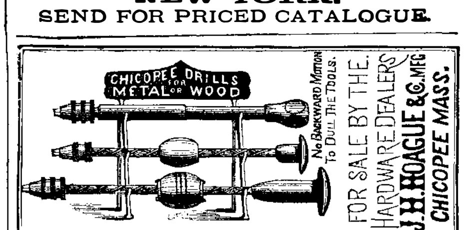

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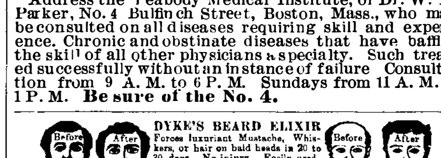

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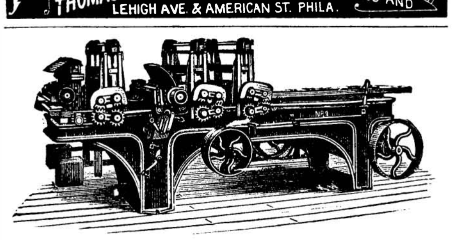

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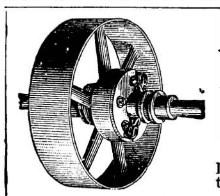

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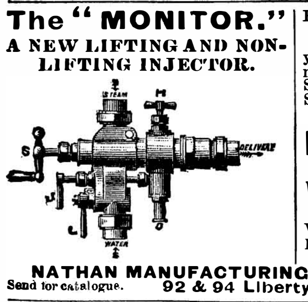

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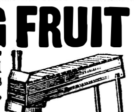

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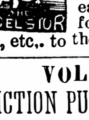

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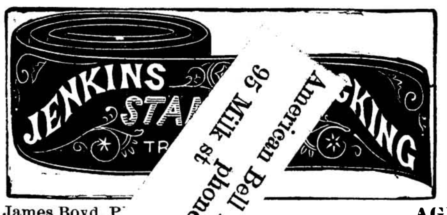

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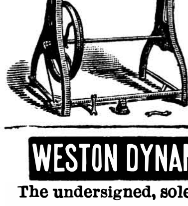

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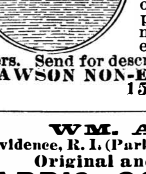

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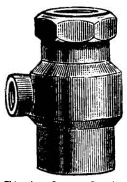

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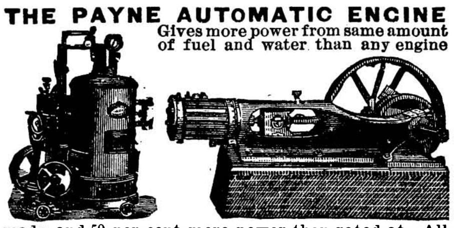

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