SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXII.—No. 8.] ESTABLISHED 1845. NEW YORK, FEBRUARY 22, 1890. [$3.00 A YEAR. WEEKLY.

THE WESTINGHOUSE ALTERNATING CURRENT SYSTEM OF ELECTRICAL DISTRIBUTION.

A great deal of attention has been excited among electricians by the development of the commercial use of the alternating current for heating, lighting, and power. In the first days of electric lighting the only specific application of the alternating current was for the supply of the Jablochkoff candle, whose construction precluded the use of the direct current. The names of the two types of current sufficiently describe them. One current alternates, or changes in direction continually. The alternations may be 250 per second, but vary greatly in different types. The other current is always in the same direction, though it may vary in intensity so as to strongly pulsate.

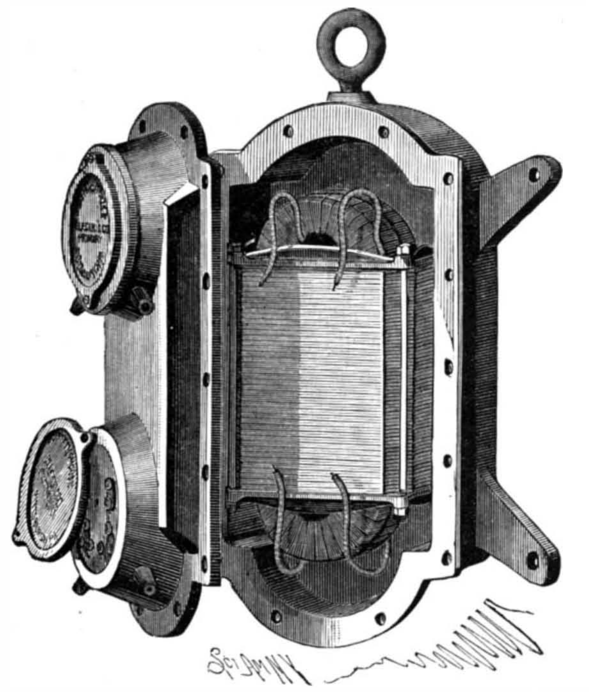

Fig. 1.—CONVERTER AND CONVERTER CASE.

In the successful development of central station electrical distribution, electrical engineers have been confronted by a dilemma. Considerations of safety to life require the use of a low tension circuit where there is any possibility of human beings touching the wires. Considerations of economy in the use of copper require the use of a high tension circuit to enable small wire to be used, thus avoiding the heavy capitalization represented by large leads. The dilemma has been solved by the alternating current converter system. Small leads forming an element of a high tension circuit are used in the streets and subways, while in buildings where the length of wire is comparatively slight a low tension circuit is introduced. All this is rendered possible by the converter. The latter is simply an induction coil. All who have seen a coil receiving a battery current of low initial electromotive force and developing therefrom an electrical tension that will produce a spark through many inches of air, and that will perforate glass of considerable thickness, can readily conceive of the reverse role being played. A current of high initial electromotive force can be converted into one of far higher intensity and low initial tension.

When it was first proposed to use converters in electric distribution, the inventors, Gaulard & Gibbs, placed them in series on a closed circuit. The counter electromotive force of the system made it economically a failure. Then it was proposed to place the converters in parallel between the two leads, and to leave the latter open at the ends. This solved the problem, and made the counter electromotive force an essential element in the economy of the process instead of an obstacle thereto. The Westinghouse system is an excellent exponent of the alternating current installation. It includes a complete series of appliances, from central station dynamo to the customer's individual converter and meter. Its leading features, as here illustrated, give an example of the most advanced alternating current system.

The Westinghouse dynamo, Fig. 3, is of exceedingly simple type, not having even the complication of a commutator employed in ordinary direct current generators. It includes a field excited by a small direct current generator, shown in the background upon a pedestal. Sometimes this exciting dynamo, is connected directly to the main armature shaft. The field contains an even number of cores, varying in number in different machines, placed radially as shown, so wound that the cores terminate alternately in a north and in south poles.

The armature, wound in a series of coils correspond-

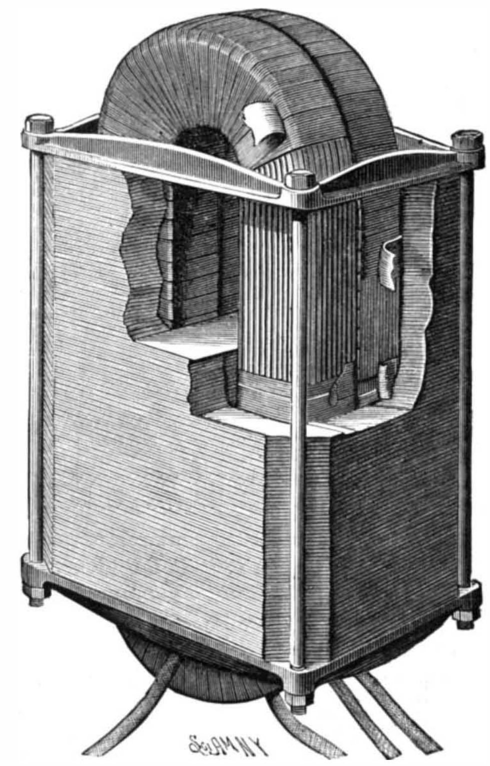

Fig. 2.—DETAIL OF CONVERTER.

ing in number with the poles of the field, is shown in Fig. 5. These coils of insulated wire are wound in opposite directions, as shown by the arrows, and lie upon the face of the armature core, all in one series, and one layer in thickness. Their two terminals are carried out along the axle and connected respectively to two insulated rings, whence the current is taken by brushes. The armature core is perforated and laminated, and by wings at the ends within it is perfectly

(*Continued on page* 120.)

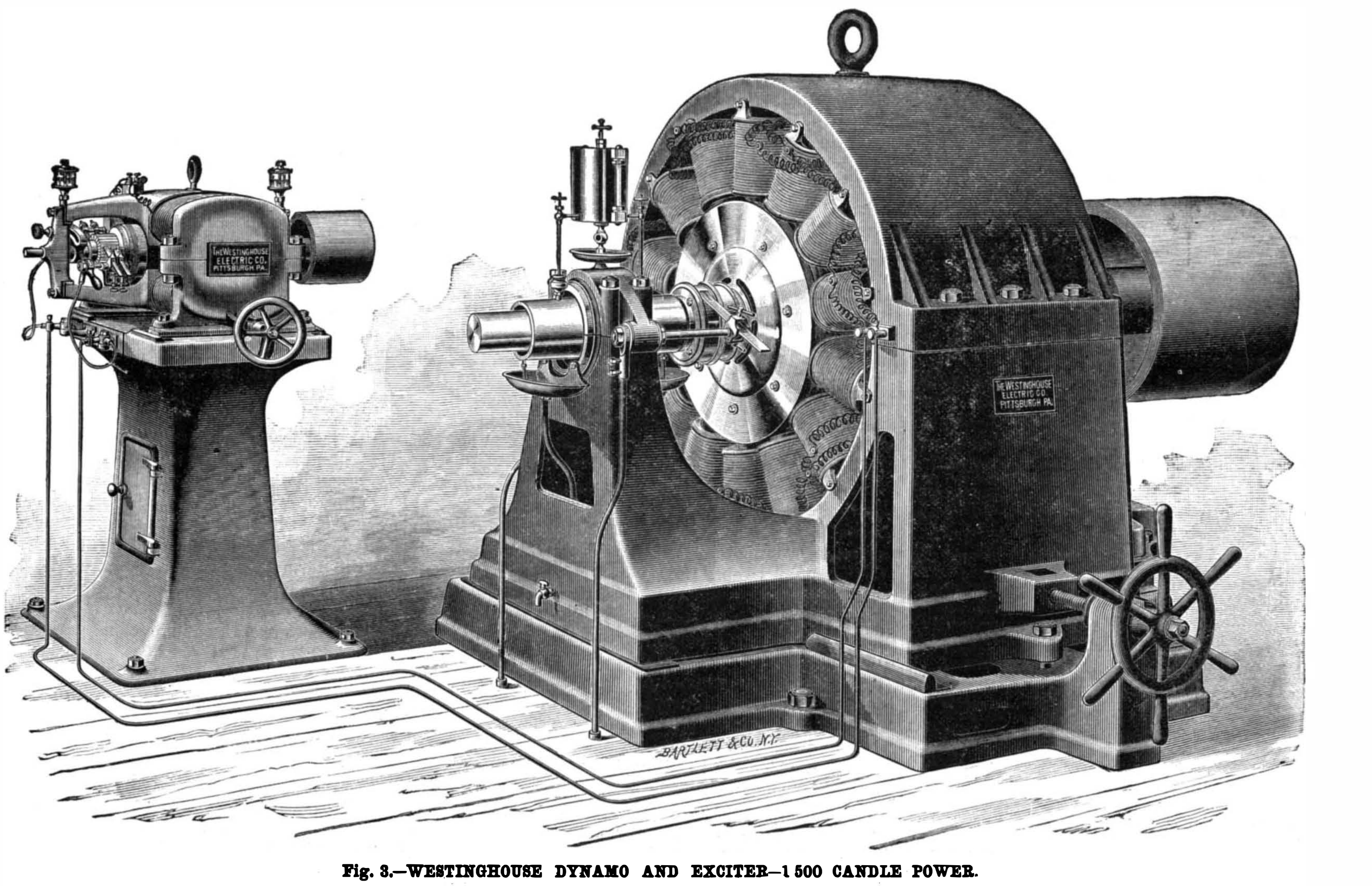

Fig. 3.—WESTINGHOUSE DYNAMO AND EXCITER—1 500 CANDLE POWER.

THE ALTERNATING CURRENT SYSTEM OF ELECTRIC LIGHTING.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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One copy, six months, for the U. S., Canada or Mexico. 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00
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MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

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NEW YORK, SATURDAY, FEBRUARY 22, 1890.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 738.

For the Week Ending February 22, 1890.

Price 10 cents. For sale by all newsdealers.

THE PANAMA CANAL—A NEW PROJECT FOR ITS COMPLETION.

The indications are that another effort will soon be made to complete the great work, and perhaps on a new basis.

An intelligent correspondent who visited the canal works several months ago found the machinery scattered about, rusted, covered with dirt, and fast going to ruin. About that time a commission was appointed by the French government to visit the locality, inspect the machinery, and report upon its condition. The people in charge set immediately to work to collect, arrange, and paint the mechanisms. They succeeded so well that the commissioners are reported as expressing themselves as agreeably surprised to find things in such good order and so well cared for. Our correspondent himself saw the wonderful effects of the paint. He said it made the old irons look brand new.

The project now brought forward for completing the canal is to imitate as far as possible the condition of the Nicaragua Canal route, namely, to create a large inland lake, to occupy the high center of the isthmus, with short sea level canals as approaches to the lake. Locks will be used to raise the ships from the levels to the lake.

This new plan is the proposal of M. Santereau, and it is claimed it can be realized at an expenditure of one hundred millions of dollars.

M. Santereau's scheme is to construct a canal that would allow of the swift and easy passage of vessels, and would render healthy and habitable a large area of land that at present suffers from the juxtaposition of swamps and marshes. The project, in short, is to make a lake in the interior by means of the water from the river Chagres. It would cover the unhealthy swamps that at present render the surrounding land uninhabitable, and would enormously increase the value of the 500,000 hectares of land owned by the Panama Company. As this lake would be 24 kilometers in length, it would only be necessary to cut 50 kilometers, and nothing would impede the course of vessels along this waterway but the strong double chamber lock that would be built at each end. As the numerous projected and, it is affirmed, impracticable locks in M. De Lesseps' canal would be done away with, M. Santereau has practically achieved the end that has long been sought after of designing a level canal. Its advantages are believed to be so numerous that the Societe Internationale d'Etudes, which has been formed for working M. Santereau's scheme, is receiving support from engineers and from the financial and manufacturing centers of France.

ANNUAL REPORT OF THE COMMISSIONER OF PATENTS.

The annual report of the Hon. C. E. Mitchell, Commissioner of Patents, to the Senate and House of Representatives, required by law to be presented during the month of January of each year, has just been duly filed for 1889. It is an able document, clear in statement and encouraging in the results set forth. The year 1889 shows a higher degree of prosperity than any preceding period. The number of new applications made during the year for patents, etc., was 40,575, being nearly 5,000 more than any previous year. The number of patents granted was 24,158. The cash receipts were $1,281,728, the expenses $1,052,955, leaving a surplus of $228,772, which was turned over to the Treasury and applied to the credit of the patent fund, which has now reached the handsome figure of $3,631,670.

The Commissioner calls the attention of Congress to several important subjects on which immediate legislation is urgently needed. The enlargement of the Patent Office is indispensable. He says:

"The present situation is most deplorable. Almost literally speaking, the Patent Office is crowded into a corner of the noble building which was paid for by its patrons and which bears its name.

"I can add nothing to what has been said by my predecessors, except perhaps to enter a little more into detail in setting forth the overcrowded condition of the office. The room occupied by Division XXVIII has nineteen by twenty-three feet of floor space. In it are nine desks, occupied by nine men and women. In addition to the desks are book and file cases arranged against the wall and extending upon all sides of the room. In the room occupied by Divison V the floor space is thirty-five by twenty feet in extent. In it are ten desks, occupied by ten persons. Book and file cases extend around the room on every side. These instances differ only in degree from nearly all the rooms devoted to the business of this bureau.

"The subject to which I am now directing attention is one in which the deepest interest is felt by inventors and by the very large portion of the American people who are directly or indirectly interested in inventions. There is a widespread feeling that the large excess of fees over expenses should be devoted to affording facilities for the conduct of the business. I urgently request that relief be afforded for the overcrowded condition of the Patent Office."

In respect to the general work of the office, which for several years has been greatly delayed, Commissioner Mitchell has succeeded in bringing it up nearly to date, notwithstanding the increase of business.

"This comparatively satisfactory condition of the work has been brought about by almost heroic efforts on the part of the examining corps, who take pride in the good name of the office, and who spare no labor within office hours or out of office hours to second the efforts of the Commissioner in bringing up the work. But the limit of possible attainment with the present force of employes seems to be practically reached."

The Commissioner urgently recommends that the work of preparing abridgments of patents may be revived and completed.

"In the first place, it would be of the greatest value in facilitating the labors of this office by lessening the work of examiners, and, excepting as the number of applications should greatly increase in the future, would permit of a decrease in the number of the force. It would also be the means of preventing the granting of worthless patents through the failure to discover apt references—a failure which must result in a certain small percentage of cases so long as examiners are deprived of the most efficient means of conducting their investigations. It would enable the patrons of the office to prepare their cases intelligently, and by enabling them to readily ascertain the state of the art pertaining to a supposed new invention would in a vast number of cases cause the withholding of applications which now take up the time of examiners to no useful purpose. It would to a very great extent transfer the work of examination from the Patent Office to the offices of attorneys, and thus afford great relief in the present overburdened condition of the examining divisions. It would enable patentees and manufacturers to definitely understand the extent of their rights as secured by patents, and by disseminating knowledge of what has been done in all the various arts, would prevent inventors from traversing the ground occupied by predecessors in their noble pursuit. It would be remunerative to the government, because such a digest would meet with a ready sale among inventors and manufacturers, and the entire cost of its preparation and publication would soon be reimbursed. And, finally, it is indispensable if the United States would keep pace with other nations in whatever pertains to the development of its patent system.

"All the inventions patented in Great Britain are to be found in a summarized form in classified abridgments, the value of which cannot be overestimated."

The incongruity of that portion of our law relating to foreign patents and the hardships suffered by American inventors in consequence thereof are presented forcibly and at considerable length. We are obliged to abbreviate.

"Section 4,887 of the Revised Statutes provides that every patent granted for an invention that has been previously patented in a foreign country shall be so limited as to expire at the same time with the foreign patent, or, if there be more than one, at the same time with the one having the shortest term.

"A law which obliges the Commissioner to place the seal of the United States Patent Office upon letters patent for American inventions which state that foreign patents must be examined and foreign laws consulted in order to ascertain when the American patent will expire, should be banished from the statute books. Aside from its being un-American in its nature, it works the greatest hardship to American inventors. By reason of it the pecuniary value of the American patent is always greatly impaired and is often substantially destroyed. It is not an uncommon occurrence for negotiations for the sale of important patents, involving large sums of money, to fall through because of the uncertainty that surrounds the duration of the grant, in view of foreign patents first obtained for the same invention. Again, the law as it now stands operates in favor of foreign countries by inducing inventors to confer their inventions gratuitously upon foreign nations rather than run the risk of impairing their domestic patents by complicating them with patents secured abroad. Thus the law, which is believed to have been originally enacted for the purpose of putting a limit to the privileges conferred upon foreign patentees, has in its operation become a standing menace to American inventors. I believe that all competent persons who have given attention to the subject agree that future patents for American inventions should be granted for the full term of seventeen years provided by statute, whether or not a patent has been previously obtained in a foreign country. I most earnestly recommend that, at least as to American inventions patented hereafter, section 4,887 of the Revised Statutes be modified so as to prevent a foreign patent previously obtained from affecting the duration of the American grant."

In subsequent numbers we shall refer to other important recommendations offered by the Commissioner.

The following eloquent tribute to the value of the patent laws and the labors of inventors forms the conclusion of the report:

"The place of the Patent Office among governmental agencies is as unique as it is important. It is concerned neither with the collection nor the expenditure of the ordinary public revenues. Unobtrusive and unsensational in its work and methods, it asks nothing of the Treasury excepting moneys which its patrons contribute, and nothing of Congress excepting measures to secure its highest efficiency. As it enters upon the second century of the system which it administers, the distrust which has existed to some extent of its functions has happily passed away.

"The triumphs of American invention have attracted universal admiration, and the conspicuous demonstration of their importance and usefulness has turned distrust to confidence. I verily believe that no law or legal system in any age or any land has ever wrought so much wealth, furnished so much labor for human hands, or bestowed so much material blessing in every way as the American patent system. If the first interest of humanity is employment, in no respect does the patent system so convincingly vindicate itself as in its tendency to enlarge the scope of remunerated toil. For just as the Western Territories—now, for the most part, happily elevated to statehood—have by inviting immigration reduced the fierceness of competition in the ranks of the established industries, so the new realms of industry that have been brought into being by American inventors have supplied millions of men with remunerative labor who would otherwise be competing for underpaid employment in the overstocked labor markets of the old-fashioned industries.

"But the territories of American invention know no Pacific sea. Their farther bounds expand as their hither borders are occupied. Illimitable in extent and inexhaustible in resources, they will yield up unimagined treasures of invention in all the coming centuries, just as they have done in the hundred years of marvels whose recorded story, drawing toward its close, is at once the tribute and the glory of the American patent system.

"Respectfully and yet urgently I invoke the good offices of Congress in behalf of justice to the Patent Office.

"Very respectfully, your obedient servant,

"C. E. MITCHELL, *Commissioner*."

HOW TO PURIFY DRINKING WATER.

BY PROF. PETER T. AUSTEN, PH.D., F.C.S.

Next to air, water is the most immediate necessity of human life. Without air one can exist but a few moments; without water life cannot be prolonged more than a few days. The human body is largely composed of water, being about seven-eighths by weight of this substance. Water is being continually eliminated from the body in proportion to the amount that is taken in. This averages, including what is contained in our more solid food, at least two quarts a day. It is the agent by which the functions of the body are carried on, supplying many of its various wastes, and giving material for its processes. Indeed, a human being may be almost described as an animated pipe. Water is drunk primarily because it is water, and a certain amount of it must be daily taken into the system. It almost always contains extraneous matter, and this extraneous matter may or may not be harmful. The more nearly drinking water approaches to perfect purity, aside from a certain amount of dissolved gases which impart to it a slight pungency of taste, the better will it fulfill the office of a solvent in the body; the more easily will it be assimilated, the more easily will it pass or osmose through the membranes, and the greater will be the amount of solid substances that it will dissolve and eliminate.

Aside from the freedom of a water from dissolved mineral matters, which make it "hard" or impart other properties to it, water may contain certain deleterious matters, which may cause it to become the means of imparting to those who drink it serious functional disorders, and often fatal diseases. It might be thought, in view of the care that is usually exercised in peeling, cleaning, and otherwise carefully preparing before eating vegetables dug out of the earth, as well as those that are not, that considerable care would be exercised in purifying the water that is drunk. But this is not generally the case. The ordinary surface well is a hole dug in the ground, and the water that oozes into it usually contains the dissolved impurities of the soil, putrefying vegetable and animal remains, as well as the pollutions from leaching cesspools and other similar abominations. So long as it is bright and sparkling it is considered both palatable and safe. But scientific investigation has shown that the sparkle of a water may be due to an excess of dissolved carbonic acid gas, and this condition may be the result of the putrefaction of organic matter; and that even when clear, sparkling, and palatable, water may still be superlatively dirty and deadly.

Biological investigation has established the fact that many diseases, such as typhoid fever, for instance, may be imparted by minute organsims popularly known as "germs," or more scientifically as "microbes." These minute organisms are given off by the patient suffering from the disease; and when they are transmitted to others, which happens in many ways, and very frequently by the agency of water as a conveying medium, they take up their abode in various organs of the human system. There, when the conditions are favorable, they develop, and live at the expense of their host, causing the functional disorders known as disease. Many sad instances of the effects caused by drinking polluted waters could easily be adduced. Water that is free from such pollution, but is simply turbid from suspended matter, as clay and the like, is unpalatable from its repulsive taste and appearance.

During the last few years the subject of water purification has received much attention, and successful methods have been introduced for filtering and purifying water on a large scale. Filtration on a small scale, while successful in many cases, comes, as a rule, under what is at present alleged to be housekeeping, and the success or failure of the method will, therefore, often depend entirely on the operative ability of some crude specimen of domestic home rule, a form of despotic government which has attained an extremely luxuriant growth in this country.

While I do not wish to undervalue any of the excellent small filters now on the market, I desire to explain a simple method by which any housekeeper of average intelligence can make an inexpensive contrivance which will do its work in a way not easily surpassed either in results, efficacy, rapidity or simplicity by any filter that can be bought. Such a filter can be set up in a short time at any place, and will be found particularly useful when one is away from home; for then special appliances are not always easy to obtain.

My attention was directed to this subject several years ago, and after some experimenting a simple apparatus was devised. Since then I have continued to experiment on this subject, and am more fully convinced than ever of the practical utility and efficiency of the method.

It has been known for many years that the addition of a minute amount of alum to a water containing bicarbonate of lime in solution (and most natural waters contain more or less of this substance) will cause the formation of a gelatinous precipitate. This precipitate entangles and collects the suspended matters and germs, forming coagulated or agglomerated masses which are easily removed by simple filtration. Waters containing clay or mud which is so fine that a mechanical filter cannot remove it, when treated with a small amount of alum can be filtered perfectly clear through a coarse filter. The alum thus added is not left in the water, but is removed by the filtration, for its active constituent, the aluminic sulphate, is decomposed and precipitated by the action of the dissolved bicarbonate of lime. This should be well understood, although if a minute amount of alum were left in the water its effects would not be noticeable, and even if present in larger amounts, it would not be at all dangerous.

The method of filtration is simple in the extreme. An oil bottle or any long, narrow-necked bottle serves for the filter. Tie around it a string soaked in kerosene, about half an inch from the bottom, set the string on fire, and hold the bottle bottom up. When the string is burnt out, the bottom of the bottle is thrust into cold water. If properly done, this causes the bottom of the bottle to split off evenly. The rim of the glass should now be burred off a little with a round file to remove any sharp edges that may be left. The bottle is then thoroughly cleaned and placed neck downward in a convenient support, as, for instance, through a hole bored in a shelf, or it may be allowed to stand in a wide-mouthed bottle, resting by its shoulders on the rim of the mouth. A small handful of cotton wool is now thoroughly wetted by squeezing it in water, and shreds of it are dropped into the bottle until a layer about two inches deep has been made. The shreds should be dropped in carefully, so as to distribute them evenly, and not to let them pile up in the middle or at the sides. When enough cotton has been dropped in, a cup or two of water is poured in and the bottle gently tapped. This consolidates the mass and finishes the making of the filter-bed.

The amount of alum needed to coagulate the water sufficiently for filtering need not, as a rule, exceed two grains to the gallon, and in many instances may be less, but in certain cases of very dirty waters, such as that of the Mississippi River, the amount of alum may be increased to four or even six grains per gallon. The alum is best kept in a solution of such a strength that a teaspoonful of it will contain a grain. To save trouble, the following prescription will enable one to get enough of the solution put up at any apothecary's to last for a considerable time:

R. Alum .... gr. 128
Aquæ dist .... ℥ xvi.
M. ft. solutio.

I may add that the expense of this prescription, including the bottle, should not exceed fifteen cents.

The treatment and filtration of the water is best done as follows:

A gallon of water is placed in a clean tin pail and two teaspoonfuls of the alum solution are added. It will save time to make, once for all, scratches on the inside of the pail, showing the height of one, two, or more gallons of water. It is then well stirred and mixed with a clean tin dipper. It is best to keep this pail and dipper for this use alone. They should be kept scrupulously clean, and frequently well scoured with sapolio or a similar kind of soap. After mixing, the water is allowed to stand five or ten minutes, and then poured, by means of the dipper, into the filter. It will run through rapidly if the filter-bed has been properly made, and will be as clear as crystal, and not seldom will form an astonishing contrast with the original water. The first half pint of the water passing through should be rejected. The filtered water may be caught in a pitcher or in any other convenient receptacle. A filter-bed will last a day, but it is not advisable to use it longer. Each day the used filter-bed should be thrown away and a fresh one prepared. The method may, of course, be applied to any of the many filters in use, by simply adding to the water to be filtered one or two grains of alum to the gallon. It will be a poor filter, indeed, that will not filter clear after this addition.

Of late, attention has been directed to the latent dangers in ice. It has been found that this apparently harmless and attractive substance may fairly reek with disease germs and filth of all kinds. Unless it is known from whence the ice comes, its use may be more dangerous than the use of water. Ice is sometimes derived from water which no one would think of drinking, as, for instance, from ponds in cemeteries and from rivers in the neighborhood of sewer outlets, and as a result may be indescribably foul. Aside from the danger of germs lurking in ice, there is risk in the indiscreet use of water cooled to an abnormally low temperature, since functional disorders are often caused by the drinking of very cold water. No water is so refreshing as that of a mountain spring, and one reason of this is that its temperature is just right. It is well to take hints that are given by nature, and the hint that the best temperature of drinking water is about fifty degrees Fahrenheit is a good one, and worth following.

I would suggest—and I am sure that every one who tries it will be more than satisfied—that the filtered water be caught in stoppered carafes, or, what is just as good, carefully cleaned sherry bottles stoppered with new, clean corks, and that these bottles filled with water and carefully stoppered be placed in the refrigerator for several hours. By putting half a dozen such bottles filled with water in the refrigerator and replacing them with others as they are taken out, a supply of clean, filtered water of a satisfactory and safe degree of coolness may be kept continually on hand.

The use of this simple method of purification of water will, I am certain, prevent many a case of sickness and not a few deaths, and it is so simple, cheap, and efficacious that any one can make a success of it.

An Oxygen Explosion.

An accident which occurred in Lexington, Ill., gives sad emphasis to the necessity for care in conducting chemical experiments. Professor J. Jess, of the high school, started to make oxygen for his chemical class. He used as a retort a piece of gas pipe eight inches long and two inches in diameter. On applying heat for a short time an explosion occurred and the retort blew up like a bomb shell. The room was wrecked, Professor Jess and several others were terribly injured, while about twenty were included in the list of wounded.

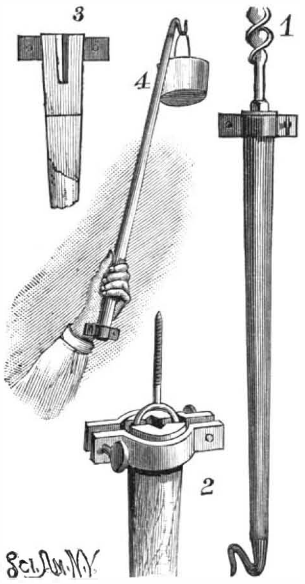
The probabilities are that the chemicals were impure. About twenty years ago a similar accident happened at the School of Mines, Columbia College. The experimenter had by mistake mixed sulphide of antimony, instead of binoxide of manganese, with chlorate of potash. On applying heat the mixture in the retort exploded and the experimenter's sight was permanently destroyed. Oxygen can with perfect safety be generated in a glass retort, flask, or test tube, but the mixture of chemicals should always be tested by heating a small quantity in the bottom of a test tube. If it evolves oxygen quietly, the oxygen mixture may be considered correctly made. Sulphide of antimony and binoxide of manganese are so similar in appearance that the mistake described above is one always liable to happen, and the result is practically gunpowder or worse. Organic matter or sulphur may bring about a similar result.

Steam Navigation on the Nile.

A new Egyptian association has been formed, styled the "Thewfikieh" Company, who are the owners of a number of steamers which have been specially fitted for a regular service of passengers desiring to ascend the river from Cairo to the first cataract, visiting the antiquities on the banks. The formation of this company has been sanctioned by a decree of the Khedive, who has just inaugurated the operations by a personal visit on board the steamer El Khedevie. The saloon, ladies' boudoir, smoking room, and all parts of the steamer are illuminated by 80 electric lights of a total power of 2,500 candles, and the decorations of the apartments are of the most elegant and luxurious character. Messrs. H. Gaze & Son are appointed agents in Europe, Egypt, and America for the company.

AN IMPROVED TOOL AND HANDLE.

The accompanying illustration represents a combined tool and handle for use in screwing ceiling hooks, etc., to place, and also to clamp a saw or auger for sawing or boring above the operator's head. The invention has been patented by Mr. Horatio Barnett, of Malvern, Ark. Fig. 1 is a perspective view of the tool clamping an auger, and Fig. 2 shows the head with a screw eye clamped therein, Fig. 3 showing a further detail of the head, while Fig. 4 represents the use of the tool for placing articles on or removing them from high shelves, by means of the hook on the small end of the handle. In the larger end of the handle is a longitudinal slot, forming two spring jaws, in the inner faces of which are produced angular recesses adapted to grasp the rectangular shank of a tool. To hold the tool rigidly a clamp is employed, adapted to slide upon the enlarged end of the handle, the clamp consisting of two straps having their ends united by set screws, whereby the clamp is made to bind the jaws against the article. This implement may also be utilized in topping, trimming, and pruning trees, vines, etc.



BARNETT'S TOOL AND HANDLE.

AN IMPROVED TOY FOR CHILDREN.

The accompanying illustration represents a wheeled toy so made that a figure, a pin-wheel, or other ornament will be revolved as the toy is drawn forward or pushed backward. It has been patented by Mr. James Wallace of No. 1845 Wylie Street, Philadelphia, Pa. At the center of the axle is a circular opening, and upon each end a drive-wheel is loosely mounted, the hub of one wheel extending some distance inward and having a pinion attached thereto. The pin-wheel or other ornament is attached to the upper surface of a block whose under face has a horizontal spur-wheel adapted to mesh with the pinion, the block being mounted to revolve horizontally in the axle, with the spur-wheel, by means of a sleeve or post loosely fitting in the central opening of the axle. This post extends below the lower collar of the axle opening, and is prevented from withdrawal by the attachment of a band or ring or screwing a nut thereon.

WALLACE'S TOY.

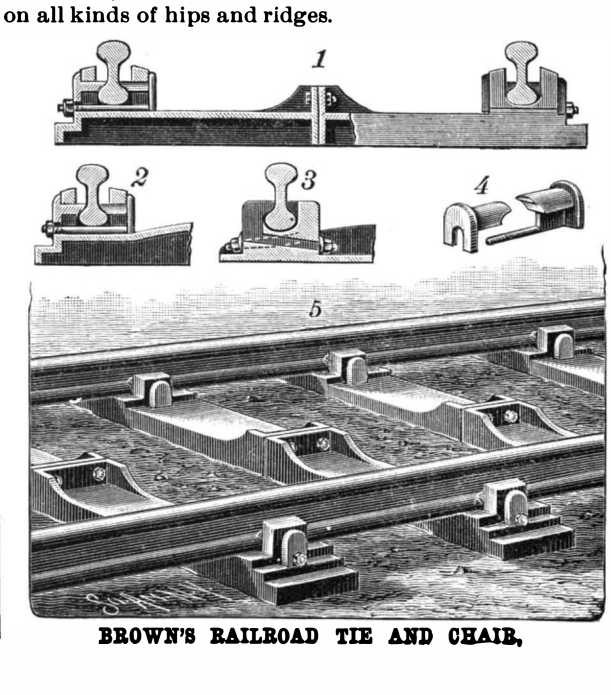
AN IMPROVED SUNSHADE HAT.

A hat having an umbrella-like sunshade, adapted to be conveniently expanded to afford shade and to allow the free circulation of air about the head, while it may be easily collapsed to present the appearance of an ordinary hat, is shown in the accompanying illustration, and forms the subject of a patent issued to Mr. Stephen B. Bartine, Pleasant Plains, Richmond County, N. Y. Rising from the inner band portion of the hat is a skeleton crown of curved reeds, wires, or rods, secured to the band portion and tied together at the top, this inner crown being covered with netting or thin fabric. Above this crown is held a second one, similarly composed of curved reeds, etc., attached at their lower ends to the band portion, and at their upper ends to a ring. To this outer skeleton crown is secured the sunshade, composed of reeds, wires, or rods, tied to the ring to stand out like the ribs of an umbrella, and covered with some heavy textile material, supporting braces being hinged to the rods holding up the sunshade and to the band portion of the hat. These braces are each made in two parts or sections hinged together, rings or keepers being placed over the hinged portions joining the sections when the shade is spread to hold the sections in line with each other to brace the ribs of the shade. A modified form of brace for the sunshade is shown in the small view. Upon shoving these rings or keepers away from the joints of the sections, the collapsing of the shade is effected by means of a draw cord passed around the hat through rings secured to the braces, this cord being tied and covered by an outer band buckled or tied upon the outside. Short plates in a suitable hem in the shade covering for each rib section cause the outer covering to form even and regular folds between the ribs when the shade is collapsed, so that the outer portion of the hat will then lie smooth and present a finished appearance, as that of an ordinary hat, such a hat when complete being designed to weigh only from two and a half to three and a half ounces.

BARTINE'S SUNSHADE HAT.

AN IMPROVED RAILROAD TIE AND CHAIR.

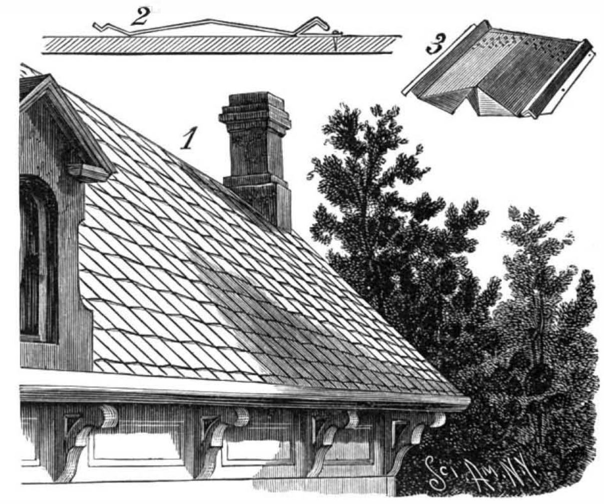
A metallic railroad tie and chair, from which the rail may be readily removed, or wherein the tie may be conveniently detached when desired, and which is designed to hold the rails firmly in contact with the tie, is shown herewith, and has been patented by Mr. Isaac Brown, of Swatara, Schuylkill Co., Pa. Fig. 1 is a side elevation of the tie, partly in section, Figs. 2 and 3 representing slight modifications. Fig. 4 shows two opposed key clamps adapted for insertion in the chairs and for contact with the rails, Fig. 5 representing the application of the improvement. The tie and the chairs are preferably integral, and may be made of a single piece, or in two sections, as shown, the latter form being more particularly advantageous for use where there are a number of tracks close together, rendering it difficult to introduce or withdraw a full-length tie. The chair consists of a base section slightly raised above the body of the tie, and a post projected upward from each end of the base, leaving room to neatly accommodate the flange of the rail. For T rails, the bottom of the chair between the posts is flat, while for double-headed and bull rails the surface is concaved to accommodate the contour of the rail. There is a key hole slot connected with an intersecting upper semicircular transverse opening, in each post of the chair, the key clamps shown in Fig. 4 being adapted for insertion into the key hole slots of the chairs, and each having a horizontal body portion adapted to contact with the upper surface of the rail base and with the web of the rail. One of the clamps has a shank on its inner face, integral with which is a horizontal rod with threaded extremity, adapted to pass out through the key hole slot in the outer post of the chair, when, by means of a lock nut, both clamps are made to bear firmly against the rail when it is seated in the chair. In order that the rail need not be raised very high to remove the tie, the posts of the chair may be so shortened that a portion of the cylindrical surface of the clamp body will be exposed.



BROWN'S RAILROAD TIE AND CHAIR.

AN IMPROVED METALLIC SHINGLE.

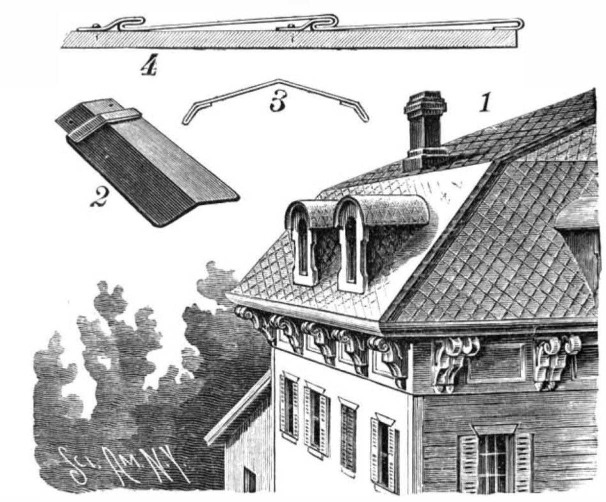
The accompanying illustration represents a new form of metallic shingle patented by Messrs. Thomas Toner and John E. Carroll, of No. 32 North Fifth Street, Philadelphia, Pa. Fig. 3 is a perspective view, and Fig. 2 a sectional end view of a shingle, Fig. 1 representing a roof thus covered. The shingle has a ridge-shaped central body part, and is folded upon itself on one outer edge to form a V-shaped ridge, the metal being continued out to form a nailing flange. On the other edge of the body is an upwardly extending inclined flange, with a channel formed on its outer edge. The entire shingle is made of one piece of sheet metal bent to the form desired, and its upper end has a short flange, and projections to prevent water driven up on the shingle from passing to the wood or being drawn up by capillary attraction. On the lower end of the shingle is formed a V-shaped saddle, adapted to fit on to the upper end of the ridge of the next following shingle. This shingle can be readily laid on a roof by an ordinary workman so as to give thereto a very attractive appearance, and its shape is such as not to unnecessarily stretch the metal if made by a press. The lock permits of all necessary contraction and expansion, thereby preventing the bottom from cupping up in the center, and the lock can be used for a valley as well as a single lock, thus giving the workman less trouble to adjust the valley shingles. The male portion of the lock has a catch basin to interrupt all moisture that may accumulate under the cap, and prevent it from finding its way to the nailing flange below. Samples may be seen at the offices of the patentees.



TONER & CARROLL'S METALLIC SHINGLE.

A RIDGE AND HIP COVERING FOR ROOFS.

A new article of manufacture, consisting of a special form of plates which may be easily and conveniently applied by the roofer, as a ridge or hip covering or as a corner finish, is shown in the accompanying illustration, and has been patented by Messrs. Thomas Toner and John E. Carroll, of No. 32 North Fifth Street, Philadelphia, Pa. Fig. 1 is a perspective view showing the application of the plates, of one of which Fig. 2 is a plan view, Fig. 4 showing a sectional side elevation, and Fig. 3 a transverse section. One end of the plate is bent under to form a bottom flange, and the other end is partly doubled up and bent over the top to form a flange adapted to be engaged by the bottom flange of the next following plate. The end of the plate, after leaving the doubled-up flange, is bent downward to form a flange to be secured by nails to the part of the building on which it is used. The bottom flange is narrower in the middle than at the outer ends, to facilitate bending it under, and the sides of each plate are bent under to increase their strength. From its peculiar form of lock this cover can be used on all kinds of hips and ridges.

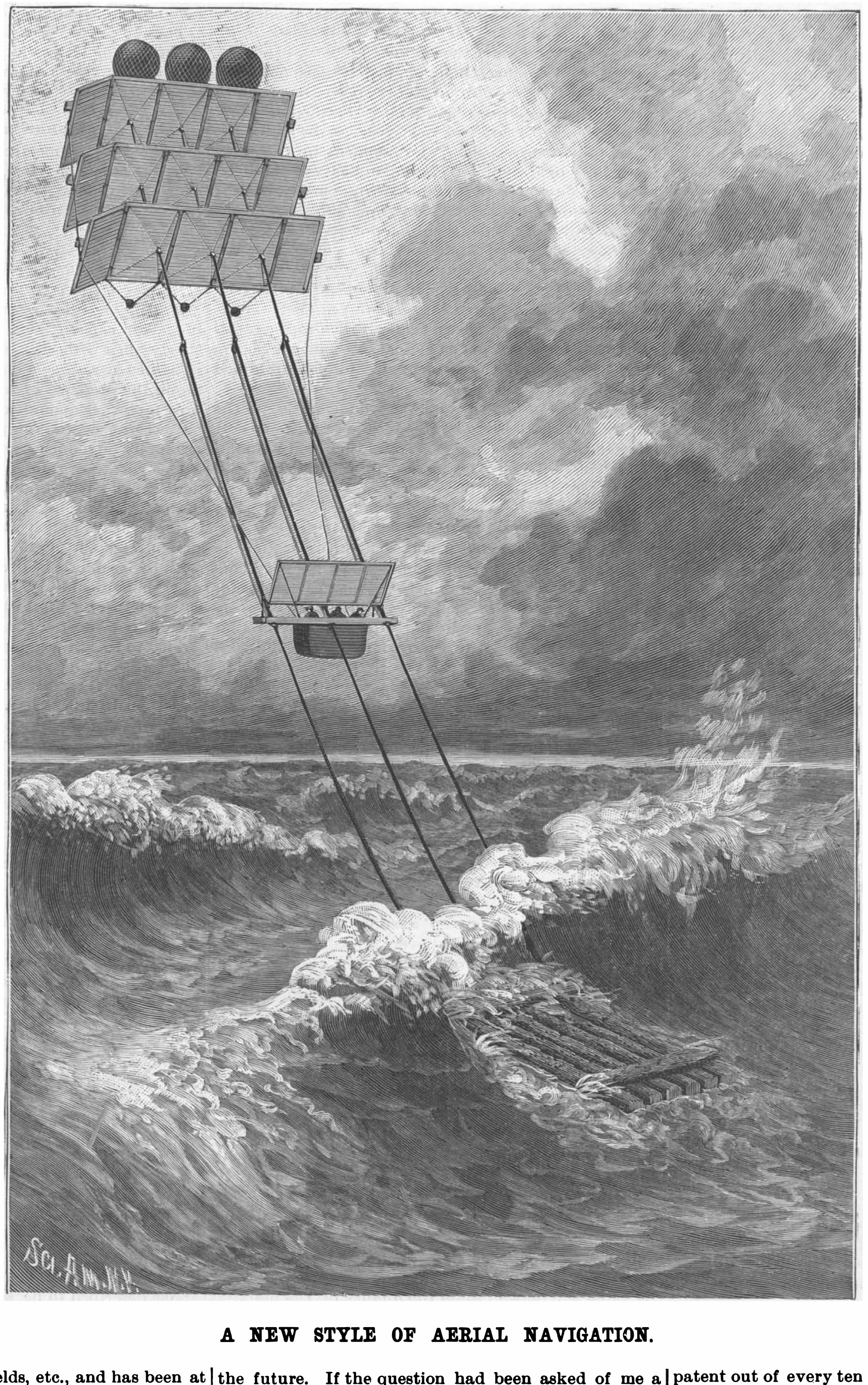


TONER & CARROLL'S RIDGE AND HIP COVERING FOR ROOFS.

A NEW AERIAL APPARATUS.

Although men have long been seeking a practical method of navigating the air by utilizing the power of the wind, the problem remains still unsolved, and we present to our readers one of the most recent efforts in that direction. Indeed, it is doubtful if there ever was a time in former years when the minds of so many men were attracted to this subject as at the present day, and the records of the Patent Office bear ample evidence that inventors are fully alive to the vast importance of the field which this subject presents. Among the latest of the patents in this line is one which forms the subject of our illustration, issued to Dr. David Thayer, of Boston, Mass., being for "an apparatus for navigating the air, and for towing vessels and vehicles over water and land." The inventor styles it an aerial railway, operated by two forces—the oblique impact of the wind upon the surface of aero-planes or kites and the resistance to this force of a drag at opposite ends of three or more draught lines. The drag, when traversing over the land, is to consist of wheels and axles with a brake, for which heavily laden sledges are to be substituted when traversing ice fields, it being suggested that excellent means will be thus afforded for the exploration of the polar zone. In the water the drag may consist of one or more boats, or a raft of logs, as shown in our illustration. The aeroplanes or kites may be multiplied as desired, and balloons are attached to them, to keep them aloft in the absence of wind. To the right and left of the central broad kites are narrower ones styled wings, to the outer edges of which brace ropes are attached, the steering being effected by flexing these wings by means of the brace ropes. To lessen or increase the altitude of the series of kites, their lower edges are connected by halyards with the car in which the passengers ride, whereby the inclination of the aeroplanes may be regulated. This car is supported upon the draught lines, and may be suspended in any desired position up or down thereon, there being a sail on the front of the car adapted to carry it up on the lines to such a distance as required, and at least sufficiently high to avoid the touch of the waves, when it is firmly held there by means of a brake which grasps the cables or drag lines. If the voyage is intended to be a long one, it is expected that the drag will be sufficient to hold all the baggage and supplies.

The inventor enumerates many objects of great importance which his aerial apparatus is designed to accomplish in the facility it affords for the crossing of land, water, ice fields, etc., and has been at great pains to illustrate a variety of forms of construction, all, however, on the principles shown in our illustration.



A NEW STYLE OF AERIAL NAVIGATION.

Tinting Incandescent Lamp Bulbs.

The following recipe is due to Mr. Arthur S. Huey, of Minneapolis: Prepare the glass by thoroughly washing in soap and water and drying. Then dip in bath (made by beating up the whites of two eggs in one and a half pounds or pints of water, and filtering) and hang up to dry. Dissolve the aniline color in photographer's common collodion. Red or blue aniline will form clear solutions, while the green solution will require filtering. Yellow aniline forms a handsome color, but the surface of the glass presents a frosted appearance after the application. Violet and purple colors may be obtained by combining red and blue in different quantities. When the solution is ready, dip the prepared glass bulbs therein, hang up to dry, and finally pass a current through the bulb for half an hour, that the heat thus generated may harden the coating of the collodion, or place in a current of air. The preparation can easily be removed with alcohol or sulphuric ether, but is not affected by water. Experience has shown that the best results are obtained by not using too much aniline. Make the color light rather than deep, and apply two or three coats.

A Business Man's Opinion.

President Roberts, of the Pennsylvania Company, when asked lately as to his views concerning the present outlook, said: "It is a difficult time to judge of the future. If the question had been asked of me a year ago I would have said the outlook was poor; but in less than three months activity began, and I ordered new cars, although there were 5,000 idle cars on our tracks. It is seldom that you can correctly judge the future; but there is no reason why the manufacturers of the country, and especially those in iron and steel, should not have a very fair season. The outlook for railroad traffic is encouraging also. I have a notion, too, that we, as a nation, are about to become exporters of manufactured products to a larger extent than ever before. Our industries will now seek success outside of the domestic market, which they have heretofore depended upon. But our large and profitable domestic consumption gives us an advantage over older producing countries, where most manufactured articles have to seek a market outside the home market."

Patents as Investments.

It has been said that the introduction of useful inventions seems to hold by far the most excellent place among human actions. Unfortunately this, like many other truths, is not sufficient of itself to incite the inventive faculty. In these money-getting times mere sentiment succumbs to pecuniary gain, and when the value of an invention is called into question, it is not its moral or beneficial effect upon the community that is considered, but rather the more practical one of its influence upon the pocket.

Do patents pay? is a question often put, and frequently answered in the negative, but erroneously so. For the amount of money invested, there are few properties that have paid more handsomely. Take the leading investments of the day, how many of them are gigantic failures?

Of course all patents do not pay, neither do all investments in any kind of property; but in these days of wild speculation, railroad bubbles, and bank failures, it may be very opportunely asked whether $35, or a little over $2 a year, paid to the government for a seventeen years' exclusive right in and to some useful invention, is not a promising investment? It at least is not a very extravagant one.

We all know of patents that have paid their millions, but we do not all know of the many thousands upon thousands of patents which have realized for their owners amounts varying from $5,000 to $50,000 and upward.

Contrast these realizations and the paltry outlay required with other investments, and where is the property which yields as large a return?

That many patents do not pay is not always the fault of the invention, but not unfrequently is due to the want of proper commercial management or to the clumsy form in which the invention, perhaps a very meritorious one, has been ushered to the public. But even these patents ultimately sometimes prove valuable, on account of the principle involved or some one particular construction or combination they cover, so that holders of subsequent patents are compelled to pay tribute, and it is never safe to consider a patent worthless because it is dormant. Its day, after the lapse of years even, may come unexpectedly.

Again, inventors frequently are at fault in not following up their inventions by fortifying the original patent with subsequent ones covering improvements in matters of detail. Nor should repeated failure discourage an inventor; for if only one patent out of every ten pays, it will many times more than compensate for the cost of the ten.

Not merely scientific men and mechanics, but men of leisure, will do well, then, to consider whether a patent, if only as a speculation, is not a cheap investment, even if the weightier consideration of advancing the cause of science or adding to human comfort by even so small a step be altogether discarded.—*Exchange.*

By Rail to Europe.

The Russian government, it is said, will begin next spring to build its 4,500 mile railroad across Siberia. It is a big undertaking, and the estimated cost is $220,000,000. This is an age when the cost of any project, however enormous it may be, provided it gives promise of a reasonable profit, is no longer considered an obstacle.

The National Electric Lighting Association.

Though the electrical generator and the science of electrical distribution have undergone a much quicker development than was the case with the steam engine in its early history, the promise of further economy, of more distant distribution from the point of generation, is so encouraging, indeed so evident, that the system may fairly be regarded as yet in its experimental stages. Every city, every considerable town, and many villages have their light and power stations. Enormous capital has been invested, and still more awaits its opportunity in the same direction. Because of this the numerous body of practical electricians composing the National Electric Lighting Association, which met on the 11th, 12th, and 13th of February, at Kansas City, devoted itself almost exclusively to economical generation and distribution, the steam engine taking an important part in the discussions, forming, as it does, so important a factor in the operation of an electrical plant. "Line Insulation," another factor in the general scheme, invited attention. So did "A Universal System of Central Station Accounts," looking to uniformity in the bookkeeping. "The Cost of the Product of Central Stations" laid down a standard of measure ment—though only a temporary one—by which these, wherever located, could estimate the relative economy of their several plants.

Perhaps the two most important papers, as discussing the general subject of economical construction and maintenance of central stations, were "Development of Generating Stations for Incandescent Light and Power," by C. J. Field, of New York, and "Construction of Central Stations," by C. J. Woodbury, of Boston.

In the first of these the author began by summarizing what he thought to be the most important considerations in putting together and ordering a plant. Here are some of them:

Safety and reliability of operation.

Economy.

Division of the generating power into the proper number of units for efficiency.

Adaptation for furnishing power as well as light.

To illustrate, he took a model plant set up last autumn for the distribution of incandescent light and power. The boilers and engines are on the ground floor, engines in front, boilers in rear, and all under the eye of the chief engineer. The boilers are of sectional water-tube type, engines 300 horse power, compound, horizontal, automatic. Each engine is directly belted to two generators. On the second floor is the electrical part of the plant; in front, directly over engine room, twenty-four dynamos, each with capacity of 750 amperes and 140 volts. Each dynamo weighs about eight tons. Here, as in the engine room, traveling cranes are arranged overhead for quick handling of apparatus. Through the center of the dynamo room is an electrical gallery where are controlled the workings of all the dynamos and apparatus, also all outside lines, everything, in short, connected with handling, generation, and distribution—one man overseeing all. From this gallery run all the feeders, which connect in the network of mains, these covering an area of about 1½ miles square. Ampere meters are set up on each feeder, showing the load in each portion of the district. No feeder equalizers are used for feeder regulation, the uniting and tying up of the system together with the use of the auxiliary bus effects this regulation. All circuits are underground, there being about 25 miles of conductors. These have given perfect satisfaction, maintaining to-day an insulation on the system as a whole of over half a megohm.

Coal is stored in the rear of the second floor, as is also the feed water heater. The offices, supply rooms, and workshops are on the top floor; in the basement, the ash pits, smoke flues, pump rooms, two large coal storage vaults of a total capacity of 1,000 tons, air blast for force draught, and so on.

Here then, in a building 75 × 100 feet, is everything complete for the generation and supply of current and power for 40,000 lights (incandescent).

Here are the most important items of cost of this plant:

Station building complete, including fittings, foundations, stacks, furniture, etc	$100,000
Real estate	36,000
Steam plant, including pumps, heaters, piping, bells.	50,000
Electrical plant	40,000
Underground system, material	115,000
Excavation and labor	35,000
Lamps, meters, tools, instruments, engineering and architectural expenses, wiring, services, etc	50,000
Total	$426,000

This includes entire cost for the plant for its entire capacity. At present there is installed generating capacity of boilers, engines, and dynamos for one-third of the final output of the plant. The electrical apparatus is complete for the entire output. The work necessary to complete the plant for its entire capacity would amount to $200,000 additional. This plant has cost from 20 to 30 per cent less than similar ones.

In order to begin such a plant's operations upon an earning basis, we had to secure a demand for a certain number of lights and power to clear the necessary operating expenses, which will exist regardless of the smallness of the load; we must have for such a capacity plant not less than 5,000 lights, with an average income of $8 per light per year. This figure we may consider as our unit of operating capacity. From this we can figure the increased earnings and profits for the larger number of lights connected. There exists practically a constant ratio of variable and fixed operating expenses. By variable expenses are meant those obtained on a variation in load and increase of business, fixed expenses referring to items remaining practically constant. Fixed expenses may be said to be 75 per cent of the whole, variable 25, if the business is doubled the expenses increasing only 25 per cent. Concluding, the author considered the use of Corliss or high-speed engine. As to the Corliss, there is excessive first cost, ponderous machinery, counter shafting, pulley, clutches, etc. He thought them to be unnecessary. The power should be obtained as directly as possible from the engine.

High-speed engines, though in piston speed not higher than the Corliss—only in rotary speed—have shown a considerable development and a marked advance within the past year, and next year, so he thinks, is going to show even more development in this line. With the single cylinder engine under variable load poor economy often results, but as compared with the Corliss under similar conditions, and allowing for discrepancy in price, the result is not so disparaging. Just now, compound and even triple expansion engines of this class are being built.

Speaking of the underground system as employed by his company, he said that it is so arranged, distributed, and connected in a network that with a drop or resistance of one per cent in the mains and ten per cent in the feeders, an almost perfect regulation is maintained in the distribution of the current.

The largest problems in underground work are the proposed new extension of the incandescent (constant current) system in New York and the underground system of feeders to be installed for the West End Railway of Boston. The copper alone for the latter amounts to over $1,000,000.

In his paper on things to avoid in arranging stations, Mr. Woodbury said many electric lighting stations in large cities have been built under easy financial conditions, where it was feasible to adopt suggestions for convenience, strength, and safety offered by the engineers in charge. The opportunities have thus far been so few and the governing conditions so diverse that the problem requires in each instance an independent treatment. The larger number of electric light stations are of moderate size, and were constructed under conditions of limited resources, which often compelled parsimony in the reduction of first cost, and did not permit the exercise of that judicious economy which yields the greatest return on investment.

It is important that the engines should be provided with an independent condenser, but not necessary that the station should be near a water course to obtain a supply of water, as is the universal custom in this country. A reservoir of suitable capacity and not over eight feet deep will furnish a supply for condensers which can be used over and over; the condensed steam and hot water entering one side of the reservoir, and the supply for the condenser being taken from an extreme side.

The most convenient width for stations using an engine to every pair of dynamos is forty-three to forty-five feet, and the length of the station is in proportion to its capacity. The roof should be of three-inch plank, each twenty feet in length, grooved and splined with hard wood splines one-half by one and a half inches, and laid on roof timbers breaking joints every three feet. In colder parts of this country, liable to temperatures below zero, it is good economy to lay a course of inch boards upon the plank, with roofing felt between. Pine is preferable to other lumber for roofing, as it does not warp so much as other soft lumber, and the roof covering will last better. The roof covering may be of any material for covering flat roofs, but its value will depend upon the quality of the material and the character of the work.

If the building is to be used for apparatus generating low tension currents, the best floor would be made by laying coal tar concrete on a foundation of broken stone or cinder, and then laying three-inch plank upon the concrete, and covering this plank with one and a quarter inch hard wood plank laid across the bottom plank and blind-nailed to it. Such a floor would sustain any weight liable to be placed upon it, but where there is need of a mass to hold rapidly moving machinery, it could be cut away wherever it might be necessary to lay heavy foundations.

On the other hand, if the generation of high tension currents in the station imposed electrical conditions requiring a higher insulation of the floor, such as could be obtained only by an air space underneath, then it would be necessary to enter into a large expense and to lay a mill floor by placing the two thicknesses of planks on beams in a manner similar to the method described for the roof.

If the boiler house is placed at one corner of the station, the latter can be extended by increasing its length; but if the boiler house is placed at the end of the station, the division wall should be made of brick and extend through the roof, entirely cutting off all wood communication between the station and the boiler room.

The wires could be run from the dynamos diagonally upward to the roof timbers, thus clearing the trolley track, and thence under the monitor from beam to beam to the switchboard on the floor under the front end of the monitor which forms the wire tower. This switchboard would be at the end of the unavailable floor space used for belts, and being in the middle of the room is away from the walls, where any combustible material is likely to be placed. It is important that the switchboard should be made of soapstone or other incombustible material.

Though Mr. Edison was not present, the phonograph spoke for him, delivering, and loud enough to be heard throughout the hall, an address previously delivered into it in his New Jersey laboratory.

Sulphur not an Element.

At the October meeting of the Vienna Academy of Sciences, Theodor Gross, of the Technical High School of Berlin, presented a paper of a very startling character, in which the author endeavored to make it plausible that sulphur is not, as now considered, an element, but a compound of carbon with some other as yet undetermined elementary substances. We quote from the *Chemiker Zeitung* of Coethen:

Heating a thin layer of precipitated sulphur in a porcelain capsule, and allowing the ignited mass to slowly burn without further application of heat, there remained as residue a black pellicle, which, after heating in the presence of air, was converted into a light brown powder amounting to 0·2 per cent of the original weight of the sulphur. Of this one part was gradually introduced into forty parts of fused potassium hydrate contained in a silver capsule, and after adding five parts of potassium chlorate the application of heat was continued until the mass ceased to foam. After treatment with water this fuse left a flocculent precipitate, the liquid, after filtration, disengaging with hydrochloric acid a comparatively large volume of carbon dioxide. The precipitate was readily dissolved by warm dilute hydrochloric acid containing a little nitric acid, barring a minute argentic residue. Added to this solution, potassa or ammonia produced flocculent precipitates insoluble in excess even after heating, but readily soluble in acids. After nearly neutralizing the excess of acid with potassa, the addition of hydrogen sulphide produced a light brown, very flocculent precipitate, which was thoroughly washed with hot water. This precipitate, according to careful investigation, contains a new body. Of all the known elements, only traces of copper might be present. This residue, when strongly heated in open porcelain crucible, fused together to small granules, having the appearance of selenium, whose weight amounted to about 2·5 per cent of the light brown powder obtained by incinerating the sulphur. Two and seven-tenths cg. of this powder strongly heated in a current of hydrogen lost 3 mg. The remainder dissolved in hot concentrated nitric acid gave a precipitate with a large excess of ammonia, which being carefully washed, was again dissolved in dilute nitric acid. In this solution hydrogen sulphide again produced a light brown precipitate, and potassium hydrate or ammonia a precipitate insoluble in excess. The author claims that this body so obtained cannot possibly be considered a contamination of the precipitated sulphur employed, for his results were always the same with samples procured from various sources, while with roll sulphur he had negative results. He considers the body a product of decomposition of the sulphur used, being related to the allotropic condition of the same in the precipitated form. For reasons to be made public at some other time he considers sulphur a compound of carbon with several other bodies now looked upon as elements. He also believes the body above described to be such a combination.—*Western Druggist.*

Eighteenth Century Beer.

At the monthly house dinner of the Laboratory Club recently held at the Criterion Restaurant, London, Dr. G. H. Morris, of Messrs. Worthington & Co., brewers of Burton-on-Trent, read a paper on some beer which was discovered walled up in the cellars of that firm, and which was brewed in 1798. It is believed that it was cellared on the occasion of the birth of some previous member of the firm. The beer was tasted by the members of the club and pronounced to be sound. It possessed no bitterness, but was brilliant, and its condition was rather of the quality of sherry. The bottles in which the beer was found have been pronounced by an expert to have been those in use at the end of the last century. Dr. Morris, in the course of his paper, stated that a microscopic examination of the sediment caused him to suspect the presence of a few yeast cells still retaining vitality.

Correspondence.

Marking Zinc Plant Labels.

To the Editor of the Scientific American:

In your number of February 1, "On Plant Labels," Mr. R. T. Jackson says that zinc is the best material for labels, but seems to have had some trouble with material for marking on it in such a way as to be permanent. I would suggest that the names be cut in the thin plates of zinc with a small set of dies, such as are used by a stencil cutter. They can be bought at small cost, and with a hammer and block make a complete outfit for cutting any names wanted. J.

Steubenville, Ohio.

South Louisiana Phosphates.

To the Editor of the Scientific American:

The conditions which in all probability went to bring about the deposits of phosphates in South Carolina and Florida have had their counterpart here.

Now that phosphate hunters have discovered a new locality of supply in Middle and Southern Florida, some one else interested in such matters might turn his attention to Southern Louisiana, for a like reason, as the phosphate nodules are extremely abundant over the prairies, two or three feet below the surface.

We give herewith the result of an examination of an air-dried nodule from Iberia Parish, made in May, 1885:

Phos. lime	14·20
Carb. lime	32·70
Ferric oxide	11·80
Magnesia	a trace
Insoluble clay	38·80
Water and organic matter	2·50
	100 00

Only three specimens were examined, one of which gave 18 per cent phosphate lime.

It might be that nearness to the surface had something to do with the small percentage of phosphate.

Wherever a considerable deposit of this phosphate rock is found, at probably a greater depth, it will show up as well as the Carolina or Florida article.

LOUISIANIAN.

Singular Vibration of Fence Wire.

To the Editor of the Scientific American:

A few days ago the writer had occasion to drive through a section of the hill country of Southern Wisconsin. A wet snow had fallen during the night and had lodged on all sides, weighing down the branches of trees to a marked degree.

Along one side of the roadway ran a barbed wire fence at the edge of a second growth of timber—three strands, on firmly set posts, about 14 feet apart. The snow had ceased falling. Not a breath of air prevailed. Suddenly my driver exclaimed:

"What's the matter with that fence?" pointing toward a section perhaps three rods in advance.

I looked, and saw that the two upper strands of the wire were vibrating violently, showing a play of one to one and one-half inches; the motion being distinctly up and down and in no perceptible degree lateral.

Reaching the point abreast of the agitated section, a distinct increase, *i. e.*, variation, in the vibration was discernible.

We proceeded on our way, and half a mile further on came upon another section vibrating in like manner, and further on still another; while in no case did the strands on either side of the agitated sections show any motion whatever.

On our return, an hour or two later, the same agitation was in progress at the same points; and we agreed that the cause was beyond our knowledge, and was certainly not a visible agent.

All to whom I have spoken on the subject are equally unable to explain the phenomenon. Hence this appeal to the SCIENTIFIC AMERICAN. Can the cause have been metal deposits reaching up toward the surface at the particular points; and if so, what metal?

Chicago, Ill. R. R. M.

[We should certainly attribute the occurrence to currents of air, perhaps imperceptible to you, but which were just right to produce the vibration of wire of the particular size and tension of that which vibrated. Telegraph wires often sound loudly when there is very little wind and are mute when it blows harder.—ED.]

The Bower Bird.

To the Editor of the Scientific American:

Under the heading "Natural History Notes," in your issue of September 28, I was interested in a short description of the habits of the bower bird. It recalls to my mind a visit I paid, together with a friend, to a nest of bower birds in the extreme northern part of Australia, about four years ago. My friend having discovered the nest some weeks previous to our visit, we proceeded cautiously to within 50 or 60 yards of the birds, and there, concealed in the bush, watched them at their play. These birds appear to have a recognized game, at which they play for hours together. Small archways are constructed by means of sticks and dirt, and through these the birds would run, one after the other, until one of their number, presumably more awkward then the rest, would knock one or more of the slight structures down. This was the signal for a considerable amount of noise on the part of the birds, which lasted for several minutes, after which they would set to work and reconstruct the arch or arches, as the case might be. We watched them for upward of an hour, and during that time the arches were knocked down six or eight times, the performance of putting them together being gone through on each occasion. It required about three or four minutes to build an arch, there being, as near as I could judge, ten birds engaged in the sport. The most amusing part of the spectacle, to my mind, was the "spectators" to the game. The latter consisted, besides my friend and myself, of some six or eight bower birds, perched in positions so that a good view of the arches could be had, and who, apparently, watched the game with the keenest admiration.

These most interesting and peculiar birds inhabit that portion of Australia which lies well within the tropics, and although by no means common, appear to exist in larger numbers near the Gulf of Carpentaria than elsewhere. They are extremely shy, and very difficult to catch. I have seen many varieties of birds in various parts of the world; but I do not remember ever seeing any in which I took such a deep interest as the bower bird. Their habits in many respects are certainly very odd. L. H. DARLINGTON.

Fremantle, West Australia.

The Brush Arc Light.

In the Circuit Court of the United States for the district of Indiana, Judge Gresham, on December 24, decided the case of the Brush Electric Company *vs.* the Fort Wayne Electric Light Company *et al.* in favor of Mr. Brush:

This suit is brought for an alleged infringement of letters patent No. 219,208, granted to Charles F. Brush, September 2, 1879, for improvement in double carbon electric lamps of the arc type. Brush assigned the patent to complainant before suit was brought.

When two ordinary pointed carbon sticks are in contact in an electric current the circuit is closed, and the current freely passes through the carbons without the production of any appreciable amount of heat or light at the point of contact. If, however, while the electric current is passing through them the carbons are slightly separated, the current will continue to flow in, crossing or leaping the small space between the separated carbon points, and intense heat and light will be produced. This is known as the electric arc lamp, and the one generally used for illuminating large buildings and halls and for lighting streets. The incandescent electric light is produced by causing a current of electricity to pass through a filament in a glass bulb from which the air has been exhausted. In its passage the current encounters great resistance, and as a consequence it is heated to a degree producing a bright white light throughout its entire length. This light is well adapted to use indoors.

As early as 1810 Sir Humphry Davy, with a battery of 2,000 cells, succeeded in producing an arc light between two horizontal charcoal pencils, insulated, except a small portion at their ends, but owing to the rapid combustion of the soft charcoal points, and the great cost of the battery, and the short duration of the light, it was of no practical or commercial value. But little progress was made in the improvement of this arc light or lamp until 1844, when Foucault substituted pencils made of a hard gas carbon for the charcoal pencils of Davy, and thereby for the first time produced a persistent but short-lived electric arc light. By a clockwork mechanism Foucault fed the carbon pencils toward each other so as to imperfectly regulate their burning away and maintain the arc. The voltaic battery did not generate electricity on a sufficiently large scale, the light was expensive, and it did not go into general use.

Later the dynamo-electric machine was developed, in which a powerful current of electricity was produced by revolving coils of wire in a field of magnetic force furnished by powerful permanent magnets, after which the arc electric light was successfully used in lighthouses in England, and later (1867) in France. But up to this time no means had been devised for producing an adequate current of electricity for illumination at a practicable cost, and it was not until the invention of the Gramme dynamo-electric machine in 1872 that electricity was produced in a manner and of sufficient strength to render electric lighting practical and useful. This machine was afterward improved in details of construction. In this state of the art, Brush entered the field of invention, and on May 7, 1878, obtained patent No. 203,412, for his arc lamp, which was superior to any lamp that had preceded it. This lamp, however, was not capable of burning continuously more than eight or ten hours, and when used for all-night lighting it was necessary to extinguish the light and renew the carbons; and in order to obviate this defect Brush invented the lamp in suit. The invention and the means by which it is carried out are thus described in this specification:

"My invention relates to electric lamps or light regulators, and it consists, first, in a lamp having two or more sets of carbons adapted, by any suitable means, to burn successively—that is, one set after another; second, in a lamp having two or more sets of carbons, each set adapted to move independently in burning and feeding; third, in a lamp having two or more sets of carbons adapted each to have independent movements, and each operated and influenced by the same electric current; fourth, in a lamp having two or more sets of carbons, said carbons by any suitable means being adapted to be separated dissimultaneously, whereby the voltaic are between but a single set of carbons is produced; fifth, in the combination, with one of the carbons or carbon holders of a lamp employing two or more sets of carbons, as above mentioned, of a suitable collar, tube, or extended support, within or upon which the carbon or carbon holder to which it is applied shall rest and be supported.

"I desire to state at the outstart that my invention is not limited in its application to any specific form of lamp. It may be used in any form of voltaic arc light regulator, and would need but a mere modification in mechanical form to be adaptable to an indefinite variety of the present forms of electric lamps.

"My invention comprehends broadly any lamp or light regulator where more than one set of carbons are employed, wherein—say in a lamp having two sets of carbons—one set of carbons will separate before the other."

Prevention of Consumption.

The health department of the city of Providence has issued the following circular:

"Consumption causes more deaths than any other disease the human race is subject to. Nevertheless it is to a very large extent preventable. It is, though not generally known, a contagious disease. Consumption, or pulmonary tuberculosis, is in every case caused by disease germs which grow in the lungs in enormous numbers. When a person is sick with this disease, these germs are coughed up in great quantities in the expectoration, and when this becomes dry and crumbles, or is trodden to dust, the germs float about in the air and are liable to be breathed into the lungs of any one. If the lungs of the person who does breathe them are poorly developed, or if the constitution is feeble, the germs are very sure to grow and cause the disease. Unfortunately, we do not know how to kill them when they are once in the air passages. The best that can be done is to build up the system and strengthen the lungs by the use of cod liver oil, good food, and fresh air.

"Much, moreover, can be done to prevent the spread of the disease by destroying the germs as completely as possible in every case.

"(1) No person with consumption should ever spit on the floor or in the street. If handkerchiefs or bits of cloth are employed, they should at once be disinfected or burned. A good plan is to use a small wide-mouthed bottle with a rubber stopper. The contents should be thrown into the fire and the bottle and stopper thoroughly scalded with *boiling* hot water every day.

"(2) The dishes used by a consumptive should be at once scalded, and the unwashed underwear and bed clothing should be thoroughly boiled as soon as possible.

"(3) When a person with consumption has diarrhea, the discharges from the bowels should at once be disinfected, as at this time they contain the disease germs. A good way is to add a half-teacupful of fresh chloride of lime, or fill up the chamber vessel with *boiling* water.

"(4) No one with consumption should sleep in the same room with another person, and the room occupied by a consumptive should be thoroughly cleansed as often as possible.

"(5) No mother with consumption should nurse an infant, and children ought never to be taken care of by a consumptive person."—*Boston M. and S. Journal.*

The Spirit of the Age.

There is no such thing in this day and generation, aptly says the *Medical Visitor*, as "making haste slowly." If the Chicago business man could be shot through a pneumatic tube into New York City in the space of a few minutes, the limited express train taking twenty-four hours to reach there would no longer be patronized. And if the New Yorker could land in Liverpool in less than two days *via* an air line, the ocean greyhounds would find their day of usefulness had fled. No one has time to build Egyptian pyramids nowadays; indeed, with every facility to visit the land of the Pharaohs, few of us have time even to stop and look at such works of art. Speed is the necessity of necessities in our time, and if lightning speed can be obtained, nothing but lightning speed will be tolerated. This rule applies equally to firing a gun, making money, or the development of science. This century has already passed through the phases of a cotton age, an iron age, and is rapidly being transformed into an electrical age.

THE WESTINGHOUSE ALTERNATING CURRENT SYSTEM OF ELECTRICAL DISTRIBUTION.

(*Continued from first page.*)

ventilated through the space between the heads and body. Strips of wood are used to hold the coils in

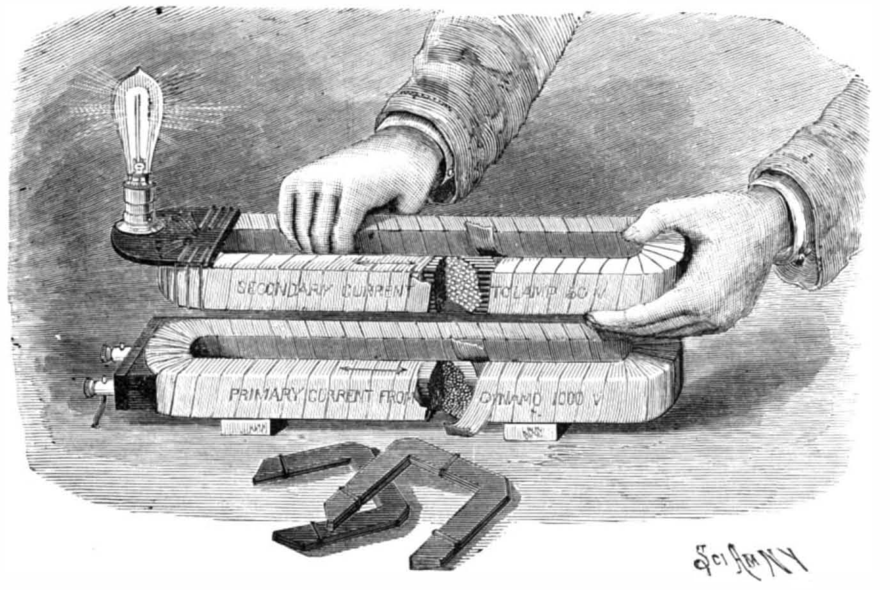


Fig. 4.—EXPERIMENT SHOWING PRINCIPLE OF CONVERTER.

place. The core is covered with mica, and the whole is held together by bands or wire winding.

If the armature be now considered as placed within the field and rotated, it will be seen that coils on the armature, wound in opposite directions, are at the same time all approaching to or all receding from poles of opposite names in the field. As they approach, therefore, a current all in one direction is started through the armature, attaining a maximum as the poles are reached. As the poles are passed, all the coils recede from poles of opposite names, and the current reverses in direction throughout the armature. The number of poles correspond with the number of armature coils. The poles multiplied by the revolutions give the number of alternations. As the center point between the poles is reached, the current is zero. All the standard Westinghouse dynamos produce a current of 250 alternations per second, the difference of potential between the dynamo terminals being 1,000 volts.

As far as risk to life is concerned, a circuit is dangerous when it exposes any one to a high difference of potential from accidental contact with any portion of it, either through distant grounding or through touching two terminals or leads simultaneously. This would be impossible with perfect insulation, but insulation may be destroyed or impaired from various causes. Accordingly, in the Westinghouse system the high potential circuit established as we have described is not permitted to enter any building. Starting from the station, the leads run underground or on poles through the district, always out of doors, parallel to each other and not connected at the ends. At places where current is to be taken off, converters are placed. These represent a device for tapping off the current, if analogy with a water or gas distributing system is employed. An experimental or dissected converter, which was constructed especially for illustrating the general principles of the converter, is shown in Fig. 4. It consists of the two coils of insulated wire wound exactly as in the ordinary house converter. The terminals of the secondary coil are connected to a lamp. If an alternating current is passed through the primary, and the secondary coil is brought near thereto in the position shown, a current is induced, and the lamp is lighted, giving a degree of illumination proportional to its distance from the primary coil. When they are laid one on top of the other, the illumination is quite strong. To show that there is absolutely no connection, the coils may be separated and a heavy plate of glass put between them, but the illumination still continues exactly as if no glass were there. The same experimental converter illustrates very beautifully the action of iron core pieces in localizing the magnetic field and concentrating the lines of force. When the coils are placed one on the other, the introduction of a few pieces of sheet iron increases greatly the illumination given by the lamp. The same drawing shows how the commercial coil is insulated, several layers of tape being wound in opposite directions, on each coil, each one being wound separately and individually insulated. All are heavily varnished with shellac and when mounted have fiber and mica placed between primary and secondary.

The principle of the commercial converter as illustrated by the foregoing experiment is practically the same as that utilized in the well-known induction coil, already alluded to. If two wires forming parts of two circuits are parallel to each other for a part of their length, and if through the first an intermittent or varying current of any type is sent, a secondary current is established in the other circuit without any contact between the wires. The general relations between the currents are expressed in Lenz's law. If the wires are wound in two similar coils of equal number of turns of wire, a current including a specific difference of potential within the first coil will produce in the second coil in general terms a current including the same difference of potential; but if the turns in the second coil vary in number from those of the first, then the electromotive force will also vary. If the current passing through the primary is continuous and perfectly even, no current will be induced in the secondary. This principle is utilized in the converter. The two coils are shown in Figs. 1 and 2. The coil in connection with the street circuit is termed the primary coil, is of comparatively fine wire, and includes a large number of turns. The secondary coil, identical in size and appearance, is made of coarser wire and includes one-twentieth the number of turns of the primary. This reduces the electro-motive force or difference of potential to one-twentieth of that of the primary coil. Wires are carried from the terminals of the secondary coil through the building, to which lamps, motors, etc., are connected. A watertight iron box contains the coils, the spaces between and around whose parts are tightly packed with thin plates of sheet iron. These, as we have just seen, greatly intensify the effects of induction, causing a more intense current to be produced than would otherwise result. Both primary and secondary circuits are provided with safety fuses. These are covered by the two round iron plates at the ends of the box, Fig. 1. These converters have become a very familiar object in our large cities, being placed upon window sills and on telegraph poles wherever needed. Mica and fiber insulation is placed between the two coils.

The general arrangement of the entire system is this. From the central station two leads are carried in parallel throughout the streets. The size of these leads is so calculated that the difference of potential between their extreme ends can only be two or three per cent less than that between the terminals of the dynamo. At intervals, wherever current is to be taken into a house, a converter is placed, whose primary terminals are connected, one to one wire, and the other to the other of the street circuit. This is done throughout the district, so that all the converters are arranged in parallel with reference to the main leads. Were the current a perfectly continuous and even one, an enormous waste of energy would be produced by all these connections permitting the passage of a large amount of current continually, and no secondary current would be possible, but in the case of the alternating current this is prevented by what is known as counter electromotive force. The primary coil surrounded by a mass of iron, forming the core, is an insuperable bar to the passage of any but the smallest amount of current, provided the terminals of the secondary are not connected. Thus, in such a system, when the secondary terminals are disconnected, a full difference of potential of 1,000 volts may be maintained between the two leads of the street circuit, while very little current will leak across. But if the terminals of any of the secondaries are connected, the counter electro-motive force of the primaries of such converters is diminished, a certain amount of current goes through the primary, inducing as already described a current in the secondary. In practice, this closing of the secondary occurs when one or more lamps are lighted, motors started, or other functions put in operation. The whole arrangement works proportionally; the more perfect or of lower resistance the connection established between the terminals of the secondary, the more current goes through the primary. Thus the converter represents a governor. It draws primary current from the main circuit exactly in proportion to its needs. On account of the counter electromotive force this same feature of automatic self-regulation appears in much of the apparatus employed in the system.

The meter for measuring the current is placed near the converter, but inside the building. It includes one main coil, through which the entire current passes. Within this one is a flattened coil built up of cop-

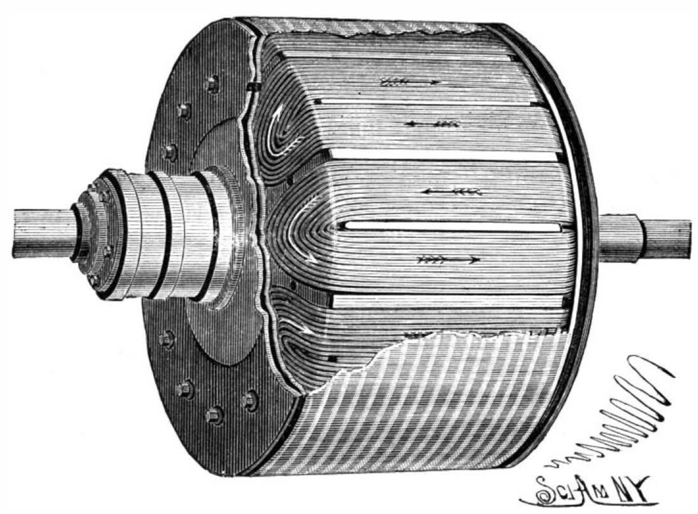


Fig. 5.—ARMATURE OF DYNAMO.

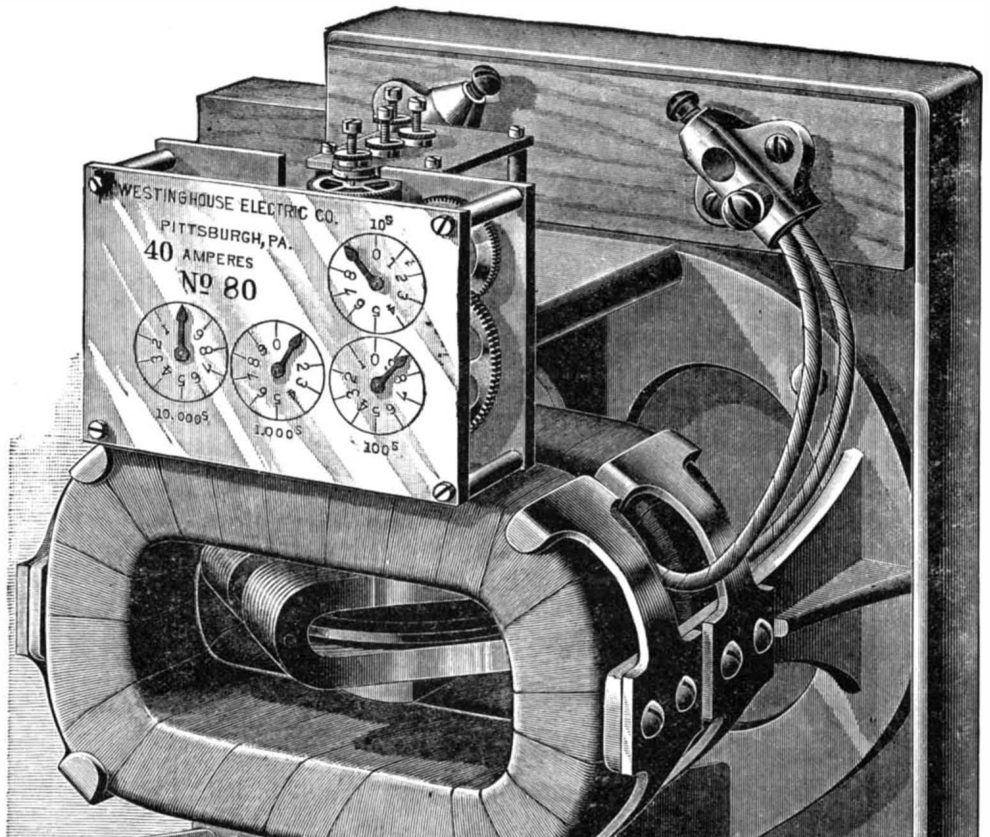


Fig. 6.—SHALLENBERGER ELECTRIC METER.

per rings. A spindle passing up through the two coils carries a disk of metal. When a current passes, the first coil establishes its own field of force. It induces a current in the second coil, thus establishing a second field of force. The induced current, differs in phase

Fig. 7.—EXPERIMENT WITH A WATCH DEMAGNETIZER.

from the first, owing to "lag," as it is termed, really a phase of or due to electric hysteresis. Polarity is established in the disk by induction, and the difference of phase and of positions of the fields cause the disk to rotate. This it would normally do in proportion to the square of the current. But as ampere hours are charged for, predicated upon a fixed electro-motive force, vanes are attached to the spindle that retard its rotations in proportion to the square of the speed, thus causing it to vary in direct ratio to the current. (See SUPPLEMENT, No. 668.)

Lamps of a uniform voltage of fifty units are used. Each 16 candle power lamp requires one ampere of current for its illumination. Hence, the meter readings represent lamp hours in 16 candle power lamps, more intelligible to the consumer than electrical units.

In the station it is essential to know the electro-motive force of the primary circuit; for this purpose a solenoidal volt meter is used, which is illustrated in Fig. 10. It is placed on the secondary of a special converter.

The compensator, which space does not permit us to illustrate, avoids the necessity of return wires for working a volt meter to indicate voltage at distant points. Its operation is very simple. In series with the volt meter the secondary of the compensator, really a special converter, is placed. It is so wound that it works in opposition to the current actuating the volt meter, and tends to displace the index from the 0 point. The intensity of this subsidiary opposition current depends on the amperage of the main line. As the latter increases it indicates a greater draught upon the system. Therefore the voltage of the dynamo should be increased to maintain the standard voltage at the points of consumption. The engineer, therefore, has to increase the voltage to cause the volt meter needle to return to 0.

A solenoidal ampere meter, also for station use, which indicates the amount of current furnished by the dynamos, is shown in Fig. 11. The elements of danger involved in the primary circuit depend upon short-circuiting or upon a human being grounding one lead when a ground exists upon the other. Hence a ground detector is used also in the station to determine when any such contact occurs. Its construction is shown in the diagram, Fig. 12. Two primary coils, A and A', are included in series in a connection between the two leads, L L', derived from the dynamo, D, within the station. To the central point between the two coils a connection including a switch or push buttons is placed by which a momentary ground can be established by the operator. Opposite each primary coil a secondary coil, B B', is arranged, in each of whose circuits a lamp is placed. The proportions are such that the two lamps normally are kept in a state of semi-illumination, their filaments showing merely a red heat. If a ground exists on any part of the outside circuit, and the push button is touched, the effect is to short-circuit the converter operating the lamp which is on the side of the ground circuit. This lamp goes out; and the other lamp receives an augmented amount of current, due to the short-circuiting of the converter, and glows with very high intensity. Thus, when the button is touched, if the lamp connected to coil B shows a bright light, the existence of a ground upon the other lead, L', is shown, as indicated by the dotted line, G, and *vice versa*.

In the experimental converter we have seen the effect of introducing an iron core in the augmentation of current. In Fig. 9 we illustrate what is termed a "regulator," designed for use in a theater. It is provided with a movable core. By pushing the handle either one way or the other, the core is brought more or less into action and the current induced in the secondary is increased or diminished. Thus when a number of lamps are connected to the secondary, they may be put out completely or their degree of brightness moderated to any extent by pushing the core in or out. The operation is analogous to the adjusting of an ordinary medical induction coil by drawing the shielding tube over the core or by withdrawing it, to diminish or increase the induced current. The action is equivalent in its effects to that of turning ordinary gas on and off.

In Fig. 7 is shown an interesting little apparatus designed for the demagnetization of watches. It consists of a bundle of iron wires surrounded by a coil which may be connected with the secondary circuit. If, when an alternating current is passing through it, a piece of steel is held against it, and the circuit is broken while it is held in the same position, it will be found to be polarized and to form a magnet. If the circuit is not broken, and while it is being removed it is rotated by hand, then it will be found to come away without any polarity. A watch treated in this way, placed against the core, and then removed and constantly rotated, however badly magnetized it may have been, is completely discharged. A plate of copper placed above the coil when it is in operation is constantly repelled as if by a blast of air, and is heated if held there, owing to the Foucault currents. A lamp attached to a coil is thrown into action

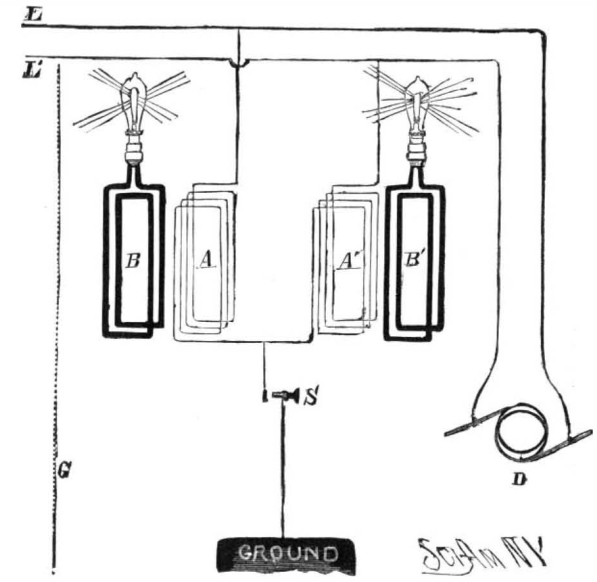


Fig. 12.—DIAGRAM OF GROUND DETECTOR.

if the coil is placed around it. Much subsidiary apparatus may be connected, as the cigar lighter, shown in Fig. 8, in which wires are heated to incandescence by the current.

Iron Electroplating Solution.

The following recipe is given by Messrs. Barthel and Moller, of Hamburg: Six hundred grammes of ferrous sulphate ($FeSO_4$) are dissolved in five liters of water; to this is added a solution of 2.400 grammes of carbonate of soda (Na_2CO_3) in five liters of water. The resulting precipitate of ferrous carbonate, $FeCO_3$, is then redissolved by the addition in small quantities of strong sulphuric acid, until the precipitate is just dissolved, when the fluid will show a green color; it is then diluted to twenty liters by adding water. The solution must be faintly acid, turning blue litmus paper deep claret color, but not red. An iron anode is used.

Fig. 8.—ELECTRIC CIGAR LIGHTER.

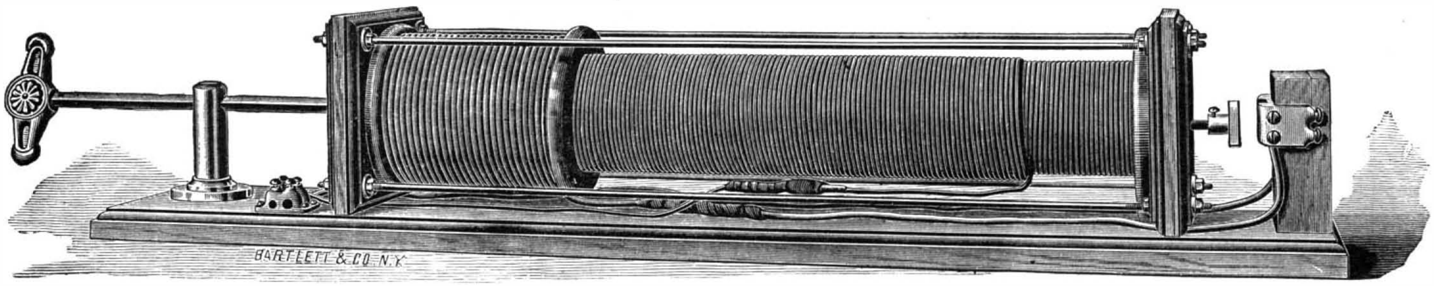


Fig. 9.—"REGULATOR" FOR CONTROLLING BRILLIANCY OF LIGHTS FOR THEATERS, ETC.

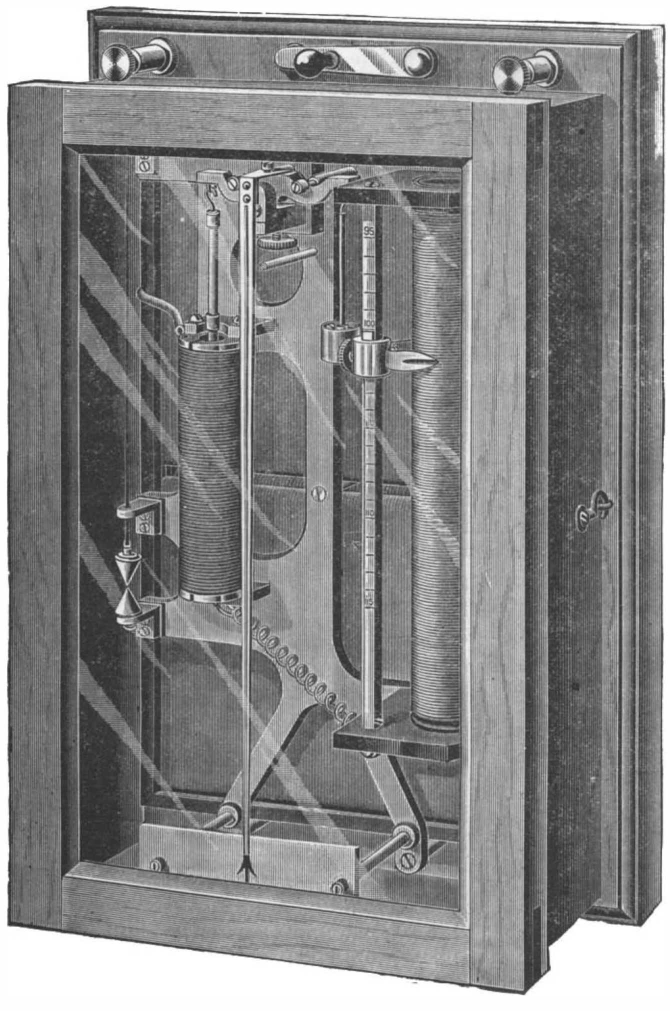


Fig. 10.—VOLT METER.

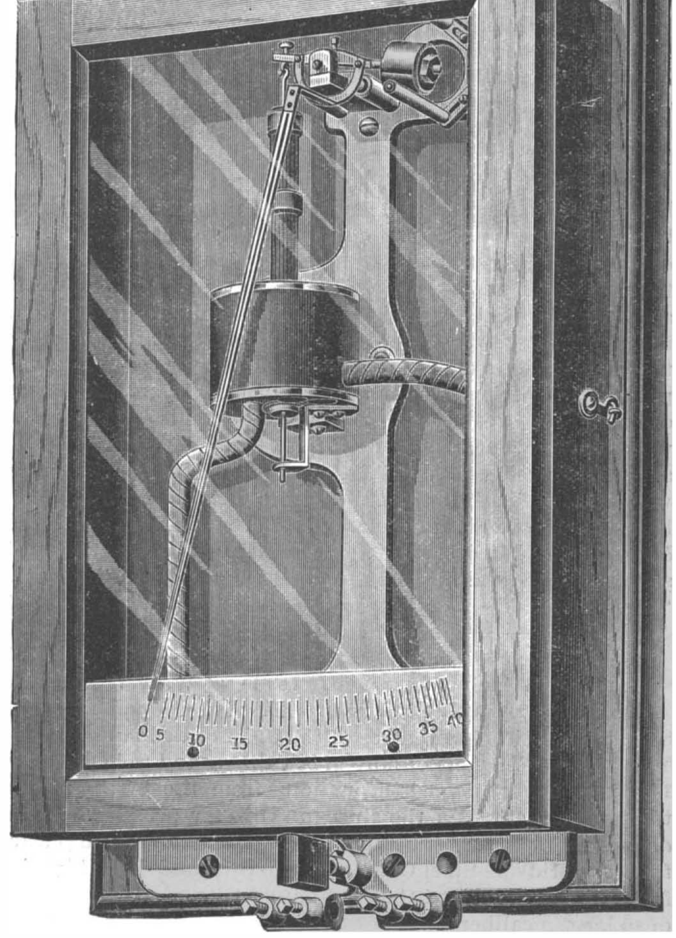


Fig. 11.—AMPERE METER.

Borax Rubber.

It has long been known that a solution of biborate of sodium, or "borax," possesses the property of dissolving or softening various resins which are unaffected by plain water and by the great majority of saline solutions. As a basis for a permanent label ink, unaffected by water or moderately strong acids, there is nothing equal to a half-saturated solution of ordinary borax—the Californian borax, as supplied by the Borax Company, of Birmingham and London, is what I have generally used for such purposes—duly charged with as much orange shellac as it will take up on boiling for twenty minutes. Similarly a most useful water varnish for photography and drawings may be prepared, only substituting bleached shellac for the colored variety.

Very much upon the same principle rubber may not only be kept emulsified by a borax solution, but may be actually dissolved therein from the raw solid gum. If only an emulsion be required, a solution of rubber in benzene or other hydrocarbon, to which a small portion of alcohol has been added, is mixed by vigorous agitation with a two-fifths saturated solution of borax, previously heated to about 120°-140° Fahr.; and the agitation must be continued—preferably by mechanical means, but not of too violent a character—until the mixture has cooled down to the temperature of the air, or nearly so. Not more than about 3·5 to 4·5 per cent of rubber should be present in the fluid when finished, as any higher strength, if attempted, quickly separates, and in such cases sometimes the entire quantity coagulates when the separation once begins. Ceara or Madagascar rubbers are best for use in connection with borax solutions; even Para, for some reason or other, does not answer so well.

For direct solution a one-half saturated or even three-fifths saturated solution of borax may be used, and here, in order to render the context quite clear, I will briefly explain what is meant by a two-fifths, one-half, three-fifths saturated solution, etc., of the salt in question.

To begin with, a "saturated" or a "one-one saturated" solution of borax is prepared by boiling any convenient quantity of distilled or clean soft water with an excess of borax crystals, for at least fifteen or twenty minutes. The liquid is allowed to cool down (during from twelve to twenty-four hours) to 60° Fahr., when the limpid solution—which has then deposited some crystals of the salt—is decanted off as "saturated," since at the above named temperature it is not capable of dissolving any more.

If a "one-half saturated" solution is required, the above solution is mixed with an equal bulk of water.

If a "two-fifths saturated" fluid be needed, two parts by measure of the "saturated" are mixed with three parts of water.

If the order be a "three-fifths saturated" solution, three measures of the "saturated" are mixed with two of plain water, and so on for any other strength required.

In use, the borax solution—after its strength has been duly adjusted at or about the temperature of 60° Fahr.—should be heated to the required degree, and the rubber, in *extremely thin* shavings, carefully stirred in. For weak rubber solutions a two-fifths saturated borax solution, heated to 170° to 200° Fahr., may be used. Medium strengths would be prepared with one-half saturated borax, at the boiling point, while strong solutions of borated rubber may take three-fifths or four-fifths saturations, and the digestion may be carried on in closed vessels at a pressure of 1½ to 2½ or even 3 atmospheres = about 23 lb., 38 lb., and 45 lb. per square inch respectively.

Solutions of borated rubber thus prepared may perhaps contain as much as 8 per cent of dissolved gum, but some care is needed to prevent their coagulating or gelatinizing just at the wrong time. However, such fluids may be utilized in a variety of ways, and they are especially well adapted for strengthening, preserving, and rendering more or less impervious to water all the coarser kinds of textile fibers and fabrics, as also pulp for paper making purposes, mats, marine bedding, etc. Moreover, where a rubber solution is needed which is fairly cheap, and does not necessarily impart a highly glazed or "varnished" surface, this method will, I fancy, be found useful. Since it is here published for the benefit of the readers of the *India Rubber Journal,* I trust that any attempt at patenting such a process will be promptly noted and declared "null and void."—*India Rubber and Gutta Percha.*

The New Army Eight Inch Gun.

The new 8 inch gun, recently made at Watervliet Arsenal, was recently fired at the Proving Ground at Sandy Hook, in the presence of the Chief of Ordnance. This gun has a length of bore of 32 calibers and weighs 14¼ tons, being hooped throughout from the breech to the muzzle. It is the first gun thus far produced *all of American steel,* and the forgings were obtained from the Midvale Steel Company, the tube and jacket forgings being the first that company had undertaken of so large a caliber.

Fifteen rounds in all were fired, commencing with a charge of 76 pounds of powder and gradually increasing to 113 pounds with American powders, and then continuing with German brown powder, increasing from 102 to 140 pounds. With a charge of 138 pounds of German brown prismatic powder and a 300 pound projectile, the muzzle velocity was 1,921 feet, pressure about 16 tons per square inch, muzzle energy 7,674 foot tons. With a charge of 140 pounds of the same kind of powder and a 300 pound shot, the muzzle velocity was 1,957 feet and the pressure about 18 tons. The muzzle energy was 7,965 foot tons. The muzzle energy realized with this gun far exceeds that of the first 8 inch gun made by the department, which was only about 7,200 foot tons, and yet the record of that gun has not been surpassed by any other existing gun up to date. The first 8 inch gun had only 30 calibers length of bore, and was made partly of Midvale and partly of Whitworth steel. It has been fired 300 rounds and is in sound condition, except that the bore is considerably eroded near the origin of the rifling. It is intended to retube this gun.

The breech mechanism of the new 8 inch gun is of novel design, devised by the department, and worked most satisfactorily throughout the firing, the breech being opened and closed with the utmost ease by one man. The gas check is the De Bange pad. Penetration in iron: At muzzle, 18·3 inches; at 1,000 yards, 16·7 inches. Range: At 20 degrees elevation, 7½ miles; at 25 degrees elevation, 7⅞ miles. Maximum range, 9 miles nearly.

Paint Preservatives for Iron.

Too much stress cannot be laid upon the condition of the surface of the iron at the time of coating; and it is perfectly essential either to have a dry surface or else a composition which is not affected by water. Prof. Lewes remarks that when an old iron structure is broken up, on the backs of the plates may often be seen the numbers painted on them in white lead and linseed oil when the work was put together, and under the paint the iron in a perfect state of preservation, the secret being that the paint was put on while the plates were hot and dry.

Compounds prepared with boiled linseed oil are open to objection, on account of the presence of lead. The drying of boiled linseed oil is due to the fact of its containing a certain quantity of an organic compound of lead; and the drying property is, moreover, imparted by boiling it with litharge (oxide of lead), so that lead compounds are present even when the oil is not mixed with red or white lead pigment. When boiled oil dries, it does so by absorbing oxygen from the air, and becomes converted into a kind of resin, the acid properties of which also have a bad effect upon iron. Protectives of the class of tar and its derivatives, such as pitch and black varnish, and also asphalt and mineral waxes, are regarded by Professor Lewes as among the best. Certain precautions, however, must be taken in the case of tar and tar products, both of which are liable to contain small quantities of acid and ammonia salts. If care is taken to eliminate these, and if it could be contrived to always apply this class of protectives hot to warm iron, the question of protection would be practically solved: bituminous and asphaltic substances forming an enamel on the surface of iron which is free from the objections to be raised against all other protectives—that is, of being microscopically porous and therefore pervious to water. Spirit or naphtha varnishes are condemned by Professor Lewes as open to several objections. Varnishes to which a body has been given by some pigment, generally a metallic oxide, are preferable to the last class, "if the solvent used is not too rapid in its evaporation, and if care has been taken to select substances which do not themselves act injuriously upon iron, or upon the gums or resins which are to bind them together, and are also free from any impurities which could do so."

At the present time, as the author truly remarks, the favorite substance for this purpose is the red oxide of iron; but care should be taken to exclude from it free sulphuric acid and soluble sulphates, which are common impurities and extremely injurious. The finest colored oxides are, as a rule, the worst offenders in this respect, as they are made by heating green vitriol (sulphate of iron), and in most cases the whole of the sulphuric acid is not driven off, the heat required being injurious to the color. The acid is often neutralized by washing the oxide with dilute soda solution; but very little trouble, as a rule, is taken to wash it free from the resulting sulphate of soda, which is left in the oxide. The best form of oxide of iron to use for paint making is obtained by calcining a good specimen of hematite iron ore at a high temperature. When prepared in this way it contains no sulphates, but a proportion of clay which is harmless if it does not exceed 12 to 18 per cent. Paint makers can easily test their red oxide for soluble sulphates by warming a little of it with pure water, filtering, and adding to the clear solution a few drops of pure hydrochloric acid and a little chloride of barium solution. If a white sediment forms in the solution, the sample should be at once rejected.

In the application of a preservative coating to iron, Prof. Lewes directs, first, thorough scraping and scrubbing from all non-adherent old paint and rust. New iron should be pickled with dilute acid to get rid of every trace of mill scale; the acid to be neutralized afterward by a slightly alkaline wash, and this again to be washed off by clean water. Under these conditions, and given a composition of good adhering properties, but little apprehension need be felt with regard to the ravages of corrosion, the chief remaining risks being from abrasion or other mechanical injury to the composition, coupled with improper constituents in itself.

Postal Telegrams.

The postmaster-general has applied to Congress for authority to make use of the present post office clerks and letter carriers for the additional purpose of collecting and distributing telegrams. This is not a project for creating a new army of government officials and offices, to be squabbled over at election times. It is simply proposed to make the present post offices and incumbents a little more useful to the public.

The bill provides among other things as follows:

For the purpose of facilitating the transmission of correspondence among the people and of promoting commerce between the several States, the limited post and telegraph service is hereby established as a bureau or part of the Post Office Department of the United States, and postal telegrams shall be received at post offices, transmitted by telegraph, and delivered through the medium of the post office service in the manner herein described. All post offices in places where the free delivery service now exists, or may hereafter be established, during the operation of this act, shall be postal telegraph stations, and the postmaster-general shall from time to time designate as postal stations post offices in other places where, in his judgment, the wants of the public may be supplied under the operations of this act.

That the postmaster-general, with the concurrence of the secretary of the treasury and the attorney-general, shall contract for a period not exceeding ten years with one or more telegraph companies, under such conditions as shall in his judgment best fulfill the purposes of this act, but subject to all the provisions named in this act, for the transmission by telegraph of postal telegrams as herein provided or for the furnishing of the lines. Postal telegrams may be written or printed upon postal telegram forms or cards, to be supplied by the Post Office Department, or upon any other suggested forms, to be supplied by the sender, provided that in the latter event stamps of sufficient value shall be affixed to the communication to cover the cost of the service, as herein provided. Postal telegrams may be forwarded by mail from any post office in the United States to any postal telegraph office, and shall there be transmitted by telegraph, provided the necessary telegram postage has been prepaid, as herein provided. Postal telegrams bearing special delivery stamps shall have special delivery.

No liability shall accrue against the Post Office Department or telegraph company on account of errors or delays in the transmission of telegrams. Nothing in this act shall be so construed as to prohibit any telegraph company from performing a general business for the public as the same is now done.

The postmaster-general shall provide suitable space or room in the post office buildings at postal telegraph stations for the wires, instruments, apparatus, and operation of the telegraph so far as he may deem necessary for the purposes of this act. The Post Office Department shall be entitled to a sum equal to —— cents for each postal telegram originating at such post office.

The charges in any one State shall not exceed ten cents for messages of twenty words or less, counting address and signature, nor over twenty-five cents for any distance under fifteen hundred miles, nor over fifty cents for any greater distance, said rates and rules and regulations to be prescribed by the postmaster-general.

Treatment of Baldness.

Dr. E. Besnier, in the *Journal de Medecine de Paris,* states that the falling out of the hair may be checked and a new growth started by the following treatment. The hair should be cut short and a mild sinapism or rubefacient applied to the scalp, then every five days the following lotion is to be applied:

Acidi acetici,
Chloroformi .... aa q. s. M.

The above should be used cautiously, as it is an irritant, and stimulates the hair powerfully. In connection with the above, the following pomade should be used:

Acidi salicylici .... gr. xv.
Sulphur. præcip .... dr. iss.
Vaselini .... dr. v. M.

This pomade should be applied fresh every morning, the scalp having been previously washed. Fatty substances retard the growth of the hair, and should not be used.—*Journ. of Cutaneous and Genito-urinary Diseases; Med. and Surg. Reporter.*

Love of Life.

Phrenologists have assigned to a protuberance under the ear the faculty of "vitativeness," or love of life, and some of them assume that in proportion to the size of the bump is the strength of the vital element in the individual.

However this may be, that the love of life is intense in some minds, and scarcely exists at all in others, nobody, of course, will deny; and it is no less true that persons who earnestly desire to live can keep a mortal disease at bay much longer than those who are comparatively indifferent to their fate.

The tenacity with which some men cling to life is marvelous. We had an instance of this in the case of a noted pugilist, several years ago, who was shot in the breast during a barroom scuffle, and his condition was pronounced hopeless by the surgeons. But he scoffed at their opinions, and actually lived several days with a ball in his heart; keeping his hold upon life—so it seemed—by sheer force of will.

A resolute determination not to succumb is, as every army surgeon knows, the salvation of many a wounded soldier, who without it would assuredly die. In the Crimean war the mortality among the wounded Turks was much greater than among the wounded French and English. The latter wrestled stoutly with death and often baffled him when their doom seemed inevitable; but the predestinarian Mussulman, when dangerously injured, said gloomily, "It is my kismet" (fate), turned his face toward Mecca, and gave up the ghost.

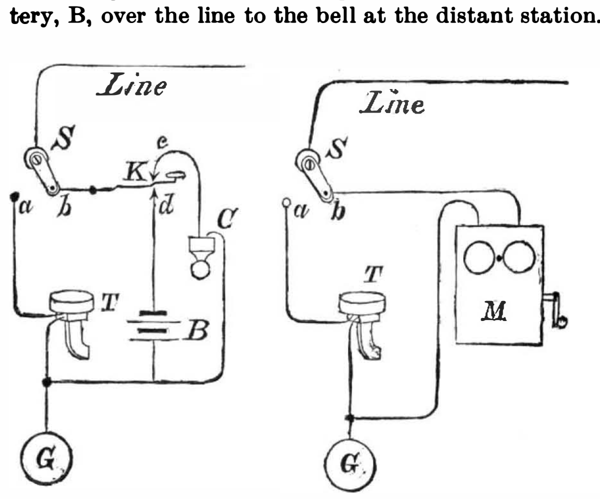
There can be no doubt that love of life and vigor of will have been the means of restoring to health thousands of patients who but for these mental characteristics must have perished.—*New York Ledger.*

SIMPLE CALLS FOR TELEPHONE LINES.

In response to many inquiries for an efficient call to use in connection with the simple telephone recently described in our columns, we give two forms of call, either of which will be found effective; but the magneto call is preferable to the battery call on lines of any considerable length.

In the left hand figure, the line wire comes to the pivot of the switch, S, and the contact, *a*, is connected electrically with one terminal of the telephone, T, the other terminal being connected with the ground, as shown. When the arm of the switch, S, is upon the contact point, *a*, conversation may be carried on over the line; but when the line is not in use for this purpose, the arm of the switch should be placed on the arm of the contact, *b*. It is then in position for signaling in either direction. One terminal of the bell, C, is connected with the ground wire; the other is connected with the back contact, *e*, of the key, K, and the key is connected electrically with the contact point, *b*. One pole of the battery, B, is connected with the grounded wire of the bell, C; the other pole of the battery is connected with the lower contact of the key, K. The key, K, remains normally in contact with the upper contact point, *e*.

With the parts arranged in this way, a current sent over the line will pass through the switch, S, and contact point, *b*, to the key, K, through the back contact, *e*, to the bell, and thence to the ground, giving an alarm. The apparatus at the opposite end of the line being arranged in the same manner, when the key, K, is depressed, it cuts out the bell, C, and forms a contact with the point, *d*, thus sending a current from the battery, B, over the line to the bell at the distant station.



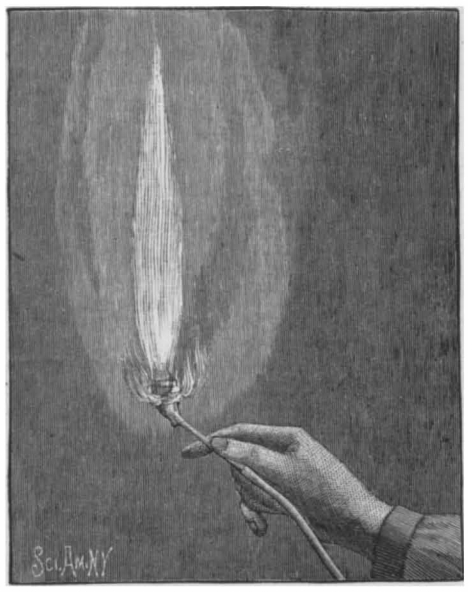
BATTERY AND MAGNETO CALLS FOR TELEPHONE LINES.

In the right hand figure, the telephone, T, is connected with the switch, S, and ground as before. One terminal of the magneto, M, is connected with the ground, the other is connected with the switch point, *b*. When conversation is to be carried on, the arm of the switch, S, is moved upon the point, *a*, thus cutting out the magneto, M. At all other times the arm of the switch, S, is on the contact point, *b*, so that whenever a signal is given at the distant point, it passes through the magneto to the ground, causing the bell to sound. When the switch arm is in this position and the magneto, M, is turned, the signal will be given at the distant station.

A CHEAP FLASH LAMP.

A great many flash lamps have been devised and put in operation, but, so far as we are aware, the one shown in the annexed engraving is the simplest, if not the best. It is thus described by its inventor, Mr. J. A. Currie, in the *Photographic Times:*

"Take an ordinary clay pipe, a wad of absorbent cotton, and a piece of string. Wrap the cotton around the outside of the bowl and tie it with the string. Take a piece of bulb rubber tubing and draw it over the stem so that you can place the tube in your mouth and blow through the pipe. Next weigh out the amount



AN INEXPENSIVE FLASH LAMP.

of magnesium you require for your flash, then place it in the bowl of the pipe. Take some alcohol and saturate the absorbent cotton. When you have focused your subject and decided where to have your light, ignite the alcohol. The flame will stand up six inches over the bowl of the pipe. Blow through the pipe stem, and your exposure is made."

Zinc.

BY GEORGE L. BURDITT.

Zinc, sometimes called spelter, is one of our most useful metals, and is widely distributed, although it never occurs alone. Sulphide of zinc and carbonate of zinc are its chief sources, and from these compounds it has to be distilled. The first step in the extraction of zinc is to reduce the ore to an oxide. Carbonate of zinc heated gives oxide of zinc and carbonic acid gas ($ZnCO_3 = ZnO + CO_2$). Sulphide of zinc roasted gives oxide of zinc and sulphur dioxide ($ZnS + 3O = ZnO + SO_2$).

To get pure zinc from the oxide, the oxide is mixed with coal and heated in a retort. The zinc volatilizes, and comes out of the mouth of the retort as a vapor. Cadmium is always mixed with the zinc, and cadmium vapor comes out first. It is lighted, and burns with a brown flame. As soon as the zinc vapor begins to come off, the flame changes to green. An iron cap is then placed over the mouth of the retort, through which the vapor passes, and is condensed into a fine dust. Gradually the cap becomes hot and melts the dust into liquid zinc, which runs into moulds and is cast into blocks.

The process described is called the Belgian process; there are two others, the Silesian and the English. The Silesian process differs only in the retort. The mixture of ore and coal is put in and heated, and the vapor passes out through a tube bent at right angles to the retort. The tube is kept cool, but not cool enough to condense the vapor into solid zinc. If this should happen, the pipe would become clogged and the retort would burst. In the English process, the retort consists of a tightly covered crucible, through the bottom of which passes a pipe. This pipe is stopped with a wooden plug, and the mixture of ore and coal is put into the crucible and heated. As the mixture grows hotter, the plug is converted into charcoal, allowing only the zinc vapor to pass through. The reaction which takes place in the furnace is, in all cases, $2ZnO + C = 2Zn + CO_2$.

The pure zinc obtained by either of these processes is a bluish-white metal, having a metallic luster and a crystalline fracture. It does not rust easily and takes a good polish. Owing to this polish, it is used for making stage jewelry. Under the most favorable conditions, however, it rusts slightly, becoming carbonate of zinc. At ordinary temperatures it is brittle, and when heated to 100°-150° it becomes malleable, and is rolled into sheets. The specific gravity is 7·03, and the melting point 412°. It is quite volatile, burns with a green flame, and is one of the metals that expand on cooling.

Next to iron, zinc is the cheapest of the useful metals, and, on account of this, has a number of uses. It is used in the galvanic battery. In this case, pure zinc would be very expensive to use, and it is not easily dissolved by acids. Impure amalgamated zinc is cheaper, does just as well, and is readily dissolved in acids. Galvanized iron is iron coated with zinc to preserve the iron. If the zinc begins to rust, a galvanic couple is formed, the hydrogen collecting on the iron, thus preserving it. Zinc is alloyed with copper to form brass; is used in making hydrogen, and is used in many places where iron and tin cannot be, on account of their rusting. Oxide of zinc, not being attacked by sulphureted hydrogen, is used in making white paint for laboratories.—*Pop. Sci. News.*

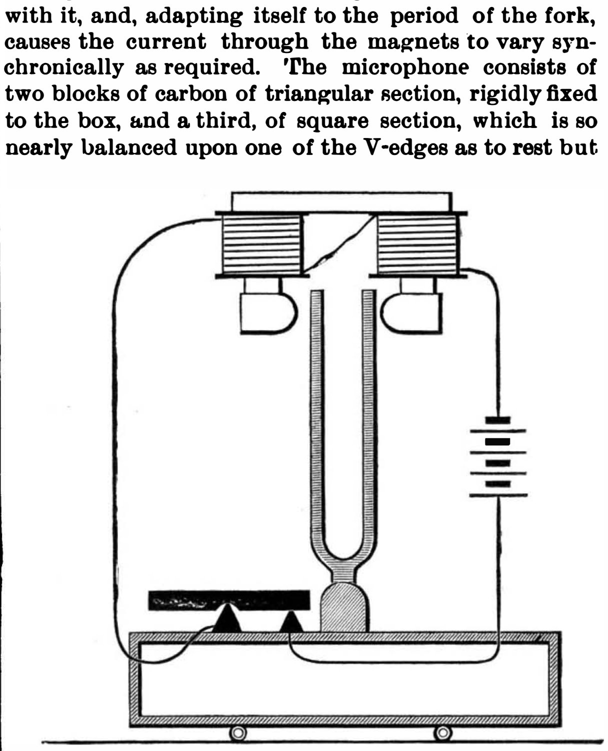
Around the World in 72 Days and 6 Hours.

"Nellie Bly," a reporter of the New York *World*, lately completed a trip around the world in 72 days, 6 hours, and 11 minutes. She left New York November 14, at 9:40 A. M., by the steamship Augusta Victoria; arrived on the 22d at London; Brindisi on the 24th; Ismailia, via the Suez Canal, on the 28th; Aden December 2; Colombo, Ceylon, the 10th; Singapore December 18; thence to Hong Kong and arrived December 24. Here it was necessary to stop until the 28th, and the next stage was to Yokohama. Arrived at Yokohama January 2; left on the 7th, and reached San Francisco on the morning of the 21st, one day ahead of time. The Central Pacific being blocked by snow, Nellie started for New York via Mojave, leaving Oakland, opposite San Francisco, at 9:2 A. M. She reached The Needles at 4:30 the next morning, and thence took a special train over the Atlantic and Pacific and the Atchison, Topeka and Santa Fe, by which Chicago was reached at 8 o'clock on the morning of January 24. From Chicago the trip was made by the regular train over the Chicago, St. Louis and Pittsburg and the Pennsylvania, leaving at 10:30 A. M. and making schedule time throughout.

The train over the transcontinental route was the only special conveyance taken over any part of the journey. The time from Oakland to Chicago, 2,574 miles, was 69 hours, and from La Junta to Chicago, 1,030 miles, 24 hours and 12 minutes, an average of 42½ miles per hour. It is said that on this part of the road 120 miles were run in 118 minutes, and that the rate of 78·1 miles per hour was kept up for a very long distance. The route taken from San Francisco was over 213 miles longer than the direct overland line, and the time made was about 11 hours less than the fastest regular run by the short route.

A NEW METHOD OF ELECTRICALLY DRIVING TUNING FORKS.

A very small weight added to the prong of a tuning fork is sufficient to alter its tone both in quality and in pitch. Hence the metallic contact piece in electrically driven forks has been to some extent a defect. The illustration herewith represents a means of driving a tuning fork electrically, devised by Mr. R. Appleyard, of Cooper's Hill College, which leaves the prongs free. The fork is mounted upon a resonating box. A small microphone, attached to the top of the box, vibrates with it, and, adapting itself to the period of the fork, causes the current through the magnets to vary synchronically as required. The microphone consists of two blocks of carbon of triangular section, rigidly fixed to the box, and a third, of square section, which is so nearly balanced upon one of the V-edges as to rest but



ELECTRICALLY OPERATED TUNING FORK.

lightly upon the other. A notch is filed in the carbon rod at its balancing point. It is interesting to observe that the same microphone has served for forks of different pitch—the deep bass F and the middle A, for instance.—*London* (*Eng.*) *Electrical Review.*

Uric Acid and Mental Depression.

Dr. Haig believes there is a relation between retention of uric acid in the blood and a state of mental despondency. When uric acid is present in excess, depression of mind and irritability of temper are marked, but give place to a feeling of mental buoyancy when the excess is gotten rid of.—*New Remedies.*

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING. — Benning Rowell, Lafayette, Wis. A lever is fulcrumed longitudinally above the drawbar and connected to the coupling pin, while a rock shaft is arranged transversely to the car, with a middle crank portion resting beneath the outer end of the lever, the rock shaft having a crank arm at its outer end.

CAR COUPLING. — Ferdinand Blauss, New York City. The drawhead of this coupling has top and bottom apertures in which fits the coupling pin, formed with a cam, combined with a link having cam faces, between which is a bridge, there being an enlarged opening back of the bridge, the device being designed to utilize the present ordinary form of drawhead.

BRAKE. — Alexander F. Smith, the Hague, Netherlands. This is a brake for cars worked by cable on inclined railways, and consists of a pair of gripping jaws adapted to clip a central rail, the jaws being worked by a right and left handed screw shaft operated from the wheel axles, the screw shaft being thrown into gear as desired by means of special mechanism therefor.

BRAKE. — Daniel S. McElroy, New York City. This invention consists in the combination with a car and ordinary car brakes of an electric motor adapted to operate the brakes without interfering with the action of the hand brakes.

Electrical.

LAMP COUPLER OR ADAPTER.—James Stewart, New York City. This invention covers a device for coupling or adapting a lamp having terminals formed of studs with heads to sockets of different kinds, a cup-shaped disk of insulating material being employed, with forked springs connected with electrodes capable of contacting with the electrodes of the socket, the disk having key slots for receiving the studs of a lamp and guiding them to engagement with the forked springs. The same inventor has a further patent providing for the employment of a hollow button of insulating material containing two flat curved springs with a screw-threaded peripheral band of metal, and with changeable contact screws, by means of which a lamp having terminals in the form of headed studs may be adapted to any of the usual electric lamp sockets.

Mechanical.

TOOL HANDLE.—Everett S. Robinson, Patchogue, N. Y. This is a handle more especially designed for use with files, having a longitudinal bore and adjustable tool carrier, with a ring clip embracing the beveled end of the carrier, affording means for securing the file or tool in its handle with facility of attachment and detachment.

DRILL OPERATING DEVICE.—John W. Miller, Newton Falls, Ohio. This is a mechanism for operating well drills with an up-and-down motion, and consists of a peculiar arrangement of a pulley caught in a bight or loop of the drill rope, an oscillating lever upon which the pulley is mounted, and an eccentric for working the lever.

DEVICE FOR TRANSMITTING MOTION. —John W. Eisenhuth, San Francisco, Cal. This is a portable device or crane automatically adjustable to the many positions a movable machine undergoes when following various angles or assuming different positions, as, for instance, a clipping machine.

Agricultural.

CORN HARVESTER.—Adolph A. Faust, Harold, South Dakota. This machine has a pair of cutter bars and finger guard bars mounted upon axles supported by two drive wheels which impart motion to the cutter bars, with devices for feeding the stalks to the cutters and carrying and dropping them after they are cut, being designed as a light and easy-running machine.

CULTIVATOR. — Otto Noack, Latium, Texas. This is an improvement in that class of cultivators whose beams and stocks are pivoted together and the latter adapted for adjustment at different inclinations for regulating the depth to which the shovel or sweep enters the soil.

HARROW. — Henry J. Ginn, Bowman, Ga. This is a sectional harrow having a frame composed of bars arranged at a greater or less angle to each other, the frame section being made integral, and having a particular form, whereby it is adapted for use in making up harrows of different contours, intended for use under different conditions of the soil or crops.

Miscellaneous.

LUMBER DRIER. — James M. Hooton, Avenger, Texas. This invention consists of means adapted to superheat steam and supply it to a drying chamber, to effect the removal of all moisture, sap, and resinous matter forced to the surface of the lumber, while producing a current of hot air through the kiln or chamber to greatly facilitate the drying process.

HAY PRESS. — Abraham J. Hill, Charleston, Texas. This is a double-acting press worked entirely from the side, whereby the horses that draw it to the stack yard or meadow will not be in the way, and is arranged for one man to put the hay in the two boxes, while the horse or mule has only to travel twenty-two feet for each stroke, the press being designed to form two hundred bales of one hundred pounds each daily.

BRICK KILN. — John B. Griswold, Zanesville, Ohio. This is a kiln for burning brick, tile or other ceramic material in such manner that a perfect combustion of the gases and fuel can at all times be insured, the products of combustion entering at the top or bottom, alternate up or down draughts being secured from the same furnaces.

AUTOMATIC PUMP GOVERNOR.—Hugh Howard, Henryellen, Ala. This governor is more especially adapted for use in connection with pumps to draw water out of mines, being arranged to work in connection with a reservoir, a float in which, with cable attachments, automatically regulate the supply of steam and cause the pump to work faster or slower as occasion may require.

STEAM JET MARINE PLOW.—Adalbert Anderl, Schwandorf, Bavaria, Germany. This is an apparatus for forcing sidewise the swell in front of the head of fast-going ships by means of steam jets, pipes communicating with the boiler to an extended nozzle below the water line at the bow, and this nozzle having laterally projecting mouthpieces, to produce a wave hollow in front of the ship.

CAP FOR OIL CUPS.—William J. Jones, Franklinville, N. Y. This is a double cap, providing for the filling of the cup without the entire removal of the cap, each cap having apertures which may be thrown into register to afford access to the interior, while by turning the upper cap the apertures will be carried out of register and the cup or can tightly closed.

REMOVING INCRUSTATION FROM BOILER TUBES.—James P. Karr, Monticello, Ind. This invention covers a process of temporarily enlarging a tube in opposite directions, so that incrustation covering it will crack and fall off, while the tube will spring back to its original size, not being permanently enlarged or expanded by the process.

HOISTING MACHINE. — Elijah Dainty, Coal Bluff, Pa. This is an apparatus with a frame having a top and bottom plate over which passes a horizontal endless rope provided with means for engaging a car, in combination with a vertically traveling endless rope adapted to be engaged by a grip and to support a load, the improvement being especially adapted for hoisting bricks in buildings, loading or unloading vessels, etc.

BARREL HOOPING MACHINE. — Frank Glankler, Memphis, Tenn. Combined with the hoop-driving arms in a barrel machine is an annular platen interposed between the hoop and the bearing points of the arms, the invention being an improvement on machines in which vertical arms or drivers with hooks are made to pull downwardly the hoops upon a barrel resting inside the arms upon a platform.

HOOP RETAINING ATTACHMENT. — Leonard L. Frost, Barada, Neb. This is an attachment applicable for use in the manufacture of cooper's ware, consisting of a hoop support formed of a single wire with a flattened or elongated hoop-receiving loop, to prevent the accidental displacement of the hoops by which the staves are held to place.

WAGON SEAT LOCK. — Michael D. Schaller, Lowell, N. Y. There is a support on the seat riser, a headed rod guided in the support and clamping the seat rail, a fulcrum piece on the clamp rod and below the seat, and a cam lever, whereby seats may be efficiently secured to wagon or vehicle bodies at any required adjustment.

SURFACE PRINTING. — William C Robertson, New York City. This invention consists in the application to the zinc or other plate of a substance that by exposure to heat becomes insoluble to turpentine, and which provides for the printing being done from oil, thus converting the plate virtually into a lithographic stone, so far as concerns the printing therefrom.

THERMO-CAUTER.—William H. Beach, Bridgenorth, Salop County, England. Combined with a thermo-cauter is a cylindrical reservoir for volatile liquid, the reservoir forming the handle, and having inlet and outlet tubes projecting axially within it from opposite ends, in connection with the pneumatic tube and with the cauter.

TRANSPARENT FABRICS. — Leziam L. Perry, Peabody, Mass. This invention relates to making transparent tracing cloth, etc., and covers a novel process of subjecting the fabric, after being bleached, to certain sizing and chemical mixtures, with other treatments, and final calendering or glazing, giving a superior cloth which may be handled without cracking.

POINTED KNIT FABRIC. — William Osborne, Brooklyn, N. Y. This invention provides an ornamental pointing for knit fabrics to be cut up to form the backs of gloves, mits, etc., which pointing can be easily and efficiently produced in the process of knitting the fabric.

SEESAW AND ROUNDABOUT. — Arthur B. Clarke, Atlanta, Ga. This is a combined device which may be readily changed to adapt it to either use, and in which the chairs may be readily adjusted to enable persons of different weights to counterbalance each other, while the chairs may be readily turned at pleasure in any desired direction.

WINDOW CURTAIN ROD. — Eli M. Wyant, Waterloo, Iowa. This is an extension rod, the length of the rod being adjusted to fit in a sash or window casing or doorway, when a lever handle is pressed up by the thumb, and sharp projections on end brackets are forced into the wood on both sides, securing the brackets firmly in position.

UMBRELLA.—Gustav A. Linke, Brooklyn, N. Y. This is an umbrella provided with spring stretchers, and is designed not only to be self-closing and to hold itself closed, but to automatically hold itself open when distended without the aid of any special fastening requiring to be released when it is desired to lower the umbrella.

THUMB TACK.—Anthony J. Schindler and Karl Schneider, New York City. The head of the tack has a rabbeted aperture on each side of the center, and the thumb tack is a spring key having parallel arms with projections at their free ends to engage the rabbeted portions of the apertures on the under side of the tack head.

NEW BOOKS AND PUBLICATIONS.

REPORT OF THE CHIEF OF THE MASSACHUSETTS DISTRICT POLICE. For the year ending December 31, 1889. Boston: Wright & Potter Printing Co., State Printers. 1890.

The sanitary aspects of factories and schools forms a large portion of the subject matter from which the present work is compiled. The thoroughness of the inspection given to such buildings by the Massachusetts authorities is here evidenced in the long lists of factories assigned to eleven different districts of the State, which lists give the number of employes, their age and sex, the sanitary condition of the building, the orders for alterations given, and notice of compliance or non-compliance with the orders, all stated in tabular form. The various and general sanitary features are treated at length in the text, and different methods of school house ventilation and warming are given, with illustrations, in order to compare their respective merits. It will be seen that the work belongs to the class of sanitary engineering, and it will be found a valuable addition to the literature of that science.

GREAT SENATORS OF THE UNITED STATES FORTY YEARS AGO. By Oliver Dyer. New York: Robert Bonner's Sons. Pp. 316. Price $1.

This little work brings vividly before the eyes the great men of a past generation, and the description of the oratorical powers and peculiarities of the great political leaders of those days is given very well and graphically. The book forms excellent reading, and is to be commended as keeping before our minds the days when America seems to have been most prolific in great men.

A TEXT BOOK OF ASSAYING FOR THE USE OF THOSE CONNECTED WITH MINES. By C. Beringer and J. J. Beringer. London: Charles Griffin & Company; Philadelphia: J. B. Lippincott Company. 1890. Pp. xvi, 400.

The art of assaying has lately received an extensive development in the branch in which it is related to chemistry. In the present book a very extensive range of metals is treated. The gravimetric and volumetric methods and wet and dry assay are all given in detail. So many substances to be determined are included in the schemes contained in the book as to make it almost an analytical chemistry. It forms a very able treatise, although it would be improved by a more liberal index, which it certainly deserves. Any deficiency of the index is made up for, to a certain extent, by the very exhaustive table of contents.

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Names 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 in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1839) C. C. S. asks: What material when mixed with calcined plaster will make it slow-setting? A. Saturated solution of alum, or a mixture of 3 to 10 per cent of ground marshmallow root.

(1840) S. H. asks: How many gravity batteries (6×8) are required to produce an electro-motive force of 8 to 10 volts? A. You may count on one volt per cell. You cannot make an electric light by means of small motors and dynamos as suggested.

(1841) A. D. O. asks: What is the electromotive force and amperes of a one gallon cell gravity battery? Also, the voltage and amperes of 10 one gallon cell gravity batteries connected in series, for intensity? A. The E. M. F. of gravity battery is 1·079 volts, resistance about 3 ohms; 10 cells in series would have an E. M. F. of 10·79 volts. By Ohm's law

$$\frac{E}{R} = C = \frac{10 \cdot 79}{30} = 0 \cdot 359 \text{ ampere.}$$

The amperage would be the same for a single cell.

(1842) G. M. F. writes: Will you give a receipt for a good "hektograph surface," suitable for both seasons? A. For the hektograph we refer you to our SUPPLEMENT, No. 438.

(1843) V. D. O. asks for the receipt for adhesive composition used for porous plasters or something similar which can be used for sticking burlap bagging, etc., together? A. Ninety parts Burgundy or Canada pitch are mixed with 10 parts yellow wax and melted together. Glue mixed with glycerine equal to one-tenth the weight of the dry glue may be used.

(1844) H. B. S. asks how to make and collect oxygen gas in quantity. A. Mix together one part of binoxide of manganese with four parts of chlorate of potash. Heat in a retort and collect the gas given off in a gas holder or rubber bag.

(1845) C. F. D. writes: My nickel plating bath is composed of nickel sulphate of ammonia, and worked splendidly in the beginning, but soon the nickel coating assumed a dull gray color. How can I remedy this? There is a reddish sediment in the bath, which I thought had something to do with this, but after filtering the bath there was no improvement, and the sediment looking like ferric oxide formed again. A. Your bath is probably lacking in acidity. It should be just acid, and show the reaction with sensitive litmus paper.

(1846) R. asks: Are buildings with a roof of slate, iron, or steel proof against injury from lightning? A. No. Are roofs of this kind ever connected with the earth by metallic rods? A. A metallic roof well connected with the ground is a protection against lightning.

(1847) W. B. asks: Will you please tell me what kind of a battery I can use for a scarf pin incandescent lamp? A. Use two small cells of bichromate or storage battery.

(1848) E. H. L. writes: Please explain the chemical action of the new Edison soda battery for phonographs—caustic soda solution, zinc and copper oxide plates. A. The caustic soda solution dissolves the zinc, hydrogen being separated by the action. The hydrogen goes to the copper oxide and reduces it, forming metallic copper. This prevents polarization. The constants of the battery are said to be as follows: R= 0·025 ohm. E. M. F. from 0·7 volt on heavy and 0·8 volt on light to 0·95 volt on open circuit work.

(1849) S. T. S. writes: In the underwriters' rules for wiring buildings for electric light, the following formula is recommended as a flux when soldering wires:

Saturated solution of zinc	5	parts.
Alcohol	4	"
Glycerine	1	"

The use of resin is repeatedly forbidden. How is the saturated solution of zinc in the above made, and why is resin so objectionable? A few years ago, I have been told, the Brush Company allowed nothing but resin, as a flux, in soldering connections in their lamps and dynamos. A. It means chloride of zinc, made by adding to concentrated hydrochloric acid all the zinc it will dissolve. Resin soldering is distrusted on copper, as the solder does not seem to take a good hold without great care. If that care is given, however, the resin soldering is better, as it never shows corrosion. This indicates the cause of the preference often awarded it.

(1850) F. E. asks: 1. What is the difference in the consumption at a burner between water gas 24 and water gas at 19 candle power? A. No exact ratio can be given, as the specific gravity does not necessarily vary in proportion to the illuminating power. 2. Between coal gas of 18 candle power and water gas of 24? A. About 6 feet of coal gas to 5 feet of water gas. For reason stated above this is also uncertain. 3. Also the difference in gravity between water gas and coal gas? A. Coal gas ranges from 0·425 to 0·475, water gas from 0·500 to 0·600, air being taken as 1,000.

(1851) D. M. asks for (1) a good recipe for making a liquid ink eraser. I cannot buy one that works satisfactorily. A. Use a 10 per cent solution of oxalic acid, to which may be added an equal weight of tartaric acid. Javelle water is sometimes effectual. 2. I would also like a recipe for an ink that would fade from the paper after being written a few days. A. We can give no really good receipt for this. A solution of a little iodine in weak starch solution may be used. 3. Have you a recipe for an invisible ink, that will appear quickly for parlor entertainments? A. Use onion or lemon juice, and develop by heat.

(1852) D. S. B. G. writes: What effect does wind have upon a thermometer, if any? A number have discussed the question and fail to agree, some claiming to hang one in the cold still air and one where the wind can strike it, the one in the wind will register the lower degree, others claiming no effect by the wind. A. Any difference in temperature due to wind is imperceptible.

(1853) W. P. asks: 1. How much wire must be used about the magnet in telephone, page 576, Hopkins' Experimental Physics? A. About ½ ounce. 2. How should it be wound—concentrated near the end or spread out more, thus bringing the wire nearer the core? A. Wind it near the end as shown. 3. I find the following caution in directions for care of the Leclanche battery: "Do not join with other batteries." What would be the result of joining in same circuit (say) a Leclanche and gravity cell? A. When several cells are joined in series, the current of the entire series is reduced by a weak cell. 4. Is the resistance of a coil of wire increased when a core of iron is placed in it? A. The resistance is not increased, but while the iron is in movement in or out of the coil, a counter current is induced in the coil, which opposes the direct primary current.

(1854) McC. & Co. ask how to dissolve oil of lemon in diluted alcohol, without injuring the flavoring qualities of the oil. How can we make soluble extract of lemon suitable for soda sirups? Where can we get a book treating on above subjects of late edition? A. You are asking for impossibilities. A small quantity of oil of lemon will impregnate a sirup with its flavor, but will not form a true solution. Diluted alcohol will not dissolve it. Extract of lemon includes citric acid, soluble, and oil of lemon, insoluble in water. The thickness of the sirup prevents separation. We recommend Sulz, Treatise on Beverages, $10.

(1855) O. A. M. asks for a recipe for waterproofing tents made of canvas and drilling, that will not make the cloth hard and stiff. A. Pass through a hot strong solution of alum, and immediately afterward through a similar solution of acetate of lead. Or simply apply a hot solution of acetate of alumina.

(1856) W. H. P. asks how small steel wires are tempered. A. Pack the wires in sand or ashes and pulverized charcoal in a wrought iron pipe headed at one end. When heated to the proper temperature, quickly tip the pipe over the water, so that the wires will plunge into the water endwise. Pack loosely, so that wires and sand or ashes will drop out together.

(1857) N. A. says: I am making a small billiard table, 2½ feet by 5 feet inside of the cushions. Please inform me the proper height the cushions should be above the level of the table, and the size of ivory ball to use. Also the correct place for the cushion to strike the ball for best results. The bottom is made of 1 inch square whitewood glued together and then planed and made smooth. What can I use to harden the wood? A. A 1½ inch ball is what you require. Make the cushion 1 inch high, beveled under, so that the balls will strike just above their centers. Varnish both sides of the table with shellac; when dry rub the top smooth and varnish again.

(1858) A. S. & W. H. M. ask for a paste or ingredient which they could add to ordinary flour paste that will fasten a paper label on to a lacquered tin vessel so that it will not come off; the label does not go all round the tin. A. We recommend a freshly made solution of gum tragacanth in water. Alcoholic solution of shellac might answer if used alone, but would be expensive.

(1859) W. M. asks how he can find out the way the solution or pickle is made for tinning or dipping wrought or cast iron in the solution. A. Pickle the iron in a solution of 1 part hydrochloric acid to 3 parts water until all scale is removed; rinse in hot water, and scrub off all adhering scale and dirt, then immerse in a solution of muriate of zinc and ammonia for a few seconds, and dip in the tin bath. Make the last solution by dissolving zinc in hydrochloric acid to saturation and add one-twentieth of its bulk of sal ammoniac.

(1860) L. L. H. asks (1) for a cheap process for hardening a vegetable oil paint. A. As driers the oil may be boiled with 10 to 15 per cent of litharge and the same amount of umber. Some oils cannot be made to harden. The same quantity sulphate of zinc or of borate of manganese may be used in place of above. 2. Also how to bleach the oil from a dark to light color. A. Expose to the sun in shallow leaden trays under glass.

(1861) "One of our constant readers" is referred for manufacture of hydrogen and water gas to our SUPPLEMENT in which much information on these subjects is contained.

(1862) D. C. M. asks: Will you please tell me the voltage, amperage, and internal resistance of the ordinary Callaud gravity battery? A. The E. M. F. of a gravity cell is 1·079 volts. The resistance may be taken at 3 ohms, but varies according to Ohm's law,

$$\frac{E}{R} = C - \frac{1{\cdot}079}{3} = 0{\cdot}359 \text{ ampere.}$$

(1863) R. S. asks: Has kerosene oil any detrimental effect on machinery, when used as a lubricant? One person says it cuts, and another says not. How about it? A. Kerosene oil is not a proper lubricant for machinery. In the refining process, sulphuric acid is used to bleach and purify it, which destroys its lubricating qualities and thus allows the cutting of journals and boxes. It is, however, good for cleaning gummy boxes and journals.

(1864) C. B. B. asks: 1. Experimenting with a small bichromate plunge battery, I find a considerable heat is produced. I have never noticed this with the bichromate battery; will you please state whether it indicates anything wrong, and the cause of the heating? The battery is, one zinc and one carbon, each two and a half inches wide, three-eighths inch apart, and immersed four inches in a cold saturated solution bichromate of potash with one-tenth by measure good commercial sulphuric acid added. There is also a slight odor, as in Smee battery. I had never noticed this in former batteries of the kind that I have used, and am puzzled to account for it. It is a desirable fault for some uses, as it makes the battery work a long time with a nearly full current. A. The heating is due to imperfect amalgamation, and is indicative of a waste of zinc. The odor is due to the escape of hydrogen. 2. Please state, approximately, voltage and internal resistance of a plunge battery with elements as follows, I want data from which to calculate resistance of magnets, etc., to be used with the same. Three carbons, two zincs, three-eighths inch apart. Each plate five and three-quarter inches wide, one quarter inch thick, and immersed six inches deep in the following solution:

Water	10 ounces.		
Bichromate of potash	2	"	by weight.
Good commercial sulphuric acid	1	"	fluid.

If different proportions would do better for solution, please state them. A. The electromotive force is 2 volts. The resistance varies from ½ ohm upward to 1½ to 2 ohms. Try a solution made as follows: Water 8 parts, bichromate of soda 1 part, sulphuric acid 2 parts. 3. Does the internal resistance of such a battery vary in the same proportion as space between plates? A. Yes. 4. Is there any good method of making connections to carbons, other than by casting on lead or by depositing copper? A. Heat the ends of the carbons, and saturate them for about an inch with paraffin. Clamp your connections on the paraffined part.

(1865) H. A. W. writes: Can you tell me anything about cooling a meat box by artificial means, or have you printed anything about it in any of your papers? A. Mechanical cooling as a rule is only profitable when executed on the large scale. In our SUPPLEMENT, Nos. 85, 91, and others, you will find described such methods. We suggest a reference to our catalogue of papers in SUPPLEMENT.

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February 4, 1890.

AND EACH BEARING THAT DATE.

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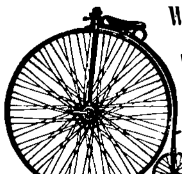

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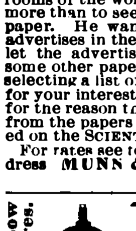

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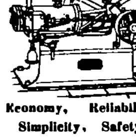

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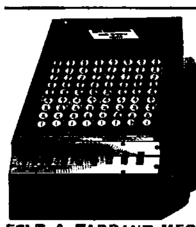

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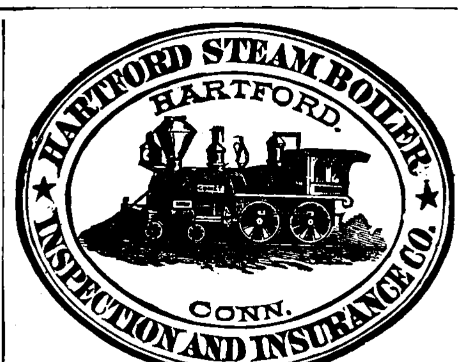

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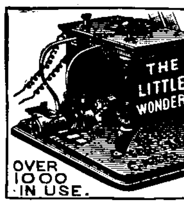

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