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THE MANUFACTURE OF LUBRICENE.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 168,

For the Week ending February 15, 1879.

Price 10 cents. For sale by all newsdealers.

THE NEW PATENT BILL AS PASSED BY THE SENATE.

An Act to Amend the Statutes in Relation to Patents (Senate Bill 300) has been passed by the Senate, and is now before the House of Representatives for its approval. As the adjournment of Congress is fixed for the 4th of March, the bill must soon be acted upon, or it will go over to the next Congress. The bill as it stands, while it contains some very excellent provisions, presents others that are very obnoxious; and unless the bad points can be eliminated we hope the subject will be postponed for the consideration of the new Legislature.

We will briefly recapitulate what to us appear to be the leading designs of the present bill, with a few words of running comment. In all there are 25 sections.

Sec. 1 provides that damages shall not be recovered for infringements that were alleged to have taken place more than four years prior to the commencement of the suit.

As the law now stands the owner of a patent may sue infringers at any time when he can find out that an infringement has taken place. But under the new provision, if the infringement is concealed or in any way escapes the knowledge of the patentee for four years, he has no remedy, and the infringer goes free. This section is an encouragement to infringers, is an injustice to patentees, and should not be passed.

Sec. 2 takes away from the inventor, substantially, the control and exercise of the patent for his own invention, and gives away to others the right to use the patent, against the consent of the patentee, for a price not agreed to by him, but fixed by people adverse to him, by means of the formalities of a court.

The existing law vests the exclusive proprietorship of the patent in the inventor, during the brief period of 17 years for which it is granted. This is one of the most satisfactory provisions of the present statute, and should be carefully preserved. If the new provision passes no man can hereafter say that he "owns" a patent. He will simply own a certificate showing that somebody else has the right to make use of the products of the inventor's ingenuity without so much as asking his leave.

Sec. 3 provides that if the inventor has the hardihood to bring a suit against an infringer and clearly proves the infringement, should the infringer then wriggle around and debar the inventor from getting a judgment for a sum less than twenty dollars, then, in that case, the inventor shall pay his own costs of the suit and also the infringer's costs.

This section practically imposes a heavy fine upon an inventor for attempting to stop infringements.

Sec. 4 gives conditional privileges to infringers to continue their infringements after a verdict is rendered against them, during the pendency of their appeals.

Sec. 5 gives to infringers the privilege of procuring the removal of injunctions, so that they may continue to infringe.

Sec. 6 provides that no re-issue shall be granted unless applied for within seven years from the date of the patent.

The present law permits the inventor to correct his patent by re-issue at any time during the life of the patent; this is an excellent provision, and tends to give value and vitality to property in patents. The provision of the new law assists and encourages the infringer.

Sec. 7 provides that if an inventor's specification happens at first to be so defective that an infringer can make and use the device without liability, the said infringer may always continue such use, without payment to the inventor, even after the latter procures a re-issue with properly corrected specification and claims.

Under the present law, if the original patent is found defective and the claims insufficient to prohibit infringements, the inventor may at any time obtain a re-issue, which shall be good for the remaining term of the patent, during which remaining term infringers must pay damages. The new provision aids and supports infringers throughout the entire term of the patent, and prohibits the inventor from recovering damages.

Sec. 8 provides a remedy where two persons have unwittingly taken a patent in their joint names, when only one of them was the real inventor.

Sec. 9 provides for the taking of testimony relating to patents, which may be stored away and used in new cases after the witnesses are dead and gone.

This appears to be another of the many provisions of the bill intended to assist infringers.

Sec. 10 provides that infringers may bring suits to have patents declared void.

This provision appears to be intended to help infringers in breaking down patents that stand in their way, but which belong to poor inventors who cannot defend such suits, or patents granted to those who are absent or deceased.

Sec. 11 requires that patentees who have requested infringers to stop such infringement, shall commence suits for damages within a reasonable time; otherwise the infringer may continue the infringement during the entire term of the patent, without liability to the patentee.

The majority of patentees are poor people, who in many cases have not the means to bring suits against infringers, and all they can do is to request the latter to desist or pay royalty; reserving until a future time, when their means admit, the bringing of suit.

The law, as it now is, permits a poor man to bring his suit for infringement whenever he desires. The new provision appears to be aimed against the inventor, and in favor of the infringer.

Sec. 12 provides that patent fees shall hereafter be paid as follows: $35 on the issue of the patent, $50 in four years thereafter, and $100 in nine years thereafter; total, $185 for each patent. Failure to pay either of the two last fees nullifies the patent.

Under the present law the fee for a patent is only $35. No other taxes or penalties are imposed. The proposed law introduces the European system of multiple taxes, and imposes a heavy burden upon the inventor. This subject will be found more fully discussed in another part of our paper.

Sec. 14 regulates the issue of licenses by joint owners and patentees. 15 provides punishment for fraudulent or deceptive conveyances of patent rights. 16. Commissioner and assistant to give bonds. 17. Prices of printed copies of patents authorized to be increased. 18 relates to certified copies of patents. 19 relates to payment of final fee in allowed cases. 20 regulates issue of patents for inventions previously patented in foreign countries. 21 permits full owners of patents to obtain reissues in their own names. 22 regulates the renewal of lapsed allowed cases. 23 regulates the stamping of date of patent on patented articles. 24 regulates the issue of patents in interference cases. 25 repeals all conflicting laws.

It will be seen from the brief comments here presented, that in our view the passage of the new law will make a very radical change in the existing system, and that its practical working would probably be disadvantageous to inventors and patentees. At the same time it must not be forgotten that patents are monopolies, which, though on the whole of great benefit to the nation, are in some cases very annoying to the public, and very burdensome and disastrous to many private interests. Perhaps the present laws can be modified so as to remove some of these difficulties. But the remedy proposed by this bill is worse than the disease. It seems unfair to enact a law like this, which in so many of its principal provisions appears to be designed to sweep away from inventors all personal benefits from the fruits of their ingenuity, and bestow them, free of charge, upon infringers.

We hope that all who are opposed to the new law will promptly use their influence with members of Congress to prevent its passage.

WILL BLOOD TELL?

Some five years ago, Dr. Heitzman announced, in the *Medical Record* of this city, an important discovery in respect to the anatomy of protoplasm. He claimed that protoplasm of every description invariably contains a network of threads and granules inclosing a fluid, and that the threads and granules constitute the living matter. This view he now asserts has been accepted by more than a dozen of the best microscopists abroad, although it has not yet been recognized in this country; and he makes it the basis of an announcement which, if satisfactorily demonstrated, cannot fail to have a marked and beneficial effect upon the practice of medicine—the announcement that a drop of a man's blood under the microscope will tell just what his condition and constitution may be.

A protracted study of the pus corpuscles in urine, in connection with clinical histories, led Dr. Heitzman to the conclusion that the constitution of a patient could be determined by such examinations, the pus corpuscles of a healthy and strong person containing a greater abundance of living matter than those of a person enfeebled by disease or otherwise. He next extended his investigations to the colorless blood corpuscles, suspecting that by their examination also he might be able to determine the constitution of the individual furnishing the blood. His expectation was verified, he says; an abundance of large granules going with a good constitution; on the other hand, if the granules were few and fine, or the entire body of the corpuscle pale, it was evidence of a poor constitution. He frequently noticed that the number of white blood corpuscles was considerably increased after a single sleepless night, so much so that it might be determined whether a man had been kept from his rest or not, by examination of his blood. It could also be determined whether a man was to have acute diseases, or whether he was to suffer from the slow processes of disease incident to a strumous diathesis.

A committee of physicians has been appointed to investigate and report on this most promising subject. If it proves possible to determine a man's physical constitution by the examination of a drop of his blood a new field of investigation will be opened, and one having very important practical bearings.

AMERICAN TEA.

Over fifty thousand tea plants have been distributed lately in the Middle and Southern States, by the Bureau of Agriculture. In three or four years these plants will be large enough to permit a full picking of the leaves. Experiments have been made with tea leaves grown in the grounds of the department and in the South, after Japan methods, the product being pronounced an excellent Oolong by dealers and experts. The only present obstacle to the profitable cultivation of tea in this country on a large scale is the amount of hand labor required in curing the leaves. The Commissioner is confident that American ingenuity can produce machinery by means of which the preparation of the leaves may be effected better and cheaper than is possible even with "Chinese cheap labor." There is no good reason why any family having a garden plat, in the southern and middle portions of the United States, should not produce with little trouble all the tea needed for home consumption, without elaborate machinery.

THE LICENSE FEE AS A MEASURE OF DAMAGES.

During the debate, on the 16th ult., in reference to the second session of Senate bill No. 300, Senator Conkling quoted the familiar aphorism that "everybody knows more than anybody," and he added: "The ablest committee in this body, or any other, may sit and listen to attorneys representing somebody else, and come to a most conscientious and intelligent conclusion, and still, in a matter so complex as this, it is more than likely that, when the converging rays of a great many minds are turned upon that subject, new considerations and new thoughts may be suggested, which it is well worth while to utilize."

The remarks of the distinguished New York statesman lose none of their pertinency from the fact that the arguments before the committee were almost wholly by eminent barristers retained for that purpose by associations more or less inimical to patents.

It is observable that advocates and apologists of the Wadleigh bill—perhaps conscious of the fallacious character of their conclusions—seem desirous to subordinate legislation to such mere judicial fictions and technicalities of the forum as that which finds it necessary to regard the infringer of a patent as a "trustee," before the rights of recovery of profits can be adjudged against him; and the fiction which would exalt the license fee from its position as one of several tests of value to be the absolute "measure" of compensation to the defrauded patentee; thus placing the clandestine user on a level with the licensee, and arbitrarily fixing the price at which the private property of one man may be appropriated by any other.

Instead of the procrustean rules with which it is sought to tie the hands of tribunals, much better would be the mode recommended by Senator Matthews, who, in closing the debate, remarked: "I am of opinion that every avenue of evidence ought to be kept open, for proof, in each individual case, according to its circumstances, and that the amount in such a case should be reasonable and fair, and that that should be left absolutely, upon that evidence, to the discretion of the tribunal charged by law with the finding of such a verdict or the making of such a decree, without any restraint, without any artificial rules to bind that discretion, without shutting out any light; so that every fact and every circumstance which is material and important to the determination of the question shall be permitted to be proved."

Now, is not the much insisted rule of the license fee, as the absolute measure of damage or profit, directly in conflict with the Ohio Senator's well stated principle of action? Does not the drift of reasoning that prescribes such a rule virtually destroy the "EXCLUSIVE" attribute which the Constitution makes inherent in the franchise?

It is conceded by Mr. Christiancy that the right, so long as it remains wholly in the hands of the inventor, is his, to do as he pleases with, as much so as the right of possession in a mine or a field; nay, more, that, in such a close monopoly, the patentee is entitled as a measure of damage against an infringer, to the entire usufruct or beneficial results of his improvement, although such results are very well known to be often manifold the amount of the customary license fee.

The sometimes relative insignificance of the license fee is well known to be attributable to the anxiety of the patentee—before many months of his brief franchise have slipped away—to get the manufacture into the hands of competent men, and, in order to accomplish this, and that the device may fight its way against the *vis inertiæ* of routine and prejudice and reach early and extensive sale, the patentee is willing to forego a very large proportion—often exceeding nine tenths of the actual benefit. He is willing to surrender so much to the legitimate manufacturer and to the public, but not one cent to the marauder.

Now, apart from questions of justice, apart from questions of constitutional right, can any one doubt that it is for the public interest that the patentee should be encouraged to relax somewhat of this strict monopoly, should be permitted, without let or hinderance, to select the mode, the agents, and the places in which and by whom his franchise shall be utilized?

An illustration may be cited familiar to many. Some twenty-five or thirty years ago the manufacture of tongued flooring was subject to the Woodworth patent. This manufacture, in Hamilton county, Ohio, was restricted to fourteen mills, of which each paid to the patentee a stipulated annuity of $1,000. The ability of these licensees to undertake the manufacture rested implicitly on the patentee's guarantee as to the maximum number of mills. Now what would have become of their contracts and of the business founded on those contracts, if any trespasser—say, a wealthy building association—could have stepped in and defied the inventor and the honest licensees, in the assurance that Justice—should she be invoked—could at most but adjudge the license fee as the reasonable compensation for the tortious use?

The frequent, somewhat promiscuous disposal of their rights at almost nominal figures, by necessitous or unthrifty inventors, does not, as some would have us believe, necessarily imply a total surrender to the public at a given price, nor does it invest any one with the liberty to appropriate such right on the terms thus granted to others, or any terms; nor does Congress, nor all the tribunals between the two oceans, step in between the humblest patentee that can be cited by Senator Christiancy and that patentee's "EXCLUSIVE" property in his own invention.

As the patentee of a valuable device, jealous of the reputation of this offspring of my brain, and regardful of the interests of those who may, with my consent, have undertaken its manufacture, can I be denied the exercise of my own discretion in the selection of licensees? Would not they, and might not even the public, be best served by my doing so? Well, now, what becomes of this option, if any irresponsible party may step in and manufacture my device on no royalty at all—for many patentees are unable to incur the expense of a patent suit, and with the further assurance that, in the event of prosecution, the measure of compensation is the ordinary license fee?

Gentlemen who concede my exclusive right to my invention in its integrity so long as I confine the manufacture to my own attic, and that even to the extent of the entire benefits, usually manifold the amount of an ordinary license fee, will scarcely allege that the interests of the community are subserved by such a narrow policy. But does not the proposed rule offer a premium for just such a policy?

Gentlemen call this a Statute of Repose. Truly, of repose with a vengeance—the REPOSE OF DEATH!

GEO. H. KNIGHT

Cincinnati, January 23, 1879.

AMERICAN INDUSTRIES.—No. 5.

THE MANUFACTURE OF LUBRICENE.

One of the inevitable problems connected with the general introduction of machinery is that of proper lubrication; this is second only to correctness of design and good workmanship in the machinery itself. Manufacturers and users of machinery well know how difficult it is to cope with this problem. It is perhaps simple enough to lubricate surfaces so that friction is minimized; but there are other elements in the problem, which are quite as important as this, among which we mention the matter of economy, the time consumed in applying the lubricant, and the effect of the lubricant on the surface to which it is applied.

These points, although apparently quite simple, are really complex and have recently commanded a great deal of attention in the mechanical world; so much indeed that it has been made the subject of the most delicate tests known in mechanics.

Oils for lubricating purposes are generally comprised in three classes, viz.: vegetable oils, animal oils, and mineral oils.

Among the vegetable oils, olive oil holds without dispute the first place; it has the great advantage that it can be purified without the assistance of mineral acids, and thus attains a higher value, which cannot be approached by other oils of vegetable origin. Next to olive oil come the oils extracted from sesame, sometimes called "gingelly oil;" from ground nuts, which, to a certain extent, can also be purified without acids. Colza and cotton-seed oils follow at a long distance; they must needs be purified by acids, which free them from the pectic and azotic matters which they contain in considerable quantities.

Unfortunately, this necessary treatment with, say, sulphuric acid, while it bleaches the oil, also alters materially its composition, predisposing it to easy decomposition. Besides, if the proper proportions of acid are not carefully employed, fatty acids are produced, which, dissolving in the oil, are detrimental to its application as a lubricant.

The second class comprises the oils and greases derived from animal substances. They are used for the finest machinery, for which they are specially valuable, and where the quantity is so small that the price is no consideration. They must all be much refined, either to remove the free fatty acids which sometimes are present in comparatively very great amounts, or other animal matters which very often accompany them in solution, which, not being wanted, are impurities. To this class belong the lard and neat's-foot oils, pressed cold, and purified with salts of lead; also, spermaceti and others. The lower qualities of these oils are sometimes used in place of vegetable oils, as not being more expensive, but their price is kept down by deficient rectification, and as thus they are apt to oxidize soon and to desiccate, they can never be used with any advantage for ordinary machinery.

Well purified animal oils are also applicable to the lubrication of heavy machinery where the bearing surfaces are large and the weight great.

Mineral oils form the third class. They are not suitable for the heaviest class of machinery, on account of their want of cohesion, and generally high degree of inflammability.

Olive oil thus stands first as a lubricant. It has of late been much displaced by mineral oils, on account of its price, but it is a question whether, all things considered, it is not cheaper in the end. Of course it must, like other vegetable oils, be purified, and is more valuable the better this has been done. These purifying processes deprive it not only of the fatty acid, but also of its odor; but, as other vegetable oils are equally neutralized and bleached, these qualities can be no guide to its lubricating properties.

Crude vegetable oils contain, as a rule, from one to six per cent. of impurities, which depreciate their efficiency, and which must be removed by the application of acids. The amount of acid left in the oil is of the highest importance, for it is this acid which attacks the lubricated surfaces and wears them away.

In 1877, the American Institute, by a series of exhaustive tests of various lubricants, conducted by Prof. R. H. Thurston, of the Stevens Institute of Technology, determined the qualities of a great number of lubricants, and as a final result, after several months of investigation, awarded the medal of superiority to Mr. R. J. Chard, of this city, for the product now widely known as lubricene, which is said to combine the desirable qualities of the lubricants above enumerated, while it is without their objectionable features.

Prior to this, in 1875 Mr. Chard received a silver medal from the American Institute, and he received a medal for his products at the Centennial.

In view of the great importance of this subject, and of the merits of this particular lubricant, we describe, as far as the manufacturer will permit, the process of making lubricene.

The works and office, which are illustrated on our title page, are located at 134 Maiden Lane, in this city. Here three principal grades of lubricants are made, which are known as Lubricene, Cylinder oil, and Engine oil. The materials used in the manufacture of these lubricants are tested and properly compounded by sample in the laboratory. The ingredients, which are common well known substances, consist of animal fats and oils, mineral and vegetable oils, caoutchouc, and an alkali.

The fat after being carefully refined is put in a melted state into the caldron seen at the upper left hand corner of the engraving; the oils, caoutchouc, and alkali are added, the whole is then subjected to a rather high but well regulated temperature for two hours, after which it is drawn off into pans, and conveyed to the cooling room shown at the lower left hand corner of the engraving. In the winter the natural temperature of the air will cool the compound with sufficient rapidity, but in warm weather the temperature is reduced by artificial means; the tables upon which the pans rest being hollow, a current of cool water is permitted to flow through. When the compound attains the required temperature, it is conveyed to the packing room, where it is removed from the pans and packed into cans or kegs, each package being weighed to insure a proper measurement of the lubricene.

The cans or pails for containing the lubricene are made in great numbers by approved machinery in the shop shown at the lower right hand corner of the engraving.

Cylinder oil, which is composed of mineral and animal oils and an alkali, is compounded in the caldron in the middle ground at the top, and is drawn directly from the caldron into barrels for shipment.

Engine oil is compounded in the larger caldron at the right. It consists of animal oil with the addition of a percentage of mineral oil.

The secret of the success of these lubricants lies in the care exercised in their manufacture, and in the peculiar combination of materials, whereby homogeneity and smoothness are secured. The engine oil is compounded with a view to the neutralization of the fatty acids, which, in the case of oils and fats not treated in this manner, are freed by the action of steam and work havoc with the valves, valve seats, piston, and cylinder.

Beside economy in the lubricant itself, Mr. Chard claims a great saving in the matter of time, as, when these lubricants are applied with a peculiar cup of his own manufacture, the friction surfaces are continuously lubricated without waste, and without the necessity of constant attention.

We are informed that these lubricants have been adopted by some of the principal railroads in the country, and that it is growing in favor wherever it is introduced.

A FLOATING ELECTRIC LIGHT.

M. de Lussex, of Belgium, has lately tried with success an electrically lighted beacon or buoy, for coast and harbor purposes, made as follows: The lantern of the buoy is provided with a Rhumkorff coil, a vacuum tube or globe. A battery composed of large zinc and carbon plates placed close together are carried on the lower part of the buoy in contact with the sea water. Wires from this battery lead to the primary circuit of the induction coil, and the secondary electric discharges appear in the vacuum tube. This apparatus yields a constant electrical light as long as the battery lasts. It is not very strong, only becomes visible at night; but the plan, it is believed, may be made useful.

Is the Subdivision of Electric Light a Fallacy?

Mr. W. H. Preece, the eminent electrician and manager of the English postal telegraph system, contributes a paper to the *Philosophical Magazine*, in which he points out that the theory of the electric light cannot be brought absolutely within the domain of quantitative mathematics, for the reason that we do not yet know the exact relationship existing between the production of heat and the emission of light with a given current. We, however, know sufficient to predicate that what is true for the production of heat is equally true for the production of light beyond certain limits. He shows that the full effect of a current can only be obtained by one lamp on a short circuit, and that when we add to the lamps by inserting more of them on the same circuit, or on a circuit so that the current is subdivided, the light emitted by each lamp is diminished in the one case by the square, and in the other case by the cube, of the number inserted. With dynamo-electric machines there is a limit which has to be reached before this law begins to act, and it is this fact that, in Mr. Preece's opinion, has led so many sanguine experimenters to anticipate the ultimate possibility of extensive subdivision of the light—a possibility which he considers hopeless, and which experiment has hitherto proved to be fallacious.

New Inventions.

An improvement in Microscopes has been patented by Mr. Ernst Gundlach, of Rochester, N. Y This invention relates to improvements in microscopes, by which the tube is not only adjusted parallel to the supporting post, but always retained during the adjustment at equal distance therefrom, so that the position of the optical axis is not changed, but kept in line with the axis of the illuminating apparatus. The stage and object carrier are so arranged that an improved oblique illumination is permissible. The mirror and sub-stage are suspended in a novel manner.

Mr. Joseph Vacaro, of Bayou Sara, La., has patented an improved iron fence post, which is so constructed that any or all of the fence panels may be repaired or renewed without disturbing the posts.

An improved Portable Fence has been patented by Mr. C. D. A. Curry, or Stonewall, Va. This is a cheap, light, and easily arranged fence that can be readily transported from one place to another, and set up and accommodated to the inequalities of the ground.

Mr. Robert Dillon, Jr., of New York city, has patented a simple and effective Device for Attachment to the rear part of the lower ends of Pantaloons Legs in wet weather, to prevent the mud from being rubbed upon the pantaloons legs and upon the rear parts of the boots in walking.

Mr. Solomon Zemansky, of Brooklyn, N. Y., has patented an ornamental and convenient Box adapted for holding or displaying small articles of sale, and forming a convenient package for sale, and of itself an article of ornament.

Mr. Richard E. Rye, of Mount Pleasant, Mich., has devised an improvement in the class of Clothes Driers having a revolving part, which is vertically adjustable on the pivot post, and to which a cord is applied for suspending the clothes.

Mr. Napoleon W. Williames, of Philadelphia, Pa has patented an improved Process for Bronzing Metals, which consists in first coating the object with paraffine varnish to close up the holes, make a smooth surface, and stop oxidation, then covering the varnished surface with plumbago, to render it conductive, and finally depositing upon said surface of plumbago a coating of the required metal by galvanic action.

Mr. Thomas F. Longaker, of West Philadelphia, Pa., has patented an improved device for Attachment to Faucets for measuring liquids as they are drawn from a can or cask. It is simple, convenient, and accurate, and will prevent the liquid from being spilled and will not allow its odor to escape into the room.

Mr. George H. Hayden, of Boston, Mass., has patented an improved Cigarette Machine, in which the paper tube is formed, the tobacco packed therein, the ends of the tube turned down, and the cigarette completely finished by one passage through the machine.

Mr. William J. Doyle, of Chicago, Ill., has patented an improved Spool Holder, in which an ornamental base supports a vertical rod fitted to revolve upon the base, and the rod carries three leaves, that are each formed with a series of horizontally projecting points, which sustain the spools by means of nipples formed on the points. At the upper end of the rod is an urn formed with barbs for retaining a pincushion. The parts are made of sheet metal.

Messrs. Francis W. Allen & Daniel Crane, of Saginaw, Mich., have patented an improved tool which they call "The Inspector's Pencil," It is especially designed for inspectors' use for marking rough lumber.

An improvement in Lamp Burners has been patented by Mr. Joseph A. Talpey, of Somerville, Mass. This invention consists in providing the flat wick tube of an oil lamp with a taper or small wick tube, which is so placed in the flat tube as to divide it into two equal parts. When the lamp is to be used for the night, the larger wicks are turned down, the taper wick continuing then to burn and to keep up a small flame for the night.

Mr. William Haas, of Lyndon, Kansas, has patented an improved Washing Machine which is an improvement on the machine for which letters patent No. 203,031 were granted to the same inventor April 30, 1878.

A NOVEL RAILWAY TRACK.

The problem of reducing the noise and vibration of the elevated railroads, which has engaged the attention of scientific experts for many months past, seems to be finally solved by an ingenious and very simple invention, just patented, and is being brought to the attention of capitalists as well as the general public.

The inventor introduces beneath each rail a series of longitudinal springs, each composed of six layers of Georgia pine or white ash, 9 inches wide and 1 inch in thickness. There is a central support, or safety check, from which the lower layers of the spring diverge at an upward angle until their ends rest upon the ties at the end of the rail. A curved spring, composed of four or more layers of pine or ash, passes over the top of the central safety check, with its ends resting midway upon the lower spring. The rail, 30 feet long, is laid over all, its center only touching the surface of the upper curved spring. By this combination the spring is constantly yielding and recovering, or readjusting itself, as the cars pass over it. The great length of the arc described by the curve of the central spring, it is claimed, makes the vibration of the cars so slight as to be quite imperceptible.

The safety check or support, immediately under the center of the curved spring, allows a certain amount of pressure upon the spring and no more, thus preventing too great a strain on the spring should the road be used for the conveyance of heavy freight. As there are but two ties and the safety check in every section of 30 feet, light and ventilation are secured to the ground floors of stores and dwellings on the line of the road; and in winter less snow and ice accumulate upon the track. The inclination of the spring also gives opportunity for the construction of gutters or troughs to conduct the oil-drippings, rain, and melted snow into the pillars supporting the structure, and thence to the ground, thus preventing another nuisance of which pedestrians complain.

The absence of the immense number of ties now in use on the present elevated railroads, and which act as a sounding board, will in itself be a large saving of expense and will reduce the noise and vibration to a minimum.

The material used in the combination is not affected by temperature or moisture. It has been discovered by careful experiment that wood is greatly superior to iron, steel, or rubber for this purpose. Georgia pine is regarded as the best, when well covered with raw linseed oil; and the next best is white mountain ash.

This invention is applicable not only to the elevated roads, but also to the construction of suspension bridges, all kinds of railroad bridges, trestlework over marshes, low ground, and elevations, and other works requiring a combination of solidity and smoothness.

Fig. 1

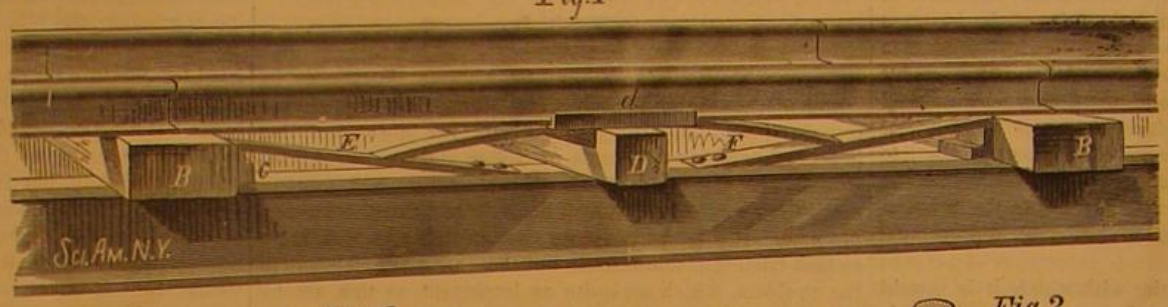


Fig. 2

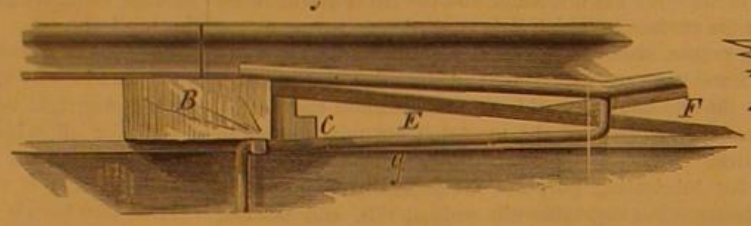
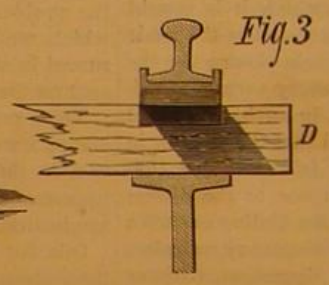


Fig. 3



HALL'S IMPROVEMENT IN RAILWAY TRACKS.

The two rails forming the track are secured at the ends to the crossties, B, which rest on the girders, C, and which in turn are supported by posts. The semi-elliptic wooden spring, F, has attached to it a chair for supporting the middle of the rail, and its ends are sustained by wooden springs, E, that rest upon blocks, *c*, and are riveted to the girders. A beam, D, is laid across the girders under the middle of the rails, and is rabbeted to receive a rubber cushion, which supports the center of the spring, F, when it is subjected to undue pressure.

To prevent oil or water dripping from the rail to the ground a gutter, shown in Fig. 3, is provided. For further information address Wm. H. Hall, 111 Nassau street, New York city.

THE Thames Embankment, London, is now lighted by electric lamps.

AN IMPROVED TYPE WRITER.

In this machine the type, D, are carried by the table, A, which is rotated by a bevel pinion meshing into the wheel, B, attached to its periphery. The pinion is turned by the wheel shown at the rear of the machine, and when the required letter comes under the follower, *d*, the latter is depressed, forcing the type downward until it strikes the paper on the platform over which the machine travels, being moved forward by the pinions, G, which mesh into racks in the base.

When the follower is relieved of pressure, are tractile spring returns the type to its place in the table, and the follower regains its normal position.

The type are inked by the rollers, E, which are supported by a crosspiece attached to the standard, A'. These rollers receive their ink from the under surface of the table, A, and apply it to the faces of the type as the table is revolved. When it is desirable to move the table without inking the type the standard, A', is pressed downward so as to remove the ink rollers from the under face of the table, A.

The upper surface of the wheel, B, is lettered to correspond with the type carried by the table.

This machine is so compact that it may be carried in the pocket, and it possesses the advantage of great simplicity.

This invention was recently patented by Mr. Jean A. Hitter, Jr., of St. Martinsville, La., from whom further information may be obtained.

Fig. 1

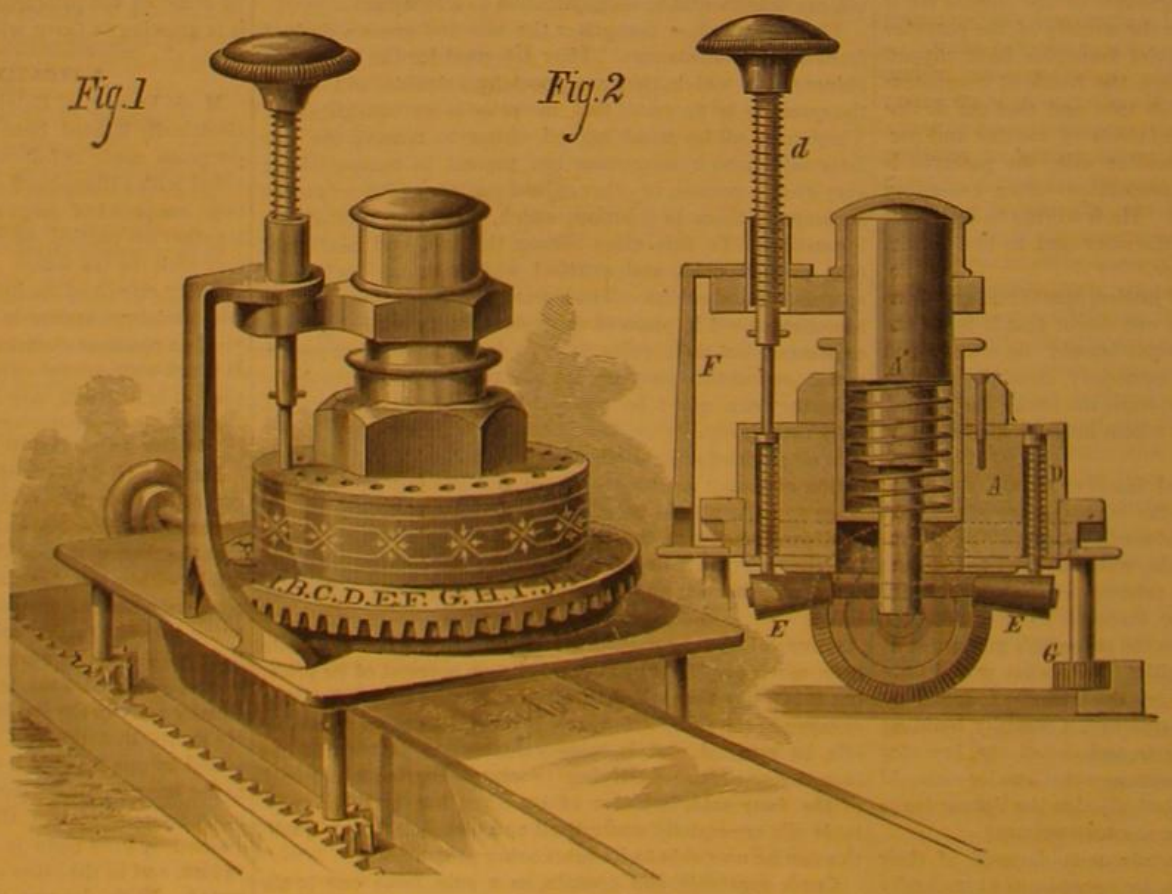


Fig. 2

HITTER'S TYPE WRITER.

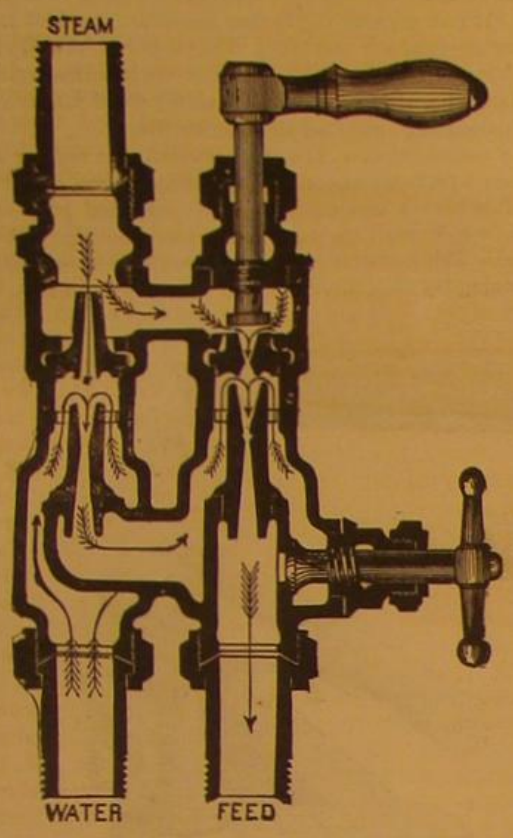
THE cabinet work of the new Cunard steamer Gallia is to be in the Japanese style, and is now being manufactured in Japan. It is claimed that she will be the model steamer of the Atlantic ocean. Her estimated cost is $850,000. It is expected that her first trip will be made in July.

THE HANCOCK INSPIRATOR

One of the recent contributions to hydraulic engineering—and one which promises to be of great value to all users of steam—is the "inspirator," so called, an invention patented by John T Hancock, of Boston.

The inspirator is a compound steam jet apparatus, for raising and forcing water, designed to do the work ordinarily accomplished by pumps and injectors, with greater economy and regularity than has yet been possible with these machines.

The Hancock inspirator consists of a combination of two sets of apparatus, contained each in a separate chamber, one being employed for lifting water from a well or other



LONGITUDINAL SECTION OF HANCOCK INSPIRATOR.

source of supply, and conveying the same to the second apparatus, which transmits it to the boiler, or forces it against a greater pressure than that of the impelling steam. The lifting apparatus raises water more than 25 feet, and can be used independently of the forcing apparatus, for raising water to a moderate height, thus supplying the place of a suction pump or a steam jet pump.

The sectional view shows the simplicity of construction which characterizes the inspirator. The illustration represents the form used on stationary boilers. Steam enters through the pipe marked STEAM, the water from the well is drawn through the pipe marked WATER, and the condensed steam and water issue through the pipe marked FEED.

The apparatus on the left in the engraving is for lifting, that on the right for forcing. No adjustment is necessary for varying steam pressures, but the quantity and temperature of the water can be varied by increasing or reducing the quantity of steam or water supply.

For locomotives the form of the inspirator is somewhat modified, but the principle is the same.

The continuity of the jet of steam and water never being broken by the jar of a locomotive passing over switches and frogs, the inspirator is a more reliable feeder than a pump. Is not appreciably affected by wear, nor is its action liable to be stopped by sediment in the water.

On locomotives the lifting apparatus serves an important purpose as a regulating device, making this instrument more sure and positive in its action.

We are informed that although the inspirator has been but a comparatively short time before the public, a large number of them (over 4,000) are now use, and that they have thus far given general satisfaction.

Many advantages over a pump are claimed for it as it needs no packing, it is not noisy, and it can be adjusted to feed the boiler continuously, which is acknowledged by all engineers to be the best and most economical method of feeding.

The inspirator is manufactured by the Hancock Inspirator Company, office 52 Central Wharf, Boston, Mass.

Houses for Workingmen.

The Chicago *Tribune* mentions a building scheme which the Union Mutual Life Insurance Company propose to carry out upon some of their vacant property in the southern part of Chicago. The plans are the work of Messrs. Wheelock & Clay. The problem of building houses in a continuous block, and yet having, to a great degree, the appearance of isolation, is accomplished by a double court in front between each pair of houses; this feature, besides giving ample light and ventilation to all inner rooms, affords the architects an opportunity of displaying considerable variety in the treatment of their designs, not only of the exterior, but of the interior. The courts in the rear are quite similar to those in front, leaving only a short line of party wall between the two houses. As the courts are thus in pairs, they give double the amount of light, and yet the windows are so arranged that it is impossible to see from one into any other. Also, by an ingenious arrangement of the staircase in each alternate house, the front entrances are entirely separate and come in regular succession.

These houses are to be of two stories, with cellar and attic; in the cellar are the laundry, furnace room, storerooms, etc. Each house has a parlor, hall, and staircase hall, dining room, kitchen, etc., upon the first floor; part of them have a library in addition, all well lighted and ventilated. The main stairs are at the rear of the parlor, and not exposed to view upon entering or leaving the entrance halls, which are to have tile floors, open and unobstructed.

A NEW CHECK ROW CORN PLANTER AND DRILL.

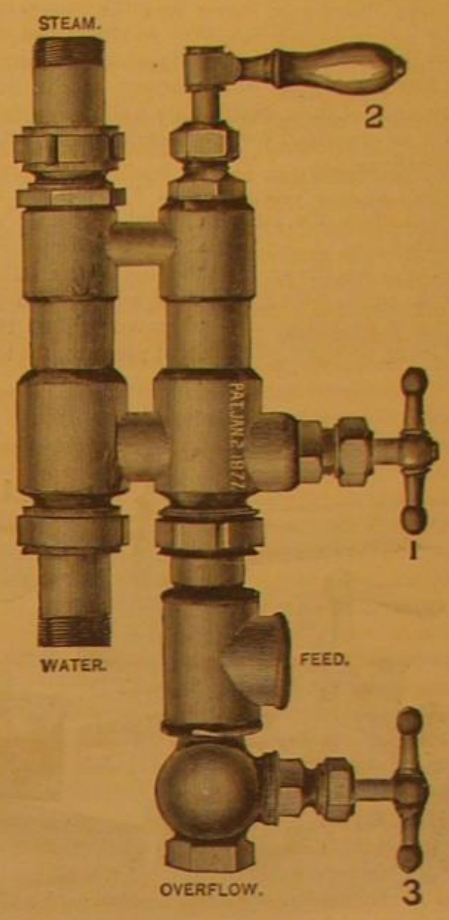
The accompanying engraving shows a new agricultural implement recently patented by Mr. Osman C. Du Souchet, of Alexandria, Mo. It is designed for planting corn in accurate check rows, and it is constructed so that all parts of its mechanism are under the control of the driver. The working parts of the machine are supported by wheels having a very broad tread, and by hollow standards, A, connected with the runners or plows, B. Seed boxes, S, are mounted on a frame that is jointed to another frame connected directly with the axle, and the seed valves are operated by a common bar that is connected with a lever, G, which is actuated by two cam lugs, F, placed on opposite sides of the axle. These lugs strike opposite sides of the beveled end of the lever, G, in alternation, and thus impart to the lever and to the seed valves a reciprocating motion. A section of the axle bearing the cam lugs is shown in Fig. 2.

The frame that carries the runners and seed boxes may be raised or lowered by moving the lever, J, and it may be maintained in a raised position by means of a latch, shown at the rear of the seat. The lever, C, is supported by a slide, which is moved by the lever, L, so as to throw the lever into and out of engagement with the cam lugs on the axle.

At one side of the machine there is upon the axle a spur wheel, which may be turned by the lever at the left of the seat whenever it is desired to change the relative position of the cam lugs on the axle. To admit of this adjustment the drive wheels are connected with the axle by pawls and ratchets. As the machine moves forward the runner, B, makes a furrow, into which the seed is dropped through the hollow standards, A. The wheels, having a wide tread, follow the runners and cover the seed.

California Raisins.

About four years ago Mr. J. P. Whitney, a gentleman widely known in California in connection with wool growing and grain raising on a large scale, began planting vines of the "Muscat of Alexandria" variety of white grapes, with a view to demonstrating that raisins can be made in America of as good a quality as those from abroad. Since that time about 200,000 vines have been planted. As the first result of Mr Whitney's experiment two car loads of 20,000 lbs. each of California-made raisins were recently sent East, one car load coming to New York city, and the other going to Boston. The New York *Times* reports that in both cities they have been received with favor, selling equally well with the best imported Malaga raisins, with which they compare favorably as to size, color, skin, stones, and flavor—the latter being the most essential quality. The United States is the greatest raisin-consuming country in the world, and uses annually more raisins than the whole of Europe. The market is mainly supplied from Spain, the raisins known as "Ma-



HANCOCK INSPIRATOR.

lagas" being considered the best. They come from a comparatively narrow strip of country in the south of Spain, which has hitherto been regarded as surpassing all other regions for raisins of that character. The annual yield of Malaga grapes averages 2,250,000 boxes of 20 lbs. each. It sometimes reaches 2,500,000 boxes, and last season about 2,000,000 boxes were marketed. Of this enormous yield the United States takes fully one half, on which it pays a duty—as on all other raisins—of 2½ cents per lb.

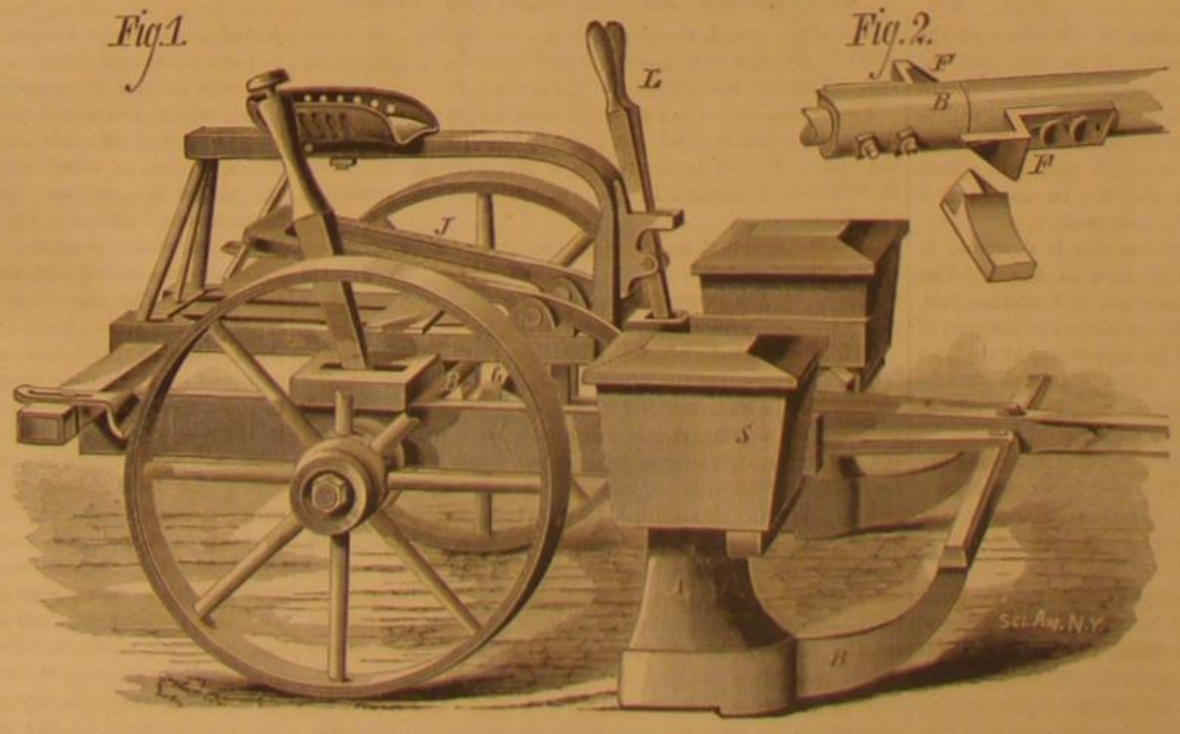
The American raisins are made from a white grape, the "Muscat of Alexandria," to the raising of which the soil and climate of a large portion of California are well adapted. The vine begins to bear somewhat in the second year, although the full bearing capacity is not developed until it is five years old, and continues to bear for about half a century, and sometimes for 75 years. In the cultivation of raisin grapes American grape growers have little to learn from Spain, but in the curing and packing of the raisins a lack of experience is still felt.

The raisins are not cured by any artificial process, however, but in a comparatively simple manner. The grapes are laid on gravel beds, and are exposed to the sun for ten or twelve days in August or September, when they are ready for packing, having turned from white to brown, and gradually changed to the familiar dark color of the raisins of commerce. The white sugar which is generally found attached to the raisins sold in the market is entirely a natural product of the grape, and comes on with age, first appearing, as a rule, when the raisins are about two years old. The packing, however, is an operation which requires great care. To properly pack a single 20 lb. box the entire time of one man is needed for a day and a half, so careful is the manipulation of the raisin bunches, while at least as much time is required to select and pick over the bunches before packing. Mr. Whitney believes, however, that raisins can be cured in California fully equal to the Malaga or any other raisin.

The chief difficulty with which the California raisin raiser will have to contend

Fig. 1.

Fig. 2.



DU SOUCHET'S CHECK ROW CORN PLANTER AND DRILL.

in the effort to compete with foreign raisins is the cost of labor. The Spanish vineyardists can get all the laborers they need for from 15 to 25 cents per day, while the California producers must pay at least $1 per day. The very much greater productiveness of the soil, however, will do much to offset this disadvantage.

AMATEUR MECHANICS.

CENTERING AND STEADYING.

To center a cylindrical piece of metal readily and accurately is a very simple matter when the workman is provided with tools especially designed for the purpose, and it is not difficult when an engine lathe or even an engine rest is available; but to do it easily and properly in an ordinary plain foot lathe may puzzle some of the amateur mechanicians.

Although some of these methods are well known they will nevertheless be described for the benefit of some who may require the information.

The method of centering shown in Fig. 1 is one of the most common where the lathe is provided with an engine rest. A forked tool, A, is clamped in the tool post in such a position that a line drawn from the point of the tail center will bisect the angle of the fork. A square pointed center, G, is inserted in the tail spindle and moved against the end of the rod being centered with a slight pressure, the tool, A, being at the same time moved forward by the screw of the engine rest until the rod turns smoothly in the fork and the square pointed center has found the center of the rod; the tail spindle is then moved forward until the cavity is sufficiently deep to permit of starting the center drill. The angle of square center, G, for very hard material, should be a little more obtuse than that shown in Fig. 4. In any case, it should be of good material and well tempered.

In Fig 2 is shown a centering tool which is designed to take the place of the engine rest and fork in Fig. 1. The part B is fitted in place of the ordinary tool rest, and the jaw, C, which has in it a V-shaped notch, is hinged to the part B at D. A screw, E, passes through the upper end of the part B, and bears against the jaw, C. After what has already been said in connection with the engine rest, the manner of using this contrivance will be readily understood.

In Fig. 3 the hand tool, F, is employed for steadying the shaft and bringing it to a center. This tool is bent to form a right-angled notch for receiving the shaft, and when in use it is supported by the tool rest after the manner of an ordinary hand turning tool.

Work that is too large to be readily centered in this manner is often centered approximately by means of the universal square, as shown in Fig. 5. A diametrical line is drawn along the tongue of the square, the work is then turned through a quarter of a revolution, and another line is drawn. The intersection of these lines will be the center, at least approximately.

This point may now be marked with a center punch, and the work may be tested in a lathe. If it is found to revolve truly on the centers it may be drilled, otherwise the center must be corrected with the center punch, and the work again tested in the lathe.

After centering by any of these methods, the center must be drilled and countersunk with a suitable tool, so that it will fit the lathe center, as shown in Fig. 6. The angle of the lathe centers should be sixty degrees. To insure uniformity in everything pertaining to the centers, the center gauge, shown in Fig. 7, should be used for getting the required angle on the lathe centers and on the drills used in centering.

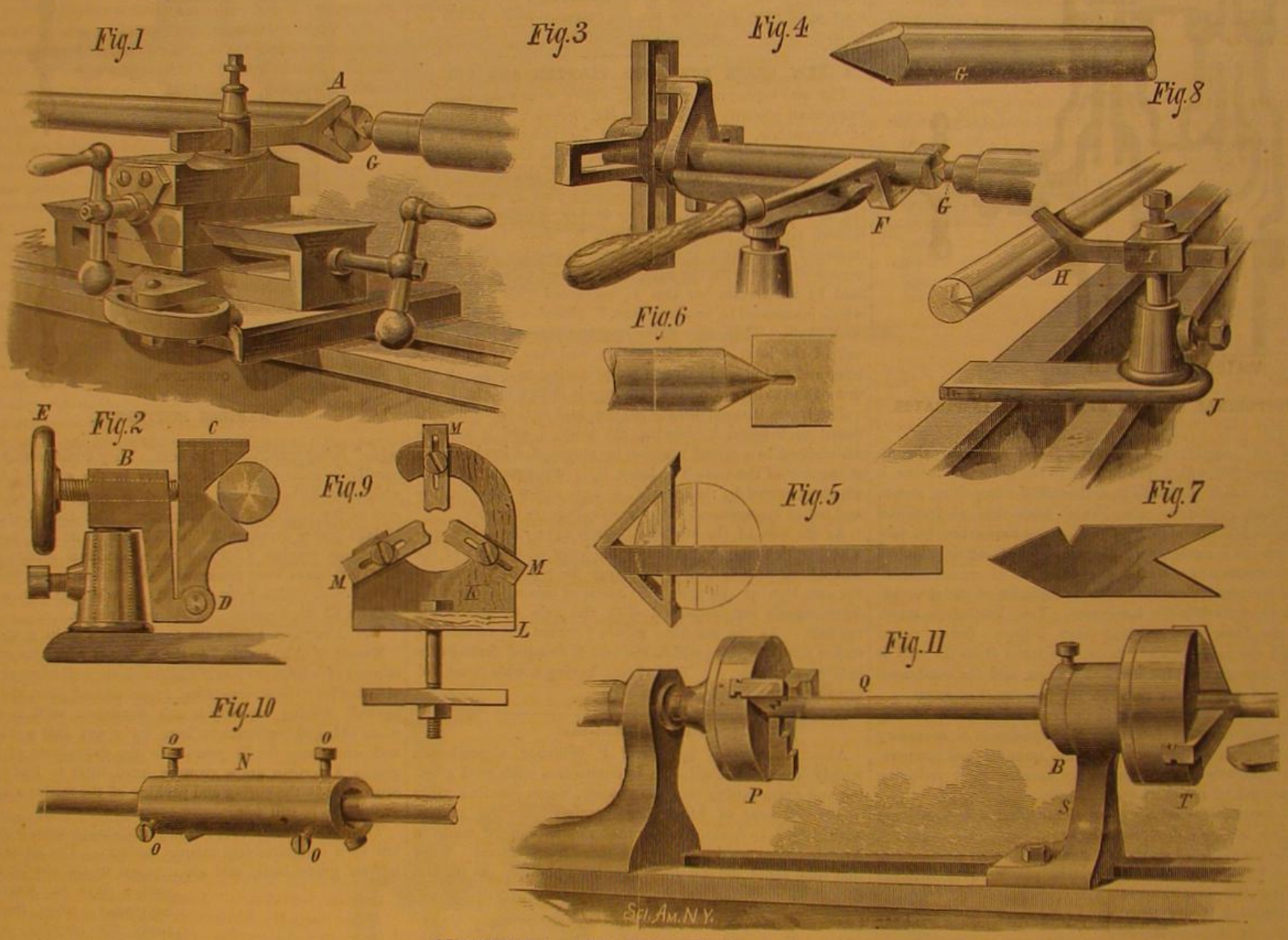
The matter of steadying long, slender rods while being turned in the lathe is often perplexing.

In some cases it may be done tolerably well in the manner illustrated in Fig. 8. The fork, H, is supported by the standard, I, which is inserted in the socket of the rest support, J. The device shown in Fig. 2, may be used in a similar way.

Fig. 9, represents a steady rest, the construction of which will hardly need explanation. For light work it may be made of wood; the upright being secured to the cross piece, L, which rests upon the lathe bed. The slotted pieces, M, are adjustable lengthwise to accommodate the size and position of the shaft. When it is required to support a bar which is not round, the sleeve, N, shown in Fig. 10, is employed. It slips over the shaft and revolves in the steady rest. The bar is centered by the screws, O.

The device shown in Fig. 11, is used where a hollow mandrel lathe is not at hand. A piece of gas pipe, Q, is held by the chuck, P, and is secured by a set screw in the sleeve, B, which is journaled in the standard, S, and carries the chuck, T.

This arrangement may also be employed for turning the ends of long rods where it is not desirable to put them regularly on the centers of the lathe. M.



CENTERING AND STEADYING TOOLS.

THE MANUFACTURE OF SEWING AND FLOSS SILK.

Twenty years ago the manufacture of silk goods in the United States was confined to so few firms and limited to such small amounts, that it was hardly to be classed among the industries of the country. Since about 1860 we have been brought into closer commercial relations with China and Japan, and other silk producing countries of the world, which has given silk manufacture a powerful impetus. American manufacturers discovered that their goods could rival those of European production in quality as well as price, and consumers found it to their advantage to patronize the home industry. Statistics could be given which would show the immense increase of American silk stuffs and the corresponding decrease of imported silks, but as the purpose of this article is to describe the process of manufacturing, they must be omitted.

The raw silk is imported in bales, each containing twenty bundles or "books." These weigh from five to eight pounds each, and are made up of a number of skeins. They are broken open and the skeins assorted according to the fineness of fiber; this is done entirely by touch and very rapidly. Ordinary grades of silk contain three sizes; the finer qualities only two. The fiber is exceedingly fine, translucent, of a white or yellow color, and very tough.

After the skeins are sorted they are soaked for three hours in a tank of soap and hot water, to remove the natural gum and the adulterating substances which are added to increase the weight. This adulteration is sometimes equal to one fourth of the entire weight. The silk is dried in a centrifugal drier without rinsing, as it is found that the presence of a small quantity of soap facilitates the handling of the material. It now goes to the reeling machine. Each of these contains thirty spools and reels. The skeins are placed upon the latter and rapidly spooled. Each machine has a single attendant who, after long practice, shows wonderful dexterity in untangling and tying the delicate fiber.

To a casual observer, raw silk appears to be regular and to possess a perfectly smooth surface; this is, however, not the case; it is uneven and contains many scales and projecting lumps, which must be removed before the silk can be twisted. This important process of cleaning consists simply in running the fiber through a pair of sharp and nicely adjusted semicircular knives. It is now ready to be combined to form the thread. Three or more fibers, the number varying with the size of thread desired, are reeled together on a spool, which, in another machine, is rapidly revolved as the silk is wound off; this process twists it loosely together. The operation of combining and twisting is repeated, and the thread is now made, though several processes are still necessary to finish it. The first of these is stretching, an operation which elongates and tightens the twist, at the same time squeezing out the soap, which had been left till this stage. The stretching machine consists of a pair of large wooden rolls placed over a tank of pure water. The silk is wet and reeled from one to the other.

It now undergoes the most delicate operation in the entire process of manufacture—that of dyeing. Those who delight in artistically combining the soft tints of floss silk into beautiful embroideries, little think of the wonderful skill and care which is necessary to produce those tints. Primary colors must be combined, the most delicate shades must be perfectly matched, and the faultless gradations of color, which blend so harmoniously in the same skein, must be most carefully chosen with reference to the general effect. The beautiful anilines are largely used, and the skeins of silk, hung upon long wooden rods, are suspended in the hot dye. A large amount of the liquid is next extracted in the centrifugal drier, and the remainder in the drying room. The dye contained in the thread makes it stiff and harsh, and to restore its natural softness and pliability it must be "wrung." A sturdy operative hangs the skein upon a

strong projecting bar of lignum vitæ, inserts a similar bar and twists the thread, turning it until all parts have been subjected to the strain.

After picking out the loose bits it is wound on large spools, and is now ready for the spooling room. The spool, already labeled by a method which will be described hereafter, is placed on a spindle, the thread wound on a few turns, and it is then set in rapid revolution. As the silk runs on the spool it passes through a guide in the end of a sliding arm, which is moved regularly back and forth by a revolving screw; this screw has the same pitch as the tightly wound thread upon the spool, due allowance being made for the difference in speeds, and the silk is consequently run on with unfailing accuracy and smoothness. When filled the spool is stopped and the thread cut and fastened. The entire operation takes but a few seconds. The spools are now weighed separately, and also in lots of one dozen, in order to correct any inaccuracy in amount. All that remains is to place them in neat paper boxes, and they are ready for shipping.

The larger part of the spools used are labeled by stamping directly on their ends, in one or more colors. This, besides causing a large saving in expense over the paper label, insures the preservation of the label. The spools are fed between a pair of inked metal rolls with reversed dies upon them, which print the design a sixty-fourth of an inch below the surface. When two colors are used a second pair of rolls become necessary.

Galileo's Museum, Florence.

In the January number of the *Pharmacist and Chemist*, published by the Chicago College of Pharmacy, we find an interesting letter from H. D. Garrison, Florence, Italy, describing incidents in the life of Galileo, which we are sure will be read with interest by many, and by those especially who have visited Florence and Pisa, which are the central cities of the physical sciences of Europe, and have seen the trophies of Galileo so carefully preserved there, and which the writer describes in connection with incidents in the life of their author. The extracts we give cannot help but revive pleasant memories. It will be remembered that not only Galileo, but Leonardo da Vinci, the philosopher, artist, and statesman, the renowned Torricelli, Michael Angelo, the painter, sculptor, architect, civil and military engineer, and diplomatist, and the powerful Medici family, honored Florence by making it the arena of their most memorable exploits in scientific research. Truly, says the writer, this is classic ground. Having been the home of Galileo during the principal part of his eventful life, this city is possessed of surpassing interest to those scientifically inclined. This great philosopher was born in a very humble, not to say hard looking, two story stone house, situated on a little crooked street in the old city of Pisa, located about sixty-five miles west of here, near the mouth of the Arno.

When young Galileo attended church, instead of looking at the saints and crucifixes or even at the pretty girls, he watched the swinging chandelier and reinvented the pendulum clock. No wonder he watched this chandelier, for it is a remarkable one, from the fact that the rope by which it is suspended is about one hundred feet long. I gave the chandelier a push, as any rather tall person may do, and during my stay in the cathedral it continued to vibrate without apparent retardation. He observed, what few will now admit without the demonstration, that the vibrations of a pendulum, whether large or small, are performed in equal times. While quite young, Galileo arrived at the conclusion that large and small bodies fall with equal velocity. To the learned men of Pisa, chiefly priests, this doctrine appeared extremely absurd. To test it, an experiment was performed by dropping bodies of different sizes from the famous leaning tower, 180 feet high. To the utter astonishment and discomfiture of Galileo's opponents, the bodies, large and small, projected simultaneously, kept close company until at the same instant all reached the earth. On account of these experiments Galileo was compelled to leave Pisa, and took refuge in the rival city, Florence.

At the latter city, called throughout Italy "Firenze," Galileo, quite unmolested, busied himself in the study of mathematics, physics, and chemistry until the year 1610, when, having heard that a Dutchman, Lippershey, had constructed a telescope, he, without having seen it, contrived and manufactured one for himself of such power that he was enabled to count forty stars in the constellation of Pleiades, where before but seven had been seen. The mountains of the moon were discerned, the phases of Venus recognized, and the satellites of Jupiter discovered in quick succession. Thus, in a few months, the doctrine of Copernicus, then regarded as heretical in the highest degree, was completely confirmed. But the Church, then unused to reverses, and unskilled in explaining away scientific contradictions, saw no way to meet the issue successfully but by physical force. The priests were directed to oppose the doctrine, and did so at once from every pulpit in Florence. The arguments used by them generally ran about as follows:

All things were made for man, and nothing was made in vain. But the satellites of Jupiter, not being visible, are useless, and therefore do not exist. Galileo was promptly arrested on the charge, then a fearful indictment, of heresy. In vain did the old philosopher explain and beg them to look for themselves. His adversaries, well illustrating the adage that "none are so blind as those who will not see," would listen to nothing but renunciation and denial of the alleged discoveries, presenting at the same time the alternative of indefinite imprisonment, probably ending in death.

Remembering the fate of the beautiful Athenian woman, Hypatia, who was torn into shreds by the monks under St. Cyril at Alexandria, for teaching the heretical philosophy of Plato and mathematics; and remembering also the fate of poor Bruno, who but a little while before had been driven from England, Germany, and Switzerland, in succession, and who, having taken refuge in Venice, was there kept in solitary confinement six years, then removed to Rome and kept two years longer in a dungeon, and finally slowly burnt to death, so slowly that he begged for more wood, or any means to end his suffering—and all this for having simply *argued* in favor of the probability of the Copernican doctrine, Galileo, concluded, very wisely, to appease the wrath of the Inquisition by the required denial. The Vatican Council supplemented this trial by formally denouncing the Copernican theory of the universe as "false, and utterly at variance with the Holy Scriptures."

Several years later, under the reign of a new pope, whom Galileo thought more liberal and generous, he ventured again to publish his discoveries and opinions, and was again promptly arrested and tried by the Inquisition for heresy. Again a public denial was required as a condition for mitigating his sentence, and again Galileo consented to make it. This time, besides his denial before the pope and Inquisition, he was required to publicly renounce the doctrine and deny his discoveries before his friends in the Santa Croce Cathedral of Florence.

Lest his friends should not all attend and profit by his recantation, they were compelled to be present. Then on bended knee, after kissing the Bible, he solemnly pronounced himself a liar and dupe, but on departing, as tradition has it, whispered to one of his friends, "nevertheless it (the earth) moves." Not content with this the Church felt bound to inflict mild, exemplary punishment, and hence detained him as a prisoner for life. Although his prison was his own house at Arcetri, a few miles out of Florence, still he was not permitted to leave it, even to attend church or to secure medical advice at Florence, nor was he even permitted to see his friends until after he became blind, when this permission was graciously accorded him.

At his death he was refused burial in consecrated ground, and his right to make a will was disputed. Now, in the same old cathedral which witnessed his public recantation, stands an elegant marble tomb, erected to his memory by his favorite pupil, Giovanni, and ever and anon the priests declaim, in glittering generalities, of the wonderful support their doctrines received from astronomy!

In the Natural History Museum, a beautiful room called the "Tribuna de Galileo," covered by a dome elegantly frescoed with scenes illustrative of his checkered life, is devoted to the exhibition of a magnificent statue of the old philosopher, his telescope and other philosophical instruments.

The telescope is astonishingly small and simple. It consists of an ash-gray colored tube, about four feet nine inches long, by two inches in diameter. The object glass, now cracked and shown separately, mounted in brass, is about 1¼ inches in diameter. The eye-glass, apparently a simple plano-convex lens, about three quarters inch diameter, is still *in situ*, apparently mounted in a wax like cement. The whole instrument being in a locked glass case, placed in a niche about ten feet above the floor, I was unable to make more accurate measurements. By the side of the telescope is shown another instrument of similar form and size, with which he at a later period discovered the spots on the sun. He also invented several other instruments, as a goniometer, dynamometer, and various mathematical instruments. He also invented the compound microscope, the original instrument made by him being still preserved in the old stone tower situated on a hill overlooking the city of Florence and valley of the Arno river, where he made his celebrated discoveries in astronomy. This instrument consists of a wooden tube about eight inches long, having small convex lenses about one quarter inch diameter, for both object and eye glasses. These were mounted in hard wax. The eye-glass was capable of slight adjustment, by being set in a wooden cap, which was screwed upon the wooden tube. The stage was simply a slip of glass, but it was illuminated by a little mirror placed below it, precisely as may be seen in our cheap microscopes. I wanted very much to peep through the microscope, and also through the telescope, but saw no possible means of doing so. The tower used by Galileo was apparently an old castle or watch tower used by the Florentines in their perpetual wars with adjoining provinces, during the two or three preceding centuries. Near the top of the tower is a square room which Galileo used as his studio and laboratory. It is said to appear now just as when used by the great master, from which I judge that he was not very fastidious.

PATENTS are now printed and prepared for issue so that they may be mailed on the day of issue, thereby bringing the patentee into possession of his patent some two weeks earlier than under the old rule. Owing to this change, there will be no patent lists bearing date Dec. 24 and Dec. 31, 1878; the list following that of December 17th is that of Jan. 7, 1879, which appears in the present number of this journal.

WE are indebted to Mr. Lewis J. Miller, Clerk of the Albany, N. Y., Fire Department, for a copy of the annual report.

Correspondence.

Isolation by Gutta Percha.

To the Editor of the Scientific American:

With reference to the artice "Isolation by Gutta Percha," in No. 25 (December 21, 1878), a few words may not be out of place, though they come from a different quarter.

The writer of the article mentioned breaks a lance for the late lamented Paymaster U.S.A., Mr. Simpson, and exhibits undoubtedly great zeal for his protégé, but the facts hereafter to be stated will probably set at rest the doubts in regard to the priority of the invention, as far as Mr. Simpson is concerned.

"Gutta percha was first imported," our informant says, "from the East Indies into England in 1845." According to all available sources, the best of which shall be immediately named, the first importation of that article was effected by the assistant surgeon, Dr. Montgommerie (or Montgomery, as some have it), from Singapore, in 1843. *Vide* Moigno, "Traité de Télégraphie Electrique," 2d ed., Paris, 1852, p. 294; Du Moncel, "Exposé," 3d ed., 2, 456; *Dingler's Journal*, 97, 237; "The Atlantic Telegraph," London, 1866, p. 108; Poggendorff, *Annalen*, 74, 157. The *Mechanics' Magazine*, 1847, 46, 474, gives the name of the first importer of gutta percha as Joze d'Almerida, but agrees about the year with the rest of the authorities enumerated above.

Our informant further says "that the first publication in England regarding the isolating qualities of gutta percha was made in March, 1848, by Professor Faraday."

Now there is but a slight mistake in this, but a mistake it certainly is. In citing dates one should be scrupulously exact. That first publication took place on the 9th of February, 1848, full one year and a half after the discovery of the isolating qualities of gutta percha was made by a Prussian officer, who since is ranked among the first telegraph engineers of the age. Werner Siemens, then lieutenant of Prussian artillery, had been trying since the fall of 1846 to isolate subterranean wires by gutta percha. In the spring of 1847 he had succeeded so far as to be able to lay before the Board of Commissioners, convened for the purpose of establishing telegraph lines in Prussia, the project of isolating subterranean wires by gutta percha. The Commissioners, well aware of the advantages which subterranean lines presented over those of any other kind, did not hesitate to have two such lines laid, both of which were executed by Siemens in the summer of 1847.

The correctness of this statement may be ascertained by the perusal of the *Philosophical Magazine*, 3d series, 32, 165; of the *Journal of the Society of Telegraph Engineers*, vol. 5, London, 1876, p. 82; and of the *Telegraphic Journal*, 4, 106.

It appears from all this that when Mr. Simpson, in his application to the Patent Office, November 22d, 1847, claimed the isolation of telegraph wires by gutta percha as his invention, he was rather behindhand, and Mr. Siemens had had considerably the start of him.

It may as well be added that Mr. Siemens, together with his partner and co-operator, Mr. Halske, constructed, as early as 1847, the first press by the means of which the telegraph wires were enveloped by the gutta percha, the envelope not showing any longitudinal seam.

It is indeed surprising that Mr. Simpson's name is nowhere mentioned as having had anything to do with the isolation of wires by gutta percha, as it is a well known fact, even on this side of the Atlantic, that Samuel T. Armstrong established at Brooklyn, in the year 1847, a manufactory "of gutta percha for the isolation of telegraph wires," and that the experiment made in 1848 to lay a wire isolated by gutta percha through the Hudson river met with such a signal success that Armstrong, elated by that event, proposed the laying of a gutta percha cable between Europe and America. (Shaffner's "Telegraph Manual," p. 254.)

Where was Mr. Simpson at that time, and why did not he step forth and assert his rights?

We, therefore, cannot accede to our informant's opinion, that Mr. Simpson's rights have been impaired through a misconception of the duties of the Patent Commissioner, but are led to believe that the Patent Commissioner concerned was rather cautious about issuing a patent, and judiciously refused what, to the best of his knowledge and belief, he could not grant.

Even the favorable report of Congress, in 1862, "on the originality and novelty of Mr. Simpson's invention," and the patent granted him rather late in 1867, "as the originator of the first practical method to lay a telegraph line through the ocean," are couched in rather cautious terms; and as for the decision of the Circuit Court of New York, we must await what the Supreme Court will have to say about the case.

F. HENNICKE.

Reproduction of Eels.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 4th you state that "the mystery which has hitherto attended the propagation of eels has at last been cleared up by the discovery of ripe ovaries by Professor Baird."

In the "Medical Repository," of 1806, of which I have a copy, I find the following, given by Dr. Mitchill: "On the 5th of September, 1806, being on a shooting and fishing party with some friends at Flatland, on Long Island, one of the inhabitants brought from the adjoining bay a basket of uncommonly large salt water eels. He soon began to skin and gut them in our presence; the eels abounded with fat. . . . I examined about a dozen of the eels as they were displayed

before me; I found there were two white organs, which, to an incautious eye, would pass for fat These on a nearer inspection were the roes or ovaria, extending in two long leaves, or legs, from the anus on each side of the spine far toward the neck They were plentifully supplied with blood vessels, and contained numberless ova of a very minute size." Yours very respectfully,

R. K. TELLER.

OFFICE OF THE HANCOCK INSPIRATOR CO., BOSTON.

MESSRS. MUNN & CO.—Permit us again to say that in all our advertising experience we have had no such results from any and all other sources, as from our advertisement in your valuable journal.

Yours very truly,

J. E. BLAKEMORE, Treasurer.

Poisonous Colors.

According to the *Chemical Review*, energetic steps are being taken in Switzerland against the use of poisonous colors. The Governing Council of Zurich has prohibited the use of all coloring matters prepared from the compounds of the metals lead, arsenic, copper, chrome, zinc, antimony, bismuth, and mercury, for decorating articles of consumption or of clothing, or their materials; also paper for wrapping up chocolate, coffee, tea, chiccory, tobacco, and eatables in general; toys, covers and cushions of children's carriages, carpets, curtains and window blinds, lamp screens, wafers, and table services. Poisonous organic matters, such as gamboge, picric acid, the aniline colors, especially magenta, are not to be used for coloring articles of food or drink, such as confectionery, jams, sirups, wines, etc. The same rule applies to the phenol colors. Imported articles containing such poisons may not be sold.

AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE.

The accompanying engraving represents a road and farm locomotive and train of wagons lately built by Messrs. Aveling & Porter for the Kohala Sugar Company, of Kohala, Sandwich Islands, for hauling sugar cane, sugar, for thrashing, and for farm purposes generally. The engine is one of Messrs. Aveling & Porter's newest design. It is fitted with differential gearing and double speed gear varying from two to six miles an hour, and is provided with governors which can be used when the engine is employed in driving stationary machinery. Wrought iron side plate brackets are used for carrying the crank shaft, countershaft, and driving axle. This arrangement, which has been in use on Messrs. Aveling's engines since 1871, has proved of great value in strengthening those parts of a road locomotive most subjected to strain and wear when used on rough roads and on farm lands. The cylinder is steam-jacketed and lagged, and the boiler is made of "best best" plates, butt jointed, carried through flush from end to end; it is double riveted, and is lagged and felted and covered with plate iron and banded in locomotive style. Besides the primal use of the side plate brackets, Mr. Aveling has lately further utilized his invention as a groundwork for the better arrangement of the driving and double speed gear of his engines. The whole of the crank shaft and countershaft gearing is now arranged to work between (instead of outside) the wrought iron brackets, and the fly wheel is fixed close to the crank shaft bearings The pinions for the two speeds are keyed fast upon the crank shaft. The intermediate shaft is fixed, and the sliding sleeve, which carries the spur wheel and the fast and low speed pinions, revolves on it. The two crank shaft pinions are of the same size, and the intermediate spur wheel gears with one or the other as required. The advantages of this improvement are that it decreases the width of the locomotive, and avoids all overhanging gear, the side plate brackets serving as sides to a wrought box in which all gearing is placed immediately over the boiler.

This arrangement strengthens the whole structure.

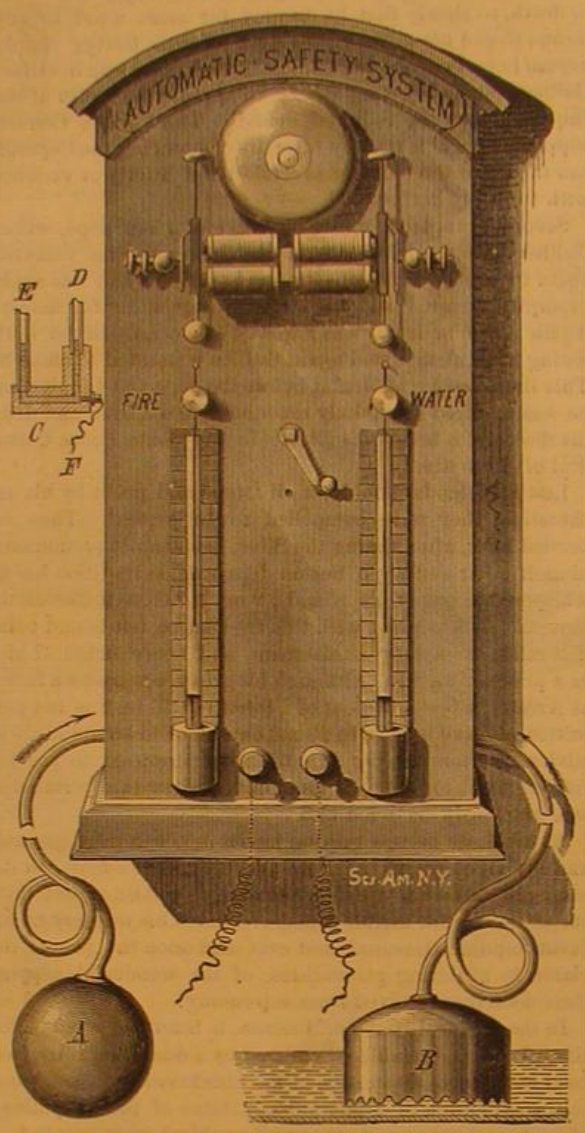
It is stated that this firm have built upwards of 1,600 road and farm locomotives, and number among their customers the governments of Great Britain, France, Russia, Austria, Hungary, Italy, and Mexico.

The British Government has purchased nearly one hundred of these locomotives, the Italian Government sixty-six, and the Russian Government bought them in large numbers at the beginning of the Russo Turkish war for the removal of ordnance and stores.

Mr. Wm. C. Oastler, 43 Exchange Place, New York city, is Messrs. Aveling & Porter's representative in the United States.

FIRE AND WATER INDICATOR.

We illustrate herewith a novel fire and water indicator and alarm, which is the invention of Col. A. Gerard. It was



AUTOMATIC SAFETY APPARATUS.

recently patented in this country, also in Canada and Europe, and is controlled by the Automatic Safety Company, of No. 40 Charles St., New Orleans, La.

The invention consists in a simple arrangement of devices, by means of which the presence of fire or undue heat or any change of temperature may be indicated or recorded at any distant point. The instrument illustrated is also designed for the detection of the presence of water in the holds of vessels.

The two vertical glass tubes shown below the alarm apparatus, and marked "Fire" and "Water," are similar in their construction. The glass tube, D, is inserted in a metallic piece, C, which extends through the support, and has a passage, E, that communicates, in the case of the fire alarm, with the receiver hollow sphere, A, and in case of the water alarm with the bell or receiver, B, which is inverted upon the floor or surface liable to the incursions of water. Needles enter the tops of the glass tubes and extend downward toward the mercury contained in the lower part of the tubes. These needles are in electrical communication with the alarm bell at the top of the apparatus, and the mercury is in communication with the battery wires, the whole being arranged so that the rising of the mercury beyond the prescribed distance in either tube will complete an electrical circuit and operate the alarm apparatus.

The hollow sphere, A, being placed in any distant apartment, a rise of temperature in the vicinity of the sphere expands the air contained by it, creating a pressure which displaces the mercury in the tubes of the apparatus and gives the alarm. Similarly, when the water rises upon the surface on which rests the bell, B, the air in the bell is displaced, and the mercury in the tube marked "water" rises and completes the electrical circuit and gives the alarm.

The necessity of an invention that will with certainty report leakages or fires on shipboard will be recognized by any one having even a cursory knowledge of shipping, and the simplicity and adaptability of the Gerard system will be apparent to our readers.

This apparatus is applicable to buildings as an indicator of high temperatures or fire, and, placed in a cellar liable to flooding, it indicates the presence of water. It is capable of many other applications, which our space will not permit us to enumerate.

Edison's Electric Light.

The Philadelphia *Bulletin* suggests that if Mr. Edison wishes public faith in that electric light of his to remain steadfast, he will have to give an early demonstration of the truth of his claim that it is a practical success. When he first announced that he had solved the problem of dividing the light and of adapting it to domestic uses, there was a very general inclination to accept the story with absolute confidence, because Mr. Edison had proved by his previous inventions that he could achieve some things which had been regarded by other men as impossible. But, after all, the proof of the pudding is in the eating, and the world, after waiting patiently for the public display of an invention which sent gas stocks down as soon as it was heralded, will be disposed, unless Mr. Edison shows his hand, to suspect that the Edison Electric Light and the Keely Motor will have to be ranked together as enterprises which contained much more of promise than of performance.

New Mechanical Inventions.

Mr. Charles F. Brem, of Charlotte, N. C., has patented an improvement in Automatic Car Couplings, and it relates to a construction, whereby the coupling pin, which is pivoted in the bumper, is prevented from being raised out of its bearings in the act of coupling or uncoupling, and is nevertheless adapted to be quickly detached from the bumper when required.

An improved Hydrometer and Liquid Meter has been patented by Mr. John M. Cayce, of Franklin, Tenn. The object of this invention is to provide an improved apparatus, chiefly for use of distillers and the government, for measuring and determining the specific gravity of spirits or alcoholic liquors. This invention cannot be properly described without engravings.

An improvement in Windmills has been patented by Mr. William Frazier, of Centralia, Ill. The object of this invention is to construct the windmill in such a way that the wind will act upon the whole or any part of the surface of the arms or sails.

Mr. C. A. Hussey, of New York city, has patented an Electro Magnetic Motor. The invention consists in providing an electric motor with two stationary and one intermediate rotary magnet, the latter arranged with regard to the other magnets and the commutator, so that the best results are secured.

Mr. Geo. W. Prescott, of Battle Creek, Mich., has patented an improved Buffer for locomotive tanks for coupling them with coaches, using Miller's or any other similar coupling. It will protect the brakeman from being crushed while coupling the cars.

AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE AND TRAIN.

THE OCTOPUS AT THE BERLIN AQUARIUM.

At the Berlin Aquarium there are several live specimens of the octopus, some of which are shown in our illustration, which we take from *Tygodnik Poroszechny*.

These animals have been for some time in the aquarium, and seem to thrive. They are very lively and exhibit a decidedly healthy appetite.

The cuttlefish family comprises several species, some of which have distinct exterior shells, like mollusca, while others are entirely naked and have interior bone-like formations. This group, to which the subject of our illustration belongs, forms a link between the vertebrates and the mollusca. The only remnants of an exterior shell in the octopus are two horny masses embedded in the flesh near the mouth.

The entire structure of the long, oval body of the octopus, with its rough, warty surface, somewhat resembles that of vertebrate animals. The body is symmetrical, both sides being equally developed. The nervous and circulatory systems and the blood corpuscles are also analogous to those of vertebrates. The eyes are well developed and protrude at the sides of the body. Adjoining them are the external respiratory organs. Eight muscular structures surround the mouth. These arms are nearly five times as long as the body, and are supplied with two rows of sucking disks. The entrance of the mouth is supplied with two horny jaws, working vertically like a bird's bill. The tongue is very large and fleshy, partially covered with recurved spines.

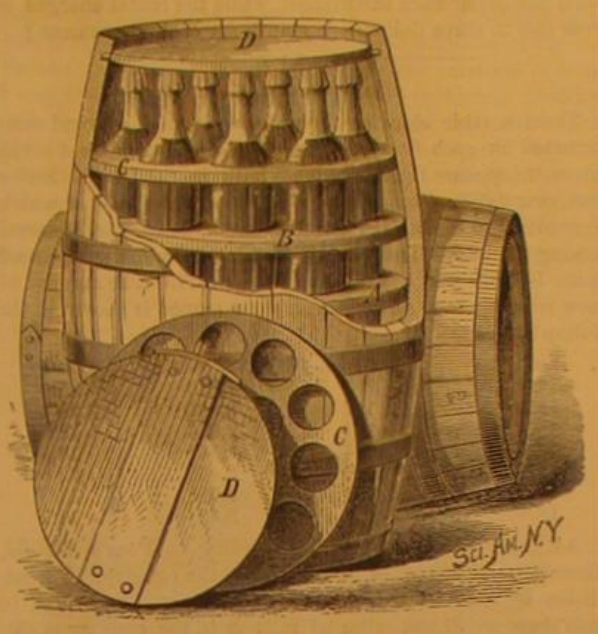
The brain is internally protected by a sheet of cartilage. The backbone consists of a shell-like formation, well known as the cuttle bone. A feature peculiar to all species of this family consists of an interior gland, secreting a brown liquid, which, being expelled by the animal, diffuses very easily in water and renders it cloudy and opaque. This brown liquid is employed as a water color, which is known as sepia.

The octopus moves with great rapidity by means of its arms and the violent expulsion of a quantity of water from the respiratory gills. When chased it instantly discolors the water by the expulsion of the inky liquid and makes its escape, or, by means of its long arms it drags its body into some narrow crevice, from which it can only be extracted by great force. Although frequently left in shallow places when the tide retires, they are nevertheless not very easily caught. In the dark they are slightly phosphorescent. They are all carnivorous and very voracious, swallowing an incredible number of small fish and shellfish, which they seize with their arms, holding them by means of their suckers, and introduce into the mouth.

There are now known about 200 species of the group of *Cephalopoda*, and of the octopus family about 40, the ordinary cuttlefish being the most common. They inhabit the seas of the moderate and tropical zones, and frequent principally rocky shores. They abound particularly in the Mediterranean; in Smyrna, Santiago, aples, and other places, they are regularly exposed at the markets as an article of food. They are ordinarily only a few inches in length, but specimens of five and six feet in length are not rare, and there are numerous cases on record of arms separated from some specimens which measured from ten to twenty-five feet.

BARREL FOR SHIPPING BOTTLED LIQUORS.

The accompanying engraving represents a novel barrel recently patented by Mr. S. Strauss, of Charleston, W. Va., for shipping bottles containing liquors, and for preventing access to the bottles by unauthorized persons.



STRAUSS' SHIPPING BARREL.

The barrel has two removable heads, D, and a stationary middle partition, A. On each side of the middle partition there are two perforated supporting partitions, B C, which hold the bottles so that they are isolated one from the other, and are therefore not liable to breakage when the barrel is moved about. The heads when inserted are locked, so that no one can open them without a key. The lock may be sealed if desirable.

For further information address S. Strauss & Co., Charleston, W. Va.

Natural History Notes.

The Migrations of Animals and Plants.—The question how animals and plants migrate, says Dr. Hagen, in a recent lecture, is an interesting one. Generally the migration took place so long ago that only a conjecture is possible. Nearly everywhere it seems to have been from East to West. Only very few cases in the opposite direction are known; among the most remarkable is that of the potato bug during the last few years. The common cockroach, said to have been originally an inhabitant of Asia Minor, was first observed in an alarming number in English ships 300 years ago; it spread more than 200 years ago from England to France; and 100 years ago more or less slowly, but faster in the time of the Napoleonic wars, through Germany into Russia and Siberia. These facts are proved by the common name given to this disagreeable insect in different countries. In Germany it is called Frenchman; in Russia, Prussian. The most disastrous instance of an eastern propagation is that of the ill-famed phylloxera killing the choicest kinds of grapes known to man. The comparatively new cultivation of America has shed at least some light on the question of migration. In most cases the intruders accompanying emigrants follow strictly the ways of the latter and spread most rapidly along railroads. A careful comparison of the European weeds growing in the United States, and found in Professor Gray's Manual of Botany, represented two thirds of all the European weeds; and, perhaps, some more out of the remaining third. It is a certain fact that in some places the original vegetation is changed remarkably by such intruders. Indigenous plants are killed, and not only the plants, but the insects living on them, so that a keen observer, Baron Von Ostensacken, has stated that particular flies, living exclusively on certain plants, and common in many places in Virginia and adjoining States twenty years ago, are exceedingly rare now, and some species perhaps exterminated. The introduction of plants is often accompanied by the introduction of insects peculiar to them; therefore many enemies of fruit trees, shrubs, and flowers, formerly not known here, are now common. Such insects are even induced to infest indigenous plants belonging to the same order or genus as the imported one. For the same reason, plants entirely foreign to a flora, if introduced, remain at first intact. Besides the well known larger animals for food and agriculture imported from Europe, smaller animals, such as insects, also come over every year. Some butterflies have already made the trip round the world. A large species of fly, well known in Europe by its curious rat-tailed larva, was found here first three years ago, and was so common the past year that hundreds were caught. As steamers make the passage in a week or two, insects are imported living, and go on propagating here. Although

THE OCTOPUS AT THE BERLIN AQUARIUM.

it is common for entomologists to credit Europe with a large number of the imported noxious insects, it must not be forgotten that many are not really native to Europe, but were introduced there from the East ages ago, and not being able to cross the Atlantic till modern times, have settled so long in Europe, as to be considered indigenous species.

Electrical Telegraphing without Wires.

Professor Loomis continues his experiments in the mountains of West Virginia to demonstrate his theory that at certain elevations there is a natural electric current, by taking advantage of which telegraphic messages may be sent without the use of wire. It is said that he has telegraphed as far as eleven miles by means of kites flown with copper wires. When the kites reached the same altitude, or got into the same current, communication by means of an instrument similar to the Morse instrument was easy, but ceased as soon as one of the kites was lowered. He has built towers on two hills about twenty miles apart, and from the tops of them has run up steel rods into the region of the electric current.

Industrial Notes.

Protection of Iron from Corrosion.—A new method of protecting iron from corrosion has recently been patented by Mr. J. B. A. Dode, in England. Its cost is about one third that of a coat of paint, one tenth that of electro-plating with nickel and one twentieth of the ordinary process of painting and gilding. It can also be colored in a variety of ways. Iron treated in this way is said to be "platinized." The articles to be protected are coated with a thin film of borate of lead, containing a little caprous oxide in solution and bright scales of precipitated platinum in suspension. They are then heated to redness and become covered with a thin, glassy, bright gray coat, similar in appearance to polished iron. It is unaffected by sewer gas, dilute acids and alkalies, and the heat of the kitchen fire.

Stearate of Soda for Painting.—A new composition has recently been invented for use in painting. An alcoholic solution of stearate of soda is made in the proportion of 50 grammes of the salt in 1,000 grammes of 66 per cent alcohol. Solutions of soap in alcohol, more or less concentrated, may be used; but the stearate forms the most impenetrable and least costly material. The solution may be colored with aniline colors, yellow ocher, etc. It takes well on wood, lime, and cement.

Bleaching Feathers.—MM. Viol and Duflot have made known a new process of bleaching applicable to the decoloration of ostrich and other delicate feathers which enter into the manufacture of ornaments for ladies. According to the inventors, feathers dipped into a liquid hydrocarbon, such as oil of turpentine, mint, or thyme, become bleached under the subsequent action of light and heat. The process is as follows: The feathers to be bleached are placed in glass vessels filled with one of the above mentioned liquids, and exposed as much as possible to the light of day, and at a constant temperature of 30° C. At the end of two or three weeks the decoloration will be found completed, and it only remains to air the feathers, dry them, and finally to prepare them for use in the usual way.

Caterpillars and Gut.—Silkworms, up to the present time, have been the only larvæ from which "gut" has been prepared. This material has valuable properties—strength, fineness, and color; and if it could be produced in long pieces and at a low cost, it could be used for many purposes. It is now proposed (in the Colonies and India) to use the caterpillars which destroy food plants for this purpose. If practicable, the project is good and useful, and the idea will probably become valuable.

The Hectograph.

Herr Levitus, of Vienna, lately exhibited an arrangement called a "hectograph," for multiplying writing, which, though not directly connected with photography, may prove interesting. The hectograph consists of a flat sheet iron box filled with a gluey mass, upon which, after moistening and drying it several times, a sheet of paper, written upon with a specially prepared ink, is placed and lightly rubbed with the hand. When the paper is raised the writing is found to be transferred reversed to the film of glue, and from that film, by simply placing pieces of dry paper upon it and rubbing them, some fifty impressions of the writing can be taken in a short time. The negative impression can easily be removed from the film by washing with warm water, and the latter can be used over and over again for a long time.

Progress of the Telephone.

The Gold and Stock Telegraph Company, in its answer filed in the suit brought against it by the Bell Telephone Company, sets up the general claim that the telephone is not a new invention, and that Gray was the prior inventor. The Boston case, it is thought, will reach trial by April or May. The Bell Telephone Company has obtained injunctions against several smaller manufacturers of telephones, and suits against others are pending.

The company is turning out 1,500 telephones a month, and orders are so numerous that many are more or less delayed. There are now 17,500 instruments out, and 15,000 actually rented. Instruments are supplied principally to telephonic exchanges, which are being rapidly introduced into all the larger cities. At Albany and Troy there are 350 instruments in circuit; at Buffalo there are 250 subscribers; at Detroit about 150 instruments in circuit; at Chicago 550; at Indianapolis 150 subscribers; at St. Louis 325 instruments in circuit; at Cincinnati 200; at Philadelphia 500 subscribers and 350 instruments in circuit; at Columbus 200 subscribers and about 50 instruments in circuit; at Baltimore 300 subscribers and 100 instruments in circuit; at Washington, New Orleans, Louisville, Nashville, exchanges are being started. In Boston there are 500 subscribers and about 150 instruments in circuit; at Lowell 200 instruments in circuit, at New Haven 350; at Bridgeport 175, and at Springfield, Hartford, and Providence exchanges are being started. An exchange has just been started in this city, where there are at present about 750 subscribers and about 250 instruments in circuit.

[The foregoing we find in the *Operator*. Some idea of the enormous profits made by the telephone owners will be gained when we state that the cost of manufacture is less than one dollar each instrument, while the rental charged is rom two to three dollars per month for each instrument.]

Railway Notes.

From a table showing the mileage of new railroad constructed in each State and Territory during the past seven years, it appears that there were built in the United States last year 2,688 miles of new road, nearly one half of which is credited to the northwest, Minnesota, Iowa, and Missouri taking the lead. The number of miles of narrow gauge road built in 1878 was 871, against 776 in 1877. The amount of new road for each of the seven years named is shown in the following table:

Year.	No. of lines.	Total built.	Av. length.
1872	210	7,340	35·0
1873	137	3,883	28·3
1874	105	2,025	19·3
1875	94	1,561	16·6
1876	107	2,460	23·0
1877	122	2,281	18·7
1878	144	2,688	18·7

At the beginning of 1878, according to Poor's Manual, there were 79,208 miles of railroad in the country. The addition of 2,688 miles is equal to 3⅓ per cent. According to this there are 81,896 miles of railway in the country at this time. Estimating a population of 48,000,000, this gives about 585 inhabitants per mile of railroad, a much smaller number than in any other country on the globe.

In the workshop of the railroad from Moscow to Nijni, the tires of wheels are not expanded by the direct action of fire, but by hot water, before being put on the wheels. With the assistance of a movable crane the tires are plunged into a metallic cistern containing water, which is kept boiling by means of steam from a boiler close by. An immersion for ten minutes expands a tire sufficiently to enable it to pass around the wheel. The heat is more uniform and the contraction more regular than when a tire is heated by fire in the usual way. It is said that in six years there was only one case of fracture of the water-heated tires, and only 1 per cent of them loosened upon the wheel.

In a review of an American work on railway service, the London *Iron* says: We do not allow for a moment that the Americans have beaten Old England either in engineering skill or in sound financial management in railway matters; yet there are a hundred things in either department in which our people may derive benefit from the splendid success and many failures of our American kinsmen. No man can go by rail from London to Inverness or Holyhead without an amount of fatigue and discomfort which would not be experienced in journeys thrice the length in the States; and we hope that our companies at home will in time endeavor to assimilate traveling conveniences a little more to that which in America the length of way has forced upon the great lines of railroad. It is small consolation that to many lines on the continent of Europe, in speed, comfort, safety from robbers, our railway trains are incomparably superior; nothing that the Americans have adopted should be overlooked in our longer lines, whether at home or in India or Canada.

Boston is working for an elevated freight railway to connect the extensive South Boston flats, which are being improved for the reception of freight at tide water, with the Fitchburg, Boston and Lowell, Eastern, and Boston and Maine roads. The track is to be double, and the lower line will pass from these roads through Prince and Commercial streets and Atlantic avenue, crossing Fort Point Channel at Oliver street. The line will be about a mile and a quarter long, and, it is thought, will cost, with terminal switches, engines, etc., less than $1,000,000.

There are at present 66⅛ miles of finished railways in Japan, 142¾ miles laid out, with working plans, sections, and estimates completed, and 455 miles projected, the general route only having been examined and decided upon. The earthworks of the existing lines have been made for a double way, and the bridges for a single way. The permanent way is of double-headed 60 lb. rails on the Yeddo-Yokohama and Kobe-Osaka lines; but on the Osaka-Kiota line 60 lb. flat bottomed rails on cross sleepers are used. The superstructure of the smaller bridges was originally of timber, but has been renewed with iron. The larger bridges are all of the Warren girder type, and as a rule of 100 feet spans. The foundations are on brick wells 12 feet in diameter, and on an average about 60 feet deep. The chief difficulty experienced by railway engineers in Japan arises from the nature of the watershed. The beds of the rivers are nearly all higher than the surrounding country, varying from a few feet to 40 feet or more. In some instances the railway has been taken unders the river by tunneling. As a rule, however, the rivers were bridged over, and approached by steep gradients and high embankments.

Nowhere else in the world have railway engineers to fight against the adverse conditions which beset railway communications in upper India, except, perhaps, on the Baroda and Bombay line. The rivers of the Punjaub are as captious as spoiled children. They shift their course with every rainy season. A splendid bridge is built across what seems the confirmed bed of a river. Next year that river abandons the channel over which the bridge has been thrown, leaves the great bridge spanning a mere rivulet, and carves for itself another channel elsewhere, sweeping away a slice of railway embankment, for which a bridge must be substituted, until, with the necessity for accommodating the fitful caprices of the snow-fed streams, the whole railway system of a large section of the Punjaub threatens to become one long bridge. In the season of the floods the officials of the railway company need to sleep with one eye open, and to live with their lives in their hands. The beds of these Punjaub rivers are littered with ponderous and costly iron work, girders, columns, etc., brought out from England, and now lost irrevocably in the all but fathomless quicksands which stud the river beds.

The Pullman Palace Car Company has been using steel tired paper wheels about nine years. The Chicago *Railway Review* publishes a table showing, from the records of the company, the mileage of a lot of sixty-six wheels on the Pittsburg & Fort Wayne and Pennsylvania roads previous to the first turning up of the tires. The average mileage is over 110,000 miles. As the poorest wheels give out first, it is evident that, by the time the last one is taken off for turning, the average of the whole will be very much greater than is shown by the table. In another table the mileage of twenty-four wheels, the most of which are still in service, is given, and the average is 184,000 miles. As each tire receives from three to four turnings, giving four periods of wear, probably a safe and just estimate from this data would be an average mileage to the steel tire of from 450,000 to 560,000 miles. It appears from the records of the Pullman Company that the average mileage per month of the cars under which the sixty-six paper wheels were run was 13,600 miles. The first cost of the paper wheel is $65, and of the best quality of cast iron wheel, $14. The mileage of the latter is usually guaranteed at 50,000 miles. The cost of renewal of the steel tire is $35. The cost of turning the tire may safely be estimated as equal to the cost of the more frequent renewals of cast iron wheels with the attendant expenses of transportation in each case. The paper wheel costs $65, and runs 450,000 miles in 2 88-100 years. For convenience in reckoning, and at a disadvantage to the paper wheel, on account of the interest money, call this period three years. At the end of this time the original cost, with 7 per cent compound interest, amounts to not quite $80. But during this period nine cast iron wheels have been used, costing $14 each. Allowing a rebate of $5 each for the worn out wheels, and calculating on simple interest at 7 per cent, the cost of the wheels for this service amounts to $91.50, showing a saving in the case of paper wheels of $11.50, and were compound interest computed, as in the case of the paper wheels, the saving indicated would be a much larger amount. In computing the cost for the second period of three years a much greater saving would by shown, since a renewal of the tire only, at a cost of $35, is necessary, instead of a first cost of $65 for a new paper wheel. The data from which this conclusion is reached are vouched for by the Pullman Company. The *Review* adds that the experience of the railway companies which have used the paper steel-tired wheels bears out the records of the Pullman Company. Among these roads it mentions the Central Vermont, Connecticut River; Cleveland, Columbus, Cincinnati and Indianapolis; Pittsburg, Cincinnati and St. Louis, and the Chicago and Alton. As engine truck wheels the paper wheels seem to be especially successful, the experience on some roads warranting the conclusion that they will make 800,000 miles before the tire requires renewal.

The Very Latest Electric Light Improvement.

At the Technical Society of St. Petersburg, M. Latchinoff lately delivered a very interesting lecture on the electric light. He made some experiments with Jablochkoff's condensators, which consist of a set of tin plates placed one on another; the surface of every plate is 0·7 square meter. Between every pair of such plates a piece of silk covered with varnish is introduced. The height of the condensator was about 6 feet. On introducing two condensators into a circuit the intensity of the electric light is doubled. Such condensators are not cheap owing to the great quantity of silk wanted, and thus the application of this apparatus is limited. The lecturer believes the new system of electric lighting devised by M. Rapieff to be a serious opponent of Jablochkoff's process. The chief advantage of the new system is that the luminating point does not change its position, and therefore this system is more suitable for the projection of the electric light at a distance. This advantage will give increase to the use of the electric light for military purposes.

A great deal of difficulty is experienced in cementing metal to glass. The *Fuerber Zeitung* says that a mixture of two parts finely ground litharge and one part white lead, and working it up to a stiff paste with three parts boiled oil and one part copal varnish, adding more litharge and white lead as required, is the best material for joining the two substances.

American Torpedo Boat in Foreign Waters.

Mr. Herreshoff, of Bristol, Rhode Island, America, who has long had a great reputation for the building of small fast steaming vessels, recently sold to the English Government one of his launches in order that the American system might be thoroughly tested against the productions of the English building yards.

The boat is sixty feet all but three inches in length, with a beam of seven and a half feet, and when fully manned and equipped will float in less than four feet of water. Her speed is stated to be over sixteen miles an hour, above the standard of the Admiralty second class torpedo boats, which are nearly as possible of the same dimensions as the American launch. The hull, which in appearance is not unlike a coffin painted a dull gray, consists of bullet-proof steel, with a wooden skin below the water line. The funnel is almost in the middle of the boat, and the screw is placed under the patent boiler, or "steam generator," which is also in the center of the craft. She is steered from near the stern by a balanced rudder, and her powers of quick stopping and going astern, and ability to turn in a small circle, are said to be surprising.

During the trial she described a complete circle in a diameter of about 50 yards, came to a dead stop when steaming 12 miles an hour, in her own length, and then went astern at the same rate of speed and equally well under the control of the rudder. She steamed several times in the course of five minutes round and round a Russian steamer, Peter the Great, proceeding down the river, and amply proved her extraordinary powers to the entire satisfaction of every one on board. The steam is supplied by Herreshoff's steam generator, which will raise 100 pounds of steam within six minutes of the fires being lighted. The generator consists of a coil of 2 inch pipe, nearly 300 feet long, and possesses the valuable quality of an inability to explode. She works at a pressure of steam of 140 pounds, but has been tested up to 300 pounds. The screw is capable of 300 revolutions a minute. The absence of a heavy boiler adds greatly to the lightness of the boat, enabling her to be hoisted on davits with wonderful facility. It seemed to be the general opinion among the engineers present that the introduction of the Herreshoff steam generator into England would create a complete change in the method of producing steam for working machinery, and the success of the new invention appeared complete.

New Electrotype Process.

A new and ingenious process has lately been introduced in France for electrotyping on non-conducting materials, such as china, porcelain, etc. Sulphur is dissolved in oil of lavender spike to a sirupy consistence; then chloride of gold or chloride of platinum is dissolved in sulphuric ether, and the two solutions mixed under a gentle heat. The compound is next evaporated until of the thickness of ordinary paint, in which condition it is applied with a brush to such portions of the china, glass, or other fabric as it is desired to cover, according to the design or pattern, with the electro-metallic deposit. The objects are baked in the usual way before they are immersed in the bath.

CHEST OF EBONY.

The engraving on this page represents an ebony chest, richly ornamented with gilt, bronze, and silver castings and repoussé work. It was one of the exhibits at the late Paris Exhibition.

EBONY CHEST, WITH GILT AND SILVER ORNAMENTS.

Subterranean Telegraph Wires in Germany.

In 1876 the first subterranean telegraph wire was laid down in Germany. Recently, subterranean lines have been completed from Berlin to Cologne, from Cologne to Elberfeld and Barmen, from Frankfort to Strasbourg, and from Hamburg to Cuxhaven. Altogether the length of these lines now amounts to 1,554 English miles. Most of the cables consist of seven wires, very few of four only. The difficulties encountered in laying down the cables in marshy or rocky ground, along the streets of large towns, across, or rather under, rivers, and through fortifications, have all been successfully overcome. Next year six other lines are to be laid down, and then the projected system of subterranean telegraphic communication throughout the German empire will be almost complete. The cost of the lines already laid down amounts to about $3,039,000.

The Origin of Petroleum Springs.

The origin of our oil springs has been the subject of a great deal of investigation among scientific men, and various have been the theories they have advanced. A writer in the London *Grocer* takes the subject up and concludes, as many have before him, that if petroleum were found in the neighborhood of coal, or even in those rocks among which coal abounds, or somewhere near to such rocks, there would not be much difficulty in explaining its origin. We then need only suppose that a slow distillation had taken place similar to that which is carried on at the works for the distillation of paraffine oils from cannel coal or shale, and that the product thus evolved had somehow found its way into cavities, or had filled up crevices, and remained there until disinterred by human effort. This theory would be aided by the fact that the quality of crude artificial paraffine oil approaches more and more nearly to that of natural petroleum the more and more slowly the distillation of the coal or shale is conducted; and as nature has certainly operated very slowly indeed in the formation of geological products, the petroleum of Pennsylvania and Baku, and other places, might thus have been the result of ages and ages of very slow distillation at the low temperature which the mineral oil maker knows to be so favorable to the production of a light-colored crude oil, containing a large proportion of the more volatile products such as abound in natural petroleum. But, unfortunately for this theory, petroleum is not one of the products of the "coal measures," as miners and geologists call the coal bearing strata. It appears to be especially absent from them, or we should long ago have found it in our own island (Great Britain) where these rocks have been so riddled with trial borings, pits, and workings. It is true that a few small dribbles of something of the kind have been found here and there. We have heard of an enterprising publican in the neighborhood of Bilston, who discovered some gas or vapor hissing from the floor of his cellar, who fixed a jet thereto and lighted it, and thus converted the cellar into a subterranean tap room, the curiosity of which brought much custom. His business rivals affirmed that he had carried a gas pipe surreptitiously under ground.

We have ourselves visited a coal mine near Lilleshall, in Shropshire, known as "the tarry pit," on account of the liquid tar that oozed out of the sides of the shaft and accumulated in what the colliers call the "sump," that is, the lower wall of the shaft where it is sunk several feet below the road that leads to the workings for the purpose of receiving the water that has to be pumped out. But these and other similar cases are mere exceptional curiosities, by no means comparable with the vast and apparently inexhaustible subterranean reservoirs from which we derive our commercial supplies of hydrocarbon oils. These occur in the Silurian and Devonian rocks, which are of vastly greater antiquity than our coal-bearing rocks. These Silurian or Devonian rocks belong to the period when life was just making its beginnings upon the earth, or rather in the waters that covered the earth at that time; for the animals whose remains we find in these rocks are marine animals; no air-breathing creature, nor even an amphibious reptile like a crocodile, is found among the Silurian rocks. Nothing approaching to forest trees or other terrestrial vegetation is there; the only vegetable remains being aquatic plants, and these so scarce that small specimens are prized as curiosities. Land plants just begin to make a scant appearance in the Devonian, but are very rare indeed in those lower beds where petroleum is found.

This has led to many speculations. As the remains of odd-looking fishes, marine things like swimming wood lice, huge lobster like brutes (*pterygotus*) five or six feet long and a foot across, a variety of soft animals in shells, and vast quantities of coral, are found in these rocks, some have suggested that petroleum is produced by the decomposition of the flesh of these strange creatures. The very "ancient and fish-like" smell of some of the Canadian mineral oils was regarded as confirmation of this, which in the early days of American petroleum enterprise was a somewhat favored hypothesis. Another, and a very bold, theory has been propounded by Professor Mendelejeff. He maintains that neither the animal nor the vegetable remains of the Silurian and Lower Devonian rocks are sufficiently abundant to supply the petroleum and other bituminous matter they contain. He goes back to the origin of the earth, and to the hypothesis of Laplace, who has tried to show that our sun, our earth, and all its companion planets, were formed by the condensation of an enormous cloud or nebulous mass of heated vapors a few thousands of millions of miles in diameter. He supposes that when our globe was formed by the solidification of a portion of this, there were great masses of iron and of carbon, of inorganic origin, in the inner parts of the earth; that the iron remained melted within the earth long after the crust had cooled down and water had condensed upon it. Then this water found its way through fissures and came upon the molten iron and the inorganic carbon or graphite that was associated with it. What would happen then? Water is composed of oxygen and hydrogen. Iron has a strong affinity for oxygen—strong enough, when heated, to take it away from the hydrogen of water. Mendelejeff supposes that such a decomposition of water took place, that the iron was thereby converted into the oxide of iron (the iron ore that we now obtain for our blast furnaces), and that the hydrogen set free from the water combined with the carbon, and thus formed the hydrocarbons which are found in the forms of petroleum, asphalt, etc.

Dr. T. Sterry Hunt, of Massachusetts, one of our boldest and most able of philosophical geologists, still adheres to the theory he expounded in 1861, that "petroleum and similar bitumens have resulted from a peculiar transformation of vegetable matters, or in some cases of animal tissues analogous to these in composition;" and he derives these vegetable matters and animal tissues from the ancient limestones. He argues that the animals of very low organization, that resemble plants in so many respects, are composed of material also chemically resembling vegetable matter, or a sort of half-and-half between wood and flesh, and that this, in the course of ages, would decompose and produce hydrocarbons. If this is correct, he may find his supply in the coralline rocks of that period, and may get it in such quantities as to leave us in no apprehension as to failure of supply; and he actually has found certain oleiferous magnesian limestones which contain within their pores as much as 4½ per cent of their bulk of petroleum supposed to be thus formed. A square mile of this only one foot in thickness would contain 221,247 barrels of 40 gallons each; and taking its actual thickness at 35 feet, every square mile contains 7,743,745, or nearly 8,000,000 of barrels, all this in store and ready to ooze and filter out into the cavities as they become pumped out. Whatever theory may be adopted, one important practical fact appears very certain, namely, that the supply of petroleum is by no means limited to the present contents of the oil wells, or the accumulations in the cavities which are tapped by the wells. This is shown by the fact that after a well has been pumped dry and then left for a while the oil returns, as though it came from such porous rock as the oil-bearing limestone of Chicago which Dr. Sterry Hunt examined. As this and other similar rocks cover some thousands of square miles of the American continent, the supplies of petroleum are likely to be quite as lasting as those of coal.

Practical Value of Science.

BY PROFESSOR S. H. TROWBRIDGE.

Can the study of geology be of use to any outside of the guild? Let us see, for a moment. The science of geology, dealing as it does with the only visible record of any considerable age, in regard to the history of life upon our planet, must settle the vexed questions—if they are ever to be settled—of the origin of species the antiquity and perhaps the unity of man. To many, the acceptance of the new theories on these points is equivalent to legislating God out of the universe. If so many are wrecked upon these questions, the correct understanding of them is a matter of no little importance.

Has a farmer any interest in knowing whether mineral products are to be found upon his land, and, if so, whether they are valuable, and in paying quantities? Has he coal, iron, lead, zinc, baryta, ocher, peat, or clay, valuable minerals or mineral springs, or rock fit for building purposes, within his limits? These questions must be answered, if at all, by the geologist. These products are found in certain layers or groups of rocks, whose position is definitely known by certain marks easily recognizable. These marks are the remains of the buried dead of ages past, that have written their own epitaphs upon the rocks, which serve the double purpose of sepulcher and tombstone. Many a man has spent all his living in trying to extract gold or other valuable minerals from deposits which one initiated could tell him at a glance were entirely worthless. Many a man has sunk a fortune in mining for coal, lead, zinc, or other ores, on the unsafe supposition that, because his neighbor in the valley below him finds these in abundance, he will have equal success by sinking a shaft to the same level. A brief survey of the inclination of the rocky strata would show that the rocks which his neighbor finds so productive, dip away from him; or, by an upward curvature of the earth's crust, which formed the elevation on which he stands, the wealth-bearing stratum was exposed, on the surface, to the action of frost and flood, and has been completely washed away.

From bitter experiences like these, prospectors and miners have learned that knowledge and advice of a well versed geologist is invaluable to them, and have not hesitated to offer and pay a thousand dollars per day for his services.

From later geological study of Hoosac Mountain, it seems probable that millions of dollars might have been saved to the State of Massachusetts if such a study had preceded the excavation of the great Hoosac Tunnel. The assertion is ventured that enough funds were needlessly expended to pay for a complete topographical, geological, zoological, and botanical survey of the whole Commonwealth, such as no State in the Union now possesses, and such as would for ever put away the danger of similar loss in the future.

How to make two blades of grass grow where one grew before; and how, in general, to get the most out of this rich old earth of ours, is the absorbing question of all ages. In the van of all exploring expeditions goes a band of scientists, or at least the geologist, to learn of the wealth which the earth possesses. And when the settler is ready to seek a home in the distant land, he finds that science has furnished for him a satisfactory showing of the natural wealth of his future home; and by the use of these revelations of scientific research, he may select beforehand his locality, and carry with him the information concerning it.

The cost of production of the precious metals, and their probable abundance for years, decades, and centuries to come, must be determined by the geologist. Upon this knowledge depends the value of gold and silver, as standards of value and media of exchange. From this source we learn that the amount of gold obtainable is constantly diminishing, while that of silver is slowly increasing. The former is much more fluctuating than the latter, hence a less desirable standard of value; and as each acts as a check upon the other, there is wisdom in accepting both as media of exchange. From this we see the important part the geologist plays in the mooted question as to the demonetizing of silver.—*The Advance.*

Stimulation of the Nerves of the Head.

Dr. Brunton, in the *Contemporary Review*, remarks that there are two nerves, known as the "fifth pair," which are distributed to the skin of the head and to the mucous membrane of the eyes, nose, and mouth. These nerves are closely connected with the heart and vessels, and by stimulating their branches the circulation may be greatly influenced, as in the case of fainting. It is a curious fact that people of all nations are accustomed, when in any difficulty, to stimulate one or another branch of the fifth nerve, and quicken their mental processes. Thus, some persons when puzzled, scratch their heads; others rub their foreheads; and others stroke or pull their beards, thus stimulating the occipital, frontal, or mental branches of these nerves. Many Germans when thinking have a habit of striking their fingers against their noses, and thus stimulating the nasal cutaneous branches, while in other countries some people stimulate the branches distributed to the mucous membrane of the nose by taking snuff.

The late Lord Derby, when translating Homer, was accustomed to eat brandied cherries. One man will eat figs while composing a leading article; another will suck chocolate cremes; others will smoke cigarettes; and others sip brandy and water. By these means they stimulate the lingual and buccal branches of the fifth nerve, and thus reflexly excite their brains. Alcohol appears to excite the circulation through the brain reflexly from the mouth, and to stimulate the heart reflexly from the stomach, even before it is absorbed into the blood. Shortly after it has been swallowed, however, it is absorbed from the stomach, and passes with the blood to the heart, to the brain, and to the other parts of the nervous system, upon which it then begins to act directly. Under its influence the heart beats more quickly, the blood circulates more freely, and thus the functional power of the various organs in the body is increased so that the brain may think more rapidly, the muscles act more powerfully, and the stomach digest more easily. But with this exception, the effect of alcohol upon the nervous system may be described as one of progressive paralysis. The higher centers suffer first, and the judgment is probably the first quality to be impaired, and this becomes the more so as the effect of the alcohol progresses, although the other faculties of the mind may remain not only undiminished by the direct action of the alcohol on the brain, but greatly increased by the general excitement of the circulation. By and by, however, the other parts of the nervous system are successively weakened, the tongue stammers, the vision becomes double, the legs fail, and the person falls insensible. It is evident, then, that only the first stages of alcoholic action are at all beneficial, the later stages being as clearly injurious.

A New Method for Vapor Densities.

The most important element in determining the formula of a chemical compound, next to its percentage composition, is its vapor density, and often this is the quickest and surest method, if not the only one, to establish its atomic weight. The number of methods proposed and introduced is legion, every prominent chemist—Hofmann, Bunsen, Gay-Lussac, and Dumas—has given his name to some apparatus for that purpose. The latest and simplest is that of Victor Meyer, in Zurich, Switzerland.

A glass vessel holding 100 c.c., and resembling a flask with long and very narrow neck, on which is set a fine tube bent like a gas delivery tube, is used. The widened mouth of the flask is closed with a rubber cork which reaches to a certain mark on the neck. The delivery tube dips under the surface of mercury or water in a pneumatic bath. The vessel being placed in another and larger vessel of water, oil, or easily fusible metal, can be heated to any desired temperature. For a while the air in the flask of course expands and escapes through the mercury or water. When all the air in the flask has reached the temperature of the bath no more will escape. At this point the opening of the delivery tube is closed, the rubber stopper removed, a weighed quantity of the substance is thrown in, and the stopper quickly replaced to the mark. Some asbestos on the bottom of the flask breaks the fall and prevents its breaking the flask. If now the temperature of the flask is higher than the boiling point of the substance introduced it will be converted into a vapor, and must expel a quantity of air exactly equal in volume to the volume of vapor generated. If the volume of the vapor generated is not over one quarter or one third that of the flask, and it is quickly vaporized, the error through diffusion will be very small. The air expelled is collected over water in a graduated tube, or in a common eudiometer, and differs so little from that of the vapor generated that it may be neglected in determining the molecular weight of body, as shown by the following figures found by Mr. J. Zueblin:

	Theory.	Found.
Chloroform (with steam)	4·13	4·32; 4·51; 4·44; 4·36
Bisulphide of carbon (with steam)	2·63	2·87; 2·91; 2·92
Chloroform (in aniline)	4·13	4·31
Water (in aniline)	0·62	0·69; 0·66; 0·62
Aniline (in ethyl benzoate)	3·21	3·27; 3·37
Phenol " "	3·25	3·28; 2·98

It is characteristic for this process that it is independent of the capacity of the vessel and of the temperature at which the experiment is made. It is only necessary to know the temperature of the room, the weight of the substance, the barometer, and the volume of the air expelled into the tube. The vapor density of substances which boil at very high temperatures can be determined in metal bath at very high and unknown temperatures. It may be used as a lecture experiment also.—*Berichte.*

Liquefaction of Oxygen.

Mr. Raoul Pictet concludes an article on the liquefaction of oxygen with the remark that his investigations necessitated an unusually large number of experiments for the establishing of preliminary data, and these he obtained by aid of the Geneva Society for the Construction of Physical Instruments, who furnished him with apparatus worth 50,000 francs, and thereby enabled him to work out results with perfect accuracy. He recommends that similar apparatus should be provided in all laboratories as an "essential means for the study of the molecular forces. Who knows," he asks, "but what crystallization and certain reactions may thereby be placed in peculiarly favorable conditions for further investigation?"

Roach Poison.

For the benefit of several subscribers, who have written for information as to the best means of ridding their houses of cockroaches, we may state that equal parts of powdered borax, Persian insect powder, and powdered colocynth, well mixed together, and thrown about such spots as are infested with these troublesome insects, will prove an effectual means of getting rid of the scourge. This powder, in all cases where its use has been persistent, has by long experience been found an infallible remedy.

Cooked Air.

A clever writer in the Philadelphia *Ledger* very happily characterizes the air which most city people breathe indoors in cold weather as "cooked air." The lower down the thermometer goes the higher the burning coal is piled; all the chinks and cracks are stopped that would let any fresh air in, and its main chance, indeed, is when the front door opens for twenty seconds, or when the beds are made in the sleeping rooms. In the living rooms of the family there is no occasion, many people think, to raise the windows ever, except to wash them on periodical cleaning days, or to close the shutters. So carpets and furniture and people, lungs and skin, are dried and baked in the hot, dry rooms, until ingenious persons can bring out electric sparks from their finger ends by skating rapidly up and down the room in their woolen slippers.

These breathers of cooked air are often extremely particular about wearing their own clothes, and would by no means consent to take the cast off garments of a neighbor; yet one and all of them are perfectly comfortable to breathe over and over again the cast off and soiled air from each other's lungs, when it is cooked especially; for in summer time they do insist on a change of it, and do get their houses ventilated. Janitors of public buildings, in a short sighted economy of fuel, will shut up all the apertures by which fresh air might get in, lest they should suffer some heat to escape thereby, and are rewarded by sleepy audiences, especially when the gas burners are at work, also draining the cooked air of what little life it has. There are some people —many, it is to be hoped—who open an inch or two of their bedroom windows every night to insure a modicum of fresh air to sleep by. But these do not in the least care to have fresh air to be awake in, it seems, for they are content to have their furnace draw all its supplies from the tightly sealed cellar, and from the stale atmosphere of the ash boxes and vegetable bins in that subterranean apartment. And these breathers of cooked, soiled, devitalized, and debilitating air, wonder why it is they take cold so easily! The writer suggests that when people learn to live in fresh air within doors as without, with its proper proportion of moisture for the skin and breathing apparatus to keep up their healthy tone, it is likely they will have found out one way at least of how *not* to take cold.

Oxide of Zinc in Diarrhea.

The value of oxide of zinc in diarrhea has long been known, but is apt to be overlooked. Some recent reports on the subject have been made by Dr. Tyson, of this city, and Dr. Bonamy, of Nantes. The formula which the latter uses is:

R. Zinci oxidi	54 grains.
Sodæ bicarb	7½ "

In four packets, one to be taken every six hours.

In all the cases which he observed oxide of zinc produced rapid cure of diarrhea. In fourteen cases observed by Puygautier the cure was even more rapid, since in only one case were three doses of the medicine required. The results are considered to have been more satisfactory, inasmuch as in several cases the malady had endured from one to many months, and other methods of treatment had not produced any improvement. Thus he concludes that, although by no means to be held as exclusive treatment, the employment of oxide of zinc deserves to be more generally known as useful in diarrhea.—*Med. and Surg. Reporter.*

Antimony in Galvanic Batteries.

Nuhn calls attention to the use of metallic antimony for galvanic batteries in the place of the carbon or platinum as negative element, especially when sulphuric acid is the liquid employed. He has used it for five years for medical purposes with satisfactory results. It has the advantage of cheapness, does not scale off, or break, or crumble; the piece retains at all times its market value, and can be fused over again at any time. The chief advantage is that the antimony begins to act as soon as it is immersed, which is seldom the case with carbons. On the other hand the chief disadvantage is that thin plates of cast antimony break easily, but this can be avoided by casting it around a core of tough metal, like copper, or by alloying it with a few per cent of a tenacious metal. Although it is not as good a negative element as carbon, its greater conductivity and other advantages make it probable that antimony may frequently prove useful as a galvanic element. Antimony melts at 425° C. (797° Fah.); in other words, it is a comparatively easily fusible metal, a little higher than lead, but, like zinc, will burn if exposed to the air while melted. Bismuth can probably be employed for the same purpose, standing very close to antimony in the electrical series.

Sewing Silk Manufacture.

But few persons who use sewing silk know the various and intricate processes the material has to undergo to produce the even thread and beautiful colors which they purchase at our stores for a few cents a spool. A recent visitor to a sewing silk factory, at Clinton, Mass., describes on another page the process of its manufacture. We invite the reader's attention to the article.

AT a recent soiree of the Union League Club, in this city, during a promenade in the picture gallery, a piece of white hot carbon dropped from an electric light upon the costly silk train of a lady visitor, and instantly burned through the fabric. The coal was quickly extinguished. No damage except to the dress.

Notes & Queries

(1) J. J. B. asks how water colors are mixed and formed into cakes, and what kind of paint is used. A. Mix almost any of the finely ground pigments with a thin mucilage of gum arabic, or dextrine.

(2) W. H. A. asks: 1. How to cast metals, such as zinc, copper, German silver, antimony, and britannia, in plaster of Paris moulds. I want to make very fine work, taken from nature, leaves and flowers, which cannot be cast in sand. A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 17, for full directions for casting soft metals in plaster moulds. 2. How to make a small furnace, to melt about from 10 to 20 lbs. of metal. A. Any of the fusible metals or alloys may be melted in an iron ladle over a common fire. Copper, brass, German silver, and the metals which fuse only at high temperatures, may be melted in a crucible in a draught furnace, which is simply a modification of a common coal stove.

(3) G. H. writes: I have a plano-convex lens two and three quarter inches in diameter and three quarters of an inch thick in the thickest part. Could I use it in a camera obscura? A. The focus of your lens is too short for a camera obscura.

(4) H. W., Jr., asks how to temper steel to the hardest possible degree. A. Heat it to a cherry red and plunge in mercury. As the vapor of mercury is deleterious it should be used with great care.

(5) F. S. C. asks: What boiler should I use for a steam buggy to go on a common country road? Give size and weight of boiler and engine, weight of water and fuel. [Perhaps some of our readers who have experimented with such wagons will be kind enough to furnish some account of their attempts.]

(6) C. F. F. asks: What would be the suitable size pipes for vacuum pan, which is fed by a one and one quarter inch live steam pipe, always open full? Also, should a check be used between the boiler and the pan, same as pump? A. It is generally best to use a check valve, and there is nothing gained by making the drain pipe larger than the supply. It should lead from the vacuum pan on an incline, and should be arranged with a vertical fall to the boiler, if possible. Unless the lowest point of the vacuum pan is above the water level of the boiler, a trap or its equivalent will be required.

(7) J. L. K. asks: 1. For recipe for cement for fastening brass collars to kerosene lamps (not plaster of Paris). A. The following is recommended by Puscher: Caustic soda, 1 part; rosin, 3 parts; water, 5 parts; boil until complete saponification is effected and mix the product intimately with one half its weight of zinc oxide, white lead, chalk, or plaster of Paris. The latter is preferred, as it hardens more quickly. 2. I have some paint brushes which are quite hard (paint dried on them) and useless. Can you tell me how to remove paint without injuring brushes? A. Long soaking in benzole or carbonic sulphide will in some cases suffice.

(8) C. F. S. writes: 1. I have an open fire place or grate for heating rooms on first story, with air-tight ash pits underneath in the cellar. There is an opening through which the ashes fall into the ash pit. How can I prevent the fine ashes from flying or blowing back when we let the ashes from under the grate down through the ash pit? A. You might make a box or trap having a door at the top and bottom. Into this, with the lower door closed, dump the ashes, then close the upper door and open the lower one. 2. Also, what will take tobacco and other stains out of marble? A. Moisten caustic lime with washing soda, and cover the marble with this for a few hours; then rinse and scour with strong soapsuds and a stiff brush, rinse again and rub dry with a cloth.

(9) H. H. M. asks: 1. With what number of wire shall I wind the core for the gas pipe magnet described in your paper some time ago, core to be of 1 inch pipe, 3 inches long? A. The size of wire depends upon the use to which the magnet is applied. 2. How much wire shall I use to make a good magnet? A. About 5 or 6 layers. 3. Will such a magnet, with three or four gravity cells, be sufficiently strong to make good telephone magnets? A. This form of magnet is not adapted to telephones. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, for directions for making telephones. 4. How should the coils be arranged; should each coil be independent, and all joined to a common conductor, or should there be one continuous circuit through them all? A. The telephones should all be in one circuit.

(10) W. S. A. asks what makes solid iron float in melted iron. Is it on the same principle as the floating of ice? A. Yes.

(11) H. P. W. writes: I have a riveted boiler iron tube two hundred and forty feet long and twenty-eight feet diameter to lead the water to a turbine wheel. Can I protect it against rusting by painting, and with what kind of paint? A. Apply one or two good coats of asphaltum varnish, allowing each coating to dry or harden thoroughly. If the water moves with great velocity, paint or varnish will not last very long on the interior.

(12) B. F. S. asks: 1. Can you tell me how asphaltum is prepared or where it is obtained? A. Asphaltum, also known as bitumen, is a black, glossy, brittle resin, probably formed by the gradual oxidation of petroleum. It occurs very abundantly on the island of Trinidad, on the northern coast of South America, at the mouth of the Orinoco, on the waters of the Dead Sea (anciently *Lacus Asphaltites*), and in several other localities. It is somewhat soluble in alcohol, and readily so in naphtha, benzole, and turpentine. It is used in varnish making (iron varnish), in engraving copper and steel as an etching ground, and as an oil paint. Asphalt mixed with gravel, sand, lime, limestone, etc., is largely used for paving purposes, being durable and somewhat elastic. 2. What are its uses, and can it be used with success in cold climates on account of frost? A. As far as we know it has been used for this and other similar purposes in cold climates with good results.

(13) A. P. asks: To increase the speed of our mill, which would be the most advantageous, to increase the size of pulley on shaft or decrease the size of pulley on mill spindle? A. The former.

(14) G. M. asks: 1. Is it necessary for the helix to exactly fit the bar of steel to be magnetized? A. No, but a good fit gives the best results. 2. How much and what size wire must I use for making magnets? A. This depends entirely on the size of the magnet and the power of the battery. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, directions for making telephone magnets. 3. Can it be made any stronger by leaving it in longer, than pushing it once nearly through and then back to its place and then breaking the current? A. No.

(15) C. R. H. asks: Is it possible for a number of persons to move a table by electricity by placing their hands upon it, without pressing upon it? A. No.

(16) "Imperial" asks in what country locomotives were invented, and when. A. In France, 1769, by Cugnot.

(17) N. H. B. asks for recipe for bronze blacking for leather. A. Make a concentrated solution of RRB methyl violet in a boiling solution of 4 parts shellac in 1 part of borax, and about 15 or 20 parts of soft water.

(18) J. B. asks: 1. What chemicals are used in Babcock fire extinguishers? A. The tank is half filled with a strong solution of carbonate or bicarbonate of soda, over which is suspended a leaden cup containing commercial sulphuric acid. 2. Can I use the chemical for fire extinguisher without using their apparatus? A. Yes. 3. Is there any other chemical which will act and answer for the same purposes? A. Carbonates of lime, potassa, iron, etc., with any of the stronger acids, will answer nearly as well, if economy is not considered. The acids must of course be kept in vessels not corroded by them.

(19) G. J. asks: What is a horse power? From whence did it originate? What is the horse power of the United States? A. A horse power is the equivalent of 33,000 foot lbs. of work per minute. The expression was first used by James Watt, we believe. According to the census of the United States, taken in 1870, the steam power employed in manufactures was 1,215,711 horse power, and the water power, 1,130,431 horse power.

(20) O. A. S. asks: 1. In making an electro-magnet for a magneto-electric machine, is it better to use coarse wire (No. 24) or fine wire (No. 32), and which gives the better result? A. The magnets are generally wound with coarse wire, from No. 4 to No. 16, according to the style of the machine. The armature is wound with fine wire for intensity and coarse wire for quantity. 2. Are "Notes and Queries" in the SCIENTIFIC AMERICAN Export Edition? A. Yes.

(21) C. H. A. asks: 1. Can charcoal be used for the carbon in the battery described in No. 149, SUPPLEMENT, in "How to Make an Electric Light"? A. No. 2. How is the wire fastened to the zinc plate? Will merely putting the wire through a hole in the zinc and twisting it answer? A. Yes. 3. Does the amalgam serve any purpose other than to keep the zinc from being destroyed rapidly? A. It improves the efficiency of the battery and keeps the zincs clean. 4. How can I make an iron mould for making carbon according to the directions given in the above mentioned article? A. Make a pattern and have it cast. 5. How is oxygen made from chlorate of potassa and binoxide of manganese? A. Potassium chlorate, 4 parts; pure manganese binoxide, 1 part; heat the mixture in a retort of porcelain, earthenware, glass, or iron, until no more gas is given off. 6. What is the peculiar odor which arises when hydrogen is being made with zinc clippings and sulphuric acid? A. It is due to impurities in the zinc, and may be removed by passing the gas through strong solutions of potash and silver nitrate. 7. Is there any truth in the statement that cotton is more quickly bleached when under peach or apple trees in bloom, than when placed anywhere else on the grass in the sun, the goods of course treated alike in other respects? A. No.

(22) C. F. S. asks if the true ratio of the circumference of a circle to its diameter has ever been found. A. If you mean the numerical value of this ratio, we answer, no; although the difference between the number used and the true number is so small as to be of no practical importance.

(23) J. R. G. writes: I see in SCIENTIFIC AMERICAN, January 4, the article "A Fast Little Side Wheeler" by C. A. Thompson, Owego, N. Y. He used vertical boiler and a small boat for private use. Please tell me whether his boat was commissioned by United States officers. I did not know that such a boiler would be allowed. I wanted to use such a boat, but the United States officers said it must be commissioned and I must use licensed pilot, captain, and engineer. A. All boats using steam power are subject to the United States inspection laws. In some sections of the country, we have heard that vertical boilers are not allowed, but we would be glad to receive more detailed information from inspectors or others who are familiar with the special regulations in such localities, and the reasons for the same.

(24) H. H. H. asks: 1. How does the injector work? Please give a full explanation. A. Bourne, in his "Treatise on the Steam Engine," gives a concise explanation which is quite satisfactory: "As the power resident in a jet of steam is expended in giving momentum to its particles, it is clear that any instrument which recovered this power from those particles, and expended it without waste, would produce the same effects which are producible by the expenditure of the same quantity of steam in an ordinary engine. This is what is done, with more or less efficacy, by Giffard's injector, an essential condition to the action of which is, that the water supplied to it shall not be so hot as to refuse to condense the steam. As the steam itself disappears, the power previously existing in it is expended in the propulsion of the water, and the amount of that power is sufficient to force the water into the boiler in opposition to the pressure of the steam." 2. Also, what is the size of the Great Eastern, and what size engine is used to run her? Give dimensions of cylinder. A. The Great Eastern is 680 feet long, 82½ feet broad, and 58 feet depth of hold. She has four screw engines, 84 inches diameter of cylinder, 4 feet stroke, and four paddle engines, cylinders 74 inches in diameter, 14 feet stroke. 3. Also what is the size of the largest steamboat run on the Ohio river? A. We must ask some of our Ohio readers to answer this question.

(25) S. A. writes: I have a high pressure engine, 30 inches cylinder, 60 inches stroke. I think of putting in a condenser. Which will give the best result, a jet condenser or a surface condenser? I have a large pond of water of 5 feet fall that I can run through the surface condenser, which I think will save the expense of a pump. All the pump I would require would be a small one about 3x6 inches to draw the water from the condenser and force into the boiler. A. From your description we think your plan for the application of a surface condenser is good.

(26) Ph. D. says: In amalgamating zincs I have used a solution of 8 ounces of mercury in a mixture of 1 lb. of nitric and 5 lbs. of hydrochloric acid. It was only necessary to dip the zinc for a moment in the milky liquid thus prepared to obtain a good coating of mercury. Lately, using the same proportions and acids of the same quality (so the druggist tells me), I have met with poor success—the solution looks less milky and it is necessary to rub the metal hard with the brush to get any coating at all. The zincs are well cleaned before putting them in the mercury solution. Is it possible the temperature has an effect? A. The acids laterally used were probably stronger or warmer than formerly, in which case a larger proportion of mercuric salt formed. The milkiness is due to basic nitrates and calomel. Dilute the nitric acid a little and allow the solution to take place in the cold.

(27) T. S. asks how phosphorescent sulphide of calcium, called Canton's phosphorus, is prepared. A. 3 parts of clean oyster shells or mother-of-pearl are reduced to impalpable powder, mixed intimately with 1 part of flowers of sulphur, and the mixture strongly heated in a crucible for an hour. Grotthusz directs that the powdered oyster shells be placed in alternate layers with the sulphur and heated for some time at a moderate temperature.

(28) T. D. F. asks how to make seidlitz powders. A. Tartrate of soda, 2 drachms; bicarbonate of soda, 2 scruples; mix and wrap in blue paper. Tartaric acid, 35 grains; powder, and put in white paper.

COMMUNICATIONS RECEIVED.

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

On Square Measure. By M. C.
On the Metric System. By W. F. Q.
On a Camera Lucida. By S. B.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 7, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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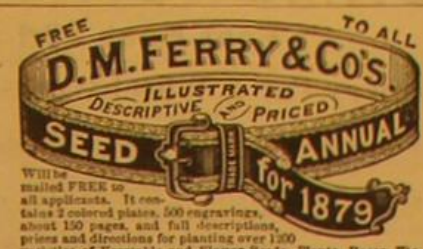

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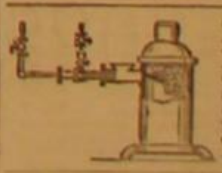

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