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AMERICAN INDUSTRIES.—No. 6.

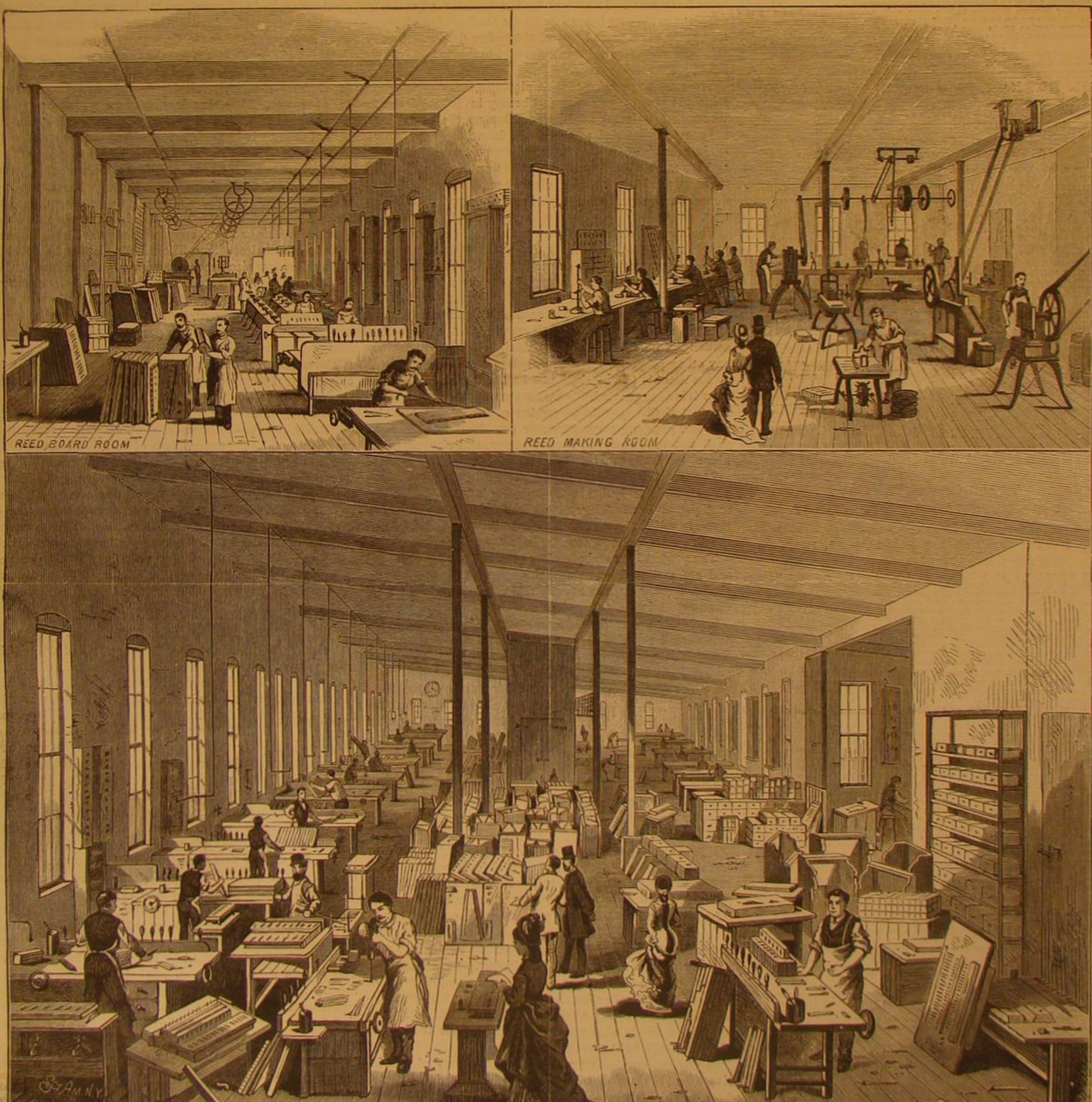
THE MANUFACTURE OF REED ORGANS.

In articles of luxury and refinement Europe, by virtue of long experience, low priced labor, and commercial prestige, in former years received a disproportionate share of trade, but more recently, especially within the last few years, there are strong indications of a change in favor of our own country. To our European neighbors this is unwished for and unwelcome, but to our own citizens it is a matter of intense satisfaction. This state of things is exhibited by many branches of American manufacture, but we do not know that it is anywhere more clearly manifested than in the manufacture and sale of reed organs, one hundred of which are now exported for every one imported.

The honor of bringing these instruments to the degree of perfection which has given them a high reputation, both at home and abroad, belongs chiefly to the Mason & Hamlin Organ Co., several departments of whose extensive works we illustrate in our present issue.

At the late fair of the Mechanics' Charitable Association, in Boston, the jury, after much deliberation, and the careful examination and comparison of organs submitted to them, and after a review of the history of the growth of this branch of industry, said in their Report that "the specialties of Messrs. Mason & Hamlin have commended the reed organ to artists and men of genius, both in this country and in Europe, in a degree claimed by no other manufacturers;" and still further, "it is not too much to repeat that Messrs. Mason & Hamlin have done more to bring the instrument in general favor and repute, both at home and in foreign countries, than all other manufacturers." This high tribute is just.

(*Continued on page* 114.)



THE MANUFACTURE OF REED ORGANS.

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NEW YORK, SATURDAY, FEBRUARY 22, 1879.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 164,

For the Week ending February 22, 1879.

Price 10 cents. For sale by all newsdealers.

THE NEW PATENT BILL.—SHALL IT PASS THE HOUSE?

In our last issue we recorded the fact of the passage by the Senate of the new patent bill (Senate Bill 300), which is now before the House of Representatives.

This bill, as we have on several occasions tried to show, is likely, if it becomes a law, to impair the future value of property in patents; and therefore it behooves all who wish to preserve the existing privileges of inventors to use their best influence with their Congressional representatives to defeat or set aside the measure. Whatever is done in this direction must be done quickly. Congress is to adjourn finally on the 4th of March, and the bill must either pass or suffer defeat by or before that day.

An esteemed correspondent writes us that he thinks it would not be difficult to defeat the bill if we would formulate specific instructions addressed to inventors and patentees, telling them how to band together to oppose the passage of the bill, specifying exactly what they ought to say to their representatives in Congress in order to induce them to give it their adverse votes.

Inventors, says our correspondent, are generally unlettered men, and although they feel strongly opposed to this attack on their interests, many of them do not know how to give proper expression to their views.

We suppose that what our correspondent desires is that now, in this closing hour of the contest, we shall briefly recapitulate the status of the present law and point out the scope of the intended substitute.

The present law, substantially, has been in operation for some forty years. It secures to the inventor an exclusive property in his own invention for the small period of seventeen years, at an official cost of thirty-five dollars. During this term no person may interfere with the patent without liability for infringement.

The existing practice of the United States Courts is to construe the present patent laws liberally in favor of the inventor and against the infringer. But on the other hand, the courts are careful to guard the interests of the public against the claims of unauthorized or pretended patentees; and the more widely a new device is wanted for public use, the more particular are the judges to require the clearest evidence on the part of the patentee in support of the patent.

The law, as it stands, as shown by the practice of the courts, provides ample safeguards for the public interests, as against untenable or wrongfully granted patents. The courts also regulate the measure of damages, so that even infringers are never overmuch punished.

At the same time it must be confessed that a patent as now granted means something. It means that a man shall actually own and control his patent, in his own way, like any other property, for the period of seventeen years. It means that his patent shall not be taxed out of existence after it is once granted. It means that a poor man who owns a patent shall enjoy the protection of the courts, and that rich and grasping corporations or combinations of interests shall not have power to harass, annoy, and altogether rob him of the fruits of his toil and ingenuity.

The amazing progress of the country during the past forty years is undeniably due to the fostering influence of the present patent laws. They have given impetus to manufactures, supplied thousands of new industries, and rendered the American name famous for industry and progress.

The present laws and practices of the courts have worked and are still working so well that it seems a great pity to change them, except as to such minor particulars where obvious corrections may require.

To boldly overthrow them and reverse, by legislation, the accustomed practice of the courts, seems to be suicidal. But this is what Senate Bill 300 seems designed to accomplish. It is the offspring of the combined efforts of the wealthy railway companies and other interests, who have become impatient to seize and appropriate to their own use every really valuable and important invention, without the customary formalities of payment or the owner's consent, as now by the law and the courts required.

Senate Bill 300 provides substantially, by section 2, that the patentee shall not for the future enjoy the full and exclusive right to control his patent; but anybody who desires may, by legal proceedings, which the inventor must defend, take the right from him.

It provides, by sections 3, 4, 5, 10, 11, that infringers may call the patentee into court and subject him to heavy costs and vexatious legal proceedings, so as practically to compel the inventor to deliver over his invention for the use of the infringers, thus reversing the present practice.

In short, the new law aims to punish the inventor and protect the infringer; whereas the present law aims to protect the inventor and punish the infringer.

Section 12 of the new law aims to tax the majority of patents out of existence after they have been issued, by requiring the inventor to pay a tax of $50 at the end of four years and $100 more in nine years, or in all $185 for the patent, instead of $35, as at present.

In our last number we gave a brief summary of the designs of all the sections of the bill, of which there are twenty-five; to which, and also to the several interesting discussions given by us week by week for a long time past, our readers are respectfully referred. We hope that every inventor and patentee who wishes to defeat this bill will make energetic use of the short time now remaining to assist members of the House in reaching the truth on the subject, and thus enable them to cast their votes intelligently.

CREOSOTED WOOD AS A PROTECTION AGAINST TEREDOES.

A series of experiments of great interest was some time ago undertaken by the Royal Academy of Sciences, of Amsterdam, to determine the best means of preserving wood from destruction by the teredo (*Teredo navalis*). The examination made by Mr. Harting (one of the commission of investigation), embodied in a recently issued report, is very instructive. It is ascertained that the mechanism of the mollusk is of a twofold nature. Those animals which are found in calcareous rocks make their excavations chemically through the agency of a dissolving acid secretion; but the teredo that perforates wood employs mechanical means only. The teredo appears to have existed at a geological period earlier than our own; this view being confirmed by the discovery of fossil wood perforated by a species of this mollusk in the Eocene formations. It has been discovered also that certain circumstances favor the increase and ravages of the animal; these being a moderate rainfall, an increase of the saltness of the water, and an increase of temperature. The experiments of the commission included processes that had been recommended to the government to protect marine works; and the pieces of wood experimented upon were allowed to be prepared by the inventors themselves. The ports of Flessingue, Harlingen, Stavoren, and Nieuwendam were selected first for the trials, the woods used being oak, red fir, common fir, and pine, in pieces about 3 feet long by about 12 inches square. By the side of these blocks other blocks of the same kind of wood were placed without any preparation, as counterproofs. The trials consisted (1) of coatings applied to the surface; (2) impregnation with different substances which modify the interior and exterior of the wood; (3) use of exotic woods.

All exterior applications—such as coal tar, paraffine varnish and Claasen's mixture of coal tar, resin, sulphur, and powdered glass—absolutely failed. A coat of mail consisting of nails is costly, and an examination of some piles proved that the coating of iron and rust was not proof against the ravages of the teredo in the interior. Sheets of iron, copper, or zinc are found effectual only as the surfaces remain intact and undamaged. Nature itself often affords a better protection than this in covering marine timber with barnacles or other shell fish. As to the second remedy—impregnation—the following substances all proved inefficacious and worthless: Sulphate of copper, copperas, acetate of lead, and mercurial and arsenical salts. The soluble glass and chloride of calcium process also proved powerless. Oil of paraffine injected into the blocks proved of no avail, as in about two years fully developed teredoes were found in all the pieces. Of the oil of creosote process, however, more favorable results are recorded—all of the woods prepared with this substance having been found intact.

The conclusions drawn by the commission are that the only effectual preservative is creosote, though in using it care should be taken that the oil is of good quality, the impregnation thorough, and that woods be used that will absorb the oil readily, as fir and other resinous woods. These conclusions are confirmed by the experiments of Mr. E. R. Andrews, of this country, who also has made interesting experiments with creosoted wood. A pine slab was taken, half of it was thoroughly impregnated with the oil, the other half being left untreated. It was then exposed during the season of 1877 in the waters of the Gulf of Mexico. When it was removed it was found that the creosoted portion was clearly and sharply defined by its darker color, and that it was perfectly sound, while the untreated half was riddled by teredoes, which had perforated it quite close to the edge of the creosote.

SKATING ON ARTIFICIAL ICE.

A skating rink, offering 16,000 square feet of artificial ice in one sheet, is in successful operation in this city. The projector, Mr. Rankin, is widely known in connection with the ice trade, particularly in the West and South, where his machines for producing ice are largely used. His present enterprise is notable chiefly for its magnitude, the area of ice produced being very many times larger than anything of the sort previously attempted. Something like nine miles of gas piping are required for the circulation of the refrigerating liquid, which is pumped through the pipes after having had its temperature sufficiently reduced in a freezing chamber some two hundred and fifty feet long, in which ice is liquefied by means of salt and other solids. The principle involved is simply that of the ice cream freezer. A tight floor was laid over a surface 200 feet by 80 feet; on this floor a network of pipes was laid, and the whole flooded by two or three inches of water. On pumping the refrigerating fluid through the pipes, the water is frozen and kept so cold that the surface of the ice remains dry, though the atmosphere of the rink is warmed by half a dozen large furnaces. The project might have been carried out equally well and much more profitably at midsummer, when a skating rink would have been more of a novelty. Mr. Rankin informs us that the temperature of the refrigerating liquid is raised but ten degrees while on its nine mile journey.

A NEW composition of iron and steel is described. A cast iron mould is divided into two sections by means of a transverse plate of thin sheet iron. The two metals are then poured into the respective compartments. The sheet iron partition prevents the mixture of the metals and facilitates the welding by itself being brought into a state of fusion. It is said that the product is well adapted for safes, and that it resists drills.

RECENT EXPERIMENTS WITH "LAUGHING GAS."

Protoxide of nitrogen, or "laughing gas," the anæsthetic properties of which were discovered by Sir Humphry Davy, is used at the present time by a very large number of dentists for producing insensibility during the process of extracting teeth. But this insensibility cannot be prolonged for any great length of time owing to the fact that asphyxia is liable to supervene. For this reason, American surgeon dentists have succeeded in performing lengthy operations by means of this gas, only in producing short, but repeated anæsthesia, separated by intervals of sensibility. The reason of this is that anæsthesia can only be produced by making the patient respire pure protoxide of nitrogen, without any admixture of air; the result is that asphyxia is a concomitant of anæsthesia. The celebrated physiologist, M. Paul Bert, has recently been experimenting on this subject with a view of discovering some means of overcoming the latter difficulty, and obtaining from laughing gas anæsthetic effects that may be indefinitely prolonged, while at the same time they shall be absolutely free from any dangers arising from asphyxia. The results of his investigations were presented in a paper read before the French Academy of Sciences on the 11th of November. It is proper to remark here that M. Bert's experiments were made upon animals solely. The fact that protoxide of nitrogen must be administered in a pure state signifies that the tension of this gas, in order that it may penetrate in sufficient quantity into the organism, must be equal to one atmosphere. In order to obtain it, under the normal pressure, it is necessary that the gas be in the proportion of 100 per cent. But if we suppose the patient placed in an apparatus where the pressure may be carried up to two atmospheres, we shall be able to submit him to the desired tension in making him respire a mixture of 50 per cent protoxide of nitrogen and 50 per cent air; we ought then to obtain anæsthesia, while at the same time we maintain the normal quantity of oxygen in the blood, and consequently preserve the normal conditions of respiration. And this is just what happens. In M. Bert's experiments he tells us that he entered an apparatus constructed for the purpose, and there under an increase of pressure of one fifth of an atmosphere he caused a dog to respire a mixture of five sixths of protoxide of nitrogen and one sixth oxygen—a mixture in which, as may be seen, the tension of the laughing gas is precisely equal to one atmosphere. Under such conditions the animal fell, in one or two minutes, into a complete state of anæsthesia, and had it not been for its respiration, which was executed with perfect regularity, it would have seemed to be dead. This state was found to last for an entire hour without the least change; the blood preserving its red color, the heart its regular beats, and the temperature its normal degree. During this whole period, all those phenomena of life called vegetative remained intact, while all those of animal life were absolutely annulled. When the bag containing the mixed gases was at length removed, the animal was observed, at the third or fourth inspiration of pure air, to suddenly recover its sensibility, will, intelligence, and natural friskiness. This rapid return to a normal state, so different from what is observed on the administration of chloroform, is due to the fact that laughing gas does not, like the latter, form chemical combinations in the organism, but is simply dissolved in the blood. As soon as none of it longer exists in the inspired air, it rapidly escapes from the system, through the lungs, as analyses of the blood have proved. As a result of many very careful experiments, M. Bert states that he feels himself authorized to maintain that the use of protoxide of hydrogen is perfectly harmless; and furthermore, he strongly recommends surgeons to use this gas under pressure, with a view of obtaining its anæsthetic effects as long as possible. By measuring, as above indicated, the barometric pressure and the centesimal composition of the mixture, so as to have for the protoxide of nitrogen the tension of the atmosphere, and for the oxygen at least the normal tension in the air, they will obtain a state of insensibility and a muscular resolution as complete as they desire, with an immediate return to sensibility and perfect state of well being, on removal of the anæsthetic agent. The sole difficulty in the way relates to the apparatus necessary to make the application of the anæsthetic under tension. For army purposes this is insuperable, but in cities the difficulty is easily remedied, for in such places compressed air baths are always obtainable, and in fact might be easily constructed in the surgical wards of hospitals at small expense. This, however, is a matter of secondary consequence, the solution of which remains with surgeons themselves; to whom, as well, it belongs to resolve the numerous questions of detail that always accompany the application of a new therapeutic agent.

A PAPER OBSERVATORY DOME.

An astronomical observatory has recently been erected for the Rensselaer Polytechnic Institute, at Troy, in the maturing of the plans for which Prof. Dascom Greene has introduced an improved method of constructing revolving domes. In making the preliminary inquiries, he ascertained that a dome of the required dimensions, constructed in any of the methods in common use, would weigh from 5 to 10 tons, and require the aid of cumbersome machinery to revolve it. It therefore occurred to him to have the framework made of wood of the greatest lightness consistent with the requisite strength, and to cover it with a paper of a quality similar to that used in the manufacture of paper boats; the advantages in the use of such materials being that they admit of great perfection of form and finish, and give extreme lightness, strength, and stiffness to the structure. A contract was accordingly made with a well-known firm of builders of paper boats, for the construction of the dome, and the undertaking has been carried out with great skill and success. The dome is a hemisphere, with an outside diameter of 29 feet. The framework is covered with paper about one-sixth of an inch thick after drying, and is of a superior quality, manufactured expressly for the purpose at Westfield, Mass.; it has a structure as compact as that of the hardest wood, which it greatly excels in strength, toughness, and freedom from any liability to fracture. The weight of the dome and its appurtenances, as completed, is about 4,000 pounds. It is supported on six 8-inch balls, which roll between grooved iron tracks, and can be easily revolved by a moderate pressure applied directly, without the aid of machinery.

THE WOODBURY PLANING MACHINE CASE.

At Boston, in the United States Circuit Court, January 28th, 1879, Judge Lowell rendered a decision in this important and long contested patent litigation. He decides that the Woodbury patent is invalid. A gigantic monopoly thus probably receives its death blow, for it is not likely that the Supreme Court will reverse the decision, though an appeal still lies to that tribunal. The enemies of our existing patent system who are claiming that the present rights of inventors shall be abridged, may see, from the principles laid down in this important decision, that the present laws as they stand afford the public ample security against the triumph of invalid patents or the progress of unauthorized patent monopolies.

The leading features of the Woodbury case, as found in Judge Lowell's decision, are as follows:

The patent was issued to Joseph P. Woodbury, April 29, 1873, and is for an improvement in planing machines, by which flat bars are placed before and behind the cutters to keep the stock firm during the operation, instead of the rollers, which were used by Woodworth, the inventor of this class of machines. This change, though slight, has proved to be of great value, and is now in general use; and this suit is defended by an association of persons who are interested to continue such use. The patentee is dead, and the plaintiffs are a corporation to whom he had assigned his patent.

The history of this grant, which was made twenty-five years after it was first applied for, and twenty-seven years after the invention was completed, is remarkable. The inventor made application June 3, 1848, and appointed an attorney, but did not give him all the usual authority. The power was so worded as not to enable him to withdraw the application. The office rejected the application February 20, 1849, and nothing further was done until October, 1852, when the attorney withdrew the application, and received back $20, of which Woodbury had no notice. In February, 1854, Woodbury instructed another solicitor to call up and prosecute this rejected application. There was, at that time, a rule in the patent office, that an application which should not be renewed or prosecuted within two years after it had been rejected or withdrawn, should be conclusively presumed to have been abandoned.

But in revising the patent laws in 1870, Congress enacted "that when an application for a patent has been rejected or withdrawn, prior to the passage of this act, the applicant shall have six months from the date of such passage to renew his application, or to file a new one; and if he omit to do either, his application shall be held to have been abandoned. Upon the hearing of such renewed applications, abandonment shall be considered as a question of fact."

Woodbury's application was thereafter revived, and after a long contest before the patent office, a patent was issued in the name of the inventor, dated under date of April 29, 1873. Meanwhile, the invention had for many years been brought into general public use, for as no patent existed all the lumber workers enjoyed the free use of the invention. The Woodbury party then began suits for damages against those who continued the use after the issue of the patent. Nothing could be collected for the use prior to the patent. The defense of Keith was, that Woodbury was not the original and first inventor, and, therefore, that the Woodbury patent was invalid. It was successfully shown that the machine built by one Anson, at Norwich, Connecticut, anticipated the invention of Woodbury.

The invention of Woodbury was made in 1846, and the machine of Anson was made in 1843. Of the date there is no doubt, for Anson applied for a patent on his invention in 1844. His machine was organized to mould or "stick," as the witnesses call it, sashes for windows, and similar articles, was adapted to planing, and was used for planing slats for blinds. There is no doubt that Anson's machine had bars instead of rollers, for he says so in his specification. The machine has been running ever since, and was produced in court.

"Two points," says Judge Lowell, "are taken against this machine. 1st. That the bed is not sufficiently solid to answer the purpose of Woodbury's bed, which is to resist firmly, like an anvil, as he says, the blows of the cutter. Upon the evidence, and upon inspection, I think the bed is a solid bed, within the meaning and use of the Woodbury machine, for all purposes of planing such stock as was likely to be planed upon it. And if the machine were to be enlarged to do general planing work, I see no reason to suppose that a similar bed, modified only as any mechanic would modify it, would not answer the purpose. The solid bed was not new with Woodbury, but was part of the Woodworth organization, which was the starting point of all these machines, and its benefits were well known and likely to be adopted by Anson. 2d. The other question is whether the bars which Anson made instead of rollers, had a yielding pressure. If not, they would not work on an ordinary planing machine, though they might possibly do in a small machine for special purposes. The machine in court has a yielding pressure, by means of weights, which allows the bar to give about three-eighths of an inch. Mr. Waters says about three-sixteenths of an inch: but he is considerably under the mark. To all appearance this organization is as old as the rest of the machine; but as the question of novelty on the part of Woodbury depends upon whether the weights were introduced thirty-five years or thirty-three years since, the appearance is of no great significance. The witnesses all think that the machine has remained unchanged in this particular from the beginning. It seems probably that any one who substituted bars for rollers would make them yield, because the rollers of Woodworth's machine were made in that way. It was not the yielding which was new, but the substitution of bars for rollers. The distinguished expert of the plaintiffs says, 'I have never seen a Woodworth planing machine organized with either rollers or bars to bear down the rough stock upon the bed-piece, by acting upon the rough surface of the stock, that was not so constructed as to allow the roller or bar, as the case might be, to yield to the inequalities almost always existing in sawed lumber; nor do I ever expect to see such a machine in practical use.' His meaning is, that the machine would stop whenever a board having the usual inequalities was attempted to be passed through it.

"In a machine like Anson's the difficulty might not present itself so often, or so soon, but I should suppose it would make itself felt sooner or later, and would need to be remedied before the machine had been run for a day.

"The witnesses, sixteen in number, are all on one side, and include, apparently, all persons now living who ought to be called. They testify from their recollection, with more or less positiveness, and with apparent fairness. None of them points to any change by which the pressure bars were made yielding after the machine was finished in 1843, but, as I before said, they all think them unchanged.

"Against this there is the evidence, which is entitled to much weight, that the drawings accompanying Anson's application for a patent do not show any opportunity for a yielding pressure, or but little. The model is somewhat damaged, and the suggestion is made that it may have been tampered with. As it appears to-day there is some play to the rods of the pressure bars.

"I do not think this negative evidence sufficient to discredit the recollection of the witnesses. The patent which Anson asked for had nothing to do with the bars, and there is no reason to suppose that he understood that there was any such advantage in bars over rollers as Woodbury saw and made known. He was not concerned with the particular matter of a yielding pressure bar; but if he made it to yield, he made the thing which Woodbury is, by a very proper and indeed necessary fiction of the patent law, presumed to have had knowledge of; and, therefore, when Woodbury pointed out the great advantage of this organization, he was merely, in intendment of law, applying an old machine to a more extensive use. I believe him to have been an original and meritorious inventor, but of a change which was not difficult to make or to invent, and of which, as it turns out, he was not the first inventor. Bill dismissed with costs."

A NEW AND IMPORTANT MINERAL.

About the first of December of last year, Dr. Henry Wurtz received a specimen of a newly discovered mineral, said to occur in considerable quantities in Utah, where it is found in veins of pipe clay. This mineral is of a dark brown color, and waxy feel, and is easily impressed by the finger nail. Dr. Wurtz made a preliminary examination, and found that it fuses at a little over 70° C., and evidently consists of a number of homologues of the paraffine series, such as those found in Europe in Moldavia and Galicia. It is the first deposit of the kind known on this continent, and may prove of great value to that section of the country.

Cold ether dissolves about 12 per cent of a soft paraffine of greasy consistence and having the color of burnt sienna. It becomes transparent on melting and resembles the urpethite of Johnston.

Boiling ether dissolves about 37 per cent, and leaves on evaporation a hard, waxy material, somewhat darker than the first portion. It is probably to be classed with ozokerite, notwithstanding its apparently greater hardness.

The third portion, insoluble in boiling ether, and comprising about 52 per cent of the original mass, is very dark brown and decidedly harder than beeswax. It appears to approach in character the Moldavian species of zietriskisite, but its melting point is somewhat lower. Lack of sufficient material has hitherto prevented Dr. Wurtz from determining the various points of interest with satisfactory precision.

C. F. K.

A recent number of the *Indian Tea Gazette* reports that a new species of tea shrub, resembling that which grows in China, has been discovered in Armenia, near Trebizond. The peasants pick the leaves and dry them in the sun, and large quantities have been sent to Persia, where the new product is highly appreciated

[*Continued from first page.*]

Prior to 1861, only a few reed instruments, known as seraphines, melodeons, etc., were made in America. In that year Messrs. Mason & Hamlin introduced important improvements, changing the form, improving the mechanism, and otherwise modifying the instrument, so that it was deemed worthy of the name which it has since borne. The improvement was so great that large popularity followed; sales rapidly increased, and numbers of other reed instruments ceased their manufacture, making organs instead. In numbering their instruments, Mason & Hamlin have already reached 103,000, having actually made and sold nearly this number.

In 1867 these makers, having taken highest honors at the more important industrial exhibitions in America, sent their new instrument to the World's Exhibition in Paris, placing it in comparison with instruments of the class from European makers. Its great merits were at once recognized; the jury awarded them the first medal, and even rival makers pronounced the Mason & Hamlin organ "worthy of imitation." At every one of the world's exhibitions since, Mason & Hamlin have boldly placed their organs in competition with the best similar productions of the world, and at every one have borne away the highest honors. At the Paris Exhibition of 1878 they received the only gold medal awarded to any American musical instruments, and, in addition, the highest co-laborer's medal.

And this suggests the fact that while their success as manufacturers is to be largely ascribed to the peculiar skill of those who have associated themselves in this company, which has enabled them to introduce so many improvements, it is in no small degree due, also, to the high standard which they set before themselves at the start, and to which they have rigidly adhered. Any mechanic who visits their factory will see evidence of the scrupulous selection of only best material, and the employment of every machine and facility for best work. The temptation to manufacturers during the last few years to lower their standard, and be satisfied with something less than the best, has been very great because of the strong competition in prices; and this has been especially the case in the manufacture of articles like organs, in which there is such abundant opportunity to cheapen. But the Mason & Hamlin Company have successfully resisted this temptation. The standard of their work is as high today as ever, and the excellence of their organs the makers state to be greater than ever before.

The New York office of this company is located at 25 Union Square; their factories are in Cambridgeport, Mass., virtually a part of Boston. Obviously we cannot represent in detail many of the various steps in the manufacture of these instruments.

The reeds, which are the most important part of the organ, are made from brass by the automatic machinery and mechanical appliances, shown in the upper right hand view in the title page engraving. Each reed consists of a block of brass having an oblong aperture, to which is fitted a tongue, secured to the block at one end, the other being left free to vibrate. The tongues of the reeds used by this company are secured by iron rivets, experience having shown that this mode of fastening is preferable to all others, the reeds secured in this way being less liable to loosen in the operation of voicing, or by long continued vibration. The shaping of the parts of a reed and the fastening of them together is comparatively a simple matter, as the greater portion of the work is done by presses and other machinery adapted to the purpose; but the voicing, as it is technically called, is quite a different matter. Here neither machinery nor mechanical appliances are of any avail, the success of the process being dependent chiefly upon a nicely trained musical ear. Voicing, which is the most difficult and important process in making an organ, consists in shaping the tongue of the reed so as to secure the best effects. This art was originated by Mr. Hamlin, of the Mason & Hamlin Organ Co., in 1848, and is now practiced, professedly at least, by all American and many European makers. It is an art that can be acquired by practice only, and it is found that but few are able to master it. The room in which the voicing is done is shown in Fig. 4. From this apartment extraneous noises must be excluded, otherwise slight defects in quality or timbre might not be discovered.

Each reed must vibrate in a cell of proper proportions, by which it is isolated from the others; these cells vary in size and form, according to the reeds which they are to receive, and are cut from the solid piece of wood which forms the reed board. The machinery employed in doing the work is shown in the left hand figure at the top of the front page engraving; it is of novel and ingenious character, and insures greater accuracy and uniformity than can be attained by handwork.

In the action rooms—one of which is the subject of the lower view on the front page—is made the apparatus which actuates the valves when the keys are depressed, a part of the organs that must be delicate and yet strong, and very precise in its operation. In this department many ingenious machines are employed in forming the several parts, each of which is made absolutely perfect, so that when all of the pieces are assembled the completed action is as perfect as machinery and skilled artisans can make it.

Fig. 4.—VOICING ROOM.

The organ cases are made in the department illustrated in Fig. 5. The mode of manufacture is similar to that of furniture generally. This company have received much credit for the tasteful designs and excellent workmanship displayed in their organ cases.

Fig. 5.—CASE MAKING.

Progress of Petroleum.

The oil business for the year 1878 presents a great contrast with that of the preceding year. The year 1877 was marked by considerable and certain prosperity both to the refiner and the producer; while the year just closed has been one of exceedingly small margins and low prices.

The chief causes for the low price in the producing regions have been the increased certainty with which oil has been obtained and the extent of territory which has been developed during the year. The Bradford field has steadily increased in yield and importance, and almost all the old operators have become attracted there. The Bradford field at the beginning of the year yielded 8,750 barrels per day from 1,100 wells, and at the end of the year it yielded 23,700 barrels per day from 2,950 wells, showing a very marked increase in the activity of the operators, and an increase of 14,950 barrels in the daily yield. This increase more than compensated for the falling off in the production of all the other districts; and the aggregate yield of the year is in considerable excess of the aggregate production of the preceding year—showing 15,163,462 barrels against 13,135,671 barrels for the preceding year; an increase of 2,027,791 barrels during the year just closed. The daily average production was 41,543 barrels against 35,988 barrels. Thus it will be seen the production of the year 1878 was largely in excess of any year in the history of the trade. The prices of crude at the wells have ruled quite low, and with slight fluctuations have gradually declined during the year.

The stocks of crude have been considerably larger than those carried in any previous year, but they have been carried with greater ease than heretofore, as the tankage and pipe line facilities have been largely increased. The export of refined and crude (in the absence of the official figures we have estimated it as equivalent to 10,000,000 barrels of crude) compared with the exports of the previous year (which were equal to 10,425,502 barrels of crude) shows a decrease of 425,502 barrels. With the exception of London, the principal old European ports have taken considerably less oil this year than last; but the ports of China and the East Indies have more than doubled their receipts.

The number of producing wells in Pennsylvania at the close of December, 1878, was 10,337. The average production per well was 4·1 barrels.—*Stowell's Reporter.*

The Value of Practical Men.

In a recent lecture on electric lighting, Professor Tyndall took occasion to say a good word for inventors, practical men, who take up the results of purely scientific investigation and turn them to public advantage. Speaking of the problems involved in electric lighting, Professor Tyndall said that all the laws of the subject were known, and there was no room for a discovery in the scientific sense, but there was room for the application of such mechanical ingenuity as had given us the sewing machine, the phonograph, and many other things. The investigator and discoverer pursued his theme for the sake of gaining knowledge; the inventor's aim was generally to make money, though he gladly recognized that in many cases the inventor was stimulated by love of his art. Sometimes these men spoke disrespectfully of each other, as Cuvier despised the man of practical application, probably not taking into account that the application of science reacted on science.

The amelioration of the condition of the community was, at any rate, an object worth laboring for. Still, it was well to remember that those discoveries and applications which struck the public mind and excited so much discussion, often comfrom men whose sole stimulus was an intellectual one. As to the philosophic aspect of the question, there was a small cohort of social regenerators, men of high aims, and for whom he had great respect, who would hand over science and scientific men to a hierarchy which would determine the particular subjects that the scientific man ought to pursue. Where that hierarchy was to get its wisdom they never explained. Those writers denounced and scorned all reference to what they considered to lie far apart from human needs, and yet upon sensible conceptions—as of molecules, for instance—sometimes depended the greatest discoveries. When the feeble magneto-electric spark was first introduced, an Oxford don expressed his great regret that such a discovery should have been made; for, he said, it put a new and facile instrument in the hands of the incendiary. Let them imagine that hierarchy of which he had spoken watching Faraday piddling over his magnets. They would certainly have sent him back to the bookbinder's bench as a far more dignified occupation. Yet it was Faraday's spark that now shone, and which he hoped would illuminate our quays and halls, and esplanades and squares, and possibly also our homes.

RECENT AMERICAN PATENTS.

In engineering we notice an improved sectional boiler by R. Cosslett, Jr., of Bristol, England, which is composed of a number of inclined tubes having connections which alternate in position and insure a complete circulation.

An improved tube fastening for boilers, contrived so that the tubes may be readily inserted and removed, is the invention of Mr. W. H. Walsh, of Fort Worth, Texas. The device appears well calculated to strengthen the boiler.

A mining car truck, the invention of Messrs. W. McGaskill and J. Meinhard, of Virginia City, Nev., is provided with wheels which turn independently, and with self-lubricating axle boxes which exclude dust from the journals.

Among mechanical patents we find a cotton press, by Mr. J. J. Hines, of Savannah, Ga., which consists in a combination of two toggle joints, with a peculiar windlass arranged in relation to the platen, so that the power is advantageously applied to the cotton bale.

Among agricultural inventions we find an improved wheel cultivator by Mr. N. T. Remy, of Brookville, Ind., which is adjustable as to width, and is arranged so that either of the horses attached to the machine may draw in advance of the other without changing the direction of the machine.

Mr. Daniel C. Fosgate, of Rochester, Minn., has invented a sulky plow, the frame of which may be leveled and the plow adjusted by the driver while in his seat.

Another sulky plow, of novel design, devised by Mr. L. Brown, of Wartsburg, Washington Ter., has its plow supported at one side of the sulky, and is provided with a ready means of adjustment.

A new form of rotary churn, invented by Mr. John McAnespey, of Philadelphia, Pa., has its dasher bars so disposed as to render it very effective.

Mr. Thomas P. Williamson, of Golconda, Ill., has patented an Apparatus for Dividing or Colonizing Bees, consisting of two hives, each made in two sections, having vertical movable walls.

An improved Fence by Mr. Josiah H. Bailey, of Wilmington, Ohio, is cheap, strong, and durable, can be easily and quickly erected or removed. It consists partly of wood and partly of iron; wooden posts are avoided.

Mr. William A. Yeatts, of Little River, Va., has an improvement in Cutters in which the hay and straw are subjected to a shear cut by the reciprocation of the knife or knives in the arc of a circle; the knives cut at every stroke backward and forward.

Mr. J. K. Boswell, of St. Louis, Mo., has a device for heating, cooking, and for drying clothes or fruit. The apparatus has the appearance of a piece of ornamental cabinet furniture, the internal parts being made of metal and the outside of wood.

A NEW ICE CREEPER.

The desirability of an efficient ice creeper is admitted, but the amount of time consumed in attaching and detaching

Fig. 1

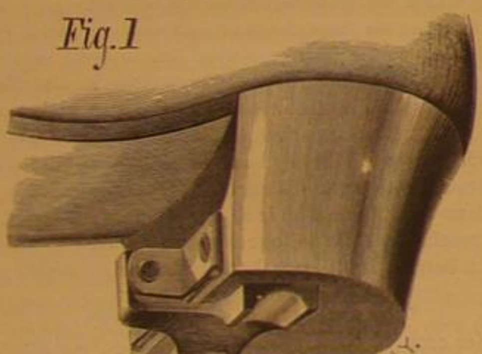
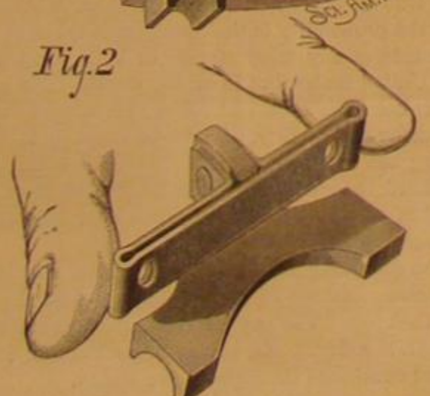


Fig. 2



AUSTIN'S ICE CREEPER.

creepers of the ordinary form is sufficient to prevent their general use.

The accompanying engraving shows an ice creeper that may be folded up against the sole of the boot when not in use, and may be readily unfolded so as to present four points to the surface of the ice.

The invention consists in a strip of metal turned upon itself to form a spring, and bent outward, forming ears, between which is pivoted the right angled arm of the plate which carries the spurs.

When the device is in use it is arranged as shown in Fig. 1. When it is not in use the concave surface of the plate is folded up against the narrower portion of the shoe sole.

A patent for this invention was recently granted to Mr. Edward D. Austin, of Erie, Pa.

AN IMPROVED FRUIT CAN.

The improved can shown in the accompanying engraving is the invention of Mr. Edwin Norton, of Chicago, Ill. It is intended for the use of packers of canned goods, and afterward to be used by families, thus saving the cost of new cans, an important item when the amount of money annually expended for the ordinary wax sealing tin cans is considered. The cans used by packers can be used but once, as they are destroyed in opening.

Fig. 1.

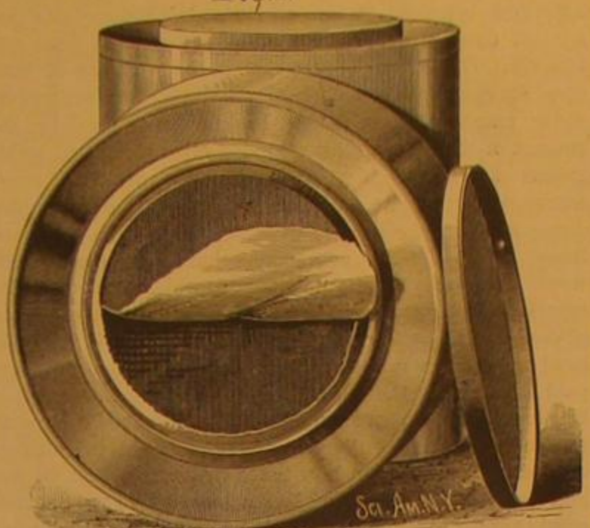


Fig. 2.

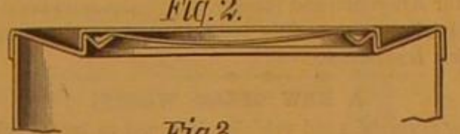
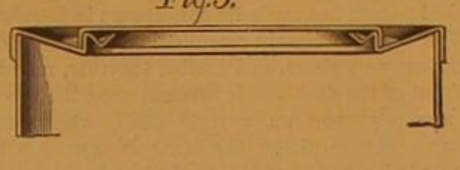


Fig. 3.



NORTON'S FRUIT CAN.

This can has two caps, the inside one being made of thin tin, which may be readily punctured and cut when the can is opened, and it cuts out smoothly, so that the contents may be readily removed, and the can will be left in good condition for further use. The outer cap adheres by friction, and there is the usual wax groove common to such can tops, which permits of using wax or cement in sealing in the usual way.

For further information address Messrs. Norton Brothers, Chicago, Ill.

The St. Gothard Tunnel.

It has been held that the workings in the Nevada silver mines are the hottest in the world; nor is this remarkable, seeing that the said workings are driven in what may be termed the crust of a recent volcano. If the stories which reach us from the St. Gothard Tunnel be true, the heat in the heading must be even greater than that in the silver mines. The total length now bored is 13,500 yards from both ends. The workmen, we are told, are subjected to such a temperature that "they can wear no clothes whatever. They return to the mouth of the tunnel streaming with perspiration, their faces are yellow and ghastly, they cannot bear the light of the sun, they walk with bent shoulders, and stagger as if carrying burdens too heavy for their strength."

This seems to denote phenomena which deserve attention. In the Nevada mines the temperature is high for very good reasons. In deep mines it is high because the nearer we approach the center of the earth the hotter things get, for reasons not too well explained. But in the St. Gothard tunnel there is no approach to the center of the earth, and the constant escape of cold air from the perforators ought to make the place chilly, rather than the reverse. Can it be that a volcano may be tapped before the tunnel is finished? Speaking seriously, says the *Engineer*, there would appear to be some very great defect in the ventilating arrangements, in consequence of which the lights used exalt the temperature. If it can be shown that the heat is as great as it is said to be, the matter should be investigated by some competent authority, as the results of such an investigation may throw light on certain questions now very obscure.

Dangerous Houses.

Houses that have been empty may become fever breeders when they come to be re-occupied. An English sanitary officer alleges that he has observed typhoid, diphtheria, or other zymotic affections to arise under these circumstances. The cause is supposed to be in the disuse of cisterns, pipes, and drains, the processes of putrefaction going on in the impure air in them, the unobstructed access of this air to the house, while the closure of windows and doors effectually shuts out fresh air. Persons moving from the city to their country homes for the summer, should see that the drains and pipes are in perfect order, that the cellar and closets are cleared of rubbish, and the whole house thoroughly aired before occupying. Carbolic acid used freely in the cellar is a good and cheap disinfectant.

Aerial Telegraphy.

Professor Loomis, of Washington, according to the New York *Tribune*, appears to be still enthusiastically carrying on his experiments in aerial telegraphy in West Virginia. Aerial telegraphy is based on the theory that at certain elevations there is a natural electric current, by taking advantage of which wires may be wholly dispensed with. It is said that he has telegraphed as far as eleven miles by means of kites flown with copper wire. 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 and perfect, 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 run up steel rods into the region of the electric current. The Professor announces that he has recently discovered that the telephone can be used for this method of communication as well as telegraphic instruments, and that of late he has done all his talking with his assistant, twenty miles away, by telephone, the connection being aerial only. He claims that he can telegraph across the sea without other wires than those necessary to reach the elevation of the current. There seems no immediate probability, however, of our getting on without poles and wire and ocean cables.

Explosion of Deflagrating Matter.

The author examines into the causes of an explosion by which a M. Zédé had been severely wounded. The latter was endeavoring to find a compound which without exploding should be entirely resolved at the lowest possible temperature into gases and vapors, and which should serve as a motive power. For this purpose he employed a mixture of gun cotton and of nitrate of ammonia. After finding the most suitable proportions he was studying in how far the speed of combustion, very slow in the open air, might be modified under increased pressure. On one occasion, when setting fire to the mixture contained in his apparatus, there occurred a violent explosion, attended by a flash of light. The tube, which had been tested up to fifty atmospheres, was shattered to pieces, and the experimentalist was seriously wounded. It would appear that a slight decrease in the orifice through which the gases escaped had changed the nature of the process from deflagration to detonation.—*M. Dupuy de Lome, in Comptes Rendus.*

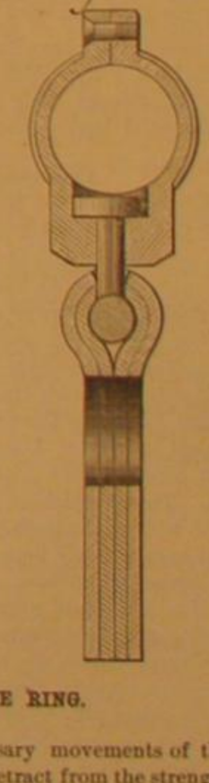
AN IMPROVEMENT IN NECK YOKES.

The accompanying engravings represent in perspective and in section a novel neck yoke ring recently patented by Mr. Leopold Biddle, of Knoxville, Iowa.

The sleeve which encircles the neck yoke is made in two parts, fastened together by screws or rivets passed through the projecting ears. In one side of the sleeve there is a socket for receiving the head of a T-shaped iron, around which is placed the leather ring that encircles the pole; an iron or steel ring may be substituted for a leather one if desired, and the sleeve may be made of brass, bronze, or malleable iron.

Fig. 1.

Fig. 2.



BIDDLE'S NECK YOKE RING.

This device permits of all necessary movements of the neck yoke, and does not in any way detract from the strength of the yoke.

To Make Fabrics Impermeable to Water.

The Bavarian *Industrie und Gewerbe Blatt* says that M. Von Mallmann, of Paris, has recently taken out a patent for a new process of rendering any woven fabric impermeable to water without affecting its color or impeding the free passage of the air. The process consists in immersing the cloth in a bath composed of water, acetate of alumina, and Iceland moss. The latter article is first boiled in the water and the acetate of alumina afterward added. The fabric is allowed to remain in the solution two or three hours and then taken out and dried.

The Spring Outlook.

The *United States Economist and Dry Goods Reporter* of this city discovers, since the first of January, encouraging business prospects for the future. Values of all kinds of property have been adjusted to a specie basis, and the close of the first month of resumption finds more gold in the National Treasury than at its commencement, although $35,000,000 have been paid out therefrom. This fact sets at rest the doubts that croakers originated about the failure of the Treasury department to continue to pay gold on demand, and assures the public that honest money is once more triumphant. The excess of our exports over imports for the year 1878 exhibits the gratifying balance of $305,000,000, with every prospect of being further increased during 1879.

During the first three weeks of January, 1879, 9,000 packages of domestic goods have been exported in excess of the amount shipped from all other ports for the corresponding period of 1878. China, Japan, Mexico, and South America are cultivating with us closer commercial relations, and our cotton fabrics are finding in these countries a widely extended and rapidly growing market. Our breadstuffs and provisions are the chief articles of freight carried by the large fleet of steamers that almost daily leave our seaboard cities for European ports, and the shipments promise to assume such magnitude in the future that larger vessels of immense freight capacity are being constructed to accommodate this growing trade. The trunk lines of railway are being used to their full capacity in transporting the produce of the West to the seaboard, while the elevators in the chief cities of that region are crowded with grain waiting for cars to transport it East.

The recent large advance in railroad bonds and mortgages is an indication of the confidence felt by the public in their security as a permanent investment, while the rise in railway stocks also demonstrates clearly that the effects of the panic are rapidly disappearing, and that a new tide of prosperity awaits the country. Railroads were the first to feel the financial upheaval in 1873, and they also give the first sure indications of a commercial revival. Real estate is improving, and in this city vacant lots that could not have been sold at even a nominal price two years ago, have advanced in some cases 100 per cent within the last six months.

The great drygoods interest, which is larger than that of any other in the land, has before it an encouraging outlook. Prices of cotton and woolen fabrics, both foreign and domestic, are now so low that any change must be upward instead of downward. Merchants cannot lose by the wide fluctuation of values as heretofore. Incompetent and unsound concerns have generally been weeded out, a higher degree of mercantile efficiency and honor is being developed, and the business generally is passing under more systematic methods and control. There are 40,000,000 of people to be clothed, the chief portion of whom have made but limited purchases during the last five years, and now, with better times in view, will become large consumers of all kinds of merchandise. To the capitalist, banker, merchant, manufacturer, artisan, and laborer, there is the sign of a business improvement. It will be slow, but it will be steady and permanent. While Europe is threatened with social and commercial disasters, and distress and suffering prevail through declining trade, in the United States peace and plenty abound, and the business of the entire country is reviving on the solid basis of specie payments. We have had our disasters and trials; they multiplied for a time thick and fast; but having been led by a kind Providence safely through them, we enter upon a higher commercial destiny than we have ever known before.

American Goods at Sheffield.

Some time ago we had occasion to call attention to a report by Dr. Webster, United States Consul at Sheffield, touching upon the subject of the sale of American hardwares in the town whence he wrote. The same gentleman has now forwarded a further report to the State Department at Washington, the subject matter of which will, no doubt, prove exceedingly interesting to the manufacturers of the town, as well as to hardware traders throughout the country. The consul states that there was at first a good deal of prejudice against articles of American manufacture, it being alleged that, although they might do well for a time, they would not last. These suspicions, Dr. Webster says, have been proved to be wide of the truth by the testimony of large importers, who have not only done well in the past, but are now doing an increasing business. As a means of furthering the connection, the consul warns his compatriots not to allow the quality of their wares to depreciate, inasmuch as "sharp and intelligent critics are watching our productions," so that American exports must be kept up to the highest standard. Having thus admonished his friends across the Atlantic, Dr. Webster gladdens their hearts by saying that the English people, having been accustomed to articles of a heavy make, will use the American lighter wares if really good.

As an example of the favor which certain imported goods have found of late years, the writer of the report instances the case of American hay forks, which were originally distrusted as being wanting in strength, whereas at the present time they are very much liked. So, at least, Dr. Webster tells us, and he grounds his observations in part on the circumstance that one Sheffield firm has sold over 2,500 dozen of these forks this season, and could have disposed of even more had they possessed the stock. American scythes and scythe-snaths, too, are coming into use, and the worthy consul tells his countrymen that "a large trade in them is looked for next year."

Leaving these generalities, however, the report next deals with specific quantities, and we are shown some of the details of the business done by one firm alone at Sheffield in various American articles. The figures given are so suggestively significant that we reproduce them here for the benefit of those skeptics whose doubts can only be removed by statistical evidence. Says the consul: "The following are some of the articles and quantities sold, viz.: 2,145 dozen locks, 14,676 iron planes, 1,185 dozen boxwood rules, 2,952 dozen hat and coat hooks, 220 dozen hammers, 572 dozen weighing machines, 2,520 screw wrenches, 230 dozen saws, 600 dozen drawer pulls, 1,680 dozen auger bits, 753 axes, 4,000 braces, 2,800 fretwork saws, 20 tons oil stones, 2,400 dozen axle pulleys, 32 dozen scythes, 250 dozen snaths, rakes, glass cutters, etc. Other firms are engaged in the same line of business, the aggregate of whose sales would be several times the above amounts. One dealer has imported goods to the amount of £7,000, consisting, among other things, of locks, spokes and rims, hubs, brackets, augers and bits, bench screws, tailors' shears, sash fasteners, hammer and axle handles, planes, spoke shaves, wrenches, hay forks, axle and frame pulleys." The aggregate value of all these goods would necessarily amount to a very considerable sum, which represents not merely the loss to Sheffield of that value, but of double the total given, inasmuch as not only have the local manufacturers lost trade to that extent, but they have paid so much for the goods from other quarters. Facts of this formidable aspect should furnish ample food for cogitation in the steel and cutlery capital, and ought to cause inquiries to be made as to how the invasion can best be met and repelled. If something be not done pretty soon Sheffield would appear to run the risk of becoming a mere distributing center for American and foreign hardwares, and her own staple industries may possibly fall into comparative desuetude.—*London Ironmonger.*

A NEW STEAM WAGON.

A new style of road vehicle, designed to be propelled by mechanical power, has made its appearance in London, England. The carriage closely resembles an ordinary dog cart; the shafts are very short, and incline together, meeting two feet in front of the dashboard; between them there is a third wheel, working upon an upright shaft, which could be turned by a handle placed the same as that of a bicycle. this handle is worked by reins, in the hands of the driver.

NEW STEAM WAGON.

The motive power is obtained by the combustion of benzoline, a small jet of which is admitted into the burner. It is then set on fire, and is completely consumed by a current of air, which, until the machine is in action, is produced by turning the small handle already alluded to. The burner, about the size of an ordinary chimney pot hat, and quite as elegant, is lined by coils of a copper tube containing water; this tube is calculated to bear 2,000 lbs. on the square inch, and in working only receives 60 lbs.; so that practically it is not likely to burst, and, if such an accident did occur, the results would not be serious, as the whole tube only contains a pound of water. The steam generated in this tube passes at one end into the cylinders of a small torpedo engine, which rotates a horizontal shaft; it then passes into a cooler, where it is condensed by the effect of a current of cold air driven against the outside of the vessel by a revolving fan, and the water so produced is forced back into the other end of the tubular boiler by a force pump; hence there is not the slightest escape of steam, nor is there any smoke, as the benzoline is entirely consumed by the current of air. The revolving engine shaft works the driving shaft, not directly, but by the medium of two cones placed side by side, their bases being reversed in position. A figure of 8 band connects the two, and, as it is moved toward the base of one it nears the apex of the other, and thus increases or diminishes the speed of the driving shaft, which is connected with the driving wheel, or off wheel, by an endless band.—*London Field.*

American Cheese in England.

A Somersetshire dairyman, writing from England on American cheese, concludes his communication as follows: "It seems to me that unless there be some stir and a great improvement made in the general average make of our cheese, we must give up cheese making, and quietly allow the American, who is over 3,000 miles distant, has a more difficult climate to contend with, and the extra cost of boxes and carriage, to beat us out of our very boots. Let dairy farmers use their eyes, and they will find this persevering Yankee opponent pushing his cheese into every little shop both in our towns and villages, and even hawking them to our door, while we are holding our cheese because he sells a better and cheaper article. At two factors' stores in our neighborhood, where I saw the other day a pile of American cheese, I was told they were obliged to have them, as every one was inquiring for them, while my cheese, which I admit are not best, although better than a good many dairies, are not wanted."

American Goods in Australia.

The *Echo*, published at Sydney, tells the Australians that it is enough to set a reflective man thinking to see the almost universal use now being made, in almost every handicraft, of tools of American manufacture. The limit of ingenuity, says the editor, seems to have been reached in England. Such firms as Elkington & Co. are being entirely cast in the shade by the Tiffanies and similar firms of America. If there is any labor-saving, novel, ingenious instrument invented, from a sewing machine to a needle gun, ten to one but it comes from the fertile brain and skillful fashioning hand of some clever American inventor. To leave Edison's marvels alone, look at the wonderful machines now elaborated to save labor in agricultural work. The reaper and binder, and a host of others, will suggest themselves immediately. Our bushmen work with American axes, the very handles being of a new Yankee pattern. We ride in American buggies, lounge in American chairs, and get weighed in American weighing machines. American inventions for domestic purposes—from the washing, wringing, potato and apple paring, churning, and other housework machines, down to the latest dodge, a self-weighing cheese knife, are the wonder and delight of our housewives. In the workshop their marvelous self-adjusting planes, screws, chisels, and splendid tools of all kinds are entirely ousting the old-fashioned productions of Sheffield. It is high time technical education and schools of design were established, or Yankee ingenuity will entirely beat us out of the market. As one of their own writers puts it: "One of the principal reasons for the success of the American manufacturers abroad is the adaptability of American mechanics. They are not only thoroughly competent to make anything that is required, but they can also design tools for any conceivable purpose. They can make machinery for any work whatever, and they are always ready to learn. They do not think that theirs is the only way in which a thing can be done. It is the versatility of American mechanics that pushes their products on the foreign market."

Australian Competition.

At a recent meeting in Melbourne of the principal Australian meat preserving company, it was stated by Sir Samuel Wilson that the meat then in course of packing in the tins cost "a farthing less than nothing per sheep;" or, in other words, that the sums realized from the sale of the skins and tallow were sufficient to cover, or rather more than cover, the original prime cost of the animals. It follows that the cost of the tins in which the meat is packed, and the expenses attending its cooking and shipment, are the only charges which the preserved meat has to bear.

Commenting on these facts the *British Farmer's Gazette* remarks that "American preserved meats have lately been running the Australian produce very close in the English markets; but the invention of machinery which enables twenty-four tins to be packed in Melbourne in the same time in which one tin is filled by hand in Chicago ought to enable our colonial brethren to distance all competition."

Is it true that Melbourne is so far ahead of Chicago in the use of machinery? If so, our American inventors will have to lend a hand. It will not do to be beaten so easily.

The Ice Crop of the Hudson.

The ice crop of the Upper Mississippi is very great, and the same is true of other northern rivers from Minnesota to Maine; but the probability is that more ice is taken from the Hudson than from any other stream or body of water, not only in the United States, but in all the world. The harvest this year has been the most successful ever known, both as regards quantity and quality. The total capacity of the ice houses along the Hudson exceeds 2,000,000 tons. These have been filled to overflowing with ice of the finest kind, and upward of a million tons in addition have been stocked for early consumption.

During the gathering time over 10,000 men, nearly 2,000 boys, 900 horses, and 100 steam engines, were employed in getting in the crop. The pay of the harvesters has ranged from $1 to $1.75 a day. The season began the first week in January, and continued throughout the month.

Original Advice for Drinkers.

Barkeepers in this city pay on an average $2 per gallon for whisky. One gallon contains an average of sixty-five drinks, and at 10 cents a drink, the poor man pays $6.50 per gallon for his whisky. In other words, he pays $2 for the whisky and $4.50 to a man for handing it over the bar. Make your wife your barkeeper. Lend her two dollars to buy a gallon of whisky for a beginning, and every time you want a drink, go to her and pay 10 cents for it. By the time you have drunk a gallon she will have $6.50, or enough money to refund the $2 borrowed of you, to pay for another gallon of liquor, and have a balance of $2.50. She will be able to conduct future operations on her own capital, and when you become an inebriate, unable to support yourself, shunned and despised by all respectable persons, your wife will have enough money to keep you until you get ready to fill a drunkard's grave.—*Lecture of C. T. Campbell at Maysville, Ky.*

Car Drivers' Maladies.

While assistant sanitary inspector of the New York Board of Health, Dr. A. McLane Hamilton made a special study of the maladies incident to the work of street car drivers. The most common, though not the most serious, of car drivers' maladies was found to be chilblains, from which not one in ten of the Third Avenue drivers escaped. The car driver invariably stands at his work, and his feet and legs are inevitably chilled by inaction and exposure. The impeded circulation of the blood due to long standing brings on a train of symptoms to which chilblains are a trifle. Even in warm weather a few weeks' driving is almost sure to bring on a swelling of the legs, with persistent pains in the feet, followed by numbness in the legs and ultimately by partial paralysis.

The doctor finds two immediate causes for this lamentable state of things: first, the constant gravitation of the blood and other fluids to the lower extremities; second, the drivers' habit of standing with their weight thrown on their heels.

The result is, says Dr. Hamilton, that the perpetual jar and jolting of the car are transmitted by direct vibration along the bones of the leg and thigh to the spinal column that continues and rests on them. In the first stages of the disease resulting from this source the man becomes irritable and nervous without being able to assign any reason for it. A little later he has dull pains in the lumbar region, and an intolerable sense of weight in the legs. The immediate cause of these symptoms is congestion of the spinal cord and its meninges, the disease being, in point of fact, a species of meningitis that seldom proves fatal in itself, but is the precursor of other nervous maladies of a more serious complexion.

In the course of a pretty careful canvass among car drivers, to test the correctness of Dr. Hamilton's statements, a writer for the New York *Times* says that he found scarcely a single driver of five years' standing who did not confess to wearing bandages, or to being subject to very considerable inconvenience from the symptoms of varicosity and spinal irritation, and medical men who have the largest practice with people of this class, express doubts whether a car driver's average term of service exceeds seven years.

We are confident that it would be no difficult thing to devise a seat for car drivers, with a brake lever, so that they could drive and manage the car while sitting. With the utmost consideration the car drivers' position will be severe enough. It is sheer cruelty to subject them to needless discomforts.

Disinfection by Cold.

In a letter to the Congressional committee on the subject of epidemic diseases, having special reference to yellow fever, Mrs. Elizabeth Thompson states that the designs for a refrigerating steamer by Professor John Gamgee, of London, England, are far advanced at the Navy Yard, but it will require at least three months from the date of signing contracts to construct this life-saving ship and its machinery.

It is intended that this steamer shall proceed to New Orleans, as the port most threatened, and there try the effect of extreme cold in the disinfection of ships coming from infected ports. Mrs. Thompson says:

"The Board of Experts [authorized by Congress to investigate the yellow fever epidemic of 1878] declare that 'ships are especially dangerous,' and 'remain sources of infection for months after having been infected with the poison;' that 'yellow fever poison is not able to withstand the influence of frost, and when exposed to a freezing temperature it is rendered innocuous and is probably destroyed;' that 'if the apparatus and experiments now projected for the utilization of extreme cold for this purpose should be found to be of practical application to the disinfection of the holds and other parts of vessels, their success would prove to be a sanitary acquisition of inestimable value.'

"The losses to this country by yellow fever 'have been variously estimated at sums ranging from $100,000,000 to $200,000,000,' and it has been computed that New Orleans alone suffered to the extent of $15,335,000. Millions have been spent in ships of war, and I earnestly hope that the opportunity we now have of testing nature's great preventive for yellow fever—cold—may be taken advantage of with promptitude and liberality."

The experiment would seem to be worthy of a trial, and, properly conducted, would be comparatively inexpensive. In the hands of a practical Yankee an ordinary tug-boat could probably be fitted out with refrigerating apparatus sufficient to test the question inside of a fortnight.

Transmission of Power at Rock Island Arsenal.

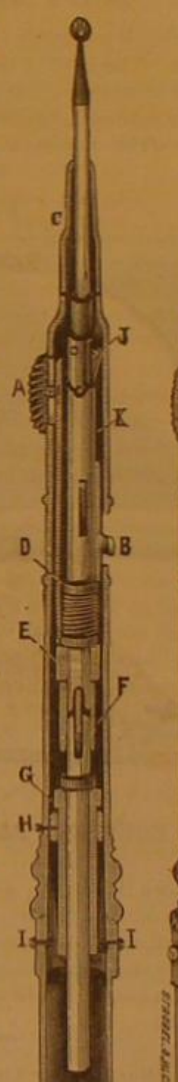
The experimental line of water power machinery with cable transmission, devised by Col. D. W. Flagler, for the Rock Island Arsenal, is said to work admirably. The full plans of Col. Flagler embrace 40 65-inch turbine wheels, working on two separate shafts, 20 wheels to a shaft. But now only four of these turbines are in place; the shaft is 9 inches in diameter, and 100 feet long. On the shore end of the shaft there is a driving pulley 15 feet in diameter, which receives a wire rope three fourths of an inch in diameter, which ascends to a tower and continues on to the shops. There are six spans of transmission, each span 400 feet in length, making the distance from the dam to the south row of shops 2,400 feet, almost a half mile. The ends of these spans are station towers of trestle work, each 40 feet high, these stations consisting of receiving and driving pulleys, each 15 feet in diameter. On one of the towers the cable turns at right angles by means of bevel gears. The four turbine wheels now being tested yield 240 horse power; and there was not a hitch in the whole length of the cable and machinery. This force will be used this winter for the shops. The great dams, the water power canal, and the minor parts of the work, have cost about $1,000,000. The pen stock is entirely of iron; and the turbines are so placed on the shaft that the stoppage of one by driftwood or otherwise will cause no derangement of the others.

The Adirondack Survey.

The reorganization of this survey, made necessary by legislative action last winter, has been successfully carried out; and the work accomplished during the past season is reported to be more than usually extensive and satisfactory. Many valuable scientific and geographical results have been obtained. A large number of the higher peaks have been measured with level and rod, and hundreds of miles of levels have been completed, covering the portions under survey with stations and permanent rock bench marks. The corners of counties have been marked, and county and town lines located. The chief rivers and lakes of the wilderness have also been surveyed throughout their whole extent.

STOP MOTION HAND PIECE FOR DENTAL ENGINES.

The advantage of being able to instantly stop the revolution of a dental burr, drill, or disk, must be obvious to every operator. Since the introduction of dental engines it is an easy matter to cut away the substance of the tooth so as to expose a nerve or unduly enlarge a cavity. To obviate such accidents, Dr. E. Osmond, of Cincinnati, O. (S. E. corner 8th and Elm streets), has perfected a stop motion hand piece for dental engines.



This instrument was recently patented and is now being brought to the notice of the dental profession. The hand piece is shown both in perspective and in section in the engraving.

The button, A, when pulled by bending the fore or middle finger, moves the arm, D, and the ring, E, which carries the clutch, F, downward out of engagement with the notched upper portion of the shaft, instantly breaking the connection and stopping the burr or drill. On removing the finger the parts regain their normal position and the drill is again set in motion. The instrument has a simple and effective drill holder, provided with a retaining spring, J, which may be exposed to view by drawing back the trigger, B. By pulling back the finger piece, A, and trigger, B, simultaneously, the drill may be changed while the engine runs.

Any of the well known dental engines may be used in connection with this instrument. Suitable means are provided for compensating for wear, and the finish is consistent with the use for which the tool is designed.

Chlorophyl as a Coloring for Preserved Vegetables.

At a recent meeting of the French Society to Encourage National Industry an important paper was presented by M. Personne on a process now being used in France for the preservation of vegetables in their natural green color, the process being based on the substitution of chlorophyl for the poisonous salts of copper formerly employed for this purpose.

The present process of preserving vegetables is that of Appert, made known at the beginning of this century. The industrial application of this process requires two operations, the first called washing, and the second, boiling. Washing consists in immersing the vegetables in boiling water for about five minutes, and then suddenly plunging them in cold water. Boiling is effected by placing the washed products in earthen vessels (or, better still, in hermetically sealed tin boxes) and exposing them to a temperature of 120° in steam boilers. It is readily seen that, after the operation, although the vegetables still retain their natural taste, they have lost their natural color and have become of a yellowish tint. The consumer, however, is not satisfied with the preservation of the taste alone; he also desires the additional satisfaction of having his eye pleased with the beautiful green color that the fresh vegetable possessed. As the export trade in these products is immense, it becomes absolutely necessary to accede to this demand, and so an artificial coloration has hitherto been effected by means of the salts of copper—principally the acetate and sulphate—added to the water in which the vegetables are washed. To the use of these metallic salts, however, there are many grave objections; and not the least of these is that of their poisonous nature. To find some means of doing away with the use of these toxic agents, by the substitution of some harmless matter, became the object of long and serious study to Professor Guillemore, of the University. He found at length, by experiment, that the less the quantity of chlorophyl in the vegetable the more rapidly and completely did it disappear on boiling; and that the fibers of the vegetable put in contact during boiling with soluble chlorophyl become saturated with it at a temperature of 100°; and finally, that the vegetables saturated with this chlorophyl, during the operation of washing, preserve and retain this color thereafter during boiling. After many experiments, the following has became the industrial process of fixing this chlorophyl coloring in a definite manner:

Spinach treated with a solution of soda gives up to the alkaline solution the chlorophyl, which it contains in large quantity; this alkaline solution is neutralized by hydrochloric acid added to the water in which the vegetables are to be washed. The chlorophyl, set free, unites with the vegetables, and this addition to the color which they naturally possess allows them to preserve their deep green tint, which otherwise would be destroyed by the boiling. The process, which is simplicity itself, has the immense advantage over the old one, that it introduces no injurious element into the preserved vegetables; indeed the products employed—chlorophyl and chloride of sodium—are such as make part of our daily food supply.

A Novel Temperance Society.

An association has been incorporated in this city, to be known as "The Business Men's Society for the Encouragement of Moderation." The purposes avowed by the society are to encourage moderation in the use of alcoholic beverages, to promote a knowledge of science and statistics relative to the manufacture and sale of alcoholic liquors, to disseminate among the people useful information regarding the principles of moderation and the means of carrying such principles into practical effect.

The society is also to exert its influence to induce retail liquor dealers to provide for teetotalers stimulating and nourishing beverages which contain no alcohol, and to encourage the establishment of places of cheap recreation and amusement where no intoxicating liquors shall be sold.

The pledges to be provided by this society are of three sorts: A total abstinence pledge, operative for one year, and renewable thereafter at the will of the pledger; a moderation pledge, binding the person who takes it not to drink during business hours; and finally, a unique engagement meant to prevent the person taking the pledge from partaking of intoxicating liquors at the expense of another person, and from extending an invitation to any other person to drink at his expense.

Utah Mineral Wax.

The great deposit of mineral wax, or native paraffine, lately discovered in Southern Utah, is described by Professor J. E. Clayton, of Salt Lake City, as occupying an area 60 miles long by 20 miles wide, and in some places forming a bed 20 feet thick. It contains more or less clay in seams and layers; but this is readily eliminated by melting, the earthy matter settling and leaving the paraffine nearly pure. It is quite black in the mass, but the sections are translucent. The quantity is said to be enormous; so great, indeed, that it cannot be controlled by any individual or company, but must prove a source of wealth to whole communities.

Professor Henry Wurtz pronounces the mineral to be zietriskisite, and says that it differs from paraffine by being insoluble in ether, and otherwise. Professor J. S. Newberry finds the specimens brought by him from Utah to be true ozokerite, and similar in all respects, except color, to that from Galicia; a true paraffine, melting at 60° C., and being soluble in ether.

As to the origin and geological relations of this remarkable bed of paraffine—which, so far as known, is without parallel in quantity in the world, and is as much of a "wonder" as our basins of petroleum—Professor Newberry cannot speak with any confidence until he has visited the locality where it occurs, as he hopes to do in a few weeks. He suspects, however, that it will be found to be an evolved product, the distillation of beds of cretaceous lignite, and the residue of a petroleum unusually rich in paraffine.

Coal Bunker Defenses.

The British naval authorities have been making experiments for some time with the view of testing the power of resistances to heavy shells of coals in the bunkers of men-of-war. The latest tests at Portsmouth seem to indicate that loose coal is the most effective means of protection yet discovered, and in the case of light, unarmored, or only partly armored vessels, the bunkers are built around the machinery. In the case of the Oberon it was proved by actual experiment that a shell from a sixty-four pounder at two hundred yards would neither penetrate the coal nor set it on fire.

High Temperatures.

By concentrating the electricity from a 13 horse power machine into the space of half an inch by inclosing carbon points in a block of lime, Mr. Edison claims to have produced the highest temperature ever reached by artificial means. When dropped into the flame, pieces of iridium, one of the most refractory of metals, volatilized immediately. A small screw driver passed across the flame would be cut in two, the part touched by the heat melting instantly. Even parts of the lime crucible fused under the intense heat.

AN IMPROVED PARALLEL RULER.

We give on this page an engraving of a novel parallel ruler recently patented by Mr. George Cousins, of Oswego, N. Y. It is intended for all of the purposes for which parallel rulers are commonly used, and in addition to this it may be used for duplicating designs, curves, etc.

The plate, A, which forms the body of the ruler, has formed in it two oppositely disposed segmental openings, whose straight sides form an angle of 45° with the beveled edges of the ruler. It has also several small circular apertures, which may be utilized in forming curved lines.

Parallel with one of the edges of the plate, A, a shaft, C, is journaled in suitable supports. On the ends of this shaft and outside of the bearings there are grooved wheels, D, which do not quite touch the surface on which the plate, A, rests.

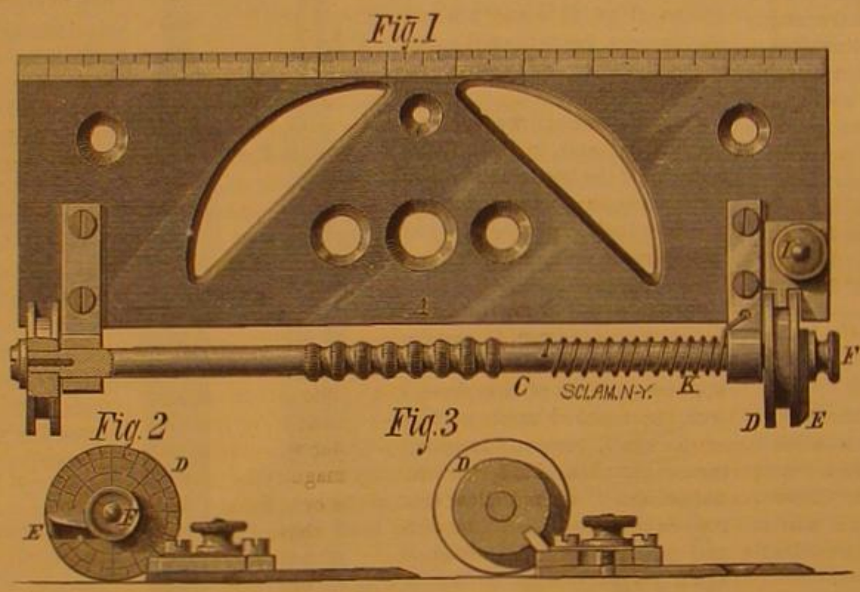
To one of the wheels, D, is an arm, E, secured by the screw, F, as shown in Fig. 2, and in the groove of the same wheel there is a pin that strikes the stop which is secured to the plate, A, by the screw, I. This stop is arranged to engage the arm, E, also.

On the shaft, C, is placed a spiral spring, K, which returns the pin in the groove of the wheel to the stop on the plate, A, as indicated in Fig. 3.

The side of the wheel, D, is graduated so that the arm, E, may be adjusted at any required distance from the pin in the groove. This distance governs the space between the lines formed along the edge of the ruler.

In drawing parallel lines the arm, E, having been adjusted as already described, the shaft, C, is pressed down until the wheels, D, touch the paper on which the lines are to be made; this tips up the beveled edge of the plate, A. The instrument is now moved forward, by rolling the milled portion of the shaft under the fingers, until the arm, E, strikes the stop on the plate, A, when the plate is allowed to regain its former position and the line is drawn. In drawing the successive lines the operation is repeated.

Section lining is done along the straight edges of the segmental openings, and curved lines are formed along the curved sides of the openings. Various designs may be duplicated by fastening patterns to the plate, A, so that they will move with it.



COUSINS' PARALLEL RULER.

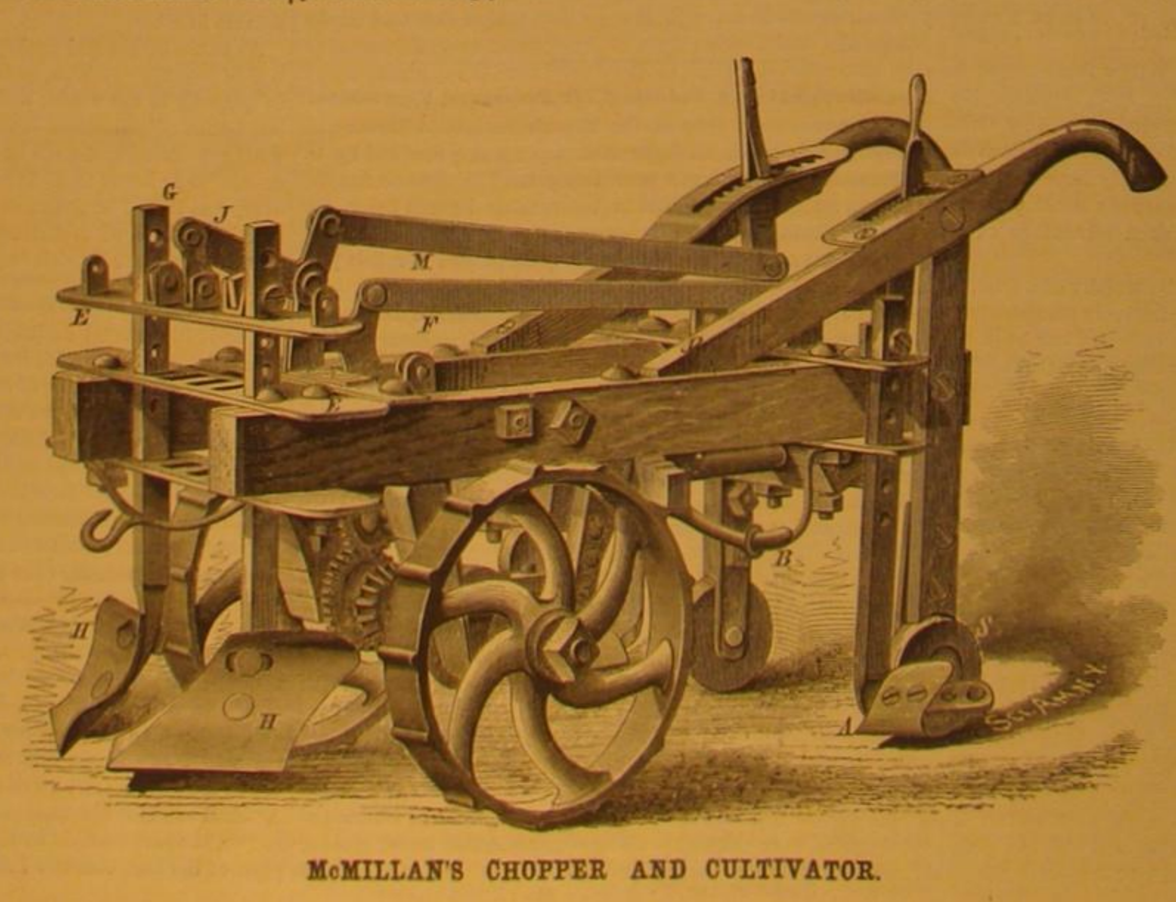
A COMBINED CHOPPER AND CULTIVATOR.

We give herewith an engraving of a new agricultural machine recently patented by Mr. John W. McMillan, of Brookhaven, Miss. This implement combines, in compact and usable form, a planter, chopper, cultivator, and a fertilizer distributer; in fact, it seems to be all that is required for the treatment of an entire cotton crop.

The machine, as will be noticed by referring to the engraving, carries two oppositely disposed plows, H, fixed to adjustable standards, G, guided by the plates, E, which are bolted to the forward end of the main frame. This frame is supported by two large wheels having corrugated or ribbed rims, and by two smaller wheels, S, which follow the small plows, A, at the rear of the machine. The standards are adjusted vertically by the hand lever at the rear of the machine through the rod, M, and angled lever, J. Behind the axle of the driving wheels there is a crank shaft which takes its motion through intermediate gearing from a bevel wheel on the axle.

This gearing may be thrown into and out of gear by means of the shorter lever at the rear of the machine, which communicates by a bar, F, with an angled lever connected with the movable portion of the gearing. The crank of the shaft referred to moves an arm, B, to which is attached a hoe whose motion is similar to that of the hand implement. The upper end of the hoe arm passes through a spring support, which allows the hoe to yield under undue strain.

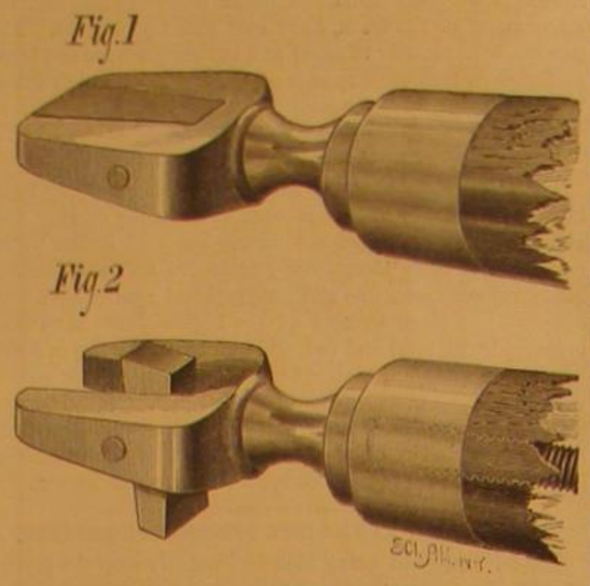
Plows and hoes of different sizes and shapes, and colters, and harrow teeth may be attached. The plows may be adjusted laterally and vertically, and the various parts are adjustable to suit different kinds of work. It it stated that the machine will "flat-break" land, ridge up and bar off, scrape and chop out cotton, as well as the most experienced hand. It is capable of distributing from 10 lbs. to 1,000 lbs., of fertilizer to the acre, and will easily perform the several operations for which it is designed.



McMILLAN'S CHOPPER AND CULTIVATOR.

A NEW WHIFFLETREE HOOK.

A novel and very simple device for securing traces to whiffletrees is shown in the accompanying engraving. Its



SMITH'S WHIFFLETREE HOOK.

construction is so clearly shown as to require very little explanation. The head of the pin in the end of the whiffletree is forked to receive a tapering tongue, whose pivot is arranged in relation to its center of gravity so that it will, by its own weight, assume a position at right angles with the pin as shown in Fig. 2. The trace is put upon the pin while the tongue is parallel with the head, as in Fig. 1; the tongue is afterward allowed to take the position shown in Fig. 2.

This invention was recently patented by Mr. Allen Smith, of Fort Randall, D. T., from whom further information may be obtained.

Phosphorus-Tin for Journal Boxes.

Ravene & Co., in Berlin, employ an alloy of tin and phosphorus for casting journal and axle boxes. It is easily fusible, melts at 330° C. (626° F.), does not heat at all when in use, and hence requires but little, if any, lubricator, and as it is scarcely at all affected by acids, cheap oils can be used. A great advantage is that no mould is required in which to cast it. The axle is placed in the box, which is closed with boards on each side and well stamped down with clay, and the metal poured directly into the mould thus formed. When cold the shell is taken out and cleaned, the oil hole bored, and it is ready for use. If not overheated this metal shrinks very little, if any, on cooling, and hence fills the mould most accurately, so that by using this metal instead of rough coating there is a saving of the cost for mould, for pattern, for boring out, and for fitting. It is said to last longer than other castings, will bear as great pressure and greater speed. The price in Berlin is, for No. 0, containing 5 per cent of phosphorus, $50 per 110 pounds; and for No. 1, containing 2½ per cent of phosphorus, $22.50 per 110 pounds.

The same alloy of phosphorus and tin is also employed for the manufacture of phosphorus bronze with great advantage both as regards cheapness and convenience, so that phosphorus bronze can be made in that manner with but little more expense than common bronze.

MISCELLANEOUS INVENTIONS.

Mr. William Vogan, of Newcastle, Pa., has an improved gate, which may be opened and closed by the wheels of a passing vehicle, and is not liable to become clogged or frozen fast.

A grain registering device for hand measures, which is contrived so that the act of "striking off" the surplus grain will ring a bell and operate the recording mechanism, is the invention of Mr. L. C. Ives, of Indian Creek, Va.

Mr. J. F. Christian, of Nurnberg, Germany, has devised a button having the head and shank formed of two separate pieces, which may be readily put together or separated.

An improved vehicle spring, which is adapted to the bolsters of wagons, and has several advantages over the ordinary spring, has been patented by Messrs. R. MacKeller and B. Lent, of Peekskill, N. Y.

An improved middlings separator, which purifies the middlings (driving off the dust and other impurities) and separates them into different grades, is the invention of Mr. W. P. Anthony, of Chambersburg, Pa.

An improved Pavement, formed of two courses of planks crossing each other at right angles, a layer of coal tar and sand, irregular bois d'arc blocks set on end with their interstices packed with sand, the whole covered with coal tar, has been patented by Mr. Samuel L. Shellenberger, of Denison, Texas.

A novel guide for matching machines, intended to prevent the planer knives from splitting the edges of the boards and to guard against the breaking of the knives, is the invention of Mr. P. Cardiff, of Marshfield, Oregon.

An improvement in brick machines, invented by Mr. J. McL. Mitchell, of Dunlap, Iowa, is contrived so that while pressure is exerted on one set of bricks, the bricks previously pressed are discharged from the moulds.

A novelty in gate rollers, the invention of Mr. William Schwendler, of Appleton, Wis., consists of a flanged roller fitted to a screw pin by a ball joint, so that it may turn on its axis and also swing like a hinge.

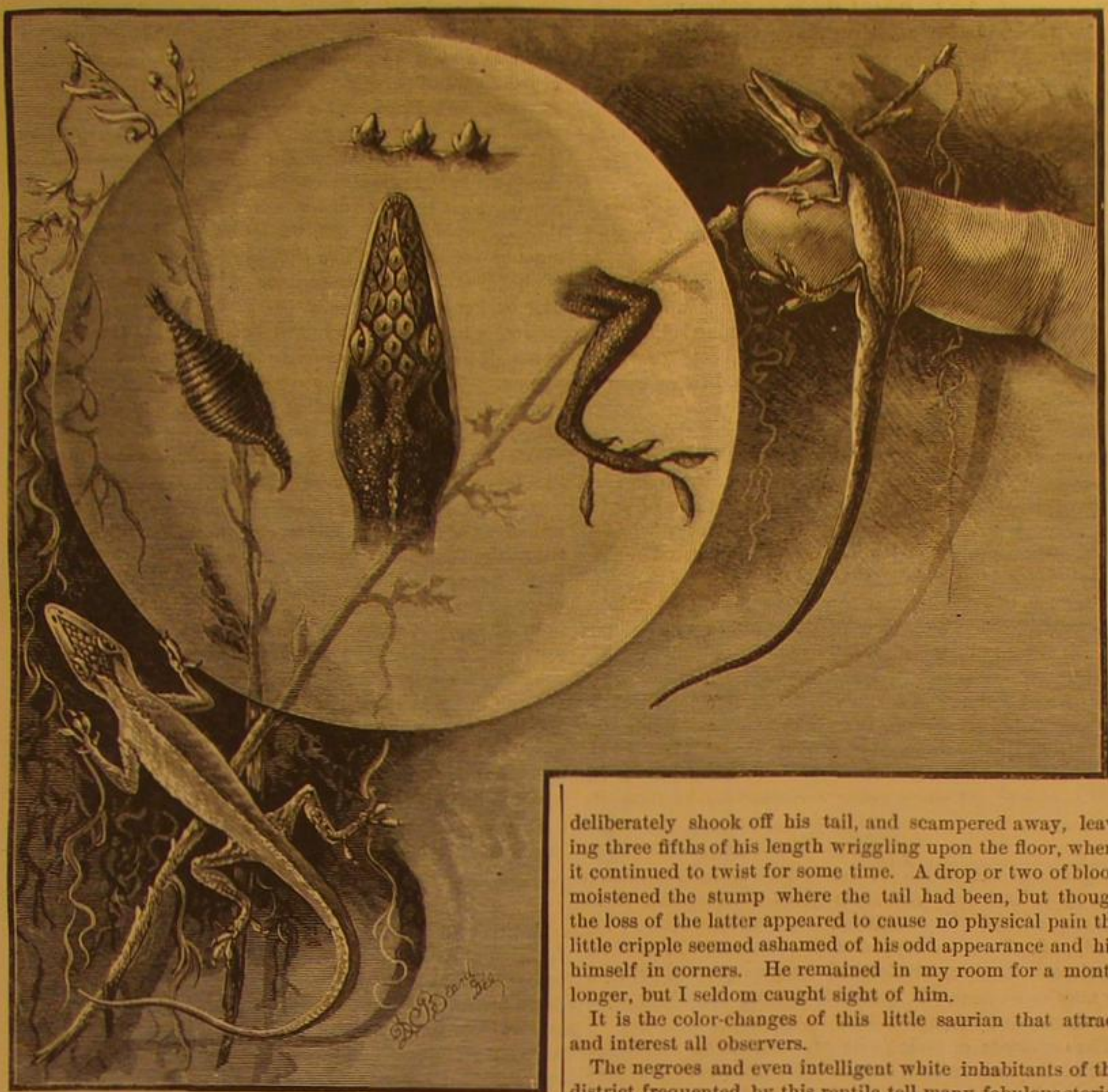
A shuttle box motion for looms, in which springs are dispensed with, and an easy and sure movement is secured, is the invention of Mr. John Barker, of Whittenton (Taunton P.O.), Mass.

Mr. J. A. Novinger, of New Bedford, O., has an improvement in gravitating platform animal traps, which insures a renewal of the bait after each operation of the trap.

An improvement in reefing fore and aft sails, by Mr. J. L. Dickenson, of Hempstead, N. Y., saves time and labor in reefing, and brings the sail into proper shape for a storm sail. It has the advantages of a try sail, and insures the security of the gaff when the vessel rolls.

Mr. Valentine Cook, of New York city, has an improvement in beer coolers. The main feature of the invention is the device for strengthening the large shallow pans used in the process of beer cooling.

A sight for firearms, which combines the advantages of the different sights in general use, has been patented by Mr. W. Matthews, of Camp Bidwell, Cal.



GREEN CAROLINA ANOLIS; OR, THE AMERICAN CHAMELEON.

BY DANIEL C. BEARD.

Perhaps the first creature that attracts the eye of the Northern naturalist upon landing at Florida is a small, slender lizard, which appears omnipresent, to be seen running up and down the walls of the Old Fort at St. Augustine, peering in at the windows of the hotel at Pilatka, scampering over the logs of the swamp at Tocoi, or scrambling along the garden fences at Jacksonville. It may also be seen exhibited for sale along with young alligators, wildcats, black bears, and many other queer objects to be found in the jewelry stores at Jacksonville.

The specimen from which my illustrations are made I captured at Tocoi. When first taken he was of a sooty black; five minutes afterward, when I opened the handkerchief in which I was carrying him to show my prize to a friend, I was amazed to find, in the place of the dark, dingy little creature I had wrapped up, a beautiful emerald green lizard. It was only then that I discovered my specimen to be the so-called American chameleon. I was somewhat ashamed of my ignorance until I met a certain naturalist from Michigan, who had made quite a collection of what he took to be distinct species of saurians, and had carefully preserved them in spirits, only to find upon inspection, that they were all exactly alike in form and color, all having assumed a yellowish-brown tint after immersion in alcohol. Two anoli that I kept in captivity proved very gentle pets, and would run over my hands waiting eagerly for me to catch flies for them. Although quick in their movements, and able by the help of their tail to spring quite a distance, these little animals never could capture the flies for themselves unless I first crippled the insect by removing a wing. They loved the sunshine and fresh air; the latter they would swallow occasionally in great gulps, expanding a sort of pouch under their neck by the process. Though gentle when treated with kindness, when tormented they would show fight, opening their mouths in a ludicrous way. One, after trying in vain to bite a lead pencil, with which I had been stroking his back and otherwise plaguing him, deliberately shook off his tail, and scampered away, leaving three fifths of his length wriggling upon the floor, where it continued to twist for some time. A drop or two of blood moistened the stump where the tail had been, but though the loss of the latter appeared to cause no physical pain the little cripple seemed ashamed of his odd appearance and hid himself in corners. He remained in my room for a month longer, but I seldom caught sight of him.

It is the color-changes of this little saurian that attract and interest all observers.

The negroes and even intelligent white inhabitants of the district frequented by this reptile tell many fabulous stories of its wonderful powers in this respect. Experiments with specimens which were in my possession at different times seemed to demonstrate that emerald green, gray, and sooty black and reddish yellow were the limits of its power. When frightened or pleased it turned green; if agitated for some time in apparent indecision, the color would fade and return in blotches. Under an ordinary magnifying glass it could be seen that the hollow around the eye changed first. Then the hexagonal plates upon the head showed the color, commencing at the edges and gradually spreading over each plate, the centers being the last points to turn. If a number of these animals be placed in alcohol they will be found to assume a dirty yellow or brown tinge. This is probably the natural hue of the skin with the coloring matter removed. The pigments appear to be contained in a network of vessels beneath the skin, and to be somewhat, though not altogether, under control of the animal. One, placed upon a bright crimson cloth, assumed a reddish yellow color, and though it did not approach the brightness of the cloth, a casual observer would hardly have noticed the lizard motionless upon it.

Green is its favorite color, and black I never saw but in one instance. When hiding in the Spanish moss or upon a tree trunk it assimilates the gray, while yellowish red it assumes with apparent effort. When put and left upon a red substance or in a cigar box, the color of the latter it approaches very nearly. From tip of nose to tip of tail measures from five to six inches, the tail being three fifths of its total length. The head is rather large, triangular in shape, apex at the nose, and covered with small hexagonal plates from the nose to just behind the eyes. The rest of the body is covered with small papillous points; the nostrils are near apex of the nose; the animal has no apparent external ears; it has bright, intelligent, almond-shaped eyes; large mouth, ten well defined teeth upon each side of the upper jaw, and four well defined teeth in the lower jaw, the intermediate space being filled with minute points; and four well developed legs, five toes upon each, each toe swelling out into a soft pad, terminating in a hooked claw. The pad or middle of the toe, under the magnifying glass, shows an odd arrangement of folds or flounces in the skin, each flounce, tuck, or fold being armed upon its edge with minute points, one half of them pointing up and the other half down, as shown in the illustration. Thus may we explain the creature's ability to run up or down the side of a house with equal facility.

In the illustration I have shown the lizard upon my finger, with mouth open; the dark color representing its favorite green hue. At the bottom in the moss is the same animal in his gray coat. In the circle appears a magnified view of the teeth, the second toe of the hind foot much enlarged, showing the peculiar arrangement of the folds of the skin upon the under side, and an enlarged view of the hind leg, and the head as it appeared under the glass while changing its color.

A NEW TORPEDO BOAT.

The accompanying engraving represents partly in section a torpedo boat recently patented by Mr. H. Mortensen, of Leadville, Col. The hull A, of the boat, has an arc-shaped keel, B, that runs the entire length, and projects beyond the stern. A portion of the keel is cut away at the stern to receive the rudder, C, which is pivoted in the support thus formed, and is provided with two arms, *a*, one on each side, that project at right angles to the face of the rudder, to receive the thrusts of the screw rods, which project through the stern of the boat, one on each side of the keel. The hull is divided into several compartments, one of which is designed to contain the men that operate the torpedo-projecting mechanism, another contains the men who introduce the torpedo into the projecting apparatus and attach it to the movable rod, and there are compartments for containing either air or water, as occasion may require. In the upper part of the boat there is a chamber which contains compressed air for the supply of the crew and for working the machinery. Under the several compartments already mentioned, there is a compartment for containing water forced in against an air cushion. This chamber acts as an accumulator of power which is expended in working the torpedo projecting apparatus.

A cylinder containing a piston is placed longitudinally in the hull, and provided with a loading chamber which projects through the bow of the boat.

The water required for working the piston may be forced into the accumulator chamber before the boat is started, or it may be forced in by hand or otherwise while the boat is under way.

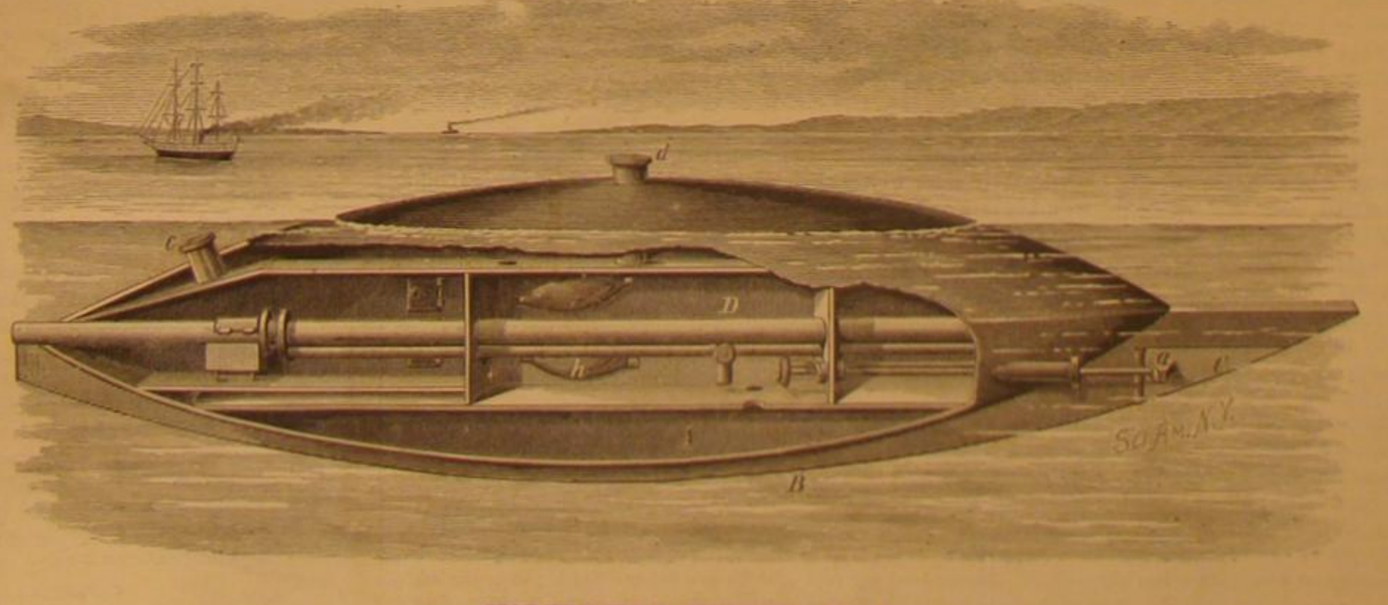
The rods by which the rudder is operated are threaded, one being provided with a right hand and the other with a left hand thread, and work in fixed nuts, and are provided with driving mechanism operated by a suitable motor or by hand.

The boat has a removable upper portion, which is secured to the hull by means of bolts. The top is comparted in the same manner as the hull, and both top and hull are provided with valves for the admission and escape of air and water. In the top there are two entrances, *c d*, provided with hinged covers that are packed to render them water-tight.

The compartments for containing the crew are provided with windows, which open inwardly, so that they may be repaired or replaced in case of breakage.

In each side of the boat there are recesses inclined in opposite directions; each of these recesses contains a screw propeller, the shaft of which extends into the boat, and is connected with a motor. By means of these screws the boat may be propelled forward or backward, and raised or lowered, as may be required.

The boat is capable of being operated wholly under the water; or the top portion may be removed, when it may be propelled on the surface.



MORTENSEN'S TORPEDO BOAT.

Development of the Lizard.

At a recent meeting of the Royal Society Prof. K. Parker presented a communication embodying part of his work on the structure and development of the skulls in the lizard group. His researches on the embryos of the common British lizards have led him to very unexpected results. Hitherto we have been accustomed to regard the crocodiles and turtles as the highest groups of the reptile family, chiefly on the evidence of the structure of the soft and more important vital organs. But the evidence from the skull leads Prof. Parker to regard the lizards not only as the most highly specialized of reptiles, but the group which approaches most closely towards birds. The term "lizard" is, however, at present used so vaguely as to include the hatteria of New Zealand and chameleon, both of which are often regarded as types of distinct orders of reptiles. The chameleon, however, which in many respects approximates toward crocodiles, is regarded as the lowest of the lizards, and even more distant from the higher types than tortoises and turtles. Yet the lizard skull is found to be but slightly modified from that of the snake. On the whole the character of their skulls leads to the conclusion that birds differ less from lizards in structure than does the ordinary perfect insect from its pupa. Of old the strong resemblance which the lizards termed "blind worms" present to serpents led to the conclusion that we see in them the limbs first coming into existence, but Prof. Parker not only regards the serpent as the more ancient and more generalized animal, but also as one which shows evidence of its degradation by the loss of limbs, which he believes the ancestral forms of the serpent types possessed. Of late years it has been customary to attach great importance in classification to the modification as presented by the ear bones. Judged by this standard the lizard is closely related to the tortoise and crocodile, and all three types are regarded as differing but little from the bird in this respect. The snake, however, is of a lower grade in the structure of the ear, while this feature in the chameleon is even less specialized than in frogs and toads. As concerns the theory of the skeleton and of the skull, Prof. Parker is led by his researches to conclude that the skull was the part of the animal first formed. Subsequently the joints of the backbone came in successive generations into existence, while the limbs and the bones which support them were of more recent origin than the trunk. From the indications furnished by development of the embryo there is reason to believe that some of the lower vertebrates had a long head, including as many as 14 or 15 divisions, which succeeded one another in a line from the front backward, and from this, as well as from the supposed comparatively late origin of the backbone, Prof. Parker is led to describe as absurd the well known "vertebral theory of the skull," originated both by Goethe and by Oken, and elaborated by Owen. Another important conclusion of Prof. Parker's, based chiefly on the researches of Mr. Balfour, is that the neck comes into existence by a long series of evolutions as a result of the subdivisions of the second vertebra, and serves "to bind the shortening head to the retreating body." In conclusion Prof. Parker expresses his opinion that even those who are content to work at the development of the lowlier types, such as the worm and the crayfish, are helping to throw light on the solution of the vertebrates.

Photography on Wood.

BY PROFESSOR J. HUSNIK.

I adopted the method of exposing gelatinized paper alone under a negative, and when the chromium salt had been washed out, placing it on a plate of glass and laying on the ink with a very small glue roller. With this I succeeded completely; I obtained beautiful pictures, perfect in the half tones, which could be at once laid on the wood block, and be printed off at one impression. Gelatine paper can be easily prepared, and kept in stock, according to the process described in my book *Das Gesammtgebiet des Lichtdrucks*, by placing sheets of paper in a perfectly horizontal position, and coating them with a dilute solution of gelatine, and they need only be sensitized at the moment of use with a one per cent solution of chromate; by this means the above described method is rendered thoroughly simple and practical, as well as being certain in its results. The wood block itself requires a very simple preparation; it must be rubbed down with whiting to which some adhesive substance has been added. This rubbing can be best effected by the ball of the hand. Gelatine paper can also be purchased from the dealers, and even my own photo-lithographic transfer paper will answer the purpose very well, provided that, before immersing it in the chromate solution, it be wiped over a few times with a damp sponge, and then rinsed well in clean water. This is done to remove any soluble matter from the surface. Afterwards the paper is dipped for some minutes in a one per cent solution of chromate, then drained, and hung up to dry at an ordinary temperature. Sensitized in this way it remains good for the above named purpose for from three to five days.

The Manufacture of Glass in Pittsburg.

Pittsburg, Pa., produces more than half the glass made in the United States. Its factories number 73, with 690 pots, and give employment to 5,248 hands, whose wages approach $3,000,000 a year. The materials employed in the manufacture were, the past year, 12,110 tons soda ash, 48,340 tons of sand, 152,000 bushels of lime, 1,218 tons nitrate soda, 793,500 bushels of coke, 4,525,760 bushels of coal, 4,025 cords wood, 6,055 tons of straw, 2,760 barrels of salt, 250 tons pearl ash, 360 tons of lead, 150,000 fire brick, 2,955 tons of German clay. The packing boxes cost $484,250, and required 2,109 kegs of nails. 96 wagons and 130 horses were employed in hauling. The space occupied by the buildings is equal to 208 acres, and the capital in buildings, machinery, and grounds is, in round numbers, $3,500,000. The business produces about $7,000,000 a year.

Memoranda for Garment Dyers.---Substances and Reagents Suitable for Removing Spots.

Steam has the property of softening fatty matters, and thus facilitating their removal by reagents.

Sulphuric acid may be employed in certain cases, especially to brighten and raise greens, reds, and yellows; but it must be diluted with at least 100 times its weight of water and more, according to the delicacy of the shades.

Muriatic acid is used with success for removing spots of ink and iron mould upon a great number of colors which it does not sensibly affect.

Sulphurous acid is only used for bleaching undyed goods, straw hats, etc., and for removing fruit stains upon white woolen and silk tissues. The fumes of burning sulphur are also employed for this object, but the liquid acid (or a solution of the bisulphite—not bisulphate—of soda or magnesia) is safer.

Oxalic acid serves for removing spots of ink and iron and the residues of mud spots, which do not yield to other cleansing agents. It may also be employed for destroying the stains of fruits and of astringent juices, and stains of urine which have become old upon any tissue. Nevertheless, it is best confined to undyed goods, as it attacks not merely fugitive colors, but certain of the lighter fast colors. The best method of applying it is to dissolve it in cold or lukewarm water, and to let a little of the solution remain upon the spot before rubbing it with the hands.

Citric acid serves to revive and raise certain colors, especially greens and yellows; it destroys the effect of alkalies and any bluish or crimson spots which appear upon scarlets. In its stead acetic acid may be employed.

Liquid ammonia, formerly called volatile alkali, is the most energetic and useful agent employed for cleaning tissues and silk hats, and for quickly neutralizing the effects of acids. In the latter case it is often sufficient to expose the goods to the fumes of this alkali in order to remove such spots entirely. Ammonia gives a violet cast to all shades produced with cochineal, lac, the redwoods or logwood, and all colors topped with cochineal. It does not deteriorate silks, but at elevated temperatures it perceptibly attacks woolens. It serves to restore the black upon silks damaged by damp.

The carbonate of soda (soda crystals) serves equally in most of the cases where ammonia is employed. It is good for hats affected by sweat.

Soda and potash only serve for white goods, of linen, hemp, or cotton; for these alkalies attack colors and injure the tenacity and suppleness of woolen and silk. For the same reason white soap is only to be recommended for cleaning white woolen tissues.

Mottled soaps serve for cleaning heavy stuffs of woolen or cotton, such as quilts; for such articles which do not require great suppleness or softness of feel the action of the soap may be enhanced by the addition of a small quantity of potash.

Soft potash soaps may be usefully employed in solution, along with gum arabic or other mucilaginous matters, for cleaning dyed goods, and especially self colored silks. This composition is preferable to white or marbled soaps, as it removes the spots better, and attacks the colors much less.

Ox-gall, which can be obtained from the butchers in a sort of membranous bag (the so-called gall bladder), has the property of dissolving the majority of fatty bodies without injuring either the color or the fiber. It may be used preferably to soap for cleaning woolens; but it should not be employed for cleaning stuffs of light and delicate colors, which it may spoil by giving them a greenish yellow, or even a deep green tint. It is mixed also with other matters, such as oil of turpentine, alcohol, honey, yolk of egg, clay, (fuller's earth), etc., and in this state it is used for cleaning silks.

To obtain a satisfactory result gall ought to be very fresh. To preserve it a simple method is to tie the neck of the gall bladder well with a string, and hold the bladder in boiling water for some time. This being done it is taken out and let dry in the shade.

Yolk of egg possesses nearly the same properties as ox gall, but is much more costly. It must be used as quickly as possible, for it loses its efficacy with keeping. It is sometimes mixed with an equal bulk of oil of turpentine.—*Moniteur de la Teinture.*

Whooping Cough and Fungus.

Some years ago M. Svetzerich made the assertion that whooping cough was caused by a certain fungus. This assertion seems lately to have been confirmed by the researches of M. Yschamer, who says he has found certain lower organisms in the spittle of whooping cough patients—organisms not met with in any other disease accompanied by cough and expectoration. Examining the spittle after it has been a short time suspended in water, there are found corpuscles about the size of a pin's head, of white or slightly yellowish hue, and these show, besides apathetical cells, a network frame of polygonal meshes, with rounded greenish sporules; at a more advanced stage, colorless hyphæ are seen, and large sporules, yellowish or brownish red, sometimes even ramified. It is interesting to learn that the champignons in question are quite identical with those which, by their agglomeration, form the black points on the skins of oranges and the parings of certain fruits, especially apples. Thus, M. Yschamer, by inoculating rabbits with this dark matter, or even causing it to be inhaled by men, produced fits of coughing several days in duration, and presenting all the characters of the convulsive whooping cough.

The Geological Relations of the Atmosphere.

At one of the recent sessions of the French Academy of Sciences a communication, with the title which heads these notes, was read from Professor Henry Hunt. This paper, of which we make a brief abstract from the text contained in one of our French exchanges, puts forth a curious theory. Taking into account the enormous quantity of carbonic acid stored up in the vegetation forming the coal deposit, and the much greater quantity of the same gas which is met with in the calcareous formations, Professor Hunt believes that it must be admitted that this gas has an extra-terrestrial origin. He believes that our atmosphere should be considered as a universal cosmic medium, condensed around the centers of attraction by reason of its mass and temperature, and occupying all the interstellar spaces in a state of extreme rarefaction.

By considering the question from this standpoint he deduces the conclusion that the atmospheres of the different celestial bodies should be in equilibrium, and so much so that every change that supervenes, be it either by condensation of aqueous vapor or carbonic acid, or by the setting free of oxygen or any gas whatever, would make itself felt in all the rest of the planets through the effect of diffusion. So, then, during those periods in which a great absorption took place on the face of our globe, our atmosphere would have been constantly fed by new portions of gas coming from the universal medium, and consequently from the gases surrounding the other planets.

From this it is understood that the proportion of carbonic acid in the atmosphere of the other planets must have experienced an equal diminution, at the moment that the excess of oxygen spread over the surface of our globe was equally diffused through their atmospheres.

Professor Henry Hunt sees in this theory the explanation of the origin of the cosmic dust.

A Quicksilver Motor.

A street car motor to be run by quicksilver is being manufactured at Aurora, Ill. About 800 pounds of quicksilver is to be placed in a reservoir at the top of the car and to pour down over a cast iron over-shot wheel, producing an equivalent of three horse power. The quicksilver is to be returned to the reservoir by pumps placed underneath the car, to be operated by a brakeman by means of a crank on the fron-platform.—*St. Louis Miller.*

There must be some mistake here in the calculations. Allowing a distance of 10 feet from the quicksilver reservoir to the point where it strikes the wheel, then the utmost force yielded by the fall of the 800 pounds of liquid metal will be a little less than one quarter of one horse power. To pump up the liquid again would keep the brakeman constantly at work. He could propel the car faster and to better advantage by simply walking behind the vehicle and pushing it forward with his hands, thus dispensing with the weight, and cost of 800 pounds of quicksilver, reservoirs, pipes, wheels, etc. In order to realize three horse power from a wheel arranged as above, 10,000 pounds, or five tons, of quicksilver would be required; and to pump it back the labor of fifteen men would be necessary. We fear that the new motor is destined to stand still.

The Metric or Decimal System.

The following simple table gives all that there is in the metric or decimal system of weights and measures:

MONEY.

10 mills make a cent.
10 cents make a dime.
10 dimes make a dollar.
10 dollars make an eagle.

LENGTH.

10 milli-meters make a centimeter.
10 centi-meters make a decimeter.
10 deci-meters make a meter.
10 * meters make a decameter.
10 deca-meters make a hectometer.
10 hecto-meters make a kilometer.
10 kilo-meters make a myriameter.

WEIGHT.

10 milli-grammes make a centigramme.
10 centi-grammes make a decigramme.
10 deci-grammes make a gramme.
10 † grammes make a decagramme.
10 deca-grammes make a hectogramme.
10 hecto-grammes make a kilogramme.
10 kilo-grammes make a myriagramme.

CAPACITY.

10 milli-liters make a centiliter.
10 centi-liters make a deciliter.
10 deci-liters make a liter.
10 ‡ liters make a decaliter.
10 deca-liters make a hectoliter.

The square and cubic measures are nothing more than the squares and cubes of the measures of length. (Thus, a square and a cubic millimeter are the square and the cube of which one side is a millimeter in length.) The are and stere are other names for the square dekameter and the cubic meter. —*Boston Transcript.*

* A meter is equal to 39·368 American inches.
† A gramme is equal to 15·433 grains troy or avoirdupois.
‡ A liter is equal to 2.113 American pints.

A WONDERFUL TREE.

The plant illustrated in the accompanying engraving is perhaps one of the most extraordinary vegetable productions, in many respects, on the face of the globe. Seldom, if ever, has the discovery of a new plant created such an amount of interest in the scientific world as did this. In the year 1860 an Austrian botanist, Dr. Frederic Welwitsch, while making explorations in Southwest Tropical Africa, under the auspices of the Portuguese Government, came upon an elevated sandy plateau about 500 miles south of Cape Negro. Here his attention was at once attracted to a number of curious objects rising from a foot to a foot and a half above the surface of the soil, varying from 2 to 14 feet in circumference, and having a flat, somewhat depressed top of a dingy brown color, and appearing more like large stools or small tables than any living plant. When his amazement at beholding such a scene was over, Dr. Welwitsch's first proceeding, of course, was to secure both a plant and sufficient and proper materials for determining its scientific classification. These materials were subsequently sent to Kew with the request of the discoverer that Dr. Hooker should examine and classify the plant; this the latter did, naming it *Welwitschia mirabilis*. The result of Dr. Hooker's labors was the subject of one of the most interesting papers ever read before the Linnæan Society.

As we have before stated, the Welwitschia rises no higher than a foot or so from the surface of the soil, and may, therefore, be called a dwarf tree. The roots branch just below the stock, penetrate several feet into the ground, and fix themselves so firmly in the hard, sandy parched soil that it was found extremely difficult to dig up a plant with the roots entire. The most peculiar part of this plant is the crown, into the edges of which (at the point of junction with the stock) the leaves are inserted. The outline of this crown is of an irregular oval or oblong form, and its surface (and indeed the whole exterior of the tree) is of a dirty brown color, hard, rugged, and cracked, and has been aptly likened by Dr. Hooker to the crust of an overbaked loaf of bread. It is seldom or never flat, but usually sunken or concave toward the center. From the edges, toward the center, the surface is covered with little pits, the marks or scars of fallen flower stalks. The leaves, like all other parts of the plants, are very extraordinary; each plant possesses two only, corresponding in width to the lobes of the crown, and running out right and left to the enormous length of six feet, and one twentieth of an inch in thickness. These leaves (which are not true leaves, but "seed leaves" or *cotyledons*) are normally entire, although they are seldom seen in that state, as they soon be come split to the base into strips. They lie spread out flat on the ground, are of a leathery texture, and of a bright green color, with almost imperceptible parallel veins. They are described as being persistent during the whole life of the plant, which is said to be a hundred years or more.

This fact affords another instance of dissimilarity with other plants; for we know that the first or cotyledonary leaves of most plants drop off as soon as second leaves are produced. The Welwitschia is *diœcious*, that is, its male and female flowers are borne on separate plants. The inflorescence is supported on dichotomously branched cymes, which spring from the small pits or scars, before spoken of, upon the crown of the tree, close to the point of insertion of the leaves, and even occasionally below them. The fruit or cone (which is the only part of the plant bearing any general resemblance to the coniferæ, to which it is related) are, when fully grown, about two inches long, with four slightly convex sides, and of a bright red color. The seeds, which are contained one in each scale, are surrounded by a broad, light-colored, transparent wing. It is highly probable that the fertilization of the female flowers is effected by insects, as it appears "that a pollen-feeding group of coleoptera, the *Cetoniæ*, abound in the regions inhabited by the Welwitschia."

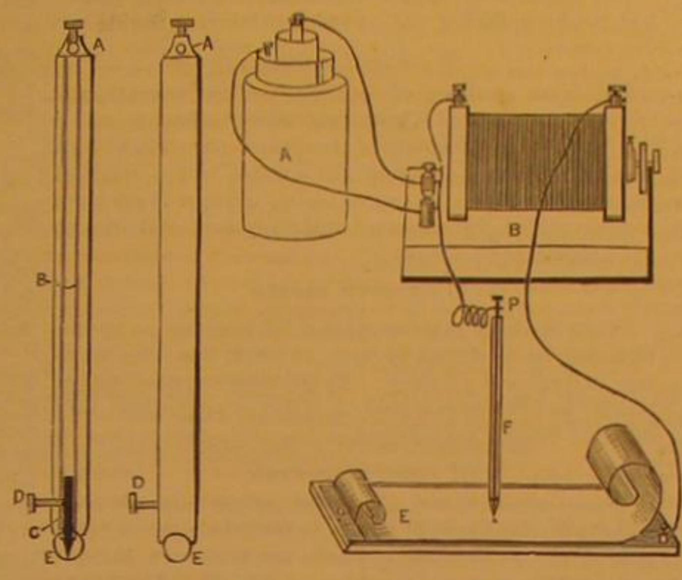
Dr. Hooker, after a careful microscopical examination of this extraordinary plant, placed it in the natural order *Gnetaceæ*, and regards it as having a very close affinity with the genera Ephedra and Gnetum. Outside of the high scientific interest with which it is invested, this plant has no recognized use. Its leaves, being tough, leathery, and not softly fibrous, are not adapted for cordage, weaving, or any similar purposes. Its tough trunk is of such an uneven, fibrous grain that the saw seems rather to tear than cut it; and besides, it is so irregular in its growth as to unfit it for any economic use.

No wonder, then, that the plants have been allowed to grow for centuries unmolested by the natives, and, consequently, up to the time of its discovery hidden from the eye of civilized man.

THE WELWITSCHIA MIRABILIS.

A SIMPLE ELECTRIC PEN.

We give below a description of a simple electric pen,



A SIMPLE ELECTRIC PEN.

which we extract from an article by Professor Wentworth Lascelles Scott in the *Electrician*.

The little contrivance which is shown in the accompanying engraving could be sold at a good profit for from 25s. to 30s. complete, or can be put together by any one possessing a very moderate amount of electro-mechanical skill at even less cost than the former sum, while the "pen" *per se* is as convenient and as light to hold as an ordinary pencil, and can be actuated by a comparatively very small single cell battery.

The accompanying rough sketch needs but little explanation, and shows fairly well the arrangement devised and actually used by me.

A is a Daniell's cell of medium size, which is all the battery power required; indeed, a very small bichromate or "Marié-Davy" couple may often be substituted here, where the pen is not required for very hard and continuous use. The battery is connected in the usual way to the primary terminals of a small induction coil, B, and for this purpose one of the little coils generally accompanying the cheap French sets of apparatus for "vacuum tube experiments," answers very well if certain simple improvements be applied thereto. As a rule these tiny "Ruhmkorffs" give a secondary spark of from one eighth to three sixteenths of an inch in length, but would give a much longer one only that the vibrating armature is not sufficiently delicate, while the condenser is often only a delusion and a snare. The former should be more delicately adjusted, a really elastic bit of spring being added if necessary, and the latter should be taken out and replaced by a sound and practical condenser, containing 300 or 350 square inches of tin foil, carefully insulated with paraffin paper. When these alterations are completed, it will be found that the spark is increased in length to some five sixteenths of an inch, or even more. The desk or writing slab consists of a plate of glass or vulcanite of suitable dimensions, upon which has been evenly laid a perfectly smooth, but rather smaller sheet of silver or tin foil, D, the whole being protected from damp by a coat of thin amber varnish; at one corner of the slab is fixed a binding screw, E, in contact with the metallic surface, and connected by a wire with one terminal of the secondary coil.

The writing stylus or "pen," F, consists of an ivory or vulcanite tube, pointed at its lower extremity, and provided at the other end with a small brass terminal; from the latter a stiff wire, furnished with an extremely fine platinum point (*p*) proceeds in the interior of the tube, and is capable of adjustment by a small set screw. In practice this platinum point should be (when the stylus is turned up) very slightly below the level of the aperture in the ivory. The "pen" being then connected to the free terminal of the secondary, and the little coil set so that the primary sparks appear almost continuous by reason of their very rapid succession, a sheet of paper laid upon the slab, C, will be quickly perforated in a series of minute holes if the point of the stylus be gently drawn over it. Any writing, plan, or outline drawing, may be traced in this way upon the paper, although in a somewhat slower manner than with an ordinary pen. When removed from the slab the paper is found to be a kind of stencil plate, from which, by laying in succession upon a number of sheets of paper, and applying the ink roller or "dubber," many hundred *fac-simile* copies may easily and quickly be obtained.

If an "electro-stencil" of a large architectural or other plan or of a map be wanted, a slightly modified stylus will facilitate the work. Fig. 2 shows such an instrument drawn to scale (half the original size), Fig. 3 being a section of the same.

A represents the terminal for the reception of wire from coil. B is a brass tube extending to within an inch of the "writing," or lower end of the stylus, where it receives a pointed platinum wire, C, which can be fixed at any required height by means of the set screw, D. A small ivory wheel, E, enables the stylus to travel easily and evenly over any long continuous lines, either with or without the aid of a ruler.

[Other applications of this simple and easily constructed electric pen will suggest themselves to the intelligent reader, and it may readily be made (if really needed) far more rapid in its action than the costly instrument before alluded to. Its use infringes no patent, as its action depends upon well known principles, which have been applied somewhat in the same way for lecture demonstrations.

The circumstance that a whole generation of students and inventors have missed this simple and useful application of electricity, strikingly illustrates the blindness even of thoughtful men to practical opportunities which lie close at hand, but a little out of the common channels of thought. For many years it has been a well known fact that the spark of an intensity coil is capable of perforating paper; and now no one can see the practical application of that knowledge without wondering why he never thought of it. Who can tell what myriads of similar opportunities—what multitudes of good things"—are within the easy reach of whoever will get his mind out of the ruts of habit?

The world is full of possibilities for whoever can see them. The art of original personal seeing and thinking is what we all lack most.]

On Bronzes and Bronzing.

Bronzing, in the narrower sense, includes only those manipulations whereby the appearance of bronze is imparted to the surface of an article made of metal, wood, plaster, or other like mass, by covering it with a metal. The meaning of the word has been extended so as to include every process whereby a metallic appearance is imparted to any non-metallic object, or the bright surface of a metal is covered with a thin, dull coating of brown, reddish, or even black color, to protect it from change.

In the former kind of bronzing very finely divided or pulverized metal is dusted upon the object after it has been painted with oil varnish and almost dry; in the latter kind of bronzing several different methods are employed. In the following lines we propose to describe the various operations, etc.

I.—BRONZE COLORS.

For the first kind of bronzing different bronze colors, metallic or dust bronzes, are employed; these are finely pulverized metallic alloys, which are much used to cover wooden, plaster, and metallic articles on account of their beautiful color and metallic luster. They are mostly made from the scraps and waste of real or imitation gold or silver leaf and other alloys, beaten very thin, mixed with honey or gum solution, and rubbed upon marble slabs. On a large scale the metal foil, greased with olive oil, is rubbed through wire sieves by means of wire brushes, and pulverized in steel mortars, then polished with revolving brushes.

The commonest bronze colors are: real gold leaf, Dutch leaf, mosaic gold, real silver leaf, imitation silver leaf, mosaic silver, copper bronze, bronze-colored bronze or bronze powder, the greenish copper bronze, brownish gold bronze, gold-colored copper bronze, blue bronze, and some alloys of bronze metal.

A.—REAL GOLD BRONZE.

This is made from the scraps of the gold beaters, and called in German grätze, krätze, schäbe, or schawine (scrappings, shavings). They are mixed with honey or gum, and ground on a glass plate, or under the hardest granite, to a very delicate powder, washed frequently with water, and then dried.

The different shades or color of gold bronze are distinguished as red, reddish, deep and pale yellow, or greenish. These shades are due to the amount of gold, or the proportion of gold to that of silver and copper.

By boiling with solutions of different salts or acidified liquids still other shades of color can be imparted to the bronze; if boiled in water acidified with sulphuric, nitric, or hydrochloric acid a bright yellow is produced; if the solution contains sulphate or acetate of copper it will be reddish; other shades are obtained by boiling with a solution of table salt, green vitriol, tartaric acid, or saltpeter.

Gold bronze can also be made by dissolving gold in aqua regia, and precipitating as a metallic powder by means of a solution of sulphate of iron, and then boiled out in different ways. The sulphate of protoxide iron must be dissolved in boiling water, and then sulphuric acid dropped into it, and stirred until the flakes of basic sulphate of sesquioxide dissolve again.

Gold bronze is also made by dissolving gold in aqua regia, and evaporating the solution in a porcelain dish. When nearly dry some pure hydrochloric acid is added, and the operation is repeated to expel any free chlorine and make a pure chloride of gold. The dry salt is dissolved in distilled water (1 liter to a ducat) and (8° Baumé) solution of pentachloride of antimony stirred in as long as any precipitate is produced. This precipitate is the gold bronze, which finds, when dry, the most extensive use for painting upon porcelain and glass.

Metallic gold in powder can also be obtained from solution in aqua regia by putting in a bright strip of some electro-positive metal like iron or zinc. The color of the gold bronze depends upon the composition of the gold employed. Its luster is improved by rubbing the dry powder.

B.—IMITATION GOLD BRONZE.

This is made, like the real gold bronze, from the waste of beating of the so-called Dutch leaf, by triturating with a solution of gum, washing in water, and drying quickly, then rubbing again to increase the luster. The color depends upon the proportion of copper to zinc; if the former predominates it is redder; if the latter, yellower; so that the deepest red consists of pure copper, the bright yellow of 83 parts copper and 17 of zinc, the orange red of 90 parts of copper and 1 of zinc. The violet and green shades are obtained by heating with a greasy substance—oil, wax, or paraffine—which produces a sort of patina.

C.—MOSAIC GOLD.

This substance is a compound of 64·63 parts of tin and 35.37 of sulphur, is free from taste or odor, soluble only in hydrochloric acid, aqua regia, and boiling caustic potash. It serves exceedingly well for bronzing plaster casts, copper, and brass, by mixing with 6 parts bone ash and rubbing on wet, also for making gilt paper and for gilding pasteboard and wood, when it is painted on with albumen or varnish. Mosaic gold of golden yellow color and metallic luster is obtained by heating 6 parts sulphur and 16 of tin amalgam with 1 part of mercury and 4 parts sulphur. A beautiful mosaic gold is made from 8 parts stannic acid and 4 of sulphur. The most beautiful and purest mosaic gold, which most closely resembles real gold, is made by fusing 12 parts of pure tin, free from lead, with 6 parts of mercury to an amalgam. This is mixed with 7 parts flowers of sulphur and 6 parts sal ammoniac, and subjected for several hours to a gentle heat, either in a glass retort or an earthen crucible, at first below a red heat, afterward, when no more vapors escape, it can be raised to a dark red. On heating, the sal ammoniac first escapes, then vermilion and some chloride of tin sublime off, and the mosaic gold remains on the bottom. The upper strata consist of delicate transparent brilliant flakes of the most beautiful mosaic gold.

D.—REAL SILVER BRONZE.

This is made either by triturating the scraps of silver foil, or by precipitating the solution with a strip of bright copper.

E.—IMITATION SILVER BRONZE.

This is obtained by triturating the scraps of imitation silver leaf, washing, drying, and polishing to increase the luster.

F.—MOSAIC SILVER.

This is an amalgam of equal parts of tin, bismuth, and mercury; 50 grammes of good tin is fused in a crucible, and as soon as melted 50 grammes of bismuth are stirred in with an iron wire until it is all liquid; the crucible is then removed from the fire, stirred as long as liquid, and then 25 grammes mercury added, and all mixed uniformly until stiff enough to be ground upon a stone.

G.—COPPER BRONZE.

This is made by rubbing copper foil very fine, or by precipitating from solution by strips of bright iron, then washing, drying and grinding. By grinding together copper powder and fine mosaic gold, in different proportions, very different bronzes are obtained.

H.—BRONZE POWDER,

or bronze-colored bronze, also called antique bronze, is made from 16 parts copper and 1 of tin, beaten into leaves and then ground up. J. Brandeis, in Furth, has invented a hammer and grinding apparatus for this purpose. The alloy is first rolled into sheets, then hammered out so thin that 1 kilo covers 120 square meters. Bronze powder is also made by dissolving bronze fillings in nitric acid and putting a rod of metallic zinc in the solution.

I.—GREENISH COPPER BRONZE.

This is obtained when copper bronze is put in a flask and covered with strong wine vinegar, stirred occasionally, left standing in the air, dried, and intimately mixed.

If copper bronze, or a bronze made by mixing mosaic gold with copper powder, is mixed with one quarter, one third, or one half its weight of verdigris (acetate of copper) a bronze is produced which imitates in color the patina upon antique bronzes.

Artificial patina powder is produced by treating bronze castings with different salts. Vinegar, nitrate of copper, sal ammoniac, common oxalate of potash, and similar compounds are employed to produce artificial patina. These solutions are used to oxidize one part of the bronze powder superficially, which is then ground with clean metallic bronze powder, producing a greenish bronze powder, with which the appearance of antique patina can be produced upon plaster casts or wooden objects.

K.—BROWNISH GOLD BRONZE.

This is made from fine clean iron filings by moistening repeatedly with a little water and exposing them to the air, then boiling several times and drying in the sun or on a stove. It forms a deep rust-brown powder, which becomes more intensely red if some nitric acid were added in the last boiling. It is elutriated to separate any metallic particles, and dried. By mixing this powder with imitation gold bronze mosaic gold, copper bronze, and greenish bronze, separately or together, the most varied and different shades of bronze color can be obtained.

L.—GOLD-COLORED COPPER BRONZE.

A copper bronze with golden color is produced by boiling together an amalgam of 1 part zinc and 12 parts mercury, some hydrochloric acid, a filtered solution of purified tartar crystals, and copper bronze precipitated from the nitrate by means of iron. This copper bronze has a reddish golden color, if only boiled a short time, and a deep yellow or green bright yellow by longer boiling. Another golden copper bronze is obtained by boiling the copper bronze with a solution of 1 part gold in aqua regia, evaporated to dryness, dissolved in 8 parts water, the solution boiled, and one half part ignited magnesia added, then boiled until the yellow color disappears. The precipitate of oxide of gold and excess of magnesia is filtered out, placed in a flask, and a boiling solution of 8 parts cyanide of potassium in water poured upon it. Aurate of soda can also be boiled with the copper powder. The gold salt, prepared as above described, is dissolved in 130 parts of water and 11 parts bicarbonate of soda added, and boiled; then the copper bronze powder is put in and boiled until the desired color is obtained. If any gold remains in solution it can be recovered in metallic state by addition of a solution of protosulphate of iron.

M.—BLUE BRONZE.

The blue bronzes are produced in the wet way by coloring white bronze with aniline blue. For a long time vain attempts were made to obtain permanent and beautiful blue shades by heating by means of so-called "Anlauf" colors, which are due to thin films of oxide, as in blue steel. A white bronze made of pure English tin is boiled for 5 hours in a solution of 20 grammes of alum in 4½ liters of water, then washed clean and put into a porcelain dish, and covered with a solution of 15 grammes aniline blue in 1½ liters alcohol, and stirred until dry. This manipulation must be repeated six or eight times until the desired blue color is obtained. When the bronze is dark enough it is washed in warm water, and before it is quite dry a large spoonful of petroleum is poured upon each kilo of bronze, intimately mixed, and the odor allowed to escape into the air for a few days.

To obtain the copper in the form of flakes, which is the best for making bronzes, the oxide is best reduced by means of the more volatile oils of petroleum, such as gasoline, rhigoline, or petroleum ether. The reduction by rhigoline vapors is accomplished in a combustion tube, in layers 1 to 1½ centimeter deep, at a high temperature. The oxide is easily and completely reduced and converted into a loose scaly metallic form, which must be allowed to cool in an atmosphere of petroleum vapor and pulverized in an agate mortar. The other methods of reduction leave the copper in the form of powder, which is less suitable for making bronzes.

N.—SUBSTITUTES FOR BRONZE COLORS.

Besides the mosaic gold, or tin bronze, already mentioned, the following are also used:

Tungsten Bronzes.—Of these there are two kinds, the so-called safron or gold bronze, which is a tungstate of soda and tungsten, forming beautiful gold yellow brilliant crystals; the other is called magenta bronze or violet bronze, and is a tungstate of tungsten and potash, violet crystals that glisten like copper in the sun. By igniting metatungstate of potash strongly, tungstic acid can be prepared of a beautiful dark blue steel color. Unfortunately the tungsten bronzes do not fill their purpose completely, for on pulverizing they take a cubical form instead of the scaly form, and cannot be evenly distributed over the article to be bronzed.

Chromium bronze, or violet chromium chloride, forms beautiful violet crystalline flakes that sparkle like mica, is easily applied, but, unfortunately, too expensive as yet for use.

We may also mention titanium bronze, crystallized iodide of lead, and organic bronzes, which latter are derivatives of hematoxyline, and which have been employed for more than ten years in making bronze paper. Recently others have been made from coal tar colors. The best of the crystalline coal tar colors is the acetate of rosaniline, which produces a beautiful effect by its fine gold-green color and metallic luster. Not less beautiful are murexin and the green hydrochinon.

The mica bronzes, also called "brocade" or crystal colors, are made of mica, which is pounded up, then ground, boiled in hydrochloric acid, washed with water, until free from acid, and separated according to the size by means of sieves. Prepared in this way, the flakes of mica have a beautiful vitreous luster and silvery appearance, possess a metallic appearance, are perfectly indifferent to sulphurous emanations, and resist all changes in the air. It is suited to most metallic, papier maché, wood, glass, and plaster articles, and toys, for flowers, paper hangings, sealing wax, etc., also for painters and cabinet makers, and especially for decorative painting.

Mica bronzes can be made of a great variety of colors, the most important of which are the following:

Pink, mica colored with a decoction of cochineal, and hence soluble in hot water, so that the color is not fast. It turns blue with ammonia or hydrochloric acid.

Carmoisin, prepared with bluish fuchsin, is soluble in hot water, turned yellow by hydrochloric acid, and the color is destroyed by ammonia.

Violet, made by Hofmann's violet, is very soluble in water, ammonia destroys the color, hydrochloric acid changes first to green then to yellow.

Bright blue, prepared with Prussian blue, or finely pulverized indigo, is not soluble in water even if acidified, unless oxalic acid is used, nor in alcohol.

Dark blue, produced with purified aniline blue or with Girard's violet, is but slightly soluble in water, turns blue in hydrochloric acid, and loses color in ammonia.

Viol-blue, colored with logwood, is slightly soluble in water, not at all in alcohol, completely soluble only in dilute hydrochloric acid, and then forms dirty violet flakes.

Light and dark green are colored with turmeric and aniline blue, are insoluble in water, but soluble in alcohol.

Golden is made with turmeric, is slightly soluble in water, more so in alcohol.

Silver is the pure mica, probably brightened by a decoction of bark, is more soluble in water than in alcohol; finally,

Black, probably a mixture of logwood pigment with litmus.

In using these mica bronzes the article must first receive a ground color, white lead for silver, ultramarine for blue, etc. For this purpose we may employ either oil paint or a glue sizing consisting of 4 parts glue and 1 part glycerine, rubbed together and applied with damar or light copal varnish. As soon as this size is dry it is coated with a paste of 4 parts starch and 1 part glycerin, and a sufficient quantity of brocade strewn over it, left half an hour to dry, and the excess of the powder dusted off. It can also be pressed on with a roller. If a ground of oil paint is used, the varnish is allowed to dry until it is no longer very sticky, when the powder is strewn on as in other cases. A beautiful appearance is produced by a final coating of thin alcoholic damar or copal varnish.

Steel bronze consists of micaceous iron (eisenglanz) in fine powder. It is not very durable.

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Notes & Queries

(1) G. N. S. asks for the process of tinning malleable iron. The castings are small and easily handled. A. The articles are cleansed by pickling them for a few minutes in a bath composed of 6 lbs. of water and 8 lbs. of sulphuric acid, and scouring them with sand. They are then heated to the melting point of tin and sprinkled with rosin powder, or dipped in melted rosin, and then in molten tin covered with tallow, brushed with a piece of hemp, and rubbed dry with sawdust or bran. If small, they are simply placed, after heating, in a shallow vessel with some melted tin, and brushed about with a piece of hemp sprinkled with dry sal ammoniac.

(2) G. J. S. asks how aniline black may be dissolved without the use of acids or glycerin, and how the color may be made permanent. I wish to use it for ink. A. There is an aniline black in the market quite soluble in hot water; it is called soluble nigrosine.

(3) J. E. F. asks how to make a freely flowing black ink for sketching, etc. A. Triturate soluble nigrosine with a small quantity of boiling water, and strain the hot solution. When cold, the ink afforded is ready for use.

(4) G. McM. asks how to color billiard balls. A. Red.—Soak the pieces for a few minutes in weak nitric acid, and then in a strong decoction of cochineal in ammonia water. Black.—Use nitrate of silver dissolved in water, and expose the pieces to strong sunlight. Or steep for several days in a decoction of 2 lbs. logwood, 1 lb. galls, and then for a few hours in acetate of iron (iron liquor). Green.—Steep in a solution of verdigris, to which a little nitric acid has been added, or in a solution of distilled verdigris in acetic acid. Sal ammoniac is sometimes added to this solution. Do not use metallic vessels. Purple.—Steep in a weak aqueous solution of terchloride of gold, or boil for some time in a strong aqueous solution of logwood extract, and then add 4 ounces of alum to the gallon of solution, and continue boiling until the ivory is sufficiently colored. Yellow.—Steep for 24 hours in solution of lead acetate, and after drying in solution of potassium bichromate. Or steep the pieces in a saturated solution of orpiment (sulphide of arsenic) in strong ammonia, and dry. The depth of color depends upon the degree of concentration of the solution. Blue.—Stain them green and then immerse in hot solution of pearl ash. Or boil in logwood decoction and then in aqueous solution of copper sulphate. Or steep them in weak solution of sulphate of indigo, to which a little tartaric acid has been added. The coal tar colors, though brilliant, are apt to fade.

(5) C. E. N. asks how to make, and how to put on a good polish for black walnut tables used for hot and cold water in a bar room. A. Use a cloth cushion moistened with clear solution of 1 part shellac in about 10 parts of alcohol, applying a few drops of linseed oil to the cushion occasionally during the operation of polishing.

(6) E. D. S. asks: Is there anything that is applicable to window glass that will keep frost from accumulating on it, in cold weather? A. Glycerin is sometimes used.

(7) H. M. A. asks if freezing injures cider for drinking or for vinegar. A. No.

(8) C. L. H. asks: Can you kindly tell me in your paper some effective, cheap alarm for a bell telephone? I am unable to use an electro-magnetic bell for reasons. A. Such an alarm as you require is described in SCIENTIFIC AMERICAN SUPPLEMENT No. 161.

(9) H. M. N. asks: 1. What causes such a variety of colors to appear on oily water? A. It is due to the phenomenon called by physicists interference of light, caused by the varying thicknesses of the film of oil. A fine illustration of this may be observed in the soap bubble. 2. Why is tallow for steam engine cylinders preferable to any other lubricator? A. Pure tallow has less tendency to decomposition than oil under similar conditions. A pure hydrocarbon is, however, preferred by many, especially in high pressure engines.

(10) U.S.A. writes: 1. In your SUPPLEMENT No. 149, you describe how to make a simple electric light, and how to make the batteries. In battery, Fig. 4, should the small hole which is in the bottom of all flower pots be closed? A. Yes. 2. Should I put the same solution which is used in the pipe bowl, in Fig. 3, in the flower pot? A. Yes.

(11) Keho asks: Would a ten pound cannon ball sink to the bottom, if thrown in the deepest part of the ocean? A. Yes.

(12) L. E. L. asks (1) for an explanation of the principle of the gyroscope. A. See SCIENTIFIC AMERICAN, vol. 38, p. 335. 2. How can I make a cheap telephone? A. SCIENTIFIC AMERICAN SUPPLEMENT No. 142, contains full instructions for making telephones.

(13) C. M. D. asks how a Maynooth battery is made and charged. What liquid in the porous cup, and what in the iron one? A. It consists of a water tight cast iron cell, containing a porous cell, within which is a plate of zinc. The iron cell is charged with a mixture of equal parts of nitric and sulphuric acids, and the porous cell with sulphuric acid 2 parts, nitric acid 1 part, water 18 parts.

(14) M. asks: Is there any cure for a cracked plantation bell without recasting it? A. Drill a hole at the end of the crack, and saw through the crack to the hole. If the bell is too hard to admit of this treatment, we know of no cure.

(15) "Reader" writes: I have a hard rubber comb, it acts on paper and hair the same that a magnet does on a steel needle, why is it? A. Hard rubber, sulphur, wax, glass, and other substances, when rubbed with silk, flannel, or fur, become electrified and acquire the property of attracting light bodies.

(16) A. H. V. asks if Brazilian pebble spectacles are injurious to the eyes. A. They are generally considered better than glass.

(17) Otto writes: It is asserted that the whole mass of water in the Hudson (down to the very bottom) would flow north during the flood tide. Is it possible? A. We do not think the entire mass of water flows back with the tide. For a considerable distance this may be the case, but there is a neutral point beyond which the downward flow of the river is simply retarded.

(18) C. N. A. writes: I desire to construct an induction coil according to the method given in SUPPLEMENT No. 160, and would like to ask if it would not be possible to use coarser wire than No. 36 for secondary coil, without destroying the effect—say No. 30 or 32? A. No. 30 or 32 will not do as well as No. 36.

(19) L. H. asks: 1. In making India ink pictures with a brush how are the shades made smooth and merged evenly out into the white of the card board on which they are painted so that they will look like a photograph? A. The first requisite is the proper quality of paper. The tints should be carefully washed, one over the other, beginning with the lightest. 2. Is there a cheaper way than the electric pen to get several copies of written manuscript? A. Manifold paper is not expensive and answers a good purpose.

(20) A. H. writes: I have occasion to work in pearl, and I find a great deal of trouble in doing so, especially in turning it, it being so extremely hard. Will you give me some particulars in working it? A. There are two kinds of shells used in the manufacture of small articles; the porcelainous and the nacreous. The former are extremely hard, and can be worked only with the apparatus employed by the lapidary. The latter are more generally used, and may be sawn, filed, and turned, with some facility. The pieces should be roughed out on a common grindstone. After turning, they should be smoothed with pumice stone and water, and polished with rotten stone wet with sulphuric acid slightly diluted.

(21) G. J. B. asks: Is it possible for the ground under fifteen feet of water in the ocean to freeze? An old captain in this place says he has known it to be frozen off Fire Island in 15 feet of water. A. Not in water freely open to the sea. In confined coves it might possibly happen in the latitude of Fire Island, but even that is doubtful.

(22) G. W. M. writes: My friend holds that not one half of the leading astronomers believe the moon to be a lifeless planet without air or water, and I hold that fully four fifths of the astronomers believe it to be dead. Your opinion is desired. A. The moon is considered as lifeless by most astronomers.

(23) E. H. G. asks: Would a sheet of copper placed between two zinc plates, in place of the platinum sheet used in the "Kidder battery," produce a current of electricity? A. It would afford a fair current for a short time.

(24) P. F.: Kienmayer's amalgam for electrical machines is prepared as follows: one part of zinc and one part of tin are melted together and removed from the fire, and two parts of mercury stirred in. The mass is transferred to a wooden box containing some chalk, and then well shaken. The amalgam before it is quite cold is powdered in an iron mortar and preserved in a stoppered glass vessel. For use a little lard is spread over the cushion, and some of the powdered amalgam sprinkled over it and the surface smoothed by a ball of leather.

(25) W. C. M. asks for the names of the latest and best receipt books and chemistries on dyeing, as he is in the dyeing and scouring business for ladies' and gentlemen's goods. A. The SCIENTIFIC AMERICAN SUPPLEMENT contains the latest information on the subject of dyes. See Nos. 53, 55, 68, 74, 75, 76. Napier's "System of Chemistry applied to Dyeing." Gibson's "American Dyer." O'Neil's "Dictionary of Dyeing, etc." Smith's "Dyer's Instructor."

(26) J. L. asks: 1. Will the armatures of a number of telegraph instruments all make the same movement when the circuit is broken? A. Yes. 2. Would all move the same distance if the circuit should be closed before the armature of one had reached its full distance from the magnet? A. Yes, as we understand you. 3. Will the telephone work on a line in connection with a battery, or must the battery be cut out? A. A battery does not interfere with the working of the telephone when the circuit is continuous. 4. What is there to prevent the use of the telephone instead of the Morse telegraph? A. It has in many instances replaced the telegraph.

(27) C. W. asks: 1. What kind of carbon is used in the porous cup of a Leclanche battery, and is it powdered, granulated, or in lump? A. Use carbon from gas retorts. It should be coarsely powdered. 2. In what proportion is it mixed with the peroxide of manganese? A. We have see batteries filled with the carbon alone that seemed to work quite as well as those containing the peroxide of manganese. The proportions of the two should be about equal. 3. Should the porous cup be packed full or only partly full? A. The porous cup should be filled. 4. Will a pencil of zinc such as is generally used give as strong a current as a piece of zinc placed around the cup as in the carbon battery? A. Yes.

(28) W. S. R. asks: How can I polish a piece of marble? A. Smooth it with sand and water applied with a marble rubber, then rub it with pumice stone, and finally with a paste of putty powder, using a felt rubber.

(29) B. E. B. asks how the gilt work on gas fixtures is produced. A. In some cases it is simply brass, spun, burnished, or polished, and lacquered; in other cases it is produced by the application of bronze powders.

(30) J. McA. writes: Wishing to construct a dynamo-electric machine, after the plans given in SUPPLEMENT No. 161, I ask: 1. Does this machine, whether magnet is excited by battery or not, require an induction coil to be used, to produce an electric light? A. No induction coil is required. 2. Would common Western Union local battery answer instead of Bunsen cells; if so, how many? A. 10 or 12. 3. A light of what candle power will this machine produce? A. We do not know the photometric value of the light, but we think it would equal 4 or 6 gas jets. 4. Will increasing width, height, and wire on both magnet and armature increase the power of this machine in proportion? A. Yes.

(31) "Canuck" writes: I have made a pair of Bell telephones according to directions as given in *Popular Science Monthly*. Used a steel bar one quarter inch diameter and five inches long for core, and wound for one half inch on bar silk covered No. 60 copper wire until the diameter of bar and wire was about three quarters inch or seven eighths inch. Took the thinnest ferrotype plates for diaphragms and have used a Daniell battery varying in strength from one to twelve cells, still it fails to transmit sound. A. Use three eighths inch magnets, and No. 36 wire. No battery is required. See SCIENTIFIC AMERICAN SUPPLEMENT No. 142, for directions for making telephones.

(32) C. H. K. asks how many pounds pressure (steam) per square inch a boiler made of No. 14 standard gauge, charcoal iron, will stand with safety. Size of boiler 12 by 24 inches. Single riveted seams. A. Safe working pressure, 40 to 50 pounds.

(33) W. W. asks: What is the largest sized steam boiler that can be practically heated by crude petroleum? A. So far as we know, the limit is the same as obtained when coal is used as fuel.

(34) H. T. asks what is used to black the inner surface of tubes of fine optical instruments. It must be easily applied. A. Coat the surfaces with good gold size, and, while still adhesive, dust over it quickly lamp black, or, what is better, ivory black reduced by grinding to an impalpable powder.

(35) A. B. D. asks in which position can a bell be heard the farthest, on an open prairie, close to the ground, or on a tower two hundred feet high. A. On the tower.

(36) F. A. T. asks how to put a polish on fine walnut furniture. A. Mix with two parts of good alcoholic shellac varnish, 1 part of boiled linseed oil, shake well, and apply with a pad formed of woolen cloth. Rub the furniture briskly with a little of the mixture until the polish appears.

(37) T. J. B. asks: Should the slides of an engine be set a trifle lower at the end towards the crank to hold the weight (of piston) off the lower surface of the cylinder on a horizontal engine or not? A. They should be level.

(38) S. wants to know how much steam power would run a fan to furnish an ordinary blast for a cupola with a melting capacity of not more than 800 lbs. of iron. Fan the old style. A. It probably would not require more than half a horse power, at most.

(39) N. G. asks what photographers use to polish or glaze photographs. A. Heated burnishing rolls.

(40) G. E. asks how to melt old rubber belting and scraps of rubber, such as hose and door mats, over again and make it elastic so that it can be used in making the moulds for plaster casts. A. Old rubber cannot be melted as you suggest—it suffers partial decomposition in heating and does not again assume its original properties. Such moulds can be made from the gum rubber, as described on pp. 35 and 105, vol. 38, SCIENTIFIC AMERICAN, but they are too costly.

(41) H. N. D. asks how to make steel run sharp when poured in moulds. A. It is only necessary to use a suitable quality of steel to insure this result.

(42) G. D. H. asks for the method of manufacturing oakum. A. By picking old hempen rope into fibers.

(43) C. A. H. asks: Is there any work published giving a history of the success reached in attempts at utilizing anthracite coal dust or culm for the purposes of fuel, or which explains the peculiarities of coal dust and the impediments in the way of its utilization? A. There is some valuable information on this subject in Bourne's "Steam, Gas, and Air Engines."

(44) W. H. C. asks for a simple method of electroplating. What shall I use to remove the fatty particles entirely from the work? A. For silver plating the bath consists of potassium-silver cyanide, prepared by precipitating solution of silver nitrate with potassium cyanide, and redissolving the washed precipitate in excess of potassium cyanide solution—potassium cyanide, 12 oz.; water, 1 gallon; silver cyanide, about 1 troy oz. Filter and use in a porcelain or glazed vessel. For the whitening bath dissolve 1 lb. potassium cyanide in 1 gallon of water, add one quarter oz. troy of silver cyanide, and filter the solution. The baths are provided with silver feeding plates for anodes proportioned in size to the surface of the work to be plated. These are connected with the positive pole of the battery. The cleaned articles are connected by a copper wire with the zinc pole of the battery, dipped for a minute or two in the whitening bath, and when uniformly coated with a white film of silver transferred to the plating bath, under similar conditions. 3 or 4 Smee cells with plates 10x4 inches will generally suffice for the plating bath, and 4 or 5 similar cells for the whitening bath; 20 to 30 minutes in the plating bath is usually sufficient to plate the work properly. Articles of copper, brass, or German silver, to be plated should first be cleaned by boiling them for a few minutes in strong potash water to free them from traces of oil or grease, and, after rinsing, in dilute nitric acid to remove any oxide, and again thoroughly rinsed. It must not be touched by the hand after cleaning. Just before putting the work into the bath, dip it momentarily in strong nitric, or a mixture of equal parts nitric and sulphuric acids and rinse quickly. After this treatment it is sometimes dipped for a moment in dilute aqueous mercurous nitrate solution, and rinsed again. This has the effect of coating the clean metal with a film of mercury, which secures a perfect adhesion of the deposited silver. For nickel plating see article on p. 209, vol. 38.

(45) J. S. L. asks: Of what material are the printer's inking rollers made? A. Usually of glue and molasses, glue and glycerin, or glue, glycerin and oil. Those of glue and glycerin are prepared as follows: Glue is melted in water by the aid of a salt water bath into a very thick paste, to which undiluted glycerin is added in quantity by weight the same as that of the dry glue. The mixture is then thoroughly stirred and further heated to evaporate the excess of water. It is cast over a mandrel in iron or copper mould well oiled, and allowed to cool slowly and thoroughly before being removed.

(46) W. B. K. asks: Can you tell me about the sized boiler and fly wheel for a cylinder 1 inch bore and 2½ inches stroke? A. Boiler 15 inches diameter, 30 inches high. Fly wheel, 6 to 8 inches in diameter.

(47) M. J. W.—See Schuman's "Manual of Heating and Ventilation."

(48) J. E. P.—A gravity battery should be used on a closed circuit, and it must not be moved about.

(49) E. asks: How can I become a mechanical draughtsman? A. Study lessons in mechanical drawing contained in the SCIENTIFIC AMERICAN SUPPLEMENT.

(50) F. J. H. writes: I wish to cast a cannon having brass and copper. I would like to have a receipt for a good composition, for I wish the gun to look nice and be strong. A. For a large gun, copper, 90; tin, 10. For a small gun, copper, 93; tin, 7.

(51) A. G. R. asks: Is there any invention for conveniently unloading hay in barns by removing the whole load at once from the wagon to the mow? A. Yes, but there is room for improvement.

(52) J. J. J. asks: 1. Can you refer me to a good book on draughting? A. See Prof. MacCord's drawing lessons in SCIENTIFIC AMERICAN SUPPLEMENT. 2. Where can I get good draughting tools? A. Consult our advertising columns. 3. How can I make a cheap invisible ink? A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 157.

(53) A. C. B. asks: What power is cheapest and most convenient for a small shop requiring 4 or 6 horse power? A. A portable or stationary steam engine.

(54) T. B. asks: What is allowed for shrinkage of iron in bridge building? A. An allowance of one-eighth inch in 1,500 feet for each change in temperature of 1° Fah. is ample.

(55) F. W. Peirce asks if there is not a point in the periphery of a wagon wheel that stops for an instant as it comes into contact with the ground. A. Yes.

(56) M. A. R.—For full description of induction coil, see SCIENTIFIC AMERICAN SUPPLEMENT No. 160.

(57) G. I. T. asks: Would you recommend the use of galvanized iron tea kettles? A. No.

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

Carl.—It is arsenopyrite or mispickel, containing a little cobalt and a trace of nickel. It contains about 45 per cent of arsenic.—F. M. M.—I_2 is an excellent quality of bituminous coal, suitable for gas making. C_2 calcite—lime carbonate. A_2 chlorite schist. B_2 contains sand, clay, mica, iron, oxide, and peaty matter. D_2, orthoclase. F_2, quartz. H_2, anhydrite.—J. S. G.—The mica (biotite) has little commercial value. Those varieties containing a high per cent of potash are sometimes utilized for fertilizing purposes. G. F. M.—It is kaolin, containing about 10 per cent of quartz sand. If properly washed it may be utilized for the manufacture of pottery, porcelain goods, etc. Fine English kaolin brings in New York from $15 to $17 per ton (barreled). A. A. G.—It is ferropyrite or crystallized bisulphide of iron (iron 46·7, sulphur 53·3) associated with quartz. When free from arsenic it is sometimes used as a source of sulphur in the manufacture of sulphuric acid and of sulphurous acid for bleaching. The mineral is commonly called fool's gold. See p. 7, vol. 36. J. D. S.—The large piece is fibrous talc. The smaller fragment is a clay containing undecomposed orthoclase.—C. L.—No. 1, trap rock. Nos. 2 and 3, gneiss and mica schist—the dark mica is biotite. No. 4, principally orthoclase.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

COMMUNICATIONS RECEIVED.

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

Heating and Pounding of Crank Pin Journals. By J. R.
On the Gyroscope. By N. D.
On Mine Water in Fish Streams. By C. Smith.
A Biography. By W. B. C.
On Middlings Purifier Controversy. By R. J. A.
On Shorthand. By H. H.
On the Sun's Rays. By B. B.
On What Congress Ought to Do. By G. H. K.

[OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

January 14, 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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