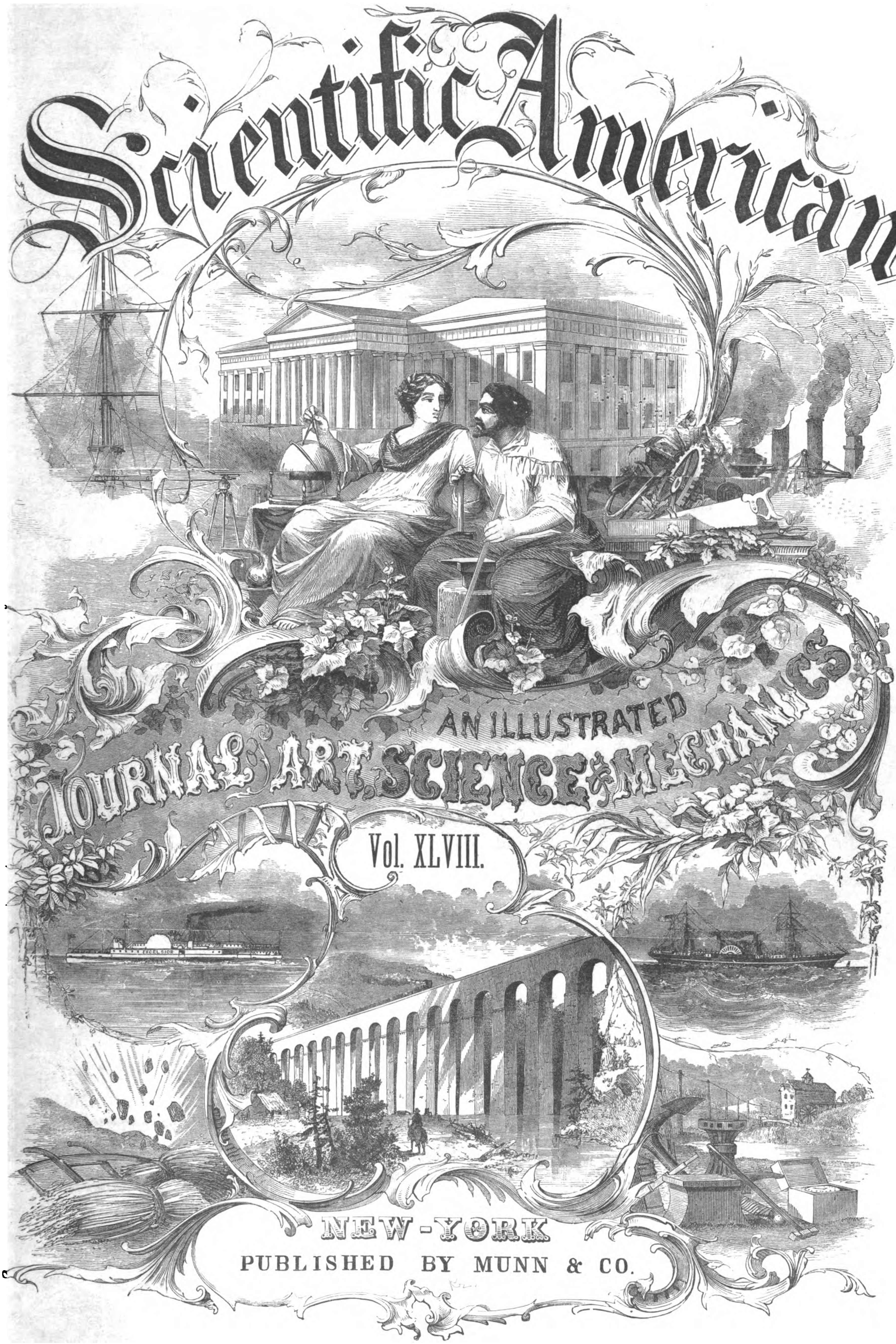
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SCIENTIFIC AMERICAN

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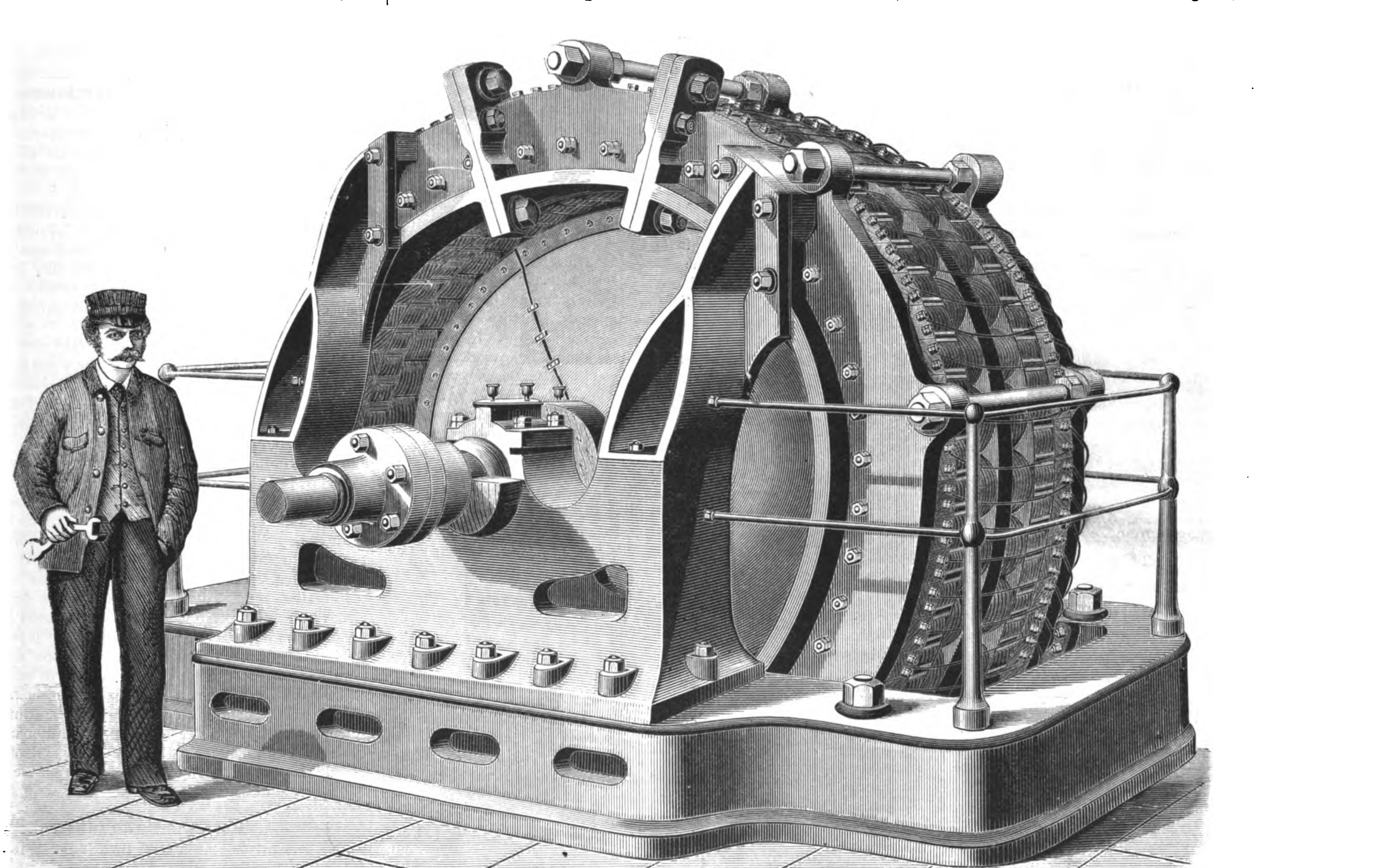
GORDON'S DYNAMO ELECTRIC MACHINE.

The first steam locomotives were crude machines compared with those which were constructed in the course of a few years after their first introduction. Just so, no doubt, will be the case with dynamo machines. The first dynamos were little more than models, and we are only now beginning to realize the fact that it is more economical to construct a dynamo which will absorb 100 horse power than it is to construct one to absorb a single horse power. Then, again, new uses require new designs. The design of a pumping engine differs from that of an express locomotive; so the design of a dynamo to supply the electric current for a large number of incandescent lamps differs considerably from that designed to supply a large number of arc lamps. A few years ago the success of incandescent systems was scouted by many and doubted by others. Time has proved that their fears were groundless, and that incandescent lighting is not only an actual fact, but it is the system the resistance in proportion to the number of lamps. If the resistance of one lamp is represented by x, the resistance of the lamps in series is represented by $n\,x$. A certain electromotive force is required to overcome the resistance, x; but n times that electromotive force is required to overcome the resistance, $n\,x$, the current being constant, and, of course, the more constant the current the better for the lights. Putting this into the familiar symbols of Ohm's law, $C=\frac{E}{R}$, we know at once that to retain C constant when R becomes n R, we must make the numerator n E.

The feature of machines required to supply the current to a number of arc lamps in series is high electromotive force. To a certain extent quite an opposite condition holds when a large number of incandescent lights are under consideration. These lamps are generally arranged in multiple arc, or each lamp provides a path for the current from terminal to terminal; or say two large main wires are taken from the and these present some curious problems when taken in connection with the electrical requirements.

The latest and most important development of the dynamo electrical machine we illustrate this week. It is the invention of Mr. J. E. H. Gordon, and has been constructed from his designs—in the preparation of which he was aided as to details by Mr. Clifford and Mr. Lucas—by the Telegraph Construction and Maintenance Company at its works at Greenwich. Before proceeding to describe the machine more minutely, it will be well to explain the principle on which it acts in general terms. The central armature is an iron disk, on which are arranged a series of wire coils, the wire being coiled in the same plane as the disk. The wires are united in a ring on the central axis, against which ring bears a gun-metal contact lever, into which is sent a current of electricity from two Burgin machines which act as exciters. The armature revolves between the two sides of a frame of cast-iron, which carries a number of electro-magnets; that



GORDON'S DYNAMO ELECTRIC MACHINE.

toward which almost all eyes and efforts are directed as the great work of the immediate future. Directly incandescent lighting became practical and no longer merely an incident of the laboratory, attention began to be directed to its introduction upon a large scale. Gas was already in possession of the field, and usually changes are not made unless the evidence of gain is very strong. There is, however, a stronger incentive to gain than mere economy, and that is fashion.

The electric light seems to have become fashionable, and this in addition to its inherent merits as a light. It is said to be, when used on a large scale, as economical as gas and as much under control. This being the case, it was to be expected that machines would be designed to supply the current on a large scale. Under the usual conditions, arc lamps have hitherto been arranged in series, that is, one after the other upon the wire joining the two terminals of the machine. Now, as each lamp opposes the current with a certain resistance, the adding of lamps in series increases two terminals of the machine, the lamps are strung between these two wires. In the case of the arc lamps, with one lamp we require, say, a current of 20 Ampères; the machine is not asked to supply more current, though 100 lamps are in the circuit. It still sends 20 Ampères through the circuit. But taking one incandescent lamp as requiring 1 Ampère, by the arrangement adopted 100 such lamps require 100 Ampères—that is, 1 Ampère through each branch wire and lamp. Hence the machine has to provide quantity in one case and electromotive force in the other. In the latter case, E, represented in the formula $C=\frac{E}{R}$, is constant, and C is increased by diminishing R.

From these remarks it will be seen that a large amount of knowledge, talent, and ingenuity may be brought into play in designing dynamos for different purposes. Besides, however, the electrical matters to be considered in such designs, there remain the purely mechanical details, such as the proportion of parts, the strains, etc., to be brought into play, is to say, of cores covered with insulated wire. From these the currents developed in them are led off to the lamps. Thus it will be seen that the field magnets are attached to the armature, and move, while the equivalents of the armature coils are at rest. There is no commutator, the machine being of the alternating current type.

This machine can, with sufficient power, light 6,000 Swan lamps, but this is not at present available, the engines used to drive it being a pair with horizontal cylinders, 20 inches stroke, and 16 inches diameter, making about 140 revolutions per minute. They were used for some time on board the Calabria for picking up cables. On Wednesday night about 1,800 Swan lamps of over 20-candle power were in use, lighting up every department of the large works. It will give some idea of the dimensions of the system if we state that there are about 8 miles of wire leads in use.

This is not the first machine made by Mr. Gordon. Mr. Gordon's present machine is an improvement upon an earlier

(*Continued on page 6.*)

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NEW YORK, SATURDAY, JANUARY 6, 1883.

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THE DEATH AND BURIAL OF WOEHLER.

We have already briefly referred to the death of the veteran scientist whose name is familiar to every chemist in America and Europe. On the 23d of September, after a brief indisposition of four or five days' duration, the light of his life, which had been flickering in its socket, went out while he was in full possession of his intellectual faculties. The machine which had kept soul and body together ceased working, and life became extinct. When the final hour came, surrounded by all the members of his family, his spirit took its flight so quietly that those present were scarcely able to tell when he ceased to breathe. It was a most gratifying ending to a long life—no pain, no wearing sickness, no anxiety—as peaceful and gentle as his life had been, so was his death.

Up to the Tuesday preceding his death, which took place on Saturday, he continued his literary activity. When he laid down his pen his table was covered with scientific papers, and the correspondence which, as Secretary of the Academy of Sciences, he conducted to the last, having carried his work forward to the very portal of the tomb. Yet death did not find him unprepared. It had long been expected, and in his will he gave full directions about his funeral, and indicated the inscription to be put on his tomb. His funeral was to be of the simplest character; no music, no speeches, no special ceremonies, no procession of students in uniforms, but everything quiet and unobtrusive, just as his own life had been. And thus it was. We are indebted to Prof. C. A. Joy, who was present at the funeral, for many of the above facts, and the following description of the burial ceremonies:

"At 10 o'clock on Tuesday morning, September 26, a few of the most prominent professors of the University gathered at the house of the deceased. The coffin stood in the center of the largest room, covered with wreaths and palm leaves, and on each side there was a row of six burning candles. The Chaplain of the University, Pastor Schultz, read the usual selection from the Scriptures, and in his prayer referred to the character of the deceased, but made no remarks. The widow was present during the exercises, surrounded by all her children and grandchildren, with a few other near relatives.

"Among those present at these services were Professor Wm. Weber, now more than eighty years old, Professor Listing, already far in the seventies, and other old and bent colleagues of the deceased. There were but few persons present from a distance, as it was vacation at the University, and no notice of the funeral had been published. But there was one old friend there that could not stay away—Professor Hermann Kopp, who came up from Heidelberg to follow in the mournful procession to the grave.

"After the short exercises at the house the body was placed in a hearse, and the procession slowly and silently moved to the cemetery. The streets were lined with people who felt that they had lost a friend. There were several hundred men in the group, many of them world renowned celebrities.

"At the grave there were no speeches. I threw in several handfuls of earth, according to the German custom, and in behalf of the many American pupils of the illustrious dead. The grave was rapidly filled up, and after the benediction the mourners dispersed."

RAILWAY TRANSPORTATION.

Mr. William P. Shinn, C.E., lately read before the American Society of Civil Engineers a paper on the "Increased Efficiency of Railways for the Transportation of Freight."

The first portion of this paper gave, from carefully gathered statistics, a valuable amount of information in regard to the actual increase of traffic upon American railways. In 1860, the tonnage mileage of the New York Central and Hudson River Railroad, the Erie Railway, and the Pennsylvania Railroad was about equal, and amounted in the aggregate to a little over three-fourths of that of the New York State canals; and in 1870 each of these railroads averaged about the tonnage of the canals, and in 1880 they averaged each nearly double that of canals.

The aggregate tonnage mileage of the other railroads was, in 1881, 1,217 per cent more than 1860. Statistics were also given showing the increase of population, of railroad mileage, of the production and export of grain and other leading exports. The means by which this rapid increase of freight transportation had been developed was considered under two general heads, namely, improvements in the physical conditions of the railroads, and improvements in the administration. The improvements in the physical condition were treated on under these heads:

1. Improved track or "permanent way," including bridge structure.

2. Additional sidings, and second, third, and fourth tracks.

3. Increased capacity and strict classification of locomotives.

4. Increased capacity of freight cars.

5. Additions to terminal facilities.

The improvements in the administration were referred to under the following heads:

6. Improved methods of signaling.

7. Running locomotives "first in, first out," and running freight trains at higher rates of speed.

8. Consolidation of connecting lines under one management by purchase, lease, amalgamation, or otherwise.

9. Running freight cars through from point of production to tide water without transshipment.

10. Issuing through bills of lading (or freight contracts) from Western points of shipment to Atlantic and European ports.

The general introduction of steel rails was stated to be the very corner stone of increased efficiency. The improvements in all the directions referred to were treated of, and described at considerable length.

The second portion of the paper presented the views of the writer as to the means whereby still greater efficiency could be most economically obtained. The constant demand is for more transportation facilities—for more cars. In the opinion of the writer, what is needed is not so much more cars, as more movement of cars. Freight blockades will be prevented, not by having more tracks to stand cars upon, but by having fewer standing cars. It was shown that upon one railway there had been a decrease in the miles run by the cars of 21 per cent between 1868 and 1881, and that the Union Line cars between 1879 and 1882 were increased 49 per cent in number, while the mileage run by them decreased 16 per cent in the same period. The remedies suggested by Mr. Shinn, were more main tracks, more locomotives, more trains, the improvement of the making up of trains at the points where cars are loaded. The detention of cars at stations and private sidings, and the absence of cars on foreign railroads were considered as among the greatest causes of loss, and the writer suggests that the remedy will be to charge a per diem charge for cars when on foreign roads, and that this charge should be based upon the average economic value of the cars in use to their owners.

It was voted that this paper should be discussed at the annual meeting. Members of the society and others interested in this subject are requested to contribute to this discussion. The annual meeting of the society will occur January 17 and 18, at the Society house in New York. The first session of the meeting will be at 10 A.M., January 17, 1883.

DANGEROUS FUNERAL APPLIANCES.

The possible agency of the undertaker in disseminating infectious diseases is not sufficiently regarded by health authorities. In many places public funerals are prohibited in cases of infectious disease, yet they are the rule rather than the exception the country over.

Where the funeral services are held in private houses, it is a common thing for the undertaker to provide chairs or camp-stools for the multitude. These are carried from house to house, and are liable to become carriers of infection. Some careful undertakers may take the trouble to disinfect such appliances in all cases of possible infection; but we doubt its being done very generally.

The ice boxes, in which the dead are laid until the time of burial comes, are still more liable to carry the germs of disease. The ice boxes are costly, are seldom renewed, and are scarcely more frequently disinfected. That they are a source of public peril is gradually becoming recognized by physicians and boards of health; and not a few have taken an interest in the devising of means for their displacement. The most promising substitute is the injection of preserving fluids into the circulatory system. Quite a number of prominent undertakers in this city and Brooklyn are reported as having adopted the new plan, under the instructions of Dr. Lukens and Professor Clark, of the Cincinnati School of Embalming. Demonstrations of the process of injecting preservative fluids have been made in the dead house of Bellevue Hospital. No mutilation of the body is required further than the opening of an artery for the injection of the fluid. There are several fluids which answer for the purpose, and the cost of embalming is said to be little if any greater than the charge for the use of an ice box.

A careless embalmer may still be a carrier of infection, but it would seem to be easier to enforce precautionary measures in the case of a man than with the bulky and variously exposed ice box, which may hold in succession the victims of every sort of disease.

MACHINERY AND LABOR.

Mr. Edward Atkinson says that it takes 160,000 men, women, and children to make the cotton cloth, the use of which is now enjoyed by the people of the United States, who are the best clothed people in the world. If those who do this work were obliged to use machinery no more effective than the spinning wheel or hand loom, it would require, he computes, 16,000,000 persons continuously employed ten hours a day to do the necessary work.

According to the view of a certain class of self-called "labor reformers"—of whom we hear less now than formerly, and less than we are likely to when hard times come again—modern labor-saving cotton machinery must be depriving 15,840,000 men, women, and children of steady work; the "reformers" would assume, remunerative work.

Where are they, and what are they doing? In every department of productive labor, machinery has been and is having a corresponding effect. The displaced millions of mythical hand workers cannot have starved to death, or have been otherwise exterminated, for there has been a rapid increase of population in all manufacturing countries, and the average length of human life is greater than it used to be.

The obvious truth—obvious, that is, to all who can see things as they are—is, that so far from displacing labor, or the demand for it, labor-saving machinery furnishes more and more varied opportunities for remunerative work, larger pay for the worker, and cheaper products for the worker to enjoy.

Machinery increases the cotton worker's capacity a hundredfold, cotton cloth is cheapened, and, as a natural result, a hundred times as many people can afford to use cotton and more of it. And a similar effect is produced in every other department of productive labor.

The anti-machinery argument holds good only on the assumption that savagery—which in our climate means incessant toil with nakedness, hunger, indifferent shelter, and general misery—is better than limited labor, made efficient by steam power and machinery, and surrounded by all the comforts that labor brings where labor is aided, as it is with us, by the fruits of a century of accumulation and invention. If any workman, or class of workmen, remain as badly off as savages are, it is wholly because of their choice to lead the lives of savages, or worse. Intemperance and improvidence, the great sources of misery in industrial communities, are not produced by machinery.

EMULSIONS OF PETROLEUM AS INSECTICIDES.

BY PROF. C. V. RILEY.

In the SCIENTIFIC AMERICAN for May 27 last I gave an account of the successful management of the chief insects injurious to the orange tree, and showed the value of kerosene emulsions based on very thorough experiments by one of my assistants, Mr. H. G. Hubbard, at Crescent City, Fla. In my forthcoming annual report, as entomologist to the Department of Agriculture, a more extended account of Mr. Hubbard's experiments is published, prepared in advance from a special report on the insects injurious to the orange tree. Mr. Hubbard's experiments with kerosene are especially valuable, and while I by no means consider them as final, I know of none ever made that compare with them in fullness or carefulness. His emulsions were made with milk, as set forth in the article in the SCIENTIFIC AMERICAN already alluded to. Emulsions of kerosene with soap suds and lye have been worked at, and recently Mr. Joseph Voyle, of Gainesville, Fla., has been experimenting, under my direction, with an emulsion of kerosene, soap, and fir balsam combined under a high temperature, and to which he gives the name of "Murvite." Experiments made here at the Department show that twenty parts of hard soap, ten parts of water, forty parts of kerosene, and one part of balsam make a very satisfactory emulsion in the form of a permanent paste which dilutes *ad libitum* with water, and it is not likely that the emulsions made by the use of mucilaginous substances or phosphates will ever supersede, for practical insecticide purposes, those made of milk or soap.

On the Pacific coast the horticulturists have, during the last two years, been very active in their attempts to effectually destroy scale insects, and Mr. S. F. Chapin, a member of the State Horticultural Commission, has recently published an extensive and interesting report (*vide* late numbers of the *Pacific Rural Press*) which bears evidence of careful work, and in which kerosene is condemned and various applications of lye and whale-oil soap are strongly recommended as sufficient for the object in view. Now, my own experience with scale-insects, and that of Mr. Hubbard, show that neither of these two substances bears comparison with a proper kerosene emulsion as an effectual destroyer of scale-insects and their eggs.

The discrepancy on the Pacific coast and in Florida can scarcely be explained by the different species dealt with, but may, I think, be explained by the difference in the trees treated and the methods employed, and as I should be sorry to see the California orange growers deterred from the use of kerosene, which has proved so successful in Florida, I have thought that a review of Dr. Chapin's report would prove interesting.

In his experiments he refers mainly to pear trees, and occasionally to other Northern fruit trees, the report being headed, in fact, "Scale-Insects on Deciduous and Ornamental Trees." The orange is not a deciduous tree, and was evidently not experimented on. Other insecticides were used by him upon pear, peach, apple, almond, prune, and plum. Now, there is no doubt but that the action of kerosene proves more injurious to some plants than to others, and in sufficient quantity is hurtful to all. It should, therefore, be used with caution where its effects are not already known, and never employed pure. Even the orange receives a shock from its judicious application, though there is abundant proof of the fact that young vigorous shoots of this tree will withstand a thorough drenching with the pure oil. Again, much will depend upon the condition of the tree and the time of application, as Dr. Le Baron long since showed that kerosene can safely be applied to apple trees in the spring of the year (Second Illinois Report, pp. 114, 115) or during the season of rapid growth. Again, the condition of the atmosphere will have much to do with the results, and the injury by kerosene will be greater during cool damp weather, when evaporation is at a minimum. The fatal results in California may also be due to the large quantity used and the coarse methods of application, for Dr. Chapin's report shows that in most of the experiments it was applied undiluted, in coarse spray, while the quantity is not stated.

As two years have now elapsed since Mr. Hubbard began the use of kerosene emulsions, I recently sent him a copy of Mr. Chapin's report, with the request that he give me a *résumé* of his views, and particularly requested him to examine the trees that had been first treated with kerosene. I give herewith his report:

"I have never seen any serious injury from applications of even pure kerosene. In 1880 one of my neighbors treated some very young orange trees for Lecanium scale by pouring the oil upon them from an oil can. The trees were not in very bad condition at the time and did not appear to suffer any injury at all, and at this date they are in very thrifty condition. The applications were made at evening. On September 13, 1881, I applied to twenty-five young trees in my own grove a wash consisting of 1 pint kerosene emulsified imperfectly with 1 quart fresh milk and diluted with 5½ quarts water. The emulsion (No. 1) was very imperfectly united, and most of the oil rose to the surface, and as the wash was applied with a brush, the first trees washed received a large amount of pure kerosene upon the trunks, branches, and in many cases upon the leaves. This application was made in the afternoon (2 P.M. to 6 P.M.) of a very hot, clear day. The trees so treated received not the slightest harm, and at this date are among the finest in the grove, and most of them have quadrupled their size within the year. About the same date (September 14) I made as a test an application to two young orange trees of a very unstable mixture, of kerosene, 1 pint; of milk, 2 fluid ounces; water, 2 ounces; which, when diluted, separated and floated on top. The mixture was applied with a brush, and the oil could be seen to penetrate the leaves, so that they appeared greasy and translucent. Applied between 12 M. and 1 P.M. on a very hot, clear day. Tree A stood in the shade of an oak tree, B in the sun. September 16, 1881, B, old, devitalized leaves loosened or fallen; A, no leaves loosened or fallen. September 20, 1881, B has dropped its leaves badly; A has dropped fewer leaves. December 17, 1881, both trees apparently cleared of living scales. February 14, 1882, trees pushing out vigorously; no apparent difference in condition of A and B; no living scales can be found. Today, November 9, 1882, these trees are in splendid condition, and have made nearly, if not quite, the maximum growth possible in the year. In these cases, the effect of the kerosene has been simply to remove the scale; the rest is due, of course, to cultivation.

"Another test, which I intended to be crucial as to the effect of diluted kerosene wash upon the roots of the orange, was made at the same time, September 14, 1881. In this experiment I selected a very small two-year-old budded orange tree, which had made no growth during the year, was starved and hide-bound, and stunted. Every orange grower knows how difficult it is to start such a tree into vigorous growth. I dished the earth around this tree and poured a gallon and a half of kerosene wash, containing 1 pint of the oil in emulsion with milk, into the cavity about the cavity of the tree, so that the whole of it soaked into the sand on and about the roots. The tree had but a few yellowish leaves, and most of these dropped within a week. It, however, pushed out new leaves during the winter, and made a respectable amount of branch growth during the past summer. At this date, far from being in dying condition, it is evidently prospering as well as its gnarled and stunted trunk will allow, and I do not hesitate to say that the shock of the kerosene started it from its dormant condition. I might give other instances of applications with kerosene used unnecessarily strong or in imperfect mixtures with other liquids, in none of which have the trees been killed within the past year, but I prefer to cite only from my own notes. In the California report the concentrated solutions of lye seem to be recommended, although the effect upon the trees is evidently very severe. *E. g.*, 'No. 3, concentrated lye, one and one-half pounds; water, one gallon. June 23, 1881, lye so strong as to burn bark and foliage. . . . August 2, 1881; . . . bark being restored and new foliage appearing.' I should call this heroic treatment. It would never do for orange trees, because it would make them hide-bound, if it did no worse. I made four experiments with potash lye (see Preliminary Report, table 6). The strongest solution is 1 pound to 1½ gallons, applied December 31, 1881 (Exp. 43). I find I have the following notes upon the condition of the tree: January 10, 1882, 'Until within two or three days, the tree has not dropped many leaves. It is now severely defoliated. January 20. Has ceased to drop leaves; defoliation complete upon the most badly infested branches; no leaves dropped on the most vigorous branches; some dropped on nearly all older branches.' At this date (November, 1882), the tree is alive, but seems to be suffering from a severe check, and hardening of the bark. The result on scale was not at all satisfactory in my experiments, but I have since had reason to suspect that the concentrated lye used was not a good article. Mr. Voyle, who has tried apparently the same brand, told me that he suspected there was 'no *potash* in it.' What was substituted he could not say, but it might be some form of caustic soda. I have had it in mind to repeat these experiments with a brand of potash known to be good. Shall I do so? In my experiments Nos. 43, 44, and 45 (see Report, table 5) the trees were in very bad condition, coated with scale. I looked at them the other day, and they seemed to me to be in dying condition. This, however, may be partly due to scale, as the lye did not clear the tree. They have, however, been repeatedly washed, with the other trees in the same grove, during the past summer, the washes used being soap and kerosene emulsions of the strength I have recommended, *i. e.*, 66 per cent oil in emulsion, emulsion diluted nine or ten times. That the present condition of these trees is not attributable to the kerosene is shown by the surrounding trees, many of which were in equally bad condition, but *all* of which show marked improvement.

Improved Formula for Preparing Gelatine Photographic Emulsion.

BY A. L. HENDERSON.

My own, Nelson's or any good photographic gelatine should be used, and must be well washed for twelve hours by soaking in water, occasionally changing the same.

Dissolve thirty grains of the washed gelatine in two ounces of warm water in a wide mouthed jar, then add in the following order:

Bromide of potassium	180 grains.
Iodide of potassium	3 grains.
Ammonia	60 minims.

Allow the solution to cool, then add in a fine stream, constantly stirring, in the dark room, the following solution:

Water	2 ounces.
Nitrate of silver	200 grains.

When these are mixed, add 240 grains of dry gelatine, then place the jar in hot water, 150° Fahr.; allow it to remain until the gelatine is melted. Remove the jar from the water, and allow the emulsion to cool and set. When set, it resembles a stiff jelly, is torn into shreds from the bottom of the jar, and squeezed through an opened meshed canvas bag into another dish. It is then washed; a simple way is to allow a small stream of water to trickle on it all night. The water is drained off, then the jelly-like emulsion is put into a wide mouthed bottle, and remelted or dissolved by immersing the bottle in warm water, the temperature of which must *never exceed 90° Fahr.* When dissolved, enough warm water should be added to the emulsion to increase the bulk to eight or ten ounces, after which plates can be coated in the usual manner.

Instead of allowing the emulsion to set as above stated, twelve ounces of warm alcohol, 100° Fahr., may be added, and the whole well agitated. The emulsion will then become flocculent, not adhering to the stirring rod, and in a short time will precipitate to the bottom.

After removing the waste alcohol, the emulsion is then set and washed as previously described. When redissolved, add water to make up from eight to ten ounces, and to every ten ounces of finished emulsion add half an ounce of alcohol, which will make it flow better on the glass. An emulsion made as above stated is rapid working and safe. By increasing the amount of ammonia, the rapidity of the emulsion is increased, but manipulation becomes more difficult, and it is possible, by a great increase of ammonia, to make an emulsion so sensitive that plates coated with it will be fogged where exposed for twenty seconds to a light rendered more actinic by passing through double thicknesses of spectroscopically perfect yellow and deep ruby glass.

The Orbit of the Great Comet of 1882.

Professor Frisby, of the Naval Observatory, Washington, has completed a calculation of the orbit of the great comet of 1882 from observations made on September 19, October 8, and November 24, and finds the orbit to be a very lengthened ellipse having a period of about 793, and probably identical with a very large comet seen 371 B.C., and 363 A.D., just about the time of the death of Constantine. Its perihelion distance is only about 700,000 from the center of the sun, and it extends outward at aphelion to about ninety times the sun's distance from the earth.

Direct Fermentation of Starch.

The investigations of V. Marcano go to show that diastase is a product of the vital process of vibrios. To prove this, the microbes observed in corn (maize) were planted in a cultivating fluid of non-gelatinous starch and artificial albumen mixed with water that had not been distilled. These organisms developed remarkably in this fluid. The filtered liquid, after the microbes had been killed by Muntz's process, possessed a diastatic power equal to that of a good malt extract. Koji's diastase was produced in like manner.—*Compt. Rend.*

Isovanilline.

Dr. R. Wegscheider has prepared a substance isomeric with the vanilline of vanilla, by heating opianic acid and dilute hydrochloric acid in closed tubes to 170° C. An aldehyde of protocatechu is also formed. Isovanilline dissolves readily in hot water, from which it crystallizes in prisms melting at 116° to 117°. It dissolves with difficulty in cold water, is easily soluble in alkalies, reduces the ammoniacal silver solution when boiled, and forms with bisulphite of soda a soluble double salt.—*Vienna Acad. Bericht.*

A Brazilian Coffee Plantation.

One of the largest coffee plantations in Brazil is the Fazenda Santa Catharina, 100 miles from Rio Janeiro, belonging to Baron de Monteiro. It covers an area of more than twenty square miles, contains 1,700,000 bearing trees, and employs six hundred slaves, who are subjected to the most rigid discipline, and, in fact, as much like machines as it is possible for human beings to become. They are well taken care of, however, and the Baron maintains a private hospital with a resident physician and assistants for the sick.

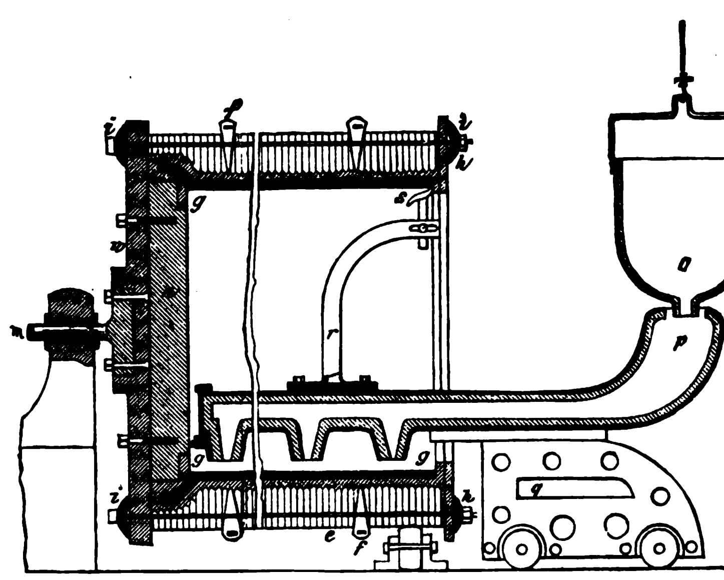
A Raid on Telephones in Paris.

The Société Générale des Téléphones has just made a raid in Paris on all persons making and selling telephones, which they assert are infringements of the Edison patent, and has issued a notice warning the public against making, selling, or retaining possession of such telephones unless they have the company's trade mark on them.

ROTARY MOULD FOR CASTING PIPES.

To cast pipes of large diameter Mr. Whitley, of Leeds, employs the rotary mould shown in the accompanying cut. The mould is fixed so as to project from a disk, *w*, mounted on the axle, *m*, and consists of a series of iron rings, *e*, which are held together by bolts, *h*. The springs, *i*, permit the mould to expand in a longitudinal direction, while the conical ring segments, *f*, which can be thrust outwardly, render contraction possible. The outer extremity of the mould is supported by one or two rollets.

The mould, properly so called, is formed by covering the rings, *e*, and the plate, *n*, with moulding clay, *g*. Before moulding, the carriage, *q*, carrying the mouth piece, *o p*, is shoved up against the mould, and the latter is made to rotate rapidly during the inflow of the metal. In order to determine the thickness of the sides of the pipe, a peculiar measuring apparatus, *r s*, is affixed to the mouth piece. The internal surface of the mould may also be produced by templets fixed on a carriage similar to *q*, in such a way that it can revolve.—*Dingler's Polytechnisches Journal.*



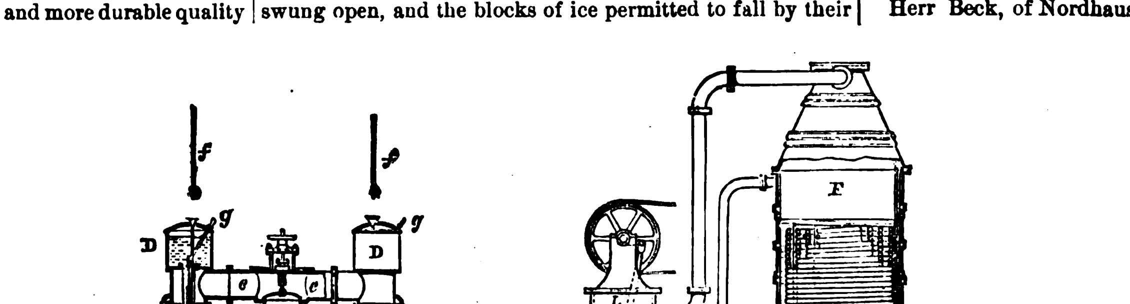
ROTARY MOULD FOR CASTING PIPES.

Rapid Growth of a Colt.

A yearling colt in Mr. Robert Bonner's celebrated breeding stud, in Westchester County, New York, weighs 1,062 pounds, and yet is fine in all his points, and promises to turn out a fast trotter. Mr. Bonner thinks he gets this early exceptional size from an experiment he tried with his dam. Before the colt was weaned, he says he had the mother brought up from pasture every night, and fed six quarts of oats; and since the colt has learned to eat he also has been fed abundantly with oats, in addition to good pasture in the summer and hay in winter. Following up this system, Northern horse breeders may get the same size at as early an age as is now obtained in our Southern States and the milder winters of California. In the latter country there is good pasture all winter, and the colts receive no check in their growth, as is common with all kinds of stock unless they receive extra care during the rigorous winters of the Northern States. Mr. Bonner's treatment of this colt is the same as that pursued by English breeders of race horses. The dam is not only fed an abundance of oats, but the colt is also taught to eat them just as soon as possible, which he learns to do at an early age from the same trough as his mother. At six months old—the general age for weaning the colt—he has learned to sustain himself well on grain, grass, and hay, so that when weaned there is no check in his growth, but he keeps steadily along the same as when sucking his dam.—*Rural New Yorker.*

IMPROVED ICE MACHINE.

This apparatus is the invention of Franz Windhausen, of Berlin. It is claimed that by its means ice can be commercially manufactured of a better and more durable quality than that produced by the freezing machines at present in use, and at from one-third to one half the cost.



THE WINDHAUSEN ICE MACHINE.

It has long been known, says the *Engineer*, that extreme cold can be produced by the rapid evaporation of water in a comparatively perfect vacuum, the heat required for vaporization being abstracted from the remaining water, which consequently becomes reduced in temperature, and if the process be sufficiently prolonged, actually converted into ice. Machines to carry out this principle have been constructed by Leslie, Carré, and others, but in all these cases the air pump served only for the rarefaction of the air in the refrigerating compartment, and not for the removal and condensation of the vapor, which had to be entirely absorbed by sulphuric acid, requiring renewal after each operation. Owing to this defect, continuity of action could not be obtained, while the removal and replacement of the acid was not only an expensive operation, but was open to obvious objections from the danger and difficulty of dealing with such a highly corrosive material as oil of vitriol. For these reasons the introduction of vacuum machines has never been general, and in point of fact they were little known or used, except for producing very small quantities of ice for household purposes and for laboratory experiments, in both of which cases the air pump was worked by hand.

In Windhausen's machine is introduced a combined air and vapor pump, which serves for maintaining the extreme vacuum of about four millimeters absolute pressure in the refrigerator, and at the same time to remove and condense the steam, while the renewal of the sulphuric acid is avoided by a cooling and concentrating arrangement, by which the absorbed water is abstracted and the acid rendered available for use over and over again.

Our illustration below gives a general view of a complete vacuum ice machine, arranged as it actually is in practice. The pump, A, shown in the present instance as driven by an independent engine, maintains an almost perfect vacuum in the freezing cylinders, C C, with which it is connected by the suction pipe, *c*, through the absorber, B, containing concentrated sulphuric acid continually agitated by revolving arms. Pure water is delivered by pipes, *f f*, into cisterns D D, from which it is gradually admitted to the cylinders, C C, by pipes with adjustable valves, projecting somewhat into the interior, and water jacketed to prevent obstruction from the formation of ice. The vacuum within the freezing cylinders at once causes rapid evaporation, and the vapor, together with a certain amount of air given up by the water, is drawn toward the pumps through connecting pipes, *e e*, and *d*, over the surface of the sulphuric acid in B, which absorbs the greater part of the vapor.

Each pound of vapor formed in the cylinders, requiring a supply of some 1,100 thermal units, has no other source of heat to draw from but the water itself, and as about 200 units are given off in the formation of one pound of ice, it will be seen that by properly arranging the supply nearly six pounds of water might be converted into ice for every pound evaporated. Actually, about five pounds of ice are obtained, the balance of the heat being drawn from the iron casings by conduction from the outside. When the process is sufficiently advanced, that is, when the freezing cylinders are filled, which takes place in about an hour—more or less depending on their size—the doors, *h*, at the bottom are swung open, and the blocks of ice permitted to fall by their own weight into receptacles of any convenient description. The freezing vessels are placed in two rows, one on each side of the absorber, with which they communicate by separate pipes with shut off valves, so that if desired each cylinder can be worked and discharged independently of the other.

The absorber, B, containing the sulphuric acid, is a horizontal cylinder within which a shaft provided with arms rotates. These arms stir the acid and mix the surface portion which is diluted from absorbed moisture with the more concentrated portion at the bottom, and being made spoon-shaped, carry up acid with them, so promoting absorption. A cold water jacket surrounds the cylinder and cools the acid, which would otherwise become heated. From the absorber the dilute acid is conveyed by a pipe to the bottom of the heat exchanger, G, and, ascending through tubes, is heated by hot concentrated acid outside, traveling in the contrary direction on its passage to the reservoir, H. From the exchanger the dilute acid, now somewhat raised in temperature, enters the concentrator, F, by a pipe at the top, and is further heated by a steam coil in order to evaporate off the water, the vapor being removed by the small supplementary pump, L. The hot concentrated acid then passes from the bottom of the concentrator round the outside of the tubes in heat exchanger, where it is cooled, into H, from which the pipe, *p*, conveys it for reuse in the absorber.

In a report by Dr. John Hopkinson, F.R.S., who has personally inspected one of the vacuum machines erected in Berlin in 1880, and in use since that date, it is stated that no undue depreciation or corrosion was apparent in any part of the apparatus, and that after most careful examination no trace of acid could be found either in the condensed vapor from the large air pump or in that from the small concentrator pump. With regard to cost, the report states that the writer found from experiment that 1 ton of coal would produce 12½ tons of ice, the average net horse power to work a machine making 12 tons in twenty-four hours not exceeding three, and that he is of opinion that, after allowing interest on capital, depreciation at 10 per cent, and estimating other expenses on a liberal scale, solid block ice can be produced by the vacuum process for from 8s. 4d. to 5s. per ton, depending upon the magnitude of the plant and whether it was continuously worked up to its full power or otherwise. Even in this country the manufacture of ice and the refrigeration of water and other liquids have become such necessities that it is quite certain the advantage of a cheaper method of producing cold than those now in use will be readily appreciated; while in hot climates, where, from the difficulties resulting from the high pressures required in ice machines in which cold is produced by the evaporation of ammonia or other volatile liquids, the use of cooling apparatus has hitherto been attended with considerable difficulties and expense, the new vacuum plant should be worked as effectually and economically as in this country.

The ice produced is not transparent, but opaque, this appearance being caused by vacuoles due to its formation in a vacuum, and which, so soon as the doors of the freezing cylinders are opened, become filled with air. On this account it is claimed that the ice is more durable than if transparent. The experimental trial lately made in London was a complete success in every respect.

Gunpowder Engine.

Herr Beck, of Nordhausen, Germany, has invented a machine of which the motive force is supplied by gunpowder. In a horizontal cylinder a piston is set in motion by small quantities of powder, which are alternately ignited before and behind it. The gases which have been used escape through lateral openings closed by slide valves at the return movement of the piston. The heavy residuum accumulates in the deepest part of the cylinder, and is pushed by the piston into receptacles which are emptied from time to time. The ignition of the gunpowder is effected by a spirit flame or by a gas jet, which is brought to bear upon it by the sucking action of the piston, through an opening provided with a slide valve. A Cologne firm of engineers has, according to the *Deutsche Industrie Zeitung*, undertaken the construction of this machine, with a view to its being introduced for sale during this autumn. Among the advantages claimed for it are the comparatively small space it takes up and the fact of its being constantly ready for use. The consumption of powder is relatively small, and no special attendance is required, as the machine is self-regulating.

Large Sugar Yields.

The sugar yields in some parts of Louisiana have been uncommonly large this year. The Donaldsonville *Chief* gives a list of "reliable reports" from some of the principal plantations in Ascension, on which the yield has ranged between 5,500 to over 6,000 pounds of sugar to the acre. The crop has, generally, largely exceeded the estimates made when the grinding began.

IMPROVED GALVANIC BATTERY.

The improvement illustrated herewith is designed to effect the rapid and complete depolarization of the negative plate, and thereby increase the efficiency of this class of batteries.

In this galvanic battery the positive plate is made of zinc, in any of the well-known shapes, and is provided with a wire conductor connected with it in the ordinary way. The negative plate, which is of carbon, is placed in a porous cell and surrounded with a mixture of granulated gas retort carbon, granulated black oxide of manganese, and mild chloride of mercury, or calomel, equal parts. These materials are intimately mixed together with a small quantity of water before being placed around the negative plate. As the fluids of this battery, when in operation, are very corrosive, the upper end of the carbon is saturated with paraffine or wax, and the electrical connection is made with it by casting lead or solder around it, and attaching to it a binding screw. The porous cell is filled around the carbon to within a short distance of the top of the cell with the mixture of gas carbon, black oxide of manganese, and chloride of mercury, and the top of the cell is sealed with a cement of resin and wax, or any other insulating cement insoluble in the fluid of the battery. Two small holes are left in the cement for the admission of water or the exciting fluid, or for the escape of gas which may be generated in the porous cell.

The porous cell, containing the carbon plate, the granulated carbon, and black oxide of manganese, and the chloride of mercury, as above described, is placed in a suitable jar, together with a zinc rod or plate which has been amalgamated. The exciting fluid is a saturated solution of ammonium chloride or sal ammoniac. The action of this battery is as follows: The zinc, calomel, carbon, and manganese being all insoluble in water, there is no internal action when the circuit is open. The circuit being closed, decomposition commences. The zinc is oxidized by the water of the sal ammoniac solution forming oxide. This zinc oxide immediately reacts with the sal ammoniac (ammonium chloride), first combining with a portion of the chlorine of the latter, and displacing an equivalent of ammonia), and then combining with another portion of the sal ammoniac, forming ammonia zinc chloride, while the ammoniac becomes converted into ammonia. The hydrogen being liberated at the negative plate, unites with its equivalent of oxygen from the peroxide of manganese, reducing this to the sesquioxide, and by this union forming water. The ammonia reduces the calomel into metallic mercury and hydrochloric acid, which latter unites with the ammonia, forming ammonium chloride, to be decomposed, as above described, or this latter acid may act directly upon the zinc, thereby intensifying the action of the battery.

The reaction given above may not be at all times fully complete, and the double chlorides of zinc and ammonia may be formed, as well as double chlorides of mercury and ammonia; but the above shows the advantage of the use of the calomel, as by its use the ammonia, which previously was a waste product in this class of batteries, is made to play a part in intensifying the action of the battery, and render it practically a constant battery, fitted for any use where a constant current is required, as well as having it still a very desirable and economical form of battery, for use with alarms or bells, or other forms of work where open circuit is the rule and closed circuit the exception, as in telephone service.

Fig. 2 shows a portable form of the battery in which the mixture of carbon, black oxide of manganese, and chloride of mercury is inclosed in a canvas rack placed between zinc plates which are wrapped in blotting paper. The inclosing case is made of rubber or other suitable material. The exciting fluid is a saturated solution of chloride of ammonium, which is absorbed by the blotting paper surrounding the zincs and by the canvas sack and its contents. As this form of the battery contains no free solution, it may be carried in the pocket without inconvenience. Further information in regard to this invention may be obtained by addressing C. D. Parkhurst, Fort McKinney, Wyo., *via* Rock Creek.

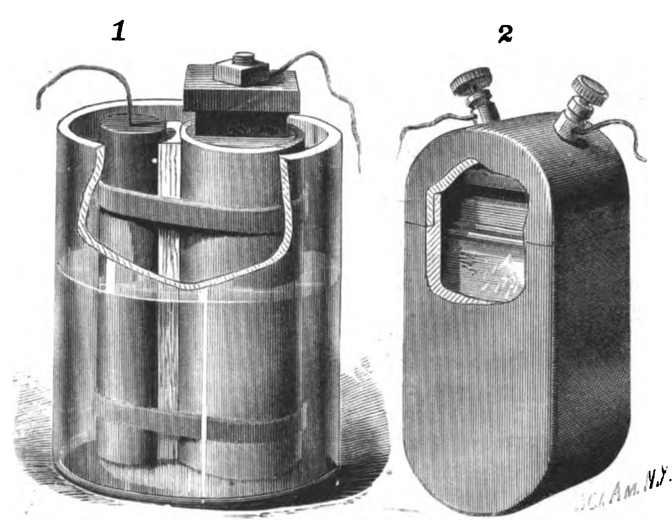
Dairy Industry in France.

To give an idea of the dairy industry in France, M. Herve Mangon recently stated at an agricultural gathering that the milk produced in the country would, if collected, form a stream about 1 meter in width and 33 centimeters in depth (say 3 ft. 4 in. and 1 ft. 1 in.), flowing night and day all the year, with a mean velocity of one meter per second. Young animals drink a part of this enormous volume of milk, man takes a good part of it, and the rest is transformed into cheese and butter. No branch of agricultural industry has so progressed during the last fifty years as the making of butter. In 1833, France bought abroad 1,200,000 kilogrammes of butter, and sold to foreigners only 1,100,000 kilogrammes. She now exports 34 to 35 million kilogrammes of butter annually, and receives in return from abroad (especially from England) a sum of more than 100 million francs.—*Nature.*

Furniture Manufacture.

The value of our annual furniture product has increased sixfold in the past thirty years, approaching the magnificent total of $120,000,000.

During the past ten years, says the *Furniture Gazette*, the main growth has been in the Western States, various causes combining to move the centers of production from their long established seat in Eastern cities. The main causes operating to bring about this result are: the shifting of the centers of population, the great demand incident to the newly settled and prosperous West, and the location of the lumber supply. These causes have exerted different degrees of influence, so that while some branches of furniture manufacture in the East have been almost annihilated by Western competition, others have prospered, suffering only a partial curtailment of their Western trade. The former class is made up of those manufactures requiring much lumber, while chairs, upholstered furniture, etc., have suffered very little by the growth of manufactories of those articles in the West. In the East the cities, as a rule, show but little growth, New York, Boston, and Philadelphia being either stationary or showing a falling off from 1870, but this is owing, doubtless, to high rate of taxation, as in the rural districts of New York, Massachusetts, and in some of the municipalities, as Brooklyn, there is a fair increase.



PARKHURST'S GALVANIC BATTERY.

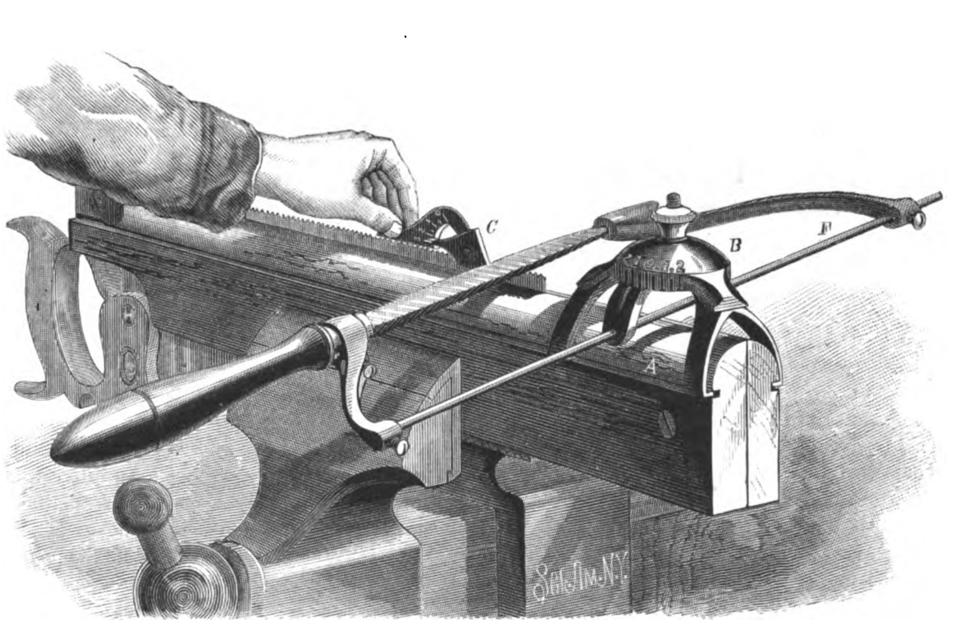
SAW FILING MACHINE.

The engraving represents an improved saw filing machine recently patented by Mr. Elias Roth, of New Oxford, Pa. This machine guides and adjusts the file so that the teeth of the saw on which it is used will all be filed to a uniform pitch and size, and will be made level. The apparatus is very simple indeed, and is easily applied and operated.

A A are the clamps between which the saw is placed and held as usual. These clamps are formed each with a longitudinal groove in the side.

B is a clamp for carrying the file frame, which consists of a head provided with legs to slide in the grooves in the clamps, A, so that the clamp, B, may slide freely lengthwise of the saw. At the under side of the plate is a semicircular or arc-shaped piece, held in place by a screw and thumb nut, the screw passing through a slot in the lower piece, so as to allow of its lateral and vertical adjustment. The ends of the lower piece are apertured, receiving the slide rod, F, of the file frame. This file frame is formed by arms upon the ends of the rod, F, the arms being adjustable and formed at their outer ends to receive the ends of the file. The file being held in the frame in this manner, and the guide rod, F, being held in the clamp, B, the file is free to be moved endwise and across the teeth of the saw, and the file may also be swung upward from the saw teeth upon the rod, F, as a center. By setting the piece which guides the rod, F, to the right or left, the angle of the file with reference to the teeth is varied. This is important, because all saws have their teeth set or bent, one to the right and the other to the left; and in order to file teeth so that their cutting edges shall be in the proper direction, the file must be set to the left while filing one-half of the teeth, and to the right for filing the other side. These changes can be readily made by loosening the thumb nut upon the clamp, B; and to facilitate the accurate adjustment of the file the plate is provided on its upper side with a scale of figures to indicate the angle.

The pitch given to the teeth is of course dependent upon the angle of the filing surface to a vertical line. This is varied by adjustment of the file in the file frame. To facilitate this adjustment and insure accuracy, a gauge, C, is provided. This gauge consists in a plate formed with a straight edge to rest upon the points of the saw teeth, and to the plate is pivoted a pointer. By turning the pivoted plate the angle of the edge is varied with reference to the straight edge of the plate, and upon the plate there is a scale of numbers to facilitate accurate adjustment. The gauge, C, being placed upon the saw teeth, and the pointer properly adjusted, the file is to be adjusted to correspond with the edge of the plate, which will give the proper pitch to the teeth. This may be done with either a three-cornered, a flat, or a half-round file, the file being secured in the frame by a set screw.



ROTH'S SAW FILE GUIDE.

Inventors and Patents.

Judged by what seems to be current opinion, it would be inferred that the failures of inventors, at least of those who secure their inventions through the operation of the patent laws, were phenomenal. Why of all men who invest means—sometimes foolishly—the inventor in a patent should be singled out to point a moral is a matter by no means plain. Unquestionably, if all patents issued from the Patent Office are looked upon as evidences of so many attempts to establish a business enterprise on the basis of their existence, a large proportion of failures to get rich can be chronicled, but even then hardly more than could be found in other business enterprises. If the same argument that is applied so flippantly to the patentee's affairs is applied in the same way to general business affairs, the scope of the inquiry into the cause of the lack of success will be widened to an extent apparently not thought of.

But it is manifestly unfair to look at best upon more than a very small per cent of the total number of patents issued as evidence of an intention to establish a business or accumulate a fortune by their means. The great majority of patentees risk the small amount necessary to obtain a patent exactly as they risk similar amounts in other side or collateral issues, that is, for the chance of getting back more than they invest, and fully comprehending the probability of failure. Looked at in this light, the failures are about as numerous in one instance as in the other, but in one case they go upon record, while in the other they are unknown. A good many men can look back to a few dollars invested —sunk—in the Patent Office, and at the same time can contemplate several other enterprises that were balanced by profit and loss. It is sometimes noted as remarkable that so many who know substantially nothing of the matter at issue attempt to improve existing appliances, and undoubtedly a large per cent of the failure of patented devices to come to the surface the second time is due to this cause; but why this should be considered more remarkable than the fact that men are forever meddling with other things with which lack of acquaintance makes success at least highly improbable, no one can tell.

If in distinction from those who invest a little in patents in the way of their regular business, or who do a little in that way as a sort of side issue, the class that may be termed professional inventors be taken in comparison with those engaged in other business affairs, it will be found that both classes are subject to the same general laws of business, and about the same ratio and degree of success and failure will appear.

Individual judgment is likely to be at fault, or one is likely to invest unadvisedly in securing a patent exactly as in a hundred other ways, and the results will be in accordance with the quality of the judgment; but the idea that there is anything phenomenal in the failure of inventors is something for which it would be difficult to find any foundation.—*The American Machinist.*

James Laughlin, Sr.

James Laughlin, Sr., President of the First National Bank of Pittsburg, and member of the firm of Jones & Laughlin, iron manufacturers, died in that city, December 18. For many years Mr. Laughlin had been identified with the iron industry of Pittsburg.

GORDON'S DYNAMO ELECTRIC MACHINE.

(*Continued from page* 1.)

one. In the former machine the revolving rings each carried the same number of magnet coils as the fixed rings carried armature coils, and it was found that an injurious inductive action militated against the efficiency of the machine. If a certain number of lamps were maintained by one coil, and the circuit of the next coil was then closed, there was a reduction of light in the lamps of the first circuit by some 20 or 30 per cent. The cause of this was in the current circulating in opposite directions in the contiguous coils. In the present machine the armature coils are twice the number of the magnet coils, hence the magnets act on alternate coils. For example, at the instant when the 32 magnets are acting with their maximum effect on the alternate coils 1, 3, 5 . . . 63, the other alternate coils, 2, 4, 6 . . . 64, are practically idle, and although the coils 1, 3, 5, etc., do not act upon each other, it is with far less effect in there being comparatively a long distance between them, so that the effect is inappreciable. Our illustration of the general view of the machine, as seen at Greenwhich, will give a better idea of the machine than mere description. Its total weight is about 18 tons. The weight of the revolving magnet wheel is 7 tons. The space occupied by the bed-plate is 13 feet 4 inches by 7 feet, while the diameter of the magnet wheel is 8 feet 9 inches. With 1,300 Swan lamps in two circuits, the 128 coils are arranged 4 in series and 32 in quantity. The number of revolutions is 140 per minute, which gives a velocity of a little over 60 feet per second to any point in the revolving wheel. The revolving magnet coils are magnetized, as we have said, by the current from two Burgin machines—one would in reality suffice—conveyed in the usual way by brushes making contact with rings. The rings are usually of phosphor bronze, and are separated from the iron collars by an insulator. The current in the magnets is 19 Ampères, with an electromotive force of 88 volts. The current in each armature wire is 27·5 Ampères. Each coil is wound with wire 0·185 inch in diameter, its cross section is 0 0269 square inch, and the total cross section of the 128 coils of wire in quantity is $0·0269 \times 128 = 3·44$ square inches.

The coils may be coupled up in almost any way desired. For example, if the full 5,000 lamps were placed on this machine, the 128 coils would be all coupled together for quantity. The number of revolutions would be raised to 200, with a current of 48 Ampères in the magnet's coils, giving the same electromotive force as before, and the same current—24·25 Ampères—in the armature wire. The armature wire will take a current of 40 Ampères easily. The core of the coil is of wedge shape, and made of a piece of boiler-plate bent upon itself, so that the angle forms the thin end of the wedge, and the free edges, which do not quite meet, form the thick end. A wedge-shaped head of a T-piece is inserted into one end of the folded plate and welded to it; the stem of the T being turned and screwed is passed through a hole in the fixed ring, and secured by nuts. A German silver flange is riveted on a shoulder cut on the end of the core. This flange has cut into it slots as nearly as possible in a direction at right angles to the currents which may be induced in it. The connection of the outer ends of the cores of the coils is made by prolonging the cores outward from the magnet coil, and securing them to a fixed iron ring-shaped plate, which forms their support.

In order that power may not be wasted in inducing currents in this plate, it is set back some distance, the cores being correspondingly prolonged. The space between the wire of the coils and the iron plate may be filled up with wooden plates or blocks, which form the second flange of the coil. The thickness is such that the algebraic sum of the magnetic potentials, induced by the magnetic poles at any point of the fixed iron ring, is as nearly as possible zero. The wheel consists of two central disks, and of two cones whose bases fit upon the central disks, and through whose apices the main shaft passes. The disks and cones are made of segmental pieces of boiler plate, so cut that the grain of the plate is radial to the wheel at the center of each segment. The segments are riveted together with butt strips in the way usual in boiler making. The disks are kept apart at the center by a cast iron distance piece. At the rim they are kept apart by a wrought iron ring. The cones are of less diameter than the disks, so as to leave a space of flat disk all around exterior to the cones. The cones and disk are separated at the center by massive cast-iron bosses, turned square to the shaft where they butt against the disk, and conical where they butt against the cones.

The flat outer portion of the wheel receives the magnet cores, which are 32 in number. Each magnet consists of a cylindrical iron core, of two bobbins of brass or other metal other than iron, containing wire, and of two pole pieces. The core passes right through a hole in the disks and wrought iron ring, and is fixed so as to project equally on both sides. The brass bobbins are then slipped on, one at each side of the disk, and the pole plates being fixed on hold the bobbins in their places. The pole plates are of iron, preferably wrought; their sides are not parallel, but form radii of the magnet wheel.—*The Engineer.*

Longest Line of Railway Under One Management.

The New Orleans extension of the Southern Pacific Railroad is nearly ready for business. When it is completed, the Southern Pacific will have a road from tide water at San Francisco to the Gulf of Mexico, twenty-five hundred miles, **the longest continuous line of railway under one management.**

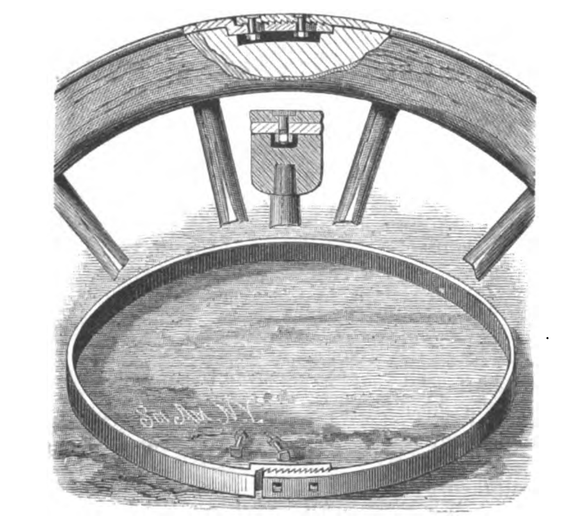
Sheet Iron Gas Mains.

During the past few months the Paris Gas Company have been engaged in reorganizing a portion of their distributing plant for the purpose of connecting the trunk mains in the principal central streets with their new station at Clichy-la-Garenne. All the main thoroughfares of the city have been affected in this operation. From the Place de l'Opera to the Courcelles gate, and thence along the national road to the works, the new main is one meter in diameter, and is made of bitumenized sheet iron. The pipes are laid in a bed of hot bitumen mixed with fine gravel—a pitch concrete, in short. This composition is said to acquire very great consistency and strength in cooling, and to protect the sheet iron so well that it does not at all deteriorate or oxidize, even in a soil saturated with damp. The pipes in the streets are placed underneath the pavement. It is worthy of notice how Continental gas engineers appear quite converted from cast to wrought iron mains, even to the size mentioned in the present example. With regard to the protective qualities of the bitumen, on which so much reliance is necessarily placed, it is not stated whether the work is carried on in all weathers. It would appear that heavy rain must materially interfere with this method of main laying.

IMPROVED WHEEL TIRE.

The engraving represents a new adjustable wheel tire, recently patented by Messrs. Wm. J. Plummer and P. Turpin, of Olympia, W. T.

The wheel rim has a stepped recess in the face, in which the offset portion of the end of the tire and the fastening bolts and nuts are located. The outer face of the offset of the tire is serrated, and the inner face of a portion of the other end of the tire is also serrated, so that when bolted together the parts cannot slip. The offset part has



slotted holes for the bolts, to enable them to be shifted along the joint for tightening the tire, and the outer part has round holes with square sockets for holding the heads of the bolts when screwing up the nuts.

To apply the tire to the wheel, it is first adjusted to the size of the wheel when tightened thereon, and bolted together. Then it is to be heated and shrunk on, in the same manner as other tires are. Afterward, when the wheel shrinks, the tire can be shortened and reapplied, as before, without the aid of a blacksmith.

Fig. 1 shows the tire; Fig. 2, a section of the wheel rim; and Fig. 3, a transverse section of the tire joint.

Drainage and Ventilation of Houses.

At a recent meeting of the Society of Medical Officers of Health, London, a paper was read by Mr. Rogers Field, M.I.C.E., on "Certain Less Recognized, but Highly Important, Points in the Drainage and Ventilation of Houses," of which the following is an abstract:

Three sanitary principles govern house drainage. These are:

1st. All refuse matter must be completely and rapidly removed from the house.

2d. There must never be any passage of air from the drains or waste pipes into the house.

3d. There must be no connection between the drains and the domestic water supply.

These, although so simple, are very frequently neglected. The first goes absolutely to the root of sanitation; for were it strictly complied with, there would be no leaky drains, no polluted subsoil, and no production of foul gases in the drains from decomposing organic matter. There cannot be a greater mistake than to assume, as is commonly done in investigating drainage, that if water runs away with freedom this is all that is required. Numerous cases are on record where the sewage from houses has apparently run away freely for years, but where the greater portion of it has really been leaking out of the drains into the ground under or close to the house. In illustration of this point, the author quoted two cases in his own practice: one in which the connection with the sewer was actually found to be blocked with shavings, which had been left in when the house was built three years before; the other that of a school in which the drainage from the lavatories had leaked through disused drains under the floor of a large portion of the building, and where, although there was a mass of filth in some places seven feet deep, no leakage had been suspected. If the drains are exposed, and found clean and jointed with cement, this is not sufficient; the tops of the joints may be good and the bottoms bad. The only safe method is to actually test the drains by plugging them at the lower end and filling them with water. Very few house drains, indeed, stand this test.

Even if the drains are outside the house, it is a mistake to assume that it is unimportant whether they are sound, for not only may sewage leak out of faulty joints and percolate under the house, but foul air may be drawn into the house. It is important to realize how small an amount of deposit will create mischief by decomposing and generating foul gases; a mere irregularity of the joints, even when the drain has a good fall, is sufficient to cause this. There is no better test of the condition of the drains than the amount of smell emitted from a ventilating opening, for, if drains be properly laid, and in thorough working order, practically no smell should exist. Examples were given. Faulty forms of traps and water closet apparatus were strongly condemned by the author, and diagrams descriptive of good and bad closets were exhibited.

The principle that there should never be any passage of air from the drains or waste pipes into the house was then considered, and the means of isolating the house drains from the public sewer, the necessity of keeping the drains outside the house, their ventilation, as well as that of the soil-pipes, the position of the water closets, the disconnection of the sanitary fittings inside the house from the drains, were referred to. It was insisted that the danger should be guarded against of trusting too much to those parts of the drainage of a house which are visible, as an index of the condition of other and important parts which are concealed; and an instance was mentioned of a house the drainage of which had been recently reconstructed, and where all the sanitary arrangements appeared at first sight to be perfect, but where a subsequent examination of the drains which were under the house showed that the joints were in many places defective, and at one point the pipes were not jointed at all, but a space left large enough to put a hand in, though it was stated that special care had been taken to make the drains water-tight. Old drains, which had no outlet connected with gullies, were found beneath the passages and rooms; the housemaid nearly died of typhoid fever, and beneath the room she occupied was found an old drain, with a large amount of foul deposit. A long list of other defects was described, leading to the conclusion that the drainage, instead of being very good, was really so radically defective throughout, that it was necessary to reconstruct the whole of it.

Another instance was given in which a lady and her cook were attacked with erysipelas and blood poisoning shortly after occupying a house. Various alterations were made in the drainage in the absence of the family, but, on their return, the lady was again attacked with erysipelas, and shortly after other members of the household. Again alterations were made, and again the lady was attacked with erysipelas, and the housemaid with typhoid fever. An examination of the house by the author showed that an old stoneware drain in the scullery, into which the sink formerly discharged before it was disconnected, had not been removed, and though stopped with cement, the stopping was imperfect, thus allowing the air of the drain to enter the house. The author next considered the various ways in which foul air from faulty drainage inside the house passes to different parts, and pointed out the opportunities which were given for the passage of air from one part of a house to another, depending chiefly upon windows and fires, the latter, of course, mainly acting by drawing air through passages, staircases, and doors. But other channels must also be borne in mind, and an interesting account was given of the passage of foul air along bell wire tubes, the proximity of the bell pull to the fireplace giving an increased opportunity for air to be drawn from a distance to this part of a room. Channels for gas pipes and for hot water pipes also not uncommonly give facility for the admission of foul air. In connection with this part of the subject a remarkable instance was given of a particular bed in a school, the occupants of which were constantly the subjects of slight attacks of pneumonia with tendency to typhoid. In this case the foul air was conducted from a lavatory, where there was defective drainage, up a staircase, and, impinging on the ceiling of the dormitory, was reflected on the bed where the sickness occurred.

An interesting account is given of the cause of the Duchess of Connaught's recent illness. Defective drainage was found in the basement of the house, and after numerous experiments the means by which the foul air entered the Duchess' bedroom was discovered. These showed that it was only when occupying certain positions in the room that she would be exposed to the influence of the foul air, while in bed she would escape. As a matter of fact, in twenty-four hours after sitting on a sofa in one of these exposed positions, her Royal Highness' symptoms fully developed themselves. These two cases were illustrated by diagrams. The necessity of a thorough disconnection between the drains and the domestic water supply was then dwelt upon, and the mistakes most commonly made in this particular pointed out.

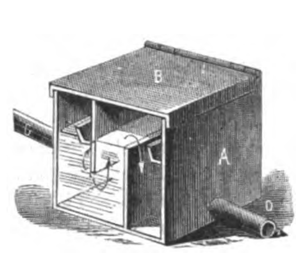
THE simple decoction of onion peel is said to produce upon glove-leather an orange-yellow superior in luster to any other. It is also said to be suitable for mixing with light bark shades, especially willow bark, and as a yellow for modulating browns. The onion dye is said to fix itself readily, even upon leathers which resist colors, and colors them well and even.

RECENT INVENTIONS.

Sewer Gas Trap.

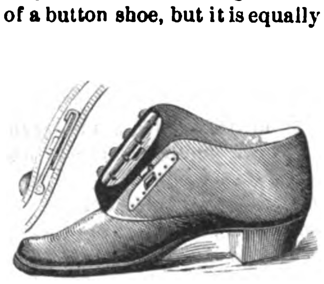
The object of this invention is to guard against sewer gas entering a building through the sewer pipe connections.

The trap is constructed with a separable cover provided with inlet and outlet pipes, divided into three compartments by upper and lower partitions, and provided with disinfectant vessels within the first and third compartments, whereby sewer gas passing through or generated in the trap will be prevented from entering the building. A is the body of the trap, provided with a cover, B, which is hung at one side to the body, so that it can be conveniently opened. With an opening in the middle or upper part of one side of the trap, A, is connected the inlet pipe, C, and with an opening in the lower part of the opposite side is connected the outlet pipe; the interior of the trap is divided into three nearly equal compartments by two partitions, one extending from the top of the trap about two thirds of the distance to its bottom, and the other extending from the bottom of the trap about two-thirds of the distance to its top. With this construction the first and second compartments of the trap will be always full to the level of the upper edge of the lower partition, and all the sewage that enters the trap must pass beneath the lower edge of the upper partition, and over the upper edge of the lower partition, into the third compartment of the trap, whence it flows out through the outlet pipe. Further information may be obtained by addressing Mr. Moses T. Williams, care Jesse West, 109 W. 11th St., New York City.



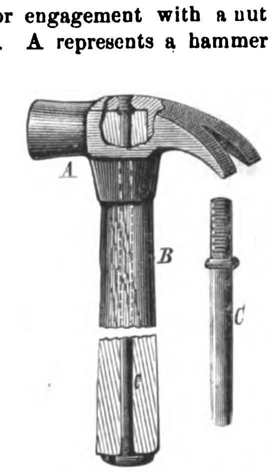
New Button Fastening.

This device is designed to be employed for fastening shoes of the kind for which buttons are employed, the object being to avoid the wear and tear of the buttons and holes and avoid much of the labor and loss of time required to fasten button shoes; and it is contrived for the application of buttons, also to give the appearance of button shoes when required, but may be used without the buttons, if desired. It is a neat, substantial, and easily operated fastening, which preserves all the appearance of a button shoe, but it is equally as effective without buttons, the latter being only ornaments. A plate of thin metal is attached to the side of the upper covered by the fly. The inner edge of this plate has a flange turned upward and over toward the outer edge, and near the middle of the plate there is a catch which is raised slightly above the surface for engagement with a plate on the button fly. This plate is attached to the button fly by a wire to which the buttons are fastened. When it is to be applied to low shoes having only three or four buttons, one set or pair of plates will be used; but for higher shoes two or more pairs of plates may be employed, because the shape of the ankle will not allow of the use of plates longer than about the range of four buttons. This invention has been patented by Mr. William Wiggins, 103 B Street, South Boston, Mass.



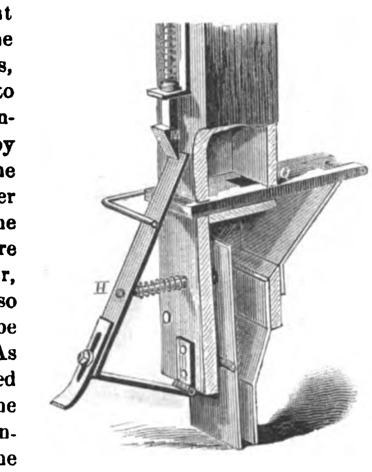
Improved Hammer.

The engraving shows a novel device for securing the handle to a hammer and for strengthening the handle. The invention consists essentially in a hammer having the outer end of its eye closed and provided with a threaded hole, a longitudinally bored wooden handle being inserted in the eye, and an iron rod passing through the handle and having one end threaded for engagement with the hole in the eye, and the other end threaded for engagement with a nut at the free end of the handle. A represents a hammer head having the outer end of the eye closed, and in the center of the closed portion there is a threaded hole. The handle, B, is of wood, and is bored centrally throughout its entire length, and has one end formed to exactly fit the eye of the hammer. C is an iron rod of the same diameter as the bore in the handle, and it has one end threaded to fit the hole in the eye, and the other end threaded for receiving the nut at the end of the handle. If desirable, the rod, C, may be welded to the hammer head. The advantages of this invention are that the handle is securely fastened to the hammer and prevented from coming off, without the necessity for driving wedges in the eye portion. The handle is made stronger by the rod running through it, so that the hammer can be used to pull nails without danger of breaking the handle. By removing the nut the handle can be taken off when desired; and by having the end of the rod smoothed and finished off even with the surface of the head, the hammer can be used in close places, such as in boxes, or in corners of a wall or ceiling, where it could not be used if the nut were outside of the hammer head. This invention has been patented by Mr. Thomas B. Bailey, of Columbus, Miss.



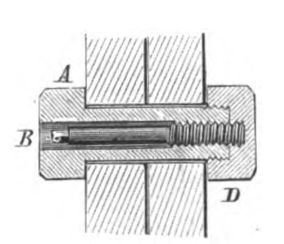
Hand Corn Planter.

This corn planter is constructed with a seed box having a seed dropping slide operated by a hinged bar, with which is also connected by a bolt and spring the hinged jaw for dropping the seed. The seed box is provided with a spring catch for holding the hinged bar, and which is operated to release the hinged bar by a cord connected with the pivoted handle of the planter. In using the planter the jaws, when closed together, are forced into the soil to the proper depth. As the foot comes in contact with the soil the upper end of the planter is forced forward, which forces the upper end of the bar, H, inward until it is caught and held by the catch, M. The inward movement of the upper end of the bar, H, opens the jaws, and allows the seed to drop out into the opening made in the soil by the opening of the jaws. As the planter is being raised from the ground, the jaws are held open by the bar, H, and catch, M, so that all the seed will be left in the ground. As the planter is raised from the ground the operator turns the handle, which raises the catch, M, releases the bar, H, draws the slide, Q, forward to again receive seed, and closes the jaws ready to be again thrust into the soil to plant another hill. Two hills can be planted at a time by connecting two planters together at the proper distance apart by one or more cross bars. This invention has been patented by Mr. Orlando T. Grattan, of Ivanhoe P. O., D. T.



Improved Nut Lock.

The bolt, A, is made with a central bore, B, through it longitudinally, which is internally screw-threaded partly or wholly throughout its length, the threads being pitched reversely to the threads, C, on which the socket of the nut is to screw for drawing up the bolt on the plates. The nut has another and smaller socket or bore, threaded to receive the end of a binding screw, which is screwed in from the head of the bolt by a wrench or screw driver, after nut is screwed on. For long bolts the socket in the nut is extended to form a bore entirely through the nut, and the bore of the bolt extends inward but a short distance, forming a socket into which, through the nut, the locking screw is inserted. It will be seen that any tendency of the nut or bolt to work loose will be resisted by the tightening of the binding screw, which will thus effectually keep the nut tight on the bolt. This invention has been patented by Mr. Charles E. Bell, of Greenfield, O.



Valuable Tin Discoveries in Alabama.

From a late number of the *Ashland Banner*, Clay County, Alabama, we learn of the discovery of large and valuable lodes of tin bearing rocks, at the Broad Arrow Mines, near that place. Within the last year Mr. G. W. Gesner, of this city, having secured proprietary rights to the above lands, has erected machinery for crushing, stamping, and washing the ores, and is now engaged in working them on an extensive scale.

The ore has hitherto been found chiefly as a finely disseminated oxide in gneiss, as in Germany and other localities, but indications strongly point to the existence of the compact oxide, cassiterite, somewhere in the lode. As the locality is readily accessible by railroad to Talladega, Alabama, and thence about twenty-five miles to Ashland, it is confidently expected that this discovery and enterprise will be the means of attracting attention to a section hitherto little known. The country is well wooded and watered, of a mountainous character, and eminently adapted for mining pursuits. It is worthy of mention that this is the first attempt in the United States to work tin ore on the spot where found.

The Deepest Coal Mine in America.

Pottsville, Penn., claims the deepest coal mine in America. The shaft is 1,576 feet in depth. The cars, holding four tons each, are run upon a platform, and the whole weight of six tons is lifted in a little more than a minute by machinery that works as smoothly as a hotel elevator. The output is 300 car loads a day.

Correspondence.

The Tides on the Bay of Fundy.

To the Editor of the Scientific American:

Referring to the article in your paper of December 9, 1882, headed "Blomidon": These high tides, and the still higher stories we often hear of them, having perplexed me from youth, I set out last summer to study their reputed phenomena, before venturing to take a party of my friends in the steam yacht. The following course was sailed over: From this city to Halifax, N. S., standing well out to sea; thence coastwise to Cape Sable and Yarmouth; across the inner mouth of the bay to Grand Manan Island; up the coast of New Brunswick to St. John and Truro, at the head of the bay; down the coast of Nova Scotia to Annapolis, which river and several others I ascended, thus circumnavigating the entire sheet of water, which is about 180 miles long by an average width of 40 miles. Soundings and deep sea and surface temperatures were taken during the cruise. A week was spent at Kingsfort, N. S., on the beautiful Basin of Minas, a few miles from Cape Blomidon and Cape Split.

These tides are, as you say, one of the wonders of the world. They are caused, as are also the dense fogs of this region and of the North Atlantic, by the cold Gulf Stream, pouring from the Arctic Ocean by Smith Sound, Baffin's Bay, and Davis Strait, along the coast of Labrador, and through the Strait of Belleisle, which discharges into the Gulf of St. Lawrence. These cold, heavy currents hug the coast line as they run.

On doubling the southeast corner of Nova Scotia, at Cape Sable, they strike for the first time the warm and lighter waters from the south, and drive the latter before them toward the point of least resistance, which is up the Bay of Fundy. At its mouth, opposite Cape Sable, the tide rises 6 feet; opposite Digby, 28 feet; at St. John, 38 feet; off Windsor, 45 feet, and when ebb, a bucket could not be filled with water in the harbor; at Truro, 60 feet, and at ebb the red clay bottom is exposed for a distance of 25 miles. These measurements refer to spring tides, which are highest. But the belief which so generally prevails, that the tide assumes, as it rushes onward with loud roar and great velocity, a high, almost vertical wave, or "bore," as it is termed, which even draws into its vortex such animals as may stray near the beach, is wholly erroneous. *There is no bore or tidal wave on the Bay of Fundy.* Navigation there is neither dangerous nor difficult, unless it be from fog or ice. In the absence of storms, the tides, ebb and flood, are accompanied by scarcely a ripple. Even at Cape Split, where the bay suddenly contracts to a width of about 3½ miles, the "wave" *will not measure one inch in height* What can have been the origin of this fable, which has not only obtained general credence among many, but is even accepted by men of science without question, and is yet chimerical as a madman's dream? Probably the very trifling bore which does really exist on two small tributaries of the bay, the Petitcodiac and Shubenacadie. The bore on the former river I measured at Moncton, N. B., 89 miles E.N.E. of St. John, and found it just 3½ feet high, with a travel up-stream of 6 miles per hour. It is caused by the last of the ebb tides being met and repelled by the flood tide in a narrow stream confined by almost vertical banks.

I cannot close this hastily written sketch without adding that the British people of the lower provinces are reasonably courteous, and quite as honest and honorable as any among whom I have ever traveled.

P. J. McCOURT, M.D.

New York, Dec. 9, 1882.

Aztec Remains in La Plata County, Colorado.

At the Denver Exposition there were exhibited some Aztec remains from Farmington, La Plata County, Colo., of intense interest to the student. They were found in the ruins of a building several stories high, which had been erected in the form of a terraced pyramid, near the mouth of the Animas River.

Nearly all the bones of the human body were discovered in a good state of preservation. Among them were three skulls, two of men and one of a woman. The latter was also young, as the distinctness of the suture joints testifies; one of the male skulls was of a middle aged person, and the other evidently of an old man, as the several parts had grown almost solid. All were very thick, showing characteristics of the semi-barbaric races. The teeth remaining were mostly sound, though one showed marks of an ulceration, and there were several empty sockets.

Besides, there were some fine specimens of Aztec pottery of perfect color, parchment, stone implements, etc., from the same vicinity. This section of Colorado has been as yet little explored, but enough has been found to demonstrate that it is a region of great value to archæology.—*F. E. S., in Kansas City Review.*

Height of Ocean Waves.

It is stated that in the North Atlantic record waves have been observed of 24 and 30 feet high, highest being 43, mean 18, in westerly gales. In the Pacific, 32 feet is recorded; South Atlantic, 22; Cape Horn, 32; Mediterranean, 14½; German Ocean, 13½; and French sailors mention 36 feet in the Bay of Biscay.

ALLEN'S APPARATUS FOR FEEDING BLAST AND OTHER FURNACES.

This invention is an improvement in the feeding apparatus of a blast, cupola, or other like furnace of the class employing a cup and cone or a bell and hopper.

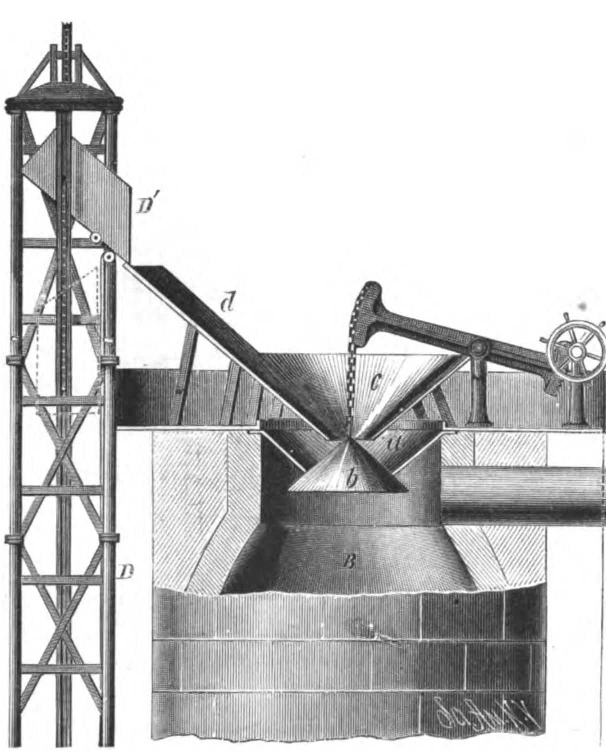
The design of the invention is to enable the ordinary feeding or charging operations to be performed from the ground. To accomplish this there is arranged immediately over the bell or cone, *b*, an open bottomed hopper, *c*, and so arranged with reference to the bell or cone that charges of material for the blast furnace, on being dumped or discharged into the hopper, *c*, will be delivered through its open bottom on to the bell or cone at or near its apex, and consequently will pass down the sides of the bell or cone uniformly all around, and so will be distributed with practical uniformity around the annular receptacle formed at the junction of the bell and lower hopper, *a*. Then, when the bell is lowered to discharge such material into the furnace, B, such charge will be supplied to the burden below uniformly all around, or practically so. Then, by the addition of a chute, *d*, from the elevator, D, to the auxiliary hopper, and of a self-tilting or dumping car, D', so that the car containing the material shall be automatically emptied into the chute, the entire work of feeding is done without the necessary presence of workmen at the top or mouth of the furnace to do or superintend the feeding.

The material may be dumped in from barrows by hand in the usual way; but the inventor prefers to so organize the apparatus that the work of feeding may be done from the ground, and without the necessary presence of workmen for such purpose at the top or mouth of the furnace.

The engraving shows an elevator, D, which may be of any suitable construction, adapted to be operated from the ground, and to raise and lower the car, D', loaded with the material to be charged or fed into the furnace. A suitable tilting mechanism is added, so that when it reaches the proper height it will be tilted, and its contents will be dumped into the chute, *d*, which discharges into the hopper, *c*. As soon as the car is thus emptied it may be lowered in the usual way and at the proper intervals. The bell, *b*, is also lowered from below by the use of a windlass and rope.

In the engraving the windlass, rope, etc., are on the side of the furnace opposite the elevator, but for ease and facility of operation, the bell lowering and raising appliances should be arranged over and down the side of the furnace near the elevator.

This invention has been patented by Mr. William H. Allen, of Pittsburg, Pa. (P. O. Box 943.)



ALLEN'S APPARATUS FOR FEEDING BLAST AND OTHER FURNACES.

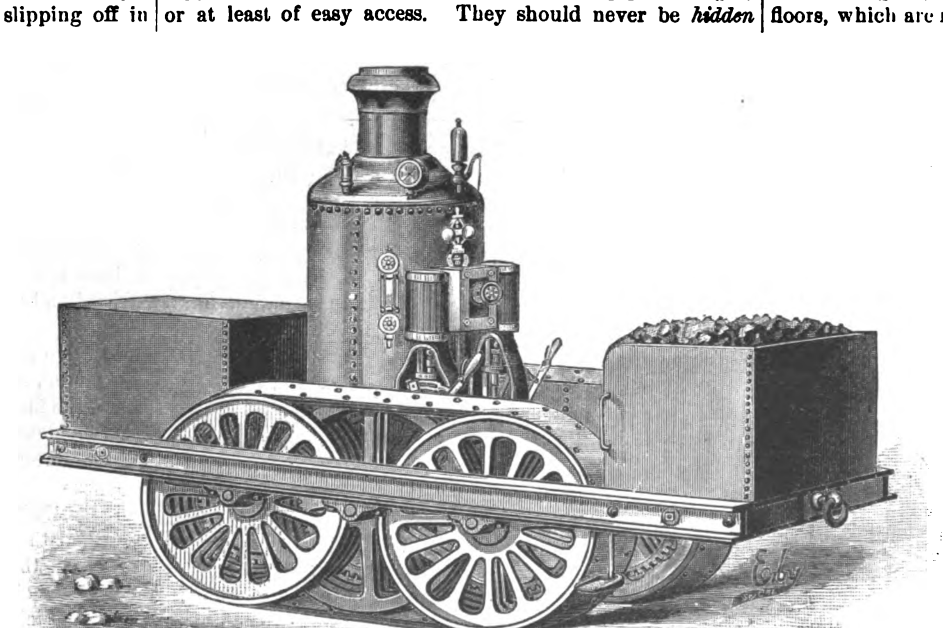
NEW TRACTION ENGINE.

This new engine is made for plowing, thrashing, road, mining, and yard transportation. The frame is constructed of four parallel I steel sills with cross beams at ends, and diagonal braces throughout, except at base of boiler, giving stiffness to frame, and supporting at ends the coal tender and water tank, thereby giving equal distribution of weight and balance on the tracks. The parallel sills are 24 inches apart from centers, to which are attached on the under side of sills, by adjustable boxes, three axles on each side. On these axles are firmly keyed three driving wheels of 2 and 3 inch faces, with a space of 2½ inches apart on axles. On the front and rear axles are four wheels; the first and fourth, or outer wheels, are 3-inch face, and are flanged with flanges on outside of wheels to prevent track from slipping off in turning. The center axles have three wheels of 2-inch face. The gangs of wheels intermesh or overlap each other; the tires of center gangs work close to the hubs of the front and rear gangs. Revolving over with these gangs of wheels are two tracks of rubber or other suitable elastic material composed of an outer and inner layer, between which are transverse metallic plates, secured through layers and plates by rivets or bolts, to retain tracks in shape transversely. The front and rear gangs of wheels are driven forward or backward, or one forward and the other backward in turning, by spur gears secured to inside of wheels; front and rear gangs are connected by idle gears on center axles. The center gangs are driven in the same direction by spur gears on axles, of the same diameter as those on front and rear gangs. Motion is given by long pinion to these gears from reversing yacht engine, one on each side of upright boiler for each track. The width of each track is 18 inches; thickness of rubber tracks, 4½ inches; height of wheels, 4½ feet; length of each track in contact with the earth, 60 inches; hence 60 × 18 × 2 = 2,160 inches of effective earth contact or traction, over which is distributed the 6 tons of weight of engine and track. A horse of 1,000 pounds weight has 48 inches of effective earth contact while pulling; hence 10 horses have 48[illegible] inches of traction.

The engines now on the market with two drive wheels of [illegible] 10-inch tires, have 48 to 72 inches only of effective earth contact, consequently are useless for plowing, or hauling their own weight over spongy ground.

This engine's tracks have no suction or adherence when the tracks leave the ground, therefore no loss of power by carrying its tracks forward. The tracks cannot be broken by passing over an obstruction, as the rubber will give to wheels until the wheel rotates over, and then instantly return to place.

The adherence of the tracks to the periphery of the one-half of the front and rear gangs and the bottom and top of center gangs of wheels, insures no slipping of wheels on the tracks when worked to its fullest capacity on steep inclines. Patented in the United States, August 29, and in Canada, August 31, 1882, by Jacob Nixon, of Winfield, Kansas, who can be addressed for further information.



NIXON'S TRACTION ENGINE.

House Plumbing and Drainage.

This subject is well worn, but so important to the well-being of every household that we believe it is doing the greatest good to the largest number of our readers by calling their attention frequently to it.

The last annual report of the Massachusetts State Board of Health, Lunacy, and Charity contains some excellent suggestions in regard to this subject of house drainage. They are the result of much study and research, and until something better is proposed much good will result if they are followed by builders throughout the country :

1. All drain pipes inside the house should be of metal, and all joints of well-calked lead or solder. Metal is recommended in preference to stone-ware, owing to the difficulty in keeping tight the joints of the latter. All connections between lead and iron should be by a calked brass nipple and solder. It is best to keep drain-pipes in sight, or at least of easy access. They should never be *hidden* under the ground. If needed below the basement or cellar floor, they should be placed in a trench lined with brick walls, with movable covers on the trench. It is a good plan to paint the pipes white, so that any slight leakage of gas may be seen readily ; for such gas generally discolors the paint.

2. Changes of direction in iron pipes should be made mostly by Y branches, leaving an open hub, to be closed by a brass nipple calked in with a movable brass clearing screw as large as the drain, to be removed for inspection and cleaning. In straight reaches of fifty feet or more in length, these Y branches and clearing holes should be introduced at intervals of not over forty feet.

3 No T branches should be allowed, except in vertical pipes.

4. All pipes should be put together by a series of straight lines, and with a general direction as straight as possible.

5. All pipes should have a fall of not less than two per cent of their length, where no special apparatus is provided for flushing. All drains should be kept free from deposit ; and, if this cannot be effected without flushing, special apparatus should be applied for this purpose.

6. A trap should be placed on the main drain outside the house walls, made of glazed earthenware, with a vent hole as large as the pipe directly above the trap, communicating with the open air. This should be made accessible for cleaning out, and a rain-spout had best be discharged into it or into the drain at some point above it. This trap should be near the house, and can be alongside the grease tank, if convenient.

7. Every separate stack of soil or waste pipe within the house should extend out through the roof, at least four inches in diameter ; smaller pipes than this are liable to be choked with ice from condensation of steam in winter.

8. Separate traps should be placed under all receptacles of drainage, as close to them as possible, and no other traps allowed to intervene between these and the outside or main trap described above (6). Each one of these separate traps should have an air pipe of iron or lead connected just below the water seal, as large as the waste pipe, and either connecting at its upper end with the soil-pipe above all other branches, or passing through the roof independently, as found most convenient. Several traps can be served by the same vertical line of vent pipe.

9. No drain pipe from any safe pan under any tub, sink, bowl, or water closet should be connected below to the drain system, but should discharge over an open sink or cellar floor.

10. No waste pipe from an ice chest or refrigerator should be connected with the drains.

11. Rain water leaders should not be used as soil or drain pipes, nor should they be depended on to ventilate drains. If connected with the drains at all, care should be taken to so connect them below the water of some trap otherwise supplied with water, unless their upper ends are remote from windows.

12. A tank or small cistern should be provided in the upper part of the house, from which the kitchen boiler should be supplied, together with the bowls and sinks; also any water closets that happen to be close by. The drinking water should not be drawn from this tank, but from a separate tap on the supply pipe direct from the street main. The overflow of this tank should not be connected with any drain, but discharge as directed for safe drains above (9). It is common in mild climates to discharge such pipes through the house wall into the open air; but this plan would be worthless in frosty climates.

13. All water closets should be supplied by a small tank directly above them, and not by valves attached to the closets themselves, nor by pipes branched from those from which drinking water is drawn.

14. Concentrate the fixtures used for drainage—such as water closets, bowls, sinks, tubs, etc.—as nearly as possible in vertical groups, to avoid waste pipes passing across under floors, which are rarely satisfactory.

15. Never locate a fixture, especially a water closet, in a dark corner where a good ventilation cannot be had. If outer air cannot be got, seek to draw off the foul air from the closet by a pipe leading up through the kitchen fire flue to the chimney top, built into the chimney for the purpose, at least four inches in diameter. Small pipes branched into the fire flues for this purpose soon get choked with soot at their mouths, and become worthless, unless extending quite to the top of the chimney.

Underground Wires.

The laying down of the telegraphic wire which is to put Marseilles in direct communication with the capital, is being rapidly pushed forward. The distance is 536 miles. Two hundred and fifty workmen are at present employed on the right bank of the Rhone, following the high-roads as far as possible. The cable is inclosed in a cast-iron pipe, laid at a depth of 5 feet 6 inches under ground, the joints of the pipes being covered with india-rubber washers and leaden rings. About every 550 yards the cable passes through a covered chamber of cast-iron, fitted with a manhole, by means of which it can be inspected. About every 110 yards the pipes are connected by cast-iron boxes, which also enable the wires to be inspected and repaired. The expense of the whole work is estimated at forty million francs, or £1,600,000. When this line shall be completed it is intended to connect it with the Transatlantic and Mediterranean cables.

Telephonic Experiments.

As a result of numerous experiments on induction in telephonic circuits, Prof. Cross, says the *Tech*, has found that the induction operating to produce telephonic disturbances is almost entirely electro-dynamic.

The effect of thin sheets of tin foil surrounding an insulated conducting wire is very slight. The diminution of inductive effect produced when a plate of metal or a spare wire is placed between the wires carrying the inducing and induced currents was found to be much greater than with the foil, and also greater with the overtones of the sounds transmitted than with the fundamental. That electrostatic induction is almost ineffective, so far as producing sounds in the receiving telephone is concerned, is shown by the fact that if a small secondary coil with a large and deep primary is held at right angles to its plane, the sound disappears; also, if the metal plate between the coils is slit radially, its effect in diminishing induction disappears.

If intermittent or variable currents are passed through a coil of wire forming a closed circuit, within which a second closed parallel coil is placed, the secondary current induced in the latter can be investigated to a certain extent by inserting a receiving telephone in the secondary circuit. If a closed wire coil is placed near to the other coils, there is a current induced in it, which, as Henry first showed, diminishes the strength of the current in the secondary coil. A heavy sheet of metal, as of brass, placed between the primary and secondary coils, also diminishes the current in the secondary for the same reason. Hence, in both of these cases, the sound produced in the telephone by induction is considerably reduced. The effect of brass, copper, and iron is very marked. Lead, also, contrary to an opinion that has been advanced, exerts a very decided effect. Thin foil, even if it completely envelops the secondary, produces but slight effect. The application of these important results to telephonic cables is obvious.

If, instead of being placed in a simple secondary coil, the telephone is placed in a double circuit of twisted wires, so arranged that the current induced in these will be in opposite directions, complete neutralization of currents is produced, and consequently cessation of sound.

Various other experiments have been performed to test the value of different "anti-induction" devices.

Prof. Cross has also found that a Hughes microphone and a Blake transmitter were capable of transmitting the sound of a high pitch bar giving 12,000 double vibrations per second, thus showing the excessive sensitiveness of the ordinary band receiving telephone. If the capacity of the line were increased, it was found that its ability to transmit high vibrations was diminished. These experiments also showed that change in quality in the sounds transmitted is not due, as has been stated, to an inability of the microphone or any part of this circuit to respond rapidly enough to their higher overtones.

Preservation of Railway Ties.

Some interesting data are published showing the relative value of different methods of injecting railroad ties. On the route from Hanover and Cologne to Minden, for example, the pine ties injected with chloride of zinc required a renewal of twenty-one per cent, after a lapse of twenty-one years; beech ties injected with creosote required a renewal of forty-six per cent after twenty-two years' wear; oak ties injected with chloride of zinc required renewal to the extent of about twenty-one per cent after seventeen years; while the same kind of ties not injected necessitated fully forty-nine per cent of renewals. The conditions in all these cases were very favorable for reliable tests, and the road bed was good, permitting of easy desiccation; the unrenewed ties showed, on cutting, that they were in condition of perfect health. On another road, where the oak ties were not injected, as large a proportion as 74·48 per cent had to be renewed after twelve years; the same description of ties injected with chloride of zinc required only 3·29 per cent renewals after seven years, while similar ties injected with creosote involved, after six years, but 0·09 per cent.

THE stock of ivory in London is estimated at about forty tons in dealers' private warehouses, whereas formerly they usually held about one hundred tons. One-fourth of all imported into England goes to the Sheffield cutlers. No really satisfactory substitute for ivory has been found, and millions await the discoverer of one. The existing substitutes won't take the needed polish.

DUCK WITH THREE LEGS.

We give below a sketch of an ornithological curiosity, in the shape of a three-legged duck, kindly sent for our inspection by Mr. George Ely, Hill-road, Wimbleton. The following particulars may be interesting to some of our readers. The bird was of no particular breed, being of the nondescript species common to farm yards. That the redundant crural appendage did not interfere with the duck's bodily welfare was evident, for its condition was excellent, and it weighed nearly five pounds. The third leg was connected to the body about two inches behind the two ordinary legs merely by skin and flesh, without the intervention of the bone called the *tibia* (more commonly the "drumstick"), and, consequently, was of no practical use to the bird, but merely trailed behind it as it walked.—*Land and Water.*

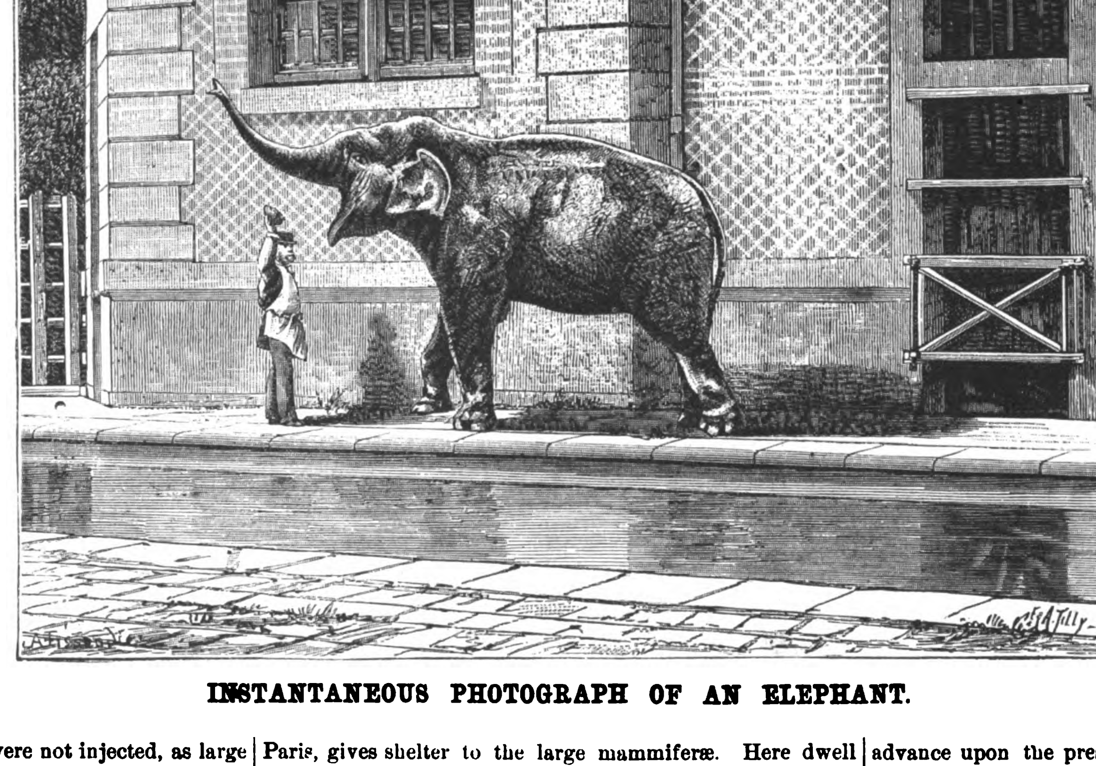
DUCK WITH THREE LEGS.

Leaf Copying.

Take a piece of thin muslin, and wrap it tightly round a ball of cotton-wool as big as an orange. This forms a *dabber*, and should have something to hold it by. Then squeeze on to the corner of a half-sheet of foolscap a little color from a tube of oil paint. Take up a very little color on the dabber, and work it about on the center of the paper for some time, till the dabber is evenly covered with a thin coating. A little oil can be used to dilute or moisten the color if necessary. Then put your leaf down on the paper and dab some color evenly *over both sides*. Place it then between the pages of a folded sheet of paper (unglazed is best), and rub the paper above it well all over with the finger. Open the sheet, remove the leaf, and you will have an impression of *each side* of the leaf. Any color may be used. Burnt or raw sienna works the most satisfactorily.—*Knowledge.*

THE ELEPHANT BY INSTANTANEOUS PHOTOGRAPHY.

The great rotunda of the Museum of Natural History, of Paris, gives shelter to the large mammiferæ. Here dwell especially the giraffes, camels, elephants, etc. We give herewith, from *La Nature*, a copy of an instantaneous photograph taken in this part of the Jardin. The elephant shown was taken just as he was in the act of opening his mouth to receive a piece of bread that his keeper was about to throw to him. Here is seen faithfully represented the reservoir for water that runs around the rotunda, and the external wall of the latter. We may recall the fact that six very similar parks that radiate from the rotunda permit of the large mammiferæ taking the air when the temperature is favorable. With each of these parks there is connected a stable, in which the animals are housed, cared for, and kept warm during winter.



INSTANTANEOUS PHOTOGRAPH OF AN ELEPHANT.

The Exhaust Injector.

On November 11, the members of the Manchester Association of Employers, Foremen, and Draughtsmen had an opportunity of inspecting, on the premises of Messrs. George Fraser, Son & Co., a feed water injector, which is actuated solely by the exhaust steam from the engine. The injector is the invention of Messrs. Davis, Hamer, and Metcalf, and the perfectly successful operation of the apparatus by steam drawn from the ordinary exhaust pipe was a matter of considerable surprise to many of the visitors. Afterward a paper descriptive of the injector was read before the members, at their ordinary meeting held in the Mechanics' Institute, by Mr. A. S. Savill, who, before explaining the invention, said it seemed to have been the opinion of engineers that it would not be possible to work an injector with steam at atmospheric pressure; that an injector must have a pressure of steam to work at; and that with the exhaust injector, this pressure must be got up in the exhaust pipe, which of course would act as a back pressure on the piston of the engine, under which conditions there would not be much, if any, economy in the adoption of an exhaust injector. This reasoning had, however, been proved entirely wrong, and the injector he had brought before them did not in any way put on back pressure, but, on the contrary, reduced or altogether removed it. The injector was simply fixed in a vertical position to a branch from the main exhaust pipe, and to start the injector all that was necessary was to turn on the steam and water. With regard to the apparatus itself, the most important point was its automatic action. As soon as the first puff of steam from the cylinders had cleared out the air from the exhaust pipe, the injector commenced to work, and kept on until the engine ceased to give out steam, restarting again as the engine restarted, without any manipulation being required. In the construction of the injector there were, as in the ordinary types, three nozzles—the steam nozzle, the combining or mixing nozzle, and the delivery nozzle. The steam nozzle was similar to the one in the Giffard injector, but of a very large bore, and inside was fixed a small spindle to concentrate the steam. The chief feature, however, was the combining nozzle, which was constructed to start the injector automatically. The nozzle was split from its smallest bore for rather more than half its length, one-half being solid with the nozzle itself, and the other half arranged to work freely on a hinge, by which it was enabled to enlarge or contract its area. The delivery nozzle was very similar to that of a Giffard injector. When not working, the hinged flap in the injector was open, and a large area was presented for the egress of steam and water. When steam and water were turned on, some condensation took place, which instantly formed a partial vacuum, into which more steam and water were drawn until such a vacuum was formed that steam was attracted with a velocity so great as to impart to the water sufficient speed to enter the boiler, the flap being at the same moment sucked down, and forming to all intents and purposes a solid nozzle. Results from actual experience had shown that by one of these injectors, the feed water entering at 66° Fahr., and a minimum delivery of 960 gallons per hour, the temperature had been raised to 190° Fahr. The injector was capable of feeding against 70 pounds to 75 pounds pressure, but when the pressure was above this an arrangement was attached for supplementing "live" steam from the boiler, which in addition further increased the temperature of the feed water. In the discussion which followed, the injector met with general commendation, the results which had been seen in actual working being admitted as surprising; and Mr. Gresham, who has long been connected with the manufacture of injectors, said he considered the exhaust injector as great an advance upon the present methods as the introduction of the Giffard was upon the methods then in vogue. He thought, however, that automaticity might be carried too far, and that the exhaust injector would scarcely be suitable for locomotives, as it only delivered its feed when the engine was working. Mr. Savill in reply, however, stated that, by connecting the injector with the boiler steam, it could be worked when the engine was standing, and that, although it did not seem a very nice arrangement for locomotives, it had been worked successfully on a locomotive both when it was running and when it was standing.

IT is estimated that there passed through the booms of the St. John River, N. B., this season about 126,000,000 ft. of logs.

ENGINEERING INVENTIONS.

Mr. Albert J. Seaman, of Stanford, Ky., has patented an improvement in what is known as "petticoat" pipes for locomotive engines; the object of the invention being a construction by which a larger exhaust nozzle can be used, so that a larger quantity of steam may be generated with a less amount of fuel than usual.

An improved dumping car has been patented by Mr. John E. Bemis, of Waupun, Wis. The platform of this car is made in two parts, divided lengthwise along the middle, the parts being hinged near about their middle longitudinally to the car frame, so as to be tilted on the hinges for dumping to the sides of the car. The inner edges of the divided platform have sides to prevent the load from falling between them when raised up and the joint where they meet together opened; and between the sides and the outer edges over which the earth is dumped they have a rod or bar extending from end to end, so that the earth will be piled up around it when loaded on, and the rod will act as a retarder to the earth when discharging and prevent it from sliding off rapidly and projecting so far away from the track as it otherwise does.

MECHANICAL INVENTIONS.

Mr. Alfredo Cottrau, of Naples, Italy, has patented an improved car wheel consisting in two concentric tires fitting over the treads, and connected at the adjoining edges by a flat ring which is placed edgewise in relation to the tires.

Mr. Allen Ditson, of Larned, Kan., has patented an improved mechanism for converting reciprocating rectilinear into continuous rotary motion, so as to avoid dead centers. The invention is especially adapted to windmills, but may be used wherever available.

Mr. Christian W. Hergenroeder, of Baltimore, Md., has patented a device for turning the leaves of sheet music which consists of a stand for holding the sheets or book, and a train of gearing connected to a pedal, by which suitable mechanism for turning the leaves is operated.

An improvement in hat pouncing machines has been patented by Mr. Theodore Hadden, of Matteawan, N. Y. This invention consists of a tension attachment whereby the action of the pouncing roller upon the felt may be easily controlled and the danger of injury to the hands of the operator from contact with the wheel is obviated.

Mr. Augustus F. Woodham, of Minneapolis, Minn., has patented a velocipede for traveling on ice and other smooth surfaces. It has a suspended driving wheel for operation by the feet of the rider, front sled runners having an attached hand steering device, and a rear spiral propeller actuated by attachments on the driving wheel arranged to engage with a screw on the shaft of the propeller, the latter and the runners forming the bearing supports for the vehicle on the surface it is designed to travel over.

A combination tool patented by Mr. Elijah A. Parks, of South Bend, Ark., consists of a metal plate or strip having one end beveled to form a screw driver, having notches in one edge for bending saw teeth or breaking glass, having the upper end of this edge beveled and provided with gauge studs or projections to be used as a gauge for the inclination of saw teeth, having a glass cutting roller journaled in one edge, and having a recess in one end, which forms a sharpened and pointed prong to be used as a can opener.

Mr. Daniel M. Reed, of Ancona, Ill., has patented an improved windmill, in which the wheel is of ordinary construction, except that the sails are made of sheet metal instead of wood, as heretofore. These sails are placed edgewise in diagonal slots cut in the edges of the inner and outer rims of the wheel in the ordinary manner, and are secured therein by the nails, which pass through the sails and diagonally into the rims. This mill is provided with improved means of regulation, so that it maintains a uniform velocity under varying pressures of wind.

Messrs. Samuel Collinge and Aaron Serfass, of Easton, Pa., have patented an improved brick machine especially adapted for short grained clay and shale, and is adapted to work it in a damp or moist state, as it is usually found when newly dug up, the machine being adapted to exert such a pressure that the clay will be formed into a truly shaped brick at one operation. The plungers being kept hot by the steam entering them prevents the clay from clogging the machine or from adhering to the plungers, so as to break or injure the form of the brick.

Mr. William C. Knox, of Groesbeck, Tex., has patented an animal power made with a small wheel placed loosely upon a stationary upright shaft, and connected by hinges with the inner ends of arms and sweeps attached to the main wheel, which is mounted upon caster wheels to support the weight of the wheel and its attachments. With the main wheel is connected by an interposed frame a large gear wheel, into the teeth of which, upon the opposite side of its axis, mesh the teeth of two small gear wheels, each gear wheel being provided with a driving pulley, whereby two separate machines can be driven by the same power and at the same time.

AGRICULTURAL INVENTIONS.

Mr. Thomas P. Hopper, of Sherman, Tex., has patented an improved cotton seed planter, by which accuracy and uniformity in the planting of cotton seed is insured, and depositing of the seed in moist soil is made practicable.

An improved Paris green and fertilizer distributer has been patented by Mr. Benjamin F. Muschert, of Morrisville, Pa. This is a simple and ingenious arrangement for distributing a greater or less quantity of Paris green or other material upon or around plants.

A corn planting machine invented by Mr. Zebulon W. Burt, deceased, has been patented by Lydia Ann Burt, of Rome, O., administratrix of said Burt. This invention relates to improvements in that class of corn planters and fertilizer distributers in which the corn and fertilizer are planted in hills instead of drills.

Mr. James B. B. Evans, of Junction City, Mo., has patented a band cutter and feeder for thrashing machines. The object being to feed to the cylinder of a thrashing machine the sheaves of grain to be thrashed, and at the same time to cut the bands of the sheaves and spread them out evenly and regularly before they are introduced into the thrasher.

An improved cotton chopper has been patented by Mr. Greene W. Dugger, of Greensborough, Ala. This invention consists of an improved chopping and hoeing or cultivating machine, in which it is sought to provide simple and efficient means for regulating and adjusting the chopper and hoes or plows, both for working together or separately, also to provide for the protection of the same from injury by obstructions.

Mr. Charles William Wilfert, of Jeffersonville, N. Y., has patented an improved hand planter made with a box having its lower end beveled upon the opposite sides, and provided with a handle and guidekeepers. At the lower ends of the sides of the box are hinged two plates, connected at their upper ends by hinged bars with a slide placed at the forward side of the box. The upper ends of the hinged plates are held apart, holding their lower ends together by springs attached to the box.

Mr. Geo. C. Mueller, of Shasta, Cal., has patented an improved corn crusher. The invention consists in a casing containing a cylinder on which saw blades are secured, between which cylinder and a curved frame, also provided with saw blades, the ears of corn pass and are cut to pieces, and these pieces are then guided by suitable guide plates to a cylinder provided with studs on its surface, between which cylinder and a curved frame, also provided with studs, the pieces of the ears of corn are crushed to meal which is to be used for fodder.

Mr. Judson B. Hurd, of Sour Lake, Texas, has patented an improved revolving plow, for cutting up, breaking, and turning over the soil or turf, in which the cutter blades are freed automatically from the soil, turf, etc., adhering thereto. The invention consists in a cylinder to which radial blades are attached, between which movable scraper blades are held and pressed against the radial blades, which scraper blades are moved to and from the edges of the radial blades by pivots attached to the arms of the scraper blades, and passing into grooves in the end plates, on which the cylinder revolves, whereby when the revolving plow is moved over the ground the radial blades cut into the ground, and the scraper blades are moved to the outer edges of the radial blades when the same are raised, and scrape off the soil, grass, etc., adhering thereto, which scraper blades are cleaned by scraper plates attached to the frame of the plow.

MISCELLANEOUS INVENTIONS.

An improved book rest for writing desks and tables has been patented by Mr. Reuben W. Terrill, of Denton, Texas. The object of this invention is to support record books upon desks or tables in such positions that they can be conveniently used.

A novel device for moving pianos has been patented by Mr. Robert L. Thompson, of Boulder, Col. This invention consists of a frame or cradle to be applied to a pianoforte, so that it can be moved with great facility and without danger of marring or injuring it.

Mr. Mineheart Brunell, of Allegany, N. Y., has patented an improved device for equalizing the draught of a team of horses, so that when one animal pulls in advance of the other, the animal that draws less will have a greater leverage than the other animal.

A novel roundabout has been patented by Mr. Cornelious R. Silabon, of Hull, County of York, England. This is a ship roundabout provided with means whereby the ships are given a rocking or undulatory movement, in imitation of the motion of a ship at sea.

An improved suspender end patented by Mr. Bernard Petchaft, of New York city, is formed of two strands parallel to each other until near their lower ends, and then crossed before reaching and at the ends, the two crossings being fastened by rigid clamping devices, forming a button hole.

An improved wire stretcher patented by Mr. Robert Milby, of Morales, Texas, consists of two obtuse angled bars, connected at one end by a detachable rod, provided with the straining devices at the other end, and having the vertices of the angles connected by a rod.

An improved scoop has been patented by Mr. Mark J. Liddell, of East Saginaw, Mich. This invention consists in a scoop body of metal secured to a head by means of a bead turned on the end of the scoop and fitting over a bead on the head. The handle is secured in the head by a wedge.

Mr. David W. Smith, of Port Townsend, Washington Ter., has patented an improved buckle for harness and other straps, designed as a buckle to which one or more straps can be secured, and by means of which a strap can be attached to a bit, ring, or other place without being stitched or riveted.

Mr. James B. Bray, of Waverly, N. Y., has patented an improved machine for perforating paper in lines as is customary in postage stamps, bank checks, etc. It consist of a perforating wheel mounted in the end of a sliding rod, and capable of being moved in a right line over the paper by means of a suitable handle.

An improved fire extinguisher has been patented by Mr. Daniel Parham, of Tyngsborough, Mass. This invention consists in a certain arrangement of devices, whereby the severing of a cord or cords by fire operates to sound an alarm and to turn on water for extinguishing the fire.

Mr. Harley A. Barnhart, of Hallsville, O., has patented an improved table. The object of this invention is to construct an extension table by the combination of two separate tables in such manner that the two tables can be used separately or combined together, as may be desired.

Messrs. John B. Davis and William Walker, of Glenwood, Pa., have patented an air blast or injecting apparatus for use with blacksmiths' forges and furnaces for the supply of air thereto, by means of a steam jet, whereby the air is applied in a moist condition, or in the presence of moisture, to facilitate combustion.

Mr. Paul E. Wirt, of Bloomsburg, Pa., has patented an improved fountain pen. This invention relates to that class of writing instruments in which a nib pen is employed in connection with a reservoir or fountain; and it consists mainly in a duct and valve formed upon the nib of the pen for controlling the flow of ink at the pen.

Mr. Hiram Kenton, of Albany, Or., has patented an improved magnetic gold separator, for separating fine gold and other metals from magnetic sand and other gold bearing sands and gravel in hydraulic mining, and also for the working of the tailings from quartz mills for saving the gold carried off in the sluiceways.

Mr. Harry T. Johnson, of Scio, N. Y., has patented an improved mechanical telephone, having a novel arrangement of the wires traversing the diaphragm for improving its vibratory action. It also consists in the peculiar construction and arrangement of a double diaphragm arrangement calculated to improve the efficiency of the sound producing qualities of the telephone.

Mr. Henry C. Fox, of Evansville, Ind., has patented an improvement in reversible sad-irons, in which the iron is made hollow and is provided with heating devices within, and has several faces, either one of which may be brought into use by shifting the position of the handle, which is adjusted in relation to the iron by means of a spring catch.

Mr. Alexander Morison, of Alpena, Mich., has patented a railroad freight car that can be easily changed so as to adapt it for carrying ordinary freight or for carrying stock, or both, as circumstances may require, and one having such construction that the stock may be easily fed and watered without taking them out of the car.

Mr. William W. Goodwin, of Philadelphia, Pa., has patented an improvement in gas cooking stoves or ranges. The object of the improvement is to construct gas cooking stoves and ranges in such a manner as to give th greatest facility and convenience for cooking operations, and at the same time insure the escape of the waste products of combustion to the chimney or escape flue.

Mr. William W. Goodwin, of Philadelphia, Pa., has patented an improved burner for gas stoves. This invention relates to gas burners of the Bunsen type, adapted for burning a mixture of gas and atmospheric air, the object being to facilitate the cleaning of the burners, which are apt to become clogged. This burner may be applied to gas cooking stoves and ranges of any construction, as well as to the simple form of stove shown.

Mr. Diedrich Schmidt, of New York city, has patented an improved fish safe, in which salted fish can be kept any length of time without losing in weight by the evaporation of water. The invention consists in a box provided with a slatted floor for receiving a box containing salted fish, below which a water pan is placed, which provides the box with moisture and prevents the rapid evaporation of the water in the salted fish.

An improvement in fence posts has been patented by Mr. Norman A. Haven, of Lime Spring, Ia. The object of this invention is to furnish fence posts of durable character for building fences of any usual style. It consists in a mortised post slotted from the upper end through the middle down to a point at the desired height of the bottom rail above the ground, and having metallic filling pieces with ears turned in opposite directions.

Mr. Frederick H. Tompkins, of Jersey City, N. J., has patented an improved shade rack for holding a variety of sample window shades so that they may be conveniently and advantageously exhibited to customers for selection, the construction being such that the rack may be quickly taken down and packed in small space or for shipment, and easily set up for use, and such that the curtains may be entirely inclosed in the rack, and thus completely protected from dust and other injury.

An improved automatic siphon has been patented by Mr. Robert Reiman, of Egg Harbor City, N. J. The invention consists in a starting and stopping device of peculiar construction to be attached to the outlet end of the tube or hose of the siphon, whereby the air may be exhausted to start the siphon by a removable mouth piece, and the flow of the liquid may be instantaneously stopped, and be suspended and started again indefinitely, without having recourse to a renewal of the exhausting operation.

An improved inkstand has been patented by Mr. Charles De Roberts, of Albion, Neb. The invention consists in a swinging ink vessel provided with a spout and with a swinging cover, which ink vessel and cover can be operated by means of levers and connecting rods in such a manner that when a knob projecting from the front of a lever pivoted in the base of the inkstand is depressed the spout will be swung downward and the cover will be raised, so that a pen can be passed through the spout into the ink.

Mr. William G. Jesse, of Georgetown, Ky., has patented an improved trap for catching tobacco flies, cotton flies, bee millers, and other insects which injure the crops. The invention consists in a box mounted to turn on a lamp and provided at its inner end with a mirror. The box has a downwardly inclined chute between the lamp burner and the mirror, to the lower end of which a bag or receptacle is attached for receiving the insects which have been killed or crippled by the flame in passing over it to the mirror.

An improvement in tanning apparatus has been patented by Mr. Wenzel Masek, of Philadelphia, Pa. This is an improvement on Letters Patent No. 118,034, for an apparatus for use in tanning hides *in vacuo*. The present invention consists in providing the tank or cylinder for containing the hides and tanning liquor with a movable footway for use of the workmen in hanging and removing the hides, and which also serves to agitate the tanning liquor and throw it upon the suspended hides, whereby the operation of tanning is hastened.

An improved thread case has been patented by Mr. Eugene L. Fitch, of Des Moines, Ia. This invention relates to that class of thread cases in which a number of spools placed transversely are held in a row in a drawer in such a manner that the spool at the outer or open end of the drawer can be released to drop from the drawer by pulling a wire upon which the spool rolls to that end of the case at the inner edge of the counter and can then be seized conveniently by the seller or clerk. The object is to facilitate releasing the outer end spool of a row of spools in a drawer.

An improved furnace grate has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The invention consists of an arrangement of rocking grate bars, so that the bars are alternately higher and lower with respect to each other to the extent of an inch and a half or thereabout, the object being to provide grate bars for burning coke in locomotives, the higher bars projecting upward into the bed of fire, so that they will break the fused cake or crust which forms in the bottom of coke fires, so as to obstruct the air to such an extent that the upper portion of the fire fails to get the due supply of air for good combustion.

Mr. George W. Smith, of Harlansburg, Pa., has patented an improved fire escape consisting of a pair of hollow guide ways made of metal tubes erected vertically in front of and projecting a little from the side of a building, and coupled by an arch at the top, to each of which tubes a balcony is fitted so as to slide up and down, being connected through a slit with a suspending and operating rope within the tubes, the two balconies balancing each other, so that persons in one or the other may command their own descent by means of a lever brake in the balcony. Means are also provided for working the brake from the ground.

Mr. Henry J. Butler, of Independence, Or., has patented an improvement in harness trace buckles. The objects of the improvements being to provide a buckle that obviates the use of the box loops or strap loops ordinarily attached to the hame tug, to connect the hame tug with the trace by the buckle in a manner that divides the strain upon the leather, thus obviating the entire strain being upon one point alone in the trace, as is the case with other trace buckles; and to obviate having any part of the buckle on the hame tug or the trace while in the course of construction, the hame tug and trace being entirely finished before the buckle is attached.

A reversible moulding for frames has been patented by Mr. Charles H. Boduritha, of Delaware, O. This invention consists in a moulding provided in each edge with a longitudinal cut, and with a cut parallel with each edge in the inner surface of the moulding, whereby a rabbet can be formed in either edge of the moulding by deepening these cuts sufficiently to loosen the strip of wood between the two cuts. With this moulding a loss of material in making the frame is obviated, as there is no necessity of cutting a triangular piece out of the moulding for each corner of the frame, as has been necessary in making frames of mouldings having a rabbet on one edge only.

Owing to the rude construction of the chimneys now in use on railroad cars, it is the practice, as soon as the summer season begins and heat is no longer needed in the cars, to remove the chimneys and pack them away, to remain until the cars are again required to be heated, when they are again put in place upon the cars for use. Mr. Charles A. Dubey, of Brooklyn, N. Y., has patented a railroad car chimney constructed so that it need not be removed from the car, but may be permanently attached thereto, thus avoiding the labor of removing and replacing the chimneys, and the wear and tear incident thereto, and to the packing of the chimneys away.

Mr. Charles Gibbs, of New York city, has patented a portable galvanic battery constructed with a case containing a jar provided with a water tight cover firmly secured to it. Through a stationary cover connected with the case passes a rod attached to the cover of the jar for raising and lowering the jar, and which is secured in place, when adjusted, by a fastening attached to the stationary cover. The electrodes are placed in the jar, and are supported by rods attached to them, passing through the jar-cover and the stationary cover, and having binding posts attached to their upper ends, whereby the electrodes and solution can be brought into contact and separated by raising and lowering the jar.

A vital heat alarm has been patented by Mr. Wilhelm Reissig, of Darmstadt, Germany. The object of this invention is to provide a device for sounding an alarm or otherwise giving notice when the natural warmth of the body and life returns in apparently dead persons—for instance, persons in a trance. The invention consists of a tube or vial containing mercury, and connected by electric conductors with a battery, which mercury is held from closing the circuit between the conductors or wires by a plug of highly fusible material, the plug melting when the natural warmth of the body returns, thus closing the circuit, so that an alarm will be sounded by the alarm apparatus connected with the battery.

An improved harness pad press has been patented by Mr Joseph W Johnson, of Lathrop, Mo. The invention consists in a harness pad press formed of two V-shaped frames, provided with longitudinal vertical ridges having one side flat and the other side recessed or curved to adapt the frame to form straight or swelled pads. The two frames are united by bolts, and the leather for forming the pad is placed between them and formed by means of the forming irons, wedges, and clinching irons placed between the leather on the frame, upon which the edges of the leather are lapped over the clinching irons, and a piece of leather is placed under the edges, and is secured to the same by means of tacks or rivets driven through the overlapping edges of the two pieces of leather, and having their points bent over or clinched by the clinching irons, whereby the two pieces of leather are united and a perfect pocket or casing for the filling of the pad will be formed.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion ; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

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

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. C. S. asks: 1. What is most satisfactory for heating a private dwelling—steam or hot water? A. Steam and hot water are both used, according to the taste or prejudice of owners as well as the depth of their purses. Hot water is cheapest, easiest managed, and gives a very even temperature, but somewhat clumsy in its get up. Steam has also its advantages in carrying its heat through smaller pipes, and allowing of more complex distribution than water with its clumsy pipes; requires rather more care and costs more than water. 2. What is the best material for radiators (direct radiation), and what the best form? A. Wrought and cast iron are used, and made into forms to suit the conditions of the place to be heated. Radiators for stores, offices, and rooms in dwellings, pipes running along walls or overhead in coils, for factories or other places where rough and cheap forms may be desirable for economy. 3. What ratio should there be between the radiating surfaces and the cubical contents of the rooms? A. The ratio of surface is empirical, and requires judgment and experience in dealing with all kinds of exposures in rooms and halls, quantity of glass, ventilation, and kinds of occupation. Upon an average, 1 square foot of steam heated surface to 125 cubic feet of space, with variations of 25 per cent, covers most cases. For water, 50 per cent more. 4. What heating surface should the boiler have for each 100 feet of radiating surface? A. 10 to 12 square feet of heating surface in boiler to 100 square feet radiation surface is the usual practice. 5. What boiler pressure will give best results? A. All pressures under 100 pounds are used—1 to 5 pounds is considered the most economical and safe. 6. Is there any standard or reliable book published on steam or hot water heating? A. Write to booksellers who advertise in our columns. 7. What is the thinnest saw (50 or 54 inch) advisable to put in a light mill to saw white oak lumber green, to be run by light power? A. About three-sixteenths of an inch thick.

(2) D. M. F. writes: I am working in the telegraph office here, and I find that sometimes when the line is wide open, without any doubt, I can hear at times a minute scratching sound on the relay, which I cannot change by adjusting. I hear it sometimes when the line is closed, but cannot adjust for it. At times it is quite plain, at others very faint; our relays are a box relay of 200 ohms, in regular use, and a pocket relay of 310 ohms, both of very fine workmanship, made by the Western Electric Manufacturing Company, of Chicago and New York. The latter I use sometimes for amusement, and with it I can tell very nearly where any one who is sending is, by the way it sounds. My main question is this: Is it (the scratching sound—I can almost read it sometimes) caused by induction from the wires hanging on the same poles which are being worked at the time? Old operators can give me no explanation of it. A. The sounds may proceed from earth currents or they may be produced by induction. By placing a telephone receiver in the circuit, or in a shunt around the relay, you will probably be able to interpret the sounds.

(3) J. W. M. asks: What is it the brass founders use to make the brass flow easily and fill up the mould? I have succeeded easily in melting scrap brass in a large upright office stove in fifteen minutes in a sand crucible. In pouring in mould, it would blubber up very much, had numerous vent holes; and a small casting, weight one pound, compact form, after cooling I would find the casting all full of holes, and sometimes completely hollow; tried twenty times, always the same result, both with borax and with charcoal, and without anything, flux nature; used stove moulder's sand. A. Heat the brass no hotter than is necessary to make it run clean. Your sand mould must be as dry as possible. Vent the mould so that the air will escape by some other passage than the one you pour through. In melting brass, never boil it. A high temperature vaporizes the metal, and fills it with vesicles that are not easily got rid of. Try again.

(4) O. R J. asks: Will you be kind enough to inform me how chilled iron globules or iron sand is made, that is used in sawing marble and granite? Could it be used in grinding pistons and valves? A. You can make the iron globules by cautiously pouring molten iron into water and breaking the small globules formed by running through steel rollers. This would be poor stuff for grinding valves, cocks, or pistons. If the material to be ground is iron, grind with fine emery, and finish with powdered glass or fine moulding sand. If of brass or composition, use no emery unless the surfaces are very rough. Ground glass is most in use by machinists. Moulding sand, such as is used in brass foundries, is much used, and makes a fine seat finish for valves.

(5) C. E. S. asks: Which, under the same conditions, will give the greatest speed to a boat—the side wheels, or the screw propeller? A. If with a boat of limited draught of water, the side wheels; if of deep draught, especially sea going steamers, the screw propeller.

(6) W. P. B. asks: Will the exhaust from an engine, if allowed to enter the chimney, increase the draught, and if so to what extent? The chimney is 70 feet high, 12 inches wall, 8 feet at base, and 4 feet at top, no inside flue. At what height would the best results be obtained? A. Yes; the amount depends upon the pressure at the mouth of the jet pipe. It is generally thought best to introduce the exhaust just at or above the flue discharge into the chimney.

(7) P. S. M. asks: 1. Can the vapor of gasoline, or rather air charged with that vapor, such as is produced by the various gas machines, be used instead of coal gas to drive gas engines, and for gas blowpipes? If such gas were used to heat the boiler of a small engine, should it be delivered under much pressure, and should it have a greater proportion of air to gasoline vapor than if used for illuminating? A. Yes; under pressure it would answer for both, and the proportions should be about the same in each case.

(8) G. J. E. asks how to keep ticks off of blooded cattle. I have tried kerosene, but that is not altogether satisfactory. A. Use a strong solution from pure Dalmatian insect powder.

(9) J. P. B. asks: Can water flow through a siphon whose short arm is more than 33 feet long? A. No; you cannot calculate safely on more than about 24 feet. 2. Will the flow of water through a siphon be increased by lengthening the long arm? A. Yes. 3. If the long arm is more than twice the length of the short arm, will the water begin to flow by filling the long arm only? A. It might, if the short arm was not too long, but it cannot be relied upon.

(10) G. J. asks: 1. Is the gas and carbonic acid from sulphuric acid and bicarbonate of soda carried into a lead chamber and passed through water, pure and harmless? A. Yes, generally. 2. Does bicarbonate of soda solution injure vulcanized India-rubber? A. No. 3. Is lead perfectly proof against a strong solution of bicarbonate of soda and carbonic gas? A. Yes.

(11) W. S. H. asks how chemical bronze is prepared to give brass a black color. I have been informed it was chloride of platinum, but all that I have made as yet deposits a thin film of the metal platinum on the surface of the brass that has a silver white color. I cannot get the black color I desire. A. Use a strong solution of hyposulphite of soda in water.

(12) "Subscriber" asks for the best method of tempering spring leafs in an ordinary shop where there are no special facilities for doing such work. A. Spring leafs for, say, carriage springs cannot be tempered without some special facilities, such as a long, even fire and a trough of water or oil long enough to take the required length of spring sidewise or partially endwise. You can make a long fire, even if you have to build a rude fire place over your tuyere.

(13) T. E. H. asks: 1. How are the brass plates used by bookbinders in embossing covers of books made? They seem to be cast and afterward chiseled deeper. A. The blocks for engraving embossing plates are cast from patterns made specially to suit the design, so as to economize the cutting away of so much metal as represents the blank spaces. They are easily made by gluing upon a piece of board of the proper size and thickness, thin pieces cut to represent the lines, borders, corners, and inside lettering, or vignette in outline. When the casting is faced off, it is ready for the graver. Where metal routing machines are in use, it is about as cheap to rout as to make a pattern. 2. What causes sponginess and blow holes in our stereotype plates? We use old type metal and the papier mache process. Plates are generally good on face but spongy under the surface or on the back. Frequently a line of blow holes follows or occupies the direction of the flow where poured in. A. Perhaps your mould is corroded or dirty on the back, or it may be that you do not take sufficient pains in pouring your metal. If poured too hot it would be likely to generate gases which might create sponginess.

(14) J. W. H: It is probable that you have a cross or short circuit in your wires.

(15) J. F. F. writes: In almost every issue of the SCIENTIFIC AMERICAN in column Answers to Correspondents are specific directions for making electrical apparatus and the amount of electricity they will develop, or that is required to operate them; also answers to questions of a theoretical as well as practical nature. Please tell me if your knowledge of these subjects is derived from the study of books or is the result of workshop experience, or both? What books would you recommend to the study of and what course of experiments or practice to a person desirous of becoming an electrical engineer? In what books will I find the data and formula for calculating sizes of wire, etc., for making electro magnets for different purposes? A. Begin with "Ganot's Physics;" then purchase "Electricity and the Electric Telegraph," by Prescott; Higgs' "Electric Light;" Dredge's "Electric Illumination;" Gordon's "Electricity and Magnetism;" and "Electric Batteries," by Niaudet. Supplement your studies by experiment, making your own apparatus. If possible, take a course in one of our technical institutions.

(16) F. N. Y. asks: Can you give me a receipt for glue, such as is used by paper box makers? A. Soften a pound of fair glue by digestion for an hour in hot water, sufficient to cover it. When soft, add sufficient water to form the desired thickness and melt by heating in a glue pot or bath of water, in which the glue vessel is placed.

(17) J. H. E. writes: 1. I have a small engine of ½ horse power. Would it be practicable to construct a dynamo machine, for running one or more Edison incandescent lamps, small enough to be run by the engine? A. Yes. 2. How many lamps would it be capable of running? A. Two or three three-candle lamps. 3. Where can I find directions for making such a machine? A. In SUPPLEMENT, No 161.

(18) A. E. I. writes. I have among a lot of photographic chemicals one bottle labeled collodion. It is of a light yellow color and smells strongly of ether. Could you through the columns of your valuable paper tell me how to prepare it for use? A. Use it as it is, if of pure light color. 2. What is meant in chemistry by the term "excess;" for instance, "add an excess of acid"? A. Sufficient to just overestimate the alkali or acid present, as shown by reddening litmus paper when acid is in excess and bluing red litmus paper when alkaline. 3. I bought some calcium sulphide, which being exposed to the light for some time, does not shine in the dark; what is the reason? A. It was not properly made or kept, and had oxidized to sulphate of lime by exposure to the air. It should be kept in an air tight bottle. 4. Is the gravity battery constant, or must it rest to regain its energy? A. The gravity is very constant.

(19) J. S. asks: What are the products of combustion of the gas generated by gasoline as used in gas machines, and whether they are injurious to health? A. They are variable mixtures of carbonic acid gas and a small amount of carbonic oxide, and consequently are deleterious; the above apparatus may be used in a well ventilated room without danger of contaminating the air.

(20) T. N. M. asks (1) how to etch on steel. A. Cover the surface with a thin coat of asphaltum varnish of fine quality, then cut the design through to the surface of the steel, and etch with a weak solution of nitric acid in water; finally wash with hot water and remove the asphaltum with hot turpentine. 2. Also, how to make impression paper used by etchers on steel. A. See method of manufacture, in SCIENTIFIC AMERICAN, No. 10, vol. xlvi., page 148, March 11, 1882.

(21) C. F. P. asks if there is anything that I can put into glue in a liquid state that will keep it from tainting or spoiling without interfering with its adhesive quality. A. Add a little of a solution of bisulphite of soda to it.

(22) T. S. asks: 1. Is celluloid a good insulator of electricity or not? A. Yes. 2. For connecting it firmly with metallic parts—say by screws or any other means—what will be the safest method to avoid its partial inflammation? A. Coat it with a solution of gutta-percha in bisulphide of carbon.

(23) J. S. asks: Can you give us a receipt for a waterproof leather cement such or similar as is used on leather belting? A. See receipts for cements in SUPPLEMENT, No. 158.

(24) F. R. S. asks: 1. Does back water affect the power of a turbine water wheel, if the head remains the same? A. Yes. 2. Is the outward pressure greater at the bottom of a tub full of water than at the top? A. Yes. 3. What part of a boiler receives the greatest pressure when in use? A. Bottom.

(25) W. E. P. writes: 1. Please give directions through the SCIENTIFIC AMERICAN how to splice a wire cable. I have one that has been used for stacking; several of the wires are broken in one place. Can I mend it without having to cut in two and splicing? A. A wire rope is spliced in the same manner as a hemp rope. Any old sailor should do it. You can mend only by splicing. 2. Is an injector as reliable as a boiler feeder as a hot water pump? A. An injector requires more careful use; any chip or other foreign matter will stop its operation, but its stoppage is at once indicated, and discovered on examination.

(26) P. N. K. writes: I am told that if air leaks into the smoke box of a locomotive it will cause the gases therein to ignite. Is this a case of "chemical combination"? If so, please give equation. A. The access of air to hot carbonic oxide will cause it to ignite and burn to carbonic acid, $CO + O = CO_2$, if the temperature is high enough, which it generally is in the smoke.

(27) C. F. writes: There is a discussion at our shop about the mode of reducing bronze powder to an impalpable condition, that is, metallic bronze. So, will you please let us know through the SCIENTIFIC AMERICAN? A. Metallic bronze is pulverized by trituration in a mortar, and the coarse is separated from the fine by elutriation. The ordinary bronze powder is bisulphide of tin, made by fusing tin with sulphur.

(28) H. and G. ask: Can you give a good recipe for making artificial cider? We have seen "manufactured" cider that has the exact flavor of real apple cider, and keeps longer, but we don't know how it is made. A. It is a solution of the required strength of tartaric acid in water to which the necessary amount of caramel (sugar coloring) has been added to give the required color. Sometimes it is sweetened with glucose, and a small portion of bisulphite of soda or salicylic acid added as a preservative.

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OFFICE OF THE COMPTROLLER, CITY OF ALLEGHENY, PENNA., Dec. 23, 1882.

Notice to Engine Builders and Boiler Manufacturers.

Sealed proposals will be received at this office until January 15, 1883, for the construction and erection of one or more (not exceeding three) pumping engines, to be located on lot on River Avenue, Eighth Ward, Allegheny, Penna.

The specifications will include the excavation for pump well, and all necessary masonry for foundations for well, also foundations of engine and engine house, also the erection of engine house for same.

The engine or engines to be of four millions (4,000,000) capacity, and to be of a guaranteed duty of not less than ninety millions (90,000,000) of foot pounds duty per one hundred (100) pounds of bituminous coal consumed, or such guaranteed duty as can be also had with the present boilers now in use at works.

The contractor must furnish specifications and detail drawings of type of engine and boilers to be furnished, also plan of well and pump house, the well to be so constructed that extra pumps can be placed therein when required.

The whole to be erected and completed, and in accordance with such plans as may be selected by the Superintendent of Water Works, and approved by the Water Committee and Councils of the City of Allegheny, Penna.

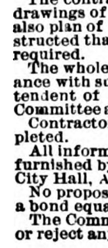
Contractors must specify when the work will be completed.

All information in regard to the above work will be furnished by Edward Armstrong, Supt. of Water Works, City Hall, Allegheny, Penna.

No proposal will be received unless accompanied with a bond equal in amount to the bid.

The Committee on Water reserves the right to accept or reject any or all bids.

JAMES A. BROWN,
Comptroller of the City of Allegheny.



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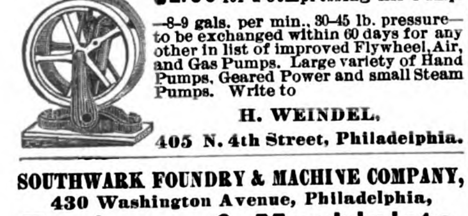

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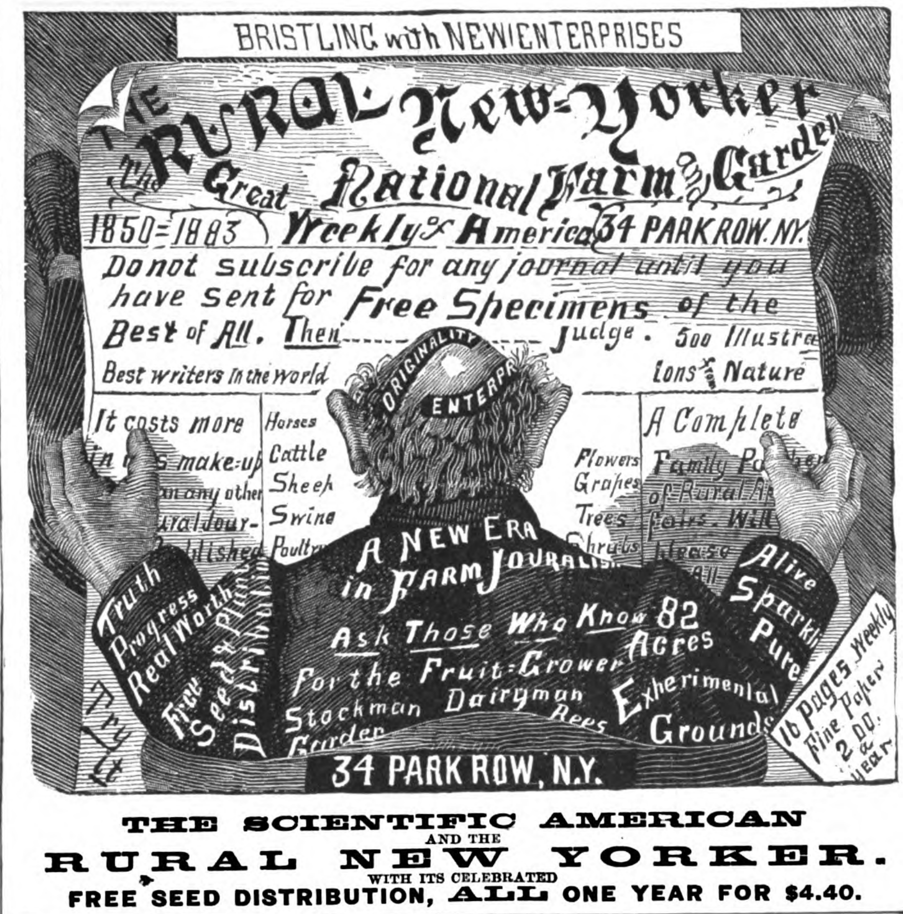

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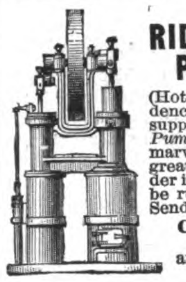

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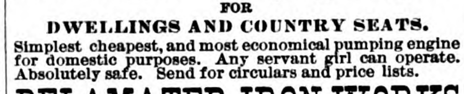

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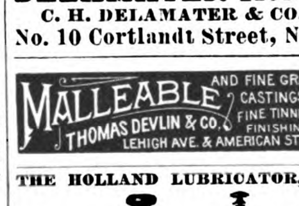

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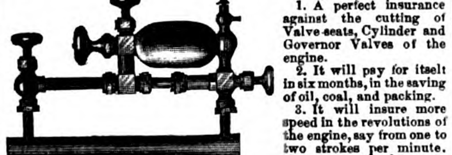

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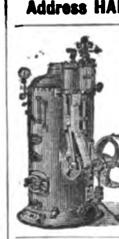

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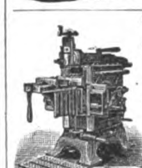

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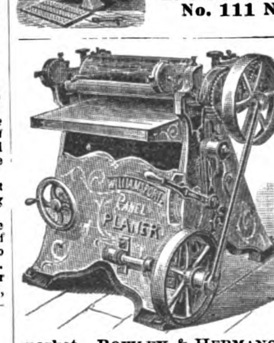

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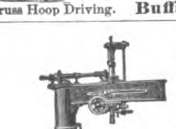

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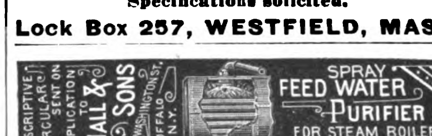

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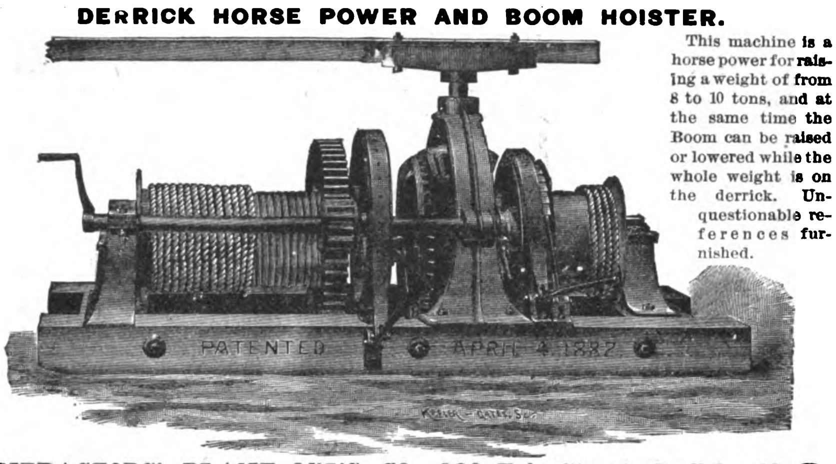

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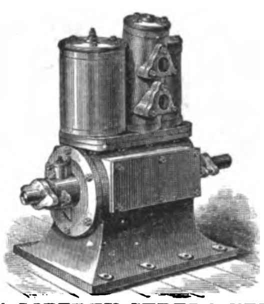

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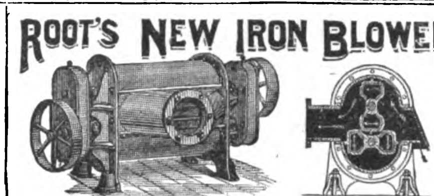

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