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THE GRAND CENTRAL RAILWAY DEPOT.

We publish herewith an accurate engraving of the interior of the depot at 42d street, New York city, built for the accommodation of the New York Central and Hudson River, New York and Harlem, and New York and New Haven Railways. As we have already fully described this remarkable structure, there is no need to do more than recapitulate its proportions, which are 652 feet in length and 199 feet 2 inches in width. The roof is supported on 32 semicircular trusses, which are spaced 20 feet 4 inches between centers, extending from a point 2 feet below the rails to an elevation of 94 feet from the springing line to the extrados of the arch. Each truss has at its foot two tie rods $2\frac{1}{4}$ inches in diameter, with a turn buckle at the mid-length. The pitch of the roof is formed by rafters secured to the top chord of the arch

THE GRAND CENTRAL DEPOT, NEW YORK CITY

The trusses weigh about forty tuns each, and were raised in sections by means of a movable staging 80 feet high, 160 feet long, and 30 feet wide, moving on ways, and shifted along step by step as the work of raising the trusses progressed. About 8,000,000 lbs. of iron were used in the structure, 10,000,000 bricks, and 20,000 barrels of cement.

The car house is lighted through three skylights extending over the entire length of the roof—one on the center, double pitched, and a single one on each side of the center, and having altogether 80,000 square feet of glass—nearly two acres. The north end is closed by an iron front, the south end by the building containing the principal offices of the companies.

The roof covers nearly three acres, the station itself about four acres. The station has separate tracks for the trains of each company, besides those for the Fourth avenue horse cars, which run into and to and from this station, which was opened for traffic October 7, 1871. The gas burners of the building are lighted at night by electricity, 25,000 feet of electric wire being used, and 20,000 feet of gas pipe. The 144 steam radiators are heated by 15 miles of steam pipe.

The roof is ventilated by six lines of ventilating slats, 6 feet high and 8 inches wide, with Z-shaped intervals between the slats.

Great Volcanic Eruption in Iceland.

Mr. Magnusson, of Cambridge, England, says:—"On March 29th, the fall of the ashes was so excessive that it covered the eastern country sides, Jökuldal especially, with a coat six inches at its thickest; and all that day, although it was bright and sunny, the people spent in absolute pitch darkness. Fountains and rivulets were dammed by the ashes, and every mountain stream, always of a crystalline purity in Eastern Iceland, where there are neither glaciers nor *moraine*, ran dark and muddy between banks covered with drifts of ashes. The farmers have fled out of the ash-covered country sides with their cattle, in quest of pastures not yet destroyed by the *scoria;* but with what chance of saving their live stock does not appear. To all appearance, the present eruption seems likely to become a calamitous event for Iceland.'

A BEAUTIFUL PALM TREE.

The plant shown in our engraving is one of the most graceful members of the class, and deserves to become popular in

our gardens and conservatories as a striking and decorative foliage plant. It is sufficiently hardy to withstand our climate during the summer months, and grows freely when planted in a richly manured soil and in warm, sheltered positions. In habit, the plant is more robust than of its congeners, if we except *s. augusta*, which frequently attains a hight of from 30 to 40 feet. treated as a warm conservatory plant. Both the last named plants are chiefly remarkable for their fine foliage; but some of the smaller growing kinds, as *s. ovata* and the even more beautiful *s. regina*, are well known flowering plants, generally grown in a warm conservatory or in a humid plant stove. These species will, however, both grow and flower well in warm, sheltered positions out-of doors, and form striking objects massed along with musas, palms, and the larger arads. Our illustration gives an excellent idea of the noble port assumed by a well grown specimen of *strelitzia Nicolai*, which is common as a half-hardy foliage plant in many continental gardens.

Railway Speed on Horseback.

A fifty mile riding match lately came off at San Francisco, Cal. between two noted riders, Mowrey and Smith. The *Alta* says: It was a contest, as advertised, for $1,000 a side, with the conditions that each man should have ten horses, and be compelled to change horses, or mount and dismount, in each mile.

Both men were of a tallish, slender build, well adapted to long hours on horseback. Of the two, Mowrey exhibited greater strength and activity, and as an expert in the mode of mounting and dismounting is by far Smith's superior. An evidence of this was clearly perceptible in the fact that he gained on an average not less than two seconds at every change. His style was that of throwing himself from the saddle by a spring from his seat, and in mounting to spring from the ground, assisted by the horn of the saddle and catch his seat while the horse was frequently under full headway. Added to this, he was greatly assisted by having a helper on horseback, who invariably accompanied him on the start and outcome by checking and starting his horse, while Mowrey had only to jump on and off. On the other hand, Smith had little or no assistance, except the equipage of his saddle, which was brought into requisition in a manner that showed conclusively his appreciation of its desirable assistance.

Mowrey came in a quarter of a mile ahead in 2 hours, 2 minutes, $36\frac{1}{2}$ seconds, Smith being 16 seconds behind. The quickest mile was made in 2·04 minutes, the slowest in 3 015 minutes.

A GOOD welding composition is made of borax fused with one sixteenth its weight of sal ammoniac, cooled, pulverized, and combined with an equal weight of quick lime. The compound is sprinkled on the red hot iron, and the latter re placed in the fire.

Scientific American.

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VOLUME XXXII., No. 26. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, JUNE 26, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

THE END OF ANOTHER VOLUME.

The present issue of this paper closes the first half of the year. Next week we shall commence a new volume.

Some persons to whom the SCIENTIFIC AMERICAN was not previously known concluded six months ago to try it, and to them we say: Now, after receiving 26 numbers costing $1.60, how do you like it? We hope that none are disappointed. We hope that every one feels that he has had a full equivalent for his money. And we hope that all who are satisfied that they have had their money's worth will evince their satisfaction by remitting $3.20 for the coming year, or $1.60 for the next six months.

Clubs may be formed on the usual terms, and the same reduction will be made on a number of names as offered in last January. To all persons who wish to keep apace with the progress of the age, the SCIENTIFIC AMERICAN is indispensable. No other publication contains the variety of valuable reading, and instead of forty-five thousand—our present actual weekly circulation—we think the publication deserves the subscription of one hundred thousand. What say our friends? Shall we have it? It is for them to answer.

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THE KEELY MOTOR DECEPTION.

During the past year and a half, we have had occasion, several times, to allude to this latest contrivance, the chief purpose of which appears to be the wriggling of money out of silly people, numbers of whom are found to invest in it—just as they do in lottery tickets—expecting or hoping to win a prize.

The thing was started over two years ago, when it was given out that one Keely, of Philadelphia, Pa., had made a marvelous discovery, namely, a new motive power, in which an enormous force was generated without expense, without the employment of fuel, fire, electricity, chemicals, or other agency; in short, a veritable perpetual motion. The only apparatus involved was a few strong metallic cylinders, containing air, into which water was admitted, when, presto, a cold vapor was instantly produced, having a force of 30,000 lbs. per square inch, more or less, capable of useful application in the driving of all kinds of mechanism. Thus were the days of steam and its costly fuels numbered, and the value of coal property diminished; while settled principles of Science, demonstrated by Joule, Faraday, and other eminent worthies, were toppled over as by an earthquake.

In one of our comments we designated the Keely Motor as one of the perpetual motion deceptions, by which the owners claim to generate a great force out of nothing. We stated that "once in a while they have a juggling exhibition of the thing for the purpose of selling stock. Keely or one of his confederates is the operating juggler. The power 'generator' is a combination of small tubes or cylinders, communicating by pipes. First they run water through, then air, to prove that there is nothing within, and that the show is 'honest.' Then Keely turns a faucet, and 'now you see it.' The pressure gage goes up. He turns again, and 'now you don't' see it. The gage falls."

Transparent as this deception is, it is a serious fact that it has been indirectly countenanced by numbers of intelligent persons; and the implied sanction they have given to it has led many less informed individuals to stake money for its shares.

In the SCIENTIFIC AMERICAN for May 2, 1874, we devoted two columns to an account of one of the Keely performances like that above described, and mentioned the names of C. H. Haswell, W. W. Wood, U. S. N., S. Parish, Joseph Patten, and other engineers and mechanics who were present, and lent their names to its support. Professor Haswell wrote quite an ingenious report in its favor. A force of 10,400 lbs. to the inch was by him certified to have been developed on that occasion. It was then given out that a new apparatus, of still greater power, was in course of construction, to be finished within a few weeks, which would be still more conclusive and satisfactory in its results; that until this new apparatus was ready, and the patents, then in progress, were secured, the matter was not to be fully explained.

Since that time the new apparatus has been completed, several private exhibitions have been given, and the interested parties are now, it seems, desirous of bringing the "great discovery" fully before the public. We judge that this is the case, because they have lately communicated much information to various members of the press.

We take the following, as a sample, from the New York *Times* of June 11, 1875:

[From our own Correspondent.]

Philadelphia, Thursday, June 10, 1875.

"The mechanical and scientific world has been greatly excited of late by the discovery of a new motive power by a Mr. John W. Keely, of this city. The lately discovered motor is generated, as the gentleman claims, from cold water and air, and evolves into a vapor more powerful than steam, and considerably more economical. It is proposed by this new invention to revolutionize the world, and turn machinery topsy-turvy. Steam will be a thing of the past, and the wonderful power of this new creation will supply all the needs of man, for the uses to which steam is now applied. Just what this vapor is, and how it is made, the discoverer refuses to make plain, or divulge his hidden secret, until he has letters patent taken out in all the countries of the world which issue patent rights. This service alone will cost about $30,000, and will not be completed until three or four months hence. Mr. Keely is very reticent on the subject of his discovery, and referred your correspondent to his attorney, Charles B. Collier, Esq. The latter gentleman said that a private view of the working of the motor had been made on the 10th of November, 1874, before a number of capitalists, and that only three weeks since another exhibition had been given before a number of gentlemen from the New England States. These latter were so well pleased with the *modus operandi*, and believed so firmly in the ultimate supersedure of steam by the new power, that they formed a stock company, purchased the patent right for the six New England States, and paid $80,000 cash immediately for their share in the invention, and are ready to forward $200,000 more as soon as called upon. They will organize a company with a capital of $3,000,000, and be ready to manufacture the engines and necessary apparatus as soon as the proper patents are secured.

HISTORY OF THE DISCOVERY.

Mr. Keely alleges that the discovery of this power was purely accidental. Up to within a short time he was a poor man, but, having a wonderful degree of natural mechanical skill, he devoted all his time for the past fourteen years to experiments with water with the view of procuring a motive power from it. He was engaged upon an idea of his own regarding the force of columns of water one day, when he accidentally discovered the vapor he has harnessed. He studied the subject, ascertained how it was generated, learned its power, and thenceforth applied himself solely to the perfection of this idea, working night and day, for a number of years, until his efforts were crowned with success. The apparatus by which this power is made is termed a "generator" or "multiplicator," and the vapor is then passed into a "receiver," and from thence to a cylinder box of the engine, where it drives the pistons and sets the engine in motion. The "generator" is about three feet high, made of Austrian gun metal, in one solid piece, and will hold about ten or twelve gallons of water. It is four or five inches thick, and made to stand the very heavy pressure of 20,000 to 30,000 pounds of vapor to the square inch. The inside is composed of a number of cylindrical chambers, connected by pipes, and furnished with cocks and valves. The "reservoir" is about six inches in diameter and forty inches long, and is connected with the "generator" by a pipe which is about one inch in circumference on the outside, with a bore of about one eighth of an inch. Connected with both "generator" and "receiver" is a "standpipe" of brass, about two and a half inches in diameter and three feet high, having a spherical chamber at the bottom, made in two parts, by flanges, and connected to the pipe uniting the "generator" and "reservoir." The vapor generated in the multiplicator is conveyed to the reservoir, which contains numerous pipes, and from there, by a "feedpipe," to the engine. The engine is of peculiar construction; but the inventor claims that the vapor can be attached to any ordinary engine now in use, with very slight alteration. Steam could not pass through the connecting pipes which are used on this apparatus, since the bore is only about the dimensions of a knitting needle. "In five seconds," said Mr. Keely, "I can supply 2,000 pounds of vapor to the square inch, and enough to run a train of ten cars from Philadelphia to New York and return."

With a Keely "motor" attached to a steamer, the voyage of the world can be made without coal.

Mr. Keely says that the first public exhibition will be upon the Pennsylvania Railroad, when he purposes to take a train from this city to New York and return. The cost of the apparatus will range from $500 to $2,500, according to the size and finish desired.

It is evident, from the character of the gentlemen who are interested in the "Keely Motor Company," and the amount of money they have advanced, that they regard this invention as the wonder of the nineteenth century. About four millions of dollars are already involved in the success of this new invention.

The gentlemen interested in the scheme in New York are Messrs. E. T. Throop, Charles G. Francklyn, Charles Lamson, Sergeant & Cuttingworth, W. D. Hatch, William W Wright, W. B. Meeker, J. J. Smith, A. H. Elliott, John M. Williams, and J. S. Andrews."

The foregoing presents the most recent statements concerning the new motor, as derived from the parties themselves. We will now add a brief "official account" of the actual working of the device, at the great trial mentioned above, made November 10, 1874, as certified by Mr. Collier, the company's counsel and reporter, and published by him in pamphlet form at that time, for the information of the stockholders.

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P. M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P. M., the reaction wheel was removed, and connection applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P.M., the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P. M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplicator was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus."

The dimensions of the "small beam engine" are not given. It is stated by the learned counsel to have been of "peculiar construction, not susceptible of brief description." Judging from the Barker wheel, with 2½ inch arms this "beam engine" was probably about the size of a dollar toy engine. These remarkable pieces of machinery were, according to this report, run for a minute or two at a time, at various intervals, extending over an entire period of 15 minutes. There was no heat and no noise save that of running water when the ear was placed against the multiplicator.

The report, after giving the foregoing facts in regard to actual performances, summarizes the results, which we condense as follows: 1. The invention produced a series of gaseous expulsions of 2,000 lbs. per square inch. 2. The force was almost instantly produced. 3. It moved instantly through a distance of 12 feet. 4. It was attended with no noise. 5, 6. Nothing was nor could have been introduced into the apparatus to produce the force. 7. No heat, electricity, or galvanic action was discernible, except that electric sparks were observed in the spur gearing of the engine, caused by friction. 8. Hydrant water, 26 lbs. to the inch, was admitted. 9. The water was drawn off unchanged after the performance. 10. The vapor had no smell or taste, and did not burn. 11. The interior of the apparatus was found to contain no residuum or substance other than air and water. 12, 13. The operations were conducted by gas light. Every facility for the closest investigation was offered to the persons present.

The counsel then adds that the object of his report is not to make known the precise nature of Mr. Keely's invention, "nor will this be done until the specifications, drawings, models, etc., now in progress, necessary for the procuration abroad and in this country of letters patent, are completed and deposited."

Following the counsel's signature to this report is a certificate by Wm. Boekel, Mechanician, Wm. H. Rutherford, Chief Engineer, U. S. N., and J. Snowdon Bell, to the effect that they were present, that the report of the facts is correct; and the conclusions of Mr. Collier, given in the summary, they say "we fully endorse, as being, in our judgment, the correct conclusions." A certificate from B. Howard Rand, M. D., Professor of Chemistry in Jefferson Medical College, is then given; the Professor says he has read Collier's report, and certifies that the "absence of heat, electricity, or galvanic action as resultants, together with the negative qualities of the produced gas or vapor, lead me to the conclusion that the result, alleged to have been produced, was by some agency or power not known at present to chemists."

The opportunities for the acquisition of knowledge by this Jefferson College Professor seem to have been very limited.

We have given above the latest accounts of this latest attempt to impose upon the credulity of the public, as written by the parties themselves and backed by their willing as sistants. The deceptions of the whole scheme are so transparent that it hardly seems credible that persons of sane minds can be found who are willing to invest. Nevertheless, we hear from a reliable source that quite a number of well known business men have invested money in the scheme, and in one instance we were told so by the party himself. He had paid five thousand dollars down, and fully believed the thing to be a great discovery, and expected to realize a large fortune from his investment. On all other subjects this gentleman was rational and intelligent; but in respect to the Keely motor he was badly hallucinated. He was present at the trial above referred to, saw 2,000 lbs. on the gage, and came away perfectly satisfied.

The question is asked: How could so great a pressure as 2,000 or 10,000 lbs. per square inch be produced, allowing that it really was exhibited as stated? We think that any ingenious mechanic, by means of a hydraulic jack and a small pipe, could readily produce and exhibit such a pressure, and could, by turning a faucet, drive a whirligig for the space of sixty seconds, or from 9:08 P. M. to 9:09 P. M., as the learned counsel gravely reports.

Keely, it will be noticed, talks about his studies regarding the force of columns of water, and describes the use of water pressure in his "generator," "multiplicator," "receiver," etc. Well, now, Keely might, if he wanted to, get up an honest show of air pressure by arranging a series of short water tubes so as to concentrate the combined weight of their water against air confined in a suitable chamber. Allowing, for example, that he had ten communicating water tubes, each holding a cubic foot or 62 lbs. of water, he might, by turning a faucet, fill the tubes from the hydrant, and concentrate 620 lbs. weight on the confined air, which, if conducted to a gage, would indicate 620 lbs. pressure; this air might drive a small wheel from 9:08 P. M. to 9:09 P. M.; it would moreover be a cold vapor, without smell nor taste; it would blow out a candle, but not burn; there would be no noise except that of running water; there would be no residuum save air and water; no heat, electricity, or chemical action would be involved.

A curious arrangement of water and air tubes, in which, by turning faucets, the water weights are concentrated, producing pressure, was illustrated and described in the SCIENTIFIC AMERICAN of April 4, 1868, page 212. It was patented by James R. Cole, of Tennessee, December 10, 1867, as a water elevator. It might be bad for Keely, if he should prove to be an infringer of this patent.

There is also a patented arrangement of mercurial tubes for concentrating the weight of mercury and air columns in an analagous manner. We allude to Quinn's patent steam gage, 1866. It is possible that Professor Rand, Professor Haswell, Chief Engineer Rutherford, U. S. N. Chief Engineer Wood, U. S. N., and other advocates of the Keely motor, are not acquainted with these devices.

One of the strangest developments connected with the Keely motor is the implicit faith which many gentlemen, in this community, of tried experience and business capability, have given to the enterprise. They have yielded not only faith but their money. We can account for this only by supposing that they mistake mere *pressure* for motive power. But mere pressure is not motive power, it is simply a resultant of motive power. A very slight motive power, if sufficiently long continued and properly applied, may produce the greatest pressure. A weight of only a single pound, hung upon the extremity of a suitable lever, is sufficient to produce a pressure, at the opposite end of the lever, of 10,000 lbs., or more, to the square inch. To persons not familiar with the laws of mechanics (and this, we think, is probably the situation of most of the Keely investors), the exhibition of a gage, showing 10,000 lbs. pressure, might readily be regarded as proof positive of an enormous power behind the gage; whereas the actual power, concealed from view, might be only a weight of one pound.

In cases of this kind, when a body is lifted or a pressure produced, the inquirer should take pains to ascertain what the extent of the original moving power or weight is. If this precaution be taken, the falsity of motors like Keely's may be at once detected. In the example of Keely, the certificate of Collier shows that a hydrant force of 26¼ lbs. to the inch is always required to run the machine. This force, if applied to a common wheel or engine, would produce a considerable amount of constant mechanical power. But the moving force is nearly all wasted in Keely's device, for he is only able to drive a toy engine for a minute or two at a time. This does not look much like driving a train of cars from Philadelphia to New York, or crossing the ocean without the consumption of coal.

THE BASTIE PATENT GLASS.

We publish on another page an account of some recent experiments with this novel material, together with the inventor's account of the process as contained in his patent, from which we also give a drawing of one of his furnaces. The apparatus consists of a chamber for heating the glass very hot; and while in this condition, it is quickly plunged into a hot tempering bath of oil, wax, resin, tar, or pitch. This seems to be a simple and easily executed process, which if practically effectual, ought not to increase the expense of the glass but very little. The owners of the patent claim that 5 per cent above the ordinary cost of glass will cover the expenses of the improvement. On this point, we shall hope, ere long, to have further information.

It would appear that Professor Egleston, of Columbia College in this city, who has been employed by the patentee to show up the merits of the new glass in public, and who has been very successful in this part of the matter, has not, during the two months that he has been engaged, made any personal experiments with the simple process itself. All that he has done is to exhibit glass, brought from France, furnished by the patentee, testing them with samples of common glass picked up in the shops here. Whether the patent glass tried by Professor Egleston was in part strengthened, as glass sometimes is, by ingredients and treatment used in its manufacture, or consisted only of common glass, subsequently treated by the new process alone, the experimentor was unable to say. The statements of the patentee in respect to the economy and practicability of improving common glass, on a commercial scale, have yet to be demonstrated.

The patentee's agents in this country deny that the alleged invention of Mr. Pieper, mentioned in an item in our paper of June 12, had the effect to arrest the negotiations for the sale of Bastie's patent in Germany. On the contrary, they inform us that the sale of Bastie's process to the German glass makers was concluded on May 9th.

A NEW FORM OF PATENT LITIGATION.

In a recent article, commenting upon the relative number of patent litigations in England, where they grant a patent to every applicant, without official examination, and in this country, where we reject over five thousand applicants for patents yearly, and employ a standing force of five hundred officials to examine, or assist the examiners, we showed that in England, out of thirty thousand law cases yearly, only eight were patent litigations. We further intimated that a very large amount of patent litigation, of a character wholly unknown in England, was carried on here, and was a necessary adjunct to our present system. We allude to the litigations before the Patent Office, such as re-examinations, appeals to the Board of Examiners, interferences, appeals to the Commissioner in person, appeals from the Commissioner to the District Court, etc.

A new wrinkle in this sort of litigations, and a new direction for appeals, has lately appeared, which seems to indicate that the time has come when Congress should, by the adoption of wise legislation, put an end to this whole business of Patent Office quarreling.

Among other duties of the Secretary of the Interior, he is required to sign all patents after they are prepared, passed, and approved by the Commissioner of Patents.

On a recent occasion, when the Commissioner, after a long and full argument of the matter before him, had decided the case of Prescott *vs.* Edison, in favor of Prescott, ordering a patent to issue in the joint names, the defendant applied to the Secretary of the Interior and petitioned him not to sign or issue the patent. The subject of controversy was a telegraph apparatus. The Secretary granted the request, and decided to hear the argument. This was on the 20th of March, 1875, and no decision has been as yet reached. Meantime the contending parties have marshalled their legal forces before the Secretary, consisting of six of our most able and expensive lawyers, have argued and re-argued, and have filed scores of pages of printed fol-de-rol upon the subject, for the Secretary's consideration. If one dissatisfied applicant may thus occupy the Secretary's time, all applicants ought to have the same privilege. If the Secretary may nullify one legitimate decision of the Commissioner of Patents, he may nullify all.

The money costs of this one litigation before the Commissioner and the Secretary are stated to have reached, at the present time, over fifty thousand dollars. Jay Gould, it is said, is an interested party on the one side, and the Western Union Telegraph Company on the other. Jay is doing all he can to injure the Western Union Company by running down its stock and inflating the stock of a rival company, of which he owns the control.

This case is a little more prominent and has been more expensive than many that are litigated at the Patent Office. But it is notorious that a very large proportion of the time of the Patent Office officials is devoted, in one way or another, to these litigations, which, in the aggregate, involve great expense, but would become obsolete, as they are in England, if we were to adopt the English system of permitting the applicant to make his own examination if he so desires, but confining the duty of the Patent Office to the prompt issue of a patent to every applicant whose papers are presented in proper form.

It is alleged by the advocates of the American system that, if our official examinations and Patent Office wrangles were abolished, then the courts would be overwhelmed with patent litigations. But the experience of other nations shows that no such result would ensue. In England, as before stated, they have only eight patent litigations before the courts per annum; while in France, Belgium, and other countries, where no official examination and no Patent Office litigations take place, the number of patent cases brought before the courts is very small.

COMMERCIAL SPONGES.

It is sad to consider how much we lose in every walk of life through lack of a little observation. There are few stonemasons who, like Hugh Miller, are led to become noted geologists by noting and studying the beautiful fossils in the stones they chisel. A butcher may cut up beeves and porkers by the hundreds, or a fisherman spend a long life on the shore, without noticing the most obvious points of interest and instruction in the physical structure of his victims; and only when a naturalist calls his attention to the beautiful adaptations, which have before passed unnoticed, will he have his interest profoundly excited, which may ever after give him a new motive and zest in his work. The most of us will use sponges in an indefinite variety of ways, all our lives, without even once stopping to think how they were formed; whether they are plants, animals, or neither, or what are their history and habits.

The ordinary sponges of commerce, which we use so extensively, have but little resemblance to animals or plants, and belong to a class of organic bodies concerning the affinities and proper classification of which there has been much doubt. And this doubt has led naturalists to apply the question-begging appellation of zoöphytes, or plant animals, to these and similar organisms. They are now generally considered members of the animal kingdom. The parts we use are the mere skeletons, composed of a kind of horny substance. The animal itself is a soft, jelly-like, amorphous mass, which fills up all the intercellular spaces, lines the tubular canals, and forms a jet black or sometimes a dark purplish skin on the outside, covering the whole skeleton, excepting the larger openings, which project beyond its general surface. In this form the sponge exists in the water, and, out of its native element, is hard and glistening on the outside, and very strongly resembles a piece of liver.

The mode of life in this low order of existence, which is regarded as a compound animal, is very simple, and we would be disposed to call it extremely uneventful. Sponges grow, by a kind of lichen-like root, to some foreign object on the sea floor, and never move from their position; they have no power to contract or expand their body as a whole, or any part of it: and they are quite insensible to every sort of irritation. Their only power seems to be that of absorbing large quantities of water, which they again yield up on pressure without any injury to their texture. The water, which permeates their whole mass, and maintains a constant circulation through it, keeps the skeleton soft and elastic, brings to the animals the air and food on which they subsist, and carries away waste matter from the body.

On examination of a sponge skeleton, it will be seen that the porous surface is finer and of closer texture than the interior, that there are large apertures scattered indiscriminately over the surface, and between these are much finer openings, covering the complete outer surface of the sponge. The latter are called pores, and serve as channels of entrance to the water, which, after circulating through the body by means of the tortuous and branching canals which make up its inner skeleton, passes out at the larger openings. These chimney-like apertures are called *oscula*, but the name is a misnomer, for they are, in reality, vents. They vary in number in the different species, and are sometimes reduced to a single one. By what force the water is made to circulate through the sponge mass is not definitely known. Some have attributed it to vibratile ciliæ, planted within the porous canals which, by their motion, create a circulation in the water. Others ascribe it to the principle of osmosis, by which membranes of all animals, and many other porous substances transmit fluids and gases according to their density and power to act on the transmitting substance.

When obtained for commercial purposes, the animal matter can be removed by soaking it a long time in salt water and then—after it is rotted by this means—rinsing it out. This leaves the horny skeletons just as we use them.

The finest sponges of commerce come from the Mediterranean sea. Our best bath sponges are doubtless from this locality, but the coarser sponges we see most commonly are largely from the coast of Florida or the Bahama Islands. Sponges are found abundantly in tropical waters generally, and perhaps nowhere more abundant than in the seas of the Australian islands. They gradually decrease in numbers towards the colder latitudes till they become entirely extinct. They vary much in shape. Some are beautifully shaped like a vase, others are semi-cylindrical, others nearly flat like an open fan; some are branched like the opened fingers of a hand, and are called glove sponges, and in others these branches seem to be reduced to only one, which is shaped somewhat like a club. These different shapes may belong to one species, and the differences are due, so far as known, to the fact that the first mentioned are found in deep water, and they grade, in the order described, up to the last, which grow in much shallower water.

Sponges are not confined to recent seas, though the commercial ones are not known to have existed earlier, because the keratose matter furnishes hardly favorable conditions for petrifaction. In the oölite and chalk formations, sponges containing flinty spicules were very abundant; and in most of the earlier formations, large sponges containing calcareous spicules abounded. These very closely resemble corals, and have been mistaken for them by some of our best geologists. The spiculæ or needle-shaped particles, which are often microscopic in size, are not thrown in without order, but are arranged to support the skeleton. The horny sponges do not secrete or deposit spicules, but these are sometimes found within the skeleton in broken and disordered form, which shows they were taken in from without.

There is an elastic sponge, as it is called, that is somewhat largely used now as a substitute for curled hair in stuffing beds, cushions, car seats, etc., but this is an entirely different thing from the sponge of commerce. Before it was used for this purpose, it was a worthless sea grass, growing abundantly among corals in rather shallow water.

Terrible Earthquake in South America.

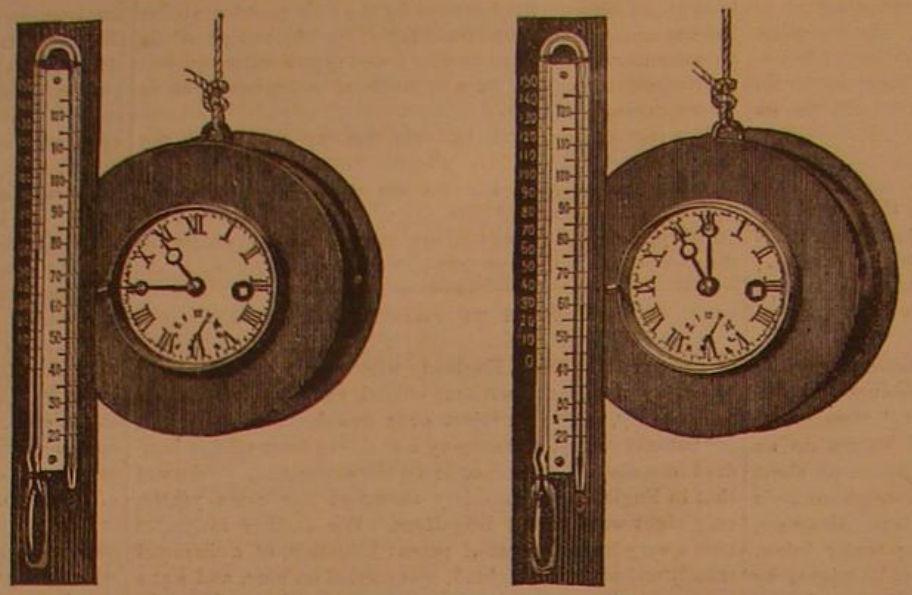
It is reported that an appalling earthquake has lately taken place on the Venezuelan frontier of New Grenada. The destruction was severest in the Valley of Cucuta, in the province of Pamplona, latitude 7° 30′ N., longitude 72° 10′ W. It is said that 16,000 lives are lost by the calamity.

A PUTTY of starch and chloride of zinc hardens quickly, and lasts, as a stopper of holes in metals, for months.

A NEW REGISTERING THERMOMETER.

This new apparatus, represented in our engraving, is designed to measure and register the temperature of ocean depths, of deep borings, or other inaccessible places, or of any locality at any desired time. It is composed of a mercurial thermometer, curved in inverted V shape, and fixed on a scale graduated to Fahrenheit degrees. The cylindrical tube which contains the mercury is slightly bent at the zero point. The instrument is connected with a clock, on the lower portion of the dial of which is a supplementary hand pointing to the numbers 1 to 12. By placing this pointer at any determined number, when that hour is reached the clockwork causes the thermometer to revolve one revolution. The effect of this is to break the mercurial column at the bent portion at 0°, and turn it into the other leg of the tube, where it remains, its hight indicating the temperature at the time for which the dial was previously set.

This will be more clearly understood from the illustration. The figure on the left shows the apparatus set to indicate the temperature at 11 o'clock, the time of setting being 10:45. On the arrival of the hour, the thermometer turns as shown by the arrows in the second figure; and the mercury, passing out into the other leg, remains at the point it then marked on the scale.



REGISTERING THERMOMETER.

THE BASTIE TOUGHENED GLASS.

We recently witnessed a number of interesting experiments upon the Bastie toughened or tempered glass, exhibited by Professor Thomas Egleston, of the School of Mines of Columbia College, in the presence of an audience composed mainly of the glass merchants of this city. Professor Egleston has been investigating the properties of the new material for two months past; but his experiments, though tending to show the remarkable strength of the glass, have given him no information as to the correctness of the process by which the article is prepared. The mechanical apparatus alleged to be used in the process is given in the annexed engraving from the patent drawings.

We summarize Professor Egleston's experiments briefly as follows:

(1). Impact of elongated rounded end steel balls entirely inelastic, with plates secured horizontally: (*a*) Weight of ball, 2 oz. Best English plate glass, $\frac{1}{8}$ inch thick, broke at fall from hight of 15 inches. Bastie glass of equal thickness broke at fall from 4 feet 6 inches. (*b*) Four oz. ball. Ordinary glass broke at fall from hight of 1 foot. Bastie glass broke at fall from hight of 3 feet 6 inches. (*c*) One lb. ball. Ordinary glass broke at fall from hight of 13 inches. Bastie glass broke at fall from hight of 3 feet. The thicknesses of the glass varied in these several experiments, but in each one the Bastie and the common glass were identical. (*d*) Plate glass inclined at about 45°; a low quality glass, such as used in conservatories, was employed. Two oz. ball. Unprepared glass broke at fall of 4 feet. Bastie glass, after withstanding 36 shocks at one point, ruptured with a 9 feet fall. (*e*) Eight oz. ball. Common glass, ¼ inch thick, broke with a fall of 3 feet 9 inches. Bastie glass, ¼ inch thick, broke with a fall of 7 feet.

(2). Weight applied at end of a strip, 3 inches wide and $\frac{1}{8}$ inch thick, secured in a vise. Common glass broke at 16½ lbs. Bastie glass broke at 46 lbs. Power was applied at a distance of 6 inches from vise.

(3). Weight applied at middle. This experiment failed owing to lack of necessary weights. A strip of Bastie glass, same size as the foregoing, however, withstood 180 lbs. and gave no signs of rupture.

(4) Heat. Lamp chimneys prepared were heated over Bunsen burners to very high temperatures without rupture. Plates and saucers were similarly treated. A plate of prepared glass, about 1 foot square, was subjected to a blowpipe flame of 1,500° Fah. for about 8 minutes. Ordinary glass broke in 7 seconds. The outer edges of the Bastie plate, for a distance of an inch or more, were cool. The spot touched by the flame became barely red hot. On cooling, the plate cracked just at the heated point, and five minutes later it disaggregated throughout its entire area.

Water suddenly thrown on a heated prepared plate caused the latter to break. It appears that, when the glass is cooled quickly at the rate of 300° or 400° Fah. at a time, it breaks; but when the operation is conducted slowly, at intervals of 50°, rupture does not occur.

Referring to experiment 1: The force required to break the glass is best expressed in foot lbs. In better tests than those quoted, Professor Egleston found that ordinary glass broke at 1·6 foot lbs. Bastie glass bore 3 foot lbs., nearly double. Using a 1 lb. knife-edge weight, ½ inch Bastie glass broke at 17 foot lbs. From experiment *d*, it will be noted that constant hammering on one spot is without effect. With reference to experiment 2, according to Professor Egleston, the glass has supported as high as 60 lbs. Experiment 3 has been conducted with a knife-edge bearing on the glass, when as high as 200 lbs. has been applied. A remarkable feature of the glass is its rupture, which is a general disaggregation of the entire piece. As the weight falls, a metallic resonance is heard; but on breaking, there is a dull crush, utterly unlike the sound caused by fracturing common glass. The rupture takes place everywhere apparently, in perpendicular and horizontal planes, a cleavage, in fact, very much resembling that of trap rock. The fragments, moreover, are destitute of sharp edges. The hand may be plunged in a vessel full of them, or they may be rubbed between the palms, with impunity.

It is claimed that there is no difficulty in polishing the prepared glass, a fact evidenced by a number of watch crystals and other articles exhibited. It may be etched with hydrofluoric acid or engraved with the sand blast, without becoming impaired in point of strength. It cannot be cut with the diamond, as the removal of a part of a piece determines the immediate rupture of the whole; so that window panes and like articles will have to be prepared in the first instance of the proper size. It may be used for photographic negatives; and finally it has, it is said, withstood for several days the action of a cupel furnace at white heat. Window panes of this glass, it is alleged, will be almost as much protection to buildings as iron shutters; since they would shut off the oxygen until the window frames became entirely consumed. The cost of the process is stated to be about 5 per cent additional to that of ordinary glass, so the holders of the patent affirm.

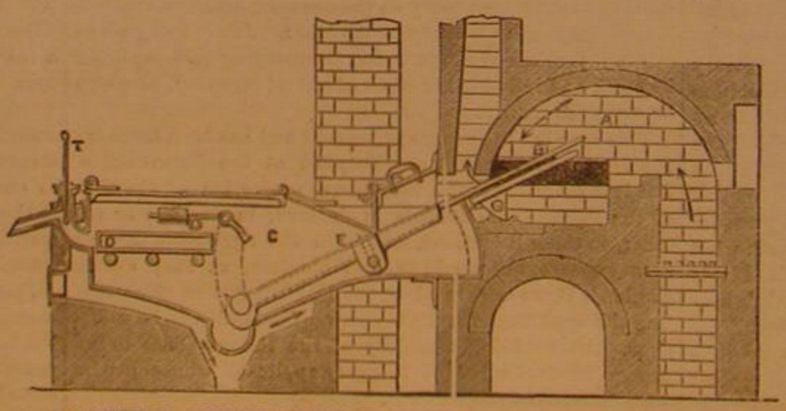
The following is from the specification of the patent as granted in this country December 15, 1874.

"To all whom it may concern:

Be it known that I, François Barthelemy Alfred Boyer de la Bastie, of Paris, France, have invented a new process of tempering flat and shaped glass, and furnaces and machinery to be employed therefor, of which the following is a specification:

This invention relates to a process of tempering glass and glass articles so as to render them less fragile, and to the construction and arrangement of furnaces for effecting the said process.

As the fragility of glass results from the weakness of the cohesion of its molecules, it may be expected that, by forcing the molecules closer together, and rendering the mass more compact, the strength and solidity of the material should be increased.



BASTIE'S APPARATUS FOR TOUGHENING GLASS.

I have found that this cannot be effected by compression, even when applied to the material in a fluid or soft condition. I have, therefore, applied to glass a system of tempering, such as is usually applied to steel, and I will now describe the process and apparatus for this purpose.

Fused glass dropped into water becomes greatly contracted, but, being shapeless, only objects of curiosity can be produced in this way. The sudden cooling in the water puts the glass into a state of unstable equilibrium in its constitution, so that the least shock causes it to break, as in the case of Prince Rupert's drops.

My object is to invert the result, to diminish, or even to remove, the extreme fragility of glass, by tempering it by immersion in a liquid. In attaining this object two essential conditions have to be determined: First, the point at which glass can be tempered without being put out of shape. I have found this to be when it is just at the heat where softness or malleability begins, the molecules being then capable of closing suddenly together, condensing the material, when it is plunged in a liquid at a considerably lower temperature.

Also, glass, when it is thin, may be tempered at red heat, even before becoming soft. Secondly the liquid to be employed for the immersion of the glass is to be such as can be heated much higher than water without boiling. For this purpose I find oils and grease, wax, resin, and tar or pitch suitable. Having settled these conditions, I have devised the process or practical method of operating, and suitable furnaces, which will hereafter be described.

In carrying out the process, it is necessary that the glass to be tempered should be raised to a very high temperature. The hotter it is, the less is the risk of breaking the glass, and the greater is the shrinkage or condensation. Hence the advantage, and often the necessity, of heating the glass to the point of softening, which is attended by the difficulties that glass in the soft condition gets readily out of shape, so that it must be plunged almost without touching it, and that, in plunging the hot glass into a heated combustible liquid, the latter is apt to take fire and cannot easily be extinguished, so that time and material are lost. These difficulties I have overcome by placing the tempering bath in immediate communication with the heating oven, and covering it, so as to prevent access of air. The oven being charged with the articles to be tempered, these are pushed or caused to slide into the adjoining bath without handling them, and the liquid of the bath, having no supply of external air, is not liable to inflame. In order that the shape of the tempered articles may not be affected, particularly for flat glass, the floor of the oven is made to cant, so that, when the glass is heated on it, it is turned to a sloping position, and the glass slides into the bath along a surface therein arranged at the same slope as that of the oven floor. Small articles may be heated on the edge of the bath and immersed by a slight push. The clearness of the glass may be affected by the dust of the furnace flame, which is apt to settle on glass and chill its surface. I avoid this by heating the glass in a muffle, to which the flame has no access, being applied externally. Moreover, the shock of the fall of glass into the bath is prevented by fixing therein a sheet of wire gauze or asbestos fabric, or providing a bed of sand or other like material for the glass to fall on."

The patent drawings contain three figures, one of which we give, and explain briefly as follows:

The sheets of glass are placed in a preparatory oven, and thence, one by one, pushed into the oven, A, by an opening, shown in black. On reaching the requisite temperature, the glass is carried upon table, B, which is normally horizontal though shown in a position for sliding the sheet off. C is the bath of oil, heated by a separate furnace, and so covered as not to be affected by heated gases proceeding from the furnace. A rocking table, E, is supported on a frame moved by a lever and shaft. This is placed in the position shown, and the table, B, is tilted by means of a lever, when the plate of glass slides off on to table, E, and so into the bath. Table, B, is then returned to its horizontal position, and another plate pushed upon it. The sheet in the bath is removed as follows: The table, E, and rocking frame are raised; and by suitable mechanism, the table is separated from the rocking frame to such an extent that the buffer of wire gauze on the frame and end of the latter are brought below the level of the table, which is held up by a latch. The plate is then withdrawn by a rake into the chamber, D, whence it is removed with others, when the chamber, being full, is lifted out of the bath.

The claims made by the patentee are as follows:

1. "The process herein described for tempering glass consisting in the immersion of the hot glass in a bath of oils, grease, wax, or resinous or bituminous substances, the boiling temperature of which is above the boiling point of water.

2. In combination with the oven for heating and the bath for plunging, communicating with each other, the rocking table, *e*, substantially as and for the purpose specified.

3. In combination with the heating oven and plunging bath, the tables, *e* and 19, substantially as and for the purpose specified.

4. In combination with the heating oven and plunging-bath, the rocking table, *e*, and the receiver, *g*, substantially as and for the purpose specified.

In testimony whereof I have signed my name to this specification before two subscribing witnesses.

F. B. A. ROYER DE LA BASTIE."

A Life-Preserving Pillow.

A new life-preserving device, which seems to be both simple and practical, has recently been introduced in the Glasgow and Montreal line of emigration steamers. It consists of two pillows of prepared cork wood, with an upper padding of hair covered with mattress tick. The pillows are attached to each other in such a manner that, when about to be used, they can be placed one on the back and the other on the chest and tied, the head and shoulders thus being kept above water. The device has been tested and has been found capable of supporting the heaviest men breast high. The pillows are utilized as articles of bedding, so that they are always at hand in case of danger.

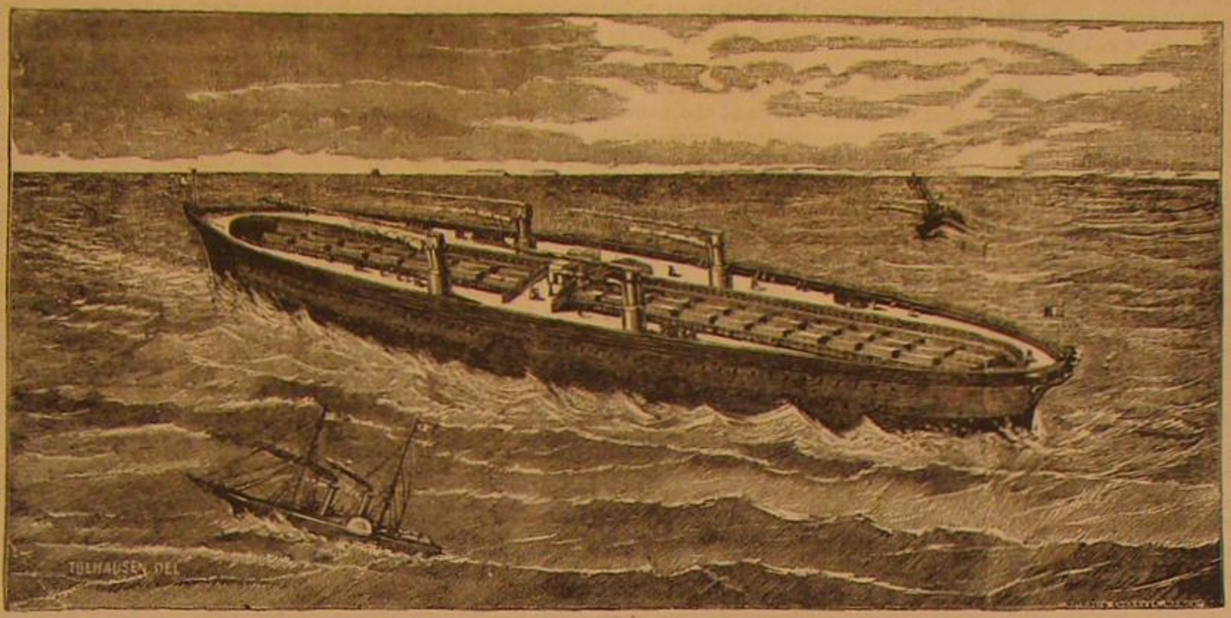
SWEET OIL rubbed on the skin is said to be a sure antidote for ivy poison.

A GIGANTIC FERRY SYSTEM.

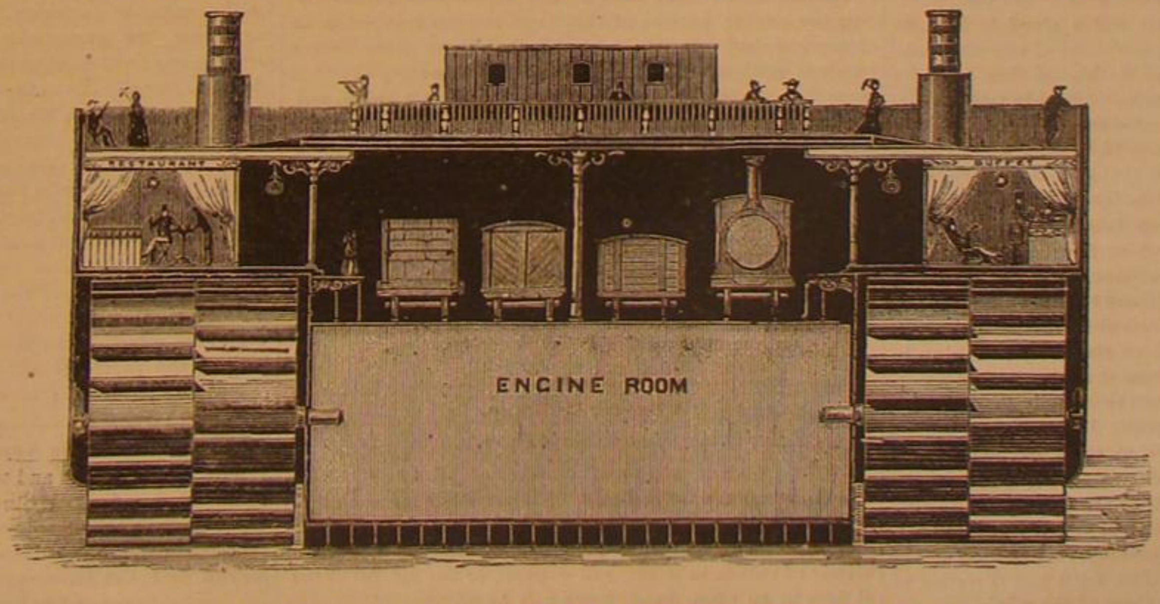
Mr. Evan Leigh is another inventor who comes forward to solve the problem of making the passage from England to France rapid and comfortable. He proposes to build vessels large enough to carry three passenger and one freight trains each, as shown in our Fig. 2, so that passengers need not leave their seats at the port of embarkation or of arrival. To enable trains to go on board such vessels, a pontoon of great size would be necessary, and the descent to it would be necessarily very gradual, lest the train acquire sufficient momentum to work damage or destruction to the ship.

The steamer is proposed to be 500 feet long and 90 feet wide amidships, as it is hoped that this great length will prevent pitching, while it is also expected that the corresponding breadth of beam will overcome the tendency to roll, which, in the narrow-sided vessels, presents an almost insuperable difficulty to the performance of a direct passage. As will be seen from Fig. 2, showing a transverse section of the boat, she is almost flat-bottomed, and her dimensions have been so calculated that she will only draw six feet of water when loaded. The chief inconvenience which such a boat might suffer in a gale is that the force of the wind, falling upon the immense surface presented by the broadside (as the tops of her bulwarks stand about 25 feet out of the sea), might, to some extent, interfere with the steering. To render the steering of the vessel all the more efficient under this difficulty, Mr. Leigh follows one of his own patents by fixing a rudder at each end of the keel, so connecting them together that one cannot move without the other moving in the opposite direction. Each rudder is also provided with a valve to diminish its area when required, which valves are so arranged that when one is open the other is shut, in order to balance the rudders to a nicety. Moreover, Mr. Leigh proposes to fit his boat with a pair of engines of 5,000 horse power capacity; each of these engines will drive the paddles independently of the other, so as to use the latter for steering the vessel independently of the rudder, by giving out more steam to one pair than the other, and so on. The boat is to carry a steering house at each end of the upper promenade. These arrangements leave the steersman the option of steering by steam or by helm, or by both together. The steering houses contain each three cabins, one for the captain, another for the steersman, and the third for the mate. The boat will not carry masts, spars, or riggings of any kind, in order to prevent top heaviness, and her capacity is measured at 8,000 tuns. Mr. Leigh, instead of employing the usual paddle wheel, introduces a paddle of his own contrivance, in the hope of saving power; the paddle wheels are 18 feet broad and 24 feet in diameter, with floats 21 inches deep, which are fastened to a cast iron cylindrical shell forming the wheel. The boat is to be propelled by inside paddles, so that the sides may be free from external projections. Four sets of rails are laid on the lower boat deck; three of these sets of rails are intended to carry the goods traffic, while the fourth is set apart for the passenger train, which alone takes its locomotive on board. The platform is raised on each side of the outer rails to a convenient hight for getting into the carriages; and sets of saloons, waiting, and refreshment rooms, affording accommodation for 1,000 persons, are fitted, on one side in the English and on the other in the French styles. Referring to Fig. 1, which represents the ferry boat at sea, the upper decks are seen connected by galleries at each end, thus forming a promenade of 350 yards length round the vessel; and underneath the first and second class saloons, those of the third class are fitted up.

When the boat enters the dock, the sliding doors at each end of the vessel are opened, and, by a self-acting process, the lines of the rails on the vessel become at once closely connected with the corresponding set on the inclined bridge; and while the steamer is awaiting the arrival of the passenger train, goods trains are run on board. As soon as the mail steams on to the boat, the gates are closed, the brakes applied to all the cars, and the vessel sails out of the dock. Arrived at her destination, and as soon as a similar connection with the main lines has been effected, the mail train steams out at the other end of the vessel under the top promenade of the ferry boat on to the existing lines of railway.



LEIGH'S CHANNEL FERRY. THE BOAT AT SEA.—Fig. 1.



LEIGH'S CHANNEL FERRY. MIDSHIP SECTION.—Fig. 2.

THE MOTIVE FORCE OF LIGHT.

In our number of the SCIENTIFIC AMERICAN for June 19, we gave engravings of the remarkable rotary instruments of Dr. Crookes, which are put in operation by the mechanical power of light, given off by a candle, lamp, the sun, or other source of illumination. The following summary and comments upon the marvelous discovery of Dr. Crookes we find in a recent number of the New York *Times*:

At a meeting of the Royal Society of Great Britain a few weeks ago, Mr. William Crookes, F.R.S., who had previously communicated some interesting facts on this subject, read a paper which may give rise to much more important discoveries, perhaps, than any contribution to celestial mechanics since the law of gravitation was demonstrated by Newton. It has always been assumed, and Dr. Balfour Stewart and other authorities have affirmed, that light, apart from heat, has no mechanical force whatever. This old theory is overthrown by Mr. Crookes, who for some years past has been making experiments, and has at last constructed an ingenious apparatus, by which he shows the power of luminous rays to drive round and round a little vane when the heat rays are excluded, being thoroughly sifted out by means of a screen of alum. We abridge from the London *Telegraph* the following account of one of the experiments, and regret that our space does not allow a more extended notice of the phenomena submitted to examination before the Royal Society:

With an air pump Mr. Crookes first exhausts a tube with a bulb at its end, and in the bulb he mounts, upon a delicate pivot, a little vane of glass or straw. This vane is made in the form of the letter X, and on each of its four arms is mounted a disk of pith, blackened on one side. The use of this blackened surface is ingenious, as will be presently seen. As soon as the machine is ready, it is exposed to the sunshine, when its disks immediately become endued, as it were, with life. They revolve around their common axis just as the planets revolve about the sun in the orrery. What is the motive force in this beautiful experiment? It is not heat. For, as before observed, the heat rays can be sifted out by the alum screen without stopping the rotation of the machine. The atmosphere and its changes have nothing to do with producing the motion. Professor Osborne Reynolds some time ago suggested that the disks revolved because there was a a latent moisture in them which, being evaporated in the experiment, gave a resilient impulse to the little orrery. To refute this theory, and, at the same time, to show that the sole motive force engaged in driving the orrery was the luminous rays of the sun, Mr. Crookes exhibited a machine made wholly of platinum which had been heated to redness while under continuous and absolute exhaustion. The disks being made of platinum, instead of pith as before, revolved as obediently as the disks of pith; inasmuch as they could contain no appreciable amount of latent moisture, the theory of Professor Reynolds was, of course, exploded. The final result was that light is now acknowledged for the first time as one of the mechanical forces, and such eminent men as Professors Stokes and Huxley, Dr. Carpenter, Mr. Norman Lockyer, and others, agree that the demonstration was perfect.

Another point of importance is that the force which light delivers is not like the force of gravitation, but differs from it in several essential respects. One of these is that, while gravitation attracts and gives a centripetal impulse, the force of light is centrifugal, and repels or pushes away the objects on which it is delivered. Thus the black side of the disk is pushed from the sun, and the orrery of Mr. Crookes is kept in constant rotation so long as the light waves dash themselves against the black surface and drive it before them. Shut out the light by covering the machine with a hat, and the rotation instantly stops, to be renewed again the moment the obstruction is taken away and the light readmitted. A green or blue screen diminishes the force of the rotation. Yellow or red glass quickens it into a much more lively activity. If a cloud passes over the face of the sun while this little orrery is working at full speed, its movements are checked and somewhat slower; but the moment the sun is visible again the mechanism responds with alacrity, and its revolutions are as swift as ever.

Mr. Crookes is well known as the man to whom Science owes the discovery of the metal thallium, and the complete establishment of its atomic weight. He has also invented the radiometer. But the little orrery we have described above is a much more remarkable contrivance. It contains the promise of further discoveries. It will perhaps raise its inventor to the front rank among the explorers of physical science. In this simple little machine, one of the most occult forces of Nature is for the first time revealed to the eye of man. "In it," says the authority from which the foregoing facts are chiefly taken, "we see the subtlest of imponderables set like a willing slave to turn a wheel; while tiny as that wheel is in these experiments, we must remember that light pervades it, flashing perpetually from countless centers like our own sun, across the infinite ether; and it may be fairly imagined that the interplanetary ether resembles the vacuum in the bulb, so that the condition of these revolving disks is, perhaps, much the same as that of the planets in space. Strange, indeed, are the thoughts which must be started by this revelation that light, pouring upon bodies freed from atmospheric friction, is in itself an active and mighty force. That so remarkable a discovery solves at once the mystery of the comet's tail—which is always seen to be driven violently away from its natural line upon approaching the sun—is, we believe, affirmed by more than one high astronomical authority. But may it not also have something to do with the axial motion of the planets? May it not have something to do with the maintenance of centrifugal force, balancing, as it were, that of gravitation? Can it be for nothing in the celestial universe that this potency and stress of light sweeps from center to circumference of each system, exercising a power which, in its totality, must be something prodigious? It seems not impossible that our mathematicians, calculating from the small surface of these disks the motive force of sunlight, may soon tell us pretty accurately what is the aggregate power which the luminous rays of the sun command; and nothing of this, by the law of forces, can be really wasted. 'Let there be light, and there was light' seems to derive a new majesty of meaning from the discovery which shows us this subtle something, no mere undulation nor 'mode of motion,' but a living force as well as the illumination of all life. It does appear as if a marvelous expansion of knowledge is about to open in these delicate experiments."

But there are no limits to the ingenious conjectures which may be advanced. To pursue them would be unprofitable in the present state of our knowledge. What is certain is that a great cosmic force has been discovered and submitted to experiment and investigation. But how long this force will be before it finds its Kepler and its Newton, the future will show. "Why in the ranks of our American astronomers should we not look for the expected teacher to rise up?" Sir William Herschel, in his "Lectures on Astronomy," gives some interesting calculations as to the enormous waste of the rays of light in the solar system. He concludes that "taking all the planets together, great and small, the light and heat they receive is only 1-227,000,000 part of the whole quantity thrown out by the sun. All the rest escapes into free space and is lost among the stars, or does there some other work that we know nothing about. Of the small fraction thus utilized in our system, the earth takes for its share only one tenth part, or less than 1-2,000,000,000 part of the whole." What is that "other work" to which Herschel refers? To this question the discovery of Mr. Crookes suggests an answer. For as Providence has created nothing in vain, so analogy would lead us to expect that the solar rays fulfil many useful purposes which, though long unknown to Science, will hereafter be discovered by the advancing knowledge of man. The present discovery, whatever else it may suggest, affords a new and beautiful illustration of the well known law of the conservation of forces, for it teaches us that the light which is incessantly pouring from the sun is perpetually converted into force, and that this force is utilized in the economy of the Universe, no part of it being wasted, or latent, or lost.

Correspondence.

The Sources of Electricity.

To the Editor of the Scientific American:

It is the general belief that the electricity of the atmosphere is generated by the friction of the air or action of the winds upon the earth's surface, also by the evaporation of moisture. Electricity is easily produced experimentally by either of these means. When we consider the immense surface of the earth and the enormous extent over which these effects are constantly being produced, we have an explanation of the immense reservoir of electricity that exists in the region of rarefied air that encircles the globe. This reservoir is continually being supplied and replenished, mainly by these two causes, evaporation of moisture and friction of the air upon the earth's surface. There is also a continuous outlet to this immense reservoir in the way of silent discharge to the earth, and by atmospheric discharge usually known as lightning. The above figure is given to represent the two great conductors, E being the earth and R A the region of rarefied air that encircles the globe.

Whenever this outward conductor is brought sufficiently near the earth, direct discharges take place; or in other words, lightning occurs. Clouds are conductors, and the above engraving is designed to show how the conductor, which is composed of rarefied air and a cloud, is brought near to the earth. It is simply a conductor of two materials. Thunder clouds extend into the air higher than ordinary clouds. They extend into the region of highly rarefied air. When this occurs, accumulation of electricity into the cloud takes place. The electricity of this immense reservoir flows into the cloud because the cloud is that portion of the conductor which approaches nearest to the earth. S represents a thunder storm floating over the surface of the earth. While this cloud is in favorable condition of form and density, the electricity in this vast reservoir of rarefied air is flowing in the direction of the cloud. The cloud becomes charged, and lightning occurs. While positive electricity is flowing through rarefied air into the cloud, negative electricity is flowing in the surface of the earth in the same direction, and that portion of the earth directly beneath the cloud is charged with electricity of the negative or opposite degree.

It is the belief of the writer that earth currents, which so often show their annoying effects in telegraphy, are the mere counter currents of those that are continually flowing in the almost ethereal regions above, and these upper currents are in continual motion, seeking that portion of the conductor nearest the earth. The force and direction of these currents are as varying as those of the winds.

In the foregoing engraving, the form and relative position, as regards the earth, of this outside conductor is represented. Of course the only visible portion is the thunder cloud. Rarefied air is a conductor, but differing from other conductors, inasmuch as electricity flows through it slowly. In other conductors its speed is comparatively instantaneous. In a former article, this cloud has been compared to a porous standpipe which is filled with or containing water. Suppose we undertake to fill this standpipe. With a certain given supply or head, we can fill it to a certain hight. The hight of the pipe is indefinite, and it is desired to burst it. This can only be done by getting a sufficient hight of water in the pipe. The hight or head, we call accumulation. Now to get sufficient accumulation we must have a certain supply, called quantity. It must have a certain force, called tension, and it must not have too great a leakage. We can, under given conditions, fill this pipe only to a given hight; but to fill it higher, or to the point of bursting, we must increase the quantity—increase the head or decrease the leakage. If the supply is lessened, the quantity accumulated is diminished. If the supply is stopped, the pipe is discharged in time by leakage alone.

The conditions of the thunder cloud are somewhat analagous. It is always charged to some extent. It may not be sufficient to produce disruptive discharge or lightning. It may occur once, and it may occur over a thousand times. We have known such to happen as often as once per second for an hour or more. How very rapid, then, is this flow and accumulation, into the cloud, of electricity from the regions of rarefied air, which the cloud reaches on account of its great elevation!

The earth, with its outer conductor of rarefied air, resembles an immense Leyden jar of almost incomprehensible dimensions, the earth itself being the inner conductor and the heavier strata of air, directly in contact with the earth, serving as the dialectric. The outer conductor is continually being charged, and this source of electrical accumulation is due to the effects of the sun's rays upon the earth. Moisture is evaporated, every particle of which produces its quantity of electricity. When the winds are set in motion, the friction thereof produces its share. Wherever this dialectric is thinnest or interposes least resistance, there accumulation takes place in greater quantity. The dialectric is made thinner by the thunder cloud. Through the agency of the cloud, the two conductors are brought nearer together, and this accumulation finds vent or relief in disruptive charges called lightning. As soon as these thunder clouds assume favorable form or begin to develope themselves, their electricity gathers in greater quantity in this part of the outer conductor, also on the surface of the earth directly beneath.

The hight of thunder clouds is estimated as extending from seven to fifteen miles above the level of the sea.

The origin of thunderstorms is believed to be due to the expansion and rarefaction of the atmosphere. When heated by the sun's rays, it expands and forms a current upwards. The hot air coming in contact with the cooler air above, deposition takes place in form of fog or cloud, and, when sufficiently condensed, falling drops of rain are the consequence. The vapor or cloud of a thunderstorm, as viewed in the neighborhood of the mountains in Pennsylvania, appears to be far above the latter, that is, the lower portions of the cloud are far above the mountain tops. In Central Mexico, the lower portions of these clouds seem to rest or come in contact with the mountains. From observations, I am led to believe that the lower portions of a thunder cloud are from two to three miles above the level of the sea. The tops or higher portions, when observed from these mountains or from a hight of two and a half miles, appear as high as when seen from an ordinary or lower position. That the upper and lighter portions of thunder clouds extend very high is admitted by every intelligent observer. If it be true that the upper portions are about ten miles above the surface of the earth, they extend far into the regions of rarefied air, and thus afford means for the enormous accumulation of electricity with which they are charged.

We have every reason to believe that, in cases of frequent and heavy discharges, the cloud extends to a very great hight. One of the most violent storms ever witnessed by the writer passed over this city on the evening of July 4, 1872. It commenced about nine o'clock in the evening, the rain falling in torrents for about an hour, flooding streets and filling cellars with water. The electric discharges during the greater portion of this time occurred as often as once per second. It was reported that there were over a hundred buildings struck by lightning in this city, and it is more than probable there were as many more, not mentioned. No person was injured by lightning, so far as known, nor was there serious damage to property, except that resulting from the immense rainfall.

It is believed that this thunder cloud, in order that circumstances should favor so many and such violent electrical discharges, must have extended to a very great hight; and the large amount of moisture, in the shape of drops of rain between the cloud and the earth, assisted immensely by reducing the resistance. DAVID BROOKS.

Philadelphia, Pa.

A Use for Bedbugs.

To the Editor of the Scientific American:

A correspondent in a recent number of your journal asks if there is any use for bedbugs. This reminds me of an accidental experiment I once made and had almost forgotten.

If nice fat bedbugs are placed in a saturated solution of nitrate of potash in water, and exposed to the air for several days in an open vessel, there will be no apparent change in the bugs; but there will be in the odor, for now it is as delicate and delicious as before it was rank and disgusting. No doubt the odorous principle could be easily separated, perhaps by digesting with alcohol or ether; and if neatly bottled and labeled, it would yield a large profit to practical perfumers.

The odor is unlike that of any other perfume I have ever smelt, and no one would suspect its low origin. This is one use for the *cimex;* there may be others. C. K.

Cincinnati, Ohio.

VELOCIPEDE RACE.—The inter-university bicycle race, between Oxford and Cambridge, England, took place this year on the road from St. Albans to Oxford, a distance of fifty-two miles. It was won by Hon. Keith Falconer, of Cambridge, in four hours, nine minutes, and twenty-four seconds, with a fifty inch wheel machine. The average speed of the winner was 12½ miles per hour.

Action of Sunlight upon Precious Stones.

Dr. Schnauss has directed attention to the fact that certain minerals are quite sensitive to the action of light. To many of our readers this may seem quite surprising, although some cases of this kind have long been known to mineralogists. Strangely enough this property extends to the very hard minerals, and reaches its maximum in the very hardest of all minerals, the diamond. According to Dr. Fright, under certain circumstances the colored diamond is as sensitive to light as chloride of silver. The ancients knew that certain colored precious stones gradually grew paler in the sun light, and that this was very distinctly the case with the beautiful grass green chrysoprase. They said that, when worn for a long time set in a ring or pin, it finally lost a greater part of its beautiful color; and that this could be recovered by wrapping it up in a cloth soaked in wine and keeping it in a cellar. The latter is evidently one of the numerous phantasies of that age, but the former statement is a fact. Even the much harder, transparent, dark green emerald is also influenced by light in time, as the author found to his sorrow in the case of an emerald ring, which he had worn seven years.

The diamond, however, exhibits the most interesting phenomena under this influence. If colored diamonds are highly heated, the color disappears more or less completely, and in most cases permanently. Sometimes, the color is merely changed by ignition, and the original color may be restored by the influence of the sun's light. A diamond merchant named Martin exposed a diamond to a very high temperature, in order to destroy its brownish color, but the stone became of a permanent rose red. Coster treated another diamond in the same way, and that too turned rose red; but the most remarkable part was that this color was only permanent in the dark, and disappeared in 4 or 5 minutes if exposed to the sun's light, the stone acquiring a weak brown color. This change also took place in a room where the light was by no means bright. Another diamond, of a dirty yellow color, was ignited in a current of hydrogen in a porcelain tube and allowed to cool there. The color disappeared, but not the luster. If this specimen were exposed to diffused light for 6 or 7 minutes, its original yellow color returned. The experiment was repeated in this way, the stone being heated in chlorine gas at as strong a heat as could be obtained by saturating the gas used with benzol vapor; it was farther heated at a lower temperature in a mercury bath, the diamond being wrapped in platinum foil. Each time the color disappeared and remained absent in the dark; but as soon as the stone was exposed for a few minutes to diffused daylight, it regained its yellow color.

These phenomena are thought by Dr. Schnauss to be related to that of phosphorescence. In addition to the cases mentioned by him, we would recall the fact, usually stated in text books on mineralogy, that a variety of topaz from Brazil, when heated, assumes a pink or red hue resembling that of the Balas ruby.

S. H. Mead, Jr.

We regret exceedingly to note the death of Mr. Samuel H. Mead, Jr., of this city, a young inventor and scientist of much promise. After patenting a number of improvements in fire arms, Mr. Mead, some four years ago, devised a safety explosive bullet, which invention he subsequently combined with one of like character patented by General Meigs. The Mead-Meigs shell, as the combination is termed, is a breech-loading metallic cartridge with a hollow explosive bullet containing fine gunpowder. On penetrating flesh or on striking any hard substance, the bullet explodes, tearing the object to pieces. The missile has been used in hunting in the West, and it was Mr. Mead's design to use it in shooting sharks off Martha's Vineyard.

Mr. Mead was an excellent astronomer and optician, and was indirectly known to the readers of this journal through his articles on astronomical subjects, and through his replies to queries of that nature, which we frequently referred to him for opinion and answer. Just before his death, he was bringing to completion a novel device whereby the recoil of a Gatling gun could be utilized so that the reloading would be effected automatically after every discharge, so long as the cartridge receptacle was kept filled. The deceased was but twenty-seven years of age.

Completion of the New Atlantic Telegraph Cable.

After many delays and much expenditure of money, the cable of the United States Direct Submarine Telegraph Company was completed on June 9. It will be remembered that the splendid new ship Faraday, built expressly for the service, left the Thames more than 12 months ago to lay the section between Rye Beach, N. H., and Nova Scotia. The company have leased two wires, belonging to the Franklin Telegraph Company, from Rye Beach to New York, and have opened an office at 16 Broad street in this city, where business will shortly be commenced.

The cable from Ireland to Nova Scotia was laid to within 200 miles of the latter country; but owing to unfavorable weather and the Faraday leaking badly, it had to be cut and the end attached to a buoy. Its construction was fully described on page 40 of our current volume. It is the fifth cable now in use in the Atlantic service, and its contract price ($6,055,000) will enable the company, it is claimed, to make a moderate tariff of charges, and reduce the rates throughout the country. A speed of twenty words per minute is anticipated.

TO CUT glass to any shape without a diamond, hold it quite level under water, and, with a pair of strong scissors, clip it away by small bits from the edges.

ELECTRO-METALLURGY.

The deposition of metals in the process of electrometallurgy is of two kinds, electroplating and electrotyping. When our object is to coat a metal with a thin metallic film of some other metal, the object to be coated is immersed in a solution of some salt of the metal to be deposited. A current is passed from the bath to the object, so as to decompose the salt and deposit the metallic portion of it on the object, which is a negative electrode.

ELECTROTYPING.

The art of copying seals, types, medals, etc., by the galvanic current in metal, more especially copper, is called electrotyping. An impression is first taken in gutta percha, wax, fusible metal, or other substance which takes, when heated, a sharp impression. While the impression is still soft, a wire is inserted into the side of it. It is then covered with plumbago to give it conductivity, a camel hair brush being used for this purpose. The wire is then attached to the zinc pole of a weakly charged Daniell's cell, and the copper plate is attached by a wire to the copper pole of the cell. When the impression and the copper plate are dipped into a strong solution of the sulphate of copper, they act as the — and + electrodes. The copper of the solution begins to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire; then it gradually creeps over the whole conducting surface. After a day or two, the impression is taken out; and the copper deposited on it, which has now formed a tolerably strong plate, can be easily removed by inserting the point of a knife between the impression and the edge of the plate. On the side of this plate, next the matrix, there is a perfect copy of the original seal.

ELECTROPLATING.

The very useful art of coating the baser metals with silver by the galvanic current is called electroplating. Theoretically it is very simple, but it requires very considerable experience and skill to make a successful application of it. Articles that are electroplated are generally made of brass, bronze, or copper. When tin, steel, iron, zinc, or lead is electroplated, it must be first electro-coppered, as silver does not adhere to the bare surfaces of these metals. Great care is taken in cleaning the articles previous to electroplating, for any surface impurity would spoil the success of the operation. They are first boiled in caustic potash, to remove dry adhering grease; they are then immersed in dilute nitric acid, to dissolve any rust or oxide that may be formed on the surface; and they are finally secured with fine sand. Before being put in the silvering bath, they are washed with nitrate of mercury, which leaves a thin film of mercury on them, and this acts as a cement between the article and the silver.

The bath wherein the electroplating takes place is a large trough of earthenware or other non-conducting substance. It contains a weak solution of cyanide of silver in cyanide of potassium (water 100 parts; cyanide of potassium, 10 parts; cyanide of silver, 1 part). A plate of silver forms the + electrode; and the articles to be plated, hung by pieces of wire to a metal rod lying across the trough, constitute the — electrode. When the plate is connected with the copper or + pole of a one or more celled galvanic battery, according to the strength required, and the rod is joined with the zinc or — pole, chemical decomposition immediately ensues in the bath, the silver of the cyanide begins to deposit itself on the suspended objects, and the cyanogen, liberated at the plate, dissolves it, reforming the cyanide of silver. According, then, as the solution is weakened by the loss of the metal going to form the electro coating, it is strengthened by the cyanide of silver formed at the plate. The thickness of the plating depends on the time of the immersion. The electric current thus acts as the carrier of the metal of the plate to the objects immersed. When the plated articles are taken from the bath, they appear dull and white; the dullness is first removed by a small circular brush of brass wire driven by a lathe, and the final polish is given by burnishing.

ELECTROGILDING.

The operation of electrogilding very closely resembles that of electroplating. The solutions are always alkaline, and usually consist of the cyanide or chloride of the metal, dissolved in an alkaline cyanide. To prepare the gold bath, *two ounces of* fine gold are dissolved in *aqua regia*; and the solution is evaporated till it has the consistence of syrup. Water is then added, together with two ounces of cyanide of potassium, and the mixture is boiled. The quantities named give about twelve gallons of solution.

The negative electrode consists of the article to be gilded. The positive electrode is a plate of fine gold, which constitutes a soluble electrode, and serves to keep the solution at a constant strength. In order that the gilding may be well done, the bath must be maintained, during the operation, at temperature of from 140° to 160° Fahrenheit.

The accompanying engraving represents a form of apparatus which *is very frequently employed*. The poles of the battery are connected with two metallic rods resting on the top of the cistern which contains the bath. The articles to be gilded are hung from the negative pole or rod. From the positive rod is hung a plate of gold, whose size should be proportional to the total surface of the articles which form the negative electrode.

The same arrangement of the battery and the cistern for holding the bath is applicable for electrotyping and electroplating as well as electrogilding.

GENERAL DIRECTIONS.

The success or failure of the electrotype process depends very much on the preparation of the copper solution, and on the strength of the battery. A perfectly saturated solution is not so well adapted for the purpose as such a solution diluted with one fourth part of water. To prevent it from becoming too weak by the deposition of metallic copper, some crystals of the sulphate are added during the process. The strength of the battery, in relation to the strength of the solution, causes the metals to be deposited either as a black powder, in a crystalline form, or as a flexible plate. The metals are deposited as a black powder when the current of electricity is so strong that hydrogen is evolved from the negative plate in the decomposition cell. The crystalline state occurs when there is no evolution of gas, and no tendency thereto. The regular deposit takes place when the electric current is stronger in relation to the solution than in the last case, but is not sufficiently strong to cause the evolution of gas.

There are various methods of preparing the solution for electroplating and of dissolving the silver, but the cheapest and best is to dissolve the silver in a solution of cyanide of potassium, by the action of a voltaic battery. Dissolve 1½ ounces of cyanide of potassium in 1 gallon of water; place one of two flat porous vessels in this solution to within half an inch of the mouth, and fill them to the same hight with the solution; in these porous vessels, place small plates or sheets of copper, and connect them with a zinc terminal of a battery; in the large solution place a sheet or sheets of silver connected with the positive pole of the battery. This arrangement being made at night, and the power employed being five Daniell's cells, the zincs seven inches long by seven in circumference, it will be found in the morning that the solution is ready for use. The strength of the solution recommended is that of one ounce of silver to the gallon. An ounce and a half of silver to one square foot of surface gives an excellent plating. A few drops of bisulphate of carbon confer peculiar qualities upon the silver.

NICKEL-PLATING.

Nickel-plating is now very extensively carried on for the covering of articles hitherto plated with silver. Nickel is very easily deposited, and may be prepared for this purpose by dissolving it in nitric acid, then adding cyanide of potassium to precipitate the metal; after which the precipitate is washed and dissolved by the addition of more cyanide of potassium. Or the nitrate solution may be precipitated by carbonate of potash; this should be well washed, and then dissolved in cyanide of potassium; a proportion of carbonate of potash will be in the solution, which is not found to be detrimental. The sulphate of nickel is also a soluble salt, and the metal is reduced more readily from it than from the nitrate. It is preferable to use the solution as strong as possible. Nickel forms a compound with the cyanide of potassium on boiling the oxide in a solution of that salt, which takes up a considerable quantity. The acetate of nickel is easily formed, by adding pyroligneous acid to the oxide of nickel, but it is a bad solution for obtaining reguline or pure metal. The chloride of nickel is formed by dissolving the metal in muriatic acid. It forms a fine green colored salt, and a very excellent one for nickel plating. It may be used with a nickel positive pole, with one or two Daniell cells.

Absence of Mind.

We heartily concur with the Philadelphia *Ledger* in its assertion that among the bad habits, which are usually classed with the minor faults of mankind, is that of absence of mind. Says the writer: "We have all laughed at the awkward blunders of the absent-minded, their irrelevant remarks, their ludicrous mistakes, their forgetfulness of the ordinary proprieties of life. Often, however, serious results ensue through these seemingly trivial oversights; property is wasted, friends estranged, losses incurred, health and even life sacrificed. In times of strong excitement or peril of any kind, nothing is so valuable as presence of mind. It is not exactly courage, or fortitude, or sagacity, or judgment, but rather the calm and well poised ability to marshal all these forces into action just where and when they are most needed. How many lives have been saved and disasters averted by this simple endowment! How much of the heroism which we delight to honor may be traced to this potent source!

It is precisely this attribute of which the absent minded man is destitute. Whatever be his knowledge, or wisdom, or skill, however excellent his motives and intentions, however great his powers and capacities, he has not that control over them that ensures the rightful action of each in its own time and place. He is continually off guard, surprised, confused, unprepared. His mind may be of the finest order, but it is not at its post of command, and his powers are scattered and lost like soldiers without a leader.

It is not only in times of emergency that this presence of mind is essential. Every hour of our lives must depend upon it for value and efficiency. If a man would be a prosperous farmer, a skillful mechanic, or a successful merchant; if he would be a kind neighbor, a faithful friend or a loyal citizen; if he would be a good and true husband, or father, or brother; his mind must be present in each of these relations, not absent. It must assume its rightful dignity of command over each phase of his life in turn, and not become absorbed in one to the exclusion of the rest, nor flutter in every chance wind. This is the chief cause of absent-mindedness. The thoughts are suffered to linger about some favorite topic or to wander aimlessly, and of course the matter in hand cannot be thoroughly performed. If we cannot or do not direct our whole attention to the object on which we are engaged and banish all others, we cannot do justice to it or to our own powers. It is the mixing up of different things and the confusion of mind thus created that are largely responsible for much of the inferior work in the world, and many of its failures and disappointments.

Much of this absence of mind might be avoided if concentration of thought upon one subject at a time were made a prominent part of education. Children should be accustomed to think earnestly for short periods, and then to dismiss the subject wholly from their minds. Weariness, listlessness, and half-hearted attention should always be prevented. It is far better for a child to play with his whole soul than to study with but a fragment of it. If he be thus trained in his youth, if work and play and study, each in their turn, absorb him utterly for the time, there will be but little danger of his growing up to be an absent-minded man. Those in mature life who have unfortunately acquired this pernicious habit may, by a similar process of self-culture, gradually overcome it. No one who indulges in it can make the most of his powers in any direction or give out to the world his full value; and certainly no one in our present varied and complex civilization can fulfil his manifold relations in life unless he resolutely bring all the powers of his mind to bear upon each one of them in its own appointed season."

Discoveries.

Discoveries in Science are the result either of experiment, of thought, or of chance. An experimental discovery is usually the result of a well planned attack upon some fortress of Dame Nature—every step, every sap, and every battery being well considered and faithfully followed; or it results from the attacking force perceiving indications of some sunken mine, or unknown treasure, and following it up with care and determination. Davy's discovery of the safety lamp is an example of the first kind. Something was wanted—its requirements were well defined; Nature was asked to supply those wants and requirements, and she was forced, by experiment and enquiry, to reply. Faraday's discovery of magneto electricity was of the second kind. He was engaged in solving a difficult and intricate problem; something attracted his attention, he followed it up, traced it out, and was rewarded with the discovery of what ought to be universally called *Faradaism*.

A discovery the result of pure thought must be bared on experience. An experiment sets

—" that inward eye
That is the bliss of solitude "

a-working. The imagination is brought into play. Thought pictures something that should be, and observation finds out that it is. Graham's discovery of dialysis, and of the occulsion of hydrogen by iron, was of this character. So have been the innumerable additions made to organic chemistry by Liebig and his followers. So have been the strides made in the theory of energy by Mayer, Joule, Thomson, Clausius, and others. Experiment has set the ball rolling, thought has kept it going, and imagination has said: "If I only direct it in such a path I am sure to alight on some treasure, or it is sure to bring me to the goal I seek."

Discoveries cannot be said to be the simple result of pure chance. Newton and the apple are said to have led to the discovery of gravitation; but the apple was only the means to direct the thoughts of the philosopher in a certain channel, which certainly led to success; but he had been previously pondering and weighing innumerable other channels and courses. Galvani and the frog are said to have led to the chance discovery of voltaic electricity; but the frog may have jerked its legs on the professor's balcony, or skipped into the physicist's laboratory with the energy of a ballet dancer, before it would have led to the discovery of current electricity unless there had been a trained mind to watch its antics, to follow up its peculiarities, and to ferret out its indications.

Daguerre's discovery of the influence of the vapor of mercury upon sensitive plates of silver is another which is included among chance discoveries. He had been experimenting on silver plates rendered sensitive by iodine, and had, after exposure, put them in a cupboard full of chemicals. To his surprise he found, after a time, pictures develope themselves on the plates, attributing the effect to some chemical. He removed the chemicals one by one, until all had been removed. The effect, however, continued. He then found an unknown and forgotten flask of mercury, which gave out its vapor, and thus produced the effect observed—and this was the origin of the daguerreotype process. But this was not purely the result of chance. It was the previous training and previous experience which arranged the conditions that led to the discovery, and which enabled the mind to seize upon those very facts which resulted in success. Training and experience are therefore essential in seizing upon abnormal indications of Nature, as they are in comprehending and appreciating her laws and applying them effectively to practice.
—*Telegraphic Journal.*

THE STEAM MAGNET.—M. Donato Tommasi states that, if a current of steam at a pressure of 5 to 6 atmospheres is passed through a copper tube of 0·08 to 0·12 inch diameter, and coiled spirally around an iron cylinder, the latter is magnetized so effectually that an iron needle, placed at the distance of some inch or two from the steam magnet, is strongly attracted, and remains magnetic as long as the steam is allowed to pass through the copper tube.

IMPROVED HAND CART.

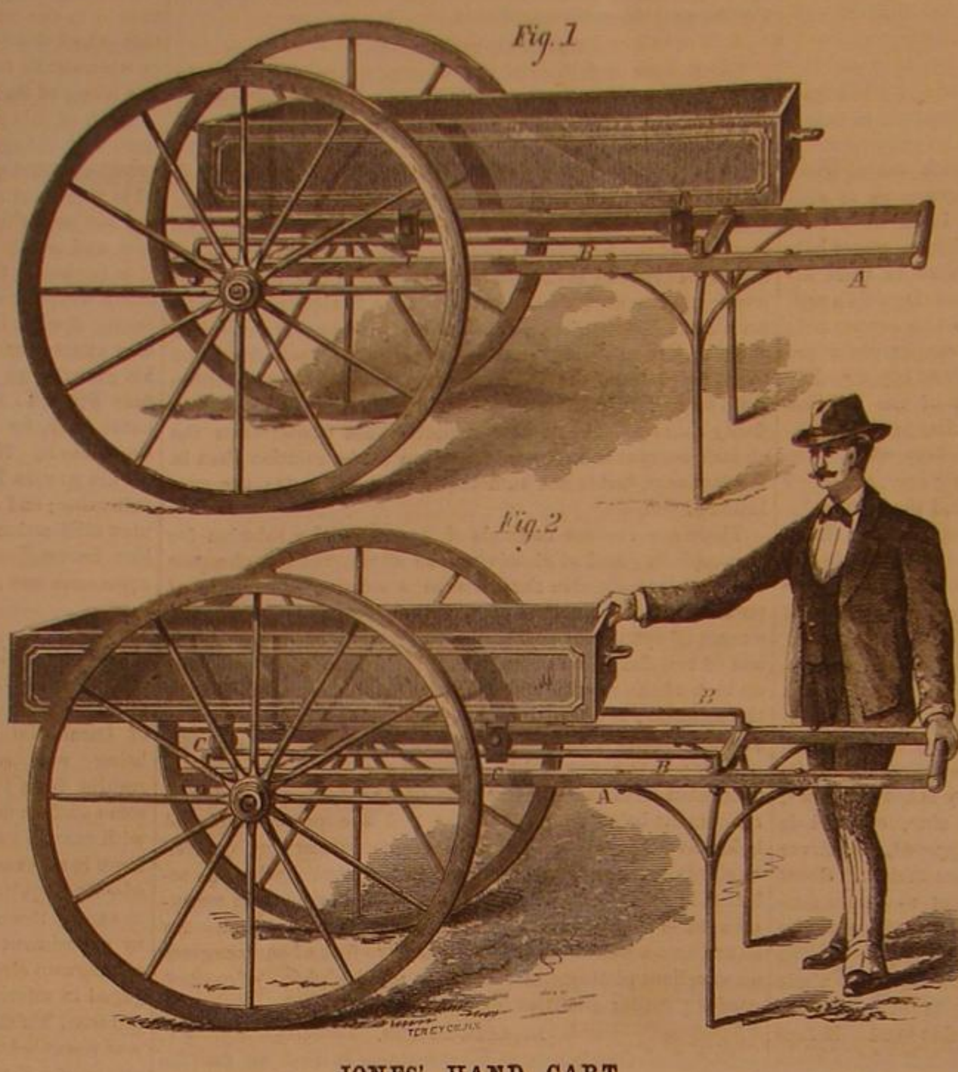
The ordinary hand cart is open to two objections: first, the impossibility of loading from the rear on account of the disposition of the vehicle to tilt; and second, the inconvenience of loading at the side, owing to the wheel being in the way. Both of these difficulties, it is claimed, are overcome in the invention illustrated in the annexed engravings, which consists in an arrangement of the bed so that it slides back and forth at the will of the operator.

A is a frame attached to the axle of the cart and further supported by the braced standards shown, which rest on the ground when the cart is stationary. On the top side of the frame are secured the metal runners, B, upon which clips, C, having eyes, and attached to the bottom of the vehicle body, fit. These clip eyes are loose upon the runners, so that the body can be moved forward from the axle, as shown in Fig. 1, to allow of loading without the interference of the wheel. When the loading is finished, the body is pushed back and balanced over the axle, as shown in Fig. 2.

It will be seen that the standards give the body a firm support when the same is pulled forward. The inventor suggests that, as there is no establishment in this country which makes a specialty of hand cart making, a profitable trade might be monopolized under his patent.

The inventor, Mr. Joseph M. Jones, desires to dispose of his right for two thirds of the United States; for further particulars regarding which offer, etc., he may be addressed at Paris, Bourbon county, Ky.

Patented through the Scientific American Patent Agency, May 11, 1875.



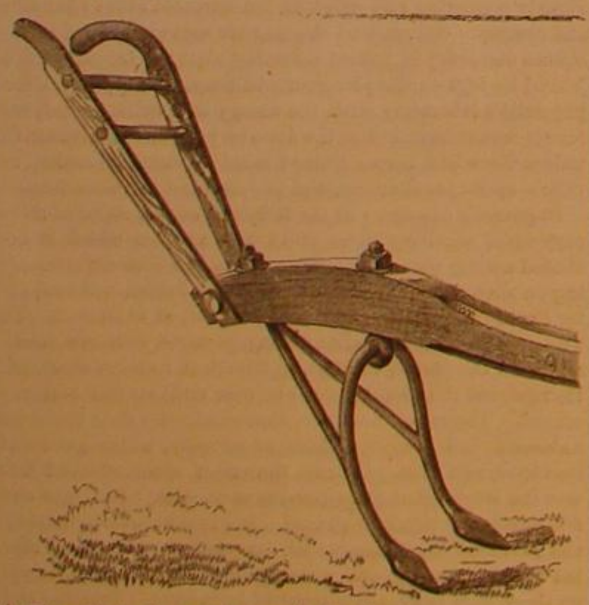
JONES' HAND CART

Feeding Marine Boilers.

The use of a second boiler for the purpose of providing a supply of fresh water to keep up the feed to the main boilers of ships fitted with compounded engines, is becoming very general. Various contrivances have been adopted also with the view to utilize the working power of the steam of this second boiler by passing it through the engines before allowing it to go to the condensers. The *Societa Nazionale* of Naples have adopted the following plan in the engines fitted by them to the ships of the Italian navy: The small boiler is vertical, with a number of transverse tubes of very simple arrangement. These boilers are easily cleaned by loosing a joint and removing the outer shell, which leaves all the parts in contact with water and steam exposed. These boilers are also used for other purposes, such as working pumps and winches, and are not always in use for their primary purpose.

DUNN'S IMPROVED VINE RAKE.

The invention illustrated herewith is an implement for pulling sweet potato or other vines off from the ridges preparatory to the digging and plowing of the ground. It consists of a supporting plow beam provided with lever handles of the usual construction, and having, in place of the plow stock and share, a fork or rake made with two forward curved teeth. This is rigidly secured to the beam by a central eye bolt and rear braces.



The rake is drawn by a pair of animals, one walking on each side of the ridge to be cleared. The beam is placed directly over the top of said ridge, with the teeth on the sides of the drill, at base of the vines. As the team advances, the teeth pass under the vines and tear them loose from the ground, carrying them along until the rake becomes full. The implement is then pulled back and raised clear of the gathered vines, and again started to clear another section of the field.

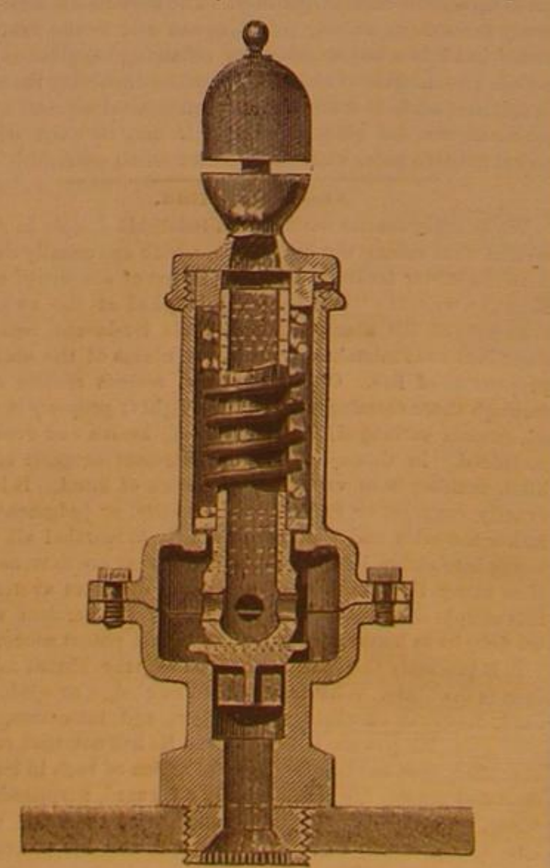
Patented through the Scientific American Patent Agency, April 20, 1875. For further particulars address the inventor, Mr. Joseph W. Dunn, P. O. Box 8, Corpus Christi, Texas.

The Odorless Broiler.

This consists of a gridiron of the usual kind, fitted within a case of tin, so arranged that, when placed over the fire of an ordinary stove or range, the smoke and odors of the cooking operation, instead of escaping into the kitchen apartment, are drawn into the fire and go up chimney. We are using this improvement in our household, and therefore speak from experience when we say that it operates with success, prevents all escape of smoke and odors, and, by concentrating the heat upon and around the meat, insures, we think, better cooking. Housekeepers will highly appreciate this invention. Maker and patentee, Joseph Mansfield, Jefferson, Wis.

SMITH'S STEAM SENTINEL.

An English inventor has recently produced a combined safety valve and whistle, which cannot be tampered with, and is, as will be seen from our engraving, an efficient and simple device. The safety valve is conical, and is kept in



place by a spiral spring, which is carefully adjusted to the required pressure. The lifting of the valve is at once made known by the sounding of the whistle.

Consumption.

At a recent meeting of the New York Academy of Medicine, the pathology and etiology of pulmonary phthisis, in relation to its prevention and early treatment, was described. The discussion was opened by Dr. Leaming, who gave an abstract of Dr. Hudson's paper

Dr. W. H. Draper said that phthisis in its early stage was one of the most unsatisfactory diseases that we had to deal with. The recent pathological views were only of indirect benefit in guiding us. Laennec held that phthisis was always tuberculosis; but Dr. Addison, in 1846, declared that inflammation was the object of destruction in every form of phthisis, and at that time his views were coincided with by some of the French pathologists. If phthisis, said Dr. Draper, is inflammatory in its nature, rest is and must be one of the most important ends to attain in its treatment, and any action, exercise, or anything which tends to increase the pulmonary circulation, of necessity is contraindicated. Dr. Roberts, of London, and Dr. McCree, of Belfast, have followed this out with good results in strapping the chest, and thus keeping it to a great extent in a quiescent state.

Those who ignore the element of inflammation in the disease consider rest prejudicial. In respect to climatic influence, there can be but little advantage gained beyond allowing the patient to live out of doors a great part of the time. Patients, however, frequently derive more benefit from a residence in the Northwest than they do from more southerly latitudes. Phthisis as a disease is most common in the tropics, and decreases in frequency toward the extreme north or the extreme south. Elevated regions have also a beneficial effect, and in mountainous sections phthisis is relatively unknown.

Dr. John C. Peters did not think that phthisis should be considered as an inflammation, though it might provoke it He was strongly convinced of its dyscratic nature.

Dr. Sullivan was of the opinion that the subject of defective ventilation had a most important bearing on the production of phthisis, and brought forward different facts to substantiate his views.

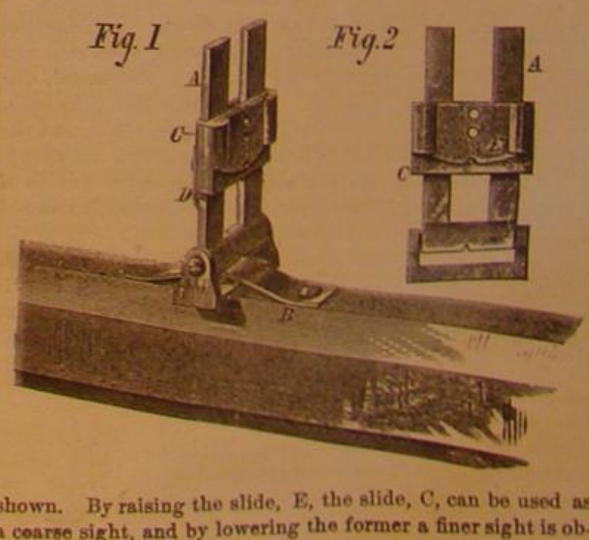
Dr. Willard Parker coincided in the views of Dr. Sullivan in respect to ventilation, and thought deficient sunlight also a most important factor to consider in reference to the etiology of the disease. He was strongly opposed to the plan of rest for consumptives in the beginning of the disease. The cases that do best are those that spend most of their time in outdoor exercise. He cited different cases in which the disease had made decided progress, and which were thoroughly cured by a life of activity outdoors.

Dr. Hubbard said that the same climate did not suit all patients; some patients do exceedingly well in Santa Barbara, where the thermometer does not vary more than ten degrees the year round; while others, who are not benefited there, improve by moving sixty or seventy miles inland.

HARRINGTON'S IMPROVED GUN SIGHT.

The invention herewith illustrated is a globe or peep sight which may be adjusted so as to present either a coarse or fine sight as desired. It can be attached to any gun, and is claimed to insure accuracy in shooting.

A is a slotted standard suitably hinged to the barrel and held upright by the spring, B. C is an adjustable slide held in any desired position by the spring, D, engaging in notches on the standard. This slide is provided with a sight hole. E is another slide adapted to move in guides on the slide, C, and pierced with a number of holes of different sizes, as



shown. By raising the slide, E, the slide, C, can be used as a coarse sight, and by lowering the former a finer sight is obtained. The finest sight hole that can be seen through may be used, and generally the size of the orifice may be easily changed to suit differing conditions of weather, whether bright, overcast, or dark.

Patented February 25, 1873. For further particulars address the inventor, Mr. Munson W. Harrington, York Center, Iowa county, Iowa.

GLYCERIN paste for office use may be prepared by dissolving 1 oz. gum arabic and 2 drachms glycerin, in 3 ozs. boiling water.

SWIMMING.

Mr. Paul Boyton's feat of crossing the English Channel by the aid of a life-preserving dress tends to prove the value of a knowledge of how to swim almost as much as it does the efficacy of the invention tested. While the dress afforded buoyancy to his person, the wearer, through his expertness as a swimmer, knew just how to use his members so as to aid in his propulsion, with the least expenditure of power. The season is now at hand when the water becomes sufficiently warm to allow of bathing at almost any hour of the day, and hence the present is an excellent time, for those who contemplate acquiring this very necessary part of the knowledge of self-protection, to begin.

The manner of swimming properly is as follows: Supposing the bather to be in the water, he throws himself forward on his stomach, his whole body being only just covered by the water and no more; his hands are brought up under the chin, knuckles upward and with the first fingers touching each other: the whole palm is slightly contracted so as to form a concave surface, and the fingers are pressed closely together. The legs are drawn up as short and as near the body as possible; the breath is fully inhaled; then the stroke is made; the hands and feet are both darted forth to their fullest stretch at the same moment; the former are still kept close to each other, and the balls of the toes are made to touch, in which position they remain unmoved till the whole stroke is finished. The hands, fully extended, are then separated and moved round, each describing part of a circle till they are opposite the shoulders, and then the stroke is finished. But observe that which is of most consequence; the exhalation of the breath begins with the stroke, and is slowly continued as long as the striking lasts; indeed, the quantity of breath determines how long the stroke will be, for it is taken only once at every stroke. It is very measuredly given out by a good swimmer, and all the time he is breathing forth he brings his hands round, making the lungs and the hands work and cease working together. The legs all the while, after the first rapid kick, remain stretched out rigidly, with the heels quite close to the water surface; thus a flat position is secured, which greatly conduces to speed.

BOYS LEARNING TO SWIM.

The hands are only slightly propulsive; their chief use is to act as a cutwater, cleaving the way for the body, but, much more, to prolong the impetus given by the legs, and to eke it out to the utmost. The breath acts as a float to the whole, and cannot be too carefully husbanded and proportioned to the long sweep of the arms. A swimming stroke resembles that of an oar in its perfection; for it is quick forward, evenly pulled out, and the recovery for a new stroke is rapid; and on these two things, namely, lying truly horizontal just under the surface of the water, and proper treatment of the breath, the art of swimming depends.

In entering the water head foremost, or "taking a header," as it is called, the water should be struck by the forehead bone, just below the hair—the hands having first cloven the water, as shown in the illustration. The angle which the body should form with the water should be less than *half a right* angle, or from thirty-five to forty degrees, as shown in the diving figure in the annexed engraving, selected from the *Art Journal*. Then recovery upwards is rapid, and the appearance of the whole graceful. Adepts have brought this branch of the art to such perfection that they can jump into less than two feet of water without touching the bottom.

In fresh water a strong swimmer will move fully five feet and a half at every stroke without great exertion. How many strokes he will make in a minute must depend on his breathing capacity; twenty-five to twenty-six would probably be the average. This will give fifty-eight yards per minute, or just two miles an hour; and we should think, to accomplish that pace without distress would be a fair criterion of a good swimmer. At racing pace the strokes are much more rapid, exceeding fifty per minute; and the highest speed that seems attainable is thus eighty-eight yards, or exactly three miles an hour.

Mastodon for Yale College.

Professor Marsh has secured, for the Peabody Museum of Yale College, the skeleton of a large mastodon, exhumed by Mr. A. Mitchell on his grounds at Otisville, seventy-five miles from New York and within a mile and a half of the Erie railroad. The bones were found on and in clay, beneath a deep bed of muck, and are in an excellent state of preservation. This Otisville mastodon is the sixth that has been found in the swamps of Orange county, N. Y.

THE GROUSE FAMILY.

Of the many feathered races that afford beauty to our moors and woodlands, sport to our gunners, and food to our tables, the grouse is one of the most distinguished. There is a great variety of birds known under this generic name, including species widely different, as for instance the ptarmigan and the black cock, or the capercailzie and the cock of the plains. The sand grouse (*pterocles*) is found in the arid deserts of Asia and Africa, also in Southern Russia. The wings are long and pointed, and the powers of flight are exceptionally great; and the toes are connected by a membrane, enabling the birds to run rapidly on loose sand. Their plumage is variegated, brown, gray, and ochereous yellow being predominant. Though the birds associate in pairs, they are often met with in flocks, and they are striking objects on the wing, being beautifully marked. Their flesh is, strange to say, coarse and flavorless.

THE SAND GROUSE.

The hen lays her eggs in a hole in the sand, and hatches out her young, which are soon able to obtain their own living, being strong and hardy.

The British Telegraphs.

From the annual report of the Post Office Department of Great Britain, just rendered to Parliament, we gather that the total receipts for telegraph service for the year ending March 31, 1875, was $5,600,000, and the expenditures for the same, $5,965,300, showing a net loss of $365,300. The Chancellor of the Exchequer, referring to the telegraphs, in his speech on the budget, took a rather gloomy view of what he termed a remarkable experiment, and held the results up before the House as a warning not to enter into any other kind of business which could better be carried on by private enterprise. He said: "Undoubtedly the telegraph service has not yet been brought into a remunerative condition. We are not as yet paying our way, and are contributing very little toward the interest on the debt incurred for the purchase."

The telegraphs of Great Britain have already cost that government about $60,000,000, and there are claims still pending which will amount to several millions more. Every year the deficiency has been enormous, to say nothing of the loss of interest upon so vast a sum. This latter item alone, at the low rate of 3½ per cent, amounts to $2,100,000 yearly. At the prevailing rate of interest in this country, 7 per cent, this loss would, of course, be twice as great. All of this has to be met, and there is but one way to meet it—by increased taxation. In this manner the burden of affording telegraphic facilities at less than cost, to the one per cent of the population whose business necessitates their use, falls upon the ninety-nine per cent who do not use the telegraph at all.—*Journal of the Telegraph.*

How Inventions are Made.

The life of George Stephenson proves that, notwithstanding the novelty and great importance of his improvements in steam transit, he did not discover these improvements. He did not discover that a floating embankment would carry a railway across Chat Moss, neither did he discover that the friction between the wheels of a locomotive and the rails would enable a train to be drawn by tractive power alone. Everything connected with his history shows that all his improvements were founded on a method of reasoning from principles, and generally inductively; to say that he "discovered" our railway system, according to the ordinary construction of the term, would be to detract from his hard and well earned reputation, and place him among a class of fortunate schemers who can claim no place in the history of legitimate engineering.

Count Rumford did not by chance develope the philosophy of forces upon which we may say the whole science of dynamics now rests; he set out, upon a methodical plan, to demonstrate conceptions that were already matured in his mind, and to verify principles which he had assumed by inductive reasoning.

The greater part of really great and substantial improvements which have performed any considerable part in developing modern mechanical engineering have come through this course of first dealing with primary principles, instead of groping about blindly after mechanical expedients; and present circumstances point to a time not far distant when chance discovery will quite disappear. —*Engineering.*

Mastic for Iron and other Materials.

The following is the composition invented by M. I. Machabee, which is said to preserve iron from rust, and also to be applicable to other materials, such as stone or wood, used in conjunction with iron or other metal, in the formation of reservoirs or other works: Virgin wax, 100 parts; Gallipoli, 125; Norwegian pitch, 200; grease, 100; bitumen of Judea, 100; gutta percha, 235; red lead, 120; and white lead, 20, all of which, says the inventor, have their special value. The materials are mixed in a boiler in the order in which they are given, the gutta percha being cut up in small pieces, or rasped. The mixture must be well stirred at each addition, and, when homogeneous, is poured into molds, and looks like chocolate. When used for preserving iron from rust, it is melted and laid on with a brush; but for stopping holes, etc., it must be in a pasty state. It may also be used as a glue to fix a piece of metal over a hole. For certain purposes, such as stopping holes in large vertical metal surfaces, the composition is slightly varied, the Gallipoli being reduced to 115, the bitumen to 90, and the red lead to 100, while 40 parts of gum copal are added next to the gutta percha.

Tasmanian Devils.

The United States steamer Swatara lately arrived at this port from Australia, with the instruments and apparatus used by the American astronomers during the late transit of Venus observations.

Among the curious animals brought home by the officers are a *sarcophilus ursinus*, or Tasmanian devil. This hideous creature is said to be the only living specimen in this country, and it will probably be sent to Central Park for exhibition. In appearance it has some resemblance to the American raccoon. It is carnivorous, and in its wild state principally lives upon birds, rats, and other smaller animals. Although partially tamed, it is deemed necessary to keep the creature confined on deck.

There is also on board a wombat or Tasmanian hog, which lives upon vegetable matter. Several kangaroos, with a walloly and two beautiful Gordon setters, were also noticed playing upon the deck of the Swatara; while a number of love birds and parrots, and a Sultana bird, were caged in different portions of the vessel. A fine collection of Australian ferns has been made by several officers connected with the expedition.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of Ohio.

PATENT FEED WATER FILTER.—THE STILWELL AND BIERCE MANUFACTURING COMPANY *vs.* THE CINCINNATI GAS LIGHT AND COKE COMPANY, THE ARMSTRONG HEATER AND MANUFACTURING COMPANY, JAMES A. ARMSTRONG, AND STEPHEN H. STARR.

[In equity.—Before SWING, J.—Decided January, 1875.]

The first claim in reissued patent for feed water heater and filter, granted to E. R. Stilwell, August 24, 1869, which is for "filtering material F, between a series of shelves and outlet, substantially as described," held valid notwithstanding the fact that filters had been used for freeing the feed water for boilers from the matter held in mechanical suspension therein, and the further fact that heaters composed of a series of shelves had been used for a similar purpose to remove from the water the matter held in solution and a portion of that held in suspension.

Although the operation of neither the shelves nor the filter is affected by the union of the two in the same machine, a new result is produced, inasmuch as the water is passed into the boiler in a condition different from that which would have been produced by either of the devices separately.

The Stilwell patent is not invalidated by the earlier English patent of Wagner, since it is doubtful whether the Wagner device could be practically used with success.

There is no force in the objection that the Stilwell patent does not specify what filtering material is to be used. The patent permits the use of any suitable filtering material, and persons skilled in the art could at once use the invention without experiment or addititional invention.

The mere making of a model of an invention held not to constitute invention, as against a patent subsequently granted to another for the same thing.

The alleged anticipation of the Stilwell invention by James A. Armstrong discussed.

It was decided by the court that the respondents infringe the first and second claims of the second patent, namely, the filtering material between the shelves and the outlet, and the arrangement of steam inlet and shelves; and that they do not infringe the first and third patents, as alleged in complainants' bill.

[*Wood & Boyd*, for complainant.
Fisher & Duncan and *John E. Hatch*, for defendants.]

Supreme Court of the United States.

PATENT LOOM.—WILLIAM MASON, APPELLANT, *vs.* E. H. GRAHAM AND W. ROUSE.

[In equity.—Appeal from the Circuit Court of the United States for the District of Massachusetts.—October term, 1874.]

[This was a suit in equity under letters patent relating to an improved picker staff motion in looms, granted to E. H. Graham, October 16, 1860, and reissued May 28, 1867, to the inventor and Wanton Rouse, a half owner in the patent.

The case as decided in the circuit court will be found fully reported in 5 Fisher, 1.

It was appealed by the defendant.]

STRONG, J.

The patent of E. H. Graham, of October 15, 1860, reissued May 28, 1867, for "picker staff motion in looms," has no relation to the mere form of a journal-bearing arm, nor does it consist in arranging a journal-bearing arm in a slot in the rocker. It embraces every combination of a rocker with a bed and loose journal-bearing arms, arranged so as to produce the result described in the specification as effected by the combination.

Inasmuch as defendant employs a combination of a rocker with a bed by loose journals projecting on each side the picker staff, and the combination is effected by means of a journal-bearing arm, it is immaterial that the form of his journal-bearing arm is unlike that of complainant's, or that its mode of attachment is different, so long as it performs the same function in substantially the same way.

Where defendant had been in the habit of selling the infringing picker staff motion both separately and attached to looms, in ascertaining his profits upon those sold with the looms, regard should be had to his profits upon those sold separately, rather than to the aggregate profits made by him upon the loom and attachment combined.

If defendant has cheapened the cost of producing the infringing device by an improvement of his own, he is entitled to a corresponding credit in the ascertainment of the profits which complainants are entitled to recover.

[*Benjamin Dean*, for appellant.
J. E. Maynadier, for appellees.]

NEW BOOKS AND PUBLICATIONS.

THE MOSAIC ACCOUNT OF CREATION, THE MIRACLE OF TO-DAY: or New Witnesses to the Oneness of Genesis and Science. By Charles B. Warring. New York city: J. B. Schermerhorn & Co., 14 Broad street.

Scientific students who attempt the task which Mr. Warring has imposed upon himself must be careful not to underrate its magnitude, and must prepare for vigorous attacks from both classes of polemics. The author, in the work now before us, has assembled a large number of coincidental similarities between the Genesitical account and the revelations of research; and although his zeal has induced him to claim as proofs some points which are rather fanciful and far-fetched, the book will repay any one who will read it attentively; for it contains much laborious thought and many evidences of careful study, and shows that the author has not too hastily thrown himself into the arena of combat. But the battle is not likely to be ended for some time; and we are not yet able to pronounce whether either side, the theologians or the sceptics, or the "harmonists" (to coin a word to describe the most recent writers), are likely to secure even a temporary victory.

HISTORY OF THE UNITED STATES OF AMERICA. Illustrated. Supplied to subscribers only, in parts at 25 cents each. New York city: Cassell, Petter, and Galpin, 596 Broadway.

This is another of the many series of finely illustrated standard works which have gained for the above named publishers an enviable reputation, both in this country and in England. The history begins with Sir Walter Raleigh's attempted colonization of North Carolina in 1584-5; and it will embrace all subsequent events up to the present time. The illustrations are excellent specimens of the wood engraver's art, and are lavishly interspersed throughout the text. Many of them are of especial interest as *facsimiles* of old pictures, documents, etc. The work is written in a clear and graphic style, and seems to fulfil all the requisites of a popular descriptive history.

THE ARTIZAN'S GUIDE AND EVERYBODY'S ASSISTANT, embracing nearly Four Thousand New and Valuable Receipts, Tables, etc. By R. Moore. Price, in cloth binding, $2.00; morocco, $3.00. Rouse's Point, N. Y.: John Lovell & Sons. Montreal, P. Q.: The Lovell Printing and Publishing Company. New York city: John Wiley & Son, 15 Astor Place.

A copious selection of instructions for using various industrial and domestic processes, well arranged and edited. The articles are classified by the trades for use in which they are designed, and so form, in many cases, complete treatises on the subjects.

DIGEST OF THE UNITED STATES PATENTS FOR PAVING AND ROOFING Compositions to January 1, 1875, and English Paving Compositions to January 1, 1874. By L. W. Sinsabaugh, United States Patent Office, Washington, D. C. Price $10.

Mr. Sinsabaugh adds another to a very valuable series, which we hope will be continued till every class of patents has been summarised. To any one engaged in operations involving the use of patented articles, whether as inventors, manufacturers, or merchants, such books are indispensable; and the high price necessitated by the labor of compiling them and their limited circulation is more than repaid by the handiness and facility of reference which they afford.

THE JOURNAL OF EDUCATION, devoted to Educational Interests, Science, Literature, and Art. Yearly Subscription, $2.50; single copies, 25 cents each. Brooklyn, N. Y.: 185 Montague street.

There has been a great opportunity for establishing a high class periodical devoted to educational subjects. The lavishness with which provision for education has been made by all our States has long been matter for congratulation and pride; while the illiterateness of many of the senior pupils causes us to wonder how so much money can be spent to produce so poor a result. The failure is undoubtedly due to imperfect and unmethodical teaching; and the science of imparting instruction needs to be carefully and studiously learnt. To this end, a literature of the whole subject is needed; and the magazine now before us is a long step towards supplying it. It is well written and edited, and is altogether a creditable publication.

NEW YORK CITY DIRECTORY. Volume LXXXIX, for the Year ending May 1, 1876. Price $6. New York city: The Trow City Directory Company, 11 University place.

The organization for compiling this indispensable book should, after 89 years' labor, be tolerably complete; and we are already (June 11) in receipt of a handsomely printed volume, containing a correct list of all persons doing business or occupying houses in New York city, including the many changes which took place as usual early in the month of May. The names in the Directory are 4,468 more in number than those of last year, and the increase of the population within the 12 months may be estimated at 22,000. The whole value of such a work consists in its accuracy; and we feel bound to testify to the care bestowed on its compilation and its consequent value as a thoroughly trustworthy book of reference.

WILSON'S BUSINESS DIRECTORY OF NEW YORK CITY. Volume XXVIII. Price $2.50. New York city: The Trow City Directory Company, 11 University place.

We have here a very compendious classification of the firms and business men of our city, arranged under the heads of their respective professions and trades. Commercial travelers, advertisers, and others wishing to obtain complete lists of persons occupied in any particular calling, will find this directory complete.

A NEW TABLE OF EXTENDED MULTIPLICATION. Devised by George A. McLane, of Chicago, Ill.

This is something of a mathematical curiosity. It is intended to take the place of Crelle's "Tables of Calculation," now generally used in life insurance offices for adjusting premiums, etc. The new table enables an accountant to divine a result involving figures up to 10,000 almost at a glance. For insurance companies, railway clerks, and others, it will save much time and greatly lighten labor. The author may be addressed, care of American Express Company, Chicago, Ill.

TARIFF REVISION, a Reply to the Proceedings of the Philadelphia Drug Exchange on the Proposed Revision of Tariff. By Daniel C. Robbins. New York city: Thitchener and Gastaeter, 14 and 16 Vesey street.

An able and convincing argument against a grinding and unjust monopoly.

ON THE DUPLICITY OF THE PRINCIPAL STAR OF *Nu* SCORPIONIS. By S. W. Burnham. Reprinted from the Royal Astronomical Society's Monthly Notices.

Mr. Burnham is continuing his valuable labors on the double stars, and the paper now before us is a report of an interesting investigation of one of the most remarkable of the binary heavenly bodies.

SKEW ARCHES: Advantages and Disadvantages of Different Methods of Construction. By G. W. Hyde, C. E. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

A valuable treatise on an interesting and somewhat difficult branch of engineering science. It is issued in Mr. Van Nostrand's excellent Science Series.

Recent American and Foreign Patents.

Improved Earth Auger.

Andrew M. Hanna, Kosciusko, Miss.—A cylinder, made of heavy sheet metal, carries a cross bar, to which are bolted blades which are curved into spiral form, and each of which makes about half a turn. To the rear edge of each blade is hinged a valve, which shuts down against the other cutter, so that the earth contained in the cylinder may be raised by and with it. To the upper end of the cylinder is rigidly attached a bail. The shaft is attached to the bail and to the cross bar, and is made in sections, the lower end of each upper section having a square socket formed in it to receive and fit upon the squared upper end of each lower section. The interlocked ends of the shaft sections are secured together by a bolt, pin, or key, so that the cylinder can be raised and lowered by the shaft.

Improved Ironing Board.

Henry Clay Green, Oshkosh, Wis., assignor of one half his right to John H. Gettman, of same place.—This ironing board has, at its upper end, a self-adjusting neck wire, and at the lower end a spring cross bar, and a groove for the bead on the bar. When the bar is turned back, it gives the side of the shirt or other garment a strain, and draws it tight over the board in a proper position for ironing. The shirt or garment being confined at the top of the board by the spring, which adjusts itself to the neck, any required degree of tension may be given.

Improved Hot Air Furnace.

William O. Crocker, Turner's Falls, Mass.—The cover of the base is provided with two rows of holes, communicating, respectively, with the space between the outer casing and a jacket, and the space between said jacket and the combustion chamber. The jacket is perforated by means of a conical punch, so that conical caps project over the opening, which receives the air and cuts it up into numerous jets, and throws it in contact with the radiating combustion chamber. The air which enters inside the jacket passes directly upward in contact with the combustion chamber. The top rim of the fire pot is provided with a series of perforations, so as to enable an indirect draft to take place by causing the products of combustion to pass through the top rim, down the rear side of the fire pot, under the partition plates, up the front side of the fire pot, and through the lower exit. The object of this arrangement is to cause the heated gases to pass over the entire surface of the combustion chamber.

Improved Harvester.

Frederic F. White, Stacyville, Iowa.—To the shaft are attached two chain wheels, around which pass two endless chains, which pass down along the upper sides of inclined bars, around chain wheels pivoted at the lower ends of said inclined bars and around pulleys pivoted to hangers connected with the framework of the machine. To the endless chains are attached cross bars, to the inner ends of which are pivoted the ends of the rakes. By suitable construction, as the rack bars are moved rearward, the rakes will be raised into a position at right angles with the cross bars; and as the rack bars are moved forward the rakes will be lowered into line with the cross bars. The rakes are lowered at the proper time to sweep the grain from the platform up an inclined apron and into a receiver, and raised and held up while moving back to the outer end of the platform by guides attached to the inclined bars.

Improved Single Rail Railway Car.

Chandler McWayne, Colfax, Cal.—Upon the upper ends of posts are crossheads running longitudinally with the track, and having deep longitudinal grooves in their upper sides to receive the base of the rails. The rails are supported midway between the posts by arched braces. To the sides of the posts are attached flat bars for the horizontal wheels to bear against. The car body is made with a deep longitudinal recess extending up from the middle part of the bottom of the car, so that the main weight of the car and load may be below the rail. The trucks, to which the wheels are pivoted, are pivoted in the upper part of the recess in the car body. The passengers and load of the car occupy the compartments in the sides, below the level of the rails. In the upper part of the car body, directly above the rail, is formed another compartment, the floor of which slides transversely in ways in the frame work of the car, so that, by moving the said floor toward one side or the other, the weight of the passengers or load in said compartment may serve as a counterpoise for balancing the car.

Improved Automatic Gate.

Hiram Krom, Dartford, Wis.—This improved gate is constructed in duplicate and aligned parts, rigidly connected to and turning upon a central pivot post, to which weighted cords are attached. The latches are so connected together as to operate simultaneously.

Improved Stirrup.

Joseph B. Waggoner, Athens, Ill.—The bottom turns horizontally on its ends in a yoke, which is pivoted to a suspending yoke which is swiveled to a suspending strap, so that it can turn in a vertical axis. The combined movements thus afforded cause the stirrup to adjust itself to the foot, so as to allow the latter to slip out without the possibility of being caught.

Automatic Car Brake.

F. L. Kirtley, Cleburne, Texas.—This invention consists in improving automatic car brakes by connecting the brake lever with a sliding drawbar, so that, as soon as the engine slows up, the drawbar is forced back by contact with that of the next adjacent car, and the brake shoes applied to the wheels. The drawbar or buffer is jointed so that the shoes may remain aloof from the wheels whenever the cars are backed.

Improved Extensible Safety Bridge.

William Campbell, Floyd C. H., Va.—This invention consists of a series of bars arranged crosswise of the car loosely on rods, which project from and slide forward and backward in another bar connected to the car for supporting them. The loose bars are linked together at the ends to limit the extent to which they may be separated; and the outermost bar of each platform is contrived to couple with the corresponding bar of another car. A practical platform is thus formed whereon persons may walk with safety from one car to the other when the cars are in motion, or the platform may be permanently connected at the middle in one part only for two cars, and be connected and disconnected with a car at one or both ends.

Improved Compound for Scouring White Goods.

Moritz Mayer, 271 East 10th Street, New York city.—This invention is an improved compound for cleaning and dressing white kid gloves and shoes of morocco, sheep, satin, cloth, and similar white fabrics, so as to restore their original glaze and whiteness. The compound consists of a mixture of French chalk and salts of sorrel in water, under an addition of a small quantity of oxalic acid and bicarbonate of soda. The compound is applied by a small sponge to the articles to be cleaned, giving them one or more coats, as required, each coat being exposed to the open air for drying. The inventor claims that any soiled or discolored parts, ink spots, etc., will be completely cleaned without hardening or injuring the fabric, which retains its original pliability, and is restored by the dressing to its former whiteness and luster.

Improved Excavator.

John S. Whitescarver and William C. Whitescarver, Pontiac, Ill.—By suitable construction, by operating a lever, the point of the plow may be raised and lowered, to cause it to run shallower or deeper in the ground. By other devices, a frame may be moved out and in to tighten or slacken an endless apron. The machine may be adjusted to carry the earth up a high grade, or even discharge it into a wagon, and the inner end of the carrier may be readily adjusted to, and held securely at, any desired hight from the ground to receive the earth from the plow.

Improved Railway Track Closer.

Isaac N. Haines, Pomeroy, Pa.—This invention consists of blocks of suitable size, which extend with their top parts over the rails, and slide in base shoes by the action of lever and double crank connections, so as to put the blocks simultaneously on or off the track.

Improved Extensible Ladder.

Edward Clark, New York city.—To the lower part of the side bars of the upper section are pivoted bars, which, when the said upper section is extended, overlap the upper parts of the side bars of the lower section, and are secured by bolts and nuts. This construction makes the joints between the sections the strongest part of the ladder. The novel features in this invention, which is composed of sliding sections, are as follows: To the side bars of the lower section are pivoted two buttons, the lower ends of which are notched to fit upon the rear upper corners of the steps to support the sections. This construction allows a pawl to be thrown back, and cords to be detached from pulleys, allowing the pulley shaft to be used for hoisting purposes.

Improved Refrigerator Car.

Richard Armiger, Baltimore, Md.—This invention consists in making the ice and provision chambers entirely distinct and airtight, so that the moisture from the provisions and in the provision chamber will be condensed at the top and held there in troughs, the provisions being perfectly dry as well as cold. In this state they keep their freshness and flavor during a travel over great distances.

Improved Ore Concentrator.

James V. Pomeroy, Boulder, Col. Ter.—This invention consists of a series of ore pans or troughs, which are placed in detachable manner in a supporting frame, to which reciprocating motion is imparted by concussions with suitable actuating mechanism. The pans are connected by one of the sides being of suitable inclination, and overlapping the edge of the adjoining pan, for facilitating the wave motion of the water, and the separation of light particles on the motion of the frame.

Business and Personal.

Charge for Insertion under this head is $1 a Line.

Notes & Queries

S. W. & Co. will find a recipe for black finish on German silver instruments on p. 283, vol 31.—W. H. S. will find a recipe for fine blacking on p. 283, vol. 31.—J. G. will find a recipe for hair stimulant on p. 363, vol. 31.—R. can clean his rusty guns by using the method described on p. 299, vol. 31.—A. C. C. can stereotype by the paper process as described on p. 333, vol. 30.—J. B. J. can cement marble to granite by using the preparation described on p. 251, vol. 31.—J. B., Jr., will find a full description of colored glass on p. 43, vol. 32.—W. H. H. can preserve eggs by the process described on p. 219, vol. 31.—F. W. A. can mend cracks in cast iron stoves with the cement described on p. 409, vol. 31.—J. C. J. will find directions for making picture canvases on p. 75, vol. 32.—H. L. W. and others will find a description of the production of gelatin relief plates on p. 272, vol. 32.—W. S. H. will find directions for gilding with leaf on p. 347, vol. 31.—W. B. can bronze iron articles by the method described on p. 283, vol. 31.—J. K. A. will find a recipe for a depilatory on p. 362, vol. 32, and for indelible ink on p. 111, vol. 27.—J. McS. should consult Bourne "On the Screw Propeller."

(1) L. J. asks: What composition can I apply to an irregularly shaped brick wall, so as to protect the mortar effectually from the effects of the vinegar generated in apple pomace? A. Coat with tar.

(2) J. H. S. asks: What will remove so-called indelible ink from linen without injury to the fabric? A. Marking inks containing nitrate of silver may be removed by rubbing the spot with a little cyanide of potassium; but it is well to caution those who use this latter salt for this purpose, as it is a dangerous corrosive poison and should be handled with the greatest care, always avoiding any possibility of its getting into an open cut.

(3) A. T. asks: Which is the best external coating with which to paint a cask in which soda water is to be charged and kept for six or seven months? The coating should prevent the escape of carbonic acid gas. A. The carbonic acid would make its escape through any such coating on a cask.

(4) A. B. S. says: Along the Mississippi river, where the water is used for drinking purposes, it is the custom to draw twenty or thirty gallons, which is put into a large earthen vessel, and then a teaspoonful of powdered alum is added and stirred up with the water to clarify it and throw down the sediment, which it does effectually. How does it act? A. The sulphuric acid of the alum unites with the lime held in solution in the water, and forms an insoluble salt which precipitates, and in settling carries down the other impurities with it.

(5) H. E. N. asks: Where can I find a description of Pettenkofer's method for estimating the carbonic acid and ammonia in the air? A. Consult Angus Smith's work entitled "Air and Rain."

(6) W. W. F. asks: 1. What is the gravity of a body which weighs 900 lbs. at the earth's surface, at the distance of 3 miles in the air? A book states that, at 1,656 miles, any object would lose ½ of its weight. Please give a simple rule to work this. A. The question is solved by the equation: $g=g'\frac{(R+h)^2}{R^2}$, where g is the intensity of gravity at the hight required, g' its intensity at sea level, R= radius of the earth, h=the hight desired. If g=32 feet, R=4000 miles. h=1656 miles, then $32=g'\frac{(4000+1656)^2}{(4000)^2}$, and g'=16 feet, which is one half its value at sea level.

(7) R. asks: Will an ordinary gas meter register more without the gas being lighted than if it is lighted, the burners in each case being open alike? A party connected with one of the gas companies of New York has been appealed to, and he states as the result of experiments that about 4 per cent more gas passes through the burners when unlighted than when lighted. Is this correct? A. The difference in rate is due to the difference in density and temperature of the unlighted gas and the products of combustion.

(8) M. W. M. asks: What is the simplest and most effective hygrometer now in use, and how can I make one? A. Place side by side two accurate thermometers, the bulb of one of which should be covered with muslin and kept constantly moist by means of a string or small wick which dips into a reservoir of water below. Evaporation takes place from the moistened bulb which depends upon the dryness of the air; and by the coldness thus produced, the mercury in the thermometer is correspondingly depressed. By comparing the difference between the two thermometers, and referring to a published table, you can easily determine the dew point, etc.

(9) J. W. D. E. asks: Is there any kind of cement or other substance that would render a wooden vessel impervious to air and water under a pressure of from 2 to 4 atmospheres? A. You failed to state for what purpose the cask is intended to be used, or the nature of its contents, whether liquid or gaseous, or the conditions of temperature. It is obviously necessary that all this should be known before any one cement can be recommended.

(10) W. P. K. asks: 1. Can borax be used for toning photo prints in lieu of gold? A. Borax has been used with chloride of gold, in place of carbonate of soda. 2. What can cheaply replace gold chloride? A. The old process of sulphur toning is sometimes employed for cheap prints; but although the tone produced by this method bears a close resemblance to that produced by the gold bath, it renders the picture less permanent. The process of sulphur toning consists in adding to the fixing bath of hyposulphite of soda, on immersing the print therein, a few drops of acetic acid, which renders the bath opalescent. This is due to the liberation of sulphur in a very finely divided condition.

What can be used in a small blast lamp furnace? A. Alcohol.

How can I mount a thin glass electrical wheel so that it shall run truly, the center hole being small? A. Place at each side of the plate a small thick disk of hard rubber, fastened securely to the axle, and having between it and the plate a thin washer of soft rubber, the same size as the disk.

(11) J. H. asks: 1. How can I distinguish an imitation from a real diamond? A. In the case of certain silicates, hydrofluoric acid would answer by attacking them; but in the case of various other imitations, it would be necessary to resort to other measures, such as specific gravity, difference of refrangibility of light, etc. 2. Would fluoric acid act on a real stone? A. Hydrofluoric acid is without action on the diamond.

(12) C. F. G. asks: What is the best kind of iron for electro-magnet cores? A. Swedish charcoal iron.

(13) W. O. asks: Will a lightning rod be safe if it runs down inside of a barn, boxed up? I built an addition to my barn on the side where the rod formerly went down on the outside, leaving the rod where it was, and boxing it. A. If the rod was safe before, it is so now. The main thing is to make a good ground connection. It should terminate in earth constantly wet, and have two or three long lateral branches.

(14) L. & D. say: 1. We have a telegraph line ⅝ of a mile in length, of No. 11 galvanized iron wire, and want to use four sounders, magnet wire No. 23, copper covered. How many cups of 4½×7 inches Callaud must we use? A. Twelve cells. 2. What is the most suitable battery to use on 70 feet of copper circuit for an electric bell, and how many cells? A. Six cells of Léclanché. 3. What kind of battery shall we use for nickel plating? A. Two cells of Callaud.

(15) J. M. says: I tried the recipe given by W. H. S. on p. 132, vol. 32, for making a cheap galvanic battery for plating. I used a quart fruit jar and sheet iron for plates. What kind of wire should I use? Will it succeed? A. Use copper and zinc plates instead of iron. This will answer best for plating. You will find instructions for gold, silver, and nickel plating in recent back numbers.

(16) E W. P. asks: 1. In making electro-magnets, is the wire wound on the cores in a continuous coil, like cotton on a spool, or is each layer wound separate and the ends afterwards joined together? A. In a continuous coil. 2. In the Tom Thumb battery, is it absolutely necessary to have a septum of paper around the zinc plate? A. Yes. 3. How large a battery would it take to drive an electric engine for a small boat 3 feet long? A. About 150 of Bunsen's large sized cells.

1. Does the term squaring the circle mean finding a square of the same area as the given circle? A. Yes. 2. Why will not the square root of the area of any circle give the length of one side of a square of equal area? A. It will; but how do you measure your circle?

(17) B. S. F. asks: 1. How can I make iron soft for making electro-magnets? A. Anneal it. 2. Can steel be made softer than iron? A. No.

(18) B. B. asks: Please give me directions for making a small galvanic battery. A. Take a glass tumbler, and place in the bottom a sheet of copper, having an insulated wire attached and extending out of the tumbler. Cover the copper with blue vitriol, and suspend a sheet of zinc near the top. Fill the tumbler with water. Connect the zinc and copper together for 48 hours and the battery will be ready for use.

(19) H. S. J. says: In your issue of April 7, in answer to the question: "How can I prepare mucilage for office use?" you tell F. M. A. to "add a little Bilitter sulphate of quinine to it, to prevent molding." What is Bilitter sulphate of quinine, and in what does it differ from the officinal sulphate? A. The term Bilitter sulphate of quinine probably refers to the bisulphate, which crystallizes in thin plates, and not to the normal sulphate, which forms silky needles.

(20) G. C. M. asks: How can I purify fat oils? I have filtered them and obtained them in a very clear state, depriving them of their color, but I am at a loss how to rid them of their taste and smell. A. Try the addition of a very small quantity of iodate of calcium, and allow to stand 24 hours or more before filtering.

(21) G. W. H. says: 1. I want to light gas by electricity. What size and length of platinum wire shall I use for one burner? A. Of the size of a pin and half an inch long. 2. I want to make an electro-magnet to lift a small weight. What sized wire, and how much, shall I wind on it? A. Seventy-five feet of No. 14 copper wire.

(22) W. J. T. says: I have just finished the construction of a Rhumkorff coil; it gives a severe shock but no spark unless the ends of the secondary wire are almost touching, when a minute spark is perceptible; and the increase of battery power does not increase the length of spark. The coil is constructed as follows: Primary wire, No. 16, copper, about 150 feet, cotton covered. Secondary wire, 7,000 feet No. 24 American gage, copper, not covered, but wound so that a paraffined cotton thread of the same size as the wire is interposed between each coil. Each layer of secondary wire is insulated from the succeeding one, by two thicknesses of paraffined paper, care being taken that, at the ends of the coil, the wires did not slip over the insulating paper and so come in contact. The core consisted of No. 20 annealed iron wire, ¾ inch in diameter and 10 inches long, cemented together with paraffin and introduced in the primary wire. The condenser has 60 sheets tin foil, 5x11 inches, laid between paraffined paper 7x11, and properly connected with the two parts of the circuit breaker. What is the trouble? Probably the first thought that would occur to you would be that the condenser was either improperly made or improperly connected with the primary wire; but that is not the case, as the same condenser works well with another coil in which the secondary wire is somewhat finer, but no longer. A. Use No. 40 wire for the secondary coil.

(23) A. W. asks: Is a quantity of frictional electricity as intense as a similar quantity of voltaic electricity? A. Yes, very much more.

(24) A. R. says: 1. A Russian claims to have invented an electric light: A small tube of glass is filled with a pencil of charcoal, the air is exhausted, and the tube hermetically sealed. A moderate current of electricity is then passed through the charcoal from an ordinary electro-magnetic machine, causing it to glow with a very brilliant, but at the same time soft, light. It is stated that the charcoal lasts for an indefinite period, and that the current required is so small that two hundred of these lights can be easily maintained by a single machine. Does such an apparatus require two carbon points slightly separated, or is the carbon in one piece, filling the tube as described? A. Two carbon pencils are used. One is attached to one pole of the machine, and the other to the other. 2. What is meant by the single machine? A. A single machine means simply one machine. No such results as claimed can be attained.

(25) G. J. W. asks: How can I dye kid gloves black or brown? A. The dyes may be applied either by immersion or by brushing over the surface. The latter method is more ordinarily practised.

(26) W. B. asks: What is suitable for staining a brick wall cherry red, so that it will hold its color? A. It is the practice to paint such walls. Clay can be so stained by oxide of iron, but not the finished brick.

(27) E. E. M. says: I have a work on electricity which tells me that a hollow coil of wire, through which a current of electricity is passing, will draw in an iron bar. I have been trying to make such a coil, but have failed. Will you give me the proper directions? A. Take a small rod of wood 4 inches long, and fasten at each end a disk of wood 2 inches in diameter. Wind copper wire, covered with cotton in close spirals, over the rod and between the two disks, filling the entire space. Then remove the coil and you have the helix. Now connect the two ends of the wire of the helix with the poles of a battery of two large Bunsen's cells, and the coil will attract a small iron bar to its center.

(28) J. G. T. says: 1. I wish to bring a stream of water from a reservoir, in a 1 inch pipe, down a hill and across a level to the bottom of the hill. The fall is 100 feet. How high will it throw the water at the foot of the hill? A. If your pipe is smooth inside, has no sudden bends, and is not too long, and you place at its lower end a conical jet of small aperture, you may throw it half the hight of the fall, or a little more. 2. How high would it throw water if the length of the pipe were 600 feet? A. For such a distance you will need a pipe of larger diameter, otherwise you may not throw the water up more than 20 feet or thereabouts. 3. How much pressure will there be on the square inch under 60 feet head and 100 feet head respectively? A. At 60 feet 26 lbs., at 100 feet 43 lbs., provided the water is at rest; when running, the pressure becomes much less, and then depends on the velocity of the flow and the distance from reservoir.

(29) W. P. D. asks: How can I calculate the amount of air in a given quantity of water, at ordinary temperatures and pressures? A. Water at the moderate temperature of 68° Fah. and 30 inches barometric pressure (15 lbs. to the square inch) contains 0·042 volumes of air, or a little over 4 per cent; a cubic foot (1,728 cubic inches) will contain 72½ cubic inches of air. But the air differs from the ordinary air in that, while the latter consists of 4 parts of nitrogen to 1 of oxygen, the air contained in the water consists of 1 part nitrogen to 2 of oxygen. When the temperature descends, the water dissolves more air; at 50° Fah. the proportion is 0·05 parts or 5 per cent, at 32°, 0·06 or 6 per cent. When the temperature ascends, the air is driven out; while, when the pressure increases, the volume of air contained is exactly proportionate to the pressure, so that, at 2 atmospheres or 30 lbs. pressure, water will dissolve 8 per cent of air, at 6 atmospheres or 90 lbs., 24 per cent, etc.

(30) B. B. asks: What is the proper quantity of soda and tartaric acid to be used to a pound of flour? A. Use 2 scruples bicarbonate of soda and 4½ drachms cream of tartar.

(31) J. H. C. asks: How can I amalgamate nickel and mercury? The nickel melts at a very high heat and the other is fluid at common temperature and is very volatile at a high heat. A. Nickel does not form an amalgam with mercury.

(32) A. S. L. asks: 1. How can I make nitrate of silver (for photography) out of good coin silver? A. Dissolve the coin in pure nitric acid and evaporate the solution to dryness. Ignite the residue until all of the nitrate of copper is decomposed. The residue is next to be exhausted with pure water, and the solution filtered and left to crystallize. These crystals should be redissolved in distilled water and re-crystallized. 2. How can I make gold solution (for the toning bath) out of coin gold? A. Place the coin in any convenient vessel, and pour over it a little nitric acid mixed two and one half times its weight of hydrochloric acid and three times its weight of water; digest at a gentle heat, but do not boil the acid, or much of the chlorine will be driven off in the form of gas. At the expiration of a few hours add a fresh portion of nitro-hydrochloric acid, the same as at first. Continue this until the coin is completely dissolved. Then decant into another vessel carefully, so as not to disturb any sediment of chloride of silver at the bottom of the vessel. Next, dilute largely with distilled water, and add a filtered aqueous solution of common sulphate of iron (6 parts to 1 of gold). Collect the precipitated gold, which is now free from copper, and dissolve in *aqua regia* as at first, and evaporate to dryness on a water bath.

(33) H. L. N. asks: How can I best remove ink spots from writing paper, so as not to injure it? A. Wash with a camel's hair brush dipped alternately in oxalic acid and cyanide of potassium.

(34) L. F. B. says, as to the hight at which a tree has to be cut so that its top will strike a given point on the ground: Square the hight of tree and the given distance from tree to point. Divide the difference of these squares by twice the hight of tree, and the quotient will be the hight from the ground where the tree has to be cut. Example: Hight of tree=60 feet, distance of point to the tree 20 feet; then $60^2=3,600$, $20^2=400$, difference=3,200. $3,200 \div (2 \times 60) = 26 \cdot 6$ feet.

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

We have received a handsome stereoscopic picture made by Mr. E. H. Train, photographer, Helena, Mon. Ter., of octohedral crystals of gold. It was sent by Charles Rumley, Esq.—A specimen of galena has been received, inclosed by a mineral supposed to be kaolin. It was, in fact, sulphate of barytes or heavy spar.—N. J.—It is clay, with some carbonaceous matter and a trace of oxide of iron.—P. F. T.—It is spiegeleisen, a kind of cast iron containing a large percentage of manganese and used in making Bessemer steel.—J. A. T.—No. 1 is hematite coated with crystals of ferruginous quartz. No. 2 is wulferite. No. 3 is analcite.—G. G. B.—It is mispickel, and consists of arsenic 46 per cent, sulphur 20 per cent, and iron 34 per cent. It possibly contains some cobalt, but the samples sent were too small to determine this. It has previously been found at Franconia, Jackson, and Haverhill, N. H.—O. A. B.—It is pyroxene, a silicate of lime, magnesia, iron, and manganese. The percentage of iron is not large enough to make it valuable as an ore.—R. T. P.—It is a mixture of clay with grains of quartz and felspar.—S. L.—It is a portion of a large octohedral crystal of iron pyrites.—C. H. W. Jr.—It is white crystaline limestone.—G. W. B.—There was not sufficient for complete analysis, but there was found to be some chloride of sodium or salt, some sulphate of iron, and oxide of iron.—F. H. McK.—It is a mixture of silex and mica, and appears similar to powder from rocks underlying the coal.

COMMUNICATIONS RECEIVED.

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

On Decay of Teeth. By E. D. P.
On the Mouths of the Mississippi. By O. P. S.
On the Inventive Power. By A. A. M.
On Lightning. By D. B.
On Powder Mill Explosions. By C. H. R.
On Fire Escapes. By L. K. Y.
On the SCIENTIFIC AMERICAN. By D. B.
On the Iron Horse. By F. H. R.
On the Potato Bug. By T. A. C.
On the Fireless Locomotive. By F. G. W.

Also enquiries and answers from the following.

E. H. S.—T. J. F.—A. L. P.—J. B. J.—M. R.—C. C. J.—H. C. T.—J. S. B.—W. C. B.—A. E. Z.—A. L. F.—W. H. G.—H. K.—W. H. L.—C. H. C.—G. M. M.—C. & N.—J. P. H.—E. M. B.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Who furnishes information as to water wheels? Who makes the most accurate water meter? Who buys sumac? Who makes mercury air pumps? Who sells the best blower for using with a cupola?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

May 25, 1875,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Addressing machine, H. H. Herr	163,773
Advertising device, C. W. Reed	163,608
Alarm, burglar, F. H. Hunter	163,779
Apple parer, E. L. Schauck	163,812
Axle box, F. Kelser	163,788
Baby tender and crib combined, A. Baird	163,625
Bale tie, J. M. Goldsmith	163,649
Bale tie, J. N. Smith	163,815
Bale tie, cotton, J. W. Philp	163,803
Barrel faucet attachment, A. Zoller	163,717
Barrel making machine, J. Y. Chapman	163,740
Bed bottom, W. Wood	163,714
Bed bottom, invalid, Ogborn and Kendrick	163,684
Bed bottom, spring, E. O. Bennett	163,627
Bed bottom, spring, E. P. Carter	163,574
Bedstead fastening, W. H. Elliot (r)	6,447
Bedstead fastening, W. H. Elliot	163,757
Bell pull, C. Clay	163,741
Bill file, C. Davis, Jr.	163,750
Bird cage mat, A. B. Hendryx	163,772
Bolts, rounding ends of, J. Nelson	163,797
Boot and shoe, laced, P. Plant	163,804
Box making machine, J. Kisor	163,788
Brewing, E. H. Wiegand	163,827
Bridge, iron, J. B. Eads (r)	6,444, 6,445, 6,446
Bronzing machine, W. J. Barber	163,722
Bucket, dinner, F. E. Heinig	163,654
Buckle or fastener, Lockwood and Ware	163,596
Bullets, swaging, W. D. Hillis	163,656
Burner, argand gas, E. R. Walker (r)	6,453
Burner, vapor, Brown and Watkins	163,634
Burner, gas, F. H. McGeorge	163,600
Butter-coloring compound, J. C. Rorick	163,610
Butter package, H. W. Campbell	163,573
Car axle box, A. A. Freeman (r)	6,449
Car brake, J. Y. Smith	163,612
Car coupling, W. H. Adams	163,718
Car coupling, P. Brown	163,633
Car coupling, Conner and Fritz	163,746
Car coupling, L. W. Powis	163,806
Car-coupling link, J. M. Clem	163,743
Car doors, operating, D. R. Hart	163,770
Carpet stretcher, A. D. Williams	163,712
Carriage, child's, W. Wuerz	163,715
Carriage curtain fastening, C. P. Ketterer	163,663
Carriage jack, R. Eldridge	163,756
Carriage jack, H. E. Nittenger	163,798
Cartridge box, G. E. Bringman	163,570
Chain and wheel, power, J. H. Whitney	163,832
Chair, pivot, J. Lemman	163,790
Chair, tilting, J. M. Waters	163,705
Chairs, etc., bottom for, C. D. Flynt	163,760
Cigar box, C. A. Siecke (r)	6,458
Circuit closer, electrical, L. L. Duerden	163,753
Clothes pounder, W. H. Castle	163,739
Coal hod, J. B. Driscole	163,751
Copper bottom for kettles, A. Cummings	163,747
Corset, L. H. Foy (r)	6,448
Corset, C. L. Olmstead	163,685
Cotton seed huller, F. Streuby	163,702
Crimping machine, O. Noack	163,602
Cup, berry, D. W. Kniffin	163,665
Cylinder cam, M. J. Carney	163,738
Dental flask, W. C. Tracy	163,615
Dental mirror, T. Cogswell	163,578
Dentist's vulcanizing apparatus, H. M. Edson	163,755
Desk, folding seat, U. Smith	163,611
Drill, steam engine, J. Brandon	163,631
Drill valve movement, D. Kennedy	163,785
Drying sized fabrics, W. H. Palmer, Jr.	163,801
Eaves trough hanger, J. F. and L. Hess	163,655
Elevator, hydraulic, T. Stebins (r)	6,459
Engine governor, steam, A. Kendall	163,662
Engine, portable steam, L. Sweet	163,823
Engine, steam, C. W. Hermance	163,773
Engine, rotary, O. Burnett	163,572
Engine, traction, W. H. Milliken	163,681
Engine fire kindler, F. Beanfait	163,723
Engine oscillating valve, W. Haddock	163,651
Fan, helical cone suction, J. White	163,710
Fans, mounting, G. Brueck	163,731
Fanning apparatus, P. J. Bender	163,628
Fare register, Rumming and Uderitz	163,695
Felly plate, J. Y. Sitton	163,698
Fence, farm, Hoffman and Shoemate	163,658
Fence, iron, M. G. Freeman	163,761
Fence post, E. Powell	163,692
Ferro-manganese, making, A. Jullien	163,782
Fire arm, breech-loading, W. H. Elliot	163,616
Fire arm, breech-loading, O. M. Robinson	163,810
Fire place, J. F. Merrill	163,678
Fire plug, water motor, W. W. Harding	163,652
Fracture box, C. Westerkamp	163,829
Furnace, heating and ventilating, S. W. Kimble	163,786
Furnace, metallurgic, T. D. Morgan	163,795
Game and other boards, C. F. Morgan	163,601
Game board, Gourn and Vermilye	163,630
Garments, cutting out, K. McKenzie	163,674
Gas apparatus, Smith and Goldthorp	163,817
Gas purifier, G. H. Wells	163,706
Gas purifier center valve, R. Briggs	163,569
Gas retort, W. Smith	163,818
Gate, farm, W. H. Pratt	163,698
Gate, sliding, J. P. McMurray	163,675
Generator, sectional steam, G. H. Starbuck	163,820
Glassware, making, W. C. King	163,787
Glove fastening, S. W. Glenn	163,764
Grain binder, J. H. Whitney	163,830
Grain tally, S. A. Hazelton	163,590
Harrow, C. Boswell	163,736
Harvester rake, J. H. Mears (r)	6,454
Harvester rake, C. Wheeler, Jr.	163,708
Harvester rake, J. H. Whitney	163,831
Heddle frame, E. S. Pike	163,691
Hook, mousing, Johnsen & Adams	163,660
Hydrant, Fisher & Fiske	163,759
Inking apparatus for hand stamps, D. A. Edsall	163,585
Inkstand, S. Darling (r)	6,443
Jack, lifting, Fayette & Meeker	163,647
Jack, lifting, W. Livingstone	163,791
Jib hand, C. W. Clements	163,577
Journal bearing, etc., C. Wheeler, Jr.	163,707
Kettles, copper bottom for, A. Cummings	163,747
Key fastener, H. Stretcher	163,822
Kiln, charcoal, W. Sparrow	163,700
Label holder, C. F. Barker	163,566
Ladder, extensible fire, J. M. Birchler	163,725
Ladder, extensible fire, Covel, Chace, & Weaver	163,580
Lamp chimney, O. D. Warfield	163,826
Lathe dog, C. B. Davis	163,640
Lathe rest, J. E. F. Leland	163,670
Lathe planing attachment, A. Hoffman	163,657
Lightning rod standard, Reyburn & Martin	163,807
Liquids, filtering, T. R. Sinclaire	163,814
Lock for bags, etc., G. Bernheim	163,629
Lock, permutation, E. Grah	163,767
Loom, J. L. Norton	163,799
Loom harness frame, Casey, Auel, & Johnson	163,575
Loom harness motion, G. Crompton, (r)	6,442
Loom shuttle, J. Rigby	163,609
Loom shuttle binder, A. Mallory	163,671
Lubricator, C. E. Holt	163,591
Mail bag fastener, R. Lee	163,789
Meats, preserving, W. C. Marshall, (r) ... 6,451,	6,452
Milking tube, S. A. Smith	163,816
Mill, feed, O. B. Knapp	163,664
Millstones, dressing, Savage & Coleman	163,811
Molding machine, Peet, Poland, & Willis	163,604
Moldings, enameling, W. Wallick	163,825
Motion for machinery, stop, J. W. Askie	163,624
Motor, J. G. Peterson	163,689
Mowing machine, Wheeler & Case	163,709
Music leaf turner, Cohen & Dietz	163,637
Musical keys, trimming of, M. Pratt, (r)	6,455
Nail blanks, making, T. T. Wood	163,6 9
Nails, heading, T. T. Wood	163,620
Net, fly, L. B. & G. W. Lee	163,668
Organ attachment, reed, H. R. Moore	163,682
Overalls, S. Deutsch	163,751
Oxide of zinc, making white, J. G. Trotter	163,704
Packing for pistons, steam, C. L. Eastman	163,584
Packing machine, A. Ralph, (r)	6,457
Painting machine, W. W. Marsh	163,598
Pantaloons, shaping, J. Kraft	163,666
Pantaloons, shaping, Viets & Shaw	163,617
Paper and cloth, uniting, C. H. Denison	163,582
Paper pulp engine, F. A. Cushman	163,638
Paper pulp-grinding cylinder, C. J. Bradbury	163,728
Paper ruling machine, W. O. Hickok	163,777
Pavement, wood, Filbert & Hoffman	163,758
Pianoforte, upright, B. E. Colley	163,745
Pipes, joint for lead, A. B. Goodall	163,588
Plane iron, J. J. Ralya (r)	6,462
Planing machine, C. B. Beall	163,567
Planing machine, C. R. Patterson	163,802
Planter, cotton seed, J. Dana	163,748
Planter, potato and seed, W. H. Whitman	163,711
Plow, swivel, J. Hapgood	163,589
Plow, wheel, Keys and De Mier	163,595
Plows, row gage for, W. E. Stanley	163,701
Pocket book fastening, L. Messer	163,794
Press, cotton, T. D. Power	163,805
Press, hydraulic, C. Peper ... 163,606,	163,607
Printer's galley, H. H. McWilliams	163,677
Propeller, steering, W. F. Zoehe	163,716
Pump, D. J. Gorton	163,766
Punching machine, C. A. Corman	163,579
Quicksilver, saving, J. W. Varney	163,616
Radiator, steam, S. J. Geoghegan	163,763
Radiator, steam, G. B. Riggins	163,808
Railway head stop mechanism, R. W. Hunton	163,593
Railway rammer head, M. A. J. Wimpee	163,835
Railway switch, street, G. T. Jacobs	163,780
Railway tunnel ventilation, J. Dixon	163,643
Refrigerating apparatus, G. H. Chinnock	163,576
Regulator with dash pot, pressure, Ball & Fitts	163,721
Regulator with safety valve, pressure, Ball & Fitts	163,720
Rubber band, R. I. Patterson	163,688
Rudder post bearing, J. N. Bitting, Sr.	163,726
Saddle spring, C. H. Harris	163,769
Safe, etc., fireproof, W. A. Shepard	163,614
Sails, reefing, I. Solomon	163,819
Sash holder, W. B. Blackman	163,727
Sash holder, R. R. Calkins	163,635
Saw-filing machine, Wilson & Noble	163,834
Saw-setting machine, Heunsch & Beyer	163,776
Scaffold, W. Burge	163,733
Scraps or offal, etc., treating, G. S. Allyn	163,565
Seat, school, B. Allen	163,622
Seat, school, I. N. Pierce	163,605
Sewing machine, G. S. & A. L. Darling	163,639
Sewing machine ruffler, J. D. Sourwine	163,699
Sewing machine table hinge, H. B. Keiper	163,661
Sheet metal, die for forming, H. Martyn	163,793
Shingling bracket, A. P. Fletcher	163,587
Shirt, J. C. Dunham	163,644
Shovel, coal, J. D. Tallmadge	163,703
Shutter bower, etc., G. F. S. & C. Zimmerman	163,6.1
Sign, illuminating, C. H. Seawell	163,697
Skirt supporter, M. P. Bray	163,730
Sleighs, thill coupling for, C. H. Johnson	163,781
Soap, variegating, G. C. Wenzel	163,828
Soap, impalpable, J. P. Bryan	163,571
Spark arrester, locomotive, A. Berney	163,568
Spectacles, J. Gall	163,648
Spinning machine spindle, Rabbeth *et al.* (r)	6,456
Spool holder, C. T. Cleaveland	163,742
Stair curves, scribing, A. Beck	163,626
Stamp-inking apparatus, D. A. Edsall	163,585
Starch lubricant, M. E. Robinson	163,809
Stave jointer, J. J. Ralya (r)	6,461
Steamer and boiler, C. Busch	163,735
Stench trap drain screw, W. A. Butler	163,737
Stereoscope, revolving, J. E. Steward	163,613
Stocking supporter clasp, E. L. Howard	163,778
Stone extracting tool, N. R. Cheadle	163,636
Stone, waterproof artificial, McMurtrie *et al.*	163,676
Stool, camp, N. R. Allen	163,623
Stove, G. W. Herrick	163,775
Stove grate, H. P. Ohm	163,800
Stove implement, L. S. Hoyt	163,659
Stove, heating, A. Brown (r)	6,441
Stove, magazine, W. Doyle	163,583
Stove, magazine heating, G. H. Timmerman	163,824
Stove platform, C. Brownell (r)	6,460
Strainer, milk, J. W. Bray	163,632
Straw cutter, B. Belcher	163,724
Street sweeper, O. W. Kellogg	163,784
Stuffing box, A. J. Myers	163,796
Sugar, manufacture of hard, E. Langen	163,667
Swing, S. McClevey	163,599
Table, folding, G. H. Williams	163,833
Table slide, extension, G. B. Lyman	163,792
Thill coupling, C. O. Gardiner	163,762
Thill coupling, G. G. Larkin (r)	6,450
Thill coupling, S. J. Wiser	163,713
Ticket, L. Brush	163,732
Toy, J. B. Safford	163,696
Toy gun, W. H. Martin	163,673
Trace carrier and back loop, spring, W. Davis	163 641
Trap, animal, G. W. Kelley	163,5
Trap, fly, Arandall & Runyan	163,719
Trap, hog, H. Ogborn	163,693
Umbrella, folding, U. G. Steinmetz	163,821
Valve movement for rock drills, D. Kennedy	163,785
Valve, safety, T. Walker	163,618
Vegetable cutter, J. F. Goolsbee	163,765
Vehicle pole tip, Grimshaw & Osgood	163,768
Vehicle seat, Cloud & Craig	163,744
Vehicle top, L. Sawyer	163,812
Wagon brakes, shoe for, J. Grimste	163,650
Wagon tyres, heating, S. B. Hopkins	163,592
Wagons, brake for hay, W. Harper	163,653
Washing machine, R. G. Orwig	163,686
Watch crystals, grinding, A. C. Norton	163,683
Watch key, A. & F. Hathaway	163,771
Watch regulator, J. A. Miller	163,680
Watches, mainspring for, Rice & Burbank	163,694
Water wheel, I. Mallery	163,672
Water wheel gate, G. W. Dunn	163,754
Well point, driven, D. A. Danforth	163,749
Windmill, W. T. Burrows	163,734
Windmill, S. Cushman	163,581
Windmill, I. Lehmer	163,669
Windmill, W. W. Marsh	163,597
Window blind, S. W. Merrill	163,679
Window blind, J. Peyer	163,690
Wood-boring machine, J. Faraday	163,586
Wool-mixing machine, S. R. Parkhurst	163,687
Wool, etc., treating, O. Braun	163,729
Wrench pipe, G. D. Dean	163,642
Wringing machine, Eisenhart & Lauer	163,645

DESIGNS PATENTED.

8,338.—BURIAL CASKET.—F. A. Field, Everett, Mass.
8,339.—BASE PANEL.—M. D. Jones, Boston, Mass.
8,340.—VASE BORDER.—M. D. Jones, Boston, Mass.
8,341.—VASE PANEL.—M. D. Jones, Boston, Mass.
8,342.—TELEGRAPH KEY.—C. W. Lewis, Chicago, Ill.
8,343.—ORNAMENTAL STAR.—W. Martin, Philadelphia, Pa.
8,344 to 8,351.—CARPETS.—J. M. Christie, Kidderminster, England.
8,352 to 8,354.—BACKS OF LOUNGES.—G. Hartzell, Philadelphia, Pa.
8,355.—NECK TIE.—R. R. Parker, Indianapolis, Ind.
8,356.—LAMP POSTS.—W. Tweeddale, Brooklyn, N. Y.
8,357—CIGAR BOX.—H. Zimmermann, Chicago, Ill.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, May 19 to June 4, 1875.

4,754.—P. W. Hart, Camden, N. Y., U. S. Lathe machine. May 19, 1875.
4,755.—A. Tracy, Pickering, Ont. Horse power. May 19, 1875.
4,756.—A. B. Sheraton, St. John, N. B. Steam carpet cleaner. May 19, 1875.
4,757.—P. N. Rugg, Compton, P. Q. Wash bench. May 19, 1875.
4,758.—J. D. Lawlor, Montreal, P. Q. Washing machine. May 19, 1875.
4,759.—J. Aikman, North Norwich, Ont. Secret lever hinge. May 19, 1875.
4,760.—M. Lesser, Montreal, P. Q. Cigar. May 19, 1875.
4,761.—D. W. Davis *et al.*, Detroit, Mich., U. S. Preparing fish for market. May 19, 1875.
4,762.—G. W. Howell, Covington, Ky., U. S. Elbow machine. May 19, 1875.
4,763.—T. Warren, Flint, Mich., U. S. Safety stop governor. May 19, 1875.
4,764.—J. Wilson, Toronto, Ont., *et al.* Horse clipping and sheep shearing machine. May 19, 1875.
4,765.—S. W. Benham, Sweetsburgh, P. Q. Fire kindler. June 4, 1875.
4,766.—H. L. Smith, Westminster, England. Single rail railway. June 4, 1875.
4,767.—I. Fréchette *et al.*, St. Hyacinthe, P. Q. Boot shank pieces. June 4, 1875.
4,768.—L. J. Atwood, Waterbury, Conn., U. S. Fireside burner. June 4, 1875.
4,769.—G. M. Mowbray, North Adams, Mass, U. S. Mica blasting powder. June 4, 1875.
4,770.—J. Struthers, Alma, Ont. Snow plow. June 4, 1875.
4,771.—J. E. Waterous, Brantford, Ont. Steam condenser and feed water heater. June 4, 1875.
4,772.—T. E. Webber, Pittston, Me., U. S. Harness lug lining. June 4, 1875.
4,773.—C. D. Wilson, Elmwood, Ill., U. S. Picture frames. June 4, 1875.
4,774.—J. Nicholson, Jr., Pittsburgh, Pa., U. S. Glass furnace. June 4, 1875.
4,775.—Wm. Ascough, Buffalo, N. Y., U. S. Pontoon boat. June 4, 1875.
4,776.—T. J. Blake, Pittsburgh, Pa., U. S. Making shovels. June 4, 1875.
4,777.—O. B. Kendall, Buffalo, N. Y., U. S. Water regulator and indicator. June 4, 1875.
4,778.—P. B. Hennessy, Hamilton, Ont. Time lock. June 4, 1875.
4,779.—G. Henry, Lennoxville, P. Q. Boiler feed regulator. June 4, 1875.
4,780.—R. G. McLellan, Woodstock, Ont. Measure indicator. June 4, 1875.
4,781.—H. E. Susand, Berlin, Ont., *et al.* Saw mill dog. June 4, 1875.
4,782.—H. Hagen *et al.*, Toronto, Ont. Marble-veneered concrete. June 4, 1875.
4,783.—Wm. Schnabel, Orillia, Ont. Elastic wooden seat June 4, 1875.
4,784.—A. G. Bayles, New York city, U. S. Gas burner. June 4, 1875.
4,785.—E. Draper, London, Ont. Musical instructor and game. June 4, 1875.
4,786.—Wm. M. Leyde, Newport, Minn., U. S., *et al.* Thrashing machine. June 4, 1875.
4,787.—Wm. P. Yeoman, Waukegan, Ill., U. S. Ear rings. June 4, 1875.
4,788.—L. M. Bissell, Addison, Ont. Sower shaker. June 4, 1875.
4,789.—L. J. Atwood, Waterbury, Conn., U. S. Lamp burner. June 4, 1875.
4,790.—D. A. McDonell, Charlottenburg, Ont. Bob sleigh. May 27, 1875.

INDEX.

ILLUSTRATIONS.

MISCELLANY.

Figures preceded by a star (*) refer to illustrated articles.

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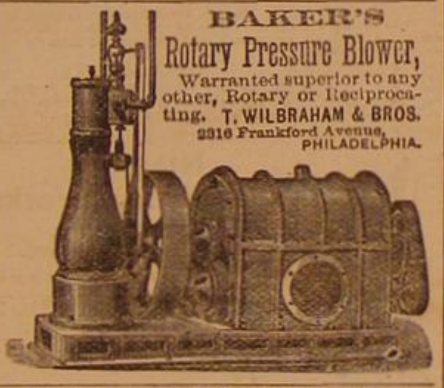

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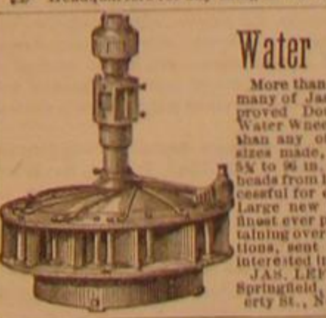

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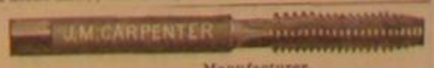

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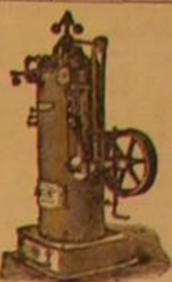

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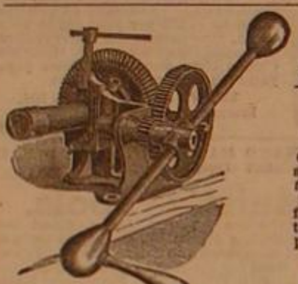

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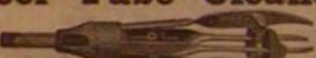

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