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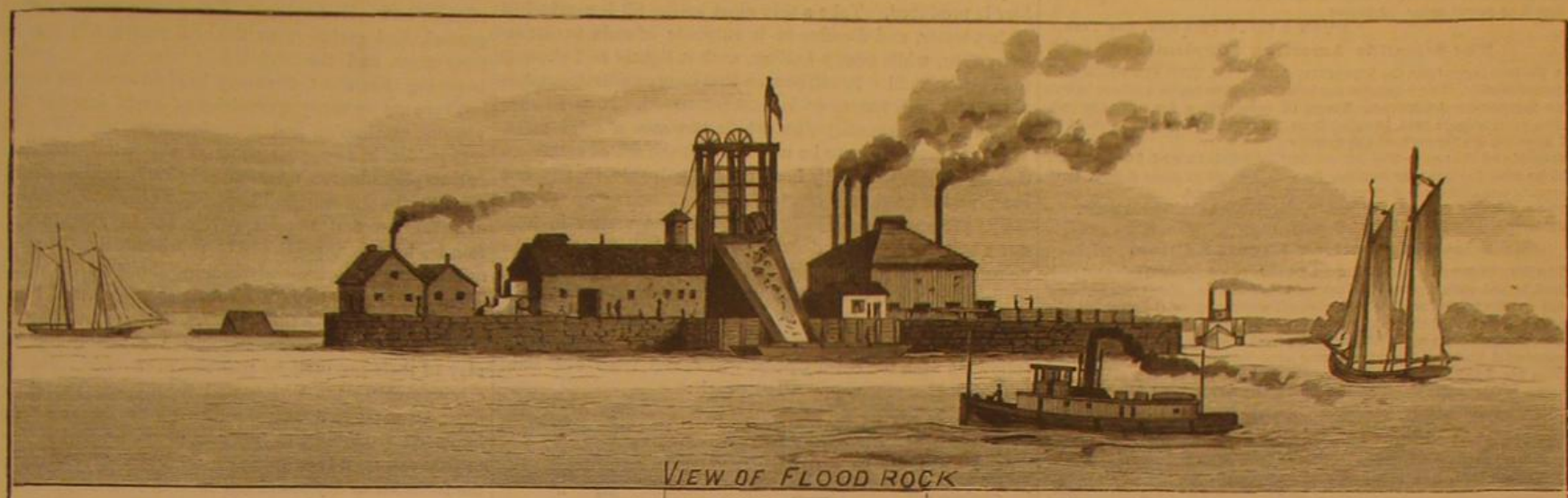
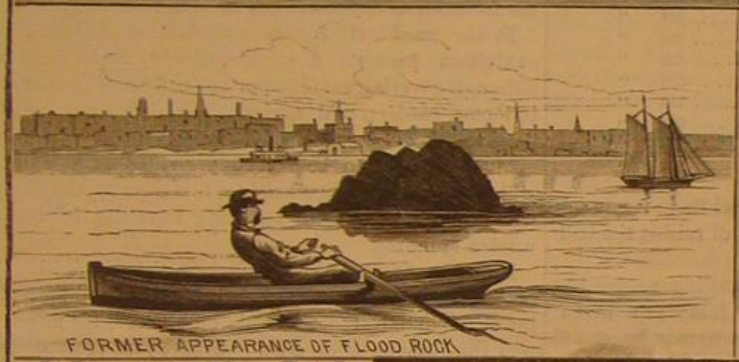
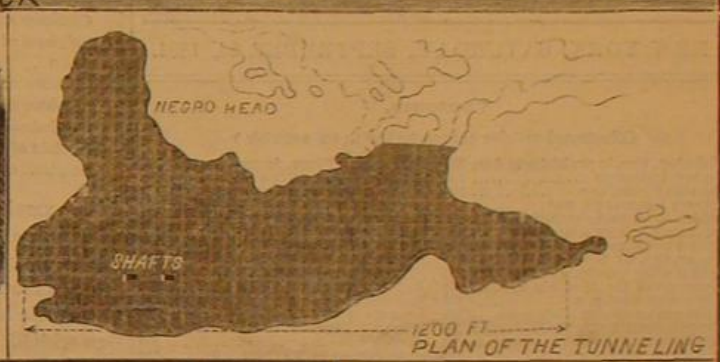


VIEW OF FLOOD ROCK



FORMER APPEARANCE OF FLOOD ROCK

IN THE TUNNEL



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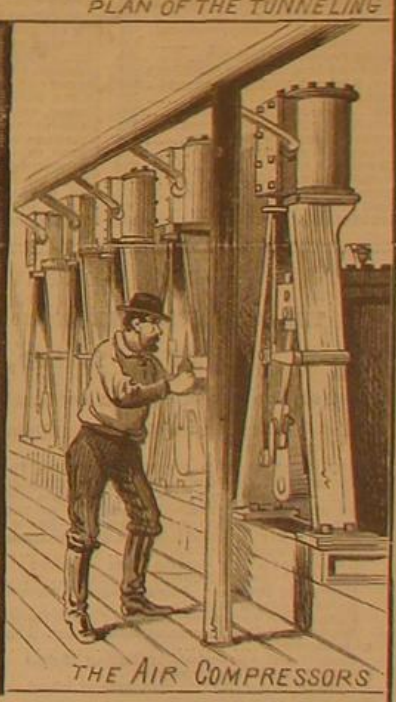

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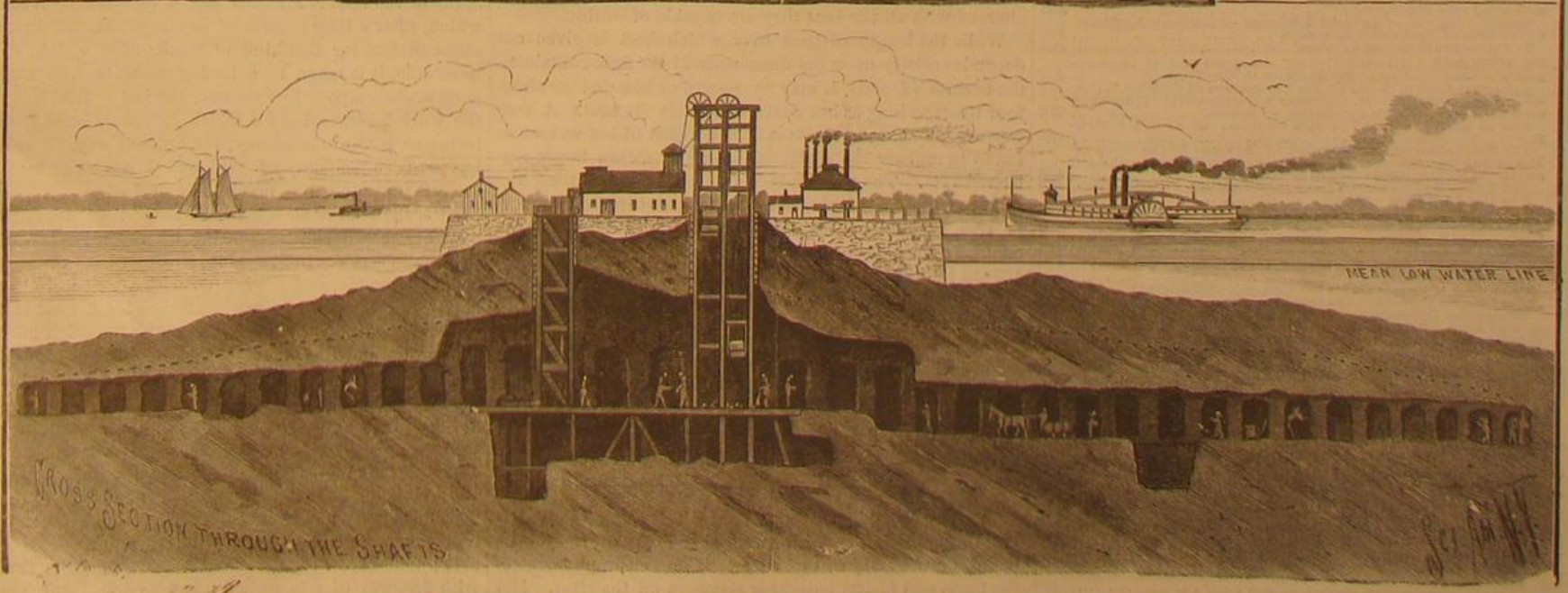

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NEW YORK, SATURDAY, SEPTEMBER 24, 1881.

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STORAGE OF HEAT.

Among the many curious phenomena connected with crystallizable metallic salts, especially those of the alkaline bodies, one of the most interesting is the great influence exercised upon temperature during the solution of such crystals.

It is known that when, for example, a glassful of crushed sulphate of soda (Glauber's salts) is sprinkled with muriatic acid, it becomes liquid, and its solution is accompanied by a degree of cold so intense as to cause any water placed therein, in a second vessel, to freeze; and almost every schoolboy is aware that when common salt is allowed to become dissolved with a quantity of snow or crushed ice the temperature is reduced many degrees below the freezing point. Without going into the subject of the conservation or even the correlation of force, which underlies all actions of this nature, it may be stated that by reversing the experiments just cited *heat* is produced. Take a thin glass bottle, fill it nearly full of hot water, and dissolve in it sulphate of soda to saturation; then, while nearly boiling, cork it tightly and allow it to get quite cold. It will be seen that no crystallization takes place, although the water is supersaturated. Now remove the cork, and speedily the whole becomes a solid mass. What we desire here to be noted is that the act of solidification is accompanied by heat, a fact palpable to any one grasping the bottle.

The presence in water of solid bodies, no matter in how fine a state of division, does not alter its boiling point; but no sooner is a crystallizable salt dissolved in water than the boiling point is at once raised, and different salts raise it to different degrees. By direct experiment Professor Tomlinson ascertained that by making saturated solutions of the following salts the boiling point was raised from 212° Fah. to that degree placed opposite to each:

Acetate of soda	256 degrees.
Nitrate of soda	246 "
Nitrate of potash	238 "
Sal ammoniac	236 "
Common salt	224 "
Sulphate of magnesia	222 "
Alum	220 "
Chlorate of potash	218 "
Sulphate of copper	216 "
Sulphate of iron	216 "
Acetate of lead	215 "
Sulphate of soda	213 "

An examination of this table shows that there is one salt which far excels all others in its property of raising the boiling point, namely, acetate of soda.

Quite recently an invention of an interesting nature has been made in which this salt is the chief factor; an invention which, divested of scientific language, may be stated to consist of the property of the acetate to absorb heat when subjected to it for some time and then to give it out afterward over a prolonged period—in effect to store up heat, which, owing to crystalline changes in the salt itself during the act of cooling, is continued to be evolved from the latent into an active form. That this is the case is indicated by the fact that the vessel containing the salt, after having been two hours removed from the source of heat, has its temperature raised about 6 degrees Fah. during the third hour by its own inner forces alone.

The physical principle upon which this curious invention is based is old and well known, although the application of the principle is novel. The form in which we have obtained a specimen "heater" consists of a somewhat large flask formed of thin sheet brass having its mouth soldered up, for it is never intended to be opened. There is also a metallic loop by which to suspend it in the vessel of boiling water from which it is to derive its store of heat. The length of time required for immersion in the hot water depends upon the size of the heater; for example, if it be so small as to be suitable for being carried in a lady's muff, by which to keep her hands warm, four or five minutes will suffice; but if, on the other hand, the dimensions be such as enact the part of a foot warmer, this time would have to be increased by six or eight times. There are some so large as to require immersion in boiling water for an hour before they are fully charged with all the heat they are capable of storing.

While the length of time over which heat is given out depends entirely upon the dimensions of the flask containing the acetate of soda, it may be roughly estimated as about four times as long as hot water will retain its heat. A foot warmer which upon removal from a vessel of hot water was found to register 153° Fah., at the end of eleven hours registered 111°. The most sudden fall took place during the first two hours, after which the temperature rose a few degrees, gradually subsiding afterward until it became quite cold. In the case just adduced the foot warmer fell from 153° to 126° in two hours; it then rose during the next hour to 131°, taking eight hours to fall from 131° to 111°, which it did with uniform regularity.

There are various purposes to which M. Ancelin, of France, the inventor of this new application of acetate of soda, intends to apply it. One or two have been hinted at in course of these remarks; others, such as keeping food or dishes warm at a distance from a fire, will suggest themselves.

THE Upper Ohio River steamer Telegraph lately left Huntington, W. Va., with twenty car loads of freight on board, drawing 3½ feet of water. The Telegraph is one of the finest and fastest passenger steamers on the river. Her length is 290 feet.

OPENING OF GREAT INDUSTRIAL EXHIBITIONS, BOSTON.

Boston has for many years had an annual Industrial Exhibition of some importance, under the auspices of the "Massachusetts Charitable Mechanic Association." This year it will have two of these "grand fairs," one having been inaugurated Aug. 18, and the other promising to open its doors Sept. 13.

The one first in progress is under the auspices of the "Manufacturers' and Mechanics' Institute," which is in some sense an offshoot or rival of the older organization, though only in a friendly way, and the result is that Eastern industries and progress will be represented in these fairs more completely than ever before, as the men at the head of each have worked hard to make the best show possible. Two large and beautiful buildings have been erected, both of them with some architectural pretensions, the newer association, however, having the largest, covering five acres of ground, and giving with the galleries nearly ten acres of floor space, and the Exhibition now open is much more imposing than any the country has had since the Centennial.

There are so many specialties of great interest to all inventors, mechanics, and manufacturers, as well as the general public, in any great show of this kind, that it is difficult to pick out for mention only such things as would be novelties to one who had kept fully abreast of the progress of invention and the improvements in machinery. The fair is, however, particularly representative of the cotton and woolen factories and machine shops of New England. The great corporations of Lawrence, Lowell, and Fall River, Mass., Manchester and Nashua, N. H., Providence, R. I., and other places have on exhibition probably the best display of their productions that was ever made. But to properly appreciate the variety and beauty of the fabrics they must be compared with those made at the same mills or imported from abroad only a few years ago, when the greatly enlarged capabilities and improved workmanship of the factories to-day stand out in high relief.

In the machinery for the manufacture of these goods the exhibition presents a comparatively small assortment, although covering some important and recent improvements in looms, carders, and mules. The deficiency in this department is due to the fact that many who would otherwise exhibit here are to be fully represented at Atlanta, but it will be somewhat amended in a few days by the tardy ones who are late in putting up some novelties in cotton and woolen spinning.

In the boot and shoe manufacture the Exhibition leaves nothing to be desired. This is by far the leading feature of the show and attracts crowds of visitors, for never before was this industry, in all its departments, so completely arranged to give the public ample opportunity for an examination into the way in which boots and shoes are made. By a happy conceit also, an aged shoemaker, working by hand after the old style and sitting on a shoemaker's bench which had been used by two workmen for a hundred years, occupies a prominent position, as he laboriously "pegs away in the midst of these modern surroundings." About 100 men work here, the machinery running from 9 A.M. till 9 P.M., and the production being about 600 pairs a day.

The leather comes to the Exhibition building direct from the tanneries and currying shops, the sole leather in sides and bundles, and the upper in rolls. The latter is all cut out by hand after patterns, as the workman has to examine the leather carefully to see that particularly strong and good parts come on the vamp or forepart of the boot or shoe. The soles, insoles, and taps are died out by machines which, to an outsider, look far larger than they need be, but this is so that a whole side may come under a cutter's eye at once, and he can place his die so as to save stock, cutting first the thickest parts into outsoles, and the remainder into taps, insoles, and heels.

The uppers, after cutting, are wet, and then passed through a powerful machine which crimps and forms them, drawing the leather out so that it can be lasted easily into proper shape. There are four of these machines. The fronts and backs of the uppers are then sewed together by a machine, which, after a long process of development, has been made about perfect for this kind of work; after which, with the inner sole, it is taken to a lasting machine, and these two parts made temporarily firm over the last. This last part of the work is something for which inventors have long been trying to perfect machinery, but nothing so far brought out has yet been generally adopted, and the machine here in use for this purpose leaves much to be desired.

After the boot or shoe has been lasted there are four different ways shown here of putting on the sole—screwing on with brass screw wire, pegging, sewing direct through from inside to outside, and sewing on with a welt in imitation of handwork. The brass screwing makes the firmest fastening for heavy work, while it does not make the sole unduly stiff and hard; the wire is actually screwed in, so that it does not break and tear the leather. The pegging machine has long been a familiar object at exhibitions, but it is always interesting to the public. The putting on of the bottom with a welt requires two machines, one of which works with a curved needle in a section of a circle, the inner sole, upper, and welt being first sewed, and then the outsole to the welt. This machinery has been improved through several years, until the goods made by it are now meeting with considerable public favor, for they meet that demand for flexibility with firmness of sole which many people think are only surely obtained with handwork.

For the trimming, blacking and staining, buffing, and burnishing of the soles and heels, a number of very ingenious machines are kept at work; but an entirely new thing in the finishing process is a treeing machine, here shown for the first time. It is so arranged that a dozen boots can be operated on at a time and moderately heated by steam while on the trees, so that the stuffing is warmed through with the leather, and the boot can be made to look, as one manufacturer said, "a dollar a case better."

Of the arrangement of goods and machinery, alike for convenience of access, facility in operating, and effectiveness of appearance, as well as the general management of the Exhibition, it may be said that too much praise cannot be awarded the officers and the executive committee. They are public-spirited men, manufacturers and merchants who have inaugurated the enterprise for the pride they have in Boston and in New England manufactures, and in such a spirit they are carrying it on.

PROMOTIONS IN THE PATENT OFFICE.

The following changes were made in the staff of the Patent Office, July 1, 1881:

Marcellus Gardner, of New York; John W. Babson, of Maine; and Schuyler Duryee: from fourth class clerkships to be chiefs of division—salary $2,000.

Samuel B. Roane, of New York; Reuben S. Parks, of Ohio; and Louis W. Sinsabaugh, of Ohio: from second assistant examiner, to be first assistant examiner—salary $1,800.

David G. Purman, of Wisconsin; Marshall B. Cushman, of Massachusetts; Edward M. Bentley, of Connecticut; and Albert C. Fowler, of District of Columbia: from third assistant examiner to be second assistant examiner—salary $1,600.

William L. Augenbaugh, of Ohio, from first class clerk to be second assistant examiner—salary $1,600.

The following have been promoted or newly appointed to the office of third assistant examiner—salary $1,400: John W. Clements, District Columbia, from second class clerk; James B. Littlewood, of Illinois, from first class clerk; Rufus A. Morrison, of Pennsylvania, from copyist; Robert G. Read of Pennsylvania, and Walter F. Rogers, of Pennsylvania, new appointments. George R. Byington, of Cincinnati, promoted from first to second class clerk—salary $1,400.

The following have been promoted to first class clerkships—salary $1,200: William Hendlay, District Columbia; Frederick W. Crocker, New York; St. Clair F. Sutherland, Mississippi; Frank P. McLean, New Hampshire; Thomas Hoge, Pennsylvania; Mrs. Frank R. Lybrand, Ohio; Daniel Clarke, Maryland.

Frederick R. Gantt, from draughtsman, at $1,000, to skilled draughtsman—salary $1,200.

The following rise from copyist, at $900, to first class—salary $1,200: Henry E. Baker, of Mississippi; Julian C. Dowell, North Carolina; Milnor R. Sullivan, Ohio; Frank M. Ward, District Columbia; Thompson J. Hudson, Ohio; George H. Evans, District Columbia To a salary of $1,000, the following: Gormond Crandall, New York; William B. Atkinson, District Columbia; William A. Redmond, District Columbia; James M. Pollard, Louisiana; Thomas H. Mitchell, Tennessee; Archibald McNaught, Wisconsin; Mrs. Mabel Hatch, New Hampshire; William H. Chapman, Ohio; Thomas R. Stuart, California, to draughtsman.

REVIVING OLD REJECTED CASES.

Under the former practice of the Patent Office cases occurred in which widely established industries, worked for years free of any patent, were suddenly injured and crushed by the unexpected reissue and grant of some aged, long slumbering, rejected case.

It would appear from a recent decision by the present Commissioner of Patents, Mr. Marble, that he is not one of those who favor such revivals.

In a recent appeal to the Commissioner of Patents, in the case of F. W. Smith, applicant for a patent for a sweat leather, it appeared that the application was originally filed and rejected in 1871. In 1879, nearly eight years having elapsed, the inventor files a new application, intending thereby to revive the old case.

The Commissioner says:

"The law applicable to this case is section 32 of the act of 1870 (Rev. Stats., sec. 4,894), which reads as follows:

"'All applications for patents shall be completed and prepared for examination within two years after the filing of the application, and in default thereof or upon failure of the applicant to prosecute the same within two years after any action therein, of which notice shall have been given to the applicant, they shall be regarded as abandoned by the parties thereto, unless it be shown to the satisfaction of the Commissioner of Patents that such delay was unavoidable.'

"The authorities cited in behalf of Smith (*Colgate vs. Western Union, Smith vs. Dental Vulcanite Company*, and others) to show that this diligence has been reasonable, and that he has not abandoned the invention, were cases under the law of 1836, and are therefore inapplicable to the present case. Under that law an application might be renewed after a lapse of any period of time unless it appear that the invention had been in the meantime abandoned (*Bell vs. Daniel*, 1 Bond, 212), and that, too, though the first application had been withdrawn. (*Godfrey vs. Eames*, 1 Wall., 317.)

"The present law was devised to overcome the many evils which had sprung up under this practice, and provided that all applications filed and rejected previous to the passage of the law would be presumed to be abandoned by the parties at the expiration of six months from the date of the passage of the act, unless in the meantime they should be renewed (section 35, second proviso), and that for the future all applications for patents not prosecuted within two years after any action therein shall be presumed to be abandoned by the parties, unless it shall be shown to the satisfaction of the Commissioner of Patents that the delay was unavoidable. I am not aware that this section of the law has as yet received judicial attention, but I find no difficulty in discovering the application of the law to the facts of this case. It is clear that only an extraordinary combination of circumstances could unavoidably prevent an inventor from taking some step in connection with his application for a period of nearly eight years.

"Attaching full credit to the statements of the affiants that Smith was continuously in straightened circumstances, and that he expressed at various times his desire to obtain a patent for his invention, I do not find that at any time he made any serious efforts to obtain assistance in prosecuting his application, or that it is clear, as a matter of fact, that it was his constant intention to renew the application or procure a patent for his invention.

"I must hold that Smith's application, filed in 1871, was abandoned by operation of section 4,894 of the Revised Statutes, and that he must stand upon his present date of filing.

STEAM-BOILER NOTES.

The percentage of active steam boilers that violently explode with fatal effect is not at any time very large; statistics show that there is but about one in two thousand annually of those in use in England, equal to one per cent in twenty years. The number of cases, therefore, that may be actually observed by any one person in a lifetime that is devoted to the common business of life is very small, so, there being not more than one person in a thousand of those who do observe these accidents who is capable of forming a reasonable opinion as to the cause, and not more than one in a hundred thousand who, being capable, does actually see and study more than his quota of cases, it is not strange that there are differences of opinion that result in bickering and recrimination among those who are accustomed to have their opinions respected and who have set up in the business of teaching a branch of engineering that they themselves have not practically studied.

The number of persons who attempt to make a thorough study of boiler explosions that have the opportunity to see one in the act is still smaller, and perhaps not a single one qualified by previous experience and by scientific attainments to be a good judge, and devoting sufficient time to the subject, has even favored the public with his views.

It seems to be a defect in the means of getting information that the informants are not reliable, being frightened out of their wits by the explosion or interested in making out that they had done their duty faithfully in the management before it occurred, and their testimony is, therefore, of the most unreliable sort, although they appear while giving it before juries to be respectable and reliable witnesses. Many times, perhaps most often, a careful examination of the remains of the boiler and its attachments would show that some of them are mistaken; that without a reversal of the laws of nature their statements could not be true; but being accepted, the whole thing becomes an inexplicable mystery. Some theory must be applied to the case by the wiseacres who should have carefully examined every detail of the wreck and eliminated all impossible and contradictory elements before giving their opinions as experts, weighing carefully all the possibilities and discarding all alleged phenomena that are in contravention of natural laws and depend on human acts, perceptions, or emotions.

DR. HEATH'S DISCOVERIES IN SOUTH AMERICA.

In the SCIENTIFIC AMERICAN of June 18, 1881, an account was given of the successful journey of Dr. E. R. Heath down the previously unexplored portion of the Beni River, Bolivia, and his discovery of abundant rubber and cinchona forests there. The Kansas City *Review* for September contains further particulars of the expedition, compiled from Dr. Heath's letters to his brother in that city, with a sketch map of the part of the river now for the first time opened up to geography and commerce.

Dr. Heath writes that the news of his successful passage through the country of the cannibals spread like wildfire. New rubber forests are to the people of that region what new gold fields are to the inhabitants of North America, and immediately something like a stampede occurred. Everybody talked "*Beni*," and 10,000 men had gone down to the new rubber region. Last year the export of rubber from the Beni was 15,000 pounds; this year it will be 750,000 pounds; and next year it will probably rise to 6,250,000.

Dr. Heath has proved himself to be not only an enthusiastic but an exceedingly plucky and capable explorer. He writes that he intends to return home this fall to organize an expedition for exploring the Madre de Dios, a river much larger and longer than the Beni, and quite as little known. His plan is to begin his survey at the ancient Inca capital of Cuzco, in Peru, and descend the Madre de Dios from its smallest beginnings, spending at least two years in the work. Besides the work of exploration he hopes to discover rich deposits of the precious metals, new forests of cinchona trees, valuable textile and medicinal plants, rubber forests, and other contributions to commerce and science.

The Exhibition of Electric Light at Paris.

To the Editor of the Scientific American:

The first public exhibition of electric light, which took place on the evening of Saturday, Aug. 27th, was, in many respects, a failure, but few of the systems being in good order, and many of them unable to be exhibited at all. Notwithstanding this fact, those who were present were forced to admire the brilliant display of the new and wonderful progress of electric lighting, and to speculate upon its future career.

It is thought by some, it is true, that the gas companies will be encouraged rather than otherwise by the exhibition of electric light, and will have confidence in their security for some time to come; but whether electricity is to take the place of gas or not, depends in a great measure upon the final decision of the general opinion of the public. At the present moment I am inclined to be of the same opinion as the gas companies themselves. Those portions of the exhibition of lights which are worth mentioning, are first, and above all, the Siemens and Halske lamps. It is only fair to say that there was nothing in the whole exhibition to compare in brilliancy and effect with the luster of the two great lamps of this firm. The Jablochkoff lamps which we have heretofore so much admired were quite thrown in the shade and actually had a mean appearance before these exquisite burners

Next in order to the Siemens and Halske lights must be mentioned those of Brush. This was a truly fine display, and attracted general admiration and wonder, not only on account of the great number and perfect working order of the lamps, but also because that the system is said to be by far the least expensive, and, therefore, the most practical on exhibition. Next in order may be mentioned the Jaspar lamps, with immense reflectors. These lamps gave a very agreeable, steady light, and for some purposes may be considered very practical. Before going further, I must speak of a new system which gave great satisfaction and was much admired by the visitors, viz., that of the Austrian engineer, Gulcher.

This exhibition consisted of eight fine lamps, which gave a steady, soft, mellowy light of a yellow color and of great strength.

The light of the Siemens and Halske firm, as also that of Brush and of Jaspar, is more white in color.

The exposition of the Swan and Edison and Maxim lamps of incandescence afforded a particular surprise and pleasure to those who had not heretofore witnessed them. They gave an impression of elegance and taste which recalled vividly to mind the candle chandeliers of our ancestors, which still retain the post of honor in many European mansions. But of the practicability of these systems we are not yet informed.

To the unprejudiced eye of the general spectator there were no other systems on exhibition which were worthy of note. However, as we have said, many of the lamps of other systems were not yet in order, and there may be occasion for a different opinion in future, in case some of these unfinished systems should excel those we have named.

The French department was a cause of regret and wonder as far as regards their exhibition of lights, that department being quite thrown in shadow by the more successful and brilliant foreign departments.

The light-house, which was intended as a great addition to the general display, proved in fact to be a perfect nuisance. its colored, revolving lights casting a ghastly and ominous shade over the different systems of lamps in the gallery and prohibiting the spectator from forming any just estimate of their value.

Some of those systems which were ill worked made a most ludicrous display, puffing and winking, now darting fire, now presenting a mere dull coal to the looker on, sometimes even going entirely out.

Finally, whatever else may be said in favor of electric light, there remains one serious and insurmountable objection to it, which will place one half the human race in direct opposition to its adoption, and that is, that it lays bare all the secrets and defects of the complexion, nay, even adds hideousness to it, whereas the mellow gaslight added many a charm and smoothed many a wrinkle.

Whether our scientists and speculators in the scientific mines will take this last-mentioned fact into consideration remains to be seen. One thing is sure, the pleasure felt in gazing upon the electric lights is much destroyed by the disagreeable feeling experienced in looking upon each other, though it must not be forgotten that the incandescent lamps are an exception in this respect, and, therefore, if practical in other respects, will no doubt take the palm for all indoor use.

GUSTAVE GLASER.

Look Out for the Pilgrim.

A mysterious star, called the Pilgrim, which was observed in 945, 1264, and 1572, is expected by astronomers to appear before long. It was described in 1572 as brighter than Jupiter, and "such was its brilliancy that persons were able to detect it at noon in a clear sky, and at night when the sky was so overcast as to hide all other stars." If it appears it will probably be visible for several weeks in the constellation of Cassiopeia.

DEEP SHAFT IN VICTORIA.—The Melbourne *Age* states that the Magdala shaft, Stowell, has a total depth from the surface of 2,930 feet, or 1,566 feet below sea level. This is the deepest shaft in Victoria.

INSTANTANEOUS PHOTOGRAPHY.

We are indebted to Gen. Henry L. Abbot, U.S.A., in charge of the Engineer School of Application, Willet's Point, N. Y., for copies of photographs illustrating the remarkable sensitiveness of photo-gelatine plates, which we will briefly describe. It became necessary, one day, at Willet's point to destroy a worthless mule, and the subject was made the occasion of giving useful instruction to the military class there stationed. The mule was placed in proper position before a photo camera and duly focused. Upon the animal's forehead a cotton bag was tied containing six ounces of dynamite. The slide of the camera was supported by a fuse; the camera fuse and the dynamite on the mule's head being connected in the same electrical circuit, as shown by the wires in our engraving. On pressing the key so as to send the electricity through the wires, both the fuse and the dynamite were simultaneously fired; the camera slide and the head of the animal fell nearly together. The photo-sensitive plate was impressed with a picture of the headless creature, still standing, before its body had time to fall.

Fig. 1 of our illustrations shows the animal, camera and electrical wires in position for firing. Fig. 2 shows the appearance of the animal after the explosion, as taken on the photo plate. The experiment was made June 6 last.

Fig. 1.—INSTANTANEOUS PHOTOGRAPHY.—BEFORE THE EXPLOSION.

The Bahama Banks.

The new data lately obtained by the United States coast and geodetic steamer Blake, Commander J. R. Bartlett, U.S.N., arrived at Providence, R. I., August 17, shows that the Bahama banks extend in an almost level plateau, nearly 200 miles wide, off the Carolinas, and drawing to a point at Cape Hatteras, only twenty-five miles off shore there being nearly two thousand fathoms. The average depth on the plateau was found to be a little over four hundred fathoms.

A Costly Dog Collar.

A San Francisco jeweler has lately made for a noted trick dog a collar described as follows:

The collar is made in twenty-four sections, comprising quartz, petrified wood, and silver silicates, such as never have been worked before, representing in their natural form perfect Japanese characters. Six of the sections are made in cabinet work representing fifty-seven different mines, with all the colors of quartz—black, pink, white, and greenish casts of every kind. At each end of the collar the section is of carbonate of silver with malachite streaks; then in regular order silver quartz; cabinets with minerals from different mines; then petrified wood and gold quartz until the center is reached, which is a large, oval-shaped cabinet with different ores, and the name of the dog, "Zip," in solid gold letters covered with Japanese crystal. As a specimen of California workmanship this is undoubtedly the finest that has yet been seen, both for beauty of design and excellence of workmanship, every prominent mine on the whole coast from Tombstone, Arizona, to Silver City, Idaho, being represented. The fastening is a lock of solid gold inlaid with platina.

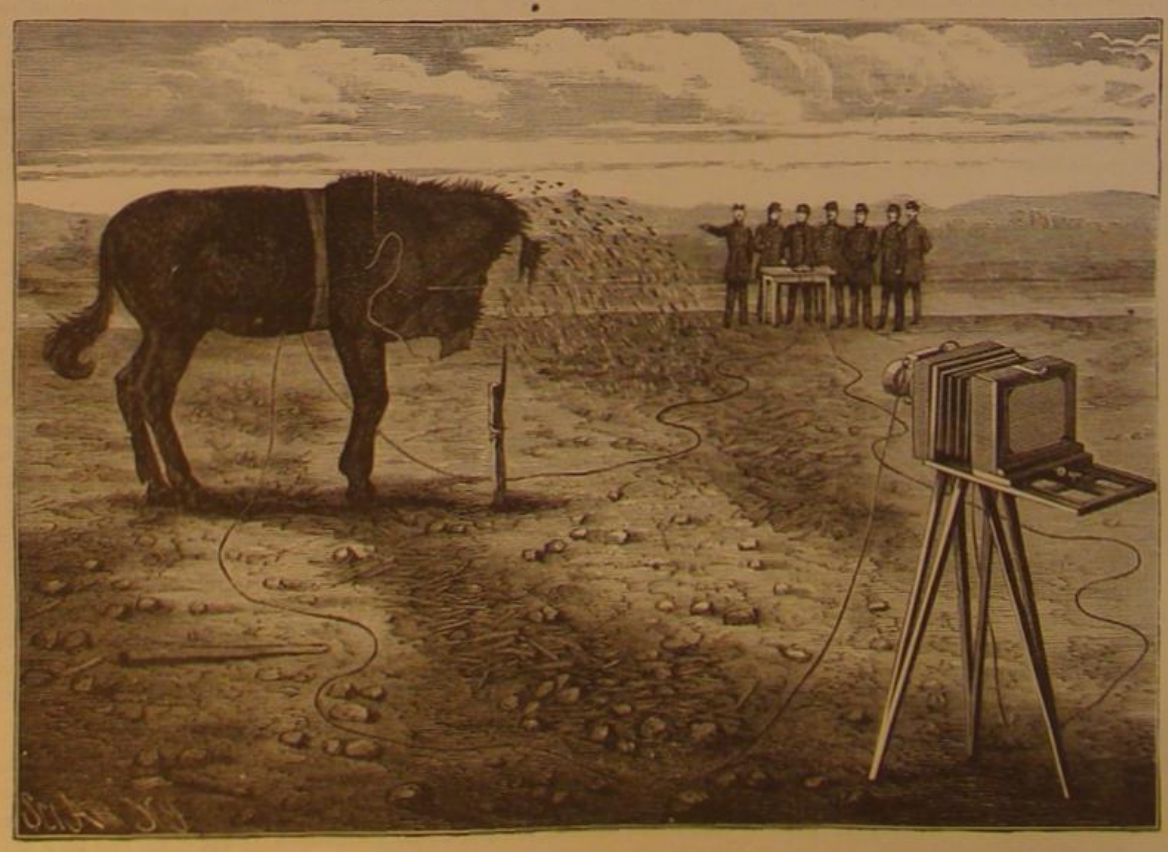


Fig 2.—INSTANTANEOUS PHOTOGRAPHY.—AFTER THE EXPLOSION.

Rapid Town Making.

About the middle of August a stampede took place from Deadwood, Central City, and Lead City, Dakota, to a new and wonderfully promising silver region about ten miles from Deadwood. A town was laid out, lots drawn for by all present, rules of government agreed to, and the place named "West Virginia City." In forty-eight hours the town contained nearly one thousand inhabitants, and nine saloons were in operation. On the third day two faro banks were opened, restaurants were started, and, to cap the climax, on the fourth day the first copy of a daily newspaper, called the *Carbonate Reporter*, was issued. Fifty buildings were erected in one week, and as high as $500 paid for building lots. The town promises to be permanent, as there have been many rich finds.

Kentucky's Biggest Tree Felled.

The Louisville *Commercial* reports the felling of Kentucky's largest tree near Carr's. The tree measured 18 feet in diameter at the base. The cut was made 6 feet above the ground, where the tree was 12 feet through. The *Commercial* adds:

"From the cut to the first limb can be made eight good length rail-cuts, each 10 feet long, which would split enough rails to fence a small farm. The first limb was nearly a half dozen feet in diameter, and it would have, by itself, made a very large saw log. Nearly all the small limbs had fallen and decayed away. Its plank measurement is computed at nearly 50,000 feet, besides several limbs that would make, altogether, 25 cords of wood. On the day of the felling a large concourse of people marched from Vanceburg to the place. Colonel W. S. Rand, an able speaker, was the orator of the day. He and others, qualified to be good judges of such things, supposed that this mighty forester was four or five centuries old. There were to be distinctly seen over 300 rings, and it is not known how long since it completed its growth, as it has been dead for many years.

MECHANICAL INVENTIONS.

An improved elevator and carrier has been patented by Mr. Daniel Dockstader, of Fonda, N. Y. The invention consists of novel devices for holding the carrier in place while loading, for unlocking the carrier so that it may be moved on its track.

An improved petticoat pipe fastener has been patented by Mr. Patrick J. Cleary, of Golden, Col. The object of the invention is to provide a secure, rapid, and convenient method of attaching, supporting, and removing the petticoat pipe in a locomotive smoke stack.

An improved cotton press has been patented by Mr. Theophilus Griffin, of Scotland Neck, N. C. The invention consists in a novel arrangement and combination of ropes and windlasses, whereby great power is obtained.

William Lay, of Atlanta, Ga., has patented a cheap, simple, and economical water motor that can be operated with a small quantity and but slight fall of water. The invention is designed as an improvement on the water motors for which Letters Patent No. 233,930 and No. 227,023 were issued to the same inventor January 27, 1880, and April 27, 1880, respectively.

An improved machine for making shoe buttons has been patented by Mr. Marcus M. Rhodes, of Taunton, Mass. These improvements relate to machines for forming the heads of the buttons from *papier mâché* blanks, cutting off the wire blanks, and forming the eyes and pressing the button heads upon the shanks of the eyes automatically and by successive operations in proper order.

A machine for beating and polishing rice has been patented by Mr. Jacob R. Sample, of Summit, Miss. The object of this invention is to facilitate the removal of the hulls of rice and the cleaning and polishing of the kernels.

Mr. Lewis R. Budd, of Cambridge, Texas, has patented improvements in moulds for constructing earth and stone fences; and it consists of a mould or guide for a solid fence made of sod and earth, or stone and earth, or other material.

An improved hoisting machine, patented by Mr. William B. Padgett, of Batesville, Ark., consists in a novel arrangement, a platform, a hollow screw shaft, a series of windlasses, a rope or chain, and a series of pulleys, whereby provision is made for raising and lowering weights, and for other purposes.

Mr. William W. Hills, of Cadillac, Mich., has patented an improved cant dog. The object of this invention is to improve the construction of cant hooks in such a manner as to make them stronger and more convenient and serviceable.

A machine for attaching tags to plug tobacco has been patented by Mr. August Markert, of Jersey City, N. J. The invention consists in a vertically sliding platform provided with suitable gauges, etc., pressed upward by springs, and provided with a removable longitudinal strip with apertures of the same size and shape as the tags, into which a series of vertical posts of the base of the machine project. The tags are placed upon the upper end surfaces of the posts with the prongs projecting upward, and the strips of paper and pieces of plug tobacco are placed upon the platform, upon which the piece of tobacco, and consequently the platform also, are depressed, and as the posts are rigid the tobacco can only be depressed until it rests on the posts; but by this operation the prongs of the tags have been forced into the tobacco.

An improved sash cord fastener has been patented by Messrs. Thomas P. Dunne and Paul Rath, of New York city. The object of this invention is to facilitate the attaching of the sash cord from which the balancing weight is suspended to the sash in such a manner that neither the stop beads, parting strips, nor the sashes need be removed for attaching the cord or chain.

ELECTRIC FLYING MACHINE.

The improvements recently made in electric motors have suggested to the eminent French electrician, M. Gaston Tissandier, the idea of employing these machines to propel air balloons. They can be used in connection with M. Planté's secondary couples, which store a large amount of electric energy and weigh relatively little. Such a motor possesses great advantages. There is no danger of firing the volume of hydrogen above, and it has a constant weight, there being no decrease by combustion.

In making his experiments M. Tissandier employed a small oblong balloon ending in conical points. This balloon, which is like that used by M. Giffard, is 3 m. long by 1·30 m. in diameter, and has a volume of about 2 200 liters. Inflated with pure hydrogen it has an ascensional force of 2 kilogrammes.

It is worked by a small electric motor resembling the Siemens dynamo, and weighing 220 grammes. This works a light propeller 40 inches in diameter. This motor is suspended below the balloon, and will propel the balloon for several miles with a Planté element of 220 grammes, while with a secondary couple weighing 1·300 kilogrammes the duration of its rotation is considerably increased. Under these conditions the armature turns 6·5 times a second, and acts as a propeller, giving the balloon a speed of 1 m. a second during more than 40 minutes. With two secondary elements, a propeller 60 inches in diameter can be used, which will propel the balloon at the rate of 2 m. a second during 10 minutes; and with three elements a speed of 3 m. can be obtained.

These experiments took place in the "Conservatoire des Arts et Metiers," at Paris, in a large hall, where the balloon could move freely, restrained only by a light rope dragging behind it, which served at the same time to guide and to measure its speed.

The working power of the electric motor was measured by the simple method of lifting weights. A secondary element, and afterwards two elements together, were attached to the motor, and it was found that the swiftness of the revolutions varied according to the weight lifted.

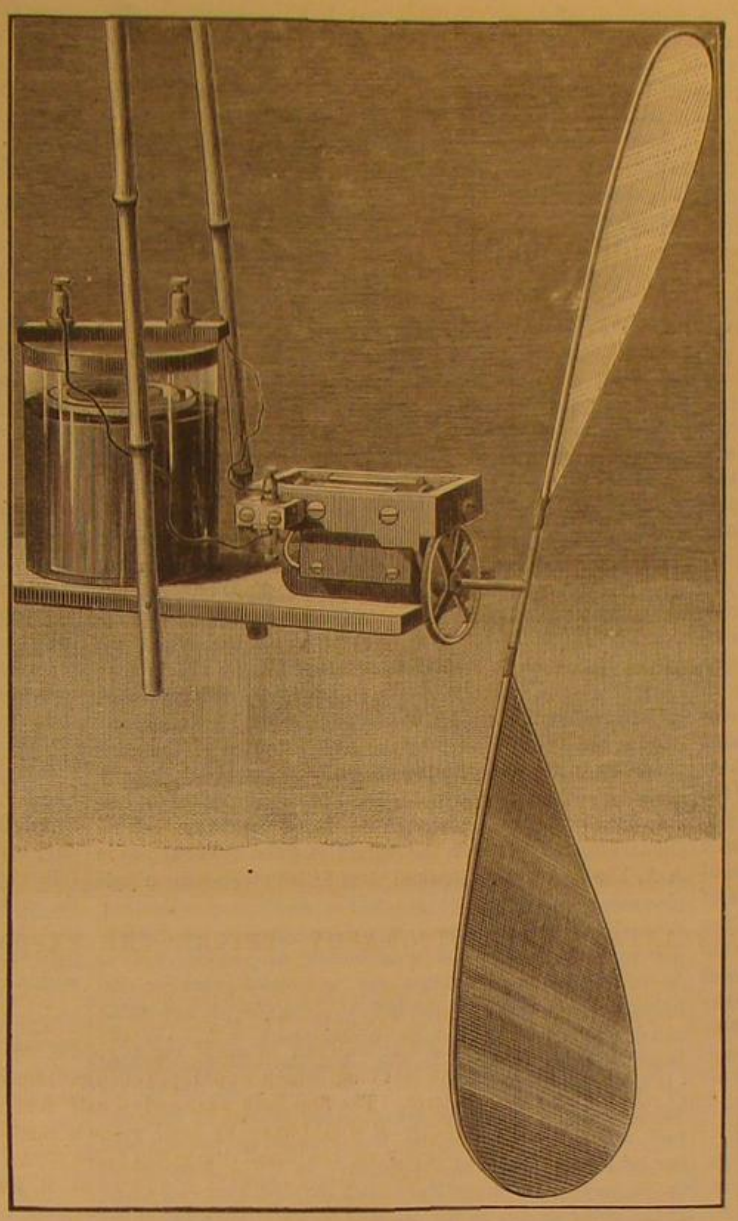
This little motor, when developing a maximum of energy with a single element, produced a force of 90 grammes at a speed of 5 revolutions a second. With two elements a speed of 12 revolutions a second was obtained and a power of 420 grammes. With three elements the power was 1 kilogramme.

In working with two elements, if the speed is reduced to 5 or 6 revolutions a second, the power is also reduced, and, on the other hand, if the speed becomes greater than that which corresponds to the maximum power, the working force is correspondingly reduced. For example, if the speed obtained is 14 or 15 revolutions a second, the power is only 375 grammes. The manner this trial balloon acted, and the speed obtained with the propeller, afford a very satisfactory outlook for aerial navigation, as it must be remembered that in balloons the surface does not increase with the volume, consequently the results obtained with larger balloons would be still more favorable.

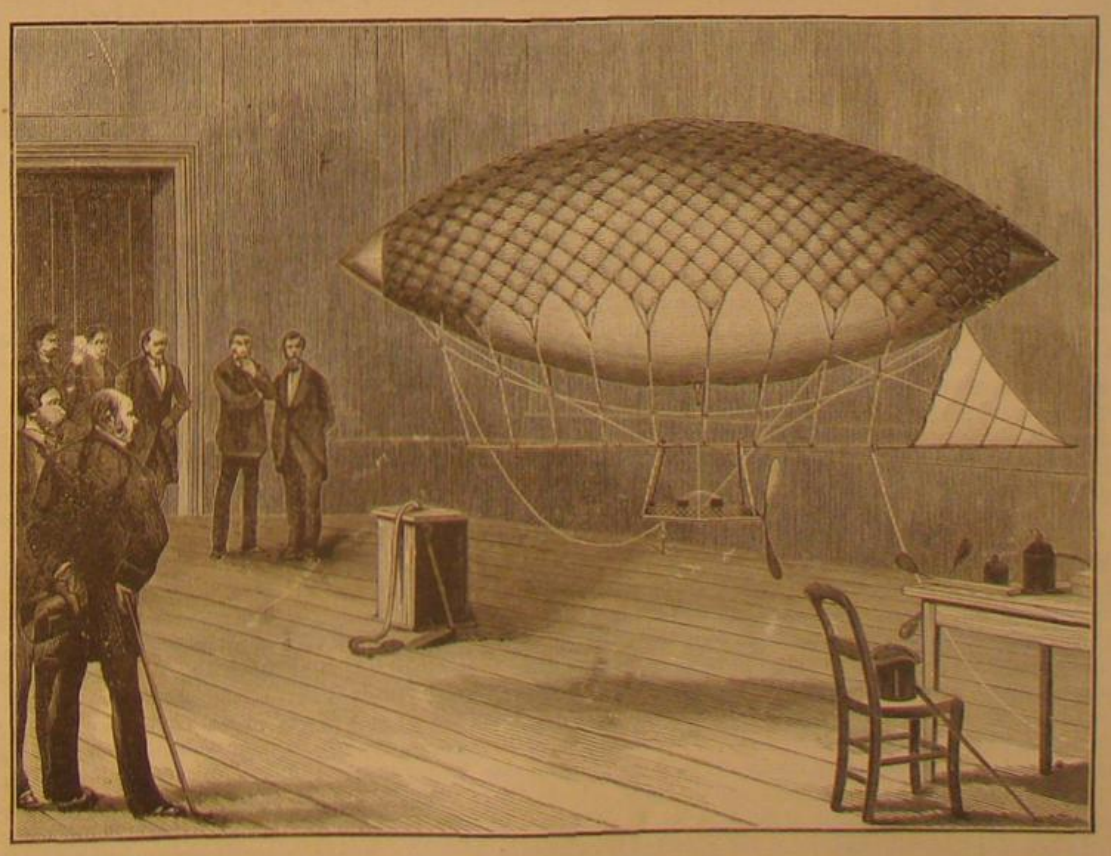
In working condition an electric motor equal to 6 horse power and weighing 3·0 kilogrammes, with 900 kilogrammes of secondary elements, would easily carry 1,200 kilogrammes when attached to in a hydrogen balloon of 3,000 cubic meters, elongated in shape like those used in 1852 by M. Giffard, and in 1872 by M. Dupuy de Lôme. This balloon would be 40 m. long by 13·50 m. wide across the center, and its ascensional force would be about 3,300 kilogrammes. It would weigh, with all its accessories, 1,200 kilogrammes; so there would remain for the voyagers and for ballast over 1,000 kilogrammes. In calm weather this balloon, worked by an armature of 5 to 6 m. in diameter, would obtain a speed of 20 kilogrammes an hour, and in windy weather would be powerful enough to move out of the direct line of the air current.*

Of course, this balloon could only go for a limited time, but that could easily be decided by experiments, in which results even more favorable might be obtained by making the motor and piles especially light for this purpose.

Until now no balloon has ever been really steered, that is, has never returned to its point of departure after having navigated the atmosphere at the will of its pilot. Necessarily such voyages can only take place in calm air and during a short time; but the essential point is that they have succeeded at all; and no physicist can deny that the electric motor and the secondary piles have solved the problem of aerial navigation.



PROPELLER OF ELECTRIC FLYING MACHINE.



ELECTRIC FLYING MACHINE.

* Of course the idea of guiding balloons against strong winds belongs to Utopia; but for short voyages, such as escaping from a city during a siege, it would be very valuable to be able to steer the balloon.

Southern New Jersey Sinking.

Professor George H. Cook, State Geologist of New Jersey, concludes that the land in Cape May and Cumberland counties is gradually but certainly sinking. From knowledge now in his possession he estimates that the surface has settled about eight feet during the last hundred years. During a recent visit he declared it his intention to test the matter by placing stone posts in the ground at certain localities, a record of which should be kept so as to insure their being found at any future time, said stones to be so set and marked with reference to their height above the sea level that it may be positively ascertained whether this portion of the State is becoming lower, and at what rate.

The Alphabet in Prehistoric America.

At the recent Science Convention, at Cincinnati, Major Wm. S. Beebe, of Brooklyn, read a very suggestive paper on the inscribed records of the Mound Builders, especially those discovered at Piqua, Ohio, and Davenport, Iowa. The former were on tablets of earthenware, the latter inscribed slates. On the Piqua tablets the characters are in horizontal lines, and in four of these lines they were, in each case, six in number. In the fifth and remaining instance there were five, but this arrangement was some distance, in the longitudinal direction of the tablet, from the group first mentioned, which were in both cases written in couples.

One of the Davenport slates was inscribed on one side, the other on both. The stone inscribed on but one side bore on its surface a series of concentric circles. Between the outer two of these were twelve equidistant signs, presumably the zodiacal signs. The slate had two perforations on one of its edges, evidently for suspension.

Major Beebe claimed that the Piqua inscriptions are the names of the eight zodiacal signs on the Davenport slate, excepting Capricornus, Aries, Cancer, and Libra, which four signs are represented by four initial letters on the back of one of the Piqua tablets, and which representing the north, west, south, and east respectively, and corresponding to the Tucatec Bacobs, or world holders, as they were called, and to which a peculiar importance is attached.

The forms of the Piqua letters are almost precisely those that occur about the Mediterranean, and whose phonetic values have been determined by Alois Hess. Major Beebe believes that he has been able to trace each form of letter to aboriginal American picture symbols, in which the same significance obtains in both European and American forms. Having fixed the significance of these letters, he has, he says, deciphered the inscription on the stone from the Grave Creek Mound, West Virginia, and that on the Pemberton ax. In all these cases the names deciphered refer to certain stellar combinations, and in the case of the slates and tablets, which are perforated, were probably in the nature of charms. In the case of the Pemberton ax part of the inscription is read with the edge of the ax up, the remainder with the edge down, and this inscription, too, probably, had reference to some rite or species of divination in which the ax played an important part.

A very significant feature in regard to this ax is, that the names read on the ax, when held with the edge up and down, have been preserved with the change of but one letter by an Esquimau tribe in Northwest America as the names of their deities of good and evil respectively, whereas the ax itself was found at Pemberton, N. J. The generally prevalent idea as to the relation of the Esquimaux and preglacial man makes this incident peculiarly suggestive.

The Crater of Kilauea.

Tourists to Kilauea will remember certain active pools of lava, the North and South lakes, which ordinarily bubbled and tossed a fiery flood at a depth of about 120 feet below the floor of the great crater. Now, says the Honolulu *Advertiser* of July 26, these lakes have all been filled up, and there have arisen peaks and cones of hard lava that rise over 100 feet above the south bank of the great crater, which is about 1,000 feet high. But there has burst forth a new opening in the great crater floor not far distant from the old lakes, a new lake, almost round in form, about 600 feet across, and 70 feet in depth, in ordinary stages, below the surrounding brink. Here the great Hawaiian volcano presents the most varied fantastic play of liquid lava. Sometimes it almost seems to sleep, and the disappointed visitor looks down into a black valley, and observes a smoking pit giving no more evidence of combustion than a tar kiln. The surface presents a dark silver gray hue, with a satiny shine. This is a crust of quiescent lava, and the observer who has expected to have his sense of wonder strained to speechlessness says: "Is this all?" No! look! the frozen, glassy lake is alive. What a

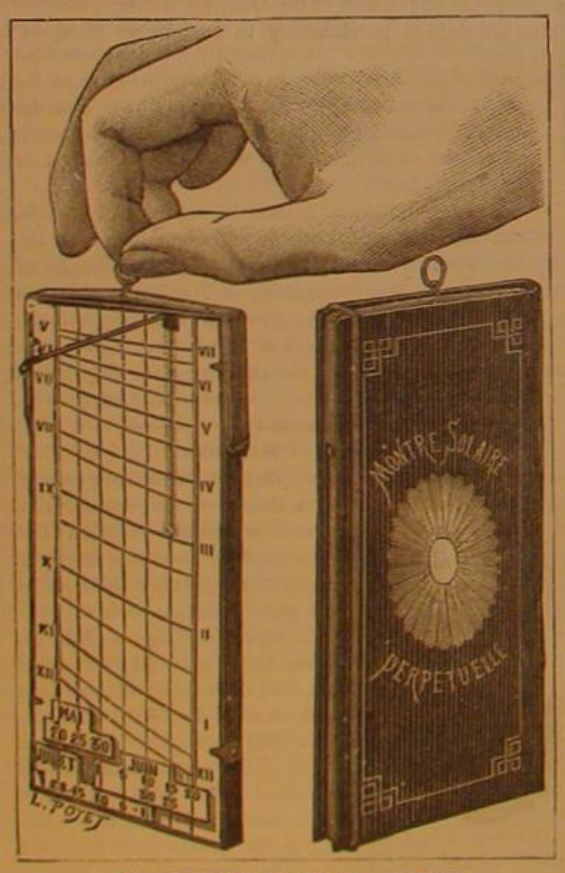
heave in the center—some mighty beast lifting up that floor! Now a wave runs round the incrusted marge, and there is an outburst, a blood-red fount, gushing and bubbling from one of earth's arteries. The broad disk of the lake heaves and trembles. Fitful gaseous flashes flit across. The moving floor cracks. A serrated fissure, like the suture of a skull, runs from marge to marge, and quick, darting streaks, sudden cracks of the crust, shoot across in all directions. These serrated streaks are at first rosy lines on the gray surface, then they widen like crimson ribbons, broadening to the view. They undulate with the billowy motion of the whole upheaving surface. Another crimson fount springs up along the now fretting and roaring rim of the lake, and another and another of the wildly up-leaping fountains of fire toss high their gory crests, even casting gouts and clots of the red spray that fall and harden near the observer's feet. By this time the spirit of our inferno is aroused. The fierce red lake is all boil and leap and roar. It is more than the roar of sea surfs. The surging tide of the molten earth sounds a deeper bass than any note of the sea; and the heaved-up crust, broken into fragments, is churned and dissolved in the boiling flood. The roaring gulf is now, indeed, a vortex of indescribable glories and terrors.

DE COMBETTE'S SOLAR WATCH.

Sun dials are of two kinds: in one the hour is indicated by the inclination of the shadow, and in the other it is shown by its length. The inventor of the very simple little apparatus represented herewith has chosen the latter mode.

The arrangement of the "watch" is as follows: To the sides of a block of mahogany are affixed four clasps, which serve for holding in place the cards upon which are inscribed the different months. In the engraving, we have the card for the months of May, June, and July. Over the top of the block extends a rubber band which is fixed to the sides by means of rings. A third ring, through which the band passes, serves for holding the apparatus. A steel needle having an aperture at one extremity serves for projecting the shadow on the card.

To use the apparatus, the unperforated end of the needle is placed between the wood and the rubber, on the line of the day of the month. Thus, in the cut it is on the line of the 15th and 20th of June. The apparatus is then held by the ring, and turned to the right or to the left until the shadow exactly coincides with the line. The luminous point projected by the eye of the needle indicates at the right the hour for the morning, and to the left that for the afternoon. It will be



DE COMBETTE'S SOLAR WATCH.

at once seen, on reading the card, that on the 20th of June the sun is at its greatest elevation, and that on the 25th it is at the same height as on the 15th; and that on the 1st of July it is at the same height as on the 10th and 30th of June, etc.

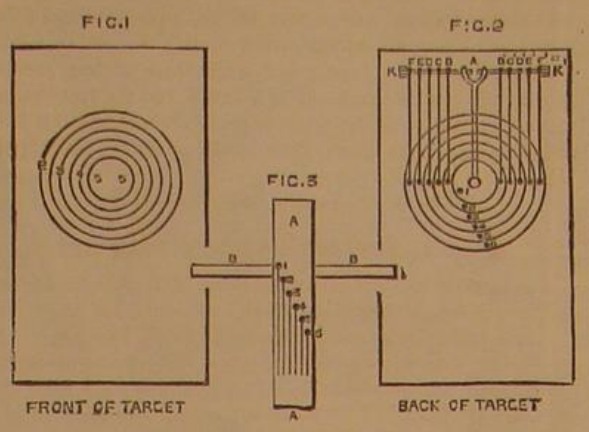
The figure to the right shows the apparatus inclosed in its case.—*La Nature.*

Scientific Exploration of the Northwest.

It is said on good authority that the Northern Pacific Railroad Company and the Oregon Railway and Navigation Company have united in putting a scientific exploring expedition into the field, for the purpose of examining into the mineral, agricultural, and other resources of the territory tributary to the two companies between Lake Superior and the Pacific coast. Prof. Raphael Pumpelly, until now in charge of the coal and iron department of the late national census, has been appointed chief of the expedition, and he has already started for Montana to examine the principal mining districts in that Territory. The work of the expedition will extend through several years.

SELF-REGISTERING TARGET.

The target here illustrated is the invention of Dr. Wilson, of Hawkhurst, Eng. It consists of a sufficiently thick plate of iron, out of which six circular disks or concentric flat faced rings of necessary breadth are made, as seen at Fig. 1. The rings must be of such diameters that there shall be a clear opening all round between each of them of about three-sixteenths of an inch or a quarter of an inch, so that the disk rings—see Fig. 2, back of target—hang by hooks of sufficient length on the cross rod, K K, and work on it, as an easy joint, may move backwards and forwards without



touching each other. They support in pairs—with the exception of No. 5—one of the disk rings, which form the face of the target, F F support ring 2; D E, D¹ E¹, support rings marked 3; B C, B¹ C¹, rings marked 4; and A supports 5, the bullseye. When the bullet hits the face of one of the disk rings, it swings back, but, by the ring's own natural weight, it immediately rights itself, and falls back into its original position. The spots, 1 2 3 4 5 6, are nipples or tongues. One is fixed in the back of each of the disk rings; and when the ring is suddenly forced back, its nipple plunges into a small hole—see Fig. 3—opposite, to correspond in the strong plank, A A, faced with iron, behind the target, and to which the target is fixed. The holes in A A, Fig. 3, are also marked 1 to 6; into these the nipple plunges deep enough to touch the sensitive needle, and through this medium sets a signaling apparatus in motion. The sensitive needle must be sufficiently deep in each hole to be entirely protected against any accidental breaking and flying about of pieces of the bullet. The electric apparatus can be made safe behind the broad plank, A A. On the inside of the crossbar, B B, Fig. 3, a short distance behind the target disk, there are pads or buffers, to deafen the harsh sound of the iron disk in dashing against an iron surface, and also to prevent the disk ring being thrown back too far by the impact of the bullet. In Fig. 1, 5 represents the bullseye; then 4 and 3 are each divided into two rings. If the bullet strikes on the opening between 5 and the inner ring 4, forcing both back, it would not be a bullseye, but the best position on 4; if on the inner ring of 4 only, it would be a more valuable position than if it struck on the opening between the two rings marked 4, forcing both back, but this position of the shot again would be still more valuable than if the bullet hit the outer 4 ring only. These hits would point out a relative value, say equal to 4¾, 4½, 4¼, 4, yet all equal to 4, but showing a difference, and they can be recorded with unfailing accuracy in the firing point at the moment the bullet hits the target. The rings marked 3 may be divided in the same manner. Thus eleven different values of hits may be recorded by this target. The hooks by which the disk rings hang require to be considerably bent outwards, all except F F, to allow the rings to swing sufficiently far back, and not touch any of the other's hooks.

Trade Schools in New York.

In the fall of 1880, under a joint arrangement between Richard T. Auchmuty, of this city, and the trustees of the Metropolitan Museum of Art, a technical school for the industrial education of artisans in the elements of mechanics and of design was established in a building specially erected and presented by Mr. Auchmuty for the purpose, and situated in First Avenue, near Sixty-eighth street. The school at once drew a large attendance. Classes were formed for practical instruction in drawing and design, decoration in distemper, modeling and carving, carriage draughting and plumbing, and no less than 143 pupils were enrolled. The school was open day and evening. Lectures were given by specialists in the trades and arts, but a prime feature was made of shop instruction by foremen and journeymen from factories in this city.

Since the schools were closed last spring a wealthy gentleman of this city has given $50,000 to the Metropolitan Museum of Art, to be devoted to the advancement of art education. It has, therefore, been deemed best to withdraw the art classes from the building at Sixty-eighth street and to establish them on an independent basis at Glass Hall, in Thirty-fourth street. The artisan classes will remain in the Sixty-eighth street building, and be known as the New York Trade Schools. The school for the decorative arts will be under charge of Mr. John Buckingham, former manager of the schools, and the trade schools will be under the supervision of Mr. Charles F. Wingate, sanitary engineer, who had charge last winter of the classes in plumbing and sanitary engineering.

The course of instruction for the coming year will embrace many new features. There is a large and well appointed workshop, where instruction will be given in the manual branches of the trades. Attached to this workshop will be a collection of the articles and materials used in plumbing. It is proposed to make this collection as complete as possible. Dr. Chandler, president of the Board of Health, and Professor Egleston, of the School of Mines of Columbia College, will take part in the series of lectures to be given to the class.

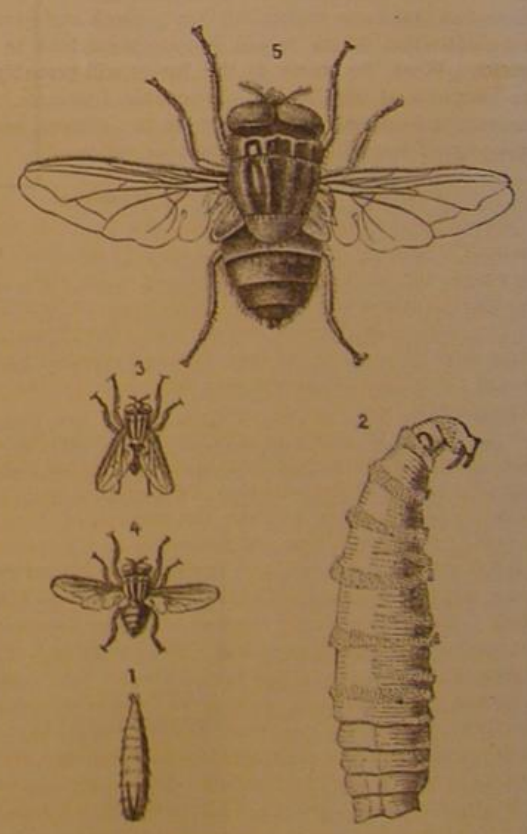
These trade schools are not intended to be either a charitable or a money making institution, the charges being based on the actual cost of the instruction given.

A DEADLY FLY.—NEW CASE OF MYIASIS OBSERVED IN THE ARGENTINE REPUBLIC.

Mr. P. Auguste Conil has recently described, in the *Annales des Sciences Naturelles*, some new cases of myiasis observed by him in the province of Cordoba (Argentine Republic). This affection, which is nearly always fatal, is brought about by a fly, *Calliphora anthropophaga*, Conil, represented herewith, and which, depositing its eggs in the nostrils of an individual, lays the germs of a horrible malady. We will allow Mr. Conil to describe in his own words one of the cases that he witnessed:

"The house situated alongside of mine is occupied by Mr. Auguste Ortiz, whose family lives at Totoral, a village lying sixty miles to the north of Cordoba, very near the line of railway connecting the latter with Tucuman. One of his sisters, Josefa Ortiz, aged 18, was taken sick, and experienced so acute pains that she decided to consult a physician, who, after questioning and examining her, said that she had an attack of angina and treated her for that affection. In spite of all the remedies administered, the pains, far from ceasing, increased in intensity, and the mother, justly alarmed, wrote to her son to consult another practitioner at Cordoba.

"He went at once to Dr. Lesbini, and gave him all the details that he had just received in regard to his sister's case. On Sunday, January 5, 1879, Josefa began to complain of insupportable itching in the right nostril, and, on the same day, had several attacks of bleeding at the nose. The days following she experienced violent pains in her face, nape of the neck, and throat. The physician in attendance, finding that he had made a wrong diagnosis, advised that the patient should be sent to Cordoba in order that she might be within reach of remedies and medical skill



CALLIPHORA ANTHROPOPHAGA.

1. Larva, natural size.—2. The same enlarged, side view.—3. The perfect insect, natural size.—4. The same, wings extended.—5. The same, enlarged.

"On the 14th of January her palate was perforated, and two larvæ, accompanied by matter, came out of her mouth. Having smelled a branch of basil, eighty larvæ, pretty well developed, escaped from her right nostril. The pains becoming more and more violent, Auguste Ortiz was notified and at once left for Totoral. Having arrived at home his sister's state seemed to him to be so grave that he resolved to take her with him to the city. He narrated in all its details the consultation that he had had with Dr. Lesbini, and said that, according to the opinion of the latter, Josefa's trouble was produced by larvæ, which, in the egg state, had been deposited in her nostrils by a fly. The relatives of the patient, notwithstanding the eighty-two larvæ expelled, could not believe such an assertion, as it appeared impossible that the *worms* that they had seen could come from a fly. They doubted it all the more, too, because the patient asserted that no fly had entered her nose.

"Struck by what she had heard, one of the sisters of the

sick girl, and younger than she, stated that on the evening preceding a fly had entered *her* left nostril, and, since in the evening she had begun to experience the same symptoms as those exhibited at first by Josefa, the family began to think that Dr. Lesbini might be right. The trip was therefore resolved upon, and it was decided that Eliza should be one of the party, a decision to which she undoubtedly owes her life. On Saturday, January 18, at ten minutes past twelve the patient took the train. At the station Jesus-Maria she got out and walked around for a moment; this was at about half past one. When the train reached the station General Paz, at ten minutes before three, the patient's state was so much worse that her family was thrown into the greatest inquietude lest she should not arrive alive at her destination. At three o'clock, when the train started, the patient became senseless, and, shortly after leaving the station, she expired in her mother's arms. The corpse, having been taken to the brother's house, was examined by Dr. Lesbini and two of his confreres, who had been at once summoned. The former desired to make an autopsy, but the family was formally opposed to it.

"Dr. Lesbini's diagnosis was fully confirmed by the larvæ which came from the mouth and nasal fossæ of the patient, as well as by the perforation of the palate. There is no doubt, then, that Josefa died from the malady under consideration, *myiasis*, and that it was caused by the larvæ of *Callíphora anthropophaga*, which probably penetrated the brain and lungs."

After citing a large number of similar cases, Mr. Conil gives a careful study of the larva and perfect state of the dangerous insect.

"Resuming the data which precede," says Mr. Conil, it results that: an egg of the fly deposited on the 15th of January in the nasal fossa of Eliza Ortiz, hatched and had already, four and a half days afterward, attained a length of one-fifth of an inch; the larva had attained its entire growth and had transformed into a pupa eight and a half days after the egg was laid; and, finally, eleven days were sufficient for the pupa to perfect its forms and become transformed into a perfect insect. This makes in all nineteen days and a half for the cycle of its different metamorphoses.

"If we consider the quantity of eggs that each female of the diptera under consideration is capable of laying at one time, we shall be astonished at the relatively small number of cases of myiasis that occur, even taking into account that many cases cannot be ascertained by science and consequently are ignored. That the fly does not multiply to a greater extent, seeing its wonderful fecundity, must be due to the fact that some enemy holds it in check and prevents a multiplication which would be so pernicious to our species. What the enemy is the future will probably tell us; I hope so, at least, and if it is possible, I propose, next summer, to pursue my observations on the diptera, and to apply myself specially to biological observations."

Michigan Frogs and Frog Hunting.

The marshes between Detroit and Lake St. Clair are the resort of millions of frogs; and it is asserted that more frogs are sold in Detroit than in any other city of its size. During the frog season heavy shipments are made to New York, Boston, and other Eastern cities. The *Free Press*, which pronounces the commercial frog as suspicious as a wolf, as wild as a deer, and as shrewd as a fox, describes the work of frog hunting as follows:

"Most of the frogs are caught for this market by men. One or two boys have some fame as successful frog catchers, but it has been demonstrated that the average boy lacks the necessary qualifications to make the business of any profit to him. We know of one old fisherman and hunter who has followed the frog catching business for the last twelve years, and he has sometimes made it pay as high as $15 per week. While there is only one way of killing a goose there are several ways of killing a frog. Frog hunting would be a great financial success if the jumpers would take a seat on a log and permit a man to walk up and crack 'em over the head with a club, but the frog is utterly opposed to any such proceeding. His eagle eye detects the enemy afar off, and the approach must be cautious. The outfit consists of a frog spear, a hook and line, a fish pole with a pointed iron in the end, and sometimes a small shotgun is taken along. First discover your frog. He may be sitting on a log ten feet from shore. He feels quite safe at that distance and will probably wait for developments. The hook and line can be used here. The line is stout and the hook big enough to hold a twenty pound bass. The idea is to fish for the frog without bait. A careful hand will maneuver the line until the hook is under the frog's throat, and then a sudden jerk takes him off his meditative roost and gives him into the power of his enemy. The spear, which is provided with a long handle, can sometimes be used, though a frog will dodge a sudden thrust as quick as a pickerel. If the shot gun is used it is with a light charge of powder and very fine shot, and the head is the point aimed at. Some of the froggers work the banks and are provided with boats, but success depends a good deal on circumstances. A good hunter has been known to bag 200 frogs per day, but three or four dozen legs are called a fair day's catch. A frog will probably live ten or fifteen years if steering clear of accidents. They are not worth catching until they are two years old, and are not "prime" until they reach the age of five. A frog sees his palmy days from five to ten. Before reaching five he is giddy and thoughtless. After that he settles down to a life of ease and contentment, and the days come and go and leave him no sorrow. Frogs have been caught in the St. Clair marshes weighing as high as seven pounds and having legs almost like drumsticks. One was caught at the head of Belle Isle two years ago which kicked the beam at nine, and one weighing only half a pound less was on exhibition at the Central Market last spring. Frog hunters say that the game they pursue is a weather bureau in himself. Before a storm he can be found only in certain localities. When there is to be a dry spell he seeks certain other localities. If the day is to be cool and cloudy his altitude betrays it. If it is to be hot and sultry the frog remains below. During a thunderstorm he is "on deck" to witness the display, and is then off his guard to such a degree that he is often killed with a club. His natural enemies are man, several species of birds, three or four species of fish, and one or two kinds of animals, and the fact that he manages to dodge all for years is proof enough that his lack of brains has been more than made good by his supple legs."

REMOVAL OF FLOOD ROCK, NEW YORK CITY.

The work of mining the seven acres of Hell Gate, known as Flood Rock, which is illustrated on our first page, was planned and barely commenced by Gen. Newton, U. S. Engineers, before his successful explosion of the extensive mine under Hallet's Point Reef, which took place Sept. 24, 1876, a full illustrated account of which appeared in the SCIENTIFIC AMERICAN of October 14, 1876, preceded by an illustrated history of the inception and progress of the work in current numbers of earlier dates. By this important operation there has been secured a clear navigable channel of 26 feet depth at low water, in place of the dangerous and dreaded whirlpool, called by the early Dutch settlers of New York "Horl Gatt," meaning whirl passage, which has become Hell Gate by modern usage. The name is now applied to the area including Flood Rock and other neighboring reefs.

The present work, begun in 1876, was suspended for want of appropriations during the whole of the fiscal year ending June 30, 1878.

Flood Rock is a ledge of gneiss, of about the same composition as Hallet's Point Reef, located about 1,000 feet northwesterly from Hallet's Point, at Astoria, L. I., where the machinery plant for mining that reef was located.

The summit of Flood Rock, as seen in the engraving, formerly appeared at all times above water. Its form was such that, by building upon it suitable retaining walls and cribs, an area of about a quarter of an acre was prepared for the necessary buildings and a hoisting tower at the opening of the shaft, which has been sunk from the apex of the ledge to a depth of about 75 feet, as shown in the section of the mine in our engraving.

The rock, as it was removed, was at first deposited by dumping scows in a deep hole off Ninety-second street, till it was filled to a desirable level. It is now being deposited between Little and Great Mill Rocks, an interval of about 800 feet, which with the rocks will form the western side or breakwater to the new channel formed by the removal of Flood Rock. This was included in Gen. Newton's original project for the improvement of Hell Gate.

A network of galleries, the plan of which is shown in the engraving, now extends under nearly five acres of Flood Rock. When the excavation is completed, piers only of sufficient size and in ample number to support the roof will remain.

The piers are then to be drilled, charged with sufficient explosives to break them down, and then fired simultaneously, when the whole mined area of the river bottom, shown by the fine cross lines now known as Flood Rock, is expected to sink into the mine, and after dredging, form a new channel of 26 feet depth at mean low water.

The amount of explosive to be employed was originally estimated at an equivalent of 100,000 pounds of nitro-glycerine.

The amount used at the former explosion at Hallet's Point was 52,000 pounds of explosive placed in 173 piers. The mine was fired by the touch of a child's hand, and Hallet's Reef was no more. There have since been dredged from this demolished reef a total of 72,084,078 gross tons of refuse, and only a few shoal points now remain, mostly near the shore.

The galleries thus far completed at Flood Rock have a total length of 13,528·08 lineal feet, from which 39,608·38 cubic feet of rock, measured in the original solid form, have been removed.

At the present rate of progress the mining will be completed about the close of 1883.

The machinery by means of which this important work is carried on is of the most approved types of modern mining appliances, and as much as possible of the labor is performed by steam, the prime motive agent. There are four large boilers, three of the horizontal two-flue type, 6 feet diameter by 24 feet long, set in brick, and externally fired, and one of the fire-box tubular or locomotive type. They have an aggregate of 140 square feet of fire grates, equal, at maximum rate of combustion with natural draught, to about 400 horse power.

The steam is maintained at 60 pounds constantly, but in a part only of this system of boilers, one or more being at all times available for cleaning and repairs. They furnish steam to the following engines and heating pipes: Five upright air compressors, steam cylinders, 9" by 18", which supply air to the small drilling engines (30 in all, a part only in use all the time), air pressure of 55 pounds per square inch; one double winding engine, having two cylinders 16"x24" geared to a 7-foot winding drum by spur gearing about 1 to 7, which raises and dumps automatically into scows all the mined rock; one upright ventilating engine cylinder, 12"x18", driving a fan 12 feet diameter; one small upright shop engine driving the machine shop and four smiths' fires; and one small double-cylinder freight hoister.

There are two ten-inch Worthington duplex mining pumps, one of which at about 75 to 80 strokes per minute, serves to drain the mines in the present condition of the leaks.

There are also three boiler feed-pumps and a special Knowles circulating pump, 8-inch water piston.

The drying chamber in the main gallery is also supplied with steam for the purpose of drying the clothing of the workmen.

The exhaust steam from all these engines is condensed in a large Lighthall surface condenser, and about two-thirds of the original feed water is returned in a purified condition and at about 100° F. to the boilers; when new and unusual leaks are developed by the blasts the second pump is used till they can be plugged by the miners, the parts thus plugged must be then approached from another direction.

The water is all taken to the pump well below the central gallery, through drains cut below the general floor level of the mine, thus leaving the gallery floors comfortably dry for the workmen.

There are now about 200 men, comprising miners, mechanics, and laborers, engaged on this work, in three shifts or watches of eight hours each, using from 20 to 30 drilling engines, which are driven by compressed air distributed from the five compressing engines through a large main, and smaller branch air pipes to the headings where each air-drilling engine has its separate flexible pipe.

Holes something over two inches diameter are now being made, each about four feet deep, at the rate of 31·72 feet per shift, by each active drill.

The blasting is done at night; the explosive used is No. 2 extra giant powder; as many as 300 holes have been fired (charges about one pound weight) in a single night, and then the ventilating fan, located at the top of the shaft, is run at its maximum rate, displacing about 50,000 cubic feet of air per minute.

Careful and experienced pioneers explore the galleries after each blast and test the walls and roof, and remove all loose rocks before the drillers and mining laborers return to work where blasting has been going on.

The detached rock is loaded upon small cars on 2½-foot gauge tracks and drawn to the shaft by mules, a number of which are stabled permanently in a chamber set apart for their use.

The cars are run upon a tilting cradle, which is pivoted upon the sill of the hoisting cage, and firmly secured to the cradles so that they may be safely dumped into the iron-clad chute at the top of the hoist-way, whence the rocks slide into the dumping scow alongside. The descending empty car counterbalances an equivalent weight of the ascending load in the adjoining lift, thus practically eliminating the cost of hoisting the cars as dead weight. The loaded scows are taken by a powerful tugboat to the dumping ground, the present state of which requires unloading upon dump cars upon the dike, as it is shown, nearly filling the space between Little and Great Mill Rocks, indicated in the engraving.

The history of the Hallet's Point mine, which may be found fully illustrated in the SCIENTIFIC AMERICAN of August 21, 1875, Sept. 30 and Oct. 14, 1876, shows the comparative cost of hand and machine drilling by compressed air to be 95 cents per foot for the former, and 36 to 37 cents for the latter.

The distribution of the whole cost of mining was then as follows:

Drilling and blasting	46·00	per centum.
Transporting in the mine	17·00	"
Hoisting	3·28	"
Dumping	2·03	"
Pumping	10·37	"
Incidentals, including costs of superintendence	21·32	"
	100·00	

The disposal of the rock from the new mine, which involves the use of a tugboat and dumping scows, modifies the distribution of the cost, making the item of dumping 7·17 per cent., while the incidental item which includes cost of superintendence is reduced to 10·4, or less than half that in the old work.

The works at Flood Rock are in charge of Gen. John Newton, U. S. A.

Imitation Amber.

Considerable quantities of beautiful objects of artificial amber are now being produced in Vienna. The substance employed in its manufacture is chiefly colophony or resin, obtained by decomposition of turpentine, though several other ingredients are used to give it the requisite qualities. The imitation is said to be perfect, and the production has even the electric properties of amber. Ingenious manufacturers have even introduced into the substance foreign bodies, insects, etc., to make the similarity more striking. Natural amber requires a temperature of 285 to 287 degrees C. to fuse it, while the imitation becomes liquid at a much lower temperature.

A Fatal Torpedo Explosion at Newport.

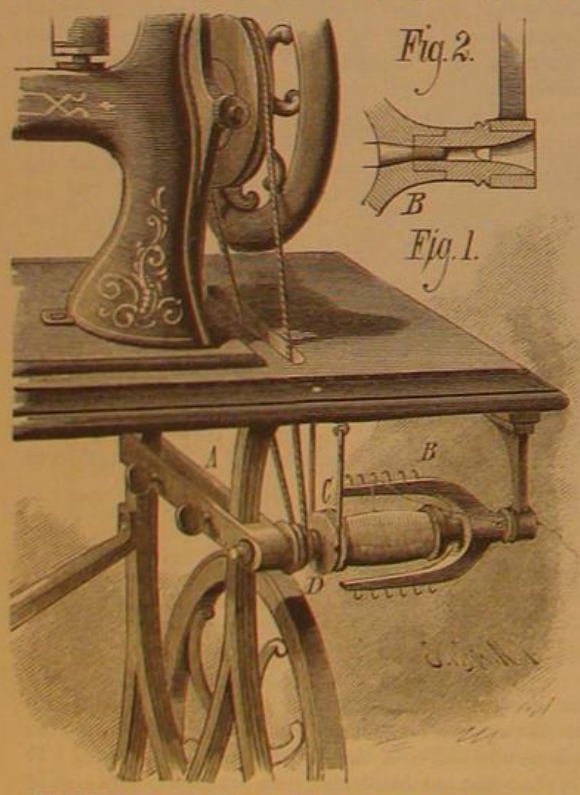
Recently two officers of the torpedo school at Newport, R. I., Lieutenant Commander Edes and Lieutenant Spaulding, were killed by the untimely explosion of a torpedo which they were placing in the harbor. According to the official report of Captain Thomas Selfridge, in charge of the torpedo station, the deceased officers were carrying out a torpedo in a small boat, when it exploded. The class had been previously instructed in all the details of the operation, and a diagram drawn that each one could see how the wires should lead, and special cautions had been given by the instructor, Lieutenant Commander Bradford. The torpedo was first to be planted. Then, of the two wires, one was to be connected to a circuit closing buoy, and the other to a firing circuit on shore. They had been cautioned not to make these connections after the torpedo was dropped until they had come ashore. As a further precaution, the wire connecting the firing battery with the torpedo in the electrical building was also disconnected, making three breaks, any one of which would make it impossible to fire the torpedo. It seems that the first torpedo planted by these officers became leaky, and in taking it up they cut the wires of the old torpedo without breaking the shore connections. In planting the new torpedo, being in a hurry, they pulled out and took up the wires from the water and connected it (the torpedo), supposing the connection in the electrical building was broken. It appears that Lieutenant Commander Caldwell, supposing, as should have been the case, that the connections of the torpedo were broken, joined this connection in the electrical building. The terrible result followed.

SPINNING ATTACHMENT FOR SEWING MACHINES.

The engraving represents a very simple spinning device, which can readily be attached to a sewing machine, and replaces the cumbersome spinning wheel generally used with hand machines for spinning. Fig. 1 is a perspective view of the device applied to a sewing machine, and Fig. 2 is a sectional view of the outer journal of the spindle.

A clamp, A, is secured to the leg of the sewing machine by thumb screws, and supports the spindle, C, flier, B, and the spool. The end of the spindle is furnished with a hollow flaring mouth.

To fit the attachment for operation the clamp, A, is to be attached to the legs beneath the table and directly over the driving wheel, with the spindle projecting in a horizontal direction, with space enough for the flier to clear the table. The bracket which supports the outer end of the spindle is then to be screwed into the table directly over and in line with the mouthpiece of the spindle. A tension band is passed around the grooved pulley of spool and secured to the table. The object of this band is to prevent the spool from turning as fast as the flier, and it can be made to turn as fast as required for taking up the thread by tightening or slackening the band by means of screws. The driving band is passed around the driving wheel of the sewing machine and around the cone pulley, D.



BLACKETT'S SPINNING ATTACHMENT FOR SEWING MACHINES.

This attachment will readily do all the work of the ordinary spinning wheels much faster, and it is much easier to work than spinning wheels. The attachment saves the necessity of having a spinning wheel where there is a sewing machine in use.

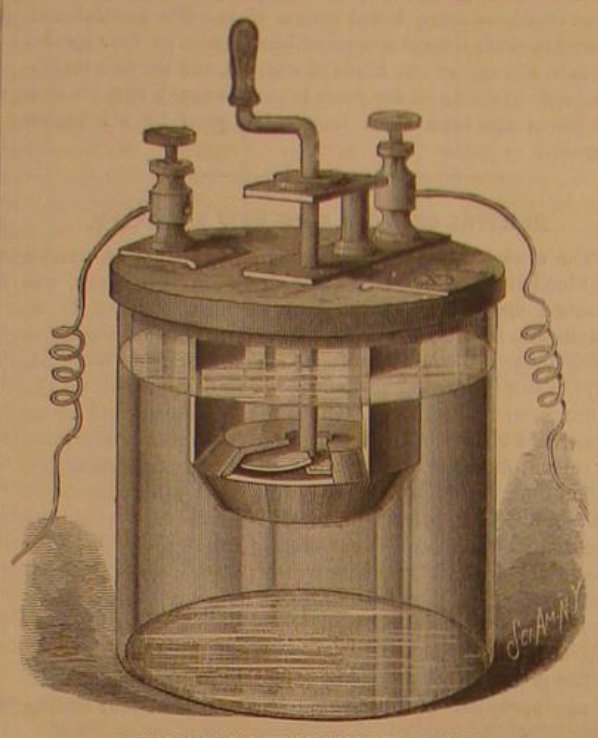
In many parts of the country a spinning wheel is just as much a necessity in every family as a sewing machine; but with this attachment to the sewing machine the large wheel will not be required.

For preparing yarn for crochet work and knitting the spinning and twisting attachment is especially useful.

This invention was recently patented by Mr. J. C. Blackett. All communications in regard to the invention should be addressed to Mr. J. R. Blackett, Caledonia Mines, Cape Breton, Nova Scotia.

AN IMPROVED BATTERY.

The engraving shows an improved galvanic battery lately patented by Mr. A. Floyd Delafield, of New York city. This battery is provided with means for increasing the strength of the current by producing a more or less rapid circulation of the solution in contact with the elements by mechanical means, operated by hand or by a motor. This is accomplished practically by fitting the negative element upon a shaft for revolution between the zinc plates, and for increasing the effect the revolving disk is made in spiral form, something like a screw propeller, so that it creates a circulation of solution in the cell, thus continuously depolarizing the elements.



DELAFIELD'S GALVANIC BATTERY.

Pictet's New Steamer.

The Geneva correspondent of the London *Times* gives the following details concerning Professor Raoul Pictet's model steamer, which he expects to drive at the rate of 40 miles an hour:

Her dimensions are 16 meters long and 3·50 meters wide. When lying at anchor she will draw 33 centimeters fore and 44 centimeters aft; at full speed, 1 centimeter forward and 16 centimeters aft. The engine will be placed amidships, from which point to the stern the screw shaft and the keel form an inclined plane; the bows are long, tapering, and wedge-shaped. Professor Pictet reckons that his invention will lead to a great saving of fuel, inasmuch as a steamer built on his plan, after being started with, say, 100 horse power, may be kept up full speed with an expenditure of force equal to 30 horses. The form of the hull, on which the maintenance of the ship's equilibrium will depend, cannot be explained without a diagram. Professor Pictet is quite confident in the success of his invention, and his scientific previous achievements have been so remarkable that many people who cannot follow his reasoning have no hesitation in accepting his conclusions.

The Improvement of the Mississippi River.

The construction committee of the Mississippi River Commission, consisting of General Q. A. Gillmore, Major C. R. Suter, and Mr. B. M. Harrod, has for several months past been holding monthly meetings in St. Louis for the purpose of hastening the preparation of the outfit required for a vigorous prosecution of work under the appropriation of $1,000,000 made at the last session of Congress, all of which will be expended on the river below the mouth of the Ohio. As bad navigation on that portion of the river is invariably due to excessive widths produced by caving banks in concave bends, the first thing to be done is to stop this caving by suitable works of bank protection, such as a brush mattress weighted with stone or some other species of revetment or covering extending down from the crest of the bank into deep water. The next step will be to narrow the stream to such widths between the high river banks that the current, with the increased velocity produced by the narrowing, will scour out and maintain, even during the low river stages, the depths required for navigation. This will be done by contracting the stream, usually at points opposite the concave bends, through the agency of light, permeable dikes, placed either longitudinally or transversely to the shore, or both. These dikes, composed of brush hurdles, or of wire and brush screens, or some similar device, will allow the water to pass through them with more or less freedom, and, by checking without arresting the current, will convert large areas next the shore into stilling or settling basins, within which the river itself is expected, during the flood stage, to build up new banks and establish new and advanced shore lines by constantly depositing the solid matter which it transports, but which the unimpeded flow would carry down to the Gulf of Mexico. Works of this general character will be begun as soon as the working plant is ready upon nearly seventy miles in length of the worst navigation below Cairo, namely, about forty miles on the Plum Point stretch, above Memphis, and thirty miles in the vicinity of Lake Providence, above Vicksburg. Nothing will be done upon the levees. It is expected that work will begin about October 1.

The National Telephone Exchange Association.

The third semi-annual convention of this association was held in Saratoga, the second week in September. There were present at the first session 250 delegates, of whom 100 represented telephone companies. Among the prominent delegates were:

G. L. Wiley, assistant general superintendent of the Metropolitan Telephone and Telegraph Company; W. A. Childs and Francis Shaw, of the Law Telegraph Company; Henry W. Pope, of the Staten Island Telephone Company; Henry Metzger, general manager of the Pittsburg Telephone Company; William Sargent, the general superintendent and electrician of the Bell Telephone Company, of Philadelphia; Mr. Goodyear, representing L. Tillottson. C. B. Hotchkiss, John A. Roebling, Washburn & Moen, and other firms were represented. Among the subjects for discussion were these: The latest improvements in all the instruments used; underground wires; wire construction and kinds of wires; also a report on electrical disturbances interfering with the telephone service.

IMPROVEMENT IN TELEPHONES.

The engraving shows an improved telephone transmitter and receiver recently patented by Mr. J. A. Lakin, of Westfield, Mass. This instrument is especially intended for mills, railroad offices, and other places wherein much local noise disturbs the successful operation of the common telephone now in general use. This instrument consists of a square box, in which are placed both a transmitting and a receiving diaphragm. From the receiving diaphragm chamber two sound tubes extend to be received one in each ear. They are kept in place by a small spiral spring, tending to draw the tubes together, and thus keep the small rubber caps on the ends of the sound tubes in place in the ear. These caps shut out all extraneous sounds and confine the sounds of the receiving telephone, so that their full effect is felt on the ear.

The lower part of the box, as seen in the drawing, contains the transmitter, which is made very sensitive. It is claimed that this instrument will talk two hundred miles or more.

Pressing the button, as shown in the cut, brings the battery into circuit with the transmitter. The inventor of this instrument has given much time and study to the construction of telephones, beginning as early as 1869, although, as he informs us, most of his attention has been given to acoustics.

LAKIN'S TRANSMITTING AND RECEIVING ELECTRIC TELEPHONE.

For further information address J. A. Lakin, Westfield, Mass.

NEW INVENTIONS.

Mr. Henry Grabach, of Clyde, O., has patented an improvement in the manufacture of boots and shoes, which consists in securing the counter stiffener to the shortened lining by a line of stitches around its edge, the lining of heel portion terminating at the edge connection, so that the friction of the heel of the foot comes upon the stiffener and a portion of the usual lining is saved.

Mr. John Murray, of New York city, has patented a toy savings bank for children, so constructed as to connect amusement with the operation of depositing money in the banks. The invention consists in a toy savings bank having a slotted base with a money receiving compartment at its rear

end, and at its forward end the figure of a tree having a slot in its rear side, the figures of a dog and cat connected with the base and tree by slides and springs, and a trip lever, whereby the weight of a coin dropped upon the said trip lever will release the dog, and the forward movement of the dog will release the cat, which will then run up the tree.

Mr. John S. Powers, of New Burlington, Ind., has patented an improved water gate, consisting of a base frame secured to the bottom of the stream, an inclined frame hinged at its upper stream end to the base frame, and supported at its down stream end by hinged standards having a crossbar attached to their upper ends, and wheels pivoted to their lower ends, and the stops attached to the base frame for the wheels of the supporting standards to rest against, so that the passage of animals will be prevented and the gate will be lowered to the bottom of the stream by a rise of water or an accumulation of rubbish.

An improved horse collar fastening has been patented by Mr Samuel Peters, of Sydney, Nova Scotia, Canada. The object of this invention is to provide the extremities of the horse collar with a fastening whereby the collar can be conveniently opened and closed, and thereby readily adjusted to or removed from the neck of the animal.

Messrs. Frederick H. Hubbard and John J. Ashley, of Brooklyn, N. Y., have patented an electric plaster which is an improvement on that class of healing plasters which are designed to have the curative properties supplemented or increased by electrical currents.

Mr. Hamline Q. French, of New York city, has patented an improvement in the construction of roofs for vaults, mausoleums, and structures of similar character built of stone and intended for burial purposes. The object of this invention is to obtain a building without vertical joints, and one held together and locked at the roof, so that by the locking and the weight of the roof the structure shall be made as enduring as the material of which it is built.

An improvement in window-cleaning chairs has been patented by Mrs. Anna Dormitzer, of New York city. This invention is designed as an improvement on the window-cleaning chair for which Letters Patent of the United States Nos. 200,441, 206,935, 206,936, and 219,234 were granted and issued to the same inventor, respectively, February 19 and August 13, 1878, and September 2, 1879, and its object is to further simplify the construction of the chair, and make it less expensive and more complete and durable.

An improved store counter seat has been patented by Mr. Willis M. Corwin, of Glen Cove, N. Y. The invention consists in a store counter seat in which a bar carrying the seat is provided with a catch recess, a hinged bar pressed forward by a spring to carry the seat beneath the counter, a catch bar to engage with the recess of the seat bar to hold the seat in place when under pressure, and a spring to raise the seat bar from the catch plate when the pressure upon the seat is removed, so that the seat, when released from pressure, will be carried in under the counter automatically.

Mr. Jacob Katzenberg, of New York city, has patented an attachment for button-hole and embroidery sewing machines for use in laying cords along the edges of button holes for the purpose of filling out or raising the stitches that surround it, thus producing more finished and durable work.

An improved baling press has been patented by Mr. Alpeus D. Channell, of Sabetha, Kan. This improvement consists in the combination, with two hoppers and two baling boxes, of hinged doors, hinged connecting bar, and the hand lever, whereby the hay in the hoppers can be forced into the baling boxes to be carried forward by followers.

Messrs. William F. Miller and Charles W. Stover, of Tipton, Iowa, have patented a hog-cholera compound consisting of turpentine one pint, spirits of camphor one pint, cayenne pepper one half of an ounce, and carbolic acid one half of an ounce.

The revenue laws extending the bonding of whisky from one to three years make it necessary to increase the number or capacity of bonded warehouses, and it is desirable that the racks in such houses should combine great storage capacity with cheapness of construction. The most approved method of construction at present is to set up rows of upright timbers within the house, about three feet apart in one direction, and brace or hold them together with iron bolts and rods having nuts on each end, and to lay on these bolts and rods the stringers in one tier above another for supporting the barrels of whisky. Mr. Thomas J. Pottinger, of Gethsemane, Ky., has patented an improved whisky rack for bonded warehouses which reduces the cost of bonded warehouses for storing whisky.

Mr. William F. Leach, of St. Clair, Mich., has patented a portable steam auger having a rotary steam engine to operate the boring tool, handles for carrying and holding the engine, a breastplate for forcing the boring tool forward to its work, and a tool holder or coupling for connecting a boring tool with the engine.

A nail-holding and starting attachment for hammers has been patented by Mr. George C. Peeling, of Lock Haven, Pa. The object of this invention is to facilitate the driving of nails in places where they cannot be conveniently held by the hand.

Mr. Robert Gawne, of Toledo, O., has patented an improvement in propellers for vessels. A hollow cylinder is fitted in the vessel at the stern and extends through the stern post below the water line. A cylinder extends from the stern of the vessel to near the engine, its diameter being proportioned to the extent of rise and fall it is desired to obtain for the propeller. The propeller shaft is placed in line with the central axis of the cylinder, and carries a pinion that meshes with a gear wheel on the engine shaft. The pinion will thus be always engaged in any position to which the cylinder may be turned. By a semi-rotation of the cylinder the propeller is shifted from the highest to the lowest point, and can be thus positioned according to the load or the depth of the water. With a light load the propeller can be brought down into the water to obtain effective action, and with a deep-loaded boat the propeller can be raised in shallow water, as may be necessary.

An improved sand and water break has been patented by Messrs. Charles W. Maxson, of Point Pleasant, and Jacob W. Buck, of Freehold, N. J. The object of this invention is to prevent the bluffs or banks of a sea beach from being washed away by the waves or covered with sand.

URN FROM SEVRES.

SEVRES URN.

The engraving on this page shows a very elaborate urn from the porcelain factory at Sèvres. Both design and ornamentation are so well shown in the cut as to require no comment.

The Root of the Cotton Plant.

The value of the cotton plant (*Gossypium herbaceum*) has been increased by the discovery that the bark of the roots yield a promising dyestuff. Mr. W. C. Stachl reports that when the bark of cotton root is exhausted by alcohol of the specific gravity of 0·84, a dark reddish-brown liquid is obtained, which, when distilled to recover the spirit, leaves a resinous matter which amounts to 8 per cent of the original weight of the bark. The new product thus obtained appears black and shining, but when pulverized takes the color of cochineal. It dissolves in 14 parts of alcohol, 15 parts of chloroform, and 122 parts of benzol. It dissolves also in caustic alkalies, and is precipitated from these solutions by acids. Hydrate of potash colors green. Sulphuric acid dissolves it with a red-brown color.

Drying Hay by Artificial Means.

The system of drying hay by artificial heat, devised by Mr. W. A. Gibbs, of Gillwell Park, Chingford, Essex, has been before the public several years, and though its adoption has made slow progress, it is now being used by several well known agriculturists. Since the construction of the apparatus was first publicly described it has received several improvements, and it is now constructed with a single vibrating trough, along which the hay gradually traverses; the coke furnaces are combined in one with the trough, and shaking and vibrating mechanism upon two pairs of road wheels for easy transport, and the width has been reduced to seven feet.

A writer in the London *Times* recently saw the machine at work, and says that grass from a water meadow was being put through the apparatus, encountering at first a hot blast of about 400°, which drives off the moisture in steam, following through other streams of less heated air, and being delivered in a condition of finished aromatic hay of rich green color. Each load of more than two tons was put through in fifty-five minutes, or a slightly longer time than it took a man to load it in the field. One feature, he says, in Mr. Gibbs' machine is its value for converting injured hay into good, wholesome hay, the fans blowing out dust and must, while the sulphurous gas from the burning coke is believed to destroy the germs of microscopic life which may be the cause of disease in live stock fed upon foul hay. It is suggested that were these hay driers in the hands of men who let out thrashing machines, and could work them at a time of year when little thrashing remains to be done, they would save an immense acreage of hay every season in splendid condition. Another system, which promises to be of even higher economic value, has recently, however, been described as in successful use for several seasons by Mr. Neilson, and more recently by Mr. Knowles, of Colston Bassett Hall, Bingham, near Nottingham. This system consists in thoroughly tedding and lightly scattering the grass as soon as cut by a machine, and so expose it to the withering action of the air, whether under sunshine or showers. In about two days the green hay, without any turning or other labor expended upon it, and whether wet or not, is, in its half-made condition, carted and stacked. The rick at once begins to ferment and heat, and the heat so generated is employed to finish the process of hay-making. The temperature to which the hay is allowed to rise is regulated, and the means employed for this and for draining off all the superfluous moisture have been thus described:

In the raised base or staddle on which the rick is to stand, whether that is an ironwork structure or raised earth, is laid an airtight pipe, which may be of earthenware, of from three inches to six inches diameter, joined with cement, and this tube or air passage communicates with a vertical one in the center of the staddle, and rising a short distance to the center of the height of the rick. An exhaust fan connected with the horizontal part of the pipe is situated at a short distance from the stack, in a building or otherwise. In case of a long rick, the horizontal pipe is continued along the middle of the staddle, and two vertical pipes are used. Each aperture at the junction of the vertical and horizontal pipes is fitted with a sliding damper, and can be opened or closed by a rod extending outside the bottom of the rick. In stacking the hay a vertical air shaft or chimney is formed over each aperture, by the common method of drawing up a sack of straw or a round chaff basket as the building of the rick proceeds; but these ventilating flues are carried up to only half the height of the stack. When the exhaust fan is set in motion, drawing air from the underground pipe and rarefying the air in the chimney, the replacement of that air can come only by currents penetrating the rick from the outside walls and roof, and gradually converging into the chimney in the center. By this exhaustion of the hot air and moisture out of the middle of the mass, cold air is induced to enter the stack at all points and to seek the central flue, bearing with it the excess of heat and the moisture, and cooling the whole substance of the rick. Very little power is required to drive a fan of the necessary size, and Mr. Knowles' five horse steam engine drives the fan when giving out a mere fractional part of its power. One horse, working a fan by means of an ordinary horse gear and intermediate motion, will do well; and two men turning a corn-dressing machine fan, arranged in connection with the air tube, have been able to accomplish all that was wanted for cooling a stack. With a gentle exhaust, the atmospheric air is caused to permeate every part of the rick in ample quantity for keeping down the temperature of the fermenting grass.

The writer referred to says: "Mr. Knowles has brought the internal temperature of a large rick from 130° down to 90° in the short period of forty minutes. In the rick while

building he lays at various heights wooden tubes of bore large enough to admit a thermometer to be introduced on a lath, these tubes reaching horizontally from the outside to the center; and thus the heat of all portions of the stack can be examined. A temperature of 100° is considered the maximum at which it is advisable to let the fermentation work, the fan being set in operation as soon as the temperature approaches this. The same provision of air ducts and a manually operated exhaust fan has been employed with advantage in keeping barley and other corn stacks from heating."

This system of drying half-made hay or dry corn deserves to be made generally known, not only because of the large quantities of crops which may be saved by it, but because of the remarkable economy of labor which it secures. The system should, moreover, afford our agricultural implement makers an additional article of manufacture, by means of which the system might be carried out with facility.

New England Life Two Generations Ago.

Recently Mr. P. T. Barnum gave to his native village, Bethel, Conn., a bronze fountain costing $10,000. At the presentation Mr. Barnum described with rare felicity the manner of living to which he was born. He said:

"I can see as if but yesterday our hard-working mothers hatcheling their flax, carding their tow and wool, spinning, reeling, and weaving it into fabrics for bedding and clothing for all the family of both sexes. The same good mothers did the knitting, darning, mending, washing, ironing, cooking, soap and candle making, picked the geese, milked the cows, made butter and cheese, and did many other things for the support of the family. We babies of 1810, when at home, were dressed in tow frocks, and the garments of our elders were not much superior, except on Sunday, when they wore their 'go-to-meeting clothes' of homespun and linsey-woolsey. Rain water was caught and used for washing, while that for drinking and cooking was drawn from wells with their 'old oaken buckets' and long poles and well-sweeps.

"The first water works ever built in Bethel were got up by my father and Capt. Noah Ferry for their own exclusive use about 1820, 60 years ago. I distinctly remember seeing the lead pipes made in Capt. Ferry's barn. The water was brought from the spring belonging to Esquire Benjamin Hoyt, on Hoyt's Hill.

"Fire was kept over night by banking up the brands in ashes in the fireplace, and if it went out, one neighbor would visit another about daylight the next morning with a pair of tongs to borrow a coal of fire to kindle with. Our candles were of tallow, home-made, usually with dark tow wicks. In summer nearly all retired to rest at early dark, without lighting a candle except upon extraordinary occasions. Home-made soft-soap was used for washing hands, faces, and everything else. Families in ordinary circumstances ate their meals on trenchers (wooden plates). As I grew older our family and others got an extravagant streak, discarded the trenchers, and rose to the dignity of pewter plates and leaden spoons. Tin peddlers, who traveled through the country with their wagons, supplied these and other luxuries. Our food consisted chiefly of boiled and baked beans, bean porridge, coarse rye bread, apple sauce, hasty pudding, eaten in milk, of which we all had plenty. The elder portion of the family ate meat twice a day, had plenty of vegetables, fish of their own catching, occasionally big clams, which were cheap in those days, and shad in their season—these were brought from Norwalk and Bridgeport by fish and clam peddlers. Uncle Caleb Morgan, of Wolfpits or Puppytown, was our only butcher. He peddled his meat through Bethel once a week. It consisted mostly of veal, lamb, mutton, or fresh pork, seldom bringing more than one kind at a time. Probably he did not have beef oftener than once a month. Many families kept sheep, pigs, and poultry, and one or more cows. They had plenty of plain, substantial food. Droves of hogs ran at large in the streets of Bethel.

"Our dinner several times each week consisted of 'pot luck,' which was corned beef, salt pork, and vegetables, all boiled together in the same big iron pot hanging from the crane, which was supplied with the iron hooks and trammels, and swung in and out of the huge fireplace. In the same pot with the salt pork, salt beef, potatoes, turnips, parsnips, beets, carrots, cabbage, and sometimes onions, was placed an Indian pudding, consisting of plain Indian meal mixed in water, pretty thick, salted and poured into a home-made brown linen bag, which was tied at the top.

"When dinner was ready the Indian pudding was first taken from the pot, slipped out of the bag, and eaten with molasses. Then followed the 'pot luck.' I confess I like to this day the old fashioned 'boiled dinner,' but doubt whether I should relish a sweetened dessert before my meat. Rows of sausages, called 'links,' hung in the garret, were dried, and lasted all winter.

"There were but few wagons or carriages in Bethel when I was a boy. Our grists of grain were taken to the mill in bags, on horseback, and the women rode to church on Sundays, and around the country on week days on horseback, usually on a cushion called a pillion, fastened behind the saddle, the husband, father, brother, or lover riding in front on the saddle. The country doctor visited his patients on horseback, carrying his saddle bags, containing calomel, jalap, Epsom salts, lancets, and a 'turnkey,' those being the principal aids in relieving the sick. Nearly every person, sick or well, was bled every spring."

In Mr. Barnum's boyhood the richest man in town was actually worth as much as $3,000.

California Silk Exhibits.

In view of the new life which silk culture is assuming, it is worthy of note that the exhibits of silk winding appliances and silk products are very rich in this year's Mechanics' Fair, San Francisco. The *Mining and Scientific Press* says: First are the handsome and well filled cases of Joseph Neumann, a pioneer in California silk culture and manufacture. His position is on the main floor, near the musicians' stand. His exhibit is an unusually large one, occupying one elevated glass stand and a glass case. Both in variety and quantity of cocoons and raw silk, the display is remarkably good, and reflects great credit upon the exhibitor for the care, perseverance, and expense he has gone to in endeavoring to build up this industry in California. Several pyramids representing the silkworms spinning their cocoons are shown, besides over twenty cases of cocoons, all raised in this State. These latter represent many different varieties, from the smallest up to the full size of the French annual. The specimens of raw silk exhibited are very fine, and establish, as clearly as it is possible to do, that the silk manufactured from the worm bred in this State is, in its raw condition, equal to that of any country in the world. Mr. Neumann, through his own unaided individual efforts, has done much to establish this, and he is deserving of every praise for it. Interspersed among his exhibits are the different medals (nine in all) that have been awarded his exhibits in other places and countries, the whole constituting a well arranged display of silkworm productions and the marks of appreciation extended toward them by others.

The two other exhibits of silk may be found adjoining each other in the east gallery. One of these is by the California Silk Culture Association, which is the name chosen by a large number of energetic and public spirited ladies for their society, which is now the most active agency in awaking new interest in silk culture. The society has already enlisted a large number of ladies in different parts of the State in sericultural experiments, and the results thus far obtained are very encouraging. The exhibit of the Silk Culture Association is very comprehensive. It contains, first, a collection of wild silkworm moths from India and China, as also a number of the ordinary kinds. They are the property of Dr. Behr, of this city. In cocoons, the finest exhibit is that made by Mrs. S. A. Sellers, of Antioch. It is made under the auspices of the association, and comprises the following different varieties, all of California growth: French annual, Japanese annual, and bivoltines. The French annual cocoons are considered the best for manufacture, being also the largest. The bivoltines, or, as the name signifies, bi-annuals, are the smallest varieties. In addition to the cocoons, Mrs. Sellers exhibits a lot in different colors of reeled raw and floss silk, together with a number of silkworm eggs and moths. The display is a very complete one, occupying one entire large case, and would do credit to any exhibition in the world. The other exhibitors in the stall of the California Silk Culture Association are Mrs. Keeney and Mrs. McLean, of San Rafael; Mrs. Dodson, of Red Bluff; Mrs. James G. Whitney, San Francisco; Mrs. F. Dennis, Sutter Creek; and Mr. Bettleheim, of Antioch. The newly invented frame for silkworms to wind cocoons, the idea of Felix Gillett, of Nevada City, is worthy of notice, as are two very fine specimens of the California wild silkworm moth. It is stated that a very similar kind of moth to the California one is found in some portions of Tartary, and that the people make from it a rough silk cloth that gives unending wear. Garments made from it have been handed down by the Tartars from generation to generation, from time immemorial. Mrs. T. H. Hittell, the indefatigable Secretary of the California Silk Culture Association, has some interesting old German illustrated works treating of the silkworm and silk culture, and Miss Mary Wackenreuder, of San Bruno, has a very pretty imitation in wax of the mulberry tree, and the silkworms feeding. The operation of reeling the silk from the cocoons may be seen on Wednesday and Saturday afternoons.

One of the most striking displays in the pavilion is that of the California Silk Manufacturing Company, of this city. It consists of a large upright glass case filled with silk manufactures, chiefly spool silk. There is an architectural method of showing this spool silk, which shows much skill, and presents a charming effect. An excellent imitation of the State Capitol at Sacramento, and the steps approaching thereto and the lawns approaching it, is all made of silk manufacture. The building is wholly of spools of selected colors and embracing all kinds of silk thread.

New Dental Alloy Amalgam.

Dr. Henry S. Chase, of St. Louis, Mo., in a paper read before the Wisconsin State Dental Society, says his new alloy is made as follows: Melt forty pennyweights of pure silver; add to this thirty pennyweights pure tin; stir it, then add five pennyweights of antimony and five pennyweights of pure tears of zinc. When mixed, add thirty pennyweights of pure tin again; stir, and throw on the surface of the "melt" one half ounce of beeswax to burn off; and while burning, pour the "melt" into the *cup* of a vulcanizing flask to *cool*. Cut it up with very coarse file. Remove every particle of iron with horseshoe magnet. This amalgam must be washed in alcohol while mixing with mercury. Squeeze it in dry buckskin. This amalgam is *whiter* for washing, and takes less mercury. Squeezing injures some amalgams; it does not hurt this. The amalgam pellets must be dry when placed in the cavity. This amalgam remains very white in the mouth. If *all* the tin should be melted at once, the antimony and zinc would never melt. If the antimony and zinc are put in the melted silver before the tin, then the antimony and zinc will burn up or oxidize.

Three-high Rollers.

The Lauth three-high mill, for rolling sheet iron or steel and plates, is rapidly gaining in favor in Germany, Belgium, and France. In the beginning, as Daelen reports in the *Zeitschrift des Vereins Deutscher Ingenieure*, some trouble was experienced by reason of the fact that the middle roll wore rapidly. This was caused by the adhesion of cinder to the roll, and its being passed through over and over again. This has been done away with by suitable stripping devices. Krupp has built a sheet mill for steel, having 26·4 inch top and bottom rolls and 15·2 inch middle roll, the maximum thickness of plates entering the rolls being 0·5 inch. In turning out 0·06 inch sheets, the engine makes 60 revolutions; it makes 50 for 0·04-inch sheets, 40 for 0·03 inch sheets, and 30 revolutions below that gauge. The engine has an automatic Corliss gear, a 37·6 inch cylinder, and 62·80 inch stroke. A Lauth three-high plate train at the same works has 35·6 inch top and bottom rolls, and a steel 17·80 inch middle roll, which is raised and lowered mechanically before every pass. The mill is run at the rate of 50 to 60 revolutions per minute.

Rapid Progress in Texas.

A special statistical edition of the Galveston *News* shows that 1,634 miles of railway have been completed in Texas within a year, and that within two years 41 additional towns of commercial importance have been reached by rail or have sprung into existence, and that the value of the State's products has increased from $57,820,141 in 1878–79 to $95,960,930 in 1880–81. The amount and value of the chief staples of the State for the past year are: Cotton, 1,260,247 bales; value, $56,711,115; wool, 20,671,839 pounds; value, $4,754,522; hides, 12,262,052 pounds; value, $1,471,446; cattle, 781,874 head; value, $15,923,018; horses and mules, 28,175 head; value, $1,408,750; grain, 39,665 car loads; value, $6,941,375; lumber, 278,609,542 feet; value, $5,572,191; cotton seed cake and oil, $1,242,315; miscellaneous products, $1,344,728; sugar and molasses, $591,470. Total value, $95,960,930.

There has been expended during the year for railroad construction within the State something like $20,000,000, which added to the above would give a grand total of $115,960,930 as the sum derived by Texas to the credit of its industrial and agricultural resources, or fully double that of the year 1878–79.

An Electric Storm at Sea.

The German war schooner Nautilus reports passing through a singular storm while crossing the South Pacific from Tahiti to Sydney, Australia.

On the afternoon of May 11, the whole heavens appeared to be enveloped in cloud, which made it so dark that the crew could scarcely see the length of the ship. The thunder became deafening, and the flashes of lightning almost blinded the sailors' eyes. All around the vessel the lightning was striking the water, so that persons on board expected the vessel itself would be hit. But this they were spared. The effect, however, was singular and grand, and at times the vessel appeared to be in flames in several places at once. Bolts of lightning on several occasions fell to the water within 20 or 40 yards of the ship's side. While this peculiar storm lasted very little rain fell and the sea was almost entirely still.

Reversing the Wheels.

Experiments lately made at Blackburn with a train made up in imitation of that of the express which ran into the train standing in Blackburn Station, to test the statement of the driver that he reversed his engine as soon as he found the brakes did not check his train, are of some interest, though they elicited the fact that the reversal of an engine of a train running at a high velocity has but a very small effect in reducing the speed. A high speed was attained, and the engine was reversed a quarter of a mile before reaching the station, but the train ran through the station at about twenty miles an hour, and had to be stopped by the brakes. Locomotive driving wheels, when running the reverse way, are not effective in stopping a train. The experiment shows how little can be gained by reversing an engine under such circumstances.

The Largest Land Owner on the Continent.

Colonel Dan Murphy, of Halleck's Station, Elko County, came to California in 1844, and may be said to have made the country pay him well for his time. He is now probably the largest private land owner on this continent. He has 4,000,000 acres of land in one body in Mexico, 60,000 in Nevada, and 23,000 in California. His Mexican grant he bought four years ago for $200,000, or five cents an acre. It is sixty miles long and covers a beautiful country of hill and valley, pine timber, and meadow land. It comes within twelve miles of the city of Durango, which is to be a station on the Mexican Central. Mr. Murphy raises wheat on his California land, and cattle on that in Nevada. He got 55,000 sacks last year, and ships 6,000 head of cattle a year right along.—*Reno Gazette.*

A Japanese Earthquake Record for 2,000 Years.

The *Japan Gazette* prints a translation from a noted *O-Jishin Neudarki*, giving a calendar of earthquakes in Japan for 2,000 years. A summary of the record is printed in the San Francisco *Bulletin* of July 25.

The first entry in the Japanese chronology is 295 years B.C.: "In the fifth year of the reign of Kôrei-tei, the seventh Emperor, the earth in the province of O-mi sank down, and in one night was changed into a lake. During the same night Fujiyami was upheaved. This was the first earthquake." The presumption is that this was the first of which there is any authentic record in Japan. We here have the origin of the famous and sacred mountain of Japan, provided the account is correct. An earthquake which made a part of one province into a lake, and raised a mountain nearly 17,000 feet high, certainly ought to have an authentic record. It is known that a mountain was lifted out of the plains in one of the States of Mexico in comparatively modern times. The next notation is about the year 412 A.D., when there was a "strong earthquake." Here is an interval of about 700 years in which no convulsion was severe enough to make a part of the ancient record, or if so the record as now read is silent. From the year 600 A. D. earthquakes were frequent. Coming down to the year 976, the record says there was "the greatest earthquake that ever took place, and the shaking continued for over 200 days." In the year 1510 it is noted that the shaking continued 75 days, and during this time a stone portal of one of the great temples was broken down.

A great earthquake is noted in 1595, during which a large temple was destroyed. In 1703 "the earth shook for 200 days in Kuanto, or the eight Eastern Provinces." In 1707 a great earthquake took place in Osaka. "Men and women escaped into boats, but they were all drowned by the sudden rising of the waves." In the southern and northern divisions of the town, 620 dwelling houses were destroyed by the shock. The number of the killed in the southern division was 3,62); in the northern, 2,331. The number of the killed by the waves in the southern division was 12,000 souls, and in the northern 12,030; 22 bridges were destroyed, and the waves rolled up with thousands of ships as far as Dôtombori. The number of the killed was counted in all at 29,981. At this time blue mud gushed forth along the shores of the Provinces of Kii, Ise, Mikawa, and Totomi, and many lives were destroyed by the sudden rolling in of high waves. Fujiyama shook and erupted. Ashes fell in the neighboring country. At this time Hôyeizan was created. Hôyeizan is a parasitic cone on one side of Mount Fuji.

The intervening earthquakes are not here noted, because there is no statement of any destructive results. In 1751 an earthquake is noted at Takata. "During this time the mountain slipped down, and 10,000 lives were lost." During the earthquake of 1847 many persons were killed. In 1854 there was a severe shock. "The dead were innumerable. Those who died by the high waves at Okata were numbered at over 6,000." A list of the towns and provinces is given where the earthquake was the most severe. This was apparently the greatest earthquake ever known in Japan:

"In Osaka, a great many ships were destroyed and persons killed by the high waves which rose after the earthquake. In the river Aikawa, 174 junks and 180 boats of various descriptions and 150 persons were destroyed. In the river Kidzukawa 590 junks were destroyed. Up to the 11th day of the 11th month (1854, December 30) over 600 bodies were drawn out of the river. Counting the dead of various provinces there were over 6,000. In every part of the city buildings of various descriptions, such as Buddhist and Shinto temples, towers, bridges, theaters, etc., were destroyed and burned. Consequently in many quarters of the city a vast number of human beings died. The sea shores and river sides were damaged, and ships of every kind were destroyed, while the men who were in them almost without exception lost their lives. In the neighboring countries or villages the damage was equally great. The commencement of the shake was at half past the fifth hour, that is, at 9 o'clock in the morning of the 12th. From this hour the shaking continued almost unceasingly until 4 o'clock in the afternoon of the 13th day, when the greatest shock occurred. After this no more severe shocks were felt. Several buildings were destroyed and men were killed. At Nagoya, in the Province of Owari, the shaking was severe on the 4th and 5th days of the 11th month (1854, Dec. 23 and 24). Great numbers of houses were destroyed, many being attacked by waves. High waves of about twenty feet in height rolled over the rice fields of Chitagori, and in three places large dikes were injured. Houses at Susaki, O-i, Kamezaki, etc., were destroyed. In Yawata, in the Province of O-mi, buildings of various descriptions, such as dwelling houses, Buddhist and Shinto temples, etc., were leveled to the ground. The damages in Hikone and Nagahama were about equal. The damages in Samegai were also great. Mount Yorozan slipped down, and the clear water of the neighboring streams became muddy. Seven or eight tenths of Kano and O-gaki were also injured. More than one-half the houses in Sunomata suffered, and mud gushed forth from fissures in the earth. Two-tenths of Hagiwara and eight-tenths of Inaba were also destroyed. In a village between Niizaka and Nakago the earth was split to a depth of four or five feet, and the level of the earth was made uneven. Yokosuka, between Okitsu and Yejiri, was half destroyed. Shimidsu, a harbor between Yejiri and Fuchui, was very much damaged. The houses were all reduced to ashes and taken by the waves far out to sea."

A list of about fifty places is given where the waves were very high and a great deal of destruction was wrought. The earthquakes appear to have lasted through the latter half of the year 1854. The earth opened in seams several feet wide for miles in extent, provinces were inundated, cattle and men destroyed. As late as December 23 of that year it is noted that great waves rolled up the rivers, and a great number of ships were destroyed. At Yusa 600 houses were swept away by the waves. At the village of Hiroura, out of about 1,000 houses, all but three were carried by the waves out to sea. In a number of other villages it is noted that half the houses were carried away by the waves. Then follows another list of towns where the earthquakes of that month or the tidal waves were the most destructive:

"Shook actively in Kojima, in the Province of Awa, and the seventh part of the city was destroyed or else burned by fire. High waves rolled up in Tanabe and Kumano, in the Province of Kii, and all the ships which were near the shore and on the river banks were thrown up and utterly wrecked. Waves equal in force to these attacked several other places. In some villages not only the houses but also the animals were swept entirely away."

The record ends with 1854.

The British Science Association.

The annual meeting of the British Association for the Advancement of Science began in York, England, August 31. It is known as the jubilee meeting, the first meeting of the association having been held in the same city just fifty years ago. It has met in York but once since, in 1844. An interesting feature of the jubilee gathering is a loan collection in which the instruments of scientific research used half a century ago will be contrasted with those now in use, with as complete a chain of intermediate links as can be obtained. Below is a list of the presiding officers of the association from 1831 to 1881, with the places of meeting:

Year.	Met at.	President.
1831	York	Lord Fitzwilliam.
1832	Oxford	Dr. Buckland.
1833	Cambridge	Professor Sedgewick.
1834	Edinburgh	Sir T. M. Brisbane.
1835	Dublin	Dr. Lloyd.
1836	Bristol	Lord Lansdowne.
1837	Liverpool	Lord Burlington.
1838	Newcastle	Duke of Northumberland.
1839	Birmingham	Rev. W. Vernon-Harcourt.
1840	Glasgow	Marquis of Breadalbane.
1841	Plymouth	Dr. Whewell.
1842	Manchester	Lord Ellesmere.
1843	Cork	Lord Rosse.
1844	York	Dean Peacock.
1845	Cambridge	Sir John Herschel.
1846	Southampton	Sir Roderick Murchison.
1847	Oxford	Sir R. H. Inglis.
1848	Swansea	Marquis of Northampton.
1849	Birmingham	Rev. T. R. Robinson.
1850	Edinburgh	Sir David Brewster.
1851	Ipswich	Professor Airy.
1852	Belfast	Colonel Sabine.
1853	Hull	Mr. William Hopkins.
1854	Liverpool	Lord Harrowby.
1855	Glasgow	Duke of Argyll.
1856	Cheltenham	Dr. C. G. B. Daubeny.
1857	Dublin	Dr. Lloyd.
1858	Leeds	Professor Richard Owen.
1859	Aberdeen	Prince Albert.
1860	Oxford	Lord Wrottesley.
1861	Manchester	Mr. William Fairbairn.
1862	Cambridge	Professor Willis.
1863	Newcastle	Sir William Armstrong.
1864	Bath	Sir C. Lyell.
1865	Birmingham	Professor Phillips.
1866	Nottingham	Mr. W. R. Grove, Q.C.
1867	Dundee	Duke of Buccleuch.
1868	Norwich	Dr. J. D. Hooker.
1869	Exeter	Professor Stokes.
1870	Liverpool	Professor Huxley.
1871	Edinburgh	Sir W. Thomson.
1872	Brighton	Dr. W. Carpenter.
1873	Bradford	Dr. A. W. Williamson.
1874	Belfast	Professor Tyndall
1875	Bristol	Sir John Hawkshaw.
1876	Glasgow	Dr. Andrews.
1877	Plymouth	Dr. Allen Thompson.
1878	Dublin	Mr. Wm. Spottiswoode.
1879	Sheffield	Dr. G. J. Allman.
1880	Swansea	Professor A. C. Ramsay.
1881	York	Sir John Lubbock.

Nearsightedness in Schools.

The results of an inquiry into this subject are given in a recent number of the *Elsass-Lothringische Volkschule*, showing that myopia is greatly spreading amid the boys and girls of the German schools, the mischief being more marked as the children get up into the higher classes of the schools. The number of shortsighted in the elementary classes was 5 to 11 per cent (the examination embracing 10,000 children); in the higher schools for girls the proportion was from 10 to 24 per cent; in the *realschulen*, between 20 and 40 per cent; in the gymnasia, between 30 and 55; and in the two highest classes of all, between 35 and 88 per cent. A physician at Tübingen has found in an examination of 600 students of theology 79 per cent suffering from myopia, and he attributes this frequency to the small, crabbed print of the dictionaries. No doubt, also, a large proportion of the children's shortsightedness arises from defective living and bad sanitary conditions. In connection with this branch of the subject may be mentioned the report of a society at Leipsic for enabling children under this condition of life to be sent either to the seaside or the country. During 1880 there were 131 children sent away, namely, 67 boys and 64 girls. Of these 119 were forwarded to the Ergerbirge, and the remainder to the baths at Frankenhausen, in Thuringia. During the six weeks of the stay the average weight of each child increased to about 1¼ kilogrammes, the measurement of the chest in nearly every case was also increased, and the sight of many perceptibly improved. The expense of the visit per child was about £2 13s.

RECENT INVENTIONS.

Mr. Charles O. Nyqvist, of Brooklyn, N. Y., has patented an improved storm rudder which enables seamen to readily control their vessels should the rudder become unshipped or disabled in a storm. The invention consists in placing rudders on the sides of vessels, and in arranging suitable mechanism for operating the rudders, whereby the vessel can be guided and controlled should the ordinary rudder become disabled.

An improved car coupling has been patented by Mr. George Holforty, of Sedgwick, Kan. The invention consists of a vertically sliding spring-actuated connecting bolt which engages with the head of the connecting link upon three sides, the bolt being adapted to move in ways formed in the drawhead.

Mr. William H. Howland, of San Francisco, Cal., has patented an improvement in machines for grinding ore. These improvements relate to machines for grinding ore, either wet or dry, and for grinding paints and other materials. The inventor makes use of a pan-shaped receptacle for the material with a ring-shaped bed, and fixed around a central shaft carrying the driver. The driver consists of a conical sleeve, to which the grinding blocks are hung, so as to be thrown out centrifugally by rotation of the driver. A pipe supplies air or water within the driver, from which it passes to the grinding surface, and acts to carry the ore or other material outward.

An improved fish and game trap has been patented by Messrs. Gottlieb Rentz and Frank. H. Herzog, of Quincy, Ill. This invention consists in a wire with hooks at the ends, and a spring coil in the middle, forming two shanks, which are provided with short bends to receive the end of a spring trigger when the two shanks are crossed. When the animal bites or nibbles at the bait the spring trigger snaps upward, thus releasing the spring shanks, which are forced apart in the mouth of the animal.

An improvement in bottle washers has been patented by Mr. Lawrence Wagner, of Jefferson City, Mo. The object of this invention is to provide a safe, speedy, and simple method of cleaning bottles.

Mr. Armand Muller Jacobs, of Moscow, Russia, has patented a process of preparing a mordant for use with alizarine in dyeing in turkey red color, which consists, first, in uniting about two hundred and twenty parts of oil or fat and fifty parts of sulphuric acid, the mixture being stirred for about three hours until a temperature of 30° to 45° Reaumur is reached, and then left at rest for about twelve hours; secondly, adding to this mixture a watery solution of crystallized soda, and allowing the whole to stand about twenty-four hours; thirdly, drawing off the neutralized oil and adding about twenty-six parts of aqua ammonia.

An improved temporary binder has been patented by Mr. George H. Reynolds, of New York City. The invention consists in combining with a book cover a stiffener having strips, flanged plates apertured and attached to covers at each end, metallic strips that are passed into the folds of the papers, and a slotted studded tube carrying a spring catch.

An improved millstone face has been patented by Mr. George A. Coles, of Middletown, Conn. The object of the invention is to save middlings by preventing the granules formed in the furrows from being crushed or pulverized by the lands as the middlings make their way toward the skirts of the stones. The invention consists in connecting the main furrows of a millstone by channels made at right angles to a given radius of the face of the stone, and being limited in extent by the furrows and distributed over the working surface of the stone from the bosom to the skirt.

An improved dish cleaner and drainer has been patented by Mr. Samuel B. Luckett, of Knightstown, Ind. The invention consists in constructing a dish washing and drying apparatus, with a base frame, posts, and a top frame having dish receiving notches, a pan to receive the drip water, longitudinal bars for supporting cups while drying, a hinged angular plate or apron for supporting dishes while being washed, and a perforated pan for supporting knives and forks while drying.

Mr. Bat Smith, of Spanish Camp, Texas, has patented a composition for preserving wood, consisting of coal-tar, crude carbolic acid, and crude pyroligneous acid.

Mr. John H. Gramps, of Stone Arabia, N. Y., has invented a holder for use with ordinary hand lamps, by which such lamps can be securely held on sewing machines, tables, etc., and at other places where there is liability of the lamps being upset. The invention consists in a combined clamp and adjustable holder adapted for being secured to the edge of a table, and for holding the lamp in any position required.

Mr. Gamaliel King, of Westfield, Mass., has patented an improved whip formed of a central cord and sectional rattan cover

An improved rein holder has been patented by Mr. Edward C. Clarke, of Circleville, Ohio. This is a device to be attached to the dashboard, seat, or other part of a carriage or other conveyance for holding the reins.

Business and Personal.

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

Centrifugal Pumps, 100 to 35,000 gals. per min. See p. 189.

Wanted—Bids for Lighting the Streets of Hazleton, Pa., either with oil, gas, or electricity. For particulars, address J. E. Giles, Chairman Council Committee.

Cook's Infusorial Earth. A superior quality. Apply to D. Judson Cook, Drakeville, Morris Co., N. J.

The American Electric Co. and Proprietors and Manufacturers of the Thomson Houston System of Electric Lighting of the Arc Style. New Britain, Conn.

Hoe and Shovel Factories send address to M. W. Chadbourne, Sheridan, Ark.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Philadelphia.

Draughtsman's Sensitive Paper. Thos. H. McCollin, Philadelphia, Pa.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Valuable Patent for sale.—Automatic Cigar Lighter. Crook, Herring & Co., cor. Centre and White Sts., N. Y.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Abbe Bolt Forging Machines and Palmer Power Hammer a specialty. S. C. Forsaith & Co., Manchester, N. H.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Improved Skinner Portable Engines. Erie, Pa.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

For Machinists' Tools, see Whitcomb's adv., p. 173.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 158.

Safety Boilers. See Harrison Boiler Works adv., p. 157.

Long & Allstatter Co.'s Power Punch. See adv., p. 158.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 156.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 157.

The Sweetland Chuck. See illus. adv., p. 172.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N. J.

Skinner's Chuck. Universal, and Eccentric. See p. 173.

See Bentel, Margedant & Co.'s adv., page 189.

Cope & Maxwell M'f'g Co.'s Pump adv., page 189.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

20,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Rolled Nickel Anodes, Grain Nickel, Nickel Salts, Platers' Supplies. Greene, Tweed & Co., New York.

Telegraph, Telephone, Elec. Light Supplies. See p. 189.

Elevators, Freight and Passenger. Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 190.

Turkey Emery, Star Glue, Pumice, Walrus Leather. Polishers' Supplies. Greene, Tweed & Co., 118 Chambers St., N. Y.

4 to 40 H. P. Steam Engines. See adv. p. 189.

The Medart Pat. Wrought Rim Pulley. See adv., p. 189.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 190.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Work, Lambertsville, N. J. See ad. p. 157.

Upright Self-feeding Hand Drilling Machine. Excellent construction. Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive. 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Av., Phil. Pa.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 189. Totten & Co., Pittsburg.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) T. H. S. writes: I have put up some rolled shafting, and some of it runs untrue. Can you inform me of any easy method of straightening it without taking it down? A. Only by using a portable press, such as used for bending or straightening railroad iron, or by drawing it with a hammer on the hollow side. The former mode is the best.

(2) S. E. R. asks: What capacity or what difference would there be in two boilers, one being 56 inches diameter, 18 feet long, the other 56 inches diameter, 12 feet long. How much larger is the 18 foot than the 12 foot—is it a half or a third? A. The 18 foot boiler, if properly proportioned, would be about 25 per cent more than the 12 foot, and should be more economical. It should have larger tubes than for 12 feet length.

(3) S. W. B. asks: What ought to be the size and length of flue, and the size, height, and distance from engine, of chimney, to secure proper draught for an engine rated at 20 horse power and supplied by two boilers, the furnaces of which are 5 feet 7 inches wide and 22½ inches high? A. 26 or 28 inches square and about 50 feet in height. 2. Will a difference of an inch or two in the level of the two boilers affect their working materially? A. No.

(4) G. G. asks: 1. What is the average weight of an English locomotive? A. 30 to 35 tons. 2. Which is the better adapted to attain the maximum amount of speed, the American or the English locomotive? A. American.

(5) J. W. S. asks: 1. What is the best regular time made on any railroad in the United States? A. From Jersey city to Philadelphia, 98 miles, in 1 hour 50 minutes. 2. What is the weight of the heaviest locomotive in the United States? A. About 40 tons.

(6) W. W. S. H. asks: 1. What is the rule for finding the horse power of a steam engine? A. You are referred to rule in SUPPLEMENT, No. 253. 2. Also the rule for ascertaining the pressure of steam in a boiler where there is no steam gauge? A. By measuring the safety valve and calculating the pressure from it.

(7) E. S. H. asks is glass as great a non-conductor of heat as any substance known. A. Glass is, relatively speaking, a good conductor of heat. Dry wool, feathers, dry saw dust, charcoal, confined air, etc., are much better non-conductors.

(8) A. G. O. asks (1) whether there is any perfectly pure and free-from-lead zinc (No. 20) made in this country, and where it is manufactured. A. Zinc manufactured by the New Jersey Zinc Company, near Franklin, is pure or nearly so. 2. What is the best process to detect lead in zinc? A. Dissolve a fragment of the metal in hot dilute hydrochloric acid, and pass hydrogen sulphide (gas) into the liquid until the latter smells strongly of the gas. If lead is present a black precipitate will be observed.

(9) P. G. R. writes: Can you give me a recipe for a good durable brown wash for fences? A. Try the following: White lime, ½ bushel; hydraulic cement, 3 pecks; umber and ocher, each 10 lb; Venetian red, 1 lb.; lampblack, ¼ lb. Slake the lime, shake up the lampblack with a little vinegar, mix well together, add the cement, and fill the barrel with water. Let it stand several hours, and stir frequently while putting on. A larger proportion of ocher will give it a darker shade. The wash covers well. Only one coat is needed. It is said that the coating will look well after five years' exposure to the weather without removing.

(10) E. S. N. writes: Within a month or so I heard in this vicinity of the action of certain boilers which might give some light on explosions similar to the one at Pottsville lately. An excellent boilermaker was telling about his going into a mill for which he furnished the boilers, and on looking under the boilers found them all red hot for eight or ten feet back from the front. He called the manager and told him his boilers were empty. "Oh, no," he said, "they are that way quite frequently; it's all right." The boilers are 5 inch shell, four inch tubes, 16 feet long, fired with sawdust for all the steam they can make. We then both called to mind an experiment made by an engineer in a flouring mill here. He carried a pipe through the front head of boiler, within an inch of the bottom, running in three or four feet, and provided with a valve outside of boiler; quite frequently when firing hard, clear, dry steam would issue from said valve when opened, showing that no water was in contact with bottom of boiler. This was a tubular 7-foot or 8-foot shell. This may not be anything new to many, but was to me. A. It is not uncommon for badly proportioned boilers, with bad circulation and under hard firing, for the water to lift temporarily from the metal; but it is dangerous, and, in the case you mention, may occur once too many times.

(11) W. B. H. writes: A note in your paper of the last issue by W. L., No. 12, on page 183, referring to the cement or whitewash used on the White House at Washington, has induced me to ask you to answer two or three questions through your valuable paper. They are as follows: 1. Would the application of one, two, or more coats of that cement stop the leaking of a tin roof so put on as to leak badly? A. The coating will hardly answer the purpose. 2. Will you give a statement of the materials of which it is composed, and the proportion of each, and how made, whether by heating, boiling, or cold; and how applied, whether hot or cold. A. See "A Durable Whitewash," page 52, current volume. 3. If that will not answer, can you tell me what will stop the leaks without a new roof? A. Give the roof one or more good coats, when dry, of good roofing paint—red ocher ground in oil.

(12) F. C. H. asks: Can an "American" locomotive, consuming from 50 to 60 lb. coal per hour, require from 350 to 500 lb. of water per mile, as stated in last issue—twenty-five times as much as a stationary engine? A. It depends upon the efficiency of the boiler. Boilers evaporate 6 to 9 lb. water per pound of coal, and if the train is so heavy as to require 50 lb. coal, per mile—then 50×8=400 lb. water. Light trains of course require less coal and water—some not more than one half the above.

(13) J. A. W. writes: 1. I blow my boiler out clean once a week. Is it best to let it dry over night and put cold water in the next day, or put water, at 100°, in from tank immediately after blowing off? A. Let the boiler cool. 2. Is there any method of preventing a safety valve from sticking other than frequent trials? A. A safety valve should be examined and cleaned frequently. Some forms are more apt to stick than others.

(14) G. H. H. asks: 1. At what part of the stroke does the steam cut off in a link motion locomotive engine, when she is said to work on full stroke? A. Usually about seven-eighths the stroke. 2. Does it take the same quantity of fuel to convert a given quantity of water into steam in a boiler under a high pressure, say, at 100 lb. to square inch, as it does at the atmospheric pressure? A. Approximately, but not exactly.

(15) E. N. M. writes: I notice that there have been a great many rotary steam engines invented, but at the same time there are but very few used. What are some of the most important objections to the use of that class of engine? A. The principal objection is, that they cannot be kept tight. Another is that the working steam expansively cannot be readily secured, and they are not economical.

(16) J. M. C. asks: Can you give me a formula for a cement to be placed under the patch, covering a rent in a large boiler? It must be watertight and not affected by heat. A. A mixture of white and red lead, with very fine iron borings, the whole made into a stiff putty with linseed oil.

(17) G. G. asks: Is there any way to remove iron rust from cloth? A. If the cloth is uncolored moisten the stained parts with hydrochloric acid diluted with about three volumes of water and warmed. Thoroughly rinse the cloth in plenty of cold water afterwards. It is nearly impossible to remove such stains from some colored fabrics.

(18) J. S. asks for an effectual remedy for the extermination of red ants. They abound in dry sandy localities, and during the summer months become a terror to housekeepers. I have tried all remedies that I know of, but all fail in accomplishing permanent results. A. The judicious use of a small quantity of oil of turpentine will often drive away the pests. It may be injected into cracks and crevices in closets and elsewhere from an ordinary sewing machine oil can.

(19) S. C. asks: Can you tell me what to do to kill the borers in pine flooring? The floor is fifty years old and perfectly sound until about two years ago, when the borers got in from pine wood stored under the house. A. Try turpentine as directed in answer to J. S., this page.

(20) J. H. W. writes: I tried to marble on paper per instructions in SCIENTIFIC AMERICAN SUPPLEMENT, but the colors sank to the bottom. What is the cause? I used Venetian red and lampblack. I burnt the lampblack to free it from grease. I cannot see where my error is. A. The colors must be ground very fine with the vehicle and floated on to the water carefully—not mixed with it. The marbling must be done immediately after the floating is accomplished. 2. Will a helix or electro-magnet increase the force of the current from a battery? A. As we understand your question, no. 3. In using a battery for medical purposes, is an electro-magnet of any benefit? Is a helix of any benefit? Which is better? A. Your question is rather indefinite. An intermittent current of sufficient tension for medical use can be obtained from either a magneto electric machine or induction apparatus when properly constructed, the electricity from both sources possessing similar qualities. The induction apparatus is more easily managed, and is for that reason usually preferred.

(21) J. G. W. asks as to the composition of rollers for a printing press. A. Best white glue and concentrated glycerine, equal parts. Soften the glue by soaking it over night in enough cold water to just cover it. Strain off excess of water, heat the glycerine over a salt water bath, add the glue, and stir until the glue is all dissolved. Continue the heat for several hours to expel as much of the water as possible. Let the composition get cold, and remelt it several times before at last pouring into the well oiled brass cylinder mould. Give the composition plenty of time to cool and harden before removing it from the mould.

(22) C. S. M. asks if young trees about six inches in diameter can be moved. If so, what is the right time to do it and the best way? A. Easily. Move in winter, when the earth is frozen about the roots. Move as large a block of earth with the roots as can be handled.

(23) W. T. B. asks for a receipt for taking copying ink stains out of linen shirt bosoms and white duck vests, etc. A. Make a strong solution of good bleaching powder (chlorinated lime) in cold water and apply to the stains; then apply a strong aqueous solution of oxalic acid (cold). Repeat if necessary until the stains disappear, then rinse thoroughly in cold water.

(24) W. L. asks: 1. In the preservation of eggs, mentioned in the SCIENTIFIC AMERICAN, No. 1, July, 1881, will the eggs keep as long in the lime pickle as they would if packed in powdered charcoal after being dipped in paraffine? A. The charcoal is the best. 2. How should the pickle be made? A. Add lime and salt in about the proportion of half a pound each for every bucket of water. 3. Would there be any risk in keeping eggs by this process for a year or more? A. If the eggs are well covered with paraffine as directed there will be little danger provided they are stored in a cool place where the temperature does not change much. 4. Would they keep as well in a room well ventilated as they would if put in a cellar? A. The cellar is best. 5. Where can an incubator be bought? A. See column of Business and Personal and Hints to Correspondents. 6. How can an artificial mother for chickens be made? A. See Incubator and Incubation, in SUPPLEMENTS Nos. 26 and 64.

(25) C. P. asks how to make the yeast, and the quantity to put to each gallon of hop beer. A. See Summer Beverages, in SUPPLEMENT, No. 192.

(26) C. T. F. asks: Can you inform me how I can get a light of glass that will stand the heat? I want to put the glass in an iron box in which I am to place articles which I am going to subject to about 300°. A. Good lime soda glass will stand a temperature of 300° Fah. very well without softening. It will not break under the conditions if the precaution is taken to heat it gradually and uniformly at first.

(27) H. A. F. writes: I have at my fisheries a large lot of fish offal and fish not merchantable which I would like to convert into guano or fertilizer in some cheap way. A. Pass the refuse through a mincing machine and expose it in layers about three inches deep in a kiln heated to about 300° Fah., until properly dried. It is sometimes mixed with three times its weight of dry earth and sprinkled with dilute oil of vitriol before drying.

(28) J. T. asks for the best polish for flax or hemp twines, that is, what composition mixed in starch will give a twine a glossy appearance? A. Try the following: To 1 lb. starch add (at blood heat) blood albumen, 2 oz.; water-glass (syrupy), 3 oz.; curd soap, ¼ oz., (dissolved in warm water). Beat together and let it stand forty-eight hours or more before applying.

(29) C. G. says, in answer to W. W. C., page 26 (24), current volume: "If he will lick over the writing with a moist tongue, the writing, after the paper has become dry, cannot be effaced even with India-rubber. The process is not very nice but is very effectual."

(30) G. R. S. writes: In your issue of August 20, 1881, you describe an improved hectograph. Will you oblige me by explaining how the negative (after once using the pad) can be erased, so as to allow the gelatine to be used a second time? A. Remelt the pad, skim off any floating matters, and let it cool again before using.

(31) C. G. asks: 1. Is there any book published on working and tempering steel, as practiced in the die maker's trade? A. There is no single work especially devoted to this subject. The information is scattered through various cyclopedias and works on mechanics. There is great need of a really practical work on working and tempering steel. We can suggest no better way for you to get the information you desire than to obtain it from practical men who have had long experience in the business. 2. If there is, where can it be obtained, and the price? A. Such books as are published can be obtained from booksellers who advertise in our columns. 3. What is the best protection for a steel worker to wear over his eyes? Where can it be bought? A. Probably a pair of good goggles with rather thick glasses would answer your purpose. These may be purchased from any optician in this city.

(32) W. H. L. asks: 1. Will you please tell me if there is any way to remove the stain made by bichromate of potassa, after it has been exposed to sunlight? A. If the substance will bear it use a solution of 1 oz. caustic potassa dissolved in 3 oz. of water, and after rinsing, a small quantity of strong warm acetic acid. 2. Is there any good method of removing freckles? If so, please give it. A. We know of no very satisfactory remedy other than bathing the skin frequently with fresh cream and protecting it from strong sunlight and wind. 3. What is the accepted theory in regard to a vacuum above our atmosphere? Is it considered a perfect vacuum? A. Probably not. 4. I have heard or read that a perfect vacuum is an insulator to heat. If so, how do we get the sun's heat? A. Heat and light pass unimpeded through vacua, that is, space practically devoid of air, aqueous vapor, or other ponderable substance. 5. Will electricity pass through a perfect vacuum? I know it will pass through the vacuum made by air pumps. A. No.

(33) D. C. B. asks: 1. Would you please inform me through SCIENTIFIC AMERICAN what ingredients and proportion of same compose hectograph described August 20, page 116 of SCIENTIFIC AMERICAN? A. Soften 1 oz. of fine gelatine by soaking it over night in a small quantity of soft cold water. Press out excess of water in a cloth, and dissolve the gelatine in about 8 oz. of concentrated glycerine by heating over a hot water bath for an hour or so. See article on copying pads,

page 100, vol. xiii. 2. What make of printer's ink is used in process? A. Best letterpress ink. 3. Can ink be rubbed from pad as in the ordinary copygraph? A. No.

(34) J. A. S. asks: Is there any known chemical which will render rope or cloth incombustible or partly so? A. Saturate the fibers with a solution of 1 lb. crude tungstate of soda in a gallon of hot water.

(35) F. A. asks how to draw water from a distance of about 15 feet in length, and about 40 feet deep. You understand the well is about 15 feet from the place where I want to place the pump, and the well is about 40 feet deep. A. Your pump should be not more than 24 to 28 feet above the surface of the water in the well, therefore you must place the pump in the well and arrange a mode of working it at the point of delivery. Or sink the pump in the earth to the requisite depth, and lead pipe from it to the well.

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

E. C. C.—Schistose rock containing a little iron oxide—probably manganiferous.—G. F. B.—Iron pyrites—iron sulphide—no value.

[OFFICIAL.]

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FOR WHICH

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

August 23, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Tunneling apparatus, A. L. Blackman, Nashville, Tenn.
Wave power apparatus, I. L. Roberts, Jacksonville, Fla.

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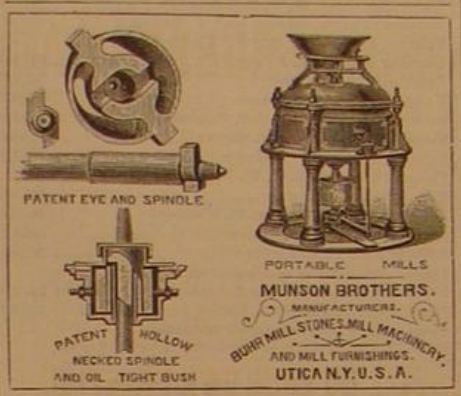

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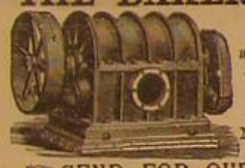

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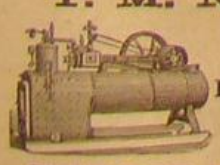

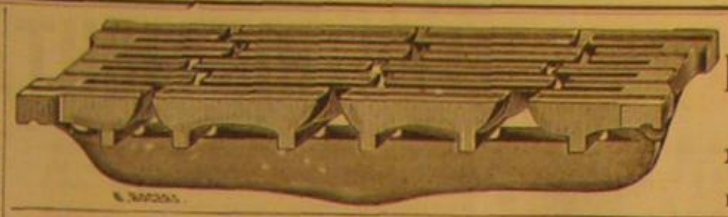

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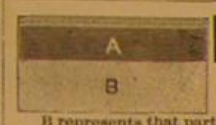

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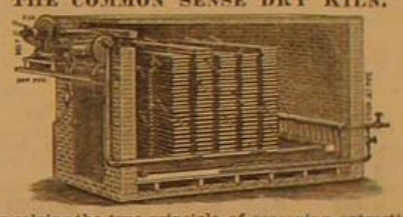

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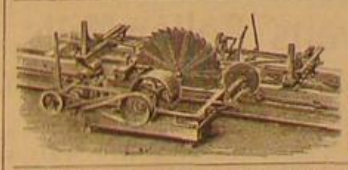

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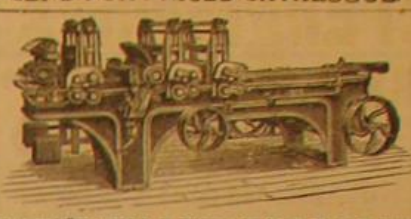

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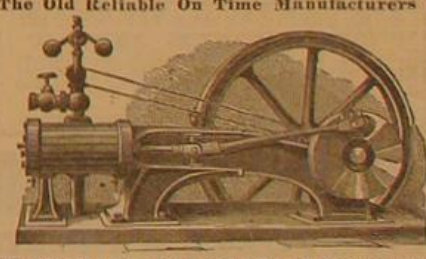

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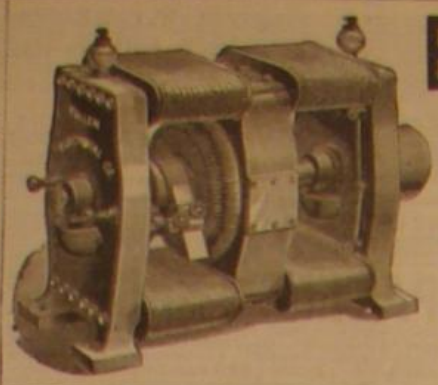

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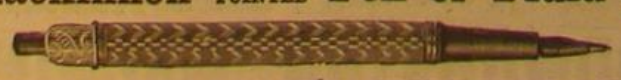

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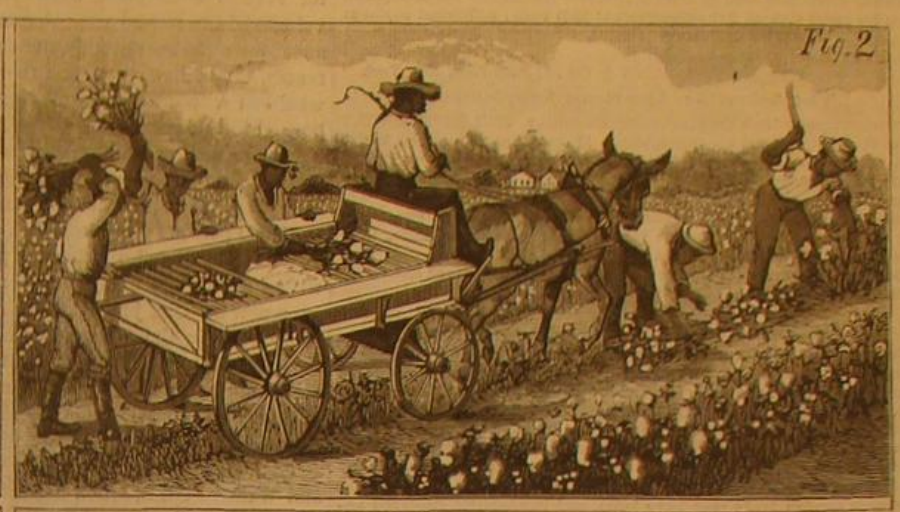
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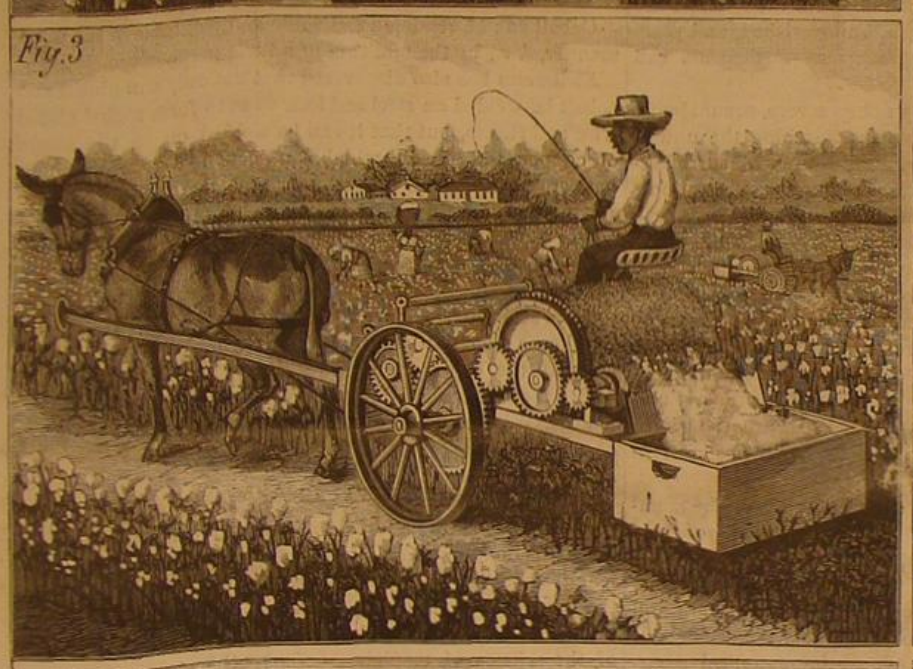
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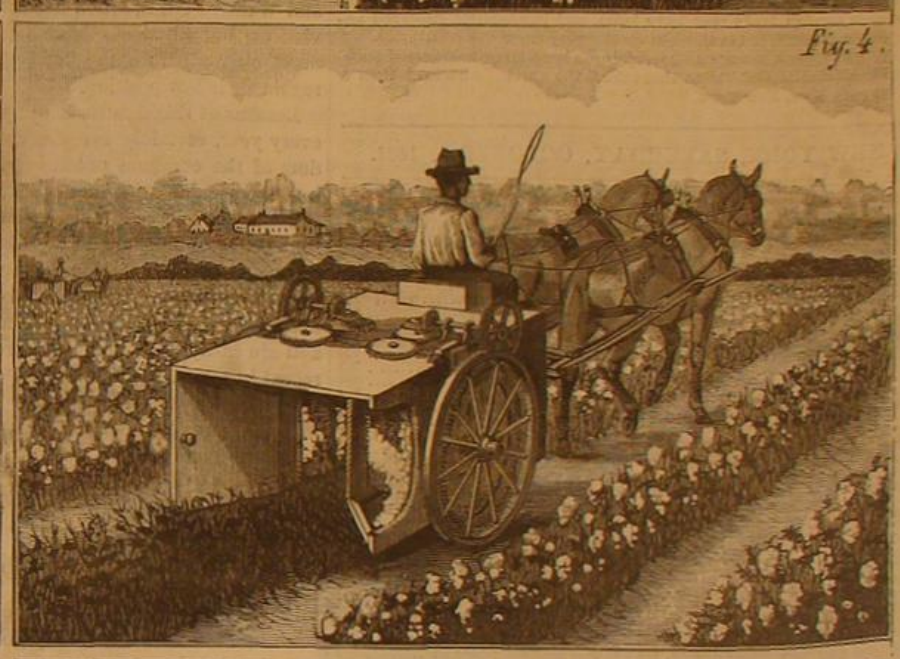
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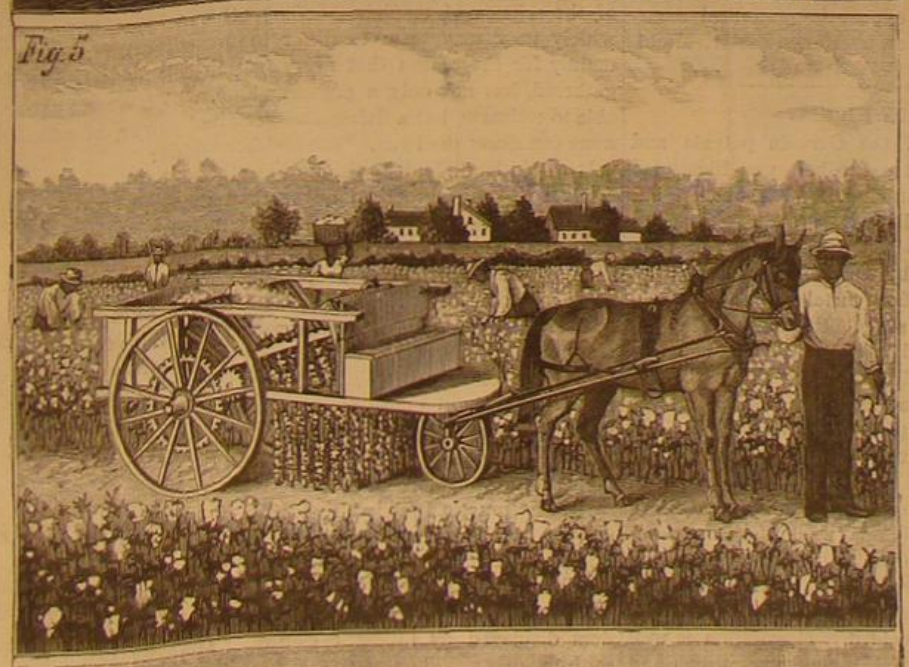
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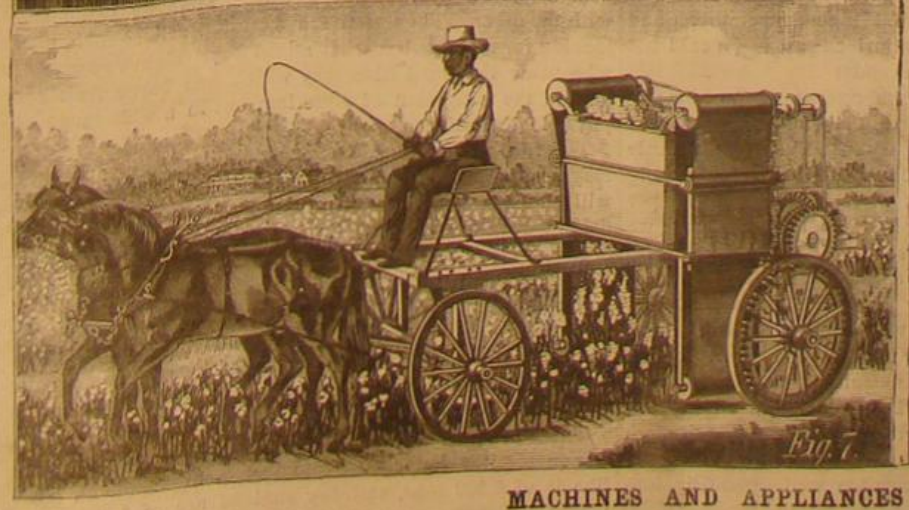
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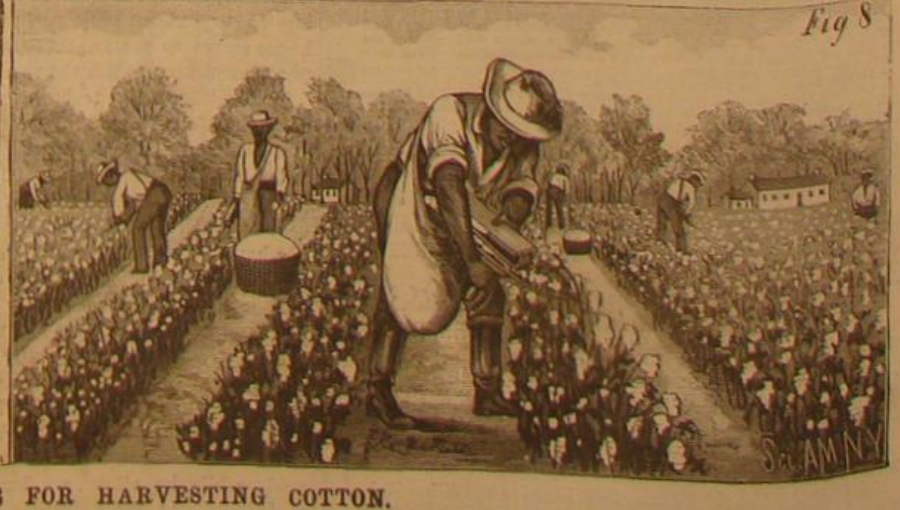
Fig 8

MACHINES AND APPLIANCES FOR HARVESTING COTTON.

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FIELD AND FOREST FIRES.

During the first week of September a large part of two counties and a portion of adjoining counties in the triangle between Saganaw Bay and Lake Huron, in the eastern part of Michigan, were swept by fire, destroying not only the remaining forest, but many small villages and a large number of the outlying houses and barns of the settlers. In the newer districts everything was destroyed and many lives were lost. Much of the country had but recently been cleared, and everywhere there were large areas covered with brush and other food for fire, thoroughly dried by the long-continued drought. For two months there had been little or no rain, and as usual small fires were burning almost everywhere. On Monday, September 5, a high wind arose, and for several subsequent days everything was aflame. The volume of fire was so great that the ordinary means of resistance were useless; woods, fields, villages, farm buildings, fences, crops, live stock, and their hapless owners were overwhelmed without chance of escape. Whole families were burned in their houses, or in the fields and roads while flying for refuge, or smothered in wells, their only resort from the flames which swept the surface. The Mayor of Detroit estimates that 750,000 acres were burned over, and as many as 15,000 persons made homeless and destitute. The whole area of the afflicted district was perhaps 10,000 square miles, with a population of 50,000 or more. Most of the people were new settlers, just getting a start in life, though the loss of property in the older settlements was heavy. The immediate loss of life is estimated at from three to five hundred. Many more were seriously if not fatally burned, and the exposure of houseless and bereaved women and children entailed great additional suffering, if not hazard of life.

Thanks to prompt and liberal contributions from Eastern and Western cities, much has been done for the relief of the victims; but hundreds have been impoverished, and years must elapse before the lately prosperous settlements can regain their lost position.

Lessons of this nature, happily not so severe, occur almost every year, certainly every dry season, teaching the unwisdom of the common practice by new settlers of surrounding themselves with materials for future conflagrations. Forests are cleared, and vast accumulations of brush, tree limbs, waste lumber, and the like are allowed to form on all sides. At last there comes the inevitable drought, with a chance that the rubbish will not yield to small and isolated fires. Ordinarily the brush fires are confined to the clearings, and are easily kept under control. Occasionally, as in the recent instance, and similarly ten years ago, a general conflagration ensues, and a terrible price is paid in property and suffering and loss of life for the neglect to burn the brush-heaps in detail and at seasons when they will not burn so readily.

It is only by concerted action on the part of all the members of a new settlement that this serious hazard of their lives and properties can be kept down, and it would seem possible that something in the way of general legislation might be devised to compel wood-cutters to clear up and burn up their rubbish as they go along. Without such laws for all wooded regions we must expect the periodical recurrence of calamities such as has now overtaken Eastern Michigan.

METALLURGY OF NICKEL.

At the recent exhibition of the German patents and designs the metallurgy of nickel and cobalt was illustrated in an interesting manner by Fleitmann & Witte, of Iserlohn. Dr. Kollmann describes it as follows:

It is only within a few years since the discovery of pure malleable and weldable nickel by Dr. Th. Fleitmann, that nickel has entered the rank of those metals which are technically employed on a large scale. Previously only the alloys of nickel with copper and other metals could be easily wrought, while pure nickel could neither be hammered nor rolled. The reason of this was that pure nickel absorbs (occludes) gases while melted (Fleitmann thinks it is carbonic oxide), and the nickel cannot be worked until these gases are removed.

Fleitmann's process for making nickel malleable consists in adding a very small trace, only one-twentieth of a per cent of magnesium, which is introduced in the form of a bar into the liquid nickel while in the crucible. This small percentage of metallic magnesium renders this brittle metal perfectly malleable, and it can even be welded. Magnesium is well known to oxidize very easily (at high temperatures) and hence serves to remove these injurious gases. (Would not phosphorus accomplish the same end?)

The extraordinary technical importance of the new discovery (which is already patented in all countries) is evident at once. Formerly alloys with comparatively only a little nickel could be used, say, for coin. The German 10 pfennig pieces (like the American 5 cent piece) contain only 25 per cent of nickel to 75 of copper. Now, on the other hand, we can have pure nickel cast in any desired shape, and also forge it and roll it like iron or steel. We may, indeed, assume with tolerable certainty that if Fleitmann's method had been known ten years ago we Germans would not have been pestered with our unhandy little 20 pfennig silver coins, for much more convenient ones could have been stamped from pure malleable nickel. Pure nickel, in addition to its malleability, possesses the great advantage that it does not lose its luster in moist air and is unaffected by organic acids, while its alloys, we know too well, gradually lose their luster and turn reddish.

Fleitmann, in his very interesting investigation, also made the discovery that pure nickel treated with a very little magnesium became weldable just like iron, and upon this he founded a method of welding nickel to iron. This discovery has gained very considerable importance, since we are now able to weld plates of nickel on both sides of the iron or steel instead of merely depositing on it a thin coating by electricity.

The question of welding, which is not yet settled in the metallurgy of iron for Bessemer metal, for example, may perhaps be solved in a manner similar to that in which Fleitmann solved it for nickel. Its importance technically and economically hardly can be overestimated. Nickel made by the new process with magnesium has a resemblance to carbureted malleable iron.

Kollmann made a series of tests of strength with Fleitmann's nickel, and arrived at a surprising result, namely, that the elasticity as well as the absolute strength corresponds exactly with those of medium hard Bessemer steel.

The expansion by rolling and forging of the two metals is the same, so that they can be rolled together.

Kollmann then gives some of the numerical results of his tests, which we omit, but they go to show that the physical properties of nickel and iron are very analogous, so that the thought arises that perhaps nickel is, after all, only an allotropic state of iron!

Since nickel and steel expand equally, blocks of nickel can be welded on both sides of an ingot of steel, and the whole rolled out into sheets of any desired thickness already covered with nickel. Iron wire covered with nickel could be drawn out just like ordinary wire. Another advantage is that the welding as well as the melting temperature of steel and nickel is close together, so that the nickelized steel can be welded as before.

Cobalt can be rendered malleable and weldable in the same manner, *i. e.*, by the addition of a little magnesium.

Fleitmann has also discovered that not only can nickel and cobalt be welded on steel and iron so as to form nickel plated wire and sheets, but that it can be welded on to the alloys of copper and nickel, which can be rolled at a very high temperature. In this operation the metals to be welded are surrounded with thin sheet iron, which is afterward dissolved off, or is heated in an air-tight apparatus. In this way, too, sheet iron can be combined with alloys of copper and nickel by welding.

To prevent articles made of nickeled steel or iron from rusting on the cut surfaces the iron beneath is dissolved away at the edges with dilute acids, and the projecting nickel then hammered down and welded over it. In Birmingham H. Wiggin makes nickel malleable by adding 2 to 5 per cent manganese.

THE GERMINAL VALUE OF NEW TRUTHS.

In his presidential address before the recent Medical Congress in London, Sir James Paget dwelt at considerable length upon the necessity of special studies in science and the impossibility of making any just comparative estimate of the relative value and importance of the several divisions of the science of medicine, or any other science, however widely they may seem to differ in present utility. This mainly for the reason that every fact in science, wherever gathered, has not only a present value, which we may be able to estimate, but a living and germinal power, of which none can guess the issue. The speaker added:

It would be difficult to think of anything that seemed less likely to acquire practical utility than those researches of the few naturalists who, from Leeuwenhoeck to Ehrenberg, studied the most minute of living things, the Vibrionidæ. Men boasting themselves as practical might ask, "What good can come of it?" Time and scientific industry have answered, "This good: those researches have given a more true form to one of the most important practical doctrines of organic chemistry; they have introduced a great beneficial change in the most practical part of surgery; they are leading to one as great in the practice of medicine; they concern the highest interests of agriculture, and their power is not yet exhausted."

And as practical men were, in this instance, incompetent judges of the value of scientific facts, so were men of science at fault when they missed the discovery of anæsthetics. Year after year the influences of laughing gas and of ether were shown: the one fell to the level of the wonders displayed by itinerant lecturers; students made fun with the other. They were the merest practical men, men looking for nothing but what might be straightway useful, who made the great discovery which has borne fruit not only in the mitigation of suffering, but in a wide range of physiological science.

The history of science has many similar facts, and they may teach that any man will be both wise and dutiful if he will patiently and thoughtfully do the best he can in the field of work in which, whether by choice or chance, his lot is cast. There let him, at least, search for truth, reflect on it, and record it accurately; let him imitate that accuracy and completeness of which I think we may boast that we have, in the descriptions of the human body, the highest instance yet attained in any branch of knowledge. Truth so recorded cannot remain barren.

THE second class steel armor-plated turret ship and ram Conqueror was launched September 8, at Chatham, Eng. She is of 6,200 tons, and her engines are of 4,500 horse power. Her armament will be two 25-ton guns.

The Removal of the President.

The successful removal of President Garfield from Washington to Elberon, on the New Jersey coast near Long Branch, a distance of 240 miles, on the morning of September 6, afforded a striking illustration of the perfection of modern means of transit. The vitality of the wounded patient had sunk so low that it was morally certain that he could not survive for many days the heat and bad air of the Capital. As a last resort it was decided to remove him. The railway companies were notified, and in a few hours the necessary arrangements were made, including the construction of about a mile of railway from the Elberon Station to the cottage the President was to occupy.

Mr. Garfield was borne on a stretcher from the White House to a wagon, and slowly drawn to the railway station, where he was as carefully transferred to a car expressly fitted up for the occasion. The seven hours' journey by way of Baltimore, Wilmington, Philadelphia, and Trenton to the sea was admirably endured, a speed of a mile a minute being maintained at times without greatly discommoding the patient.

Opening of the Mechanics' Fair in Boston.

The second of the great exhibitions which Boston is having this fall was opened with due "pomp and ceremony," September 13, the Governor of the State, the Mayor of the city, and numerous other officials participating, with the military, in the exercises. The attendance was large, so that the great building in which the fair is held was comfortably filled, and this, too, without lessening the crowds which all day flocked to the other exhibition, which had been about four weeks in progress. The fact that two such great shows are so well attended at the same time in a city no larger than Boston, and but moderately populous suburbs, not only speaks well for the management of these exhibitions, but tells of the active interest which nearly everybody in New England feels in manufactures and the mechanic arts.

The building in which this exhibition is held is an ornament to the city, and is so well fitted for the purposes for which it was designed as to reflect great credit upon the managers of the Massachusetts Charitable Mechanic Association. It is triangular in ground plan, having a frontage of 600 feet on Huntington avenue and 300 feet on West Newton street, a section of the city which has been wholly made by "filling in" the "back bay" on the Charles River, and all of this new portion is being built up with public edifices and private buildings which reflect great credit upon Boston architects.

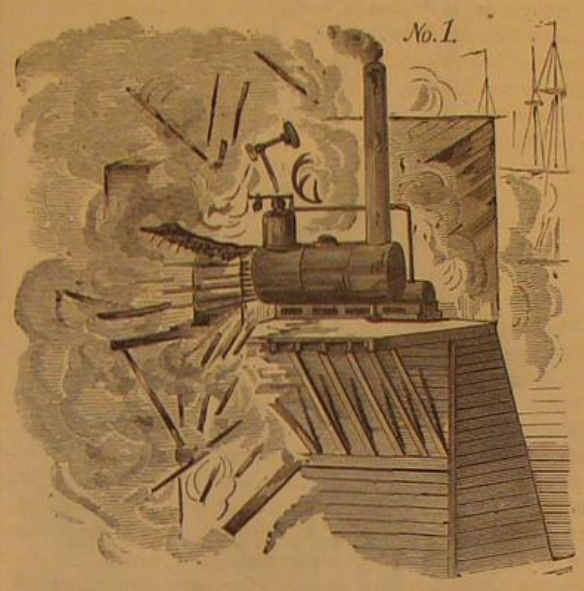
The exhibition building is in the Renaissance style, with free treatment. Distinct lateral lines, except that designating the basement, have been avoided. Arches of graceful curves rise nearly to the coping—giving space within their sweeps for numerous windows, through which the interiors are thoroughly lighted. These arches and the adjacent walls are massively laid in red brick with sills and caps of Longmeadow freestone and terra cotta ornaments. On one side of the main arch is a head of Franklin, on the other that of Oakes Ames, representing respectively electricity and railroading. They are surrounded by spandrels of palm, oak, and olive branches, in which appear the arm and hammer of the association's seal. Around the structure is a wide space of sodded ground, through which is laid a brick sidewalk, and in which are placed numerous gas and electric lights, under whose combined glow the beauties of the front are to be seen almost as plainly by night as they are by day. In the verdant triangle, at the eastern end of the building, a fountain of highly ornamental design is placed. An octagonal tower forms the easterly termination. It is about 40 feet in diameter and 90 feet high, and has in its upper story a lookout, from which a fine view may be obtained. There are two wide entrances into the tower, one directly from Huntington avenue sidewalk, the other through a covered porch and steps twelve feet wide, from the covered carriage porch, built of brick and stone, with hard pine open timbered and tiled roof. In the center of the octagon is the ticket office, and leading from it, and separated by a fence with three turnstiles, is a corridor 20 feet wide, which is the main avenue of approach to the exhibition halls. The administration building, which adjoins the tower, has a basement 15 feet high and three stories above it. At the left of the corridor, which runs through the building from the main entrance to the exhibition hall, is the president's room, a large apartment for the use of the president and directors of the association. Adjoining this is the treasurer's room; then comes a large room fitted with desks for the accommodation of the representatives of the press; and beyond this is the superintendent's office. At the right of the corridor is an elevator running from the basement to the upper stories; adjoining this is the janitor's room, the remainder of the space being occupied by toilet rooms and coat rooms. On the second floor of the administration building is the dining-hall, measuring 34 by 84 feet, and well finished. On the same floor, and separated from it by a corridor corresponding with the one on the main floor, is a private dining room for the managers of the association, the serving room, and ladies' toilet rooms. In the third story is a hall, 46 by 84 feet, which, during the fair, will be used for the military museum. At the close of the fair it will be handsomely finished for the use of the association, and will also be let for concerts, theatricals, lectures, balls, etc., the seating capacity being about seven hundred. It will have an open timbered roof, finished in hard wood, a hard wood floor, suitable for dancing upon, a stage, ladies' and gentlemen's dressing rooms, toilet rooms, committee rooms, etc. Five elevators are conveniently located in different parts of the building, giving ready access to each of the four floors on which the exhibits are arranged, and it is thought that, after the exhibition, and the reservation of the portions which the association will permanently occupy, the other parts may be so let as to cover the interest on a large portion of the money invested in the structure.

BOILER EXPLOSION ON A DRY DOCK.

The steam boiler on Bollman & Brown's floating dry dock, foot of Essex street, Jersey City, opposite New York, exploded with astonishing violence on the morning of September 13. No intelligent engineer who examines, even in a cursory manner, the principal witnesses, namely, the corroded safety valve and the torn crown sheet, will be likely to doubt the cause, while the responsibility may almost as readily be placed.

Capt. L. D. Decker, of the iron tug Gladwish, and James Tammany, a calker, were instantly killed, both being

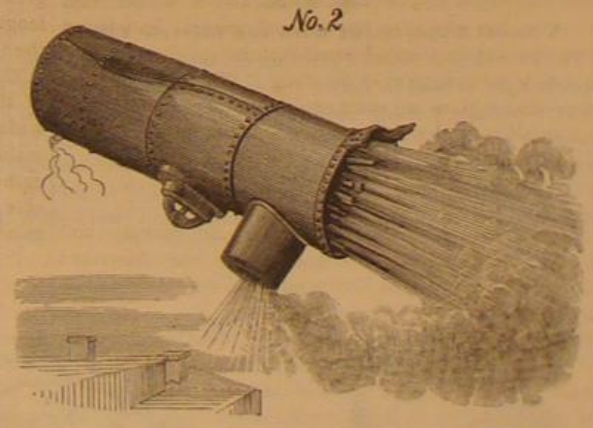
No. 1.



nearly abreast of the boiler and on the tugboat Gladwish, which was on the dock and about to be lowered after having undergone repairs. The names of the deck hands who were injured are John Smith, Alex. McQuinn, Walter Everson, who had temporary charge of the boiler in the absence of the regular attendant, and Victor Lambeck. Three of these persons will doubtless die of their injuries.

Sketch No. 1 shows how the boiler, which was of the locomotive type, was located on an overhanging platform, built upon the second section of the dock, about 20 to 25 feet,

No. 2



according to the stage of the tide, above the street level. It furnished steam to a 14" x 24" horizontal engine which stood alongside of it, through a 2½ inch wrought iron pipe flanged to the body of the safety valve, as shown in the engraving. The engine and boiler were covered by a shed building having a tinned roof, and they were used in connection with suitable gearing to pump the water from the four pontoon sections that composed the floating dock. The boiler was 16 feet long, including the 4 feet of the fire box

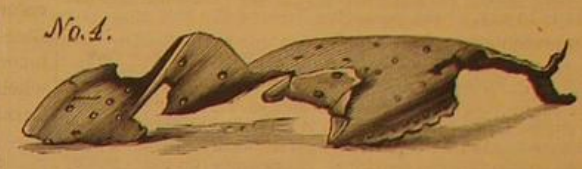
No. 3.

part (see Fig. 1) which was blown to pieces. The original form of this part is shown in dim outline, while the external sheet, with the screw stays attached, is seen spread out in the act of commencing its flight to parts unknown. Up to this time this plate has not been found.

The top and sides of the inner shell of the furnace were flat and formed of a single plate, which was driven down upon the grate bars by the pressure as soon as the overloaded stays gave way by pulling through this plate. It fell upon the dock in the background of Fig. 1, and its condition is shown in Fig. 4. It is five sixteenths of an inch thick; and in another part of the firebox the quality is indicated as Glasgow C H No. 1 flange, tensile strength 50,000. The barrel of the boiler is three eighths, single riveted, and contained 37 tubes 3 inches in diameter and 10 feet long. The boiler itself, well made, is clean inside, and shows no defects indicating long use. It is said to be four years old.

There was no indication of overheating of the plate shown in Fig. 3, which would be the first uncovered portion of the fire

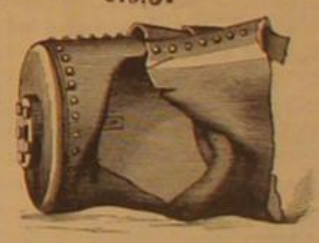
No. 4.



surface in case of low water in the boiler; but there was unmistakable evidence that the so-called safety valve was and had been for some time absolutely inoperative. The iron stem of the valve was immovably fixed by corrosion in the iron bonnet of the valve case. This valve, which is of the wing pattern, is 2½ inches diameter, was loaded by lever and weight to blow off at about 60 pounds when in order.

On the morning of the explosion the engine was not running, the temporary attendant was absent, a brisk fire was burning, and there being no outlet for the steam the pressure accumulated till the boiler gave notice by leaking steam through the weaker seams of the fire-box. The young man in charge, on seeing this, was in the act of running to open the furnace door when the explosion took place. The stay bolts pulled through the inner plate, and the flat top of the furnace was forced down upon the furnace grate bars, and the outer shell plate was forced upward, as indicated in the sketch No. 1. The whole furnace part of the boiler was thus separated from the barrel, which, impelled by the issuing contents, flew like a rocket in nearly a direct line of its projected axis, as indicated by sketch No. 2, up Essex street, plainly marking its trajectory upon buildings and signs; it reached the ground after turning about one-fourth of a revolution on its axis, at a distance of about 300 feet, where it encountered and cut down a fire hydrant, leaving the marks of the fluted casting plainly embossed in the iron of the dome, which was crushed and detached from the boiler, as shown in sketch No. 5. At this point in its course it struck the curbstone, and several rivet heads were ground smoothly off as though by contact with a fast running dry grindstone, changing the iron to a blue color by the heat of the friction. Here also it struck two large trees near the ground and the man-hole yoke was broken off. It was diverted by contact with these objects slightly to the left, and thereby prevented from entering a large dwelling house, and continued by a single bound up the middle of the street to a total distance of nearly 750 feet from the starting point—demolishing two wagons, killing a horse, and finally resting upon a two-wheeled truck to which the animal was attached. The explosion was followed by a terrible roar of the expanding water, which so frightened the horses along the street that they ran away; and the people fled terror-stricken into the nearest buildings.

No. 5.



The safety valve was found after the explosion firmly fixed in its seat, in which it is rusted in. The coroner proposes to weigh the force that will be necessary to move the safety valve from its seat, and no doubt there will be many guesses at the pressure that was required to do this work of destruction.

This case is very nearly parallel to one that occurred at the works of the Standard Oil Company, in Centerville, N. J., in 1878, and from the same cause—overpressure from a defective safety valve. Some of the parts of that boiler, which was also of the locomotive type, flew a distance of 1,200 feet. The boiler was broken into twelve principal fragments, and scattered over several acres of open ground.

The lesson taught by these disasters is obvious and should be learned by every steam user. It is that no steam boiler is safe without an efficient and well kept safety valve.

The worn-out theory of low water as a common cause of boiler explosions must soon give way to the more common causes—defective safety valves and weak boilers. It has become a trite remark among engineers that the most stupid boiler attendant knows enough to keep plenty of water in his boiler, while, on the other hand, many well-informed engineers are too careless about their safety valves, and seem to think if once well fitted and properly proportioned it will remain a safety valve without trouble and care. There is now more than one observer of boiler explosions that believes that the Eleventh street explosion in New York City arose from leaving the fastening upon the valve after the annual hydrostatic test, simply forgotten by the person who placed it there.

Strong Magnets.

For some time past M. Trouvé, the eminent Parisian instrument maker, has been engaged in discovering the best mode of making powerful magnets of identical strength. For this purpose he has investigated the best kinds of steel, the most suitable degree of temper, and the most practical and simple method of magnetization. In testing the different kinds of steel, he cut the pieces of the same dimensions and magnetized them, then measured their portative force. They were afterward tempered and magnetized anew. The portative force after this second magnetization has led M. Trouvé to the conclusion that the best French steel for making bar magnets is that of Allevard, as already known. He also finds that the portative forces, as determined after the two magnetizations, are connected by a simple law, which can be expressed by saying that they are to each other in the ratio of $n : n^2$, that is to say, if the portative force of the first magnetization is represented by 2, 3, and 4, that due to the final or saturated magnetization is represented by 4, 9, 16. As regards the temper of the steel, M. Trouvé finds that a regular temper is necessary, and to insure this condition he employs a muffle furnace heated by gas to a constant temperature. The actual magnetization of the bars is performed by placing them in two solenoids in juxtaposition, and closing the magnetic circuit by means of two plates of soft iron. The solenoids are then electrified by means of the current from six Wollaston elements. By proceeding in this manner M. Trouvé succeeds in preparing bar magnets which will sustain from twelve to fourteen times their own weight, and if they are bent into the horseshoe form the portative force is quadrupled, that is to say, it becomes from forty-eight to fifty-six times the weight of the magnet.

Absorption of Oxygen in Coal Mines.

The Belgian Academy of Sciences has received a report on the researches made by M. Fabre, regarding the diseases to which coal miners are especially liable. He finds that, as coal absorbs rapidly up to one hundred times its own value of oxygen, the air which the miners have to breathe is deprived of oxygen to a hurtful degree; the atmosphere of a mine is also further vitiated by the gaseous carbon compounds given off by the slow combustion of the coal. M. Fabre concludes that a supply of air is more essential than that of light, and even the best ventilated mines require better ventilation.

A Suspended Aqueduct.

A cheap suspension aqueduct was invented and used by some miners in California in 1852. A river ran between two bluffs, one of which was considerably higher than the other. Water was available on the one, but it did not "pan out" as well as that upon the lower. Some sailors, including the mate of a whaler, took up a claim, and succeeded in making a hose of strong duck, about eight inches in diameter, and stretching it from the higher to the lower hill, by means of a strong rope running through it. Water was then carried through this weak hose, which could not have resisted the pressure if lowered into the valley, and the ingenious sailors realized handsome fortunes out of the land that had been hitherto worthless.

AN EASILY MADE CHAIR.

We give an engraving of a very cheap yet strong and comfortable chair which may be made as elegant as the tastes of the maker may dictate. The chair, as will be seen by reference to Fig. 1, consists merely of a barrel cut off above the second hoop so as to form a complete back with half arms at the side. The barrel thus cut is mounted on two strips of wood, having casters under their ends, and brackets above to form the legs and to add to the appearance of the chair. A head is fitted to the circular portion, and the whole is neatly upholstered, as shown in Fig. 2.

Of course it is necessary to select a good barrel bound with iron hoops, and a little care should be taken in the upholstering to disguise the barrel form as much as possible.

A Strong and Handy Cement.

One of the strongest cements, and very readily made, is obtained when equal quantities of gutta percha and shellac are melted together and well stirred. This is best done in an iron capsule placed on a sand bath, and heated either over a gas furnace or on the top of a stove. It is a combination possessing both hardness and toughness, qualities that make it particularly desirable in mending crockery.

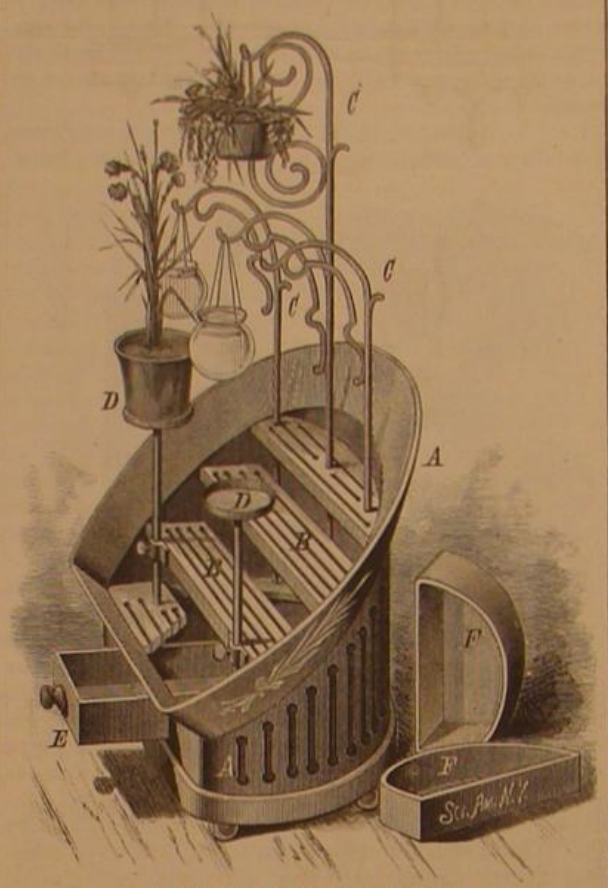
When this cement is used the articles to be mended should be warmed to about the melting point of the mixture, and then retained in proper position until cool, when they are ready for use.

Whooping Cough.

On an extended trial the author, Dr. Gaspar Griswold, of this city, finds *carbolic acid in whooping cough*, in doses of one-fourth minim to a child of six months, one-half minim for one of a year, and one minim for one of two years and upward, to be the best remedy. "The whoop goes; the vomiting ceases; the paroxysms are modified in intensity and frequency." This result he believes to "arise from a similar action to that of creosote on the motor fibers of the vagus to the stomach and from a lowering of the vitality of the specific germ of whooping cough disease."

IMPROVED FLOWER STAND.

The engraving shows an improved ornamental flower stand lately patented by Mr. William D. McCallum, of Truro, N. S. The stand, as will be seen by the engraving, is intended not only for the support of flower pots and vases, but for hanging baskets, fish globes, etc. When properly filled it makes an elegant window garden, holding a great number of plants, while the ornamental brackets support the fish globes and hanging baskets, and form a trellis for the vines.



McCALLUM'S FLOWER STAND.

The capacity of the stand is increased by two or more vertical rods, provided with cups at the upper ends for receiving flower pots.

The flaring rim around the stand supports the foliage and prevents water from getting on the floor while sprinkling the plants.

A Naval Experiment with the Electric Light.

The Providence *Journal* gives an account of a trial of the electric light as used to detect the movements of vessels, at night, especially torpedo boats in time of war. The light is placed in a parabolic reflector, which is pivoted to turn in any desired direction and moved by a small electric engine in the horizontal plane of the motion. In this respect it seems to differ from the calcium reflectors that were often displayed on our streets, although hand power may be applied to the new reflector by detaching the small motor. The experiment was directed by Captain Selfridge, of the United States Navy, and with the United States steamship Nina and a small steam launch from the torpedo station of Newport, R. I. The launch was sent to the outer harbor, followed after some time by the Nina, fitted with a light on each side, to seek for her in the darkness. The launch was to play around and approach with muffled ores and hidden lights as near as possible to the Nina without being heard. The little craft was promptly detected at considerable distance as soon as the light swept over her locality, and the experiment was considered a success.

Fig. 1.

Fig. 2.

A CHEAP AND COMFORTABLE CHAIR.

RECENT INVENTIONS.

Mr. John K. Harris, of Springfield, Ohio, has recently patented a novel and comparatively simple construction of buttonhole worker, applicable to the ordinary sewing machines, which, for neat and substantial work, bids fair to greatly extend the use of this class of devices. In its general organization it comprises a cloth clamp that holds the cloth and oscillates it under the needle at right angles to the line of feed, first on one side of a center line, and then (after shifting its position at the end) returns on the other side of the center line, which center line is then opened or cut with a knife to disconnect the two lines of stitching and form the buttonhole. The cloth clamp is oscillated by a connection with the needle bar of the machine. The prominent feature of the invention is to be found in causing the lateral oscillation of the cloth clamp to be converted directly into a secondary intermittent progressive feed longitudinally with the buttonhole, by the direct impingement of the cloth clamp against an adjustable stop or resistance that causes the cloth clamp to react and move longitudinally, the length of feed and depth of stitch having always an automatic correlation to each other. This, in connection with the other features of the device, gives a nicety of adjustment and accuracy of work that must be seen to be fully appreciated. Mr. Harris has also patented other constructions aiming at analogous results.

Mr. Rece W. Trude, of Lock Haven, Pa., has patented a cheap, simple, and durable folding drier for drying clothes.

Mr. John J. McLean, of Hillsborough, Ill., has patented an improved folding case or cabinet for holding and preserving court and other papers for use particularly by clerks of courts. It is so constructed that the file papers in different causes on the docket may be conveniently selected from and returned to their respective pigeon-holes, and which will exhibit at all times the absence of papers and by whom taken.

An improved animal trap, patented by Mr. Russell Elliott, of Somerset, Ky., consists in a box divided into three compartments by two partitions, a sliding plate for closing the entrance apertures in the front of the trap, the rock shaft carrying the sliding plate, an oscillating treadle, and chains or cords connecting the treadle and the rock shaft.

An improved wardrobe bedstead has been patented by Mr. Ernest N. Doring, of New York city. This wardrobe bedstead is so constructed that the frames or cases of the bedsteads and the weight boxes can be readily disconnected, when desired, for convenience in moving the bedstead from place to place.

Mr. Fred Terstegen, of Elizabeth, N. J., has patented an eyeglass having the nose-piece or bow-spring jointed in the middle so as to permit the lenses to fold sidewise toward each other, and having the ends of the two sections of the nose-piece or bow-spring extended past the pivot and provided with locking devices for holding them in position for use.

Mr. Charles Oyston, of Little Falls, N. Y., has patented an improvement in syringes. The invention consists of a nozzle with flaring lip, containing several fixed crossbars and adjustable basket-like devices and a tapering screw thimble, by whose adjustment relatively to each other and to the crossbars the fineness of the spray issuing from the nozzle is regulated.

Mr. Albert Back, of New York city, has patented an improved box for packing and exhibiting ruchings, laces, embroideries, and analogous articles. The invention consists in a box provided with a reel pivoted to arms of one of the longitudinal sides of the box, which side is hinged to the bottom of the box so that it will swing outward into a horizontal position, the arms carrying the reel being in a vertical position, and thus permitting the reel to turn freely.

Mr. John M. Cookingham, of Hudson, N. Y., has patented a secure and inexpensive fastening that is durable and will not require openings cut in the inner case. This invention is applicable to hunting and open cases and key and stem winders; and it consists in a locking pendant fitted to slide on a stem and formed to lap over the case.

Mr. Joshua W. Trussell, of Rockland, Me., has patented an improved door securer for fastening doors, drawers, cases, or where locks are ordinarily used, in which a central shaft armed with sharp projections from two opposite sides is inclosed in a rectangular wedge shaped frame, the shaft being provided with a thumbscrew head in one instance and a lever in the other, for turning it at right angles with the frame.

Mr. Bertram G. Seebach, of Peru, Ill., has patented a composition for cleaning and polishing metals, consisting of potash, lime, mineral oil, and the oil of *Elais guineensis*.

The American Institute Fair.

The annual exhibition of the American Institute Fair began September 15. As this is the fiftieth exhibition of the Institute special efforts have been made to celebrate its semi-centennial becomingly. The applications for space are said to have been larger than ever before, and the exhibition promises to be the finest ever held. But the exhibitors are, as usual, sadly behind in their preparations, and the exhibition opens in the customary state of unreadiness.

COTTON AND ITS FUTURE.—AN OPPORTUNITY FOR INVENTION

The International Exhibition to be opened at Atlanta, Georgia, October 5, will not inaugurate a new industrial era for the South, as some have assumed, but will rather serve to convince the world that such an era is already well advanced.

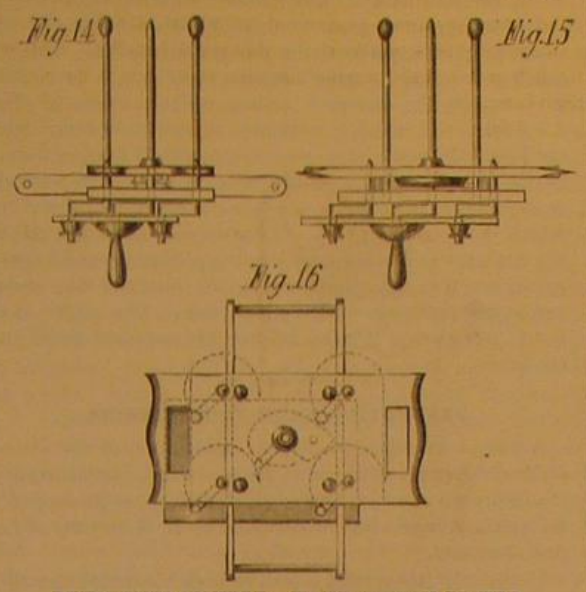
The enterprise began with the cotton interest, and was at first promoted for the especial furtherance of the industries which immediately turn upon the production and manufacture of the South's chief staple. That the scope of the exhibition has been widened to take in all the industries and resources of the Cotton States is both natural and encouraging; for while cotton is the leading interest, its prosperity must necessarily give life and energy to all the rest, and at the same time whatever forwards the general development of the natural and industrial capabilities of the South must react beneficially upon the cotton interest.

An immediate effect of the Exhibition is likely to be a great increase of knowledge among capitalists touching the opportunities which the South affords for profitable investments. But of still greater value probably will be the lessons learned by Southern cultivators with respect to means and methods of increasing the productiveness of their fields and the money value of their crops. Until recently the agricultural processess and appliances of the Southern planters have not been remarkable for economy and efficiency; and even yet the liberal adoption of modern labor-saving machinery is the exception rather than the rule in the South. It is true that in the aggregate the products of the Cotton States are enormous in quantity and in money value. The world is well aware of that. But not so many are aware that probably not a hundredth part of the productive capacity of the country has ever been developed.

RECIPROCATING HAND COTTON PICKER.

For the past five years the cotton crop has averaged nearly five million bales, and last year it approached six million bales; yet not more than two or three acres in every hundred available for cotton have been under cultivation, and on the land cultivated the yield has not been half as much in quantity or anything near as valuable as it might have been. During the census year the cotton acreage was 14,441,993 acres; the yield was 5,737,257 bales, or an average of 4 bales (of 475 pounds) to ten acres. Under proper cultivation and handling a bale to the acre is common, and two bales to the acre not uncommon. In his preliminary report on the cotton crop, Special Census Agent Hilgard remarks that even with the imperfect tillage and incomplete picking of the crop now prevailing in the Yazoo bottom (between the Mississippi River and the Yazoo, in the State of Mississippi), the average product per acre is over three quarters of a bale. Estimating the lands reclaimable by simple exclusion of the Mississippi overflows at only 3,000,000 acres, the annual product could readily be raised to 2,250,000 bales, without any change in methods of culture, on the Yazoo bottom alone. With improved cultivation, he says, the production could easily be brought up to 5,000,000 bales, and thus, with a similar improvement in the culture of the uplands, the State of Mississippi could easily produce the entire crop of the United States. He adds, in a foot note, that, so far from overestimating the possibilities within reach of careful culture, this statement does not adequately represent them. Without any stipulation as to improved culture Mr. Atkinson has estimated that one-tenth of the cotton area of Texas might yield as much cotton as the entire South now produces.

There is no ground for fear that the cotton market can be permanently glutted, provided the cost of the increased product can be kept sufficiently low. Not one in the hundred



REVOLVING SPINDLE—HAND COTTON PICKER.

of the population of the world has yet been reached by machine-made cottons, and the chief obstacle to the rest being made tributary to our cotton fields and cotton mills is a paltry fraction of a cent, perhaps, in the cost of a yard of cloth. The lowering of the cost of cotton to the cultivator, and the consequent extension of the area under profitable cultivation, can be brought about only by increasing the efficiency of the laborer and the productiveness of the soil. The first is being rapidly done by the introduction of improved cultivators, and the latter by the employment of fertilizers, by cleaner and more efficient methods of collecting and handling the fiber, by more thoroughly utilizing the hitherto waste products, and by the introduction of economical and effective remedies for the destructive cotton worm and similar pests: for example, by the use of pyrethrum solution, as recommended by Prof. Riley in another column of this paper.

Perhaps the most promising field of effort—at any rate the one in which successful effort would yield the highest results—is in the development of some practicable and economical method of gathering the lint by machinery. A device which should do for cotton picking what Whitney's gin did for the work of freeing cotton lint from the seed would give an incalculable impetus to the extension of cotton culture. The demand for such an invention is urgent, increasingly urgent. It is doubtful whether any phase of agricultural labor needs the aid of the inventor so badly, or promises so rich a return for successful effort. Already a crop amounting in value to three or four hundred million dollars is every year made difficult to secure, and subjected to serious hazard and no inconsiderable loss, through lack of efficient harvesting machinery; and any rapid increase in the crop is prevented by the lack of laborers at the critical season, laborers whose unattainable services might be dispensed with were it possible to relegate the work of gathering the cotton, in any considerable degree, to machinery.

As an illustration of what has already been accomplished in the direction of mechanical aids to cotton picking, we show on the front page of this issue of the SCIENTIFIC AMERICAN a dozen or more patented devices for use in the cotton field. How far any of them meets the requirements of the case we are not prepared to say. That none of them is entirely satisfactory would appear probable from the single fact that cotton is still picked by unaided human fingers.

The appliance shown in Fig. 1 was patented by Mr. William J. Lynch, of Old Town, Ark., and is designed to assist the cotton picker in supporting his body while stooping in the act of picking cotton, thus relieving the legs of weight that would otherwise come upon them. This device consists of two wooden staffs having foot rests pivoted at the bottom and provided with adjustable slides near the top, which are connected with a waist belt worn by the picker. The slides are provided with a clamp connected with the waist belt, so that when the staffs are thrown outward by the pressure of the knees the clamps bind the staffs and support the waist belt at that point.

The cotton harvester shown in Fig. 2 consists of a wagon having a straight body open at the top, and provided with a number of transverse stretched wires, over which the stalks of the plants are struck in such a way as to loosen the cotton from the bolls, when it falls into the wagon box. This is the invention of Mr. D. C. Hubbard, of Point Coupee Parish, La.

The cotton harvester shown in Fig. 3 is provided with a large picker cylinder covered with a close surface of bristles, forming a complete bristles brush face extending the entire length of the cylinder. This picker cylinder is revolved by connection with one of the drive wheels as the machine is drawn along over the rows of cotton plants. The bristles seize the ripe cotton from the pod without drawing out the unripe cotton or injuring the cotton or plants.

The machine is provided with a reel in front which bends down the cotton plants toward the face of the brush. There is a cleaning cylinder behind that draws the cotton from the picker cylinder and deposits it in the box at the rear of the machine. All of the rotating parts receive their motion from one of the supporting wheels of the machine. This invention was patented in 1872, by Mr. O. P. Meyers, of Canton, Ohio.

A machine, in some respects resembling that of Mr. Meyers, is shown in Fig. 4. In this machine there are four

ENDLESS CHAIN COTTON PICKERS.

vertical brushes, arranged in two pairs; one pair on each side of the row of cotton plants. These brushes remove the cotton from the boll and carry it into the receptacles arranged on either side of the machine. The brushes revolve against combs arranged along the vertical edges of the openings in which the brushes revolve. This machine is the invention of Mr. Thomas P. Moores, of Milliken's Bend, La. It was patented in 1880.

The principle of the machine represented in Fig. 5 is quite different from those above described. In this picker, series of barbed flexible rods are pushed down into the cotton plants in alternation, each in its ascent removing the cotton from the other, being assisted by brushes arranged along the edges of the vibrating arms. The cotton is carried from the tops of the arms by endless bands and delivered to a receptacle at the rear of the machine. This picker was patented in 1877, by Mr. Orren R. Smith, of Raleigh, N. C.

The cotton harvester shown in Fig. 6 operates by air pressure, the necessary vacuum being created by a horizontal fan driven by the supporting wheels of the machine. A series of shells or curved hoops loosen the cotton from the bolls, the hoops being inclosed by a hood, from which the cotton is drawn by the fan, and discharged into the wire cloth receptacle at the rear of the machine, the cotton being retained while the air is allowed free escape through the meshes of the wire cloth. This machine was

PNEUMATIC COTTON PICKER.

patented in 1877, by Mr. F. Van Dorn, of Basking Ridge, N. J.

In Fig. 7 we represent an electric cotton picker, patented by Mr. Robert F. Cooke, of Brooklyn, N. Y., in 1870. In this machine two endless rubber belts, arranged vertically on opposite sides of the machine, are excited electrically by friction, the cotton plant being agitated by a reel, or otherwise, when the ripe cotton, being disengaged from the bolls, is attracted by the electrified belt, by which it is carried upward. It is disengaged at the top, and falls into a receptacle placed between the two belts.

Fig. 8 shows a hand cotton picker, patented in 1867, by Mr. Joseph E. Carver, of Bridgewater, Mass. This invention consists in a reciprocating tongue provided with teeth and fitted to an oblong box carrying a sack at its rear end. The box is provided with an elastic plate having spines, and when the tongue is reciprocated by the handle it takes the cotton from the boll, and, by moving it forward by a succession of steps, carries it into the box, from which it finally drops into the sack.

In Figs. 9 and 10 is shown a hand cotton picker, which is remarkable for its simplicity and cheapness. It consists of gloves provided with wire hooks inclining backward toward the wrist, and a brush worn upon the waistband over the bag or other receptacle intended to receive the cotton.

The ripe cotton is readily removed from the bolls by means of the wire hooks, and it is removed from the hooks by passing them over the brush. Figure 10 is an enlarged view of one of the fingers of the glove. This invention was patented in 1876, by Mr. R. A. Cutliff, of Shreveport, La.

A form of hand cotton picker, employing an endless chain carrying barbs, is shown in Figures 11 and 12, Figure 12 being a detail view of the stripper. In this device the endless toothed chain is driven by a sprocket wheel, and in turn drives a pair of winged wheels or strippers which remove from the chain the cotton picked from the bolls by the teeth, and allow it to fall into the bag attached to the under side of the apparatus. This invention was patented in 1866, by Mr. George A. Howe, of Brooklyn, N. Y.

Figure 13 represents a pneumatic picker applied by hand, the hose being connected with a fixed exhaust fan or pump. This is one of several similar inventions patented by Mr. John Griffin, of Louisville, Ky. The patent was issued in 1866.

The hand picker shown in Figures 14, 15, and 16 consists of a rotating spindle, having a crank by means of which it may be turned. The spindle is moistened continuously, so that when thrust into a cotton boll the cotton will adhere and wind upon the spindle as the latter is revolved. When the spindle is full it is placed over a basket, and a board—called by the inventor a "shedding board"—is moved outward along the four guide pins, and pushes off the ball of cotton.

In the engraving Fig. 14 is an end elevation, Fig. 15 a plan view, and Fig. 16 is a face view, showing the shedding board with handles in the ends. This invention was patented in 1879, by Mr. T. W. Ham, of Frosa, Texas.

For those of our readers who may be interested in this problem, and yet unfamiliar with the conditions under which a mechanical cotton picker must be operated, a few words with reference to the growth of cotton and the manner of its cultivation may not be out of place.

As the high bush or "tree" cotton which produces the long staple "sea-islands" cotton furnishes but a small part of the crop, we may assume that the picking machine will be primarily designed for the upland cotton fields. In these the cotton bush grows from two to four feet high, the more common height being under three feet. The branches spread like those of an apple tree in miniature, and the cotton bolls are distributed about the limbs somewhat as apples are on a sparsely-bearing tree. The green bolls, which are an inch or so in diameter, expand and burst at maturity, exposing the snowy fiber for which the plant is cultivated, the bolls on the lower branches usually maturing first. The bolls are supported by foot stalks from two to four inches long, and for the most part grow near the outer ends of the limbs. A pull of about one ounce suffices to draw the lint from the ripe pods. In gathering the lint it is needful to keep it free from leaves, stems, or fragments of the shell of the pods, all of which goes by the name of "trash," and impairs the value of the fiber.

The plants are set in rows, from two to seven feet apart, according to the quality of the soil, and are thinned out in the rows so that the plants are from two to four feet apart. In the extreme south the bolls begin to burst as early as the first of July; further north, the picking begins a month or two later. The picking continues at intervals or continuously according to the thrift and energy of the farmer until winter sets in or the crop is all gathered.

The more serious obstacles to mechanical picking arise from the irregular height and spacing of the plants; the irregularity in the maturing of the bolls; the necessity of avoiding injury to the plants in the earlier gatherings; the difficulty of withdrawing the ripe lint without admixture with husks, stems, and broken leaves.

The problem is a complicated one, yet it cries aloud for solution and promises a liberal reward to any who shall solve it wholly or in part. If comparatively simple and inexpensive, the successful machine will bring a speedy fortune to the inventor, prosperity to thousands of small planters, occupation for multitudes of mills, and cheaper clothing for half the world.

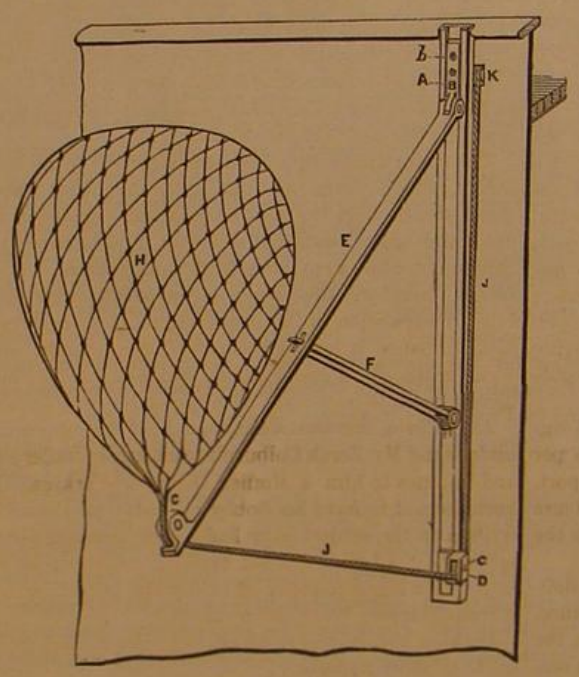
An Electrical Sheathing for Ships.

It has long been known that zinc, when in contact with iron, only preserved it from corrosion. A year ago Mr. J. J. Atkinson and Mr. C. F. Henwood, of London, taking advantage of this fact, patented a system of sheathing by means of a solder chemically combining atoms of zinc and tin. About three months ago a steam yacht was subjected to the process. The zinc sheets were attached to the iron by a dynamo machine, at spots about 9 inches apart, the connection being easily made by the melted solder. The iron below was left quite naked, so that there might be nothing to intercept the galvanic action. After a cruise of about 5,000 miles the vessel is reported as perfectly clean, while the iron below the zinc was absolutely without a trace of corrosion. The attachments formed by the solder were also so strong that in no place were they affected by an accident which the vessel met with. Experiments have proved that the wear of the zinc amounts to between 2 ounces and 3 ounces per square foot per annum, so that 20 ounces of zinc should last at that rate from six to nine years. The solder is the last to wear away, it being a much less negative metal than the zinc.

PREVENTING SHIPS FROM SINKING.

A recent modification of the application of the air bag method of preventing ships from sinking, or assisting in that when an accident causes a serious leak, is illustrated by the annexed engraving, as designed by R. G. Sayers, of London, England.

If the ship has sprung a leak or been otherwise damaged, and is expected to go down, each of the flexible bags is



filled with air as quickly as possible, the wing, E. and stay, F, being fixed in the position shown in the engraving; the bar, B, is lowered into the grooves provided for that purpose in the fixed bar, A, and is secured to the ship's sides by two or more bolts, *b*. The end of the rope, J, having been passed through the hole in the ship's side and over the pulley, K, to one of the ordinary winches or windlasses, or to a winch provided for the purpose, the bag is thrown overboard and hauled down into the water into the position shown. These operations, it is said, may be performed in eighteen minutes from the time of the disaster, therefore no vessel need sink at sea in future. The wing, E, and stay, F, serve to prevent the bag from chafing against the ship's side in case of a rough sea. Each bag with its apparatus being independent of the others, several of them can be filled and hauled down at the same time, according to the number of hands employed.

Longevity in Europe.

M. De Solaville analyzes in the *Revue Scientifique* the results of recent European censuses by ages, and the register of deaths also by ages. If we strike a mean of the census from 1869 to 1872, we find that Europe (exclusive of Russia, Turkey, and some small Southern states) possessed in 1870 a mean population of 242,940,376, classed as follows from the point of view of advanced ages: 17,313,715 of more than 60 years, 79,859 of more than 90, and 3,108 of more than 100 years; *i. e.*, 1 inhabitant in 12 of more than 60, 1 in 2,669 of more than 90, and 1 in 62,503 of more than 100. Women, M. Solaville finds, are more numerous in extreme old age than men, and the difference increases with the age. Thus at 60 years the advantage is with the women in the proportion of 7 per cent, at 90 and above it rises to 45, and with centenarians to 60 per 100. It is in France that we find the greatest relative number of inhabitants at the age of 60 and upwards; but it is not so for centenarians, of which France has less than all the other states of Europe except Belgium, Denmark, and Switzerland. From a calculation of deaths by ages the result is reached that, to the total deaths, those at the age of 90 and upward bore the following proportions to the countries named, and arranged according to the decreasing order of importance: Great Britain, 9·73; Sweden, 7·39; France, 6·58; Belgium, 6·07; Switzerland, 6·00; Holland, 4·47; Italy, 3·76; Bavaria, 3·42; Prussia, 3·06; Austria, 2·61. The result is in accordance with that we know of the mean age of the deceased in the same countries.

How Postage Stamps are Made

The number of ordinary postage stamps issued in 1881 was 954,128,440, and value $24,040,643. The method of printing postage stamps is as follows: The printing is done from steel plates, on which two hundred stamps are engraved, and the paper used is of a peculiar texture, somewhat resembling that employed for bank notes. Two men cover the plates with the colored inks and pass them to a man and a girl, who print them with large rolling hand presses. Three of these little squads are employed all the time, although ten presses can be put in operation, if necessary. The colors used in the inks are ultramarine blue, Prussian blue, chrome yellow and Prussian blue (green), vermilion, and carmine. After the sheets of paper on which the two hundred stamps are engraved have been dried, they are sent into another room and gummed. The gum used is made of the powder of dried potatoes and other vegetables mixed with water. Gum arabic is not desirable, because it cracks the paper badly. The sheets are gummed separately, they are placed back upward upon a flat wooden support, the edges being protected by a metallic frame, and the gum is applied with a wide brush. After having been again dried, this time on little racks, which are fanned by steam power for about an hour, they are put in between sheets of pasteboard, and pressed between hydraulic presses, capable of applying a weight of two thousand tons. The sheets are next cut in halves; each sheet, of course, when cut, contains a hundred stamps. This is done by a girl with a large pair of shears, cutting by hand being preferred to that of machinery, which method would destroy too many stamps. They are then passed to the perforating machine. The perforations between the stamps are effected by passing the sheets between two cylinders provided with a series of raised bands which are adjusted to a distance apart equal to that required between the rows of perforations. Each ring on the upper cylinder has a series of cylindrical projections which fit corresponding depressions in the bands of the lower cylinder; by these the perforations are punched out, and by a simple contrivance the sheet is detached from the cylinders in which it has been conducted by an endless band. The rows running longitudinally of the paper are first made, and then by a similar machine the transverse ones. This perforating machine was invented and patented by a Mr. Arthur, in 1852, and was purchased by the government for $20,000. The sheets are next dressed once more, and then packed and labeled and stowed away in another room, preparatory to being put up in mail bags for dispatching to fulfill orders. If a single stamp is torn, or in any way mutilated, the whole sheet of one hundred is burned. Five hundred thousand are burned every week from this cause. The sheets are counted no less than eleven times during the process of manufacturing, and so great is the care taken in counting, that not a single sheet has been lost during the past twenty years.

The postage stamp would seem to be only a humdrum sort of article, which fulfills a very useful, but withal extremely prosaic, purpose. Yet we learn from the Chicago *Inter-Ocean* that it can be made a delicate and subtle medium of delightful flirtation or romantic love, when skillfully manipulated by the sender of a letter and intelligently interpreted by the receiver, who by one swift glance at the stamp may instantly learn, from the manner of its affixture, whether to expect bliss or misery from the contents of the inclosed missive. The explanation of the whole matter, as given by the *Inter-Ocean*, is as follows: "Some ingenious persons have given a meaning to the location of a postage stamp on a letter. For example, they say that when a stamp is inverted on the right hand upper corner it means the person written to is to write no more. If the stamp be placed on the left hand upper corner and inverted, then the writer declares his affection for the receiver of the letter. When the stamp is in the center at the top, it signifies an affirmative answer to a question, or the question, as the case may be; and when it is at the bottom, or opposite this, it is a negative. Should the stamp be on the right hand corner, at a right angle, it asks the question if the receiver of the letter loves the sender; while in the left hand corner means that the writer hates the other. There is a shade of difference between desiring one's acquaintance and friendship, for example: The stamp at the upper corner on the right expresses the former, and on the lower left hand corner means the latter. The learned in this language request their correspondents to accept their love by placing the stamp on a line with the surname, and the response is made, if the party addressed be engaged, by placing the stamp in the same place but reversing it. The writer may wish to say farewell to his sweetheart, or *vice versa*, and does so by placing the stamp straight up and down in the left hand corner. And so on to the end of the chapter." There are in the world about six thousand varieties of stamps. The museum at Berlin contains between four and five thousand specimens, half of which are from Europe, and the rest are from Asia, Africa, America, and Australia. Among the many kinds of decoration which have been used on stamps are coat-of-arms, stars, eagles, lions, the effigies of five emperors, eighteen kings, three queens, one grand duke, several titled rulers of less rank, and many presidents.

STEAM BOILER NOTES.

The absurdity of rating steam boilers by the extent of heating surface, meaning the areas that are exposed to the gases that emanate from the combustion of the coal, was made obvious, as it had been before, by some practical experiments made by Mr. J. Graham, an account of which was read before the Philosophical Society of Manchester, England, about the beginning of 1858. He placed a series of vessels along over the thoroughfare of the gases of a boiler furnace. The first one, being directly over the fire, represented the crown sheet and sides of a fire box boiler, or the fire sheet of an externally fired boiler; the second, third, and fourth vessels of the same size, corresponding in regard to efficiency to successive parts of a boiler toward the chimney. Their respective rates of evaporation were as 100 pounds for the first is to 27, 13, and 8 for the other three together, making 148 in a given time.

If, now, these had been a continuous boiler instead of separate vessels they would have had a common system of circulation, which might somewhat modify the results; but as it is not practicable to determine what each successive unit of a surface common to the same body of water would actually do, and as it is probable that the results, if they could be obtained, would not greatly differ, we may fairly make a comparison in boiler practice.

Mr. Perkins, some time about 1835, sought to establish the theory, in explanation of boiler explosions, that water thrown into superheated or anhydrous steam at high temperatures would flash into steam of a highly elastic character. But this is shown to be contrary to the deductions from the established laws of heat. Not only so, but experiments have uniformly failed to produce boiler explosions by this means. The experiments by a committee of the Franklin Institute, which were cited in the SCIENTIFIC AMERICAN of August 13, were full and exhaustive, and confirmed the laws of heat; they should be studied by every one who attempts to explain boiler explosions for the purpose of promulgating new theories.

Previous to the date of these valuable experiments the idea prevailed that boilers would not explode violently by a gradual accumulation of pressure, but would burst at the weakest place and harmlessly relieve themselves of strain. The eighth inquiry of the committee related to this subject. They made small iron and copper boilers, which they exploded by placing them in a sealed condition in a furnace prepared for the purpose in a pit. The pressure at which these boilers exploded was ascertained by a registering spring balance, so constructed as to be as safe as possible from injury.

One of these boilers exploded with a loud report, and was projected some distance, at a pressure of 172 pounds per square inch, 11½ atmospheres, "and," says the report, "stones and combustibles were widely scattered. A dense cloud of smoke and flame, capped by steam, arose from the pit."

A second experiment was with a copper boiler, with similar results, the difference being in the course of the rupture, which was along the head seam, it being weaker than the other joints from too close spacing of the rivets. This second explosion occurred at a pressure of about 255 pounds, 17 atmospheres. The registering apparatus having been broken by the explosion, an accurate statement could not be made.

But Mr. Perkins' favorite theory, as he put it, was certainly plausible when applied to cases in which it was by their conditions admissible. It is still believed by great numbers of engineers who have not had the opportunity to observe for themselves to be a very common cause of explosion. It may be stated thus: water being allowed to get too low, the plates become overheated and superheat the steam, which, it was claimed, would contain a large quantity of heat. And here is where the fallacy lies, for steam has only a limited capacity for heat in its gaseous state, and, of course, can yield no more than it contains to bodies that come in contact with it in falling to the equilibrium due to the mixture or to the contact. The theory then supposes that water is mingled with the highly heated steam either by being pumped in upon the hot plates and quickly evaporated, or projected in the form of foam into the hot steam, forming a highly elastic vapor with explosive suddenness; or else the water remaining in the boiler below the heated plates is suddenly lifted by its contained heat and covers them, on a relief of pressure occurring from sudden escape of steam from the safety valve or by an open throttle valve on starting the engine.

This theory was first contested by Dulong upon deductions from the known laws of heat, and others have since proved by experiments the soundness of his conclusions. A writer in the journal above quoted declares that steam has been superheated to a temperature corresponding to 900 pounds per square inch of saturated steam, but not being saturated its pressure was less than 120 pounds per square inch. In this state sufficient water was injected to completely saturate it, which, instead of causing an explosion, lowered the pressure to 70 pounds.

The writer cited refers to the same experiments that are above referred to above, in reporting which the committee say: "We see that in no case was an increase of elasticity produced by injecting water into hot and unsaturated steam, but the reverse."

Some time previous to 1849 a gentleman of Brooklyn, N.Y., claimed the Rumford Medal of Harvard University on account of a discovery which seemed to him to fulfill the specification governing its award. He believed that steam heated out of contact with water became transformed into a new chemical compound, or perhaps a simple permanent gas, possessing valuable properties that rendered it more efficient as a vehicle of heat for the steam engine. He called this newly discovered body "stamm." His communications, having been published in the SCIENTIFIC AMERICAN, fell under the observation of Dr. Haycroft, of Greenwich, England, who made some experiments, first in a small way, which established his faith in "stamm." His first experiment, which appeared in the SCIENTIFIC AMERICAN, May 10, 1850, was with a steam engine and a tubular condenser. The cylinder was fitted with a steam jacket. He worked the engine first with common saturated steam, which was condensed, and the resulting water measured from a given volume of steam, the volume used being determined by counting the strokes of the engine piston. One hundred and seventy strokes yielded sufficient water to fill a given measure; but on admitting steam at a temperature of 440°, or somewhere near 500 pounds pressure per square inch, 1,800 strokes or charges of steam were required to fill the same measure with condensed steam, which seemed to indicate a very great gain. From this the experimenter was induced to believe the "stamm" was at least ten times more economical than steam. He therefore had a large engine built, and placed its cylinder in the fire, which, of course, was soon destroyed, although for a time it seemed to be successful. Subsequent experiment and calculation showed him that "stamm" returned to steam precisely such as was described by former investigators and engineers, and at atmospheric pressure occupied about 1,700 times the space that was occupied by the water from which it was generated. In consequence of the demand of Mr. Frost, the discoverer of the supposed new body or new property of steam, for the Rumford medal, some experiments were made at Harvard on the effect of superheating steam upon its expansion, which showed that 1,580 units of volume at 212° Fah. became 1,600 when heated to 216° Fah., and 1,630 at 228°, and their decision was against granting the medal to Mr. Frost.

The experiments have been since carried to an exhaustive extent, which prove that out of contact with water anhydrous steam obeys the laws of heat and expansion that govern simple gases, and that steam is a permanently gaseous compound while kept at a high temperature. It seems to follow, therefore, that when steam overcharged with heat falls by expansion in the steam engine to a temperature due to its pressure, it becomes saturated steam again, and at last water when given up its latent, which is less as the tension increases while in contact with the water of generation.

An Indiana correspondent some time ago seemed to misunderstand Mr. Zerah Colburn's teachings in boiler explosion, and imputes to him a similar theory to Perkins. But Colburn seemed to have no hobby or universal theory as most writers on the subject have had. Our correspondent properly says, "a boiler will not explode merely from suddenly injecting a large quantity of cold water into the steam space; it would merely lower the pressure."

Perkins' theory was doubted by Colburn, and figures were made to show its fallacy.

A terrific boiler explosion occurred near the west end of Third Street Bridge, in West Bay City, Mich., August 22, killing James Kealy, of Bay City, William J. Abrams, of West Bay City, and severely scalding Edward Finneron. The boiler was of the kind used for running thrashing machines, and at the time of the explosion was engaged in running a saw, sawing cedar blocks for the pavement in West Bay City. Abrams was cut in two by the boiler and horribly mangled. Half of his body was thrown over a slab pile 150 feet northwest, and the remainder to the north about half the distance. His head was terribly disfigured. He had been working here for two months as engineer. He was between 35 and 40 years of age, and it is thought came from Caseville. Mr. Kealy was 25 years of age and a native of Bay City, having a wife and child. He had been engaged by the contractor to saw the blocks, and was superintending the work when the boiler exploded. He was struck by a piece of iron on the neck, and was almost beheaded. He was blown about 50 feet north, and was alive when found, but died directly afterward.

Finneron was standing by Mr. Kealy's side at the time of the explosion, but was not struck by the flying pieces. He was, however, scalded very severely about the face and shoulders. A 14 year old boy, named Will Craft, who was standing on a raft of logs to the eastward about 50 yards, was struck on the hips by something, supposed to be a belt, and knocked down. Pieces of the boiler and engine, and the wagon on which they rested, were blown in all directions. The accident is the most terrible that has happened here in several years, and consequently there is no little excitement.

The jury of inquest returned a verdict to the effect that the explosion was caused by low water and the incompetency of the men having the boiler in charge.

The boiler at Henry Moody's sawmill at Campbellsville, Ky., exploded August 29. Henry Gaines was killed instantly, and John Fletcher and Samuel Cook were fatally injured. Benjamin Allen was badly scalded, but will probably recover. Two other employes were injured, but neither seriously. The explosion is said to have been caused by the use of sulphur water in the boiler.

Mineral waters should not be used in steam boilers; not so much on account of the possibility of an explosive compound being formed, as on account of the large amount of solids that are precipitated when these waters become concentrated by boiling. Sulphydric acid may arise from sulphur water, and although the gas mingled with certain proportions of oxygen is explosive, that is, it burns rapidly and completely when ignited, yet it is highly improbable that it ever was the cause of an accident to a steam boiler by taking fire and exploding in the presence of saturated steam.

The boiler on a hoisting sloop at Haverhill, Mass., exploded August 25, injuring two men, one seriously. The boiler was "old and unsafe, and there were 80 pounds of steam on."

The boiler of a thrashing machine exploded near Patoka, Ill., September 3. Six men and a woman were killed, and some of them horribly mangled. Several others were seriously scalded.

AJAX METAL.

About sixteen years ago, Mr. Francis J. Clamer, after considerable research, hit upon a peculiar chemical amalgamation, having copper for its base and possessing extraordinary hardness and tensile strength. This substance the inventor manufactured for some years under the name of "Ajax metal." The great usefulness of the article in various arts and industries having become widely known, Mr. Elkins, of Philadelphia, at the beginning of the present year, made a business arrangement with the inventor; invested a large amount of capital in buildings and machinery; and, under the name of the Elkins Manufacturing and Gas Co., began the manufacture of the substance on a large scale. At the present time, we are informed that the daily production is about 14,000 pounds, with a demand fully equal to that amount. To meet the requirements of the various industries in which the Ajax metal is applicable, the company furnishes this product in three different grades.

One of these, and perhaps the most important, is for use in the manufacture of bearings for steam and horse cars and machinery generally—a purpose for which long experience has proved it superior to any other metal or combinations of metals known. A second grade is designed especially for making steam and acid valves for use in coal-oil refineries, chemical works, and other industries where the application of ordinary metals for such purposes is attended with constant loss through corrosion.

The third grade is especially adapted for making fine ornamental castings (such as statuary, chandeliers, etc.) in greensand—a purpose for which it is peculiarly fitted, owing to the fact that the fluidity of the molten metal is such that the finest lines in the pattern are in every case exactly reproduced in the casting.

These various grades of the Ajax metal, which are furnished either in ingots or in castings made from patterns furnished the company, all possess the same characteristics of hardness and closeness of grain, and the same enormous tensile strength of 29,300 pounds to the square inch.

In addition to the foregoing, the company manufacture three grades of the metal in sheets. The first of these resembles 18-carat gold in color, and can be spun into almost any shape desired without annealing and without any danger of fire-cracking. It can be brazed with the hardest copper smith's solder without burning, and will take a very high polish, fully equaling that which is given to gold. The second grade is of a lighter shade, but has the same toughness as the first; while the third is of the same color as high brass, but very much stronger than that metal.

The jeweler's plating composition, made by this same house, and furnished in either bars or sheets, is now so well known to manufacturing jewelers that it scarcely requires description. It need only be said that it possesses the same hardness as that of the gold generally employed for plating, and will roll out even with the gold without causing the latter to crack, thus obviating a trouble and an expense to which manufacturers of jewelry have hitherto been subjected. The great usefulness of the Ajax metal in every application where toughness, hardness, tensile strength, and consequently great durability are requisite, promises a still wider field for its employment than we have briefly noted above, and its manufacture is probably destined to be ranked among our most prominent American industries.

Grain Storage in and around New York.

The great grain elevators and warehouses of this port provide storage for 22,800,000 bushels. Their capacities are given as follows: New York Central, 2,300,000 bushels; New York, Lake Erie, and Western Railroad, Jersey City, 1,500,000 bushels; Pennsylvania Railroad, Jersey City, 1,500,000 bushels; Dow's Elevators, Brooklyn, 2,500,000 bushels; Hazeltine & Annan's Elevators, Brooklyn, 2,500,000 bushels; Grain Warehousing Association, Brooklyn, 6,000,000 bushels; Robinson's Stores, Erie Basin, 2,800,000 bushels; Pinto's Stores, Brooklyn, 1,000,000 bushels; Woodruff & McLean's Stores, Brooklyn, 1,500,000 bushels; other elevators in New York and Brooklyn, 2,200,000 bushels.

The stock in hand August 27 was: Wheat, 3,882,051; corn, 3,070,716; oats, 2,817,638; barley, 7,041; rye, 9,692; peas, 9,713; malt, 82,273—total, 9,879,124.

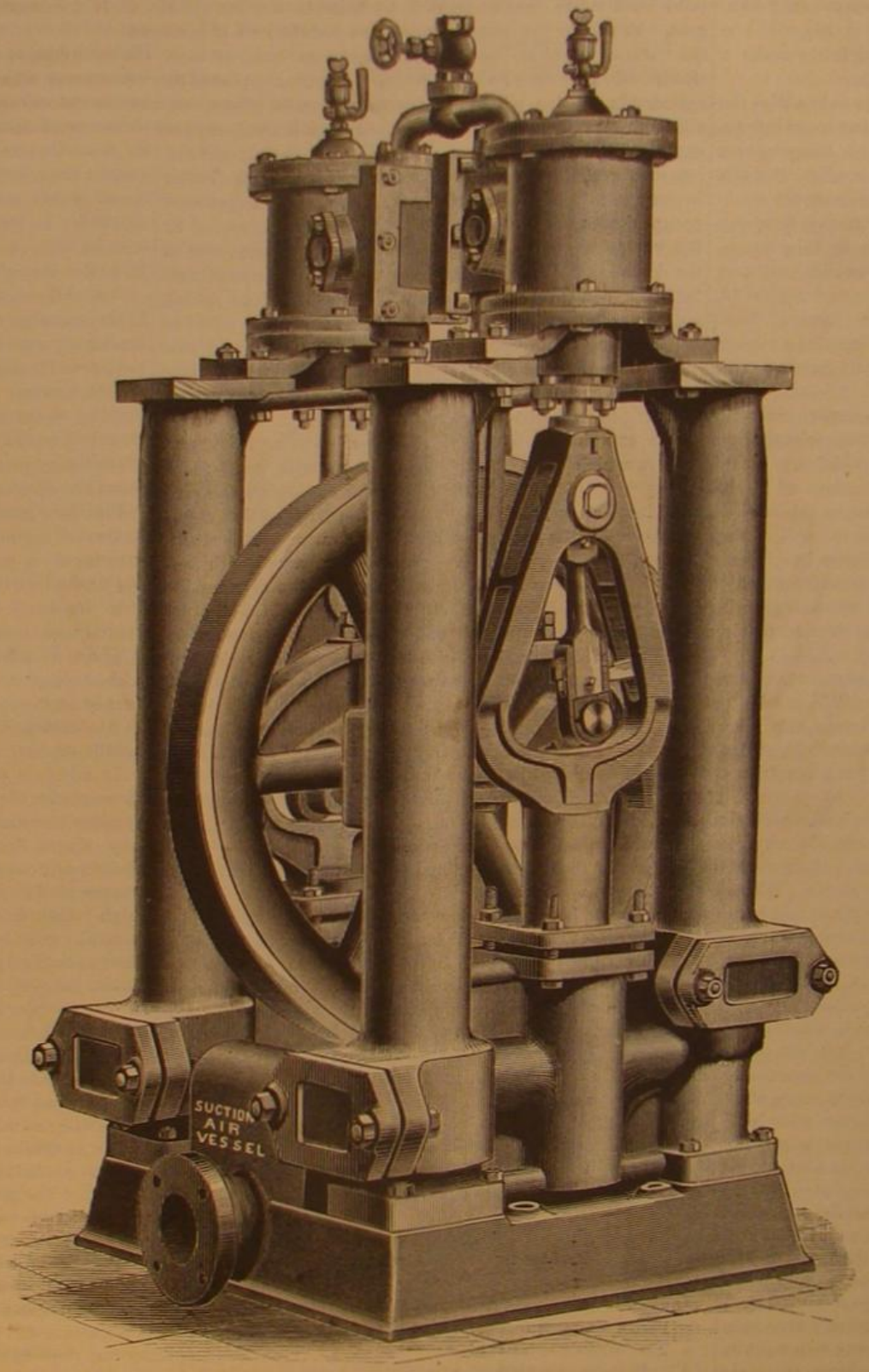
The Cost of Carelessness.

The report of the New York Board of Fire Commissioners just issued gives a very interesting table, showing the number of fires in the city between June 1, 1868, and January 1, 1881, which were distinctly traced to carelessness, and the loss that has been sustained thereby. The principal items included carelessness of occupants with matches, lights, cigars, hot ashes, 4,689; children playing with matches, 887;

defective flues and furnaces, 687; bad arrangement of stoves, 275; escaped gas, 345; fat, varnish, etc., boiling over, 323; foul chimneys, 1,709; fireworks, 482; heat from grates or flues, 340; hot coals from grates, 133; incendiary, 347; kerosene lamps falling, 1,287; overheated stoves and pipes, 858; sparks from chimneys and engines, 900; spontaneous combustion, 457; vapor of naphtha, gasoline, etc., 88; window curtains catching fire, 907; malicious mischief, 236. Of the 17,500 fires that occurred in the city during the period named, about 15,000 are accounted for under some of the above heads. With the exception of incendiary or malicious mischief, there is not one of them that might not have been prevented by ordinary care and forethought. It is estimated that at least a hundred million dollars is the money value of the loss sustained.

IMPROVED DOUBLE-ACTING STEAM PUMP.

The accompanying illustration represents a double-acting steam pump which for simple but substantial construction and effective and reliable working has gained considerable favor in England. It is the specialty of Hulme & Lund, Manchester, and is particularly suitable for the drainage of deep mines, some pumps of this class being at work at the present time forcing water 1,200 feet vertically in one lift. Four substantial columns support the steam cylinders and serve at the same time as air vessels for the pumps. The steam valves are of the ordinary kind, worked directly from eccentrics on the shaft below. The water valves are furnished with separate bonnets or doors, and are therefore at all times capable of easy inspection. The flywheels are heavy, and are turned true, so that they run with accuracy and will carry a belt for driving purposes. In all parts the most suitable materials are employed. The connecting rods and shafts are made of the best scrap iron, the piston and valve rods of steel, and the glands, bushes, steps, eccentric straps, and water valves are all of the best gun metal. The pistons are furnished with metallic packing, and the joints throughout are planed and faced. All the working parts and the packings are easy of access and of ready adjustment. Pumps of this class are specially made, capable of pumping against any pressure up to 1,000 lb. per inch.



DOUBLE-ACTING STEAM PUMP.

A Hoisting Engine without Drums.

A simple and effective hoisting plant has been put into an underground shaft of the Maria Colliery, near Hoengen, in the Wurm District. The endless wire rope reaching down to the lowest part of the shaft, 886·5 feet deep, lies on a sheave placed directly over the shaft. The diameter of the sheave is made to correspond to the distance between the centers of the two hoisting compartments. The sheave has a very deep groove, so that the rope cannot slip. The cages, for two mine cars of 1,000 lb. capacity, are placed side by side, so that there is room for a wrought iron tube, through which the rope passes. The cages are fastened to the rope by strong screws. The two-cylinder hoisting engine is placed on a level with the center of the sheave and runs it through the medium of gearing, which acts upon cog wheels wedged on to each side of the rim of the sheave. Drums are thus entirely dispensed with. The engine, which is run by compressed air, has 13·4 inch cylinders and 31·5 inch stroke, with a Farcot expansion gear. It is running with 60 lb. pressure, and can easily manage 200 tons per shift of 12 hours. It is noted that the machine occupies little room, because there are no drums, and the sheave need not be placed as high. The wear of the rope is less, because it is only bent once, and the position of the hoisting cages may be readily changed. The *Zeitschrift für Berg-, Huetten- und Salinen-Wesen*, from which we gather the details given above, calls attention to the fact, however, that in case of breakage, the cages and the rope would be a total loss.

Prolific and Long-Lived Families.

The Hartford, Conn., *Post* says that among recent applicants for life insurance was one of 53 years, whose fifteen living sisters were from 35 to 63 years old, their ages running as follows: 35, 36, 38, 40, 42, 43, 45, 47, 49, 51, 55, 57, 59, 61, 63. Another applicant stated that he was 37 years of age, and that he had eleven brothers and ten sisters. His father died at the age of 65 years, but his mother was living at 67 and was in good health. The ages of the children, twenty-two in number, ranged from 16 years to 47. The applicant was a Virginian. A third case was of a man 32 years of age, who had eleven brothers and five sisters. His father was 68 years of age, and had just married his fifth wife. An applicant from Brooklyn belonged to a long-lived race. His father had died at the age of 80 years, his grandfather at 108, and his great-grandfather at 110 years of age, the average age of the three being a trifle less than 100 years.

Distilling Alcohol by Ice.

M. Raoul Pictet, of Geneva, so well known for his discoveries of the liquefaction of gases, announces the discovery of a method of distilling alcohol by ice. Two kilogrammes of ice are needed for the production of a liter of alcohol; that is, for the distillation of 110 gallons of alcohol a little less than a ton of ice will be required. The cost of production will include only coal for working the steam engine which drives the air pump, and the sulphuric acid, the evaporation of which produces the ice. M. Pictet declares that this will notably diminish the expense of distillation.

Large Cast Iron Wheels.

Three flywheels have been lately cast at Mr. Lycett's foundry, Wolverhampton, England, each wheel weighing 40 tons in the rim, and cast in one piece. The diameter is 26 feet; depth, 23 inches; and measure across the face, 15 inches. Each rim will have eight arms affixed, which will weigh about 25 tons, making the total weight of each wheel 65 tons. Flywheels weighing 60 tons have been cast in this district before, and some of them with a diameter of 30 feet, but it is believed that they have all been cast in either two or four segments, one great reason for this being that it would be impossible to convey such a ponderous piece of machinery *en masse* along a road. Casting them whole reduces the cost. The operation of casting occupied seven minutes.

NEW INVENTIONS.

Mr. Daniel D. Clark, of Mystic, Conn., has patented a new device for removing the motes that fall down from the saws of a cotton gin when the lint is being brushed off of the saws. The invention consists in providing a cotton gin with a mote receiver, consisting of a longitudinally flanged cylinder that straightens the cotton it leaves the saw, knocks the sand and trash out of it, and deposits the motes in a receptacle beneath it.

A new and improved tie for bales of cotton, hay, wool, etc., has been patented by Mr. James L. Griffin, of Cusseta, Tex. The invention consists in a metal band provided with a series of longitudinal slots at each end in combination with a plate with a button fitting into these slots on its under side, this button being passed through the slots of the two overlapped ends of the strip or band, then turned a quarter revolution when the bale has been compressed sufficiently.

An improved saddle girth fastening and harness buckle has been patented by Messrs Isaac I. Lancaster and Homer A. Sears, of Goldendale, Washington Ter. The invention consists in a novel construction of a plate and a pair of pivoted spring pawls, a novel girth, and certain details of construction by which provision is made for securely and quickly tightening or loosening the girth.

Mr. William A. Lorenz, of Brooklyn, N. Y., has patented an upright piano case. The object of this improvement is to utilize the tops of upright piano cases for holding books, sheet music, etc., by making it possible to open a cover or lid for the purpose of increasing the volume of sound without disturbing the top.

Messrs. F. W. Jensen and Carl J. L. Olsen, of New York city, has patented an improved hospital bed. The improvement relates to the construction of the bedstead, and to devices combined therewith for the use of the sick person. The inventors use an iron frame bedstead, the bottom of which is formed by longitudinal rods sustained by cross-bars and held in place by nuts at their ends. The head and foot boards are hung in slots in the side rails, so that they can be adjusted or swung down out of the way to give free access to the person on the bed. Combined with the bed there is a swinging arm carrying a vessel fitted for being raised to carry the vessel through an aperture provided in the bed bottom and mattress. The bed is also fitted with devices for automatically removing and replacing the cover of the vessel as it is moved to and from its place.

An improved apparatus for removing snow and ice from streets has been patented by Mr. Oscar F. Boomer, of Brooklyn, N. Y. The invention consists in laying steam pipes along the street gutters for receiving the exhaust steam from the boilers that are used for heating or mechanical purposes in the buildings bordering on the streets, or for receiving steam from other sources especially arranged for that purpose.

A combined desk and folding wardrobe bed has been patented by Mr. Ernest N. Doring, of New York city. The object of this invention is to furnish folding wardrobe beds provided with desks so constructed that they can be opened and used with as much facility as though they were only desks, and which at the same time will not interfere with the opening and closing of the wardrobe beds.

Destruction of Fish by Torpedoes.

The alarming destruction of the fish in many of the Indiana streams by means of dynamite torpedoes, has led to the organization of a State Fish Protection Society, of which Alexander C. Jameson is president. County and local societies are to be formed throughout the State to assist in enforcing the new fish law. Unless steps are speedily taken to prosecute the vandals who are using these torpedoes so destructively in some of our streams, the fish will to a great extent disappear.

The manner in which the dynamite fisherman operates is to sink the torpedoes in the holes or deep water in the streams, and set them off with a fuse. The concussion is so great as to kill or stun all the fish within a radius of fifty feet or more, when they rise to the surface of the water. The larger ones are then scooped up in nets, and the smaller remain to rot and taint the air.

WOODPECKERS.

The peculiar characteristics of the woodpeckers are the construction of the beak, the feet, and tail. The beak is constructed for chipping away the bark and wood, the feet giving them the power to hold fast to the trunk of the tree, and the tail to support them in position, which gives to their strokes the greatest force. Their beaks are long, powerful, straight, and pointed; their feet, formed for grasping, are set far back upon the body; their tails are short and stiff, and act as props when pressed upon the rough bark. Woodpeckers were for a long time thought to be injurious to trees, but that prejudice naturalists now agree was wholly an error. Often, in walking through the woods or orchards, there will be seen strewn in profusion, at the foot of a tree, flakes of bark and chips of wood, sure signs of the woodpecker's industry. It looks as though a work of destruction was being carried on, but these flakes, having become separated from the living bark of the tree, were mere excrescences under which insects and their larvæ found shelter, and to obtain them for food the woodpecker removes the dead flakes of bark and wood, so that in reality, instead of being an enemy to the farmer, he is one of his most faithful servants.

The woodpecker makes its nest in a tunnel which it excavates in the *unsound* timbers. Water, when admitted to a tree, causes its center to decay; but if a perforation is made through the trunk, gallon after gallon of dark brown water will rush out, mixed with fragments of decayed wood, showing the extent of the damage done. This often occurs when a branch has been blown off close to the trunk; the woodpecker is quick to discover it, and begins to cut a tunnel.

Wilson and Audubon both state that many of our woodpeckers will excavate tunnels in apparently sound and undecayed wood, boring through several inches, till they reach the decayed portions of the center of the tree.

The burrowing powers of the great giant gray-bellied woodpecker are marvelous, its chisel-like beak having been known to chip splinters from a mahogany table, and to cut a hole fifteen inches in width through a lath-and-plaster partition. Even the small downy woodpecker is able to bore its way through solid wood of a tree, making an ingenious nest, the burrows sloping for some six or eight inches, then being driven perpendicularly down the tree. The tunnel is barely wide enough to admit of the passage of the body of the bird. But the perpendicular hole is roomy, and is fitted up in a style sufficient to dignify it with the name of a chamber. The male and female woodpeckers labor alternately in the burrowing and making of the nest, but they find an implacable enemy in the saucy little wren, who, when the woodpeckers' apartments are ready for occupancy, coolly takes possession, and holds them against the builders and proprietors, notwithstanding their vehement and noisy expostulations.

WOODPECKERS.

Picus principalis is distinguished by a superb red carmine crest and bill of polished ivory. This is indeed no common bird, but is a king among his kind. No fence rails for him to perch upon, but rather the tops of lofty trees, the giant pines of the cypress swamps, where the trumpeting notes and loud strokes awaken and reawaken the echoes. From the base of some of these enormous pine trees cartloads of bark have been removed, and the trees so perforated with holes that it would seem to be impossible that it was the work of birds.

The Sense of Hearing.

Some observations on hearing have been lately recorded, which suggest striking analogies between that sense and vision. Herr Urbanttschitsch, in *Pfluger's Archiv*, indicates a way of demonstrating "fatigue" of the ear. Two tubes having been adapted to the ears so that a given sound equally affects the latter, a strong tuning fork is vigorously sounded and brought to the mouth of one tube for a few seconds. It is then deadened somewhat, but not wholly, by touch. The ear on that side then fails to catch the weak sound, but if the fork be brought to the other tube the sound is heard distinctly. The fatigue passes off in two to five seconds. A weaker tone of different pitch from the strong one is heard equally with both ears. Again, the same author has experimented with regard to subjective sensations of sound occurring after a strong tone has been heard for a little. The after sensation may come close upon the other, or be separated from it by a short pause. In the latter case (the only one studied as yet by the author) the pause varies up to fifteen seconds; then the sensation is revived, generally for five to ten seconds, then a pause and a renewal of the sensation, etc. Some persons have only one after sensation, while others have as many as six or eight. The time thus occupied (from cessation of the objective tone) is seldom over two minutes. A correspondent of the Cleveland (Ohio) *Leader* has described some experiences of his own in hearing, which remind one of color blindness. Certain sounds he never hears—*e. g.*, the song of birds. A room might be full of canary birds all singing, but he would never hear a note, though he would hear the fluttering of their wings. Nor does he hear the hissing sound of the human voice. He was taught to make it, and he never makes it without effort. About a quarter of the sounds of the human voice he fails to hear; and he has to be guided a good deal by the motion of the lips and the sense of remarks made. The upper notes of musical instruments he misses, but he hears the lower ones. In the Pennsylvania Medical Society, once more, Dr. Turnbull has recently called attention to the danger to life and property arising from deafness on the part of railway men, a considerable minority of whom have ear affections resulting from the conditions of their work. After citing personal observations and the evidence collected by Moon and Hirt, he recommended that all candidates for railway service should be carefully tested as to hearing by the company's physician, who should also report to the superintendent each case of deafness discovered in locomotive men, so that they might be transferred to positions where perfect hearing is less important.

Prophylactic Inoculation of Germs.

Prophylactic inoculation, which has been so carefully investigated in France, was the subject of communication by Grawitz to the recent Surgical Congress at Berlin, which dwelt also with the question of the transformation of innocent into deleterious organisms. Fungi which grow in bread, milk, etc., develop in an acid medium and at the ordinary temperature. Inoculated in an animal, they rapidly die, being in uncongenial conditions; but by successive systematic cultivation Grawitz has succeeded in acclimatizing the fungi in a medium, such as the blood, of a decided alkaline reaction, and at a temperature of 37° C. They are found to have then become infectious germs, the degree of their deleterious action being proportioned to their power of adaptation to their new conditions of existence.

Inoculating rabbits with the products of cultures more and more perfect, Grawitz has noted a progressive increase, not only in the intensity of the disorders thus produced, but also in the localization of the local lesions. As soon as the spores are sufficiently adapted to the conditions of the blood, they become established in the kidneys and in the liver, accumulating in foci, and causing swelling of the organ, and fatty degeneration of the cells. With still more highly developed products of culture, colonies of parasites are met with in the muscles, then in the intestines, in the spleen, and, finally, in the brain and lungs. Grawitz, like the French observers, has also found that the inoculation either of large doses of fungi of low "culture," or of smaller quantities of the organisms which have acquired more deleterious properties, will confer an immunity against future more virulent inoculations. Inoculation with uncultivated spores, not suited to the animal organism, confers no immunity.

Grawitz attempts to explain these facts by the following theory. The organs are invaded by colonies of organisms, in the order of the functional activity of their cells, taking as the measure of that activity the consumption of oxygen in a given time. He speculates that the germs in contact with the anatomical elements of the organism attack first those which have the least vital power of resistance, and somewhat fancifully suggests that the tissue elements, if successful in the struggle, acquire an increased power of resistance, which they transmit to their successors.—*Lancet.*

The Phylloxera in France.

Mr. C. H. Perceval, H. M. Consul at Bordeaux, reports as follows:

"The information which I have gathered on this subject, from official and other sources, tends to reduce the methods used to the following three: First, submersion of the vineyard, when practicable; secondly, by employing insecticides; and, thirdly, where the vineyards have been destroyed, by the plantation of American varieties of vines, whose roots offer more resistance to the attack of the insect. M. Armand Lalande, the President of the Chamber of Commerce of Bordeaux, proprietor of extensive vineyards in the Médoc, a gentleman to whom I am much indebted for the information and assistance which he has been kind enough to afford me in drawing up this report, addressed a meeting of that body held in March last on various topics, and I translate the following from his remarks regarding the phylloxera: 'The Chamber of Commerce has not ceased to show the extreme importance which it attaches to all the means employable in combating this dreadful scourge. Of the 2,200,000 hectares which composed the vineyards of France, 500,000 are destroyed, 500,000 others are greatly attacked; it is a loss of more than three milliards to the country. The Gironde is one of the departments which has suffered most; one third of the vineyards are destroyed, another third is badly attacked. We must admit, with sorrow, that the very sources of our commerce and of the well being of our southern population are most seriously compromised. Still we have great hopes that, by energetic and intelligent efforts, we may be enabled gradually to arrest and repair the evil. For the very important vineyards of the Gironde, where submersion is possible, it is a sure remedy, which is generally employed, and with invariable success. In the cases of vineyards already destroyed, the remedy seems to be to reconstitute them by planting American vines as stocks for grafting French cuttings on, which plan has been the subject of satisfactory and conclusive experiments for the last few years, especially in Languedoc. Where the vines are not too far gone, a judicious use of sulphur of carbon is a certain means of preservation, and, in most cases, practicable, owing to the moderation of the cost.'"

The Mississippi and Tributaries.

A pamphlet on the Mississippi River and its tributaries gives the following statement of the mileage of the navigable portion of each of the following-named rivers above its mouth: Missouri, 3,129; Mississippi, 2,161; Ohio, 1,021; Red, 986; Arkansas, 884; White, 779; Tennessee, 789; Cumberland, 900; Yellowstone, 474; Ouachita, 384; Wabash, 365; Allegheny, 325; Osage, 363; Minnesota, 295; Sunflower, 271; Illinois, 270; Yazoo, 226; Black (Ark.), 112; Green, 200; St. Francis, 180; Tallahatchie, 175; Wisconsin, 160; Deer Creek, 116; Tensas, 112; Monongahela, 110; Kentucky, 105; Bartholomew, 100; Kanawha, 94; Muskingum, 94; Chippewa, 90; Iowa, 80; Big Hatchie, 75; St. Croix, 65; Rock, 65; Black (La.), 61; Macon, 60; Bœuf, 53; Big Horn, 50; Clinton, 50; Little Red, 49; Big Cypress and Lake, 44; Big Black, 35; Dauchitte, 33. Total number of rivers, 33; total number of miles of navigation at present, 15,710.

A Balloon Experiment.

After waiting several days for favorable weather, Prof. King's balloon, "Great Northwest," was started on its way to the East from Minneapolis, Minn., September 12. Prof. King was accompanied by Mr. Upton, of the Signal Service, and five newspaper correspondents. The balloon rose about 3,000 feet, and drifted slowly in a southeasterly course. It dropped near Fort Snelling, and nearly fell into the Mississippi River. A liberal discharge of ballast secured another ascent, but a brief one, and the balloon came to ground in the woods near St. Paul. When the wind rose it was deemed too violent, and the project was abandoned.

Passenger Birds.

According to a writer in *Nature*, the small migratory birds that are unable to perform the flight of 350 miles across the Mediterranean Sea are carried across on the backs of cranes. In the autumn many flocks of cranes may be seen coming from the north, with the first cold blast from that quarter, flying low, and uttering a peculiar cry, as if of alarm, as they circle over the cultivated plains. Little birds of every species may be seen flying up to them, while the twittering songs of those already comfortably settled upon their backs may be distinctly heard. But for this kind provision of nature, numerous varieties of small birds would become extinct in northern countries, as the cold winters would kill them.

Natural Gas in Iron Works.

A correspondent of a Pennsylvania paper thus describes the use of natural gas in the Kittanning (Pa.) Iron Works. The gas is brought from a well some three miles distant, in four inch casing, and at the mill is distributed among eighteen boiling furnaces. The furnaces are the same as those in which coal is used. The gas enters the rear of the furnaces in three small pipes, shaped at the end like a nozzle. There being quite a pressure, the gas enters with considerable force, and by means of dampers to regulate the draught, an intense and uniform heat is obtained. After a heat the furnace is cooled and prepared for the next heat, in the same manner as with coal. When the metal is in place the gas is turned on, and the operation of puddling is the same with the exception that it is somewhat slower.

The puddlers like the gas very much, as it reduces their labor to some extent, and they say they can make better weight than with coal. The furnaces being free from sulphur, a better quality of iron is produced, and it brings a slightly advanced price in the market. These furnaces have been running all the time for some months past, and have used nothing but gas for fuel, which has proved satisfactory in every respect, is found to be much cheaper than coal, and has demonstrated the fact that this vast amount of natural gas, now going to waste, might be used in all our iron manufactories.

Mr. R. L. Brown, having purchased another and larger well, has organized a stock company, and is about negotiating for the erection of a steel works, to be run with gas. Mr. Brown claims that he has a process by which he can manufacture steel of a superior quality and with less expense than by any process now in use.

Should this latter enterprise prove a success, the same parties who have control of the old Cowanshannock gas well propose to erect glass works, and will apply the gas to the manufacture of glass.

The gas which I have referred to as supplying the boiling furnaces is brought, as I said, a distance of three miles west of Kittanning, in East Franklin township, about ten miles from any oil development, the nearest oil well being at Great Leather. The gas well was put down two or three years ago as a test well for oil on the Reed farm; and was left to burn and go to waste until Major Beale and others bought the well with the idea of making lampblack. But the mill proposed to utilize it for fuel, and it has done so with the most satisfactory results. Only one half of the well's production is in fact consumed by the eighteen furnaces here described.

Notes on Wheel Making.

The first thing that gives way on a buggy is commonly the wheels. I have frequently seen new buggies go out of the shop, and before they had been out a dozen times the spokes would commence to squeak and work in the hub, or one or more of the wheels would dish back. The question then arises, is the woodworker to blame, or is it the carelessness of the smith in setting the tire, or does the fault lie in the selection of the timber used in making the wheels? Let us try and see where the trouble lies.

In the first place, the manufacturer may make a grand mistake in the selection of his timber. Some have an idea that they must have good spokes any way, but are not so particular about the hub or rim; while others must have the hardest hub they can find, saying: "I have got a fine set of hubs, but mixed or forest growth spokes will do well enough." Now we will see how such wheels turn out. We find, after they have been run a short time, that around the mortise of the hub the paint is cracked, the dish is out of the wheel, and the owner of the buggy is mad enough to kill the wheelmaker and blacksmith, and swears he never will pay the balance due on that buggy until he puts on a new set of wheels.

Well, the carriage maker goes to work and puts in a new set of hubs that he happens to have in the shop of much softer timber than the first ones. He thinks these are good enough, but gets the best second-growth spokes he can find. The new wheels are finished, but in a short time they work just the same as the first.

Now the difficulty in the first set was a soft spoke driven in a hub as hard as iron; while, in the second case, a hard spoke was driven into a soft hub. Point first: Care must be taken to have the hub and spoke of the same hardness. Point second: A tolerably good set of wheels can be made out of softer timber, providing this rule is observed.

Next, wheels should be made with the spoke driven straight, and the tenon on the spoke should have but little taper, as by driving spokes like a wedge into a hub they are more liable to work back and get loose.

In regard to the rims, great care should be taken not to have them too long, for this prevents the tire from supporting the wheel.

A great deal has been said in the *Hub* about the proper dish of a wheel, some claiming one-half of an inch, while others claim that one-fourth of an inch is sufficient. A wheel with but little dish looks well to the eye, but my experience has been that three-quarters of an inch is not too much to make a durable wheel. SCOTT SMALLWOOD.

Chicago, July 23, 1881.

Statistics of Cotton.

The report of Census Agent Eugene W. Hilgard, just submitted, shows the acreage and production of cotton by States for the year 1879, as follows:

States.	Acres.	Bales.
Mississippi	2,093,330	955,808
Georgia	2,617,138	814,441
Texas	2,173,732	803,642
Alabama	2,330,086	699,654
Arkansas	1,042,976	608,256
South Carolina	1,364,249	522,544
Louisiana	864,787	508,569
North Carolina	893,153	389,598
Tennessee	722,569	330,644
Florida	245,595	54,997
Missouri	32,711	19,733
Indian Territory	35,000	17,000
Virginia	24,900	11,000
Kentucky	2,667	1,367

The average product per acre in pounds was:

States.	Seed Cotton.	Lint.	Cotton Seed.
Mississippi	651	217	434
Georgia	444	148	296
Texas	528	176	352
Alabama	429	143	286
Arkansas	831	277	554
South Carolina	546	182	364
Louisiana	837	279	558
North Carolina	621	207	414
Tennessee	651	217	434
Florida	318	106	212
Missouri	861	287	574
Indian Territory	693	231	462
Virginia	654	218	436
Kentucky	729	243	486

Rain in the United States.

Mr. Henry Gannett, geographer of the tenth census, has issued a report showing the distribution of rain-fall throughout the United States and the distribution of population according to rain-fall. It appears that the highest annual rain-fall in the country has been 150 inches, which was reached for one year only in Puget Sound. The average annual fall upon the surface of the United States, exclusive of Alaska, was, in 1880, 29 inches. This average implies a large area unfit for the purposes of vegetation, which with the rapid evaporation that occurs on this continent, requires a much higher ratio of moisture. Hence, population is found to center principally on such parts of our surface as have from 35 to 50 inches of rain. The following table from Mr. Gannett's compilations will show the relation between rain-fall and number and density of population in the United States in 1880:

Inches of Rain-fall.	Population.	Pop. per Sqr. Mile.	Percentage of total Population.
60 and above	855,680	12·4	1·70
55-60	2,813,896	19·7	5·61
50-55	4,311,502	22·1	8·60
45-50	12,754,479	57·7	25·43
40-45	11,357,392	40·1	22·65
35-40	10,037,170	38·6	20·05
30-35	4,993,336	23·0	9·96
25-30	1,179,136	8·7	2·35
20-25	829,340	3·8	1·65
15-20	537,313	1·3	1·07
10-15	309,438	0·6	1·62
Below 10	154,304	0·6	0·31

The heaviest population is in the classes between 35 to 50 inches, which comprise 71 $\frac{53}{100}$ per cent of the total population of the country, while the classes between 30 and 60 inches comprise 92 $\frac{3}{10}$ per cent of the population. The densest settlement is in the class 45 to 50, which also contains the greatest absolute population. In this class also is the greatest absolute increase in density. A rain-fall of 45 to 50 appears to best suit the purposes of wealth-making; for a larger number of our people have settled within an area having that fall than in any other. From the data above given, we reckon that the total rain-fall in the United States, exclusive of Alaska, in 1880, was 414,999,040,307,660,000 cubic inches, or 1,796,532,642,000,000 gallons, which is about double the water contents of Lake Erie and Lake Ontario combined, these lakes containing 893,158,008,000,000 gallons. This will afford some idea of the extent of the evaporation effected on our 3,026,494 square miles of surface within twelve months.

MECHANICAL INVENTIONS.

An improvement in pistons has been patented by Mr. Henry Waterman, of Brooklyn, N. Y. This improvement relates to pistons having their main portions formed by expansible rings carried by a central hub and face plates. The invention consists in the combination, with these essential portions, of devices that give solid and adjustable backing to the rings; also, in a metallic packing disk for the joint between the face plate and rings.

Mr. William P. Brosius, of Richmond, Va., has patented a seam gauge for determining the amount of lap in sewing together two pieces of leather in the manufacture of boots and shoes, or in connecting parts of any other material, so that a uniform amount of lap is preserved and the line of stitching kept at the proper distance from and in parallel position with the edge. It is an improvement in that form of gauge in which a guide face is arranged to rest in the plane of one of the sections of work and bear against its edge, and a second guide face is arranged in the plane of the other sections of the work and is arranged to bear against the other edge, and the distance between which two faces may be varied to regulate the width of the lap.

An improved nut lock has been patented by Mr. John B. Abernathy, of Covington, Ky. The invention consists in a nut provided with a threaded central recess or cavity in its upper surface to receive a central threaded projection of a second nut, which is screwed on the bolt after the first nut, the threads of the projection taking in those of the cavity, thus uniting the two nuts.

Mr. Samuel W. Evans, of New Orleans, La., has patented an improved apparatus for holding a hose nozzle in any position, thereby enabling a person to direct a stream of water in any desired direction. The invention consists in a ring or sleeve for receiving the nozzle, and provided with trunnions journaled in uprights of a plate swiveled on an upright pivoted to a folding base frame, provided on the under side with spikes to prevent it from slipping.

Gelatine Emulsion.

Mr. A. L. Henderson, of London, lately gave a demonstration of the method of preparing a gelatino-bromide emulsion he has for some time past been working with great success. The following is his formula and method of working:

Make a solution of 200 grains of silver nitrate in 4 ounces of water, then add sufficient ammonia to redissolve the precipitate thus formed (about 2½ drachms of ammonia are requisite for this purpose). This solution of ammonia nitrate of silver is now heated to about 100° Fah., and the following solution, also heated to about the same temperature, is poured slowly into it (the mixture being stirred with a glass rod meanwhile): Gelatine, ½ ounce; ammonia-bromide, 150 grains; ammonia, 2 drops; water, 4 ounces.

The emulsion is now cooled as rapidly as possible, and then forced through a fine gauze disk, and washed by means of a stream of water. The emulsion thus obtained is of a grayish-blue tint, of a very fine grain, and extremely sensitive. The rapidity is increased in the same proportion as the silver nitrate is converted into ammonia nitrate, thus (for example), if 20 per cent only is converted into ammonia nitrate, the plate will not be nearly as rapid as if the whole, or nearly the whole, of the silver is converted.

Another important point in this process is that the bromide of silver is formed in an excess of silver, thereby giving greater rapidity and density.

This emulsion is so rapid that even an Edwards lamp with a ruby chimney (that will stand the spectroscopic test) and two thicknesses of ruby paper is not too safe a light.

The emulsion may be converted into pellicle by pouring it slowly (after washing) into three times its bulk of alcohol, stirring meantime. The precipitated emulsion will cling round the rod in a spongy form, but by a little working with the hand the whole will be reduced to the size of a walnut. It must then be torn into small pieces and dried in a current of air. The weight of this quantity, when thoroughly dried, will be about 6 drachms.

This pellicle will keep an indefinite time, and when wanted for use has only to be redissolved in 10 to 12 ounces of water, and strained, when it is ready for coating.

Photo Substitute for Glass.

Professor Stebbing, of Paris, has made a new film substitute for glass plates, which has been laid before the French Photographic Society. The basis of the support is gelatine, rendered insoluble, and the tissue is of such thickness as to be easily handled even when wet, without the slightest danger of injury. It is pliable and "leathery" in its character, thus obviating any tendency to fracture from accidental bending as would be the case possibly if the gelatine were more brittle. The development of these film negatives is extremely simple. It is first of all necessary to take means to prevent the developing solution from passing between the sensitive film and the support. This is effected by drawing the edges of the undeveloped tissue between the thumb and forefinger, which have been previously slightly greased with tallow. The film is then laid in a dish and developed in the ordinary way. When the action of the developer is complete the solution is poured off and the negative washed while still in the dish; in fact, the whole of the operations are performed in the one dish, so that the film is submitted to as little handling as possible. After a short immersion in chrome alum the negative is finally washed and spread upon a sheet of glass to dry. Here the great difficulty previously experienced in getting the films to dry flat has been

overcome by Mr. Stebbing in a very simple way. When the film negative has been laid smoothly upon the glass a narrow strip of gummed paper is laid along each edge, attaching it firmly to the glass, so that when dry it is stretched perfectly tight; the paper can then be cut and the negative detached.

Fire Risk from Spontaneous Combustion.—An Invention Wanted.

The President of the Boston Manufacturers' Mutual Fire Insurance Company, Mr. Edward Atkinson, states in a recent circular to millowners that since the beginning of 1878 the several mutual companies have lost over $300,000 from fires in dry-houses or finishing departments of print works, all caused by the spontaneous combustion of dyed cotton goods or yarn. The loss to the millowners must have been much greater, since, as in the recent fire in the finishing and packing department of the Slater Mills, a comparatively small fire may seriously interrupt the business of a large establishment. Within the period mentioned there were nine other fires from spontaneous combustion of dyed goods, which were extinguished with little or no loss. All the fires of this class occurred in the night or in the early morning before bell-time. In several cases the watchman passed the points where the fires originated a little before the outbreak, and perceived no smell or other sign of fire. In one case a watchman entered a room in which there was a pile of dyed yarn upon the floor. There was no smoke or other sign of fire; but as the watchman approached the yarn it burst into flames. The movement of the air, or the influx of fresh air when the door was opened, probably supplied the oxygen needed for rapid combustion.

According to a report of the Massachusetts State Assayer, Mr. S. Dana Hayes, to whom the question of the origin of such fires was submitted, there are several colors produced in calico print-works and in dye-houses which are sources of danger from combustion, and which should be most carefully made and controlled. They are the colors developed, after the materials have been applied to the cloth or yarn, by chemical reactions in the tissues, with the production of heat, and also by the aid of heat applied to the fabrics in the aging boxes and chambers.

The development of these colors is believed to be obtained by oxidation—by the union of oxygen, derived from the atmosphere or from oxidizing ingredients of the color-mixture, with the coloring matter itself, on the cloth—in much the same way that the oxygen of the air unites with linseed-oil, when exposed upon rags or other porous materials, producing heat and "spontaneous" combustion. That dangerous chemical action goes on is proved by the increase of temperature, and, in the case of developing colors, by the disengagement of acetic acid and other vapors.

The color dyes in the aging of which heat is developed to a degree making combustion liable are: black made from aniline or its salts, and even in logwood and iron blacks; browns made from catechu, cutch, gambier, or terra japonica; iron buffs; indigo blue; and in preparing cloth with oil for Turkey red.

These colors are produced by oxidation, and are therefore dangerous.

They may cause fires, and they often weaken fabrics unless the aging process is carefully watched.

The most effective means of preventing loss from fires spontaneously generated have proved to be automatic sprinklers and plastering overhead on wire lathing with the covering of exposed woodwork with tin. To prevent the loss incident to the injury of goods by over-heating is not so easy. The insurance company named above are convinced that the problems involved must be reinvestigated in a complete and systematic manner before any hope can be reasonably entertained of economically preventing the risks and difficulties now encountered.

To further such investigations they have engaged a graduate of the Massachusetts Institute of Technology, who, under the supervision of Prof. John M. Ordway, will make a special study of the processes now in use to see if some general principles or methods cannot be determined of wider application than any now controlling the common practice.

The main fault in the usual methods of drying yarns, Mr. Atkinson believes to be that "no consideration has been given to the fact that *air* is merely an *instrument* which may be used to take up moisture from the goods and carry it somewhere else; or that its power is greater or less, as such an instrument, not only in proportion to the heat imparted to it, but in some measure in proportion to the removal of the moisture already in it, before it is used."

It seems scarcely credible that this obvious truth has been so largely overlooked as Mr. Atkinson asserts; in other words, that practical men would expect to dry yarn in air already saturated, however hot.

But facts are stubborn things, and facts like the following are significant. Mr. Atkinson says:

"In one case the air intended to be used for drying purposes has been taken from a wet scouring-room, where it had already become saturated with moisture, and could only become a suitable instrument to take up more by being heated to excess. In another case, the same air has been kept in circulation at a very high degree of heat, with no ventilation, and no chance for fresh air to come into the room except through cracks. In this case, the only deposition of moisture of any great moment must have been at night, when the room became cooler."

Mr. Atkinson states as a well ascertained fact that if drying can be compassed at a degree of heat less than 120° Fah. no injury will be done either to the stock of cotton or wool; but if a degree of heat greater than 120° is used, the fibers are more or less baked and the yarn made harsh and brittle. Most of the drying of dyed cotton and dyed yarn is now done at a higher temperature than 120°, and it is commonly held that a less heat would not dry with sufficient rapidity.

There is obviously an opportunity here for a profitable invention by means of which yarn can be dried at a low temperature, and the heat developed in the oxidation of dyes in yarns and fabrics carried off so rapidly as to obviate the risk both of spontaneous combustion and the injury of fabrics by internal heating. Our inventive readers will do well to think of it. Meantime it is to be hoped that managers of print-works will further wherever possible the investigation which the insurance company's expert is making. Prof. Ordway's report of results cannot fail to be valuable.

Spontaneous Forests.

A writer in a West Virginia paper combats the opinion, held by many arboriculturists, that an open country is never converted into a forest through the operation of natural causes, and, as establishing the fact that such change does sometimes occur, brings forward the case of the Shenandoah Valley. When first settled, about 160 years ago, it was an open prairie-like region covered with tall grass, on which fed herds of deer, buffalo, elk, etc., and having no timber, except on ridgy portions of it; but in consequence of its settlement, the annual fires were prevented, and trees sprang up almost as thickly and regularly as if seed had been planted. These forests, having been preserved by the farmers, cover now a large part of the surface with hard wood trees of superior excellence. These facts would also seem to substantiate the theory that the treeless character of the prairies of the West is due to the annual burning of the grass by the Indians.

Boil Doubtful Milk.

It is with the following words that Dr. Pichon closes his account of the epizootic of 1879–80: "Most authors are silent as to the quality of the milk yielded by cattle during the prevalence of epizootics. It is possible that experience has not as yet supplied sufficient ground for its condemnation, and it is true that while a diminution of milk secretion is usually an early symptom in almost all diseases of the cow, complete suppression of that secretion accompanies any aggravation or prolongation of disease. The source of danger is thus removed by the operation of natural causes, and the discussion is narrowed to the question whether milk secreted at the very onset may not have acquired hurtful properties. In this state of uncertainty, which has not been cleared up by any authority on hygiene, the precaution of boiling the milk should be adopted. Boiling destroys any infective germs that it may contain."

How Our Fresh Meat is Handled.

A prominent dealer in live stock gives the *Tribune* the following facts and figures relative to the trade in cattle, sheep, and hogs in and around this city:

The cattle come to Jersey City mostly by the Pennsylvania Railroad, which brings the cattle shipped by the Baltimore and Ohio from Southern points. Many also come by the Erie Road. The majority are shipped from Chicago, St. Louis, and Cincinnati, by dealers in those places who are either interested with the sellers in New York or have their stock sold on commission, the charge for which is generally $1.50 per head. The best bullocks for beef come at this time of year from Ohio and Kentucky, and in the winter from Illinois and Missouri.

The breeds are usually natives or grade Shorthorns and Durhams. Illinois, Iowa, Missouri, and Kansas are the States where the most corn is fed to bullocks, and the stock from those States, therefore, makes superior beef. A great many beeves are coming from the plains of Colorado, and are very fair stock. About 40 per cent. of the arrivals at this time of the year are Texans and Colorado half-breeds. They are composed in a great measure of bone and horn, and usually bring very low prices. As the country is more thickly settled the Texas cattle become tamer and easier to handle, but they are still the subject of a few stray "cuss words" from drovers and butchers.

The Cherokee cattle raised by the Indians are much like the Texans, only smaller and neater. Some dealers buy the Texas cattle and fatten them on corn in Illinois, Kansas, and Missouri, and so make fair beef of them. Others, in Cincinnati, Chicago, Sterling, and Peoria, Ill., and Cynthiana, Ky., fat many Texas steers on distillery refuse or "slops"—the grain after it has been distilled. This feed makes healthy meat of fair quality. Some say, however, that the meat of this kind is softer and more flabby, and that a distillery-fed animal will die in very warm weather, when a corn-fed one will be in good condition.

The cattle-growing part of the country has moved West rapidly in the last few years, as the new States have been opened up, until now the most of the stock coming to this market is raised west of the Mississippi. Kansas, Nebraska, Colorado, Iowa, and Missouri have taken the business from Ohio, Indiana, and Illinois, and many farmers in the latter States are turning their attention to raising sheep and hogs as more profitable. Chicago is the great cattle depot of the country, and handles about 30,000 head a week, while New York's average was, last year, 13,018. But Chicago is a distributing point, while New York is a market. New York eats most of the live stock she receives, while Chicago has much more than she can masticate, and so sends it away.

Live stock usually stops over several hours in Chicago, and is again unloaded, watered, and fed at Pittsburg, or some other point on the way to New York. The trains arrive at Jersey City at all hours of the night. The cars are open or "slatted," and the animals are found to ride best put in loose with no stalls. Extra floors are put in for sheep and hogs. The cars hold fifteen to nineteen native bullocks or twenty to twenty-five Texans. The arrivals are nearly a hundred and fifty cars daily.

At daylight the sales begin and last till about 12 o'clock. The buyers are wholesale slaughterers and shippers. These glance through the yard, look at the bulletin of animals, and then begin to bargain for some lot of cattle which has struck their fancy. If the supply is small, however, they will not bargain long, for fear a rival may step in and "leave them in the cold." There are three market days at the cattle yards—Monday, Wednesday, and Friday—Monday being the principal one. At one time Sunday was the principal day for selling cattle. When a slaughterer has selected his cattle they are driven up to the scales, on which about forty can be weighed at once.

A well-fatted native steer will weigh from 1,200 to 1,500 pounds; occasionally they go as high as 2,500 pounds. The dealers in New York have a curious way of selling bullocks, which is different from any other market, and as unique in its way as the tenaciousness with which the New York potato dealers cling to the "York shilling" in their business. A bullock is sold at its dress weight before it is dressed—that is, a lean animal would be estimated to dress fifty-three to fifty-five pounds a hundred, a good one fifty-six to fifty-nine, and fancy ones sixty to sixty-two pounds. Thus, for every hundred pounds of live weight the price per pound of dressed beef is charged on the number of pounds the animal is estimated to dress a hundred.

The Jersey City Stock Yards are owned by the Central Stock and Transit Company, and they are a heavy-paying investment. The charge for every head of cattle coming to the yard is 45 cents, called "yardage," and this pays for very little more accommodations than a railroad company usually furnishes for nothing in the shape of depots. The company also charges $2.50 per hundred for hay, an outrageous price, but one which the cattle men are compelled to pay. The charges are about as heavy at the other principal market of this city, the Sixtieth-street yards, the two being virtually under the same management. The Sixtieth-street yards accommodate particularly the stock coming over the New York Central and Erie railroads, and nearly as many cattle arrive there as at the Jersey City yards. The method of handling and selling is the same.

The hog yards for the New York Central Railroad are situated at Fortieth street and Eleventh avenue, where about 10,000 hogs are now arriving and being slaughtered every week. New pens for the brutes are building, which will lessen the inevitable smell from the swine. They are shipped mainly from Chicago, which now far eclipses Cincinnati in its hog traffic, and which handles from 100,000 a week in summer to 50,000 and 60,000 a day in winter.

The supply of sheep is divided about equally between Jersey City and Sixtieth street. They are shipped largely from Ohio, Indiana, and New York. Lambs now are arriving mainly from Kentucky and Virginia, and they later will come from New York State and Canada. The stock yards around New York have changed a great deal in the past few years, the old ones at Communipaw, Weehawken, and other points being discontinued, until they have narrowed down to three large yards, one of which—Fortieth street—is solely for swine.

To Remove Ink Stains.

The *Journal de Pharmacie d'Anvers* recommends pyrophosphate of soda for the removal of ink stains. This salt does not injure vegetable fiber and yields colorless compounds with the ferric oxide of the ink. It is best to first apply tallow to the ink spot, then wash in a solution of pyrophosphate until both tallow and ink have disappeared.

Stains of red aniline ink may be removed by moistening the spot with strong alcohol acidulated with nitric acid. Unless the stain is produced by eosine, it disappears without difficulty. Paper is hardly affected by the process; still it is always advisable to make a blank experiment first.

Pearl Hunting in Tennessee.

The search for pearls in the mussels of Ohio has been a considerable industry for years. The Nashville *American* reports an outbreak of pearl hunting in Stones River, Rutherford County, Tennessee. Not less than 500 people were engaged daily in raking the bottom of that stream, delving down in the mud for mussels, which are piled along the banks, opened, and critically examined for the treasures contained in many of them. One pearl is reported for which $80 was paid in New York. The general range of value, however, is said to be from 50 cents to $25.

A Shoe Black Plant.

The "shoe-black plant" is the popular name of the *Hibiscus rosa sinensis* in New South Wales. Its showy scarlet flowers contain a mucilaginous juice which gives a glossy finish to leather. The plant grows freely in almost any kind of soil, and the flowers are much used when dry as a substitute for shoe-blacking. They may be used with or without a brush.

Mr. H. P. Feister, the well known mechanical engineer, has resigned the superintendence of the machine works of Messrs. Rex & Bockius, of Philadelphia, and assumed the superintendence and general management of the Franklin Machine Works. R. S. Menamin proprietor, 517 to 521 Minor street, Philadelphia. Mr. Feister still continues designing and constructing special machinery for various purposes.

Business and Personal.

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

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Paragon School Desk Extension Slides. See adv. p. 204.

Foot Lathes, Fret Saws, &c. 90 pp. E. Brown, Lowell, Mass.

Wanted—Two First-class Machinists. Address W. W. Oliver, Buffalo, N. Y.

Common Sense Dry Kiln. Adapted to drying all kinds of material where kiln, etc., drying houses are used. See p. 205.

Small Machine Shop for Sale. Established 1873. List free. E. Side, 370 S. First St., Brooklyn, E. D., N. Y.

For Sale.—Fast 42 foot Propeller Yacht and 50 foot Side-wheeler. S. E. Barthan, Worcester, Mass.

The advertiser, an electrician, experienced in the practical construction of electrical instruments, wishes a situation. Moderate salary expected. Address Electrical Worker, Box 773, New York.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N. Y.

Improved Skinner Portable Engines. Erie, Pa.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

For Machinists' Tools, see Whitcomb's adv., p. 173.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Vocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 204.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

4 to 40 H. P. Steam Engines. See adv. p. 189.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N. Y.

Cope & Maxwell M'f'g Co.'s Pump adv., page 189.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

The I. B. Davis Patent Feed Pump. See adv., p. 205.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 157.

The Sweetland Chuck. See illus. adv., p. 172.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Skinner's Chuck. Universal, and Eccentric. See p. 173.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 204.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 204.

Leather Belting, Rubber Belting, Packing and Hose Manufacturers' Supplies. Greene, Tweed & Co., N. Y.

Brass & Copper in sheets, wire & blanks. See ad. p. 204.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Clark & Heald Machine Co. See adv., p. 206.

Blake's Belt Studs. The best fastening for leather and rubber belts. Greene, Tweed & Co., 118 Chambers St., N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 204.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Wren's Patent Grate Bar. See adv. page 205.

Use the Vacuum Oils. The best car, lubricating, engine, and cylinder oils made. Address Vacuum Oil Co., No. 3 Rochester Savings Bank, Rochester, N. Y.

Supplee Steam Engine. See adv. p. 204.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 205.

New Economizer Portable Engine. See illus. adv. p. 205.

Renshaw's Ratchet for Square and Taper Shank Drills. The Pratt & Whitney Co., Hartford, Conn.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

For the best Diamond Drill Machines, address M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 222.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) M. Z. asks: Can you please tell me through your valuable paper the greatest number of tons that ever an ocean steamship carried, and what is the name of the same? A. The Great Eastern had the greatest tonnage capacity, but we do not know the greatest tonnage she has actually carried.

(2) A. R. M. asks for a simple method of testing and assaying silver ores. A. Charge into a six-ounce crucible (a Battersea F answers very well) one ounce each of the ore and dry bicarbonate of soda, two ounces of litharge (free from silver), half an ounce of argal, and cover with a quarter of an inch of dry salt. Heat the crucible until the contents are in a quiet state of fusion; remove from the fire, cool, break, and clean the lead button by pounding on an anvil. If the button weighs more than, say, half an ounce, scorify it down in a scorifying dish in an open muffle. Heat 1¼ inch bone ash cupel in the muffle, drop into it the button, and keep up the temperature of the muffle to a bright red heat until all the lead has been scorified off and absorbed by the cupel, and the small bead of gold or silver (if the ore contains any) becomes well rounded and clear. The ore must be finely powdered, and the whole of it passed through an eighty-mesh sieve.

(3) A. G. wants to know how to recover silver from old solutions. A. Precipitate the warm solution by addition to it of common salt; allow it to settle, decant the clear liquid, and throw the precipitate together with several scraps of zinc, into warm dilute sulphuric acid. When the chloride is all reduced, pick out the remainder of the zinc, decant and press out the liquid from the precipitate, dry, mix it with a little borax, glass, and powdered resin in a small clay crucible, and heat to complete fusion. Cool and break the crucible; the silver will be found as a button in the bottom. With a small crucible, a good fire in an ordinary cooking stove will answer for the fusion.

(4) E. J. S. asks how to silver plate iron and steel. A. Dissolve 12 oz. cyanide of potassium and 1 oz. (troy) of chloride of silver in 1 gallon soft water; filter, and suspend in this bath the chemically clean work and a plate of pure silver, exposing a surface somewhat larger than that of the work. Connect the work with the negative or zinc pole of a small Daniell or Smee battery of two or three cells by means of a stout copper wire, and join the silver plate in a similar manner with the positive pole of the battery. The work may be prepared for the bath by boiling it in a strong aqueous solution of caustic potassa or soda to remove traces of oil, rinsing in running water and scouring with a brush and pumice powder moistened with strong cyanide of potassium solution; then quickly rinsing again, and without fingering, placing in the bath, and in circuit. A somewhat weaker (in silver) bath, called the "whitening" bath, and a stronger battery, is generally used to whiten or throw on the first film of silver. The proportions for this are: Cyanide of potassium, 1 lb.; chloride of silver, a quarter of an ounce (troy). If the silver runs on dark, use a weaker battery, or break the current so as to give alternate intervals of rest. Thirty minutes ordinarily suffices when a battery of three or four Smee cells, plates 1x4 inches, are used. In the whitening process an additional cell or more is employed. Iron takes silver better after having received a light deposit of copper. The metal must be freed from oxide by pickling in dilute acid and scouring with sand. For coppering a slightly acid bath of the sulphate and a strong battery may be used.

(5) N. W. writes: In building a dry room to dry lumber, is it best to admit the dry air in at the top, and take the moist air out at the bottom of the room, or *vice versa*? is not the moist air the heaviest, and will it not consequently fall? A. Admit the dry air at the bottom. The levity of the moist air will be sufficient to carry it off with a proper flue or chimney.

(6) J. H. asks: What is the best apparatus in use for heating 20 or 30 gallons of water quickly, by gas or oil? A. We think a coil of iron pipe in a furnace alongside your tank, with the water circulating through the coil into the tank.

(7) C. E. B. asks for a cheap preparation that could be applied to strawboard in form of a bath that would prevent dew and rain from injuring berry boxes made of it. A. A dilute solution of shellac in alcohol is the best coating we think of. See article on waterproofing in No. 6, current volume.

(8) A. S. P. asks: What space would a cubic foot of gas (atmospheric pressure) occupy at six atmospheres, and formula for finding above? A. Approximately, the space occupied is inversely as the pressure; or one cubic foot at one atmosphere would occupy one-sixth of a cubic foot at six atmospheres.

(9) E. M. J. asks how to make tracing cloth. A. Wagner's tracing cloth is said to be prepared as follows: Boiled bleached linseed oil, 20 lb.; lead shavings, 1 lb.; zinc oxide, 5 lb.; Venetian turpentine, half a lb.; boil for several hours, then strain, and dissolve in the strained composition 5 lb. white gum copal. Remove from the fire, and when partly cooled add purified oil of turpentine sufficient to bring to the proper consistence. Moisten the cloth thoroughly in benzole, and then give it a flowing coat of the varnish.

(10) A. L. asks: 1. Is asbestos packing for stuffing boxes in general use in the United States? A. Yes. 2. Who are the principal manufacturers? A. See our advertising columns. 3. I am told the raw material comes from Canada. Could you give me the name of the place? A. It comes from mines or quarries on the north side of the Ottawa River.

(11) W. H. F. asks what kind of wood is used in a piano into which the screws for receiving the wires are inserted? Is it one piece, or several layers glued together? Must the screws have a deep cut or a fine one? Which is the best wood for this purpose? A. Use maple wood, with a veneering of the same about three-eighths of an inch thick, glued to the front face, and having the grain at right angle with the back. Your cheapest plan for the screws is to buy them at any piano hardware store ready made.

(12) H. asks: 1. In making the secondary of an intensity coil out of 7 oz. of No. 34 (B & S) gauge silk insulated copper wire, insulated from and wound over a primary, 7 inches long, of No. 14 wire, about what length of spark could I get, using a battery power of six carbon cells? A. Your primary wire is rather coarse. You should use three layers of No. 16. If the coil is properly made and provided with a condenser, you should get a spark one inch long. 2. Could I continue to wind one pound of the fine wire, without changing any of the other conditions of the coil, and get a larger spark? Or what changes would I be obliged to make in the other parts of the coil to meet the added half-pound of induction wire? A. You might increase the quantity of secondary wire with advantage. 3. In making an intensity coil for a large spark, would I have to employ coarser wires and very much increased battery power? A. Yes.

(13) G. E. M. asks how much difference the expansion and contraction of a steel railroad rail makes in its length when in use during an average year in this latitude. A. For difference of extremes in temperature of 130° Fah., will be about one-eighth of an inch in 12 feet, or on a 36 foot bar say three-eighths of an inch.

(14) J. M. K. writes: 1. It is claimed by some that lightning strikes wire fences very easily; if it is so, would not putting in ground wire (connected with all wires and running down into the ground) make a sure remedy? A. A ground wire connected with all of the wires, with its lower end buried in earth that is continually moist, and surrounded by coke or tin scraps to increase its underground conducting surface, would carry off the current. 2. How far should the ground wires be apart? A. About 500 feet. 3. Is copper better for the conducting rods in lightning rods than iron? A. Yes, but iron is cheaper, and if a larger conductor of iron be used, it is just as efficient. 4. Some parts of my portable boiler and engine are run over with waste oil (lard oil) which is burned hard, and I would like to have it removed, as the paint underneath is not spoiled. Can you tell me how to remove it? A. We know of no way of removing the oil without removing the paint underneath it. Better take it all off, and repaint. Make a strong lye, and apply it freely with a swab. It will soften the oil, so that it may be readily removed. 5. Do you think acoustic telephones are good for one to one and a half miles? A. Under favorable circumstances, yes.

(15) W. E. T. asks: 1. What kind of iron is suitable for making the cores of magnets? My manual says soft iron. Does that mean common or refined iron? If not, where can I procure the right kind? A. Common refined iron answers very well if thoroughly annealed. Heat it red hot and bury it in ashes, allowing it to remain until cool. 2. How many feet of wire do I want to make a common magnet, and about what number? A. It depends upon the size of the magnet and the purpose for which it is to be used. For a small magnet for experimental purposes, a core wound with No. 22 wire answers very well. 3. Would silk-covered wire be better than uncovered? A. Yes, it should be silk or cotton covered. 4. How many thicknesses of wire would answer around the cores? A. The thickness of the wire coil may generally be equal to the diameter of the iron core.

(16) J. H. J. asks (1) for directions for making a Leclanche battery. A. Place in a porous cell a rod or plate of caroon, and fill the cell with coarsely powdered black oxide of maganese and clean coke o retort carbon. Seal the cell, leaving two holes for the air to escape when the battery is set up; place the porous cell in a jar containing a saturated solution of sal ammoniac, and place in the sal ammoniac solution a rod of amalgamated zinc. 2. Would Fuller's mercury bichromate battery do for gold or silver plating? A. No; it is not intended for continuous work. See Batteries, in SUPPLEMENT, Nos. 157, 158, and 159.

(17) F. K. asks for the compositions of red brass. A. Red brass—80 parts of copper, 11 parts of zinc. Red bronze—86 parts of copper, 11 parts of zinc, 3 parts of tin.

(18) N. O. M. asks: Is there any resistance to overcome in a dynamo electric machine except that caused by friction? A. Friction is an inconsiderable element in the resistance of a dynamo electric machine. The resistance due to the attractive power of the field magnet exerted on the armature is enormous, and it takes a great deal of power to revolve the armature when the circuit of the machine is closed.

(19) J. D. asks: 1. What is the best polish to use in polishing the inside of gun barrels with? A. Emery flour, with a very little oil, is about as good as anything. 2. What is the best oil to use to prevent gun barrels from rusting? A. Pure sperm, or sperm mixed (by aid of heat) with about three per cent of paraffine wax. 3. What is the best polish for a walnut gun stock? A. Good clear shellac varnish rubbed on with a rag very slightly oiled.

(20) D. N. M. asks: 1. Will the stain recommended for fishing rods, in answer to J. B. A. (4), No. 8, anwer for worn gun stocks? Is the preparation solid or liquid? The stocks are white wood; I want them brown. A. The preparation is liquid, and can be advantageously used for the purpose mentioned. 2. I have found a sort of jelly fish, or *radiata*, in the Ohio, attached to a water-soaked log. The outside is covered with fern-like spines, very clear and about half an inch long. Are these of any value? A. The animal described is common and not valuable.

(21) In answer to the query of S. S., p. 172 (11), current volume about treating over-salted hams, etc., D. N. M. says: "Immerse the hams for about fifteen hours in cold sweetmilk, rinse with water, and sweeten with sugar or sugar curing. Ham or bacon left in milk over night is much improved in taste." C. E. B. says: "Soak the meat twenty-four hours in cold water, then put the pieces down in a barrel, with a weight on top to keep them down, and pour over them a pickle prepared from: Water, 6 gallons; brown sugar, 2 lb.; saltpeter, 4 oz.—boiled together and cooled. Pickle in this four to six days, then take out and smoke."

(22) F. F. J. asks: Can you inform me what substance I can apply to a wooden surface probably best in the form of paint, which, when dry, shall afford a light-colored surface which will allow a pencil mark to be made upon it, and then easily erased by moisture? A. We know of no colorless substance or composition that will satisfactorily answer the requirements. A white tablet surface varnish is prepared by mixing very finely ground clear quartz or glass, with a dilute alcoholic solution of pale shellac. It may be applied as a paint, and dries quickly. A sirupy solution of water glass can be made to take the place of the shellac varnish in the above receipt, but it dries slowly.

(23) J. V. asks: 1. For a covering for steam pipes. A. Hair felt, wool felt, or wool carpets, new or old, make good covering. There are many fancy and patent coverings, but you could not probably get them readily. 2. Also, for scale preventive for boilers. A. We cannot say what you should use without knowing the character of the scale or the water.

(24) N. H. writes: 1. I am thinking of building a steam buggy, and wish to have your opinion on it. I propose to have two horizontal iron tubes about 7 inches diameter for the foundation or reach, one to be a reservoir for water, the other for petroleum, the boiler to be between them, with furnace underneath; the engine (2x3) to be fastened on top of boiler, and all suspended on springs from hind axle, which will be above, and driven by belt or flexible shaft from engine. The buggy will be longer and have lower front wheels than ordinary. 1. Will crude petroleum do for fuel? A. Yes, it can be used successfully. 2. Will it have to be blown in in fine spray? A. The best mode must be determined by experiment. 3. Can a furnace be made to consume the smoke while running? A. Yes, partially. 4. Has any person made a practical steam buggy; if not, is there any reason why one could not be made as suggested. A. Not that we are aware of. We do not know of a successful attempt. The weight of the complete vehicle is a great objection.

(25) J. W. G. writes: I have a three story flouring mill that I wish to warm with the exhaust steam from my engine. Can I do it by running a continuous eight inch galvanized iron pipe through the mill, and would it do for the condensed water to flow back to the heater on the bottom of this pipe? The building is 40x50 feet, 11 foot stones. How many square feet of heating surface would I need? The engine is 16x24, 75 revolutions, slide valve. A. Yes; you can heat the mill in that way. You should apply to some party who is engaged in putting up steam heating apparatus for best arrangement of pipes. To do this properly requires a personal examination of the building and its surroundings.

(26) L. H. asks for a mixture that will, by plunging in, temper a heavy piece of steel of irregular form to the temper of a cold chisel. Said piece will crack when plunged in hot water. A. Try an oil or tallow bath as a first dip, then water.

(27) E. R. asks: 1. In the Holtz machines illustrated in SUPPLEMENT, Nos. 278, 279, are there four paper inductors cut, two being pasted at each aperture in stationary plate on opposite sides of glass? A. There are four inductors, two at each aperture, on opposite sides of the glass. 2. Is the gilt paper pasted on them or on the glass? A. It is pasted on the paper inductors.

NEW BOOKS AND PUBLICATIONS.

ANNUAL REPORT OF THE DEPARTMENT OF MINES, NEW SOUTH WALES, FOR 1880. Sydney: Thomas Richards, Government Printer. 7s. 6d.

Gives with great fulness of detail the mining operations and discoveries of the year. A valuable geological sketch map accompanies the report. A summary of the mineral products will be shown in another column of this paper. The total value of the gold, silver, coal, shale, tin, copper, iron, antimony, lead, and other less important minerals raised in New South Wales down to the beginning of 1881 was something like $230,000,000. Gold, coal, tin, and copper are the chief minerals.

SPONS' ENCYCLOPÆDIA OF THE INDUSTRIAL ARTS, MANUFACTURES, AND COMMERCIAL PRODUCTS. Edited by G. G. Andre. London and New York: E. & F. N. Spon. In 30 parts. 75 cents each.

Parts 18 to 25 of this encyclopædia cover the subjects Hair and its applications, hats, honey, ice, India-rubber, ink, ivory, jute, knitted fabrics, lace, leather, linen manufactures, manures, matches, mordants, narcotics, nuts, oils and fatty substances, paper, perfumes, photography, photometry, paints and pigments, pottery, etc.

CIRCULARS OF INFORMATION OF THE BUREAU OF EDUCATION. 1881. Washington.

No. 1. "On the Construction of Library Buildings," by William F. Poole. No. 2. "The Relations of Education to Industry," and "Technical Training in American schools," by E. E. White. No. 6. A report on the Teaching of Chemistry and Physics in the United States, by F. W. Clarke. No. 7. Spelling Reform.

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[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Water meter, W. L. Hunt, New York city.

PATENTS.

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$15,000 Worth of Elegant and Useful Gifts to be Positively Given Away Absolutely Free

TO EVERY ONE WHO WILL SEND US A TRIAL ORDER, large or small, every one having the same chances of receiving a valuable gift if their order is but for a single 10 cent article as they would were it for $100.

THE OBJECT OF THIS ADVERTISEMENT and why we offer these IMMENSE INDUCEMENTS is, first, to increase our own business, and second, to make so GRAND and ADVANTAGEOUS AN OFFER that every reader of this paper will give us A TRIAL ORDER, large or small, and by that means get acquainted with us and our principle of BEST GOODS, LARGE SALES, and SMALL PROFITS. Being BONA FIDE MANUFACTURERS and importers, and the LARGEST IN OUR LINE IN THE UNITED STATES, we propose to sell direct to the consumer and SAVE THE MULTIFARIOUS PROFITS of middlemen, which, in many cases, amount to more than the first cost of the goods. Therefore, to get the readers of this paper to see that MONEY CAN BE MADE and money saved by buying goods from us, we earnestly invite every reader of this advertisement to give us A TRIAL ORDER, no matter how small, and be convinced that we can SAVE YOU MONEY; and to make this invitation more earnest, we promise to GIVE TO YOU and to every one who sends A TRIAL ORDER in answer to this advertisement AN ELEGANT GIFT ABSOLUTELY FREE.

WE SHALL GIVE AWAY $15,000 WORTH OF VALUABLE PRESENTS to people who send TRIAL ORDERS in answer to this advertisement. ONE PRESENT POSITIVELY GIVEN WITH EACH TRIAL ORDER, whether the trial order be for only 10 cents or for more than $100.

THESE GIFTS CONSIST OF SEWING MACHINES, CABINET ORGANS, WATCHES, SOLID GOLD and Plated Rings, Elegant Gold-Plated Sleeve Buttons, Neck Chains, Vest Chains, Ladies' Sets, Coin Silver-Plated Tea, Table, and Dessert Spoons, Casters, Butter Dishes, Coin Silver-Plated Table Knives, Butter Knives, Sugar Shells, China Tea sets, Dress Patterns, Shirts, Shawls, Ladies' Lace Ties, Photograph and Autograph Albums, Pocketbooks, Toilet Sets, Vases, Pictures, framed and unframed, Gents' Studs, Fine Nickel-Plate Revolvers, Toilet Articles, and hundreds of articles too numerous to mention.

REMEMBER, ALL THE ABOVE ARTICLES TO BE POSITIVELY GIVEN AWAY to persons who shall send us TRIAL ORDERS in answer to this advertisement. ONE PRESENT WITH EACH TRIAL ORDER, whether the trial order be large or small. Remember, a FAIR FIELD AND NO FAVOR in the distribution of these gifts. Every one treated alike, whether their trial order be large or small.

HOW THESE ELEGANT GIFTS ARE DISTRIBUTED.

First—Let it be distinctly understood that in the distribution of these splendid presents every one is treated alike, whether the TRIAL ORDER is large or small. You will receive the same treatment if your order is 10 cents as you would if it were $100. We will now explain how these gifts are distributed: We have procured a large quantity of long, narrow strips of paper, gummed or coated with mucilage on one side, and on the other side of this paper are written the names of these magnificent gifts that are to be given away as freely as air to every one who sends us a TRIAL ORDER in answer to this advertisement. A clerk now takes a package of letters and opens them, and the first TRIAL ORDER he comes to (that is sent in answer to this advertisement) he tears off from the top of one of these lists of BEAUTIFUL PRESENTS the name of the first article on the list, and sticks it on with the gum on the back to the order. The next TRIAL ORDER will have the name of the next order on the list attached to it, and so on. These orders will be handed to the packer, who will pack the articles ordered and also PACK IN THE GIFT named on the slip of paper attached. It is thus seen that all have an equal opportunity of obtaining one of the most valuable gifts and a POSITIVE CERTAINTY of receiving a splendid present with their TRIAL ORDER. Here let us remark, and let it be distinctly understood, that some of the gifts are WORTH $50. Many are worth from $10 TO $20, others from $1 TO $5, and none worth less than from 10 cents to 50 cents, and all we ask you to do to obtain one of these gifts is to send us a TRIAL ORDER on any of the goods mentioned below, and see for yourself whether or not we do not give the best value of any house you ever dealt with. Your orders shall receive the same attention, and you shall receive just as elegant and valuable gifts if your order is for 10 cents' worth as you would if for $100.

THIS ADVERTISEMENT is intended to bring the great economic MONEY-SAVING PRINCIPLE OF BUYING DIRECT from the manufacturer and importer, and saving the ENORMOUS PROFITS of middlemen that sap the life and substance out of the community, and for that reason we wish every merchant and every peddler, every canvasser or agent, and in fact every one who desires to get the MOST GOODS FOR THE LEAST MONEY to send us a TRIAL ORDER, and we agree not only to give a large value for the money, but a MAGNIFICENT PRESENT ABSOLUTELY FREE.

HOW CAN WE AFFORD TO DO THIS?

This question is often asked. In answer we would say, we often spend THOUSANDS OF DOLLARS to pay for newspaper advertisements. We can afford to do this because people read the advertisements and send us orders for goods on which we make a profit. Now, by offering these MAGNIFICENT GIFTS, we hope to draw the attention of and obtain a TRIAL ORDER from every man or woman, rich or poor, who reads this advertisement; and we know that they will be so well satisfied with our goods and prices that we will continue to receive their orders, and on these future orders we depend for OUR PROFIT.

REMEMBER, AN ELEGANT AND VALUABLE GIFT TO EVERY ONE WHO FAVORS US WITH A TRIAL ORDER. A fair field and no favor in the distribution of gifts, whether your trial order be large or small.

Below we give A LIST OF GOODS, EVERY ARTICLE OF WHICH IS A REAL BARGAIN. Look over the list, select what you want, and give us a TRIAL ORDER.

	Sample by mail.	1 doz. by mail.	1 doz. by ex.
Gents' Underwear.			
SHIRTS OR DRAWERS.	$ c.	$ c.	$ c.
White or Gray, good	40	3 50	3 00
White or Gray, better	50	4 75	4 00
White or Gray, No. 1	60	5 00	5 50
Overalls and Jumpers.			
Blue Denim	65	6 25	4 50
Heavy Duck	75	7 00	5 50
Cardigan Jackets.			
Cheap	1 00		8 50
Better	1 35		12 50
Fancy	2 25		20 00
All Wool	3 50		32 00
Gents' Fine White Shirts.			
With Cotton Bosoms	75	7 50	6 00
With Linen Bosoms	1 00	9 50	8 00
Very Fine	1 50	13 50	12 00
Overshirts.			
Heavy Cotton	50	5 50	4 50
Fancy Woolen	1 00	10 00	8 00
All Wool Blue Flannel, Single Breasted	1 25	15 00	12 00
Double Breasted	1 75	18 00	15 00
Linen Collars.			
Stand Up, 4-ply	15	1 35	1 10
Stand Up, 4-ply, best	20	1 75	1 40
Turn Down, good	15	1 35	1 10
Turn Down, best	20	1 75	1 40
Linen Cuffs.			
Reversible	25	2 50	2 25
Reversible, better	30	2 85	2 50
Reversible, best	35	3 10	2 75
Neckties.			
Black Bows	10	70	60
Black or Fancy Bows	15	1 10	90
Black or Fancy Bows, better	25	1 50	1 25
Black or Fancy Scarfs	50	3 50	3 00
Black or Fancy Scarfs, best	75	6 00	5 00
Gents' Suspenders.			
Fair Quality	25	1 80	1 50
Better	40	3 00	2 50
Fine Worsted	50	4 50	3 75
Extra Fine and Heavy	65	6 00	5 50

	Sample by mail.	1 doz. by mail.	1 doz. by ex.
Gents' Stockings.	$ c.	$ c.	$ c.
Cheap Cotton	10	1 00	75
Fancy	15	1 50	1 25
British	25	2 25	2 00
Woolen	30	3 00	2 60
Heavy Woolen	40	3 75	3 40
Heavy Woolen, extra	50	4 75	4 50
LADIES' FURNISHING GOODS.			
Ladies' Hosiery.			
Cotton	10	1 00	75
Cotton, better	15	1 35	1 10
Fancy Repped	25	1 75	1 50
Fancy, extra fine	25	2 25	2 00
Fancy Cotton and Wool	30	2 50	2 25
Wool, new style	40	3 30	3 00
Heavy Merino, white	50	4 50	4 00
Corsets.			
Job	38	3 75	3 00
Good Quality	50	4 50	4 00
Fine	1 00	9 00	8 00
Corset Laces		10	10
Ladies' Lace Ties.			
Assorted Colors	10	75	60
Oocra Fringed	10	70	85
Fine White Net Lace Ends	25	2 25	2 00
Fine Old Gold, Plaited Ends	25	2 25	2 00
Lace Collarettes and Ruches.			
No. 33, Box Plaited	10	60	50
Very Cheap		25	20
No. 120, Marie Stuart Plait	10	50	40
No. 600, Wide Lace Edge	10	50	35
		per box.	per box.
Ruching, 12 yards in a box		50	40
Ruching, 12 yards in a box		75	60
Ruching, Very Fine Lace Finish		1 25	1 00
Handkerchiefs.		1 doz.	1 doz.
Fancy Border		40	35
No. 7, Ladies' colored border, 15 in.	10	60	55
No. 24, Ladies' corded border, 16 in.	10	75	65
No. 8, Gents' Polka dot, 17 in.	15	90	85
No. 35, Gents' corded border	15	1 10	1 00
No. 29, Gents' extra corded colored border	20	1 75	1 65
No. 405, Ladies' Hemstitched	20	1 60	1 50
No. 187, Fine, warranted linen	30	1 35	1 30
Turkey Red, 15 in.	10	60	55
Turkey Red, 18 in.	10	90	85
Turkey Red, 21 in.	15	1 25	1 15

	Sample by mail.	1 doz. by mail.	1 doz. by ex.
Garters.	$ c.	$ c.	$ c.
Fulled Elastic Web	10	90	80
Napkins.			
Fancy check, warranted linen		85	75
Fancy check, warranted linen, Extra Large		1 40	1 25
Turkey red damask		75	65
White damask, cut and fringed		80	75
Shoe Laces.			
3-4, per gross		28	18
4-4, per gross		45	35
5-4, per gross		48	35
6-4, per gross		60	40
Worsted Dress Braid.			
All Colors	b	65	60
Tooth Brushes.			
Small Size	10	60	50
Good Selling Article	15	1 10	1 00
Superior Wired	25	2 00	1 80
Autograph Albums.			
Small, 60 page	10	70	60
Lithograph Cover, larger	15	1 25	1 10
Fancy Cover	15	1 10	1 00
Very Fine	50	4 50	4 00
Very Elegant, pure muslin	1 00	9 50	8 00
Large, Fine Leather Covers, Embellished with Designs in Gold Leaf	2 50		24 00

	Sample by mail.	1 doz. by mail.	1 doz. by ex.
Photograph Albums.	$ c.	$ c.	$ c.
Fine Gilt and Colored Cover, 12 picture	25	2 00	1 60
Fine Gilt and Colored Cover, 24 picture	50	4 00	3 25
Larger and finer	1 25	15 00	12 00
Very Large and Elegant Albums at $2, $3, $4, and $5 each.			
Pocketbooks.			
No. 200, Small	10	85	75
No. 208, Small with Silvered Chain	10	1 00	85
No. 230, Large, 4 Pocket, Metal Trimmings	10	1 25	1 15
No. 267, Ladies' Size, Fine Leather, Nickel Trimmings	25	2 25	2 00
Old Style Leather Strap Wallet with Bill Holder	25	2 00	1 75
Leather Purse with Clasp	10	80	70
Leather Purse with Clasp, large size	15	1 25	1 15
Stationery.			
Good Note Paper, per ream			70
Better Note Paper, per ream			85
Best Note Paper, per ream			1 00
Envelopes, per 1,000			1 20
Pipes.			
Bengal Wood Bowl, Nickel Band	10	1 00	80
Bengal Wood Bowl, Nickel Band, cheaper	10	80	65
Assorted Wood, Nickel Trimmed, with Nickel Bowl Cover	20	1 75	1 50
No. 1,211, Brier, straight stem	25	1 60	1 45
No. 259, Brier, curved stem	25	1 60	1 45
No. 7, Brier, Rubber mouthpiece	30	2 00	1 75
No. 35, Meerschaum, curved Cherry stem, Rubber mouthpiece	50	4 00	3 75
No. 36, Same as No. 35, only larger	75	6 00	5 50
No. 38, Meerschaum, straight stem, Nickel Trimmings	50	4 00	3 75
A very fine line of real German Meerschaum Pipes in cases in both curved and straight stems at $2.50, $3.50, $5, and $6 each.			
Cigar Holders, Brier	10	80	75
Cigarette Holders, Brier	10	70	65
Cigarette Holders, Meerschaum	25	2 25	2 00
Very fine Meerschaum Cigar Holders in satin-lined cases at $1, $1.50, $2, and $3.			

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GOSSAMER RUBBER CLOAKS, $18, $21, and $24 per dozen. Samples by mail, $2, $2.25, and $2.50.

GENTS' GOSSAMER RUBBER COATS, $21, $24, and $30 per dozen. Sample coats by mail, $2.25, $2.50, and $3 each.

RUBBER APRONS, not oil cloth, but real Simon Pure black rubber, extra large ladies' size. Sample by mail, 50 cents; one dozen by mail, $3.25; one dozen by express, $2.75. Misses' size, sample by mail, 35 cents; one dozen by mail, $2.75; by express, $2.25.

DRESS SHIELDS for ladies' wear, to prevent perspiration from soiling the dress, causing unpleasant odor. Black, sample pair by mail, 15 cents; one dozen pairs by mail, 75 cents. White, sample by mail, 20 cents; one dozen by mail, $1.25.

GOSSAMER RUBBER SLEEVE PROTECTORS, a marvel of excellence for ladies' wear, as they protect the entire sleeves from becoming soiled by housework. Sample pair by mail, 25 cents; one dozen by mail, $1.65; by express, $1.50; smaller size, $1 per dozen by express, or $1.10 by mail.

LADIES' LARGE SIZE WATERPROOF APRON, sample by mail, 30 cents; one dozen by express, $2.50.

COMMON-SENSE SPECIE POUCH. A common-sense article for agents to sell, and for every one to use. Made of handsome black *Rubber*, gold embossed. When empty, takes up no more room than a dollar bill, and can be distended to hold $50 in specie. Sample by mail, 10 cents; one dozen by mail, 70 cents.

We specially recommend our HONEST STATIONERY PACKAGE, because it gives more for the money than can be bought at any store; and the certainty of obtaining AN ELEGANT GIFT that would cost twice as much as the whole package if purchased at a retail jewelry store. Add to this *the chance of obtaining a valuable watch*, are sufficient inducements for any one to buy.

We consider that the following prices are lower than any other house can make on stationery packages of the quality and quantity. Sample by mail, 25 cents; one dozen by express, $1.50; one gross by express, $16.50.

LIGHTNING SELF-SHINING STOVE POLISH. Entirely new, and most wonderful stove polish the world ever saw. No dust, no dirt, no tiresome rubbing; once used people will have no other. Sample box by mail, 10 cents; one dozen by mail, 20 cents; one dozen by express, 50 cents. Don't fail to try this if you want a good selling article.

REVOLVERS, 7-shot, full-nickel plate, handsome, No. 22, $1.35 by mail; $12 per dozen. Cheaper ones for $10.50 per dozen. No. 32, 5 shots, extra heavy; will shoot hard enough to kill a buffalo. Sample by mail, $2.75; $24 per dozen.

KITCHEN GOODS, new labor saving articles, must be seen to be appreciated. Radial Nutmeg Grater. Sample by mail, 10 cents; one dozen by express, 50 cents; 12 dozen, $4. Advance Egg Beater. Sample, 25 cents; one dozen by express, $1.50. Combination Apple Parer, corer, and slicer, warranted to work perfectly. Sample by mail, 30 cents; one dozen by mail, $2; by express, $1.50. Ready Mender for tin ware, with which any housekeeper can mend her own tin ware. Sample, 10 cents; one dozen, 60 cents.

WATCHES AND JEWELRY. Sent by mail, post-paid, on receipt of price. American Stem Winders, open face, nickel case, $4. Swiss Key Winders, open face, $2.50. Aluminum Gold Warranted Timekeepers, $10. Solid Virgin Gold Hunter, cased, $22. Elegant Imitation Gold Trading Watches, equal in appearance to $300 watches, $6 each; six for $30.

SOLID GOLD RINGS, $1. Extra heavy-plated rings, 75 cents; $6 per dozen. Gilt Vest Chains, 25 cents; $4 per dozen. Elegant Plated Vest Chains, $1, $2, and $3 each; half price by the dozen. Plated Sleeve Buttons, 25 cents; $1.75 per dozen. Studs, per set of three, 10, 25, 50, and 75 cents; half price by the dozen.

OUR ILLUSTRATED CATALOGUE describing a large line of agents' goods will be sent to every who sends us a *trial order*, but to no one else, unless green stamp is enclosed. To make it an object for every one to send for catalogue, we shall pack an order *good for* $5 worth of goods in one of every 1,000 catalogues sent out.

READ! READ! READ! READ!

IF YOU WILL GET UP A CLUB among your neighbors and send for $5 worth of goods, we will give you a set of 6 elegant coin silver-plated spoons, and a gift for each member of the club. (*Every member* of club must order a full dozen of goods to get them at dozen prices.) Orders for less than a dozen will be filled only at sample price.

For a club of $10, we will give a solid gold hand ring to the getter up of the club, and a gift to every member of the club.

For a club of $20, a handsome stem winding watch and a gift to each member.

For a club of $50, a very handsome black all-wool cashmere dress pattern, or gent's elegant solid aluminum gold hunter case watch and chain, and a gift to each member.

For a club of $100, we will give either a lady's solid gold watch, or a 4-octave Mason & Hamlin organ, or an elegant sewing machine with magnificent black walnut Mansard top, drop leaf and drawers.

Bear in mind if you get up a club you will still stand the same chance of obtaining a valuable gift that any one does who sends a trial order, and a CERTAINTY of getting the above articles extra to pay for the trouble. Now, if you do not delay, you can take this paper and go around among your neighbors and in half a day get up a $30 club or more. If you wish to try for one of the large clubs you may send in the orders, if you wish, $5 at a time until you get full amount, when we will ship your premium to you.

TO SHOW THAT YOU RUN NO RISK in sending money to us, and that you may know that we are every way to be relied on, we refer you to the Adams, American, or U. S. Express Companies, of Boston, and through them to their agents throughout the country; also to P. M. at City Mills Station (where our factory is located), or to Manufacturers' National Bank, Boston, Mass.

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N. B.—Always send money by registered letter, money order, or bank draft, on New York or Boston, and in answering this always state that you send a *trial order* in answer to this advertisement, otherwise it would be confounded with our *regular* orders and no *gift* packed.

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1 Act.	3 Can.	5 In.	7. Nit.	9 Rain.	11 Sac.	13 Tan.	15 Urn.
2 Air.	4 Cant.	6 Is.	8. Nut.	10 Ran.	12 Sat.	14 Tar.	16 Ut.

Priority will be awarded, in case of ties, to those lists having the least number of incorrect words.

NAMES OF SUCCESSFUL COMPETITORS ON "CURTAINS" IN SEPT. NO.	Total No. w'ds sent.	Number correct.
1 Chas. G. Hardy, Oakland, Cal.	146	112
2 Mrs. J. W. Grisier, W. Unity, O.	154	112
3 Jas. M. Welch, Millville, N. J.	208	112
4 A. E. Waddell, Char'tesville, Va.	192	111
5 Udilla Thomas, Onargo, Ill.	243	111

The words must be *standard English* ones only, and such as can be found in the late edition of Webster's Dictionary. *Abbreviations, plurals, and proper names not allowed. Words spelled alike count only as one word.* When a list contains words incorrectly inserted, *such words only will be rejected.* The benefits to be derived from this department, by those who compete, does not alone consist in the premium which may be secured, but the mental development which will result from the exercise in spelling and wordmaking will amply repay all for the time bestowed upon this pleasant and doubly profitable feature.

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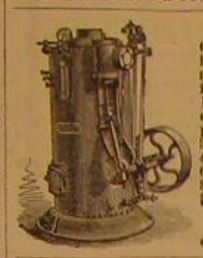

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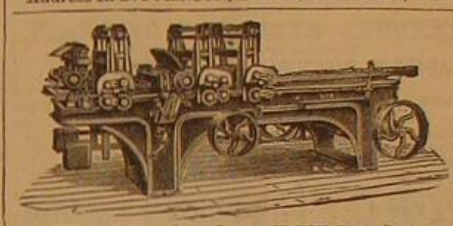

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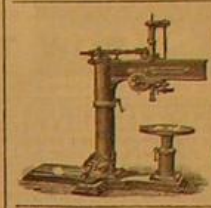

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Letters Patent, No. 46,364, date of issue February 14, 1865, relates to elastic and non-elastic feed rollers, with gauges, slides, etc.

Patent No. 50,140, issued September 26, 1865, relates to check link for limiting spring bar, with attachments.

Patent No. 61,543, issued January 29, 1867, relates to sharp-edged fertilizer feed slides, with attachments.

Patent No. 61,544, issued January 29, 1867, relates to axles, gear wheels and shields, etc. (subject to State rights of Henry Kuhlman to manufacture in Illinois and Missouri).

No. 61,545, issued January 29, 1867, relates to fulcrum placed between boot and spring hoe; also, vibrating seats, etc.

No. 90,556, issued May 25, 1869, relates to fertilizers and wheat sowers, with gauges opening each way from the center.

No. 104,854, issued June 28, 1870, relates to double acting reversible movement of fertilizer feeder.

No. 105,810, issued July 26, 1870, relates to slide block for adjusting the angle of spring hoes.

No. 105,811, issued July 26, 1870, relates to double rotary fertilizer sower.

No. 137,929, issued April 15, 1873. A peculiar arrangement of locking bars or hoe shifting.

No. 150,328, issued April 28, 1874, relates to improved slide blocks, with attachments.

No. 153,345, issued July 21, 1875, and reissued as No. 8,343 and No. 8,344.

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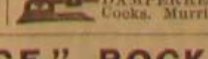

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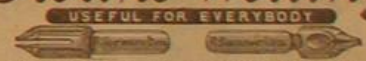

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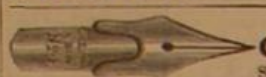

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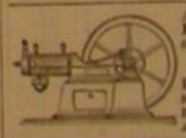

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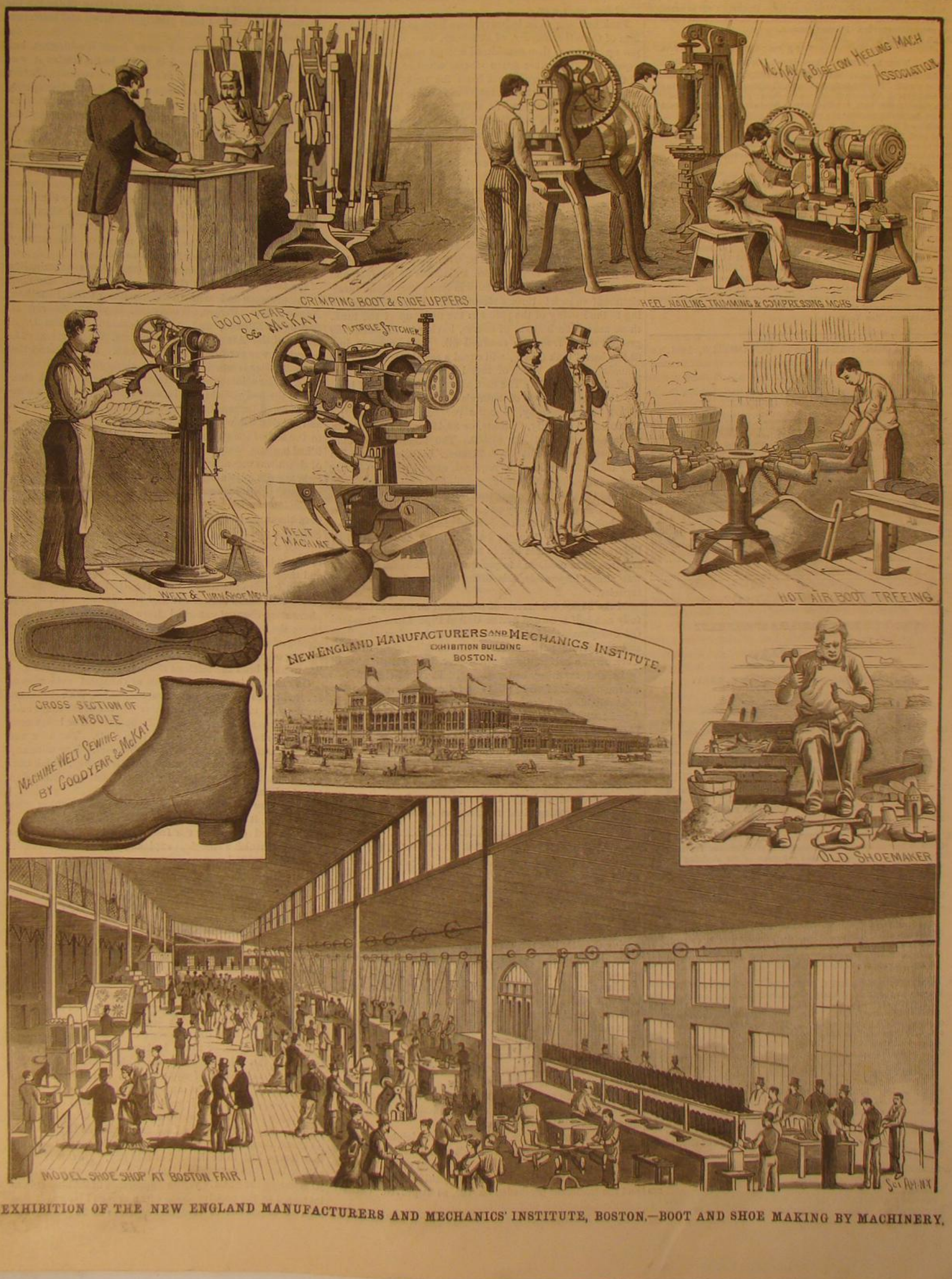

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THE STORAGE OF PETROLEUM.

There is at present, in round numbers, 25,000,000 barrels of crude petroleum stored in iron tanks in the oil regions of Pennsylvania. It is an inland lake of oil that may be described as having reached its highest ebb, inasmuch as indications now point unmistakably to a falling off in the daily production of the wells and a consequent decline in the amount tanked. Not the least striking feature of the oil regions are the clusters of these enormous iron reservoirs, located on hill and in valley, and whose construction keeps actively employed great workshops and an army of men in Pittsburg, Titusville, Pa., Oil City, Pa., and elsewhere. The oil held by the 1,800 tanks dotting the oil regions would fill to a depth of ten feet a square reservoir or lake measuring 3,747 feet each way.

Tank building as an industry dates back to 1861, when the firm of Carroll & Snyder, of Pittsburg, were called upon to put up what was then considered a large tank, 4,500 barrels capacity. There were grave doubts whether the pressure of the liquid inside would not burst the tank, and the iron plates forming its bottom and sides were made heavier than is now considered necessary in a 35,000 barrel tank. When the tank was finally tested—with water—the spectators kept at a respectful distance until their doubts were dispelled by the water's appearance over the brim. The tank stood like a rock, and is still in existence and doing service at Natrona, 25 miles from Pittsburg. From that time the success of iron tanks in storing petroleum was assured. In capacity they were yearly increased, until to-day few if any storage tanks hold less than 25,000 barrels, while the majority of those lately contracted for hold 35,000 barrels. These monsters when set up cover as much ground as a circus tent. All are perfectly circular in form, with perpendicular sides and flat top. The largest have a diameter of 94 feet, and are 28 feet high. The iron plates in these vary from three-eighths of an inch to three-sixteenths of an inch thick, according to the locality of the plates in the make-up of the tank, those nearer the bottom, of course, having to withstand the greatest strain from the confined oil. This pressure, in a 35,000 barrel tank (filled), will equal a tensile strain of 7,000 pounds on an inch width of metal surrounding the lowest portion of such tank. The cost, at the present rates of iron, for these storehouses of nature's oil is as follows: For a 35,000 barrel capacity, 28 cents per barrel, or $9,800; a 30,000 barrel capacity, 27 cents, or $9,450; and a 25,000 barrel capacity, 30 cents, or $7,500. The largest sized tank when ready for oil will weigh 93 tons. In their construction very little skilled labor is required, except when "setting up." Improved automatic machinery cuts, bends, and punches the plates with extreme rapidity and accuracy, so that on being set up every one of the 200 plates with their rivet holes is found in its appointed place. The three lowest "rings" of plates, it might be added, are double riveted. Before the use of plate iron in tank building, wood or wood and iron were used, and to prevent such tanks from leaking was almost impossible, this difficulty increasing with their capacity.

Of the 25,000,000 barrels of petroleum now stored in tanks fully one-half is owned by the United Pipe Lines (Standard Oil Company), the balance being owned by other pipe lines and by private parties. A single banking firm of New York owns a half million barrels stored in Pittsburg built tanks and awaiting better prices. The growth of this enormous stock of oil has been as follows, according to the most reliable statistics—the barrels are of 42 gallons each: August 31, 1878, 4,599,362 barrels; 1879, 7,620,525; 1880, 15,063,651; July 31, 1881, 24,888,337; August 31 (estimated), 25,000,000.

Until very recently only crude petroleum was tanked, but at present a Pittsburg builder is at work on iron tanks for the Standard Company for the storage of refined oil at Louisville, Cleveland, Chicago, Indianapolis, St. Louis, etc. To retain this searching fluid requires an extremely tight and well built tank.

PRESIDENT GARFIELD'S FATAL WOUND.

President Garfield was shot on the morning of July 2, while passing through the Baltimore and Potomac Railway Station in Washington. The assassin—previously known as a petty swindler and disappointed office seeker—fired two shots from a heavy pistol, one ball taking effect.

The wound was expected to be immediately fatal, and during the first day the physicians sought only to diminish the more alarming symptoms by administering stimulants and hypodermic injections of morphia and atropia. In the evening the patient rallied a little and a superficial examination was made. The bullet entered the body about two inches to the right of the fourth lumbar vertebra, between the tenth and eleventh ribs. It was mistakenly assumed that it passed through the liver and lodged somewhere in the front wall of the peritoneal cavity. From the supposed nature of the wound the attending physicians thought that death would ensue before midnight. The President did not die, and the expected symptoms of peritonitis and those which should have followed a serious lesion of the liver, kidney, or intestines did not appear.

On the 4th of July, Dr. Agnew, of Philadelphia, and Dr. Hamilton, of New York, were called in consultation. No thorough surgical exploration of the wound appears to have been made, or indeed was possible or justifiable at that time, and the treatment proceeded on the, as it proved, entirely mistaken diagnosis first made.

By the latter part of the month symptoms indicating pus poisoning were apparent. On the morning of the 24th, Dr. Agnew opened a pus cavity, which had formed a few inches below where the ball entered, and removed a splinter of bone. It was now evident that the ball had struck a rib—the eleventh, breaking it in two places; and it was inferred that it had been deflected downward. Its actual course, however, remained undetermined. Relieved by the better drainage of the wound the President seemed to improve slightly. Another operation was performed by Dr. Agnew, August 8, but its nature and purpose have not been made public. During the ensuing week the decline was steady, if not rapid, and then a more hopeful period set in. This was broken by the appearance of an abscess in the right parotid gland, August 18, followed by trouble in the lungs and a distressing cough. Since the operation of the 8th the patient's stomach had been greatly disturbed and intolerant of food.

The patient's desire to get away from Washington had been persistent, and by the first week in September it was apparent that it was useless to wait for improvement before making the attempt to remove him. Foreseeing speedy death if he remained, it was decided as a last resort to attempt the journey to Elberon, near Long Branch, by the sea. The removal was accomplished September 6, but was unavailing. The sight of the ocean helped to soothe the remaining days of the President's life, but the inevitable end came on the night of Monday, September 19.

The *post-mortem* examination revealed the not unexpected fact that the wound was in all probability fatal at the outset, and the surprising fact that throughout the physicians had been entirely at fault touching the course and position of the deadly bullet. The official report of the autopsy, dated 11 P.M., September 20, runs as follows:

"By previous arrangement a *post-mortem* examination of the body of President Garfield was made this afternoon in the presence and with the assistance of Drs. Hamilton, Agnew, Bliss, Barnes, Woodward, Reyburn, Andrew H. Smith of Elberon, and Acting Assistant Surgeon D. S. Lamb, of the Army Medical Museum, Washington. The operation was performed by Dr. Lamb. It was found that the ball, after fracturing the right eleventh rib, had passed through the spinal column in front of the spinal canal, fracturing the body of the first lumbar vertebra, driving a number of small fragments of bone into the adjacent soft parts, and lodging below the pancreas, about two inches and a half to the left of the spine, and behind the peritoneum, where it had become completely encysted. The immediate cause of death was secondary hemorrhage from one of the mesenteric arteries adjoining the track of the ball, the blood rupturing the peritoneum, and nearly a pint escaping into the abdominal cavity. This hemorrhage is believed to have been the cause of the severe pain in the lower part of the chest complained of just before death.

"An abscess cavity, six inches by four in diameter, was found in the vicinity of the gall bladder between the liver and the transverse colon, which were strongly adherent. It did not involve the substance of the liver, and no communication was found between it and the wound. A long supplementary channel extended from the external wound between the loin muscles and the right kidney almost to the right groin. This channel, now known to be due to the burrowing of the pus from the wound, was supposed during life to have been the track of the ball.

On examination of the organs of the chest evidences of severe bronchitis were found on both sides, with bronchopneumonia of the lower portions of the right lung, and, though to a much less extent, of the left. The lungs contained no abscesses, and the heart no clots. The liver was enlarged and fatty, but free from abscesses. Nor were any found in any other organ except the left kidney, which contained near its surface a small abscess about one-third of an inch in diameter.

"In reviewing the history of the case in connection with the autopsy, it is quite evident that the different suppurating surfaces, and especially the fractured, spongy tissue of the vertebræ, furnish a sufficient explanation of the septic condition which existed.

(Signed)

D. W. BLISS. FRANK H. HAMILTON.
J. K. BARNES. D. HEYES AGNEW.
J. J. WOODWARD. ANDREW H. SMITH.
ROBERT REYBURN. D. S. LAMB."

HEAT, SUN STORMS, AND YELLOW LIGHT.

The first week in September was characterized by a number of days of extremely hot weather, the temperature in this city rising above 100° Fah. During the days of greatest heat the sun appeared to be greatly disturbed by storms. Whether the terrestrial high temperature was due to the direct action of solar disturbances, or to the forest fires then raging in Michigan, or to the indirect effect upon our atmosphere of the volumes of smoke which darkened the sky over many thousands of square miles, it is impossible to decide. The phenomena apparently connected with the smoky condition of the air were sufficiently marked to make the week a memorable one. On the 5th and 6th a peculiar yellow haze overspread the land from Canada to the Atlantic coast, deepening in many places to brown and black, so that lamps had to be lighted at mid-day. In this city the yellow haze was noticeable, but not so dense as elsewhere. At Saratoga the ghastly yellow appearance of the atmosphere increased to the positive shade of an orange lily, and it was next to impossible to recognize a person at no greater dis-

tance than the width of Broadway (125 feet). Between 8 and 9 o'clock A. M. it grew still darker, and many predicted another "dark day" similar to the one chronicled in the early part of the century. The hotels and stores were lighted just as at night, and the peculiarity of the jets was that they resembled the cold, silver color of electric lamps, but of much less power. Another effect produced by the inexplicable state of the atmosphere was the extremely bright green appearance of the lawns and foliage. This was especially noticeable from the fact that the shades of everything else were of a decidedly subdued color. During the early forenoon, outside of the regular routine, business and pleasure were practically suspended. So dark was it at 9 o'clock that when the American Social Science Association met in Putnam Hall every gas jet had to be lighted, and it bore the appearance of an evening entertainment. The extreme humidity of the atmosphere was the subject of general remark, and several who had taken an early drive into the country stated that their clothing was as damp as if they had passed through a shower. The darkness lifted about noon.

At Toronto the darkness continued all day, though as the day advanced the yellow of the sky was brightened to a rich orange hue. In northern New York the atmosphere was of a greenish yellow hue. At Lake Placid, in the Adirondacks, a greenish fog covered the country; the grass seemed artificially colored, the animals had a sea-green color, the mountains disappeared, and in their place were wreaths of green vapor; the clouds were yellowish green; the sun appeared a ball of golden fire through the mist, and all nature seemed to have a strange and mysterious hue. Some people when they rose in the morning feared that their own eyes were jaundiced; others thought that some strange calamity was at hand, some great convulsion of nature; people in many places were in a state of anxiety and dread.

The Boston *Journal* of the 7th compared the previous day with the famous Black Friday of 1780. No fog or haze was perceptible, except when looking off toward the horizon from an elevated position, but the sun was thoroughly obscured, and the atmosphere was pervaded with a yellowish light which lent a strange appearance to every object. There was a weird luster to the surface of the streets and the fronts of the buildings. This aspect of the sky was such that some timorous people's minds were directed by it to the scriptural prophecy concerning the brassy appearance of the sky which is to be one of the features of the "last day." The interiors of buildings grew dark as the day advanced, and the outer air as viewed through a window seemed to be pervaded with the reflected light from some vast conflagration. It became necessary to light the gas in stores and offices, and the jets admitted a white flame that strongly resembled the electric light. The faces of people in the street were of a deep saffron color, as if jaundice had begun to show its work in complexions tanned by a summer of exposure to wind and sun, and some skins even displayed the tint of those yellow beach shoes which have of late come into fashion. A few buff dresses seemed as yellow as dull gold, and the grass took on a rank and metallic hue like verdigris. The phenomenon became more marked in the afternoon than it was during the forenoon. As late as 1 o'clock it was possible for a person sitting near a window to see to read or write without the aid of artificial light, but after that hour the gloom deepened rapidly, the sky grew still more brazen in appearance, and the gloom was that of late twilight. The front windows of stores on Washington street were illuminated as at night, and there was not a single usual aspect of the daytime to be seen in any direction. There was something terrible in the scene, and it is not to be wondered at if some weak minds allowed themselves to be tormented by fears of what the extraordinary event might presage. The climax was reached at about 3 o'clock, and after that light began gradually to return, although perfect daylight was not restored. At 5 o'clock, the ruddy glare had disappeared from the sky, and the light, such as it was, seemed more natural than during the day. Before 8 o'clock the moon had come out, the clouds had disappeared, and the atmosphere had resumed its normal condition.

As already remarked, this peculiar disturbance of the atmosphere prevailed throughout New York, the Eastern States, and Canada. The forest fires of Michigan and Canada were most commonly thought to be the immediate cause. Professor Emerson, of Dartmouth College, suggested as an additional agent the pollen from northern fir and pine trees. Others suspected that the excessive moisture of the lower atmosphere might have had something to do with the phenomenon. It is possible, however, that some extra-terrestrial cause may have had a controlling influence; something, for instance, like the band of yellow light which spanned the sky on the night of the 12th. As described by the observer above named at Hanover, N. H., the yellow luminous band was from 5° to 10° in width, quite uniform throughout, and extended from about 20° north of west to 30° south of west, dividing the heavens into northern and southern divisions of about three fifths and two fifths respectively. Its direction was about at right angles with the Milky Way. A very distinctive feature was the regular and definitely marked northern boundary. From 8 P.M. to 8:15 P.M. it remained comparatively fixed. At 8:30 o'clock it swept off toward the south, gradually disappearing. Just south and east of the crossing of the streamer with the Milky Way were ten or twelve lines of light, and at right angles with the streamer, but separated 3° or 4° from it, and nearly parallel to each other. These bands were 5° or 6° in length. During this time there were faint northern lights streaming up at right angles to the band.

By some it was thought that a nebulous belt had touched the earth's atmosphere. Had such a contact occurred in the daytime, penetrating the atmosphere more deeply, the effect might have been like that of the 6th.

During the auroral display, and for some hours after, the Atlantic cables were greatly obstructed by a magnetic storm, and the land lines also as far west as Chicago. The storm neutralized the force of the batteries, but the atmospheric currents of electricity were not strong enough to telegraph with, as was the case during the memorable electric storm of October, 1872.

THE TEMPERATURE OF MAMMOTH CAVE.

BY H. C. HOVEY.

It is estimated that twelve million cubic yards of limestone have been displaced by the great excavation known as Mammoth Cave. The importance of ascertaining exactly the temperature of the volume of air and bodies of water found in such a locality appears on considering the fact that it would coincide with the temperature of the earth's crust in the region where it is located.

The task has its difficulties. The darkness of the cavern makes it necessary, of course, to make the observations by lamplight, and the proximity of the flame renders the mercury liable to expand by an increase of heat. The warmth of the hand may also be imparted to it in carrying the instrument along; and a sensible impression is made even by persons standing with their lamps at a distance of several feet. Add the fact that all thermometers increase their readings with age, and an explanation is found of the errors into which observers have sometimes fallen, and which I have tried to avoid in the experiments now recorded. The result of such errors is an oft-quoted statement that the uniform temperature of the above cavern and the region around it is 59° Fah. at all seasons of the year. I shall show this to be too high by about 6°.

My first set of observations were made in August, 1878, with what was regarded as a good thermometer of German make. The table of readings, though not on the whole satisfactory, may be of some value for comparison, and are given below:

At the hotel on the hill the mercury stood, at noon on the 19th of August, 1878, at.	102 deg. Fah.
At the entrance to the cave	66 " "
In the Rotunda (1,000 yards within)	58 " "
In River Hall (a mile and a half within)	57 " "
At the Bottomless Pit, Mary's Vineyard, Marion's Avenue, and various other points, including the waters of the Dead Sea, Lake Lethe, and Echo River	56 " "
In El-Ghor, Washington Hall, and Rhoda's Arcade,	55 " "
In Lucy's Dome	54 " "
In the waters of Helen's Spring, Hebe's Spring, and in the Cascade of the River Styx.	53 " "
In the water of Richardson's Spring	52 " "

According to this table the temperature varies from 52° to 58° in the cave, the average being 56° Fah.

But this, although 3° lower than the previous observations of local physicists would justify, proved on comparison with Yale standards to be still too high by two or three degrees; and I therefore determined to make a new set of experiments of such a nature as should insure perfect accuracy.

A common, but fairly reliable thermometer was fixed at a point 1,000 yards within the cave, where it was allowed to remain for six months undisturbed. This gave it time to adapt itself to its surroundings, and gave the manager of the cave, Mr. Francis Klett, an opportunity to take daily observations during the transition from winter to summer, and in all sorts of weather. His report to me was summed up in the statement that after being, so to speak, acclimated, this thermometer did not vary more that 1° for months together, and indicated a uniform temperature of from 53° to 54° Fah. This was as I had anticipated. But my object being to ascertain the temperature of a large area it would not do to base a conclusion on the testimony of a single witness, and that an instrument remaining constantly in one place.

Accordingly, on revisiting Mammoth Cave, last August, I armed myself with two of the best mercurial thermometers belonging to the Winchester Observatory of New Haven, kindly lent to me by Prof. Waldo, the astronomer in charge, and which are described as follows:

(No. 1.) Casella, London, K. O. 10,662. The gradation allowed one-fifteenth of an inch to a degree, ranging from +10° to +120° Fah., marked both on the glass tube and on a porcelain slide, and determined by comparison with Yale standards to be accurate within two-tenths of a degree. Mounted in a copper frame with a large ring attached, by which it could be swung, in order more quickly to bring the temperature down to that of the air, the tube and slide being also detachable from the frame for convenience in immersion in water.

(No. 2.) J. & J. H. Green, New York, 1879. No. 4,509. Space allowed to one degree, one-eighteenth of an inch. Graduated from — 30° to + 120° Fah., marked on glass tube and metallic scale, and carried by a brass holder. This instrument, having been "seasoned" at the Winchester Observatory, was said to be accurate to within one-tenth of one degree.

With these practically perfect instruments I took the temperature, first, of White's Cave, about a mile distant from the mouth of Mammoth Cave, with which it is supposed to have a point of connection. Here the following results were obtained:

At the mouth of White's Cave, August 12, 1881, the mercury indicated, in the shade	86 deg. Fah.
Just within the entrance	80 " "
At the Naiad's Bath (in the water)	53 " "
" " " " (in the air)	54 " "
At the end of the cave	54 " "

The entire length of White's Cave being but a quarter of a mile, the rapid fall of the mercury from 86° at the mouth to 54° at the end confirms the opinion, formed on other grounds, that it has a secret connection with the far larger cavern adjacent.

The difference of one degree between the water of the basin and the air above it is not due to evaporation—care being taken in this and similar cases to avoid this cause of error. It is probable that the temperature of the water is that of the surrounding earth, while that of the air is modified by external influences.

The following observations were made on the 13th and 15th days of August, 1881, in Mammoth Cave:

At the hotel on the hill the mercury indicated	92 deg. Fah.
At the mouth of the cave (at noon)	65½ " "
" " " " " (at 7 P.M)	60 " "
At the Iron Gate, 100 yards within, where the current is strongest	52½ " "
In the Rotunda (1,000 yards within)	53 " "
In Audubon's Avenue	54 " "
In Little Bat Avenue	54 " "
In the Gothic Avenue (oldest and driest portion)	56 " "
In Richardson's Spring (in the water)	54 " "
In the Arched Way	54½ " "
At the Bottomless Pit (top)	54 " "
" " " " (midway)	56 " "
" " " " (at the bottom)	53 " "
In the Mammoth Dome (top, 250 feet above bottom)	54 " "
" " " " (midway)	53½ " "
" " " " (bottom)	53 " "
At the Echo River (in the water)	55 " "
" " " " (in the air)	56 " "
" " " " (where it empties into Green River)	58 " "

From this second table of observations it will be seen that the temperature is more uniform throughout the cave than appeared from the notes taken in 1878. The variations occurring are due to actual differences caused by the sinking of cold air to the lowest places. The single exception to this is found at Echo River, which is known to be 328 feet below the surface, and yet has as high a temperature as any other locality in the cave. This may be explained by reason of its connection with the outer pools known as the Upper and Lower Big Springs, and lying beneath the high bluffs of Green River.

The fact that the temperature of the Bottomless Pit at a point midway is higher than at either the top or bottom, may be accounted for by reason of an avenue here setting in that was anciently the path of drainage into River Hall, where the mercury stood at 56°.

It should be stated that the greatest pains was taken to keep the bulb and stem of the instruments dry, except, of course, in observations of the water, which, however, were always taken after those taken in the air, so that results need not be modified by the evaporation of moisture. As a rule, the thermometer was, in each instance, left for half an hour where it could not be influenced by animal heat or that of any lamp, and when the degree was read it was done as quickly as possible, before there was any perceptible rise of the mercury.

By these observations I claim that those made previously and with less accuracy ought to be superseded, and that the following facts are definitely settled, namely:

1. That the highest temperature found in any part of Mammoth Cave, during the hottest season known in Kentucky for many years, does not exceed 56° Fah., and that may, therefore, be regarded as the *maximum*.

2. The lowest temperature found in any portion of the cave during the six months from March to September, 1881, was that indicated at the Iron Gate, namely 52½° Fah., and that may be regarded as the *minimum*. (It is admitted, however, that the very strong air current at this point may have slightly lowered the mercury by causing the evaporation of unobserved moisture from the surface of the tube.)

3. Reviewing all my observations, made in numerous widely separated localities, I find the *mean* temperature of Mammoth Cave in midsummer to be 54° Fah.

4. I regard the temperature indicated on the floor of the Rotunda, and at the bottom of the Mammoth Dome and of the Bottomless Pit, namely, 53° Fah., as the best indication of the true temperature of the earth's crust in the vicinity of Mammoth Cave; and presumably so for the belt lying along the 37th parallel of latitude, near which that cave is located.

More Comets.

E. E. Barnard, of Nashville, Tennessee, discovered at his observatory, at 2 A.M., September 19, a bright telescopic comet in 7 hours 46 minutes right ascension and 13 degrees 28 minutes north declination, with a daily motion of three degrees northeast. Its position is described as near Zeta Virginis. No tail was apparent. The observation was confirmed the next day.

Director Swift, of the Warner Observatory, Rochester, N. Y., announces the discovery by him, at 1 A.M., September 20, of the expected Encke's comet, near Beta Aurigæ.

Four comets are now visible with a good telescope—B, C, D, and Encke's.

MECHANICAL INVENTIONS.

An improved horse power mechanism has been patented by Mr. William McE. Dye, of New York city. The object of this invention is to furnish an improved horse power mechanism for various industrial operations usually performed by steam, water, or wind power. This invention is an improvement in that class of power mechanism which combines a continuously acting lever and an endless inclined plane, formed practically of a circular disk pivoted at its center on a ball-and-socket or other universal joint, upon which joint the disk is made to oscillate by the weight of a draught animal moving in a regular manner around its perimeter and up the inclined plane.

Mr. Adam Breth, of New Washington, Pa., has patented a new and improved device for cutting or clipping bolts. The invention consists in pivoting the movable jaw of bolt clippers to a block made adjustable by a clamp screw passing through slots of spring and jaw.

An improved wagon has been patented by Mr. Fredrick Borntrager, of St. Clair, Mich. This invention relates to that class of wagons which have jointed reaches for enabling the wagon to be turned within a small compass.

Messrs. Charles E. Mayo and William L. Perry, of Lowell, Mass., have patented an improved foot power machine for driving saws, lathes, and performing work of similar character requiring small power and high speed. The invention consists in a clutch pulley of novel construction and a treadle arranged to act always in one direction, these parts being combined to secure continuous motion of the driven shaft.

An improved ice cutting machine, patented by Mr. James Shannon, of Cohoes, N. Y., consists of a sled-shaped frame supporting vertical side standards, on which are pivoted forward projecting arms, that are adjustable in a vertical plane by eccentrics and levers, and carry on their free ends vertically-revolving circular saws for cutting the ice, which saws are operated by suitable belts and pulleys on gearing that form part of the device; and it consists, further, of a series of revolving toothed wheels keyed on a horizontal cross shaft in the rear portion of the device, which wheels are designed to rest upon the ice and to urge the machine forward by their revolutions. The saw carrying arms and the rear portion of the machine are also provided with platforms for the operators to stand upon or for the reception of weights to force the saws and toothed wheels into the ice for their more efficient work.

IMPROVED STEAM ENGINE PISTON.

The engravings illustrate the improvements patented by Henry Waterman, of Brooklyn, N. Y., July 12, 1881, and relate to metallic pistons. The object of the invention is to render the piston tight and prevent loss of power by passage of steam into and through the piston; also to compensate for wear and render the packing and its parts easily adjustable. The invention will commend itself to engineers as being very practical in all its details, easily made, durable, and readily adjustable.

In the accompanying drawings, Fig. 1 is a plan view of the piston, with the face plate and packing disk removed. Fig. 2 is a transverse section of the piston; and Fig. 3 a section of the convex spring packing plate.

A is the hub, formed with the face plate, *a*, and with radial arms, *b*, to which the face plate, *c*, is secured by screws, *d*. B B are split rings placed upon a wide inner split ring, C, between the plates, *a c*. The ring, C, is backed at three equidistant points by spring plates, *e*, and keys, *f*, and at the side opposite its open ends by a curved block or plate, *g*, and key or keys, *h*. The arms, *b*, of the hub are recessed at their outer ends to form lugs, *i*, between which the keys, *f h*, enter. The plates, *e*, at each point are two or more in number, so as to form leaf springs, and are secured by a rivet or otherwise to the keys. The block, *g*, is formed with a central hemispherical socket, *k*, in its inner face, and the key, *h*, is formed with a hemispherical stud, *l*, which enters the socket, *k*, the stud thus preventing lateral movement of block, *g*, while permitting it to rock. The outer convex surface of block, *g*, is formed with a transverse groove, *m*, that is engaged by a stud, *n*, projecting from ring, C. By this construction the ring, block, and key are retained in their proper relative positions, and the block may adjust itself accurately to the inner surface of the ring.

In the recesses of the arms, *b*, behind the keys, *f h*, are filling plates or strips, *o*, of any desired number, as required to expand the ring, C. These being placed to fill out the space when the piston is set or from time to time, as required, furnish solid resistance, and unequal wear can be accurately compensated for.

It will be seen that the expansible ring, C, is held rigidly at its middle portion between the ends, while the remaining portion is allowed a limited amount of movement by the leaf springs, *e*.

Between the plate, *c*, and the edges of rings, B C, is the packing, *p*. This may consist of a circular plate of spring metal, of convex concave form, as shown in Fig. 3, which being clamped by plate, *c*, packs the joints between the plate and rings, so as to exclude steam from the interior of the piston.

For large size pistons I prefer to use packing rings or ring segments. These will be made of spring metal and curved transversely, so that when placed upon the expansible rings and clamped down by the face plate they insure a tight joint.

This piston, when fitted with plate, *g*, is especially adapted for use in horizontal cylinders, where, on account of the sag, the wear on the packing rings, B, is unequal. Such wear can be readily compensated for by adjustment of the backing without affecting the solidity of parts.

Fig. 1.

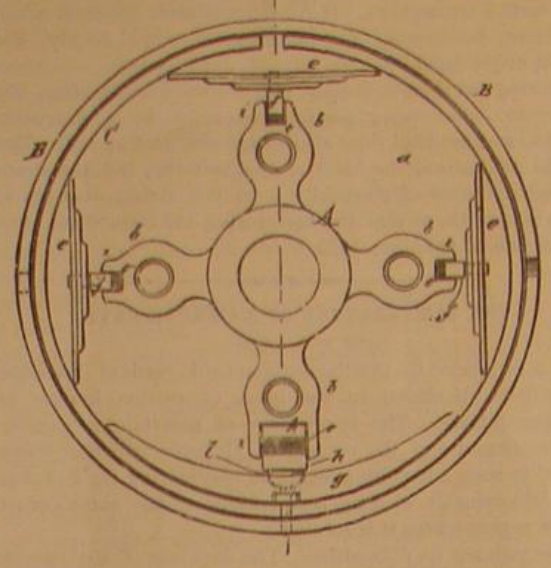


Fig. 2.

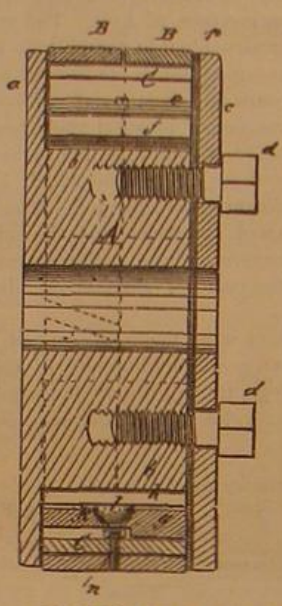


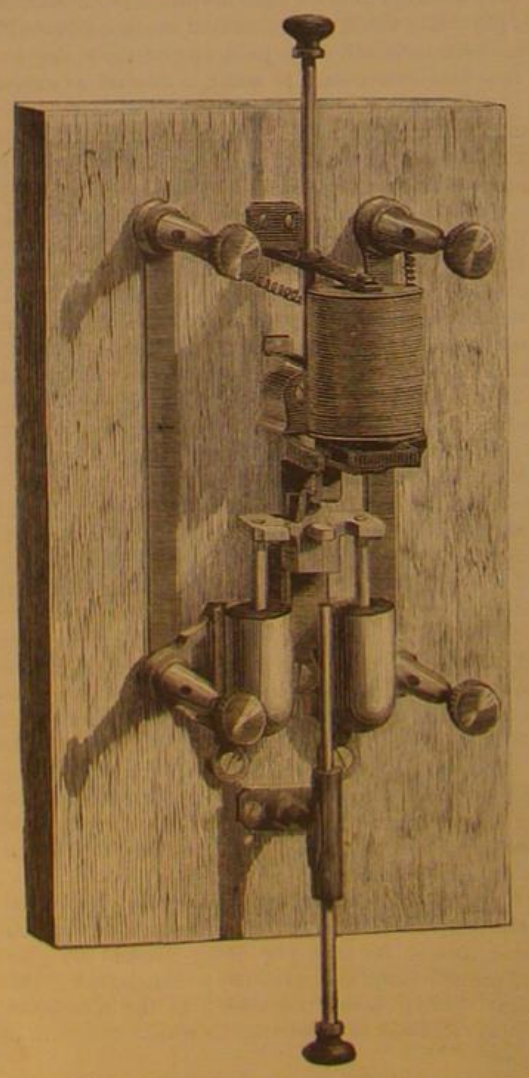
Fig. 3.

WATERMAN'S IMPROVED PISTON.

For use in vertical cylinders the plate, *g*, is not essential Further information can be obtained by addressing the patentee, Henry Waterman, 18 Dunham Place, Brooklyn, N. Y.

CUT-OFF FOR ELECTRIC LAMPS.

The present tendency in voltaic arc systems is to place several lamps in the same circuit, their number varying from three or four up to *forty*. The great advantage of such an arrangement exists, as well known, in the great saving in wire that results from it. But, as an offset, it is necessary to employ currents of very high tension, and if this be too great the apparatus may become dangerous; and then, too, the insulation of the wire is very difficult.



RAPIEFF'S CUT-OFF FOR ELECTRIC LAMPS.

In practice it is well not to attain so exaggerated tensions, but to be content with placing only ten, twelve, or sixteen lamps, at the most, in the same circuit. But under these conditions all the lamps are mutually independent, and if one of them, through some accidental cause, is extinguished all the rest go out at the same time. This is a very grave trouble, for which various remedies have been sought. It was for the purpose of obviating it that Mr. Rapieff devised his "safety apparatus," and that all the Brush lamps are furnished with an arrangement called a "cut-off." Mr. Anatole Gérard's "automatic sentinel," which we are about to describe, accomplishes the same object with at least as great a simplicity and with one additional advantage—it is completely independent of the lamp; it forms an apparatus apart, easy to watch, and always within reach of the hand whenever it is desired to make several lamps in the same circuit independent of one another; and it is applicable to all lamps in service, whether they are continuous current or alternating current, voltaic arc or incandescent.

The accompanying cut will allow the working of the apparatus to be readily understood. It consists of a straight, fine wire and single-bobbin magnet, the extremities of whose wires are connected with the two upper terminals, to which, also, are joined the two wires coming from the lamp to which the apparatus is adapted. The conductor coming from the machine is connected with the lower terminal to the left, and the wire proceeding from the lower terminal to the right goes to the second lamp and second apparatus.

The two lower terminals are in metallic communication with two small iron cups which are half full of mercury. Above these cups there are two iron rods fixed to a metal cross-piece carrying a hook which engages with a second hook fixed to the armature of the electro-magnet. When the current passes it divides itself between the lamp and the fine wire of the electro-magnet without the armature being attracted thereby. In case of an accident or the extinction of a lamp, the entire current passes through the fine wire, and, the electro-magnet becoming active, attracts its armature, which, on tilting, disengages the hook and allows the two rods to drop into the cups of mercury.

The current then passes directly from one lower terminal to the second, that is to say, from one lamp to the other, through the intermedium of the iron rods; and thus the circuit is not interrupted by the accident which happened to one particular lamp, and all the others continue to operate just as if nothing unusual had occurred.

As may be conceived, it would be easy, instead of establishing a *direct* communication, to intercalate a resistance equivalent to that of the lamp put out of service, so as not to disturb the conditions of the electric circulation; and it would be easy likewise to utilize the fall of the rods for actuating an alarm bell, or even an indicating tablet, and thus to convert the apparatus into an automatic tell-tale, which would not be without utility in certain kinds of night work.

This apparatus also replaces the ordinary commutator; since, in order to relight a lamp when extinguished it is only necessary to press on the button located beneath. On raising the rod it strikes against a spur projecting from the cross-piece which supports the two rods, and, lifting it, causes the two hooks to engage, and the current then passes through the lamp. To extinguish a lamp it is only necessary to press upon the upper button, when the rod to which it is attached tilts the armature, disengages the hooks, and closes the circuit anew by the dropping of the iron rods into the mercury cups.

In a more recent model than the one here represented Mr. Gérard has arranged the mercury cups one above the other, instead of placing them side by side. The present arrangement gives greater width to the apparatus, which often has to be located on a narrow support, but the principle is in no wise changed thereby.—*L'Electricien*.

A Wrong to be Righted.

The schooner M. C. Mosley, of Boston, on the way to Charleston, picked up at sea the captain and crew of the brig Alphonse, which had been disabled in a recent storm and abandoned. At Charleston the health authorities learned that the shipwrecked mariners were from the infected port of Cienfuegos, and properly ordered the Mosley to quarantine. The chance of yellow fever infection from shipwrecked sailors, who had endured twenty-four hours of severe exposure to storm in open boats, was certainly slight; but the law was specific, and the health officers were constrained to obey it.

It does not seem right, however, that the performance of a meritorious act on the part of the captain of the Mosley should meet with no other recompense than the inconvenience and losses incident to quarantine. That would be very like imposing a penalty for doing an act of humanity. The case would seem to be a suitable one for special action on the part of the national government, to recognize and reward appropriately the conduct of the captain and crew of the Mosley, and to repay the owner of the vessel for the loss occasioned by the delay in quarantine. The case is not likely to be often repeated; still, it would be a misfortune to have an evil precedent established by means of it.

Fire Engineers' Convention.

The ninth annual convention of the National Association of Fire Engineers assembled in Richmond, Va., September 13, President Green, of Boston, in the chair. The officers elected for the ensuing year were: President—G. Watt Taylor, of Richmond. Vice-Presidents—One from each State. Secretary—Harry Hill, of Cincinnati. Treasurer—A. C. S. Hendrick, of New Haven, Conn.

LIME-EXTRACTING HEATER AND FILTER.

Where the feed water is pumped directly into the boiler without being purified, the heat soon frees the impurities, which are precipitated upon the inner surfaces of the boiler shell and upon the flues, to which they cling in the form of scale, which is a non-conductor of heat, and being interposed between the water and the boiler shell, allowing the fire to act injuriously on the iron, rapidly deteriorating it, soon weakening the boiler, and incurring the dangers of explosion and the expense of frequent repairs. Stoppages and delays in cleaning boilers, as well as priming or foaming, which carries grit over into the engine to its great injury, must be reckoned among evils resulting from impure feed water.

The actual cost and damages sustained from these more prominent evils, together with many minor ones unmentioned, all of which directly and inevitably result from the presence of scale in boilers, if summed up and expressed in dollars would greatly astonish steam users.

Much thought, time, and money have been expended in experimenting with reference to the nature and effects of boiler incrustations. In an able paper on "Incrustation of Steam Boilers," read before the American Association for the Advancement of Science by Dr. Joseph G. Rogers, he says: "The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power as compared to that of iron is as 1 to $\frac{2}{3}\frac{1}{0}$. This known, it is readily appreciated that more fuel is required to heat water through scale and iron than through iron alone. It has been demonstrated that a scale of one-sixteenth of an inch thick requires the extra expenditure of fifteen per cent more fuel. As the scale thickens the ratio increases; thus, when it is one-fourth of an inch thick, sixty per cent more is required; at one-half of an inch, one hundred and fifty per cent, and so on. To raise steam to a working pressure of ninety pounds the water must be heated to 320° Fah. This may be done through a one-fourth inch iron shell by heating the external surface to about 325°. If a one-half inch scale intervenes the boiler must be heated to 700°, almost a low red heat. The higher the temperature at which iron is kept the more rapidly it oxidizes, and at any temperature above 600° it soon becomes granular and brittle from carbonization or conversion into the state of cast iron. Weakness of boilers thus produced predisposes to sudden explosions, and makes expensive repairs necessary."

Ordinarily there will have accumulated in a new boiler after four months' use one-sixteenth of an inch of scale; after eight months' use, one eighth of an inch of scale, and so on. Now, if Dr. Rogers' theory is correct, it necessarily follows that after one month's service a boiler will consume three and one-fourth per cent more fuel than at first; after two months' service, seven and one-half per cent more, and so on, making an average for the year of over twenty per cent more fuel than it would have consumed if using pure water.

The difficulty of this scale formation can be overcome in three different ways:

First.—Picking the scale off by mechanical means.

Second.—Purging the boiler by means of the chemical compounds known as boiler powders. This is dangerous, chiefly from the fact that an acid or other chemical strong enough to eat off the scale will not stop there, but will go ahead and eat the boiler shell as well.

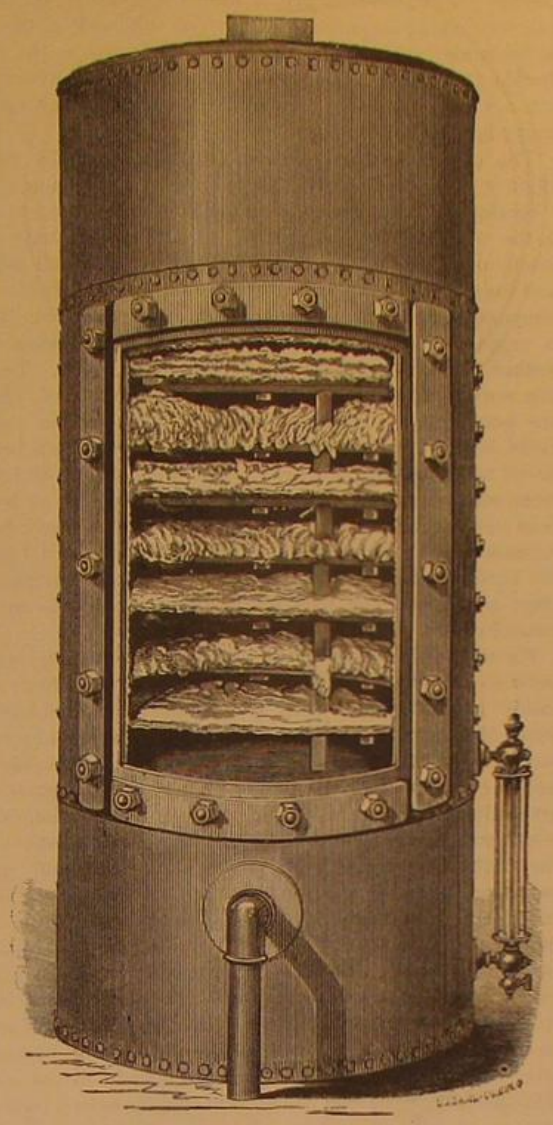
Third.—The use of pure water. The simplest and surest way is always the safest and best. If the water is purified from scale forming material before entering the boiler, certainly no scale can form.

This brings us directly to a consideration of the means acknowledged by competent engineers as the best in use for the prevention of this formation by the furnishing of pure water, and this is exactly what the Stilwell heater accomplishes. The water enters the heater at the top, and in its downward passage traverses a large area of heating and depositing surfaces, arranged in the form of removable shelves, having alternate openings. As the thin sheet of water passes over these shelves, all of which are very hot, and descends from shelf to shelf, it is met in its downward course and constantly acted upon by an ascending current of steam which enters the heater at the lower port. The action of this lower current of steam completes the separation and precipitation of the foreign particles which is begun when the water enters the heater. The construction of the heater is such that not a drop of water can pass down through it without being thoroughly boiled. The lime, magnesia, sulphur, iron, silica, etc., which this process of boiling sets free from the water, are deposited in a crystallized state upon the entire series of shelves, the deposit always being heaviest upon the upper shelf and diminishing in quantity as it approaches the lower shelf. From this lower shelf the water passes through the filtering chamber, which completes the purification, and it is then fit to enter the boiler.

In this heater the escape steam from the engine is utilized, and the volume used enables the purifying of large quantities of water, while every particle of the water is boiled thoroughly.

The arrangement of the shelves and the case with which they can be handled and withdrawn for cleansing.

The filtering system, the leading point in which is that the water passes upward through the filtering chamber on its way to the discharge pipe and not downward or sideways, as is usually the case.

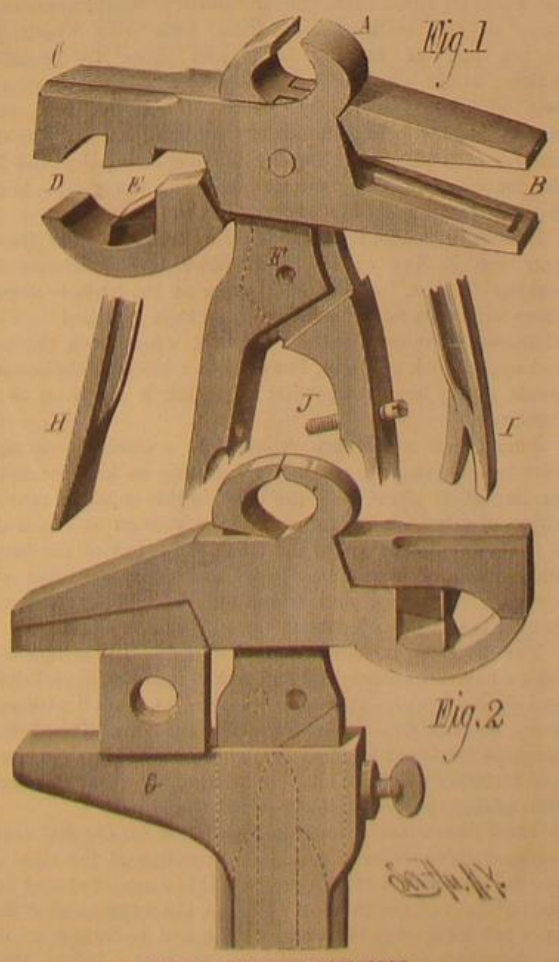


STILWELL'S LIME-EXTRACTING HEATER AND FILTER.

These heaters have been tested abundantly during the past ten years, and we are informed that there are to-day over three thousand in active use. They are manufactured by the Stilwell & Bierce Manufacturing Company, of Dayton, Ohio.

IMPROVED COMBINATION TOOL.

The engraving shows a new implement combining many useful tools in a compact and handy form. It forms a pair



NEW COMBINATION TOOL.

of nippers, A, a pair of pliers, B, which are provided with a rib in one jaw and a corresponding groove in the other jaw for the purpose of crimping the ends of stove pipe to facilitate putting the lengths together.

The end opposite the pliers is formed into a hammer head, C, against the under side of which the jaw, D, closes. This jaw and the adjacent surface of the hammer head are recessed, forming a holder for the nail, enabling the user to start and drive a nail with one hand.

The two halves of the tool are perforated at F, at the joint, to form a wire cutter, and an adjustable jaw, G, is fitted to the handles, forming a monkey-wrench.

A screw, J, in one of the handles, and a corresponding hole in the opposite handle, forms a punch and die for making holes in metal.

The end of one of the handles forms a tack puller, and the end of the other a screwdriver.

Fig. 1 shows the head of the implement and the end of the handles.

Fig. 2 shows the implement with the wrench jaw attached.

This invention was lately patented by Mr. John Straszer, of Manchester, Mo.

Eruption of Mount Lapwai, Idaho.

The recent report of a volcanic eruption in Idaho Territory is confirmed by a correspondent of the *Eagle*, of Butler, Pa., who visited the volcano about the middle of August in company with a representative of a Walla Walla newspaper.

As seen from Camas Prairie the column of smoke rising from Mount Lapwai was like that of a steamer beyond the horizon at sea. The mountain is two days' ride from Camas Prairie. Omitting unimportant personal details, the correspondent's account runs as follows:

"About 500 feet below the cone a large column of smoke sprang into the air hundreds of feet and then folded over to the east. Flames shot up to a great height, and a seething flow of lava was at that time rushing down into a small valley to the west and emitting a strong, sickening sulphuric odor, which made it impossible to remain by it any length of time. The lava had moved a distance of one mile from the mountain and was gradually making its way toward the Salmon. The neighboring hills were covered with ashes."

The visitors were informed by a Lapwai Indian that the lava flow is intermittent. With the wind at their backs they climbed the cone when the crater was quiet, though greatly disturbed and sickened by the sulphurous odors. The crater was about 500 feet below the rim of the cone, and appeared to be about an acre in extent. When the flow ceased the visitors went down to the edge of the crater, after covering their faces with rubber folds and their eyes with glasses. The heat was great. On one side it was possible to descend twenty feet into the crater without being nauseated, thanks to a favorable wind. The lava poured into the crater from the sides, and, when it was full, bubbled over and ran into the valley. The surrounding country is volcanic, and the Indians reported a recent eruption of Mount Idaho, a large peak a few miles from Mount Lapwai.

The visitors spent twenty minutes in the crater. At 5:45 P.M. the flow began again, and they hastily retreated. Scientific parties were fitting out at Portland, Oregon, toward the end of August, to visit the volcano. Mount Lapwai is one of the Blue Mountains, a low range crossed by the Snake River.

New Steamer for Oregon.

The new iron steamship, Walla Walla, the seventh vessel built by John Roach & Sons for the Oregon Navigation and Improvement Company, is now taking in cars and railroad material for the company, preparatory to her voyage to Oregon. The Walla Walla is 336 feet in length, 40½ feet beam, 23½ feet depth of hold, and of 5,000 tons displacement when loaded. She is constructed wholly of iron, with seven watertight compartments, with one complete iron deck, and the second deck is three-fourths iron. As she is constructed for the purpose of carrying coal between Seattle, Puget Sound, and San Francisco, and will probably return without cargo, she is fitted with three water-ballast tanks to retain the center of gravity on line with the keel, when the vessel is discharged of cargo. All the deck houses are built of iron, and a handsomely furnished cabin and staterooms aft afford accommodations for thirty first-class passengers. The vessel is fitted with compound engines of 2,000 estimated horse power, and has six cylindrical boilers, and her estimated speed when fully laden is twelve knots an hour. She is schooner rigged, with a square sail forward, and upon her arrival at San Francisco will take her place on the regular route with the two other colliers recently built—the Willamette and the Umatilla.

Battery Carbon.

A useful method of preparing cheap carbon poles for voltaic batteries has been devised by M. Mauri. It consists in taking finely powdered graphite mixed with an equal weight of sulphur free from carbonate, and heating the mixture in a crucible until all the sulphur is fused. The temperature, however, should not be raised over 200° Cent. When the mass is fluid it is poured into a suitable mould of metal, and a stout copper wire is inserted to serve for an electrode. When the mass is cool and solid it is ready for use. Its conductivity is practically as good as that of the best retort carbon, and as it is more electro-negative than simple carbon, the electromotive force of the cell is higher. By increasing the proportion of sulphur in the mixture a highly resisting composition may be obtained which can take the place of copper or platinum silver coils for telegraphic or electric lighting purposes.

AMERICAN INDUSTRIES.—No. 76.

MACHINERY IN THE BOOT AND SHOE MANUFACTURE, AT THE FAIR OF THE MANUFACTURERS AND MECHANICS' INSTITUTE, BOSTON.

Never before has there been so good an opportunity for the public to become familiar with the modern processes of boot and shoe making as is presented in the "Model Shoe Factory" of Messrs. Houghton, Coolidge & Co., now running in the Fair of the New England Manufacturers and Mechanics' Institute at Boston. About 100 hands are employed, making an average of 600 pairs of boots a day, and doing the work thereon in the same way as the business is followed in half a hundred towns in Massachusetts, with all the modern appliances for facilitating production and making the best finished goods in complete and regular operation. There have been other exhibitions in which portions of the work have been shown, and much of the machinery now employed in the boot and shoe manufacture has been in use many years, but here a visitor can see every detail of the work, from the leather as it arrives from the tanneries and currying shops until the finished goods are boxed up in the cases which are to convey them from the exhibition building to distant parts of our own country, or even to foreign ports. We have, it is true, but a small export trade in boots and shoes, but this exhibition has been an object of great interest to many foreign visitors interested in the trade, as well as to our own manufacturers, and some orders for goods for export direct have been placed by foreigners who have been there looking into our processes of manufacture.

The illustrations on our first page give a good representation of this "Model Shoe Factory" and the building in which the exhibition is held, as well as of some of the most important machinery used. The building is a solid structure of iron and brick, and occupies a ground space of 403 by 551 feet, the shoe factory taking up an area of about 50 by 450 feet, and in this section are to be found nearly 100 machines, large and small, operated by over 300 feet of shafting. But it is curious to note that, with the vivid portrayal of the methods of modern manufacture here brought before the eye, the crowds constantly passing and repassing seem nowhere to find so great an attraction as in watching the work of the venerable looking shoemaker, who, occupying an old shoemaker's bench on which he has followed his trade for fifty-six years, continues here to represent, in the midst of such surroundings, the difference between "the old and the new."

The cutting of the sole stock, as in most modern factories, is here done with dies, and the fitting up of a large factory with the different sizes and shapes of dies required forms no inconsiderable item of expense, leading the manufacturer to strenuously oppose any change of fashion which will necessitate the making of a differently shaped sole. In many cases the sole leather is first cut into strips, the width of which equals the length of a sole, but the later and more approved plan is to cut directly from the whole side, as here shown. The whole side is laid out upon a large table, the top of which is level with the bed of a machine long enough to take in its entire length, so that the workman can place the die on any portion of the side, and then, by a treadle movement, instantaneously bring down a bar with sufficient force to cut out the sole. This may be done as rapidly as the operator can place the die, but good judgment is required in selecting the most thick and solid parts of the leather for outsoles, the thinner and poorer portions being used for insoles and heels. Smaller machines of the same style are used for cutting out the taps, counters, and heel lifts, as these are cut from the parts of the side left after all the outsoles possible have been cut therefrom, the idea in each instance being to so place the dies on the stock as to avoid waste.

The cutting of the uppers is all done by hand, the sides of upper and calfskins being laid out where the cutter can have good opportunity to examine the leather in every part before placing his patterns thereon, in order not only to cut up the stock with the least waste, but to be sure and have good strong leather on the vamp and forepart of the boot, the poorer portions being used for the backs.

In order, however, to give the leather such shape that it may be brought to fit the last snugly, and not partially straighten out or lose its form at any time afterward, the uppers must be broken or crimped. To do this work well was always a laborious and tedious operation, until, about ten years ago, the S. W. Jamison crimping machine was introduced. A view of these machines is shown at the top of the page. By their use the vamp of a boot of the heaviest cow-hide leather can be forced into the desired shape for lasting almost instantaneously, the stretch of the leather required in this forming being so evenly distributed that the strength of the stock is not impaired and the leather will hold permanently its new form. The machine is a powerful but not very complicated one, a former, worked by a lever, forcing the upper into suitably shaped jaws, which close upon and smooth it into the desired shape. These machines have so fully met the requirements of the trade that they have become deservedly popular and been widely introduced, as it had hardly been possible, before this machine was brought out, to thoroughly crimp the leather used in heavy boots and brogans so that they would steadily retain their shape after repeated wettings.

For the putting together of the uppers of boots and shoes two distinct styles of machines are used, one using waxed thread for heavy leathers, and for stock in general which has oil or stuffing in it, and the other using dry thread for goat and kid and sheepskin work, for fancy stitching generally, and for putting in linings, working button holes, etc. The goods made in the "Model Shoe Factory" being a standard grade of heavy work, wax thread machines only are used here, two, with steam-heated wax cups, being used for siding-up boot legs, two for sewing in the heavy sole leather counters which give a proper stiffness to the heel, two for making stays over the seams on the inside of the leg at the ankle, and another stitching on the straps at the top. Besides the machines here shown doing this work, there are others shown in the Fair for similar use, and for sewing on heavy harness and belting.

The uppers having been put together, and the soles, slightly dampened, having been pressed into shape by a "beating out" or sole moulding machine, the next operation is the "lasting," or the drawing of the upper snugly and evenly over the last, so that it will fit closely in all parts, and the edges just lap over the outer edge of the insole, all temporarily fastened until the outsole can be attached. This is commonly done by hand, the workmen drawing the leather over with pincers and tacking it in place. To do this work by machine has been a task the solution of which has been sought by mechanics and inventors for many years, but no machine for the purpose has yet been introduced which has met with any considerable degree of favor from manufacturers. There is a lasting machine at work here upon which years of labor and experiment have been expended, and it appears to do its work fairly well, but it can hardly be said to have passed beyond the experimental stage as yet, and has been adopted by the trade to only a limited extent.

For the putting on of the soles, four different methods are shown—one by a machine sewing directly through from the inside to the outside (this being under the well-known Blake-McKay patents), one by pegging, and another by wire screwing, and the fourth by what is known as the Goodyear and McKay system. Of the machinery for the latter we give illustrations on the first page, in connection with which will also be found views showing the appearance of the stitch on a finished shoe, a cross section of insole prepared for stitching, and bottom with welt attached. The boots and shoes made by this process differ from all other machine-made work, and are a direct imitation of hand-made goods. The shoe is lasted as for hand sewing, except that the insole is channeled, and then a machine working with a curved needle and awl in a small circle sews on a welt, in the same way as it would be done by hand, after which another machine sews the outsole to the welt. The only difference that can be detected between a boot or shoe made on these machines and one made by hand, is that in the latter the stitches are not likely to be as regular and even as they are in the machine-made work.

Of course, boots and shoes made in this way have no nails or threads on the inside to hurt the foot, they can be readily repaired the same as a hand-made shoe, and they have all the advantages of flexibility with a proper firmness of sole, which is always found in welted shoes. The machines for making this work have been perfected only by the expenditure of many years' labor and a great amount of money, but Mr. Charles Goodyear, their inventor, whose father gave to the world its great India-rubber industry, would never stop short of the realization of the idea with which he started out, of making boots and shoes by machine which would be in every respect equal to the best of those made by hand. That he has succeeded is now being abundantly attested, not only by the samples of work shown, but by the increasing demand for the machines in shoe factories, and for the goods made thereon from buyers in all sections of the country.

Besides the machines for making welted goods, the Goodyear and McKay exhibit also shows their machines for making "turns," a technical name in the trade to denote shoes which are made inside out, and then "turned." This of necessity can only be done in work where both the sole and upper stock are light, but there is a heavy trade in such goods, a very large proportion of which is made on these machines.

Among the machinery required in a modern boot and shoe factory, that for making and putting on heels occupies an important place, and the work in this department is an object of never-ceasing interest to the visitors at the Fair. It is represented in one of the views at the top of the page, and consists of a combination of machinery covering the forming, attaching, and trimming of heels, by what are known as the McKay, Bigelow, and Fisher machines.

The Bigelow machine takes a heel, the lifts or layers of which have been assembled and tacked together, consolidates and shapes it under enormous pressure, punches it with nail-holes, and inserts and partially drives the nails. The McKay machine receives a heelless shoe and the heel thus prepared, and instantly nails and clinches them together, at the same time paring the heel to the required shape.

The Fisher machine, now on exhibition for the first time, we have given the most prominent position at the right of our cut on account of its novelty. It is a modified and improved form of the Bigelow machine, the substantial difference being found in the construction and operation of the mould which compresses and forms the heel. In the Bigelow machine, the mould is made in one piece and is adapted only to certain shapes of heel, while in the Fisher machine the mould is made in halves, which first approach each other and compress the heel laterally, then vertically, and finally punch it with nail-holes, all at a single descent of the plunger; thus closing every joint in the heel, which, upon this machine, may be made of any shape whatever. This machine is the simpler and less expensive, as well as applicable to a wider range of styles.

After the bottoms and the heels have been attached and trimmed, there is quite a variety of machines for trimming and shaping the edges, for buffing the bottom, and for burnishing the edges of the sole, shank, and heel, in all of which operations the work is greatly expedited and generally better done than it would be possible ordinarily to do it by hand. But one of the last operations is the treeing, which has much to do with the making of a nice looking boot, for the leather, which has been repeatedly wet and constantly handled through so many operations, must be again made to look its best, with all the seams smoothed down, and the shape of the boot effectively brought out.

For this purpose a machine is here used which is quite new in the trade, a representation of which is given in one of the separate views on the first page, while it can also be readily seen in the foreground of the large view at the bottom. By this machine hot air is used to warm the leather thoroughly through, and so soften the oil and tallow with which it has been curried. The operator, after putting the wet boot on an arm of the machine, passes it on and adjusts another, until, when twelve boots are thus placed, the first one has come round to him again, sufficiently warmed and dried to be ready for the final rubbing, after which it goes to the packer. The amount of heat usually applied is only about one hundred degrees, though this can be regulated at pleasure, and the better feeling and fine finish which this process gives to the leather are easily perceptible. The hand rubbing is also materially lessened, as is the work of taking out and putting in the feet, and far less space is required for drying than is called for under the old system.

Our illustration gives a view of the machines as they have thus far been constructed, but patterns are now being made for a new style of table, in which the trees are so arranged by a slotted joint that they may all hang down instead of being rigidly extended in their circuit as at present. A company has been formed for the introduction of these machines under the title of the Hot Air Boot Tree Manufacturing Company.

In all the work of a modern shoe factory, two points stand out in marked prominence. One is the extreme care which is taken in the cutting of stock, not only to see that there is nowhere any waste, but to have every piece of leather, so far as the best experience can effect the object, worked up into just the part of a boot or shoe for which it was intended when the leather was bought. The other, and equally important point is the minute division of labor.

It has often been said of late years that there are no shoe makers now as we used to know them in former times, and this is to a great extent true, for but comparatively few of the workers in shoe factories now know more than one or two special details of the work. But this limiting of their labor has made them especially skillful therein, and machines have been devised for nearly every separate operation. In the boot and shoe manufacture Massachusetts has always been almost immeasurably ahead of every other section of the country, and Boston is by far the largest market for boots and shoes in the world. There were shipped from there during 1880 over two and a quarter million cases of boots and shoes and rubbers, to interior and coastwise ports, the cases holding from twelve to seventy-five pairs per case, but containing, at a low estimate, over fifty million pairs. But with this vast trade the competition is especially keen, a dollar profit on the cost of twelve pairs of staple boots being considered a fair working basis on the business as it is being done this year, with much of the business being done at even less than this figure. It is, therefore, particularly appropriate, that in one of the two great fairs now being held in Boston, we should have so thorough a representation of an industry so distinctively pertaining to that section, and one in which the people everywhere are so directly interested.

The firm of Houghton, Coolidge & Co., who make the exhibit, run several factories, in different towns, for the production of a variety of leading styles of goods, which are sold in all parts of the United States, their aggregate manufacture not being exceeded by that of any other house in the country, and being materially greater than that of any foreign house. Mr. A. L. Coolidge, being one of the executive committee having in charge the getting up of the fair, proposed and undertook the setting up of the "Model Shoe Shop," when but little time was left to make the arrangements, but in selecting as its superintendent Mr. C. H. Tilton, who was a manufacturer for him in Ashland, Mass., he obtained a practical manager of rare executive ability, and the work has gone on smoothly from the day of the opening in such a way as to form the principal attraction of the exhibition, and be in every way a credit to the originator of the plan and the great industry it so well represents.

Portrait of Columbus.

In the Spanish Colonial Office of Madrid there has lately been discovered a portrait of Columbus, made when the great explorer was about 40 years of age. It represents him without any wrinkles on his broad forehead, with dark, thick hair, a brilliant eye, and a beaked nose. The portrait is in perfect state of preservation and the inscription is intact. It reads: "Columbus Lygur., novi orbis repertor." The size of the portrait is about 16 by 20 inches.

POTATOES AND THEIR UTILIZATION.

One of the leading qualities of the potato is its extraordinary productiveness, far exceeding that of any esculent with which it can be placed in competition, one authority placing the yield from an equal quantity of ground at thirty pounds of potatoes to one pound of wheat.

In 1870 there were nearly one hundred and forty-four million bushels of potatoes produced in the United States, and certainly much more than that quantity will be gathered this year. In spite of the great market for this staple of food, it very frequently happens, especially in some of the extensive farming districts in our Northwestern States, where transportation rates are high, that overproduction so affects their value as to make the tubers unprofitable to handle, and, as a consequence, thousands of bushels of them are annually lost or thrown away.

In this connection we have been so frequently asked for what purposes other than as a food the potato can be utilized, that we will endeavor to answer the question.

Potatoes are composed very largely of starch and water, their average composition in northern latitudes being: Water, 75 per cent; starch, 21 per cent; albumen, cellulose, fat, and salts, 4 per cent. The water can be expelled by exposure to heat at a temperature of about 212° Fah., the residue having the composition: Starch, 83·8 per cent; albumen, cellulose, fat, and salts, 16·2 per cent.

Nearly the whole of the starch can be separated from potatoes by simple and inexpensive mechanical operations, and as starch is a commodity for which there is always a good market, and as it can be stored for an indefinite time without danger of deterioration, it is obvious that potatoes may be profitably utilized in the production of starch.

The plant required to make marketable starch is quite simple and easily constructed by any intelligent farmer—a wire basket to wash the tubers, a rotary rasping machine, a few large tubs or watertight hogsheads, some wire and hair-cloth sieves, and a drying room, comprising the principal pieces.

A simple rasping machine is shown in Fig. 1, and consists of a band wheel, A, over the rim of which has been secured, rough side out, a piece of sheet iron previously roughed up like a nutmeg grater by punching it full of holes with a blunt-pointed tool. The wheel is mounted on an axle supported by the wooden frame so as to revolve immediately beneath the mouth of a metal-lined wooden hopper, B.

A more effective rasper or grinder is shown in Fig. 2. It consists of a cylinder, *c*, twenty inches diameter and two feet long, mounted on an axis. It is armed with steel saw plates placed about three quarters of an inch apart, parallel with the cylinder, and having small and regular teeth. The plates are held in position by iron clamps, so that the toothed edges project about four-fifths of an inch from the periphery of the drum. It is driven at the rate of about eight hundred revolutions per minute before the hopper, and is capable of pulping about forty-eight bushels of potatoes an hour. In both these machines the rasping surfaces are kept clean by the action of small jets of water projected with some force.

As the washed potatoes are passed through one of these machines the pulp and wash water is run off into tubs, and after the coarser particles have been deposited, the milky liquid is drawn off into other tubs and the starchy matter allowed to settle. Or, as in large factories, the pulp may be rubbed and washed through a series of sieves, ranging from coarse wire gauze to fine hair cloth. After repeated washings with fresh water in the tubs to separate the gummy and fibrous matters, the starch granules are finally allowed to settle, and after the water has been drawn off the pasty mass of starch and water is run off into long wooden troughs, slightly inclined, wherein the paste gradually hardens as the water drains off. When hard enough it is cut into blocks and put on shelves in a warm room to dry out. With good management from seventeen to eighteen pounds of clear starch can be obtained by these simple means from one hundred pounds of average potatoes, which could be disposed of in bulk at present prices.

Starch is not only used for "starching" and sizing fabrics and for various food preparations, but also for the manufacture of grape sugar, glucose sirup, gum dextrine or British gum, and alcoholic liquors. When gradually heated in the dry state to about 160° Fah., in a rotating cylinder similar to a coffee roaster, and kept at that temperature for a short time, the starch is transformed into a gummy substance called dextrine or British gum, soluble in cold water, and extensively used as a substitute for gum arabic.

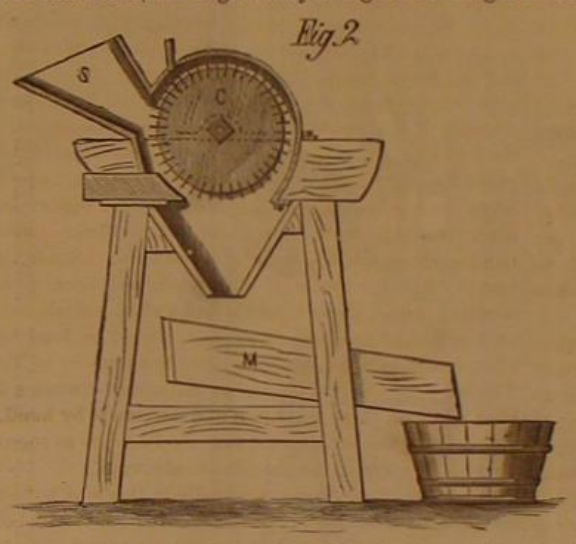
When boiled for a few hours with water containing a small quantity of sulphuric acid it is gradually transformed into grape sugar or glucose—a kind of sugar extensively used by confectioners, brewers, distillers, and wine makers. The acid used is removed from the sweet solution by adding to it the proper quantity of chalk or lime with which the acid forms an insoluble substance easily separated.

Whisky can be made directly from potatoes. The potatoes, after being finely mashed with boiling water are mixed with about five per cent of malt, the diastase of which on standing converts the starch into grape sugar, one and one half or two per cent of yeast is then added, and the fermentation allowed to proceed at a temperature of about 80° Fah., until the sugar has been converted into alcohol and carbonic acid. The alcoholic liquid when submitted to distillation yields whisky—one bushel of good potatoes yields about seventeen pounds of the liquor. The fermented potato mash can also be converted into a vinegar by allowing the fermentation to continue after the sugar has all been changed to alcohol, or more rapidly by passing the alcoholic liquid through an *Essigbilder* or quick vinegar apparatus. A cheap apparatus of this kind may be made from a large barrel, as shown in Fig. 3. The barrel is provided with a perforated false bottom at *a*, and a tight shelf at *b*. Birch shavings soaked in good vinegar are loosely packed into the space between the shelf and false bottom. The shelf is perforated with a number of

Fig. 1

small holes, through each of which is drawn a few strands of packing thread knotted at the top so as to loosely close the hole, *d d d*; in the figure are short pieces of glass tubing secured in larger holes in this shelf. Around the sides of the barrel, just above the line of the false bottom, are pierced a number of air holes. When a warm alcoholic liquid is poured over the upper shelf of this apparatus it gradually trickles down through the pack thread and over the shavings, where it is brought into intimate contact with an upward current of air from the air holes below to the glass tube exit above, and is gradually changed into vinegar which

Fig. 2



collects in the portion beneath the false bottom and flows off through the curved siphon tube, *g*. If the barrel is small it is usually necessary to pass the liquid through the apparatus three or four times before acetification is complete.

Recently a company has been formed in California for preparing (among other things) desiccated or dried potato. The drying is accomplished by passing a current of dry air, at a temperature of about 140° Fah., over the potatoes, cut in very thin slices, in kilns or ovens provided with a system of movable shelves. Doubtless a large demand for such an article would not be difficult to develop.

Fig. 3

Boiled (dry) potato mixed with zinc chloride and barytes has been used to form an imitation alabaster and coral-like composition.

AGRICULTURAL INVENTIONS.

An improved arm seeder has been patented by Mr. Philip Strong, Jr., of Saranac, Mich. This device is to be carried or worn by the person using it, by means of which all kinds of grain or seed may be scattered or sown broadcast over the ground evenly and with less exertion than heretofore; and the invention consists, principally, of a bag having a flexible tube or smaller portion connected to a sectional metal distributer, which is provided with a valve, and adapted to be swung from side to side for throwing and scattering the grain, the supply of grain from the bag being regulated by means of the valve.

An improved cotton chopper has been patented by Mr. Jay J. Johnson, of Aberdeen, Miss. The object of this invention is to facilitate the chopping of cotton and other drilled plants to a stand.

An improved fence has been patented by Mr. Jesse M. Womack, of Log Town, La. The object of this invention is to economize space and material and produce a substantial and durable fence.

An improved cotton chopper has been patented by Mr. Friederich A. Helmecke, of Round Top, Texas. This invention consists in a novel construction and arrangement of devices for raising and lowering the hoes and throwing them in and out of gear.

An improved harrow, patented by Mr. Benjamin Jones, of Orange, Ill., has a series of long stationary beams, a series of short stationary beams interposed between the rear parts of the long beams, the connecting cross bars, and moved by crank rods pivoted to the stationary beams.

The Great Fires in Michigan.

While the loss of life during the terrible fires in Michigan, during the first week in September, proves to be less than was at first estimated, the resulting distress is far greater than any one supposed possible. The state of the afflicted communities is accurately described in the proclamation of Governor Jerome, dated Detroit, Mich., September 15. He says:

"Portions of four counties of this State, lying principally between Saginaw Bay and Lake Huron, have been devastated by forest fires. A drought, almost unprecedented in this section of the country, had prepared the way for the calamity, and houses, barns, fences, crops, cattle, agricultural implements, household furniture, clothing, and human life have been destroyed by its ravages. In some townships the destruction is complete, and only a picture of ruin left. It is known that more than 200 lives have been lost by burning and suffocation. Many individuals have become helpless through injuries and exposure, and some are blind. The number of men, women, and children left without shelter is estimated at 15,000. The benevolence of the citizens of the State responded promptly to the first necessities of these afflicted people, but ample time has now elapsed, and sufficient details have been received to make it evident that a wider appeal is needed. The destitution prevailing in the suffering counties is appalling. Entire neighborhoods are involved in a common calamity, and cannot help each other. Sufferers have no provisions, except such as are brought from a distance, and no utensils to cook with. Necessaries of life, both large and small, have been destroyed. They need shelter, clothing, shoes, cooking stoves, kitchen utensils, beds and bedding, wagons, harness, plows, hoes, tools of all kinds, seed for future crops, and whatever helps to make men self-supporting."

Four days later, after traversing a large portion of the burned district, Governor Jerome announced that his estimate of the loss of life and the number of sufferers was not exaggerated.

The burnt district covers a territory of about 1,800 square miles, about one half of which escaped the flames; the other half is a blackened waste, the destruction of property being pretty evenly distributed over the whole territory. It was an agricultural country, with occasionally a village or small business center, where were flouring mills, sawmills, stores, churches, etc. Many of these places and their industries were wholly destroyed, and in the farming portions, in the track of the fire, nothing is left for man's use but the land. Barns, cattle sheds, and structures of every kind that remain are being utilized as temporary shelter for the homeless. Hospitals for the care of those who suffer from burns are already established.

Any one who has had experience of forest fires on a considerable scale will be able to frame a faint conception of the terrible whirlwind of flame that burst upon the Michigan settlers that fatal morning. Words are inadequate to convey any idea of it.

The Governor says further:

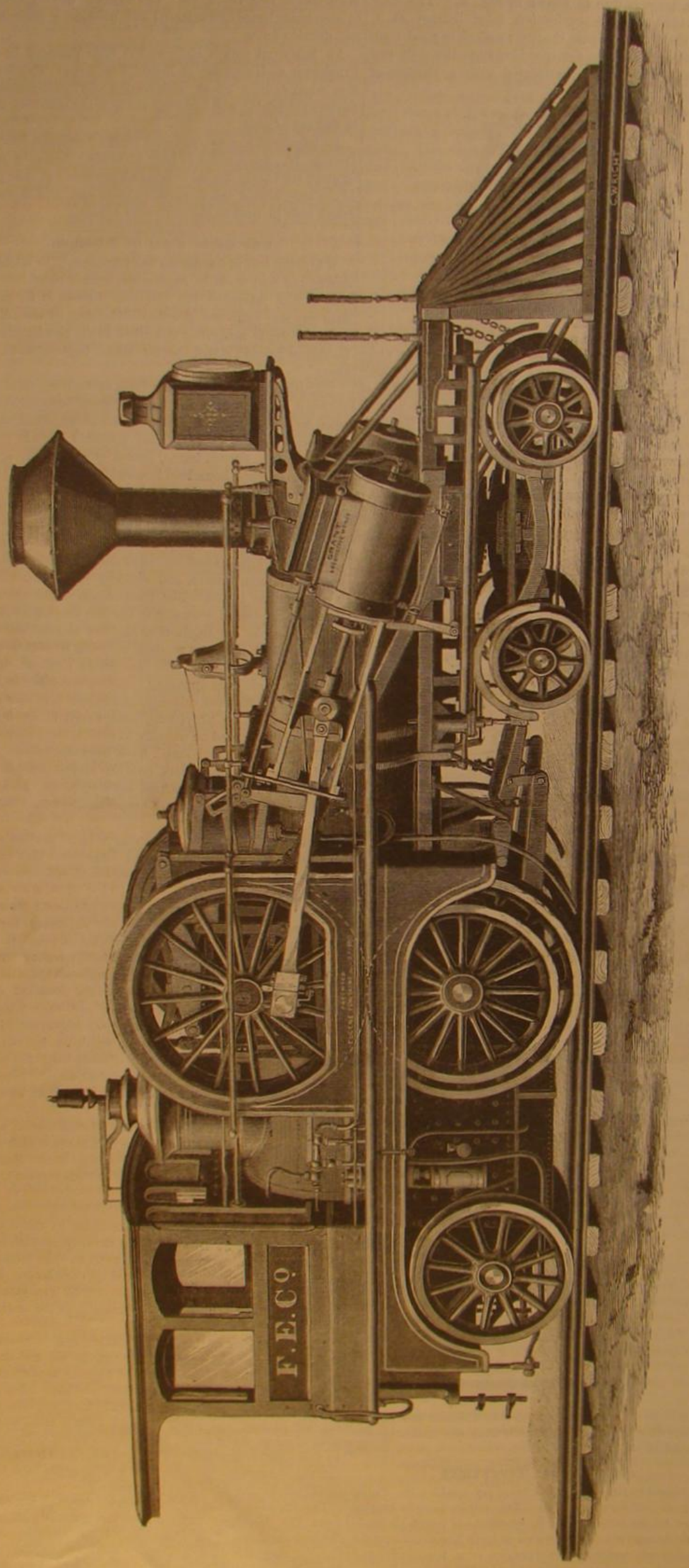
"The aid extended to the unfortunate by those whose homes were saved will soon exhaust the surplus of the latter. What these people require is aid to procure such necessities as will enable them to live upon and till their lands. They must have food until the harvests of 1882 are gathered. Anything short of this will fail to accomplish the undertaking.

"The first effect of this disaster was to stupefy or paralyze the energies of these people. The prompt aid and encouragement received have stimulated them to new efforts to help themselves. With the bare land and their labor only left they begin to build anew. Already many are constructing log houses, and every available team is being worked with vigor to put in wheat, the seed for which is furnished by the relief committees. They appreciate their condition and the necessities for labor, and will struggle hard to do their part as they have the opportunity."

The attention of the public has been diverted somewhat from the Michigan sufferers by the national affliction through the death of the President. It has been suggested that the materials used in draping dwellings and business places be contributed to the victims of the fire. Very much of the material may be made useful for clothing, bedding, and other household purposes; and liberal gifts of clothing and money would be likely to accompany such contributions. Winter is fast approaching, and what is done should be done speedily.

THE FONTAINE LOCOMOTIVE.

We present an engraving of the Fontaine locomotive, which is just now attracting considerable attention in engineering circles. This machine has been in practical use for some time on the Canada Southern Railway, and is credited with being capable of attaining a speed of ninety miles an hour. The second engine of this class was lately turned out of the Grant Locomotive Works, at Paterson, N. J., and is to be tested for two weeks on the New York, Lake Erie, and Western Railroad before it is shipped to its destination.



THE FONTAINE LOCOMOTIVE, BUILT BY THE GRANT LOCOMOTIVE WORKS, PATERSON, N. J.

The peculiarity of the engine is that it has two sets of driving wheels, one on top of the other. The main driving wheels in the Fontaine engines are secured to an elevated axle, above the boiler, and running in boxes supported by a suitably braced frame, the cylinder and slides being set obliquely and in a diagonal line to the axis of the driving axle. The driving wheels are of the usual construction, but do not touch the rails. Resting on the rails are other driving wheels of the same size as the upper ones, with which there is a frictional contact. There being no resistance, when motion is communicated to the upper wheels, the same motion is transmitted to the lower ones by friction. The lower wheels are constructed with two treads, the periphery resting upon the rails, and the other supporting the upper wheels.

To prevent slipping, an air pump is employed, which is operated from the cab, and which acts on a system of levers, by means of which the frictional contact between the upper and lower drivers is diminished or increased, as occasion may require, without disturbing the bearing of the lower wheels on the rails. The engine is also provided with an equalizing truck, so as always to preserve the bearing on the rail.

With this improved construction the running speed may be materially increased without increasing the number of reciprocations of the pistons, and the parts are so arranged that the center of gravity of the locomotive will not be so elevated as to render it liable to leave the track in turning curves.

An increase of the speed of locomotives as ordinarily constructed can be attained only by an enlargement of the driving wheels, or by an increase in the number of the revolutions of the pistons. To enlarge the drivers beyond a certain limit is found objectionable, since by so doing the center of gravity of the locomotive is so elevated as to cause a swaying or gauge motion, and the locomotive is liable to leave the track, especially on curves; and it is found impracticable to materially increase the number of reciprocations of the piston, except at the expense of fuel and a possible straining of the boiler to carry steam at such a pressure as to overcome the backlash or expansion of steam in the cylinders, which cannot, under such circumstances, escape with sufficient rapidity through the ordinary exhaust ports.

In the Fontaine locomotive these difficulties are overcome. We give below a table of the principal dimensions, for which, as well as for our engraving, we are indebted to the *Railroad Gazette:*

Gauge of road	4 ft. 8½ in.
Total wheel base	21 ft. 5 in.
Total weight of locomotive in working order	62,000 lb.
Total weight on driving wheels	32,000 lb.
Diameter of driving wheels	70 in.
Diameter of upper friction wheel	72 in.
Diameter of lower friction wheel	56 in.
Diameter of truck wheels	42 in.
Diameter of cylinder	16 in.
Stroke of cylinder	24 in.
Outside diameter of smallest boiler ring	48 in.
Size of grate	62¼x33¼ in.
Number of tubes	140
Diameter of tubes	2 in.
Length of tubes	11 ft.
Square feet of grate surface	14½
Square feet of heating surface in fire box	100
Square feet of heating surface in tubes	806
Total feet of heating surface	906
Exhaust nozzle—single or double	Double.
Diameter of nozzle	3 in.
Size of steam ports	12x1¾ in.
Size of exhaust ports	14x2⅜ in.
Throw of eccentrics	5 in.
Outside lap of valve	¾ in.
Inside lap of valve	None.
Size of main driving-axle journal	7½ in.
Size of truck-axle journal	5 in.
Capacity of tank	2,000 gallons.

RECENT INVENTIONS.

An improvement in tooth brushes, patented by Mr. Roger S. Tracy, of New York City, relates to tooth brushes having removable pads or brush portions, and the object is to provide a simple, convenient, and inexpensive article of that character.

Mr. Ernst Schultz, of Berlin, Prussia, Germany, has patented a compound for cleaning and preserving polished wood surfaces, consisting of linseed oil, olive oil, mastic, sulphuric ether, tincture of benzoin, oil of turpentine, tincture of curcuma, and nitro-benzole.

An improved grate for stoves has been patented by Mr. John Straszer, of Manchester, Mo. This invention relates more particularly to wood burning stoves of the form known in some localities as the "Tod" stove. The improvement consists in combining a lugged and ribbed reciprocating grate with a stationary grate.

An improved machine for rolling and turning logs has been patented by Mr. William E. Hill, of Big Rapids, Mich. This is an improvement on the construction of the machines for rolling and turning logs for which letters patent No. 233,755 were issued October 26, 1880, to the same inventor.

An improved machine for bending and flaring barrel hoops has been patented by Mr. Erastus Hibbard, of South Barre, N. Y. The object of this invention is to furnish a hoop which will have the proper flare to fit a barrel or tub, and will be of nearly the same thickness at both edges and ready for application to a barrel without work upon it by the cooper; and to construct a machine for manufacturing such hoops, the machine being capable of making the hoops of uniform size, and bending and flaring them at the same time.

Mr. Louis C. Graupner, of Red Bluff, Cal., has patented an improved blind-finishing machine which will bead, rabbet, and joint blinds rapidly and accurately, leaving the side edges of the blind parallel. It can be readily adjusted to operate upon outside blinds or upon inside blinds, rabbeting one edge and making the other edge knuckle-jointed or of any other desired shape.

NEW INVENTIONS.

A device for holding a cuspidor, in connection with a chair or other article of furniture, in such a manner that it can be used very conveniently when desired, but is concealed when not in use, has been patented by Mr. Willard F. Wellman, of Belfast, Me.

Mr. Adrian C. Selby, of Maysville, Ky., has patented an improved soap that is adapted to all of the household uses, for cleaning clothing and fabrics, furniture, tinware, and for toilet use, the properties of the soap being such that it will remove grease, ink, and iron stains from fabrics without changing their color and causing the colored figures of the fabric to run upon the lighter ground. This soap is composed of sal soda, unslaked lime, soft water, bar soap, resin, alum, borax, benzine, salt of lemon, and cream of tartar.

Mr. George Wolfe, of Peoria, Ill., has patented improvements in earthenware pans, such as sauce and stew pans, which have their bails attached in a substantial way, and are so constructed that they are not damaged or broken by the action of the excessive heat. The invention consists in the peculiar means for connecting a bail to such earthenware pan, and in constructing the bottom of the pan with a series of spirally radiating ridges which are of greater depth as they approach the outer edge of the pan, so that the outer surfaces of these ridges rest in a plane, while the bottom of the pan is slightly curved, giving a slightly rising course to the air currents as they circulate outwardly from the center.

Mr. Orrando P. Dexter, of New York city, has patented an improved instrument for dividing and subdividing circles and angles. It consists in an instrument combining a series of bars or arms pivoted to a common center, and slide links connecting the bars.

A lunch box, in which tea, coffee, and other liquids can be carried and heated, has been patented by Mr. Henry B. Dummer, of West Troy, N. Y. The box is provided with double bottom and sides forming a space or chamber all around the box for holding liquids, which chamber is closed at the top, with the exception of an orifice through which it may be filled and emptied, the orifice being provided with a suitable stopper for preventing the escape of the liquid.

An improvement in railroad switches has been patented by Mr. Abraham Ayres, of New York city. The object of this invention is to simplify and cheapen the construction of the kind of railroad switches that are operated by the weight of the car horses.

Mr. John T. Crowther, of Carbondale, Ill., has patented an improved dumping car to run upon rails. It may be used in building railways or for carrying ore or coal at mines, or for loading or unloading grain, and for various other purposes.

Mr. Daniel B. Smith, of Topeka, Kan., has patented an improved car coupling formed of a draw-bar provided with an arm on which a lever is pivoted having a block sliding on an upright of the draw-bar suspended from its inner end, the coupling pin being attached to this sliding block, which is connected by a chain with a beveled link guide pivoted to the draw-bar, so that this link guide will be raised to the outer end of the draw-bar when the coupling pin is raised thus guiding the link into the aperture of the draw-bar.

Mr. Hans J. Müller, of New York City, has patented certain new and useful improvements in electroplating circuits for the purpose of preventing the secondary current of the plating bath from reversing the polarity of the machine. The invention consists in a third or separate line which leads from a piece of carbon or other electric conducting material to the inner positive end of the magnet wire or to a post connected with the end of the magnet wire.

Mr. Joseph H. Wright, of New York City, has patented an improved form of pencil holder for use as an attachment of writing desks. The body of the holder is a box or hollow cylinder having a funnel-shaped or flaring tubular extension to receive the pencil, and adapted for attachment to a desk or some appendage thereof. The cylinder contains a spring reel similar to those employed in a certain class of curtain roller attachments, and the pencil is connected with the reel by means of a cord that is quickly drawn off or wound up, according as the pencil is required for use or not.

Mr. Samuel E. Rusk, of Croton-on-the-Hudson, N. Y., has patented a novel telegraph relay and main line sounder; and it consists, essentially, of a permanent magnet having a movable pole extension surrounded by a helix, the pole extension projecting between the poles of a second permanent magnet and carrying the movable contact of the local circuit. The invention also consists in a local circuit, including a certain amount of resistance additional to that of the sounder magnets, which is either short-circuited or put wholly in the local circuit by the action of the relay.

Mr. William Russell, of Kilmarnock, County of Ayr, North Britain, has patented an improved apparatus for use in the manufacture of Scotch bonnets, etc. The invention consists of an improved "jack" to fashion or shape knitted fabrics while being woven or knitted by a straight bar hosiery frame into circular shaped fabrics.

An improved ice cutter has been patented by Mr. Peter D. Falardo, of Cohoes, N. Y. This invention relates to machines that are operated by steam engines for cutting ice on ponds, rivers, and lakes. It is designed for cutting ice blocks lengthwise and crosswise.

An improved door and window securer has been patented by Mr. William Seeman, of Honesdale, Pa. The invention consists in constructing a window sash fastening with two plates attached to each other at their lower ends and connected at their upper ends by a swiveled screw, and the pawl hinged to the upper end of one of the plates, whereby the fastener can be adjusted to the size of the space between the sash and casing, and can be made to secure both sashes.

Mr. Thornton F. Williams, of Lower Cascades, Oregon, has patented an improved revolving dip net for catching fish as they are ascending streams. It is simple in construction, automatic, and adjustable to the height of the water.

Mr. Henry D. Hurley, of Weedsport, N. Y., has patented a convenient and efficient device by which eggs may be tested by means of a stream of light, the eggs being contained in a dark chamber.

Mr. James Baldwin, of Huntington, Ind., has patented an improved ink well which cannot be upset, preserves the ink in good condition, and is simple and convenient.

Mr. John Turner, of Springfield, Ill., has patented an improvement in sulky plows, the object of which is to lock the forward end of the plow beam of a sulky plow automatically when the plow is raised from the ground.

SLEEPING FISHES.

SLEEPING FISH.

Since the invention of large aquariums the inhabitants of the marine world have been carefully studied in their native element, and many interesting observations and important discoveries have been made. The Berlin aquarium is especially well arranged for the scientific study of fish life, and lately it has settled a much disputed point.

"Do fishes sleep?" has often been asked, but never authoritatively answered. Older investigators denied the possibility, but lately this opinion has been changed in consequence of the following facts.

Generally the life of a fish is more simple and monotonous than that of animals or birds. The fish devotes its time entirely to seeking nourishment. It does not regularly hunt its prey, though it is known that it is much more active at some times than at other times when it seems to rest quietly. This active state is more frequent, as even when the fish is apparently playing at rest it is still ready to seize on any passing prey; but when tired or satiated it remains quiet in a way that resembles the sleep of the beasts of prey.

Generally fish hunt night as well as day; indeed some only commence their activity with the twilight, and rest during the day, in certain places, either lazily floating in the water or hidden in the mud, their belly only visible. These facts have been lately proved by Dr. Hermes and others.

In one division of the Berlin aquarium were about a dozen carp (*Caprinus carpio*) that commence in October to act curiously. From time to time the majority of the fish, occasionally all of them, would assume a crooked position (see engraving), and remain so for hours, or until they were disturbed. When worms or other food were thrown into the water they would spring up to seize it, and immediately resume their old position. These fish were often very particular in choosing their resting places. Some would examine carefully with their heads the surrounding rocks and stones, then slowly turn themselves over on the right or left side, and either remain quiet or swim away to seek some other place. Other fish would lie on the gravel, resting on their heads and tails, in the form of a bow. One carp always stood on its head with its body erect in the water—a veritable wonder of balancing that showed the capabilities of its fins. It was easy to arouse most of the fish by means of food or of a noise, but some of them slept so soundly that it was only possible to disturb them by hitting or shaking them repeatedly. The lidless, always-open eye of the fish makes it difficult to distinguish its sleep from its periods of ordinary rest, but this last experiment was conclusive.

The suggestion that this behavior is the result of illness is answered by stating that this habit of sleep was observed nearly every day for more than six months, and during all that time the fish ate regularly, and were free from any appearance of sickness.

It is possible that, as carp bury themselves close together in the mud during the winter, when they are free in the ponds, this behavior in the aquarium was simply their usual winter sleep, modified by disturbances and their altered mode of life.

Improved Tobacco Pipe.

Mr. Jacob H. Van Riper, of 184 Market St., Newark, N. J., has lately patented an improvement in tobacco pipes, the object of which is to prevent the entrance of nicotine and essential oils of the tobacco into the mouth of the smoker, and to retain them in the pipe stem. The improvement consists of a sectional pipe stem having two central sections with large bores or chambers for the condensation of the nicotine and essential oils. These are coupled together with a coupling nut of comparative small bore, provided with reduced terminal central bosses, that serve to retain the condensed oils in the pipe stem, the nut being inserted into the opposite ends of the central sections. In effect this improved pipe stem is a doubly chambered reversible stem.

The Geographical Congress.

The first session of the Geographical Congress in Vienna—the third annual meeting—took place September 15. Many explorers and other celebrities were present. The congress was opened by the retiring president, M. De Lesseps. The acting president was Prince Teano, president of the Italian Geographical Society. One of the American delegates, Professor Barnard, of Columbia College, proposed a general meridian for all the world with a system of standard time. The plan is to divide the globe into twenty-four meridians of fifteen degrees each, each comparing with the twenty-four hours of the day, the prime or first meridian to pass through Behring Strait, the hours of the day to be counted from one to twenty-four, the A.M. and P.M. of the present system being abolished.

ENGINEERING INVENTIONS.

Mr. James Manes, of Denver, Col., has patented an improved machine for pulverizing and amalgamating ores. This invention relates to a machine for extracting gold and silver from their ores or from tailings. It consists, mainly, in a series of metal cylinders placed horizontally and made cone-shaped or tapering, so as to be larger at one end than at the other, the said cylinders being provided at their large ends with detachable heads, and being arranged with the large end of one above the small end of the other, and the cylinders being connected by spouts arranged alternately at opposite ends, so that the ore travels by gravity down to the larger end of the cylinder and enters the smaller end of the next subjacent cylinder, and in each of which cylinders is arranged a rotary shaft bearing mullers, brushes, or other devices for pulverizing, stirring, and mixing the ore with mercury or other chemical as it passes through the machine.

Mr. Jacob J. Anthony, of Sharon Springs, N. Y., has patented a new and improved car truck, which is strong and durable, and has a broad spring-bearing for the car body, and which prevents undue wear of the wheels and rails at the curves of the latter.

An improved furnace for steam boilers has been patented by Messrs. Josef Nitsche and Theodor Grellneth, of Vienna, Austro-Hungary. This invention may be carried out in various ways, but the main feature in all is that a part of the air which passes through the grate and is thereby heated, is led to a passage or chamber, whence it, at a certain height above the grate, is made to meet the gaseous products of combustion before they escape over the bridge. The carbon particles which have not been consumed, or the carbon which has only been formed into carbonic oxide and otherwise escaping into the chimney, are thus again brought into contact with the oxygen of the heated air, and thus completely burned.

An improved steam engine valve has been patented by Mr. William Hopkins, of Dubuque, Iowa. This invention relates to that class of valves known as "steam actuated steam valves," that are operated by steam and not by mechanical attachments.

Mr. Robert Holbon, of Alpena, Mich., has patented an improvement in car couplings, which consists, principally, in providing the draw heads of each of the cars with horizontal draw bolts, upon which are pivoted the spring actuated bevel-headed connecting bolts, which may be simultaneously operated from either of the cars for disconnecting the same by means of double-acting tumblers.

An improved side bar for locomotives has been patented by Mr. John R. Fish, of Grand Rapids, Mich. The object of this invention is to prevent the side bars of locomotives from breaking in cold weather. The invention consists in a side bar connecting the driving wheels of a locomotive, having longitudinal strips of wood attached thereto parallel therewith to break the shocks or vibrations caused by irregularities of the track.

A breakwater for protecting harbors and roadsteads, and keeping open channels through bars at the entrances of harbors, the mouths of rivers, and in other places, has been patented by Mr. Alexander G. Follett, of Velasco, Texas.

Mr. Wendel Collin, of Pittsburg, Pa., has patented an improvement in car couplings, the object of the improvement being to construct a coupling which will lock automatically, and may be unlocked from the platform, sides, or top of the car. It may be used where the cars differ in height.

Mr. David Nevin, of Silver Cliff, Col., has patented an improved stamp guide for ore mills, which is durable, easily kept in order, and it provides better facilities for taking out stamps and changing and repairing guides as they wear out.

The Absecom Beacon Light.

There are a few great beacon lights on the Atlantic coast that are known by the mariner the world over. One is at Hatteras, others at Cape Ann, Cape Cod, Grey Head, Minot's Ledge, and Nantucket, and another at Absecom. This great Absecom light at Atlantic City, furnished by a Fresnel lens of the first order, which gives a mass of light six feet wide and ten feet high, burns steadily from sunset to sunrise, and can be seen from the deck of a vessel twenty miles at sea. It is a fixed white light, exhibited from the top of a tower 167 feet high, and is visible all round the horizon. To protect the tower thousands of tons of stone and huge dikes are placed on the seaside, but the washing of the waves seriously threatened it, until three years ago a pier was constructed a long distance out to sea, and since then the land has made, removing the beach hundreds of feet away from the tower and the town. About twenty-five years ago a huge package was sold by auction in New York for unpaid custom duties, and brought about $200. It had been consigned in France to a person who had never called for it. Being opened, an immense Fresnel lens of the highest order was found, and this is now the Absecom light. It had cost the Government about $11,000, and they thought it was lost. Let us make this great lighthouse a visit. Major Wolf, the keeper, lives in a modest brick building at the foot of the tower. He is a bird fancier, and has a large lattice-work house near by, with almost a hundred pigeons, many of them carriers, and some of them most amusing tumblers, while over the assemblage presides a solemn wild goose. As we signed the book a pretty little rose-breasted grosbeak, which had been caught in the netting outside the lantern, chirped merrily in its cage. Were it not for this netting the birds flying against the lantern at night might break the glass. As it is many are caught in the netting. The Major said he once caught seven brant at one time, and they had thus captured as many as 300 birds in a single night.

Let us climb laboriously up the winding stairs of the gradually narrowing tower, and count 228 steps as we ascend. It is a tough job even for the keepers who are used to it, and the climber winds around and around the twisted stairway, until he gets almost into the condition of the whirling dervish. The stairway finally comes to an end in a little room beneath the lantern, and on a level with the balcony outside the tower. Here they sit at night serving four-hour watches, and as the tower vibrates in the wind they superintend the light above. We go up into the lantern and see the wonderful construction that makes this powerful light. Imagine yourself in the chimney of a mammoth lamp, ten feet high and six feet across, the central part of the sides made of thick curved glass, and all the rest, top and bottom, of curved prisms acting as a multitude of reflectors. In the center is a large lamp with four circular wicks, arranged regularly one inside the other. Above and below are huge reservoirs of lard oil, with pumps moved by clockwork which regulate the supply. Two gallons of oil are burnt in a night to keep up this artificial sun for the mariner, which outshines any other light that has yet been adapted for lighthouse use.

The view from the top of this tower is grand. Far out to sea the haze over the water obscures the junction of the ocean and sky, but vessels spread their white sails in all directions.

Draining a Bog.

The following account of draining a bog in Holland was furnished the *Times* of London by a local correspondent:

My steps were directed to the well-known reclaimed estate of Mr. Nering-Bölger, called Principell, about two miles from the little station of Mill, on the Boxtel-Wesel Railway.

The entire estate is of 1,500 acres, and cost Mr. Nering £10,000 about twelve years ago, he having paid that sum for it when in the original bog state to the community of Mill. Mr. Nering, in the meantime, went over to North Germany and studied the methods of reclaiming bog lands as followed at or near Osnabrück and Arenberg-Meppen, and other places, and after a careful study of those methods returned home, determined to make the experiment on a bold scale. Bold it certainly was, for in addition to his £10,000 paid down as purchase-money of 1,500 acres of a treeless waste of bog, it cost him £12,000 more in draining, labor, manures, and putting up the requisite farm-buildings, including his own residence. As Mr. Nering truly told the writer, those in Holland who have the money will not enter upon experiments of this kind, and those who have not the money cannot.

The general plan of the estate has been to select 1,000 acres for reclamation, which has been done, while the remaining 500 acres are left for future operations, when Mr. Nering's convenience may permit. In the meantime he prefers to wait the result of his 1,000 acres and the experience he will gain year by year before he attempts to reclaim the remaining 500, which will also supply him with fuel for himself and the fifty men or so who work the farm for him. Mr. Nering commenced operations about eight years ago, by cutting suitable ditches and roads, all in parallelogram form, thus dividing the 1,000 acres into four divisions of about 250 acres each, and each division again subdivided into suitable plots for drainage and cultivation purposes. For each of the four principal divisions Mr. Nering built a suitable farm and outbuildings for stock, etc., and over each division he appoints a farmer, who is put upon his mettle by being made a kind of partner, his remuneration depending entirely upon the results of the land under his care. The whole estate is closely supervised by Mr. Nering himself, assisted by an intendant or bailiff. I, of course, could not see more than the springing crops which, however, seemed quite as backward as in England, many of the fields of oats and maize especially having only just been sown; but the cattle were in capital condition, and Mr. Nering seems inclined to devote himself largely to stock for the development of his estate and for present and ultimate profit. The manure of the beasts is, of course, all used in the cultivation of the land, and as the stock increases, Mr. Nering is enabled to do with less of some of the chemical manures with which he began the experiment after the methods of the Osnabrück and North German school of waste-land reclamation. The land yields capital pasture of grass and clover.

This brings me to the main point of the experiment, viz., the use of chemical manures, which is a method that has only been practicable since the great potash deposit discoveries in the Stassfurth district and Anhalt duchy some dozen years ago, or rather more. Prior to those remarkable discoveries of potash salts in various combinations, the supply of this fertilizing material was limited to costly methods and sources, which made the article too dear for agricultural purposes of this kind, and this discovery may truly be said to have come in time to revolutionize the agricultural procedure in the reclamation of bog land. The method pursued is to dig broad ditches, to drain and to divide the bog into suitable plots, and at the same time to supply the requisite amount of sub sand to put an even layer of four or five inches in thickness on the neighboring plot of bog land. Mr. Nering then spreads upon the sand after a slight working of it his mineral manures in the following proportions—viz., of kainit, which is a double sulphate of potassium and magnesium, about 240 pounds per statute acre, which costs 5s. for 200 pounds, including carriage from Stassfurth. He also uses about 80 pounds of nitrate of soda per acre, which costs him about 30s. for 200 pounds, and then he uses a fair proportion of the more costly, but necessary, phosphate of lime, which he makes himself by first buying bones at about £4 to £5 per ton, and mixing them with sulphuric acid.

Mr. Nering uses large quantities of his farm-yard manure, and finds it better to put the farm yard manure separately on his land, because of the difficulty of evenly mixing it with the mineral manures. These latter he therefore applies as guano is sometimes or generally applied—that is by scattering it with the hand, thereby insuring a tolerably even distribution. He has experimented with various quantities of the kainit per acre, having used as much as 400 pounds per acre; but as he did not find any proportionate advantage, he of course now restricts himself to supplying only 240 pounds per acre. Mr. Nering suspects that the potash and nitrate soon pass away, from their soluble nature, into the drains, and so into the river. Notwithstanding this, he is amply satisfied with the profitable results of his experiments, which have shown a steady four to five or six per cent on his capital outlay per annum since 1875, although the latter seasons have not been propitious in Holland any more than in the British isle.

In a recent pamphlet Mr. Nering's example is cited as a notable example of the North German and Dutch method of bog reclamation, and the assertion is made that Mr. Nering had realized in one year (1875) a net profit of twenty two per cent on his outlay. I took the opportunity of calling Mr. Nering's attention to this statement, asking if it were really true, and he at once declared that he had never realized more than the modest four to five or six per cent I mentioned before.

Any way, the truth is that Mr. Nering's experiment is a substantial success, and it is well that the error just mentioned has been discovered and rectified at a moment when the Irish land question is to the front, and when, no doubt, vast sums of the public money will be asked for and probably voted for reclamation of bogs in Ireland. It is of the first importance, therefore, that the facts should be known, both in the interests of the Irish and the other nations forming the British Isles. I especially put the question to Mr. Nering as to his opinion of the conditions requisite to a bog being reclaimable, and yielding a reasonably profitable return. He distinctly gave his opinion that the first requisite is that the land can be drained successfully, and the second that the bog is not deeper than five feet, or six feet at the outside; further, that it should rest on sand or on marl, but not on stiff yellow clay; the marl, to be spread on the surface of the bog, would weather and fall under the frosts and rains, and would, like the sand, give the requisite top dressing upon which the chemical manures could be spread. But if the bog is more than five or six feet deep, it must be pared down to that depth before there can be a reasonable prospect of profitable reclamation, and if that can be done and the water can be drained away, the experiment, properly conducted, must be a success. Mr. Nering's land is, in fact, a mere skin of turf or bog of from one foot to certainly not more than three feet in depth, and probably not averaging more than two feet, and this rests on a hungry sand such as might have been left on the shore of an estuary.

History of the Screw Propeller.

The erection of a monument to Sauvage, who is believed to be the first to have practically applied the screw propeller to the driving of ships, has given rise in France to a discussion of the true history of the propeller, and the interesting fact has been elicited, says *Engineering*, that it was actually applied on a small scale by Leonardo da Vinci about the end of the fifteenth century. That great artist and engineer endeavored all his life to find a means of flying; and though his admirable studies on the flight of birds are well known, few are aware that he invented several apparatus for elevating man above the ground and wafting him through the atmosphere. All these solutions of the aerial problem are independent of the principle of levitation, and aim at realizing flight by apparatus heavier than the air. Among these numerous plans, which can be seen in the "Codice Atlantico" deposited in the Ambrosian Library of Milan, and also in the volumes belonging to the library of the Institute at Paris, there is the design of a large screw destined to turn round a vertical axis, beside and below which are written some notes in Italian to the effect that the thread of the screw should be of iron wire stiffened with light supports, and covered with linen cloth having its pores stopped with gum. According to the author, when this screw is rapidly turned, it mounts into the air. The design is a very rough one, but it is perfectly clear, as may be seen at page 401 of the *Comptes Rendus* for August 29. We see, therefore, that Leonardo da Vinci in all probability invented the screw propeller, and first applied it to aerial locomotion, thereby anticipating M. Tissandier in his recent application of the same device to a balloon by means of stored electricity. The latter employs bamboo for the framework of his screw, and curiously enough the Italian philosopher also suggests the use of long stout reeds. Moreover, on consulting the "Saggio delle Opere di Leonardo da Vinci," published at Milan in 1872, M. Govi finds that that universal genius had studied the effort exerted in striking the air with plates of a given size, and also invented the well-known parachute, of which a rough design is given, showing the figure of a man clinging to it.

The Tehuantepec Ship Railway.

While the preliminary works of the Panama ship canal are in progress—though, according to the imperfect information afforded, the progress is very small and the difficulties far greater than were foreseen—Captain Eads is earnestly developing his project for the construction of a ship railway across the isthmus at Tehuantepec. The abilities of Captain Eads, both as an engineer and a financier, have been too well established by the successful completion of one of the great engineering works of the world—the deepening of one of the mouths of the Mississippi—for this scheme to be passed lightly on one side, and pronounced chimerical; on the contrary, emanating from such a source it commands the most serious attention both in a professional and a commercial point of view; it would be at once the most original and boldest engineering work ever attempted, and if successful would have an incalculable effect upon the carrying trade of America, and to a less extent upon that of the whole world. In the United States the question is one attracting great attention, for not only is the work of M. De Lesseps generally regarded with a feeling of mistrust, and with a sentiment of jealousy also, but the route located by Captain Eads lies so much nearer the direct line of travel that it would naturally absorb nearly all the trans-isthmian traffic.

On a subsequent occasion we shall consider this point in more detail, but at present we will content ourselves with a few figures relating to the two routes. Speaking roughly the ship railway route is at the north and the ship canal at the south of the isthmus connecting the two continents, the lines of crossing being about 1,100 miles apart. This is a matter of the utmost importance, especially since Captain Eads has opened for large ships the great waterway of the United States, and converted New Orleans into a vast seaport. A ship leaving the mouth of the Mississippi for California, Japan, or China would, if intending to cross the isthmus by the canal, after passing the site of the railway, be obliged to follow the coast for 1,100 miles to reach the canal, and having crossed, pass up the coast on the western side for the same distance before reaching Tehuantepec. Thus the voyage would be necessarily 2,200 miles further than by the ship railway. This would represent a saving of about nineteen days on a round trip between New Orleans and San Francisco, and a saving of twelve days on a round trip between New York and San Francisco. Shipowners and merchants alike will understand the practical results of such an economy.

Although Captain Eads' project has not yet advanced so far upon the ground as that of M. De Lesseps, it stands upon at least as firm a foundation, and its ultimate prospects are probably far brighter, apart from its physical advantages. The concession granted by Mexico to Captain Eads is a peculiarly advantageous one, the estimate for construction is only £15,000,000, as compared with £48,000,000 for the canal, and if these figures are insufficient, the excess of cost in each case will probably be in the proportion of the estimates; the work could be completed in four years, and there is no doubt as to the amount of traffic which would await the railway on its completion. Naturally the undertaking will meet with much political opposition in the United States, but on the other hand it will meet with widespread and powerful support. The chief opponents will be those whose material interests lie in preserving railway monopolies, and preventing the carrying out of any work which, no matter how vast the national benefit resulting from them, would produce competition and destroy monopoly. On the other hand, support will come on all sides from those who desire the welfare of the country, and who also have great material interests at stake, such, for example, as the merchants of New Orleans now possess. Under these conditions we think there is little doubt but that the United States Government will accord the guarantee asked of six per cent on two thirds of the capital for a maximum term of fifteen years, subject to conditions which throw the whole responsibility on Captain Eads, and also to special advantages which would well repay them for a guarantee which they might never be called upon to redeem.—*Engineering.*

Recent Elevation of the Himalayas.

The superintendent of the Geological Survey, Mr. H. B. Medlicott, and the deputy-superintendent of the same work, have prepared a manual of the geology of India, in two large volumes. With regard to the movements producing the Himalayas the authors say: "During the interval that has elapsed since Eocene times, while no important movements, except small and partial changes of elevation, can be traced in the Peninsula, the whole of the gigantic forces, to which the contortion and folding of the Himalayas and other extra-peninsular mountains are due, must have been exercised. The sub-Himalayan Eocene beds were deposited upon uncontorted Paleozoic rocks; and, although the Himalayan area was probably in great part land at a much earlier period, there is no reason for believing that this land was of unusual elevation, while the direction of the Himalayan ranges is clearly due to post-Eocene disturbance. It will be shown, in the chapters relating to the sub-Himalayan rocks, that the movement has been distributed over the Tertiary and post-Tertiary period; and a great portion is of post-Pliocene date. Indeed, the fact that earthquakes are now of common occurrence in the Himalayas, the Assam hills, Burma, Cutch, and Sind, and that many of the shocks are severe and some violent, while the peninsula area is but rarely affected by earthquakes, may indicate that the forces, to which the elevation and contortion of the Himalayas are due, are still in action; and that the highest mountains in this world owe their height to the fact that the process of elevation is still in progress to a sufficient extent to counterbalance the effects of denudation.

"In Sind and the Suleman ranges, there is much probability that some movement took place during Miocene and Pliocene times. Some slight unconformity between beds, elsewhere conformable, and the absence of different groups in parts of the country, may thus be explained; but the principal disturbance is clearly of post-Pliocene date. To the eastward, in Burma, however, the Pliocene formations of the Irawadi valley are but little disturbed, and the Miocene beds, although contorted, are unaltered; while many of the Eocene and Cretaceous rocks are greatly changed, besides having undergone excessive disturbance and folding. These facts may, perhaps, indicate that the disturbing forces were more severe to the eastward in middle Tertiary times, and that the main action to the westward was of later date; a view partly supported by the fact that there is evidence of elevation having taken place in the Himalayas, near the Ganges and Sutlej, at an earlier period than farther to the westward. In the Simla area there is marked unconformity, due evidently to upheaval and denudation combined, between the Sirmúr and Siwalik series, and between the lower, or Náhan, group of the Siwalik series itself and the next overlying subdivision; whereas farther west, in the Northern Punjab, all the groups follow each other in apparently comformable sequence. The evidence, however, is not sufficient to prove that the contortion to the eastward is older than to the westward; and the absence of any important break in Burma is opposed to the suggestion of great movements having taken place in that country in early or middle Tertiary times.

"It is evident that the forces, to which the principal ranges in the extra-peninsular area owe their direction, have not only been exerted throughout a considerable portion of the Tertiary period, but that these forces have acted contemporaneously, at all events in the post-Pliocene period."

Antarctic Ice.

Mr. Buchanan made experiments on the melting point and amount of salt contained in salt water ice.

He came to the conclusion, from analyses of successive meltings, and the varying of the melting point, that in salt water ice "the salt is not contained in the form of mechanically inclosed brine only, but exists in the solid form, either as a single crystalline substance or as a mixture of ice and salt crystals."

He thinks that by fractional melting salt water ice might be made to yield water fit to drink, although when a lump is melted as a whole the resulting water is undrinkable.

We crossed the Antarctic circle on February 16, passing about six miles to the south of it. There was open water ahead, but the Challenger was not strengthened for ice work, and we were not ordered to proceed further south, so we turned back.

There seemed to be a deep opening in the pack here nearly due south of Heard Island.

We subsequently passed within six miles of what is marked on maps as Wilkes' Termination Land, and found that this did not exist.

Wilkes, no doubt, was deceived by the land-like appearance of distant icebergs.

It is to be noted that he merely says that he saw appearance of land here, sixty miles distant, but high and mountainous. Others have named it for him and placed it on the charts.—*H. N. Mosely, Challenger Notes.*

New Lead Process for the Extraction of Gold from Ore.

The tall chimneys of a large building at the foot of West Fifteenth street, New York city, have attracted some attention of late. An *Evening Post* reporter who investigated the building found that it contained machinery designed to extract the precious metals from ores and tailings by a new process which is said to be a great advance upon all previous methods.

Mr. Hamilton, the inventor of the process, said: "The whole thing lies in the affinity of lead for silver and gold. It was discovered, many years ago, that if into a bath of melted lead you plunge a piece of gold or silver heated to the same temperature as the lead, it will disappear so fast that you cannot see it melt. The extraordinary thing about it is that lead will melt at 630°, while silver only melts at about 2,000°; yet, if you take a bar of silver as thick as your finger, and, after heating it to 650°, plunge it into a bath of lead at 650°, you cannot withdraw it fast enough to save it; whatever part has touched the lead will have disappeared.

"The great trouble that I have experienced in my years of experimenting has been that if I crushed my ore and plunged it into melted lead it would not stay there long enough for the lead to get through the mass of ore to the metal. The ore is about thirteen times as light as the lead, so that it would rise instantly to the top. I could succeed in small quantities, but for practical working in which hundreds of tons of ore would be used every day, the difficulty of mixing together two substances of so unequal density as lead and ore was found almost insurmountable. I think that I have succeeded at last by means of a certain apparatus contained in a furnace of brick and cast iron. The lead has an ample chance to reach each particle of ore and extract all the gold and silver. Everything will be done automatically from the time the ore arrives until the lead containing the gold and silver is poured out to cool. We expect to reduce a ton every ten minutes at a cost of one dollar."

Mr. Hamilton then showed the reporter through the works, in which nearly one hundred men are employed fitting the machinery together. As about thirty-five tons of molten lead are used in this machine, it has to be of the most substantial character. The furnace for heating the ore and the blast fires for furnishing heat are all enormous structures.

MISCELLANEOUS INVENTIONS.

Mr. J. N. Proeschel, of Milwaukee, Wis., has lately patented an improvement in firearms which consists mainly in the combination, with the usual self-cocking lock, of a concealed trigger readily projected from a small guard by a pressure of the thumb or finger. This arrangement, by doing away with the usual open guard and projecting trigger, notably diminishes the bulk and weight of the lock while increasing the safety in handling and carrying the arm. While the invention applies to all firearms, the advantages which it affords when applied to revolvers are especially noticeable. These advantages are, of course increased safety and diminished bulk.

An improved machine for treating grain has been patented by Mr. Charles T. Schramm, of Pontoosuc, Ill. The invention consists in combining an air flue and sliding screens, the flue provided with two openings and hinged plates.

Mr. George W. Logan, of New York city, has patented an improved hat and clothes rack which can be folded very compactly, and the arms of which can be raised, lowered, and locked at any desired inclination very conveniently and quickly.

An improved attachment for cloth-shearing machines has been patented by Mr. David McColl, of Cleveland, Tenn. The object of this invention is to take the curl and slack out of the selvages of cloth, so as to present a smooth, even surface to the shearing cylinder.

Mr. John Brunny, of Fort Scott, Kan., has patented an improved calf and cow weaner. The invention consists in a wire pointed at the end, bent to form a hook, a spring coil, and two angles, and having a pointed wire attached to it in line with its pointed end, the wire bent into a loop at its center, coiled around the main wire, and having its pointed ends projecting. The device is to be applied to the nose of the calf.

Anchor chains are usually connected to the shank of the anchor by a ring or shackle that is held on the end of the shank by a pin or bolt. With that manner of connection the chain frequently fouls with the anchor and prevents it from holding. Mr. John J. Moule, of Fishkill-on-the-Hudson, N. Y., has patented an improved shackle bar for anchors, which prevents anchor chains from fouling without limiting free movement of the chain and anchor.

Messrs. Daniel W. Shaw and Pleasant W. Brown, of Murfreesborough, Tenn., have patented an improved steam engine. The object of this invention is to economize steam and to cause a constant equal pressure or strain upon the driving shaft of the engine. The invention is an improvement on steam engines having more than one movable piston working in the same cylinder, each of which is separately connected with the crank shaft.

Lizzie I. Jones, of Texarkana, Ark., has patented an improved portable bath tub, which when not in use can be compactly folded.

An improved car coupling has been patented by Mr. Nicholas Barr, of Cayuta, N. Y. The invention consists in the peculiar construction and arrangement of the parts, whereby all danger of accident in coupling and uncoupling cars is avoided.

An improved lumber wagon has been patented by Messrs. John G. Seifer and John Maschek, of New Orleans, La. The invention consists, essentially, in a novel construction and arrangement of the reach and connections, whereby provision is made for extending and contracting the length of the wagon to accommodate it to long or short lumber.

An improved thill coupling has been patented by Mr. Clarence J. De Witt, of Havana, N. Y. The object of this invention is to lessen the labor and time required in removing or replacing the thills or pole of a vehicle. It consists in dispensing with the removal of the ordinary bolts, eye-pieces, and rubbers, and providing each thill or pole iron with a loop, through which the projecting end of an eye-piece is passed and secured to the thill or pole iron by a bolt passing through the thill or pole iron and secured by a thumb nut.

Mr. Hiram A. Laws, of Thompson's Station, Tenn., has patented an improved car coupling provided with a lever having double hook at the front end, a fulcrum near its rear end, with a shoulder against which rests the end of a spring for throwing the hooks into engagement.

An improved hoisting machine has been patented by Mr. Henry Field, Jr., of New Bedford, Mass. The arrangement of the parts of this elevator or hoisting machine is such that, by means of a continuously rotating wheel or pulley and link-and-lever mechanism, and friction and clutch mechanism, the action of the machine and the weight will always be under sudden and easy control with the outlay of very little power upon the governing lever.

An improved windmill has been patented by Mr. Isaac M. Steward, of Stromsburg, Neb. The object of this invention is to insure a uniform speed from a variable wind, and also to cheapen the construction of windmills, and economize space.

Business and Personal.

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

New Method of Graining, etc. J. J. Callow, Cleveland, O.

Loud Speaking Telephones, $5 a pair. Illus. circulars for stamp. Agents wanted. W. R. Brooks, Phelps, N. Y.

10 Horse Baxter Engine for sale cheap. Good as new; all improvements. E. J. Morgan, Bridgeport, Conn.

Agencies solicited for Pittsburg and vicinity. Address G. A. Jackson, Washington Ave., 32d ward, Pittsburg, Pa.

Inventor's Institute, Cooper Union, New York City. Permanent free exhibition of new machines, inventions, and patents. See advertisement page 236.

The proprietors of the Boomer & Boschert Cider Press challenge the world to produce another press that will extract the same amount of cider from a given quantity of apples. This press is acknowledged the best made. Their New York Office, 15 Park Row.

Professor Huxley's recent interesting address before the International Medical Congress, London, on the Connection of the Biological Sciences with Medicine, is published in SCIENTIFIC AMERICAN SUPPLEMENT, No. 300. Price, 10 cents.

The Cable Street Railways of San Francisco, with fifteen engravings. By A. S. Hallidie, M.E. A full description of the several street railways of San Francisco, with engravings of the cars, grappling apparatus, and other machinery; also description of all the mechanism, dimensions, grades, results of operations, etc., is given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 298. Price, 10 cents. For sale at this office and at news stands throughout the country. These railways have been worked in San Francisco since 1878 with success, having displaced horses for the propulsion of street cars.

Draughtsman's Sensitive Paper. T. H. McCollin, Phila., Pa.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Foot Lathes, Fret Saws, &c, 90 pp. E. Brown, Lowell, Mass.

Common Sense Dry Kiln. Adapted to drying all of material where kiln, etc., drying houses are used. See p. 205.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Improved Skinner Portable Engines. Erie, Pa.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 204.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

4 to 40 H. P. Steam Engines. See adv. p. 189.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Cope & Maxwell M'f'g Co.'s Pump adv., page 189.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 204.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 222.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

Supplee Steam Engine. See adv. p. 204.

The American Electric Co. and Proprietors and Manufacturers of the Thomson Houston System of Electric Lighting of the Arc Style. New Britain, Conn.

See Bentel, Margedant & Co.'s adv., page 221.

Silica Paints (not mixed); all shades. 40 Bleecker St., N.Y.

The None-such Turbine. See adv., p. 206.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Telegraph, Telephone, Elec. Light Supplies. See p. 221.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 221.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 213 Chester St., Phila., Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 222.

Safety Boilers. See Harrison Boiler Works adv., p. 222.

The Medart Pat. Wrought Rim Pulley. See adv., p. 221.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 221.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 221.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 421, Pottsville, Pa. See p. 221.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Av., Phil. Pa.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 220. Totten & Co., Pittsburg.

Combined Concentric and Eccentric Universal and Independent Jaw Chucks. The Pratt & Whitney Co., Hartford, Conn.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) J. A. asks for the best method of putting on tinware the appearance of crystals, such as is seen on window panes in frosty weather. I see a great many trunks ornamented that way now. I have tried acids, but do not succeed. I want to ornament a patented article that is made of tin, to make it more attractive. A. The *moir metallique* or crystallized tin plates, are usually prepared from well annealed and well tinned charcoal iron plates, by rinsing the plates with dilute nitric or nitro-muriatic acid and then with water. The cleansed plates are dipped for a few moments into nitric acid or aqua-regia (nitric acid 1, muriatic acid 3), diluted with from one to three volumes of water and heated to about 180° Fah., and after a moment's exposure in this bath removed and rinsed in running water. This is repeated, if necessary, until the crystals are properly developed, when the plate is finally rinsed in hot water, which causes it to dry quickly without rubbing. The plates are then oiled or lacquered to preserve them. Plates which have been heavily rolled or too quickly chilled after tinning do not afford a good crystallized surface. Hot tannin or strong caustic soda solutions can also be used to develop the crystalline structure of tin plates.

(2) S. M. S. asks for the best process for bleaching sheepskin parchment white, or nearly so, without leaving streaks and spots or injuring the smoothness and durability of the parchment. A. Expose the pieces to strong sunlight under glass in a moist atmosphere until bleached.

(3) J. N. asks: Would California red wood do to make wine casks, and how could it be prepared that it would not stain the juice? Red wood is much cheaper than white oak staves for casks, and if a way could be devised that would not stain the grape juice, its use in wine making would be very advantageous. A. If the wood were impregnated by soaking it for some time, with a strong, hot, aqueous solution of alum, and then (after rinsing lightly) with a hot, slightly alkaline solution of soap, containing a little glue, followed by rinsing in water, so as to fix the color and fill the fibers with insoluble aluminum soap and gelatine tannate, it might be made to serve the purpose of wine-storage vessels very well.

(4) G. B. asks how to soften white lead that has stood four years so as to render it fit for use. A. Break up the hardened paint and triturate it in a mortar (or paint mill) with just enough hot linseed oil to soften it properly, then thin down with oil of turpentine.

(5) A. C. asks: 1. Should a frame house be painted soon after its erection, or allowed to remain for a time unpainted, exposed to the weather? I think, some time ago, you advised the latter course, but I have forgotten the reason you gave for it. A. It is not well to put paint on new woodwork at once, unless the latter has been previously thoroughly seasoned, which is very frequently not the case; and under any circumstance it is well to delay such painting until the new work has been exposed to sunshine and dry weather for a few days. 2. Likewise, should a cistern be covered or allowed to remain uncovered so that the air may get to it? A. Cover the cistern.

(6) J. F. K. C. asks if there is any cheap mode of inscribing on brass, besides engraving. Have seen something of the kind in the SCIENTIFIC AMERICAN. A. Use a fatty ink and a rubber stamp having a negative die. Print the design with this on the metal, let it dry somewhat, and etch away the uncovered parts with dilute nitric acid: water 3, acid 1. Clean off the ink with sand and benzine.

(7) E. R. asks how to prepare leaf tobacco with chemicals or otherwise for cigarette or pipe smoking. It has been packed down one year. I now break up the leaves, then dry in the oven; but it smokes too strong. A. Try the following: Thoroughly wet the tobacco, then pack and put under strong hydraulic pressure, after which spread it out as soon as possible in thin layers to dry quickly in contact with cool dry air.

(8) C. A. S. asks: How much power will the new battery, described in SCIENTIFIC AMERICAN of September 3, develop in connection with an electro-motor? Or how many cells would be required to develop one horse power, constant use ten hours per day? Is there a better battery for this purpose? A. This is a matter of experiment we have not sufficient data at hand to make the required estimate. The Grove, Ladd, Bunsen, and similar forms of battery produce currents of greater electromotive force, but they require very much more space and attention, and cost more to maintain.

(9) F. H. G. asks: 1. What is the best way of preparing a solution for silver plating, and the one least liable to strip? A. The following is a good bath: Soft water, 1 gallon; cyanide of potassium, 8 ounces; nitrate of silver, 5¼ ounces. Dissolve the silver nitrate in a small quantity of soft water, and gradually add, with constant stirring, solution of cyanide of potassium until no further precipitate of silver cyanide forms (avoiding any excess of the precipitant). Throw the precipitate on a fine cotton cloth filter, and as the liquid runs through, wash the precipitate on the cloth with pure water. Mix and dissolve this washed precipitate with the water in which has previously been dissolved the cyanide of potassium. If the silver cyanide does not dissolve readily add more cyanide until it does. 2. Is it necessary to use pure silver both for making solution and for anodes? What effect does it have if the silver is not pure? A. Yes; if the silver used is impure the bath will be likewise, and it is impossible to obtain a reguline deposit of pure silver from such a bath. 3. What battery is the best for silver plating? A. The Smee form is generally preferred for fine work. See article on Silver Deposits, page 81, vol. xliv.

(10) J. J. R. asks: 1. Can you inform me of any way of silver plating iron or cast steel polished surfaces, without first depositing a copper surface or the usual process of scouring with lava dust? A. See article on Silver Plating, page 81, vol. xliv. 2. Is there not a solution or solutions that remove the saponified grease from the surface of the article to be plated which leaves it immediately ready to receive a deposit of silver? A. Iron and steel can only be satisfactorily freed from the last traces of oxide—after rinsing in hot water on coming from the lye dip—by scouring. If properly pickled and scoured in the first place the pieces will not require much after scouring.

(11) G. P. H. asks how to make a good quality of court plaster. A. Soak isinglass in a little warm water for seventy-four hours, then evaporate nearly all the water by gentle heat, dissolve the residue in a little proof spirits of wine, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cool. Now stretch a piece of silk or sarsanet on a wooden frame, and fix it tight with tacks or packthread. Melt the jelly, and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is said to be very pliable and never breaks.

(12) E. Y. asks how to make a cement for glass that will resist acids. A. Take 10½ lb. of pulverized stone and glass, and mix with it 4¾ lb. of sulphur. Subject the mixture to such a moderate degree of heat that the sulphur melts. Stir until the whole becomes homogeneous, and then run it into moulds. When required for use it is to be heated to 248°, at which temperature it melts, and may be employed in the usual manner. It resists the action of acids, never changes in the air, and is not affected in boiling water. At 230° it is said to be as hard as stone.

(13) X. asks how to mould ornaments for patterns for stoves, vases, etc. A. The following composition is commonly used: Soften 12 lb. of good glue in water enough to cover it, then heat until the glue is dissolved. Melt 7 lb. of resin, ½ lb. of pitch, and 2½ pints of linseed oil together. Stir the hot glue solution into this and add enough whiting to thicken. It should be mixed in small quantities and used at once; otherwise it will require steaming before it can be used.

(14) O. E. M. wants to know how to bleach straw. A. Straw goods are bleached by submitting them to the action of the vapor of burning sulphur—or better, to the vapor of burning bisulphide of carbon. The straw, which must be perfectly clean, must be well moistened with pure soft water before submitting to the sulphuric oxide. The bleaching is carried on in tight wooden sheds. Straw may be bleached by chlorinated lime, but the fiber is liable to be somewhat injured thereby. Moisten the goods thoroughly in a strong aqueous solution of the bleaching powder (defecated), and then pass them through a bath of sulphuric acid diluted with about 20 parts of soft water. Repeat if necessary, and finally rinse thoroughly in water containing a small quantity of sulphur or hyposulphite of soda.

(15) A. W. M. wants to know what is the best general antidote to poison. A. If a person swallows any poison whatever, or has fallen into convulsions from having overloaded the stomach, an instantaneous remedy, most efficient and applicable in a large number of cases, is a heaping teaspoonful of common salt, and as much ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is scarcely down before it begins to come up, bringing with it the remaining contents of the stomach. And lest there be any remnant of the poison however small, let the white of an egg or a teaspoonful of strong coffee be swallowed as soon as the stomach is quiet; because these very common articles nullify a large number of virulent poisons.

(16) "Photo" asks for a good receipt for retouching varnish. A. In his recent work on retouching, M. Janssen, the *Photo Correspondenz* says, recommends the following varnish: Alcohol (sp. gr. 0·830), 60 parts; sandarac, 10 parts; camphor, 2 parts; Venetian turpentine, 4 parts; oil of lavender, 3 parts. This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The varnished film is in the best condition for retouching when a day old.

(17) E. J. writes: I am overrun with rats and mice, and as yet have found no remedy. Can you give a receipt for an effective rat and mouse exterminator? A. Try the following: A mixture of two parts of well bruised common squills and three parts of finely chopped bacon is made into a stiff mass, with as much meal as may be required, and then baked into small cakes, which are put around for the rats to eat.

(18) H. E. K. asks for a cheap way (cheaper than by windmill) to raise half of the water from a spring that throws two and a half gallons of water a minute, up to the house five rods distance, ten feet high. A. We know of nothing that will answer your purpose. A hydraulic ram will raise only about one-fourth to one-sixth of the water expended.

(19) L. B. asks: 1. What is the horse power of a horizontal tubular boiler 10 feet long, 42 inches diameter, 36 3-inch tubes? A. Your boiler would be usually called 25 horse. 2. Can I get more power of an engine with a larger fly wheel than a smaller one? I have an engine, 8x12 inch cylinder, and have 5 foot fly wheel, weighs about 600 lb. Can I get more power out of the engine by putting on a larger wheel, and what size; or will it do as well to add another wheel of 600 lb. weight on the other side of the shaft? The engine makes about 140 revolutions in a minute. A. You cannot increase power by more fly wheel. You can only equalize speed. If the power is not uniform it might be well to add another wheel.

(20) P. R. writes: 1. Suppose a sash and its counterweight to weigh 100 lb. each, the pulley to support 200 lb. Then, will the tension on any part of the cord be 200 lb.? If not, please explain. A. The tension on each side of pulley will be 100 lb., and total weight on pulley 200 lb. 2. Why could not the cables of the East River Bridge be kept higher in the middle and consequently the bridge, as the greatest objection is because it is too low; or is it necessary to have a certain amount of sag in the cables? A. To do so would necessitate carrying up the towers to a greater height. The cables cannot be straightened without enormously increasing the strain.

(21) C. C. G. writes: Please inform me approximately the quantity of coal a 25 horse power engine, run to its full capacity, would use in twenty-four hours; also, how much water it would require? A. It depends much upon the character and condition of the engine and boilers. An average would be 100 to 130 lb. coal, and 750 to 950 lb. water per hour.

(22) T. J. M. asks: Why is it that an injector attached to a steam boiler of 12 horse capacity, and running under a pressure 50 lb., will not raise water for feed supply from a well 50 feet deep? Ours has so far failed and a competent (so regarded) engineer says 50 feet is the limit. If this be so what is our best resort to accomplish the work indicated? A. The very best form of injector will not raise (or lift) water reliably, one half of 50 feet. If it would produce a vacuum, it could not be relied upon to lift water higher than a good pump, say 26 or 28 feet. We think your best way will be, to set a pump in the well about 22 to 25 feet above the surface of the water and lift the water into a tank for the injector.

(23) R. E. M. wants to know how to make a plaster cast from the human face. A. Place the subject upon his back, with the head raised to the normal position by a pillow of bran or sand; cover the parts intended to be cast with a film of olive or true almond oil, applied with a feather brush or lump of cotton; plug the ears with cotton wool, and insert two quills or pieces of glass tubing in the nostrils and secure the space around them with cotton. When all is ready mix the plaster of Paris with warm water to about the consistence of cream, and with this cover the face from the forehead downward to the lower border of the chin. The eyes should be firmly closed, but in such a manner as not to cause distortion by too violent compression. Then cover the parts of the chest and arms to be represented, carrying the plaster upwards, so as to join the cast of the face. Then (when properly set) carefully remove each, and soak or brush it with linseed oil boiled with a little sugar of lead or litharge. Instead of casting the face and chest in two separate pieces, it is preferable to make the casting in one piece, and to divide it into 4 or 5 sections before removing, by means of threads placed in position before the plaster is applied, and withdrawn when the latter has nearly set. The cast of the back of the head is usually taken by lowering it (well oiled) into a deep trencher partially filled with the liquid plaster, and the back of the neck with the subject face downward. When the mould is finished it is firmly tied together, the joints plugged with a little cotton wool, well oiled on the inside, and a sufficient quantity of tolerably fluid plaster poured in. When the outer portions of the model have nearly set the inner portions are scooped out, and the whole thoroughly dried before removing the mould. The model is trimmed with a sharp knife. If the eyes are not to be represented as closed they must be carved out from the mass.

(24) G. L. asks how to temper large curved dies for cutting iron and steel plate. A. Fill the holes with fire clay and wire to keep it in place. Heat evenly and slowly in a furnace. Lift the dies from the furnace with the face vertical and plunge vertically into water heated to about 50° and containing about ½ lb. salt per gallon. Hold them still at the bottom of the water until cooled.

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

C. H. H.—1. It is a ferruginous earth mixed with small fragments of broken glass—not metalliferous. 2. We could not undertake to say just what drugs the mixture is composed of, but we can recognize in it flour,

sulphur, camphor, mustard, and oil.—J. McF.—1. It is a piece of common red jasper with a few crystals of iron pyrites. 2. It is feldspar with a little quartz and hornblende.—R. S.—The clay is very impure—it might be used for the manufacture of cheap red bricks, but would hardly pay to attempt purification for pottery. The other sample has not come to hand.—P. B. O. J.—It is coal shale. The markings observed are those of fossil ferns of the coal period. These shales are quite too common to be of any commercial value.

NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON THE MANUFACTURE OF STARCH, GLUCOSE, STARCH-SUGAR, AND DEXTRINE. By Julius Frankel. Edited by Robert Hutter. Philadelphia: Henry Carey Baird & Co. 8vo, cloth, pp. 344. $3.50.

This, the only volume on the subject in the English language, is chiefly on the work of Professor Ladislaus von Wagner, of Buda Pesth, reputedly the best treatise produced in Europe. It is illustrated by half a hundred engravings, including examples of the most recent American machinery. It describes briefly yet fully the history and chemistry of starch, the different methods of manufacturing starch from potatoes, wheat, corn, rice, and other grains and starch yielding substances; the history, literature, technology, and manufacture and uses of starch sugar, dextrine, and allied products; and seems throughout to be well calculated to accomplish its avowed purpose, namely, to advance and improve a group of industries which have suffered from mystery, secret processes, and empiricism, and the lack of progress inseparable from such modes of procedure in any industry.

SPITZLI'S MANUAL AND ILLUSTRATED CATALOGUE. By Alfred Spitzli. Second Edition. West Troy, N. Y.: A. & A. F. Spitzli. 1881. $1.

The catalogue is a fairly comprehensive list of instruments, accessory apparatus, books, etc., for designers and manufacturers of textile fabrics. The manual contains nearly two hundred pages of definitions, derivations, and explanations of technical terms peculiar to textile manufactures, descriptions of the nature and uses of many substances employed in such manufactures, processes, rules, tables, etc. The compiler professes to have no theories to introduce, his aim being simply to present the best authenticated information of value, especially to beginners in textile manufactures.

UNDERGROUND TREASURES: HOW AND WHERE TO FIND THEM. By James Orton. Philadelphia: Henry Carey Baird & Co. $1.50.

A new and enlarged edition of the late Professor Orton's little key for the ready determination of the more common useful minerals. Seventy-seven different minerals are plainly described and the principal places of their occurrence in the United States are named. With a set of illustrative specimens it would make a valuable addition to any boy's or farmer's library. By itself it will enable any intelligent person to make a fair estimate of the probable value of any minerals he may discover.

AMERICAN NERVOUSNESS: ITS CAUSES AND CONSEQUENCES. By George M. Beard. New York: G. P. Putnam's Sons. 12mo, cloth, pp. 352.

In this volume Dr. Beard has presented in the bright and suggestive style which is characteristic of him the observations and opinions already familiar to the public through his lectures and contributions to the periodical press. Unlike most medical specialists he is disposed to take a hopeful view of the maladies he has chosen to study, so far at least as to consider them largely curable and likely to be diminished in severity by the natural progress of American society toward more reasonable and wholesome living.

MENSURATION AND METRICAL GEOMETRY. AN ELEMENTARY TREATMENT OF MENSURATION. By George Bruce Halstead. Boston: Ginn, Heath & Co.

So far as can be judged without working through it with a class of students this treatise appears to be excellently well planned and executed.

SHAKESPEARE'S OTHELLO, THE MOOR OF VENICE. By Rev. Henry N. Hudson. Boston: Ginn & Heath. Sq. 16mo, pp. 209. 65 cents.

The twentieth of Mr. Hudson's edition of Shakespeare's plays annotated for use in schools and families. The editor's rank as a Shakespearean critic is well known. The type and printing are attractive, the paper good, and the size of the volume convenient for holding and carrying.

ELEMENTS OF ALGEBRA. By G. A. Wentworth, A.M. Boston: Ginn & Heath. $1.45.

In the preparation of this school book Professor Wentworth has given abundant evidence of a clear appreciation of the needs of the student as well as of singular skill in the art of book-making.

English Patents Issued to Americans.

From September 6 to September 9, 1881, inclusive.

Coffee beans, utilizing products of, R. S. Jennings, Baltimore, Md.
Electro-magnetic telegraph, A. F. & F. B. Johnson, Brooklyn, N. Y.
Electro-magnetic machines, coiling wire on, Haase & Recker, Indianapolis, Ind.
Electrical apparatus, C. Dion, New York City.
Electric light, W. S. Hill, Boston, Mass.
Faucets, C. Whittaker, Chicago, Ill.
Fire extinguishers, A. Burritt Hardware Company, Waterbury, Conn.
Gas, manufacture of, F. Egner, Norfolk, Va.
Lighting, W. Wheeler, Massachusetts.
Loom shuttles, J. S. Jaques & Co., Lowell, Mass.
Pyroxyline, J. W. Hyatt, Newark, N. J.
Pentograph machines, J. Hope, Providence, R. I.
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A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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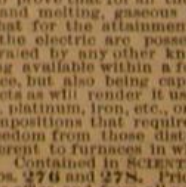

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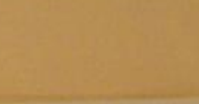

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Fully Warranted for Six Years.

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All who wish to secure this Organ at $90 must order at once as the price will soon be advanced to $125.

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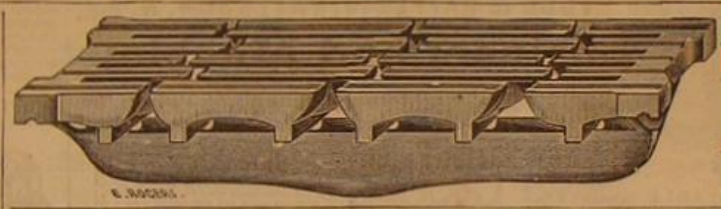

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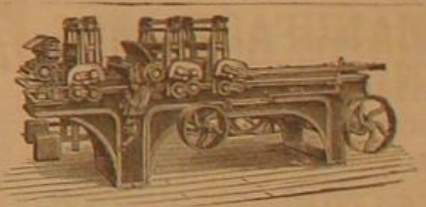

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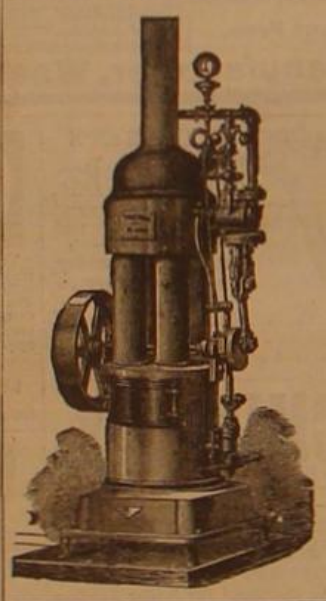

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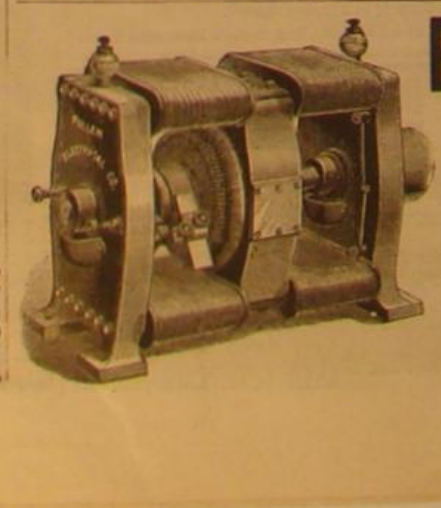

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Vol. XLV.—No. 16. [NEW SERIES.]

NEW YORK, OCTOBER 15, 1881.

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THE RAUB CENTRAL POWER LOCOMOTIVE.

We present illustrations of a new system of constructing railroad locomotives, recently patented by the inventor, Doctor Christian Raub, of New York city. The object of this invention is to construct a perfectly balanced locomotive, in which the center of gravity is coincident with the vertical median line of the engine, and in which the motive power is located at the middle of the engine in a plane extending through the center of gravity. These two objects being attained, it is hardly possible to overestimate the value of the invention, since the locomotive will then be constructed upon correct principles and according to natural laws. It works from its center, and has its motive power situated in a plane extending through its center of gravity, and has therefore no dead weight.

It is not within the scope of this article to review the various attempts and experiments undertaken in the course of time in this direction, but it may be stated generally that the problem of locating the center of gravity in a railroad locomotive upon the center of its base formed by the driving wheels, and to place the motive power at that center, had not been solved before the invention of Dr. Raub; and probably the reason why these attempts have not been successful is, that the fact was not sufficiently realized that Stephenson's system was at variance with the principles above referred to, and that nothing short of a radical change of

[*Continued on page* 245.]

Fig. 2

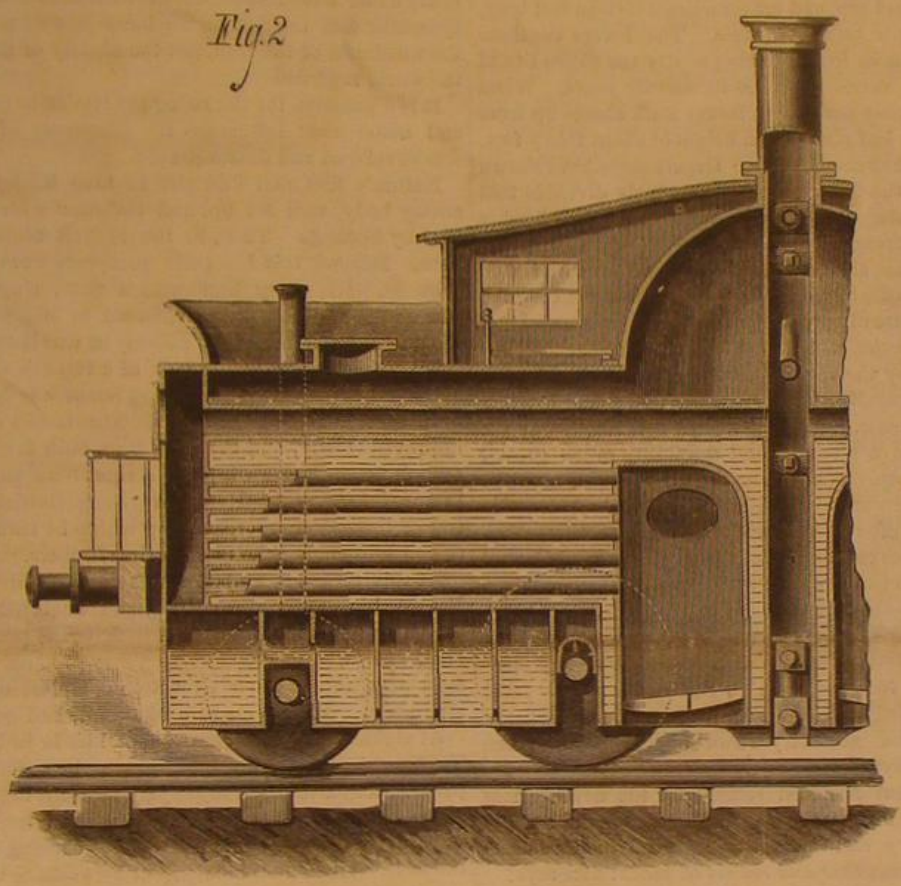
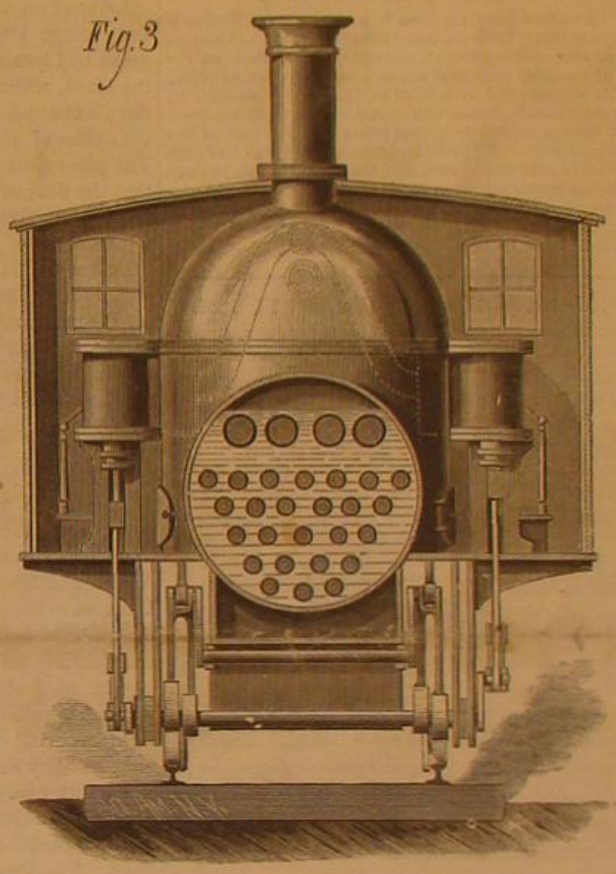
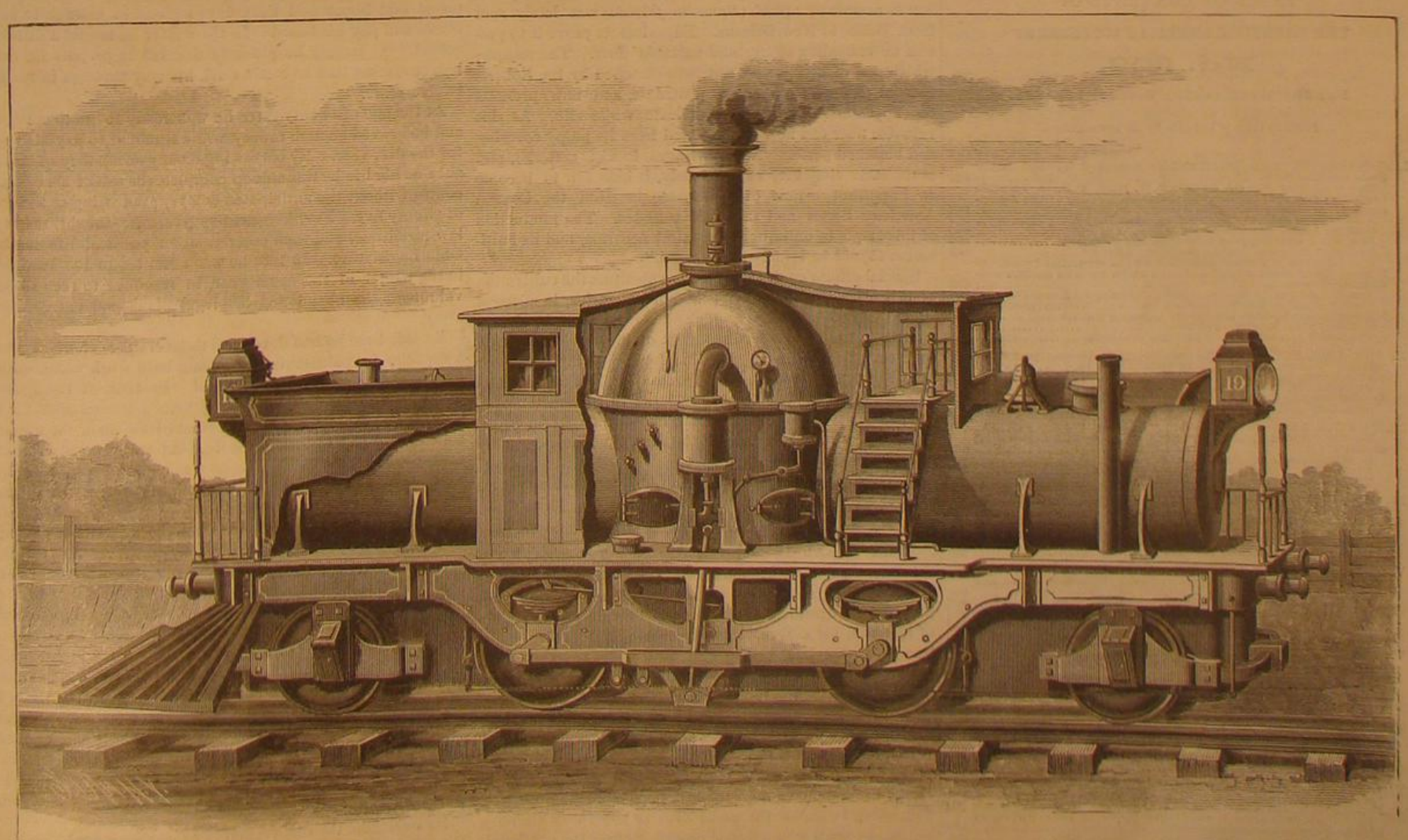


Fig. 3





THE RAUB CENTRAL POWER LOCOMOTIVE.

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NEW YORK, SATURDAY, OCTOBER 15, 1881.

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A FIELD FOR INVENTION.

With the utilization of every new natural product there is required a more or less extensive group of new machines and implements. It is not surprising, therefore, that with the increasing attention paid to the American agave as a fiber plant there should come a demand for new implements and appliances to be used in securing and cleaning the fiber.

The plant (*Agave americana*) is described as a member of the amaryllis family. It is put to a great variety of uses by the natives of Southern Mexico and Yucatan. A gentleman commercially interested in the development of this plant says that a coarse thread has long been made of the fiber. The disagreeable gummy substance which forms the bulk of the thick leaves has peculiar saponaceous properties, which has caused the agave to be known sometimes as the soap plant. When the leaf is split longitudinally the surface of the hollow center is found to be so thickly covered with fine particles of silica that it makes an excellent hone for sharpening knives, razors, and other edged tools. There are quite a number of varieties of the agave. In arid soils and on the uplands its leaves, in a cluster around a stalk which reaches but a few inches above the ground, are often not more than a foot or two feet long, very thick, and six to eight inches broad at the base. Other varieties are known as Bromelia, Henequin, silk grass, Ixtle. On the lowlands, especially in Yucatan, Honduras, and Nicaragua, where the pita grows most luxuriantly, the leaves are narrow and thin, containing a smaller amount of gum and sap, and are sometimes sixteen feet long, the average length being ten feet. The leaves continue green and increase in length during nearly the entire life of the plant, which varies from ten to seventy years. When the plant approaches maturity a flower stalk shoots up from the center of the leaf cluster to a height of about thirty feet. The plant then flowers and dies. Experiments have shown that the fiber of the finest varieties is so finely divisible that it can be advantageously woven with silk. It bleaches without loss of strength, and takes dyes as perfectly as any fiber known. It has also been successfully woven with cotton and wool. The uses to which the natives have put the fiber are the manufacture of bowstrings, nets, ropes, mats, sacking, fish-lines, hammocks, and a few coarse garments. They obtain the fiber by the very primitive method of gathering the leaves and pounding it out between stones and "whipping" it to cleanse it. Yet prepared in this rough way the product possesses a strength and durability much greater than manila hemp. When combed out with a comb or hackles it has been pronounced equal to the best Russian flax. From the different varieties of this plant fibers of all the different grades can be obtained from Mexico and Central America sufficient to supply the whole world. Exports from Yucatan to Europe have been found very profitable, although the quantity exported is yet small. An American company has recently established a mill with machinery for preparing the fiber not far from Vera Cruz, but the yellow fever which has prevailed at that port has prevented the company from securing the necessary labor and work has been unnecessarily delayed.

Another company has been formed for the development of this and other fiber plants in Honduras, having secured for this purpose a vast tract of country on the Caribbean coast. The Panama *Star and Herald* of recent date says:

"A sample of 'pita' (*Bromelia febrista*) was lately sent from Belize to New Orleans. Experiments prove it to possess an exceeding strong and valuable fiber. The sample, which was of a yellowish tint, was bleached by the Roberts Kendal process to a snowy whiteness, and now presents the appearance of fine and delicate white silk. As this valuable fiber can now be extracted from its pulpy covering and bleached perfectly white without loss of material, and at the same time very expeditiously, it bids fair to become an important article of commerce between the Central American States and the United States. The production of this staple is unlimited in Central America, and its cultivation should be largely encouraged."

Special efforts are being made to substitute the cultivation of this plant in the French island of Mauritius, in place of sugar and other crops which have failed. A planter appeals to the Paris correspondent of the *World* to set the problem of inventing a machine for preparing the fiber before our "clever American inventors." He says: "The man who does that will not only powerfully contribute to the prosperity of our little island, but—which is far better to a practical mind—he will at the same time most certainly make his own fortune."

The pita or agave fiber brings in London an average price of $150 a ton.

THE MORAL INFLUENCE OF THE TELEGRAPH.

"One touch of nature makes the whole world kin."

Men have accepted this saying in a broader sense than Shakespeare dreamed. But for a world-wide manifestation of its truth, for a signal demonstration of the kinship of humanity, men have had to wait until science and invention had brought all nations into something like instant communication. It was the touch of the telegraph key, a favorable opportunity being presented, that welded human sympathy and made possible its manifestation in a common, universal, simultaneous heart throb.

We have just seen the civilized world gathered as one family around a common sick bed, hope and fear alternately fluctuating in unison the world over as hopeful or alarming bulletins passed with electric pulsations over the continents and under the seas. And at last, on the same day, the nations stand in sympathetic mourning: a spectacle unparalled in history; a spectacle impossible on so grand a scale before, and indicative of a day when science shall have so blended, interwoven, and unified human thoughts and interests that the feeling of universal kinship shall be, not a spasmodic outburst of occasional emotion, but constant and controlling, the usual, everyday, abiding feeling of all men toward all men.

THE LESSON OF MR. GARFIELD'S YOUTH.

Nothing that Mr. Garfield ever did will mark so grand an issue, or contribute so much to emphasize the new era upon which humanity has entered, as his dying. It was everything that he did and attempted in life, however, and especially the manner of his doing and attempting, that made it possible for his death to be one of the notable deaths of history.

After all, there is nothing that the world esteems so highly as broad, forceful, generous, genuine manliness; and it was because Mr. Garfield had acquitted himself nobly as a man in his long and arduous struggle with life and death that the best men and women of all nations lamented the untimely ending of his career. It is true that the exigencies of political life had resulted in his achievement of one of the most conspicuous and honorable positions among men; but neither that nor the atrocity of the crime which cost him his life could alone have awakened such national and international sympathy and interest as we have just witnessed. It was the manliness of the man, not the dignity of his station, that the world regarded.

It is a question for the rising generation to consider: How and under what influences the manliness of Mr. Garfield was developed and demonstrated.

Nature's first and best gift to man he had at birth—a strong body, well set up, and endowed with vigorous and healthy instincts. Thus, in the highest sense, he was well born. Beyond this his early prospects were certainly not brilliant. His early home was a rude, single-roomed log house in the wilderness. Orphaned in his second year by the death of his father, the poverty he was born to was intensified and saddened by the lack of a father's care and guidance. For fourteen years the log house was his home, and hard work his chief educator. The family circumstances improved slowly, and the older boys built for their mother a small frame house with three rooms on the ground and two under the roof. Here was young Garfield's home for two or three years more, during which he earned something at odd jobs among the neighboring farmers.

At this time his ambition was to be a sailor on the lake. His ambition was not gratified, and he hired himself to a cousin at ten dollars a month to drive the horses of a canal boat. He was now seventeen years old, an age at which most boys regard their education complete or hopeless of attainment. His, so far as books went, had not begun.

At eighteen a fit of sickness kept him in bed for months. To divert him from his intention to be a sailor his mother persuaded him to begin to prepare himself to be a country school teacher. Then, if he still desired to, he could sail summers and teach winters, and so be earning something all the time. He had no money, but by working with a carpenter at odd hours and Saturdays he earned enough to buy books and pay his board. In the winter he taught a district school. At twenty he pluckily decided to prepare for college, counting that he could work his way through in ten or twelve years.

At the age of twenty-three he was ready to go to college, and had saved enough money while teaching to pay his way for the first year. By borrowing money on a policy of insurance on his life he was able to complete the rest of his college course without the anticipated delays, graduating at the age of twenty five. For the next five years he taught, reading law meantime, and then entered upon political life in the Ohio Legislature. In 1861 he was admitted to the bar, and in the winter of the same year, in response to the call for volunteers, he abandoned his legal plans and entered the army.

By this time he had developed those traits of character and a capacity for painstaking effort and hard work which made his promotion comparatively rapid. In 1863, at the age of thirty-two, he resigned a major-general's commission for a seat in the U. S. House of Representatives upon the urgent solicitations of President Lincoln. After seventeen years of diligent service in the House he was chosen to represent his State in the Senate, but before taking his seat he was elected President of the United States.

It is impossible here to touch upon those details of character and circumstance which fittingly illustrate the nature, severity, and grand success of the struggle upward to be seen in the life we have so baldly outlined. The lessons to be learned from such a life cannot be too strongly commended to the young, whether born to poverty or wealth.

The early life of poverty and hard work which young Garfield inherited undoubtedly developed much of the force and manliness which he displayed in after life, and saved him from many of the hinderances and temptations incident to inherited riches and social position; but it must not be forgotten that the vigorous body and passionate nature, which he disciplined and made the basis of a pure and lovable manhood, carried and involved moral hazards not less than those of wealth.

He overcame the disadvantages of early surroundings, as thousands of other young men have, simply because he

willed to and was willing to pay the price of personal and social advancement in hard and patient effort, integrity of purpose, and a readiness to do his best in everything that might fall to him to do. He made opportunities to work where he found none open, and when responsibilities were laid upon him by his townsmen or countrymen he met them bravely and studied hard to fit himself for the duties to be performed. Above all, he sought to prove himself in all things worthy of his own self-respect. There was one man, he said, whose good opinion he desired before all others, for that man he had to eat with, and work with, and sleep with; his name was James Garfield.

There is not a young mechanic who reads these lines, however humble his position, however scanty his opportunities, who cannot rise in position, knowledge, and personal worth by the same means. He may not gain great learning, great wealth, or fame by the effort, but he cannot fail to gain what is worth more than all these in themselves—a higher, truer, and more enjoyable manhood.

The failures of some men are grander than the successes of others. And while Mr. Garfield's life, tried even by conventional standards, was a splendid success in the end, it should not be forgotten that during most of his life sudden death would have found him in the ranks of the worthily inconspicuous, with those "who failed on earth great men to be, though better than the men who wore the crown."

It was a sincere, purposeful, kindly, and laborious life that made it possible for the close of his life to be signally conspicuous and his memory revered. Any youth who will can accomplish the life, though kind Fortune may spare him the pain and the glory of so tragic a termination of it.

THE HOLY WELL AT MECCA.

When Mohammed captured Mecca, which had been regarded for ages by his countrymen as a place of peculiar sanctity, he interfered with the worship of the Black Stone (probably a meteorite) which the angels had brought from heaven, and of the Zemzem, or Holy Well of Hagar, only so far as to suppress the ancient polytheistic rites. This well is close beside the Caaba or Square House, the chief sanctuary of the Mohammedan world.

The princes of Islam maintain at Mecca keepers of the Holy Well, who annually supply them with water to be used on great occasions and in great emergencies, as when stricken with disease. Every pilgrim to Mecca—and thousands come thither from all countries—visits the well and is purified by drinking the water or pouring it over his person, or both. The water is described as unpleasant in taste and cathartic in effect—qualities which are now to be accounted for without recourse to miracle.

With Occidental irreverence the British Consul-General at Jeddah has sent a bottle of the water to the Royal College of Chemistry at South Kensington to be analyzed. Dr. E. Frankland, in his report of the analysis, says that the water is of the most abominable character. "In fact, it is sewage more than seven times as concentrated as London sewage, and it contains no less than 579 grains of solid matters per gallon. Knowing the composition of this water, and the mode of propagation of Asiatic cholera by excrementitious matters, it is not to be wondered at that outbreaks of this disease should often occur among pilgrims to Mecca, while it would scarcely be possible to provide a more effective means for the distribution of cholera poison throughout Mohammedan countries."

It would be interesting to know the composition of the waters of other holy wells of which Islam has by no means the monopoly.

STEAM BOILER NOTES.

A foreign correspondent wishes to know why locomotive boilers work satisfactorily with so much less steam room per horse power than is usually found in marine boilers. He cites good English practice to show that fully three-fourths of a cubic foot of steam room is allowed per indicated horse power in marine boilers, while only one-eighth to one-twelfth of a cubic foot is allowed in locomotive boilers, and asks, To what shall the steam room be proportioned, if not to the indicated horse power? The answer to the first part of the inquiry is, the greater pressure relatively to the power developed in the locomotive. But the subject does not seem to admit of such categorical treatment as our correspondent seems to indicate by the tone of the query. Perhaps an empirical rule might be made from a sufficient number of experiments, embracing most of the conditions of modern practice, but the factors of the problem include everything that affects the rate of evaporation and the free escape of the steam from the surface of the boiler water and the steam pressure.

The efficiency of the heating surfaces, the ratio of grate to heating surface, the rate of combustion, the circulation of the water, the quantity of water and its depth upon a unit of heating surface, the surface area from which the steam escapes into the steam space, the pressure upon that surface relatively to the power developed by the engine; and inasmuch as the number and volume of the cylinder charges for cut-off engines are determined, in some degree, by the grade of expansion for a given power, the point of cutting off enters with the other numerous factors into the problem.

An illustration in point is of a small winding engine the boiler for which was, for special reasons, made small and upright, and intended to work at about one hundred and fifty pounds of steam, but it was thought best to test the machinery at a lower pressure than the design contemplated; so, in order to get full speed, it was adjusted to work steam nearly full stroke of the piston. The foaming and priming of the water was, however, so bad as to prevent the use of the engines under these conditions; but at the higher pressure, and with a correspondingly high grade of expansion, there was no further trouble from foaming. It will probably occur to the inquirer that locomotives are worked at all grades of expansion and at considerable variations of pressure, but a little thought will lead to a correct appreciation of the difference in causes that produce priming in different types of boilers.

As a general proposition, it may be said that, other things being equal, high-pressure boilers require less steam room per unit of power than low-pressure ones.

The explosion of the boiler in Card & Co.'s sawmill, near Monroe, Jasper County, Iowa, resulted in the instant death of E. N. Garnant and the fatal injury of M. L. Card, on the 17th of September.

The locomotive of a freight train between Chetopa, Kansas, and Parsons, on the Missouri Pacific road, exploded September 21, wrecking the engine and a dozen cars, killing Geo. Adams, engineer; Simon Bailey, fireman; John Denny, and a man named O'Neil. One of the victims was blown two hundred yards and terribly mangled. Bailey's head was blown off and could not be found.

A boiler explosion occurred at the mines of the Dunbar Furnace Company, Dunbar, Fayette county, Pa., on the 16th of September. James McDonald, fireman, was fatally, and George McAnally dangerously injured, and several others were slightly hurt.

The boiler of a thrashing machine exploded at Thurlow, Ont., Friday night, September 23, killing Andrew Lloyd, Messrs. Malcolm and Anson, and Miss Caldwell, and seriously injuring three others.

The method of feeding water to steam boilers has fully kept pace with other improvements in steam engineering. The plan of serving cold water to locomotive boilers, which prevailed only a few years ago, is now a thing of the past, greatly to the advantage of the boilers. The injector in its early days was not understood, was not reliable, and it was therefore shunned by careful engineers as a boiler feeder. The difficulty has now been fully met and overcome by the Korting Double Tube Injectors, which are shown in full lines at the American Institute Exhibition. They are made to work at all pressures, and to *lift* hot or cold water and deliver it at the rate of from 80 to 4,000 gallons per hour. They are compact, self contained, and easily set up by any steam fitter, and they will start readily, operated by a single handle, without any adjustment for variations in steam pressure. The boilers of the Institute are being fed with one of them, which any one, no matter how inexperienced, can learn to put in motion and regulate while "you wait."

These fine goods, with a line of Straightway check valves are shown by A. Aller, of 109 Liberty street, New York.

Exhibition of Smoke-preventing Apparatus.

The Department of State at Washington is in receipt of a communication from the British Legation, relative to the exhibition to be held in London of apparatus of all kinds devised to prevent smoke and to consume smokeless as well as other kinds of fuel. The exhibition will be open from October 24 to 26 inclusive, and the Department has been further informed by the British Charge d'Affairs at Washington that the committee has decided to consider favorably all applications from foreign exhibitors throughout the whole of September, and they will, as far as possible, reserve space for late exhibits, so that none may be excluded.

American Awards at the Geographical Exhibition in Venice.

The following awards were made to the American Section of the Geographical Congress:

Group First.—A letter of distinction to the engineering department for topographic and hydrographic surveys of the Northern lakes, the St. Lawrence and Mississippi river internal improvements, maps of battle fields, and other geographical works; also a letter of distinction for the geographical surveys in charge of Captain Wheeler for accuracy in topographical surveys west of the one hundredth meridian.

Group Second.—A letter of distinction for the best model of the Gulf of Mexico and for the sea soundings of Commander Sigsby and other officers of the navy; also a letter of distinction for the report of Commander Green on international longitudes, hydrographical charts, American ephemerides, a publication on the solar eclipse of 1878, and other papers by naval observers; a diploma of honor of the first class for a list of lighthouses, bound sets of charts, and other publications; a letter of distinction to the engineers of the Department of Geological Natural History and for the examination for Clarence King's exploration along the fortieth parallel; also a letter of distinction for Captain Wheeler's geographical surveys and works on natural history west of the Mississippi; a similar letter to the Signal Service Department and Weather Bureau for an extended series of tidal weather maps.

Group Sixth.—A letter of distinction to the Post Office Department for a series of announcements and other publications; a diploma of honor of the second class to the Agricultural Commission, and for reports on forestry by Professor Hough; honorable mention is made of the statistics of the Treasury Department for their quarterly and other reports.

Group Eighth.—A letter of distinction to the Engineer Department for Captain Wesscher's exploration and survey west of the Mississippi.

ELECTRO-METALLURGY.

ELECTROTYPY.

In taking impressions or moulds of *under-cut* or highly-wrought work it is necessary to use a flexible substance to admit of separating the mould and model without injury to either. For these purposes gelatine—or gelatine and glue or sirup—and gutta percha are employed. Glue (of the finest quality) or gelatin is softened by soaking over night in cold water, then removed from the water and dissolved by aid of heat in a quantity of pure glycerine equal to the dry glue taken. This mixture is kept over the water bath for several hours, and is then ready to pour over the warm, well-oiled model. After standing for several hours, or until thoroughly cooled, it may be removed from the model by careful manipulation. When removed it is dipped repeatedly in a solution of one ounce chromic acid in a quart of water, each time being exposed to strong sunlight (every part), which renders the surface waterproof and non-absorbent. When dry the surface may be metallized, and a strong current with a large anode used at first in the bath. With such work much care is necessary to exclude air bubbles from the deep-wrought portions.

In using gutta percha the moulding operation is conducted either by press, by hand, or in a stove.

By hand.—After purification in boiling water, plates of various thicknesses or lumps are formed.

A quantity sufficient for the intended mould is cut and put into cold water, which is gradually heated until the gutta percha is soft enough to be kneaded like dough. After having pulled the gutta percha in every direction the edges are turned in so as to form a kind of half ball, the smooth convex side is applied to the middle of the model, then it is spread over and forced to penetrate the details of the object. The kneading is continued as long as the material remains sufficiently soft, when it is allowed to cool somewhat. While at a temperature of about 80° Fah. it is separated from the model and dipped into cold water to harden, and may then be handled without danger of impairing its accuracy.

With some models it is preferable to heat the gutta percha in a copper dish with constant stirring until it becomes a semi-fluid paste. This is poured over the pattern previously placed in an iron ring. After a few minutes it may be kneaded in with wet or oiled fingers until it scarcely yields to pressure. In removing the mould from the pattern all useless parts, especially those which have passed under the pattern and bind it, must be first removed. Then the proper position and shape of the covered pattern must be ascertained so as not to break the model or tear the gutta percha.

For moulding by sinking or kneading the following composition is preferable to pure gutta percha: Gutta percha, 2 parts; linseed oil, 1 part. Heat the oil in a copper vessel to about 212° Fah., then gradually stir in the gutta percha cut fine. When the whole is in a pasty form and begins to swell up with the production of thick fumes, throw the contents of the kettle into a large volume of cold water, where, without loss of time, the paste must be kneaded, and, while still hot, rolled upon a slab of marble and passed between mediumly warm rollers.

Gutta percha may be used an indefinite length of time.

In moulding by press.—After the object has been coated with plumbago or tallow it is put square and firm upon the table of a screw press, and surrounded with a frame or ring of iron a little higher than the most raised portions of the model. A piece of gutta percha at least the thickness of the pattern is cut so as to fit the ring or frame of iron, and then heated on one of its faces only before a bright fire. When about two-thirds of its thickness has been softened it is placed, soft portion downward, in the iron ring or frame, and the whole covered with a block of metal exactly fitting. It is put under light pressure at first, the force being increased as the gutta percha becomes harder or more resisting.

Stone moulding is resorted to with models the brittleness of which renders them liable to injury when pressure is applied—plaster of Paris, alabaster, marble, etc. The object is placed upon a plate of iron or earthenware, a ball of gutta percha is placed on the middle of the object, and the whole is set in an oven where the temperature is just sufficient to melt the gutta percha, which, as it softens, penetrates all the details; when it has sunk completely it is removed from the oven and allowed to cool off until it retains just enough elasticity to be separated from the pattern.

Gutta percha is entirely insoluble in water, weak acids, or acid salts. When moulded it is prepared for the deposition of metal by being coated with a film of graphite or bronze powder.

Grass Fired by a Meteorite.

A fire ball was seen to fall at Springfield, Ill., about 10 o'clock of the night of September 21. It resembled in appearance an electric light, and it fell with a rushing sound like that of a sky rocket. The dry grass was set on fire where it struck, and the grass burned to a wooden sidewalk connecting with fences and wooden buildings, before the fire could be extinguished with water.

Vegetable Blacking.

The "Shoeblack Plant" is said to be the name popularly given to a species of Hibiscus growing in New South Wales, and remarkable for the showy appearance of its scarlet flowers. Growing freely in almost any kind of soil, the plant is frequently cultivated for the flowers, which, when dry, are used as a substitute for blacking. The flowers contain a large proportion of mucilaginous juice, which, when evenly applied, gives a glossy, varnish-like appearance, which is said perfectly to replace ordinary blacking, with the advantage that it is cleanly in use and can be applied in a few moments. Four or five flowers, with the anthers and pollen removed, are required for each boot, and a polishing brush may be applied afterward, if desired. A few plants of the *Hibiscus rosa sinensis* growing in the garden would remove one of the minor disadvantages of a day in the country, where the roads are dusty and Lee and Bixby are almost unknown. Chinese ladies use the juice of the flowers for dyeing their hair and eyebrows. In Java the flowers are really used for blacking shoes. The plant is a native of India, China, and other parts of Asia. It would be interesting to ascertain to what extent, if any, the Althea, or Hibiscus Syriaca, and the Swamp Rose Mallow, another member of the Hibiscus family, possess the same property.

NEW CLOTH-CUTTING MACHINE.

The enormous quantities of ready-made clothing annually produced in this country has created a demand for some more expeditious plan of cutting out garments than the usual way of cutting them by hand. Several kinds of cutting machines have been manufactured to meet this expressed want. None of these machines, however, have met satisfactorily all of the requirements of the trade, and their introduction has been effected to a limited extent only.

The machine shown in our illustration is claimed to be practically perfect in its operation, upward of two years having been spent in perfecting every detail of the machine and bringing it to the high standard which it has attained.

The machine is based on a principle radically different from any cutting machine that has heretofore been devised, and, as claimed by the inventor, the great success of the machine is due to this novel principle of action.

Instead of being laid on a solid wooden table, as usual, the layers of cloth, piled up to a height of from two to four inches, are placed upon a bed or support consisting of rows of upright wires fastened to a backing of wood, the wires being cut to a uniform length, so that their upper ends present a perfectly level surface.

The working parts of the machine are mounted on a firm base, alongside of and independent of the supporting bed, and are constructed to travel over a surface fifty or more feet in length, if desired.

The cutting instrument cuts upward instead of downward, and can be freely moved in any direction so as to follow the lines of a pattern marked on the top layer of cloth, the peculiar character of the supporting table permitting this movement without difficulty.

The machine has been in use in Philadelphia for some months past, and has been examined by numerous manufacturers from different parts of the country, who have been unanimous in their indorsement both of the machine and its work.

The machine now in use, driven by a two-horse power engine, works with wonderful rapidity and accuracy, the knife easily following the most intricate designs and cutting through thirty-four thicknesses of heavy cloth without apparent effort. As the cloth is not lifted from the table while being cut the arrangement of the layers is not disturbed and the cuts are perfectly uniform in each layer, and as the movable parts of the apparatus are above the cloth the manipulation of the machine is effected without that friction or drag which attends the operation of an ordinary cutting machine.

The machine has an estimated capacity of 2,500 coats per day, or a product equal to that of 25 skilled cutters.

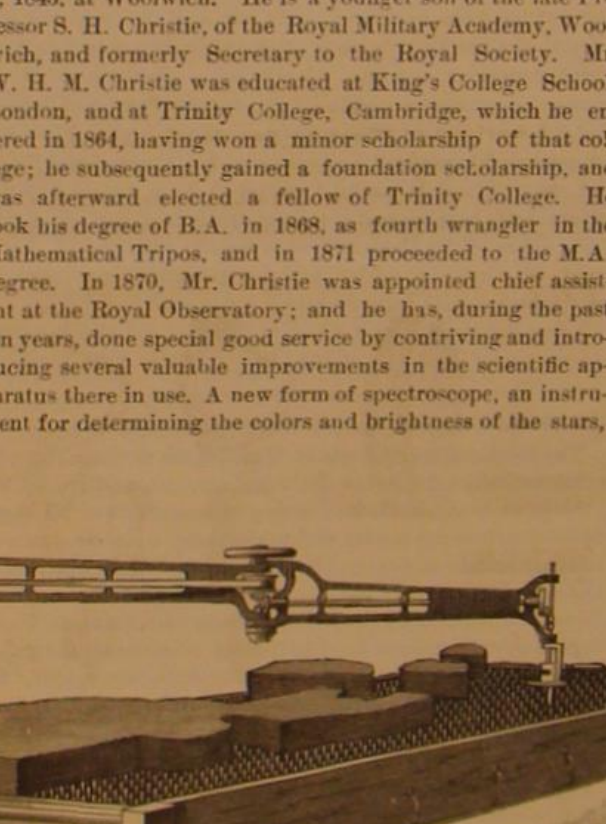
With this machine is an attachment for accurately cutting, without previous marking, from one to two hundred strips of materials of any width at a single cut, and cuts them either on the bias or at any angle across the pile of goods. They are very convenient for seam binding and other purposes. The attachment travels on the side of the table, and is connected when in use to the pressure foot of the machine, which it causes to pass in a straight line.

The machine is the invention of Mr. W. R. Fowler, the inventor of the well-known Fowler fly fan, and is manufactured by Mr. Martin J. Myers, of 819 and 821 Market street, the owner of the patents, who may be addressed for further information.

THE AMERICAN CLOTH-CUTTING MACHINE.

THE NEW ASTRONOMER ROYAL.

Mr. William Henry Mahony Christie, who has succeeded Sir George Airy in the office of Astronomer Royal at the Royal Observatory, Greenwich Park, was born on October 1, 1845, at Woolwich. He is a younger son of the late Professor S. H. Christie, of the Royal Military Academy, Woolwich, and formerly Secretary to the Royal Society. Mr. W. H. M. Christie was educated at King's College School, London, and at Trinity College, Cambridge, which he entered in 1864, having won a minor scholarship of that college; he subsequently gained a foundation scholarship, and was afterward elected a fellow of Trinity College. He took his degree of B.A. in 1868, as fourth wrangler in the Mathematical Tripos, and in 1871 proceeded to the M.A. degree. In 1870, Mr. Christie was appointed chief assistant at the Royal Observatory; and he has, during the past ten years, done special good service by contriving and introducing several valuable improvements in the scientific apparatus there in use. A new form of spectroscope, an instrument for determining the colors and brightness of the stars, a recording micrometer, and a polarizing solar eyepiece, are to be mentioned as his inventions. In the recent address of the President of the British Association, at York, a passing reference was made to Mr. Christie's work in verifying the results obtained by Dr. Huggins, with regard to the motions of stars, as inferred from spectroscopic observations. The new Astronomer Royal has directed particular attention, at the Royal Observatory, both to spectroscopy and to photography, as a means of recording the observations. He is a fellow of the Royal Society, and was elected Secretary of the Royal Astronomical Society last year. He contributed to the proceedings of the Royal Society, in March, 1877, a paper "on the magnifying [illegible] of the half prism, as a means of obtaining great dispersion, and on the general theory of the half prism spectroscope." To the monthly notices of the Royal Astronomical Society he has furnished these: in June, 1873, a paper on the recording micrometer; in January, 1874, on the color and brightness of stars, as measured with a new photometer; in May, 1875, on the determination of the scale in photographs of the Transit of Venus; in 1876 (January) on a new form of solar eyepiece; (May) on the displacement of lines in the spectra of stars; (November) on the effect of wear in the micrometer screws of the Greenwich Transit Circle; same year (December) on the gradation of light on the disk of Venus; in 1878 (January) on specular reflection from Venus; (June) on the existence of bright lines in the solar spectrum; in 1879 (January) on a phenomenon seen in the occultation of a star by the moon's bright limb; in 1880 (November) on the spectrum of Hartwig's comet of that year; in 1881 (January) on Mr. Stone's alterations of Bessel's refractions; (May) on the flexure of the Greenwich Transit Circle, and some further remarks on Mr. Stone's alterations of Bessel's refractions; besides various papers on the Greenwich spectroscopic and photographic observations, communicated by the late Astronomer Royal; and a paper which will be found in the Memoirs of the Royal Astronomical Society, published in January, 1880, on the systematic errors of the Greenwich North Polar distances. Mr. Christie is also the founder and editor of a journal entitled *The Observatory, a Monthly Review of Astronomy*, which has been published during the past four years; and he is author of the "Manual of Elementary Astronomy," published in 1875 by the Society for Promoting Christian Knowledge. These particulars we gather from the *Illustrated London News*, and our portrait from the London *Graphic*.



PROFESSOR W. H. M. CHRISTIE, F.R.S.,
The New Astronomer Royal.

MISCELLANEOUS INVENTIONS.

An improved fastening or locking device, especially designed to endure without injury the excessive strains that trunk locks are subject to, has been patented by Mr. David W. Eggleston, of Terryville, Conn. The invention consists of a laterally swinging unjointed hasp, designed to be pivoted on the body of the trunk, having a large opening in its free end that sets over and coincides with a socketed and perforated nose or lock plate which is designed to be fixed on the trunk cover.

An improved electric lock has been patented by Messrs. William R. Manierre and Henry B. Porter, of Chicago, Ill. The object of this invention is to provide an electrical attachment for locks, which will indicate at once the surreptitious opening of the lock by other means than the key.

An improved folding leaf extension table has been patented by Mr. John Bismann, of Fairview, W. Va. It consists in the peculiar construction and arrangement of the parts, the extra leaves being folded within the table and always ready for use.

Mr. William Weiss, of New Orleans, La., has patented an improved and simple device for opening tin cans, which device can be used as a cover for the opened cans. The invention consists in a circular plate of metal provided with a flange, and with a pointed or sharp edged tooth or stud a short distance back of the edge, and projecting in the same direction as the flange, and with a handle on the opposite surface, which plate is pressed upon the head of the can, so that the stud will pass through the head, when the plate is turned by means of its handle, causing the sharp stud to make a circular cut in the head of the can.

An improved cigar maker's working board or table, which is handy and compact and can be transported very conveniently, has been patented by Mr. Bernhard Becker, of New York city.

Mr. Heinrich A. W. Braune, of Memphis, Mo., has patented a cheap and efficient solar camera, which is light and portable, and may be readily taken apart or set up, as required. Any ordinary tube may be used in the instrument, and no extra tubes are required. The print being detached from the camera box, the printing may be watched and the light regulated according to the shades desired. The instrument may be readily handled and managed by one person.

PATENTED IMPROVEMENTS IN JEWELRY.

We give illustrations of a few recently patented improvements in jewelry. The invention shown in Fig. 1 is an improved method of incrusting and enameling precious stones, such as onyx and agate. It consists in first engraving the design into the stone to be ornamented, then pressing or moulding a thin plate of gold into the indentation, then removing, enameling, and burning the plate, next replacing and cementing the plate into the stone, and finally grinding the surface of the enameled portions flush with the surface of the stone. This is the invention of Messrs. Peter Appel and Charles P. Appel, of West Hoboken, N. J.

Fig. 2 represents an improved fastening for ear jewels, patented by Mr. G. W. Washburn, of West New Brighton, N. Y. In this invention a neat and inconspicuous curved tube is made to inclose, conceal, and protect the bolt and spring of a secure locking device, adapted to fasten automatically with a distinct "click," which gives audible notice to the wearer when the ear wire is locked. The ear fastening is readily unlocked by the wearer or an attendant. The engraving shows the fastening both closed and open, and gives also an enlarged sectional view of the fastening.

Mr. David Untermeyer, of New York City, has lately patented an improved separable finger ring, shown in Fig. 3. This finger ring is so constructed that the shanks can be detached from the heads and replaced with larger or smaller shanks. The head has sockets upon its inner side, and the shank has hooks upon its ends, so that the setting may be detached and replaced by another at the will of the wearer. The engraving shows the ring and setting separately, also a sectional view of the two parts put together.

Fig. 4 shows a combined finger and scarf ring, patented by Mr. Carl Bachem, of Pforzheim, Baden, Germany. This is an improved finger ring, which can be used in a convenient manner as a scarf ring without any extra fastening device. The invention consists in making the ring in five parts, which are hinged together so that the two hinged sections opposite to the central stone setting may be sprung inwardly for use as a scarf ring. The hinged sections adjoining the stone setting are provided with raised cheeks, which abut against the setting when throwing the remaining sections in outward or inward direction.

An improved method and device for connecting gems, patented by Mr. August Schaffer, of New York City, is shown in Fig. 5. The object of this invention is to connect agates and similar stones of natural or artificial color, cameos, and the like, in such a manner that the upper stone projects above the surface of the lower stone or table. By this connection a larger variety of combinations can be made from this class of stones, to be used for articles of jewelry and other purposes. The improvement consists in connecting two agates or other stones by recessing or dovetailing the lower stone or table on its upper surface and the upper stone or step at its bottom surface, inserting into the recess a connecting piece or key of copper, and filling up the small wedge-shaped spaces or cavities between the connecting key by electro-deposition.

Fig. 6 shows a very pretty article of jewelry that may be changed so as to be used for different purposes. This piece of jewelry is made in the form of a cross, with detachable side pieces, pin, and hanger, so that by removing the side pieces the middle piece can be used as a lace pin and the side pieces as earrings. This invention has been patented by Messrs. Leon P. Jeanne, of Woodside, and Louis P. Jeanne, of Greenville, N. J.

IMPROVEMENTS IN JEWELRY.

NEW INVENTIONS.

Mr. John Flinner, of Millersburg, Ohio, has patented an improvement in gates. The object of this invention is to combine with a vertically swinging gate a suitable latching device adapted to be operated by the lifting rods and the levers by which the gate is raised. The gate has a stationary latch near the bottom of its swinging end, and a sliding latch near the top of same end, in combination with a recessed gate post and suitable mechanism for operating the sliding latch and raising the gate.

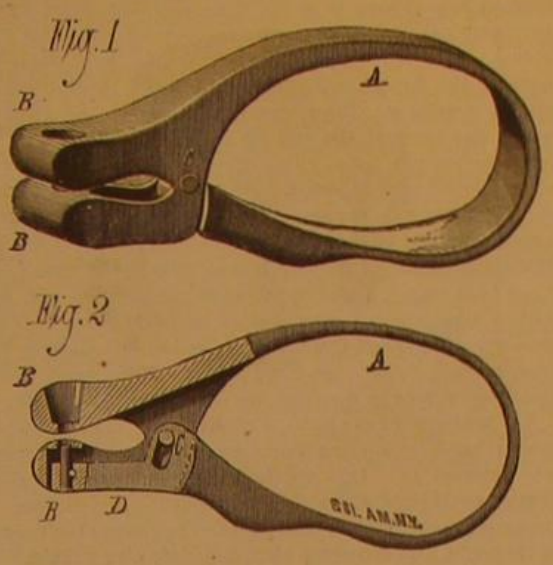
An improved loom shuttle has been patented by Mr. John W. Sohn, of Columbia, Pa. The invention consists in the combining, with a shuttle body and vertical spindle, of an end perforated lever and a subjacent spring.

An improved butter worker has been patented by Mr. Elvearo Stout, of Ottumwa, Iowa. This invention relates to improvements in that class of butter workers in which a frame carrying a roller is reciprocated in a box having slots in its sides, the bottom faces of the slots serving as bearings for a transverse rod in the roller frame as it is moved back and forth in the box.

Mr. John Murray, of New York city, has patented a toy wagon with a figure of a driver having a hinged body, and connected by a rod with a crank formed upon the forward axle, so that the movement of the wagon will give the figure the appearance of whipping the horses; and also with a figure of a boy connected with a crank formed upon the rear axle, so that the movement of the wagon will give the figure the appearance of jumping up at the rear end of the said wagon.

NEW TICKET PUNCH.

The engraving represents a novel ticket punch recently patented by Mr. George A. Gunther, of Bath, and William Kowalski, of Brooklyn, N. Y.



GUNTHER'S TICKET PUNCH.

The object of this invention is to simplify and cheapen the construction of ticket punches and to make them convenient to carry.

The ticket punch has a curved spring and jaws made in one piece, the upper jaw having a groove to receive the lower jaw, a curved recess to receive the ticket and carrying the female die, and the lower jaw carrying the male die and having a slot to receive the stop pin that limits the movements of the jaws.

Fig. 1 is a perspective view of the punch, and Fig. 2 is a sectional view.

A Carload of Blasting Powder Exploded.

A remarkable explosion occurred at Council Bluffs, Iowa, Sept. 26. A car laden with blasting powder consigned to Denver had been refused by the Union Pacific Railway Company and returned to the yards of the Chicago and Rock Island and Pacific Railroad, where from some unknown cause it was exploded. The concussion demolished the company's round house, repair shops, brick freight houses, and about forty or fifty freight cars. The explosion dug a hole in the ground fifteen feet deep and forty-five feet in diameter. Large windows in all parts of the city were shattered, sheets of plastering were torn from houses, and damage was done in all directions. Even in Omaha, on the opposite side of the river, large windows were broken by the concussion, and as far as the Missouri Valley, twenty miles north of Council Bluffs, the damage done was heavy.

Accidents to Railroad Employes.

British railroad accidents during the first three months of the current year are reported to have killed 269 and injured 1,078 persons. These accidents, however, include injuries to persons on the track, etc., by trains, as well as train accidents. There were but 3 killed and 276 injured by the latter, against 17 killed and 225 injured in the first quarter of 1880. The comparison with the accidents in this country, as reported in our columns, is as follows:

	1881.		1880.	
	Killed.	Injured.	Killed.	Injured.
United States	95	612	36	132
Great Britain	3	276	17	225

We were working something more than five times as many miles of road as there were in Great Britain; but our train-mileage was not by any means large in proportion. The *Railroad Gazette* says: The result in 1880 was decidedly favorable to this country; but for this year it is extremely unfavorable, our train accidents having killed *thirty-two* times as many and injured more than twice as many as the British train accidents. We may comfort ourselves somewhat by the reflection that last winter was extraordinarily unfavorable and productive of accidents.

Discovery of Beautiful Minerals.

Prof. B. Silliman records, in the *American Journal of Science*, the discovery of vanadinite and other crystalline salts of lead, of great beauty of color and perfection of form, in the Territory of Arizona. Some of the varieties—crocoite, a chromate of lead, and vauquelinite, a variety containing copper—have never before been found in North America. Vanadinite, chloride of lead, and vanadium, hitherto a rare species, promise now to be comparatively abundant in the silver district in Yuma county and other localities.

It is found in veins of quartz which lie between foot walls of granite and hanging walls of porphyry, the latter being similar to the usual associates of silver ore the world over. The quartz veins have also other salts of lead and argentiferous galena, but no gold. Vanadinite occurs in the "Hamburg," the "Red Cloud," and the "Princess" mines. That in the "Hamburg" is the best. The crystals are small and highly lustrous, varying in color from deep orange-red to reddish-yellow and brown.

In "Red Cloud" they are a rich flame color, and are found in rather confused masses. In "Princess" mine occur slender crystals of a brilliant red color bedded in white calcite. They are very perfect in form, and have been mistaken for chromate of lead.

Other rare species are found in the *Vulture District*, in the vicinity of the "Vulture" mine, while at "Collateral" mine, about twenty-five miles northeast of "Vulture," is the most interesting locality. The vein is about four and one-half feet wide in soft gray talcose rock. About one-half of the thickness of the vein is quartz stained green with chrysocolla and chocolate-brown with ground mass which contains vanadium. The colored masses all give strong reaction for vanadic acid.

A seam of very red ferric oxide and calcite follows next. The calcite contains crystals of vanadinite, and the oxide reacts for vanadic acid; then there is a seam of lemon-colored crystals. The whole soft mass of the vein reacts for vanadic acid, and specimens of rare beauty are found in the cleavage fragments of the calcite.

Among the ores found in this "Collateral" mine is a mineral which may prove to be descloizite. The tests of it indicate the presence of vanadium, lead, copper, manganese, and zinc, but more specimens are needed to complete the study of it.

A specimen is referred provisionally to the volborthite species.

This mineral has a green color, and contains copper, lime, and vanadic acid. It was named after Volborth, its discoverer; but the specimen discovered in "Collateral" mine may turn out to be a new species.

A mineral like Domeyko's *eKleite*, but not a clay-like mineral, which yields a globule of lead containing a nucleus of copper, occurs both in this mine and in the "Chromate," and something similar also is found in the "Phœnix" mine. The Montezuma lead mine abounds in vanadinite in the form of hexagonal prisms.

What may prove to be *mottramite* has been found at the "Frenchman's" mine. Wulfenite, molybdate of lead, which does not contain vanadic acid, has been found in crystals of rare beauty in "Red Cloud" mine, as well as the vanadinite before mentioned. It is also found in the "River" mine.

Three or four species of the *crocoite* group, that is, chromic acid with oxide of lead, occur in the "Collateral" and the "Chromate" veins, but as yet it has not been found

well crystallized. Before the study of these interesting localities can be complete a personal visit must be made by a mineralogist to the mines and sufficient material obtained on the spot to allow of a chemical analysis.

Correspondence.

A Stroke of Lightning.

To the Editor of the Scientific American:

Your article of August 6, describing the lightning stroke at Manhattan Beach Hotel, calls to mind a similar occurrence at Masonic Temple a few years ago.

The flagstaff, about fifty feet high, on the central dome, had at the top a gilded ball. It was struck by lightning soon after it was put up, and about twenty feet of the top of it was broken off and thrown two hundred feet from the building, leaving a tall splinter on a stump.

The metallic ornamental cresting of the dome had been carefully gilded, and connected with the sewers of the city, through the cast iron water conductors of the building, by means of twisted copper rods, about three-eighths of an inch by three fourths of an inch, in anticipation of possible lightning strokes.

The missing portion of the staff above the stump and below the top of the tall splinter was reduced to matches and toothpicks, and scattered upon the main roof of the building.

The track of the fluid was marked upon a portion of the original surface of the spar remaining on the splinter by a spiral line scorched on the wood, but below a point six feet above the iron band, to which the guys were attached, no marks were seen to indicate that the spark had followed the wood to its connection with the iron.

The gilded ornaments of the cresting were twelve feet at least from the point where the track disappears from the wood, so that if the fluid left the spar to follow the prepared lightning conductors, and rejected the course through more direct metallic connections, there must have been strong reasons for its preference.

I write this hoping you may have something more to say on the subject of protecting buildings, as well as persons and animals, from the capricious action of lightning. Its freaks appear to be little understood by the public.

New York, September, 1881. JOHN W. KELSEY.

Encke's Comet.

This celebrated periodic comet is now in a favorable position for observation in the eastern sky after midnight. Its period is the shortest of any known comet, making its revolution about the sun in three and one-third years. It has no tail, but presents a round flat disk, slightly condensed near one edge, ill-defined, and brush-like upon the opposite edge.

The comet's position in an observation made by me yesterday was right ascension 6 hours 42 minutes; north declination 42 degrees 54 minutes. This brings it on a line drawn easterly from Capella through Beta Aurigæ and about one and a half times as far from Beta as Beta is from the first named star. It is at present moving about three degrees daily in this direction—a very little south of east. On October 1 its position will be R. A. 8 hours 2 minutes, + 42 degrees 5 minutes, or about 10 degrees northeast of the well known star Castor. On October 10 it will be in Leo Minor, R. A. 9 hours 51 minutes, + 34 degrees 50 minutes. October 20 the comet will be in R. A. 11 hours 31 minutes, + 19 degrees 59 minutes, or about 4 degrees north of Denebola or Beta Leonis.

This very interesting comet may be well seen with moderate sized telescopes, and will amply repay the trouble of picking it up. It is quite a bright object in the five inch aperture reflector. A three inch refractor with a good low power or comet eyepiece should readily show it. It is visible with an aperture reduced to two inches.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,
September 26, 1881.

An Erratic Season.

Of the first eight months of 1881, four—January, February, March, and June—were decidedly wet, the rainfall exceeding by six inches the average of the corresponding months for a period of forty-one years. April, May, July, August, and September have been exceptionally dry, particularly April and August. During these months the rainfall was over ten inches below the average. The record by months for the longer and shorter periods named, as compiled by Dr. Draper, Central Park Observatory, stands as follows:

	41 years. Inches.	1881. Inches.
January	3·30	4·80
February	3·40	4·93
March	3·76	5·81
April	3·80	0·95
May	4·51	3·20
June	4·13	5·35
July	4·02	1·25
August	4·74	0·86
Average total	31·66	27·15

The maximum rainfall, in forty-one years, for the month of August, was 15·26 inches in 1843, and the minimum this year 0·83 inch. The maximum for April, for the same period, was 9·05 inches in 1857 against 0·95 this year.

STEAM ENGINE NOTES.

At the last weekly meeting of the Polytechnic Association of the American Institute, the President, Mr. Stetson, read an abstract from one of our technical journals, in which a correspondent avers that he runs an engine of 5 inch stroke at 600 revolutions, and has run it for a short time at 2,000 revolutions per minute. The diameter of the cylinder is 5 inches.

Mr. Sutton said the high velocity of piston was one of the marked innovations in modern engines, but these figures were extreme, and undoubtedly far beyond what was good policy. An Allen engine, 12 inch stroke, in one of the recent fairs of the American Institute, made 500 revolutions per minute regularly. High speed was one of the elements which has lowered the cost of fuel from 8 lb. to 2 lb. per horse-power per hour. Our Corliss engines, running at about the old rate of speed, have, in many cases, got considerably below 2 lb. per actual horse-power, and the Buckeye, a quick running engine, has got down very close to it. The Wheelock engine, at the late Millers' Fair in Cincinnati, had stood high among a host of excellent competitors, and had, with a high velocity, regulated so perfectly as to vary less than one of its quick revolutions in suddenly changing load from running light to ten-horse power. Even speed was of great importance in spinning fine thread, especially silk.

The tendency of the parts to change their dimensions and proportions by springing under great strains at high speeds was referred to. One speaker knew a modern upright engine, considered the acme of proportion and stiffness, to be sprung enough when heavy loaded to change the relation of the parts, and introduce obviously defective working. It was always all right when examined cold, and when worked slowly and lightly.

Steam-engine packing, was the subject of a brief paper by L. F. Lyne.

The paper referred to the difficulty encountered in the fact that almost all piston-rods are not true, and cites an instance in which the piston-rod, 12 inches in diameter, was out of the center of the cylinder about three-eighths of an inch, and varied in diameter about three-sixteenths of an inch. This rod was neither perfectly round nor straight, and was run at a high speed. This is a worse than ordinary example, but it is well known that it is almost impossible to get a piston-rod perfectly accurate. Piston-rods that have been long in use will, as a rule, be found smallest in the middle, and of an oval shape at the ends. It has been found, from experience, that the follower ends of a rod will be worn most upon the bottom, while the crank end will be most worn upon the top. All these causes make it hard to make the packing steam-tight.

It is customary upon locomotives, when putting in a new piston and rod, to set the piston about one thirty-second of an inch high, thus destroying the perfect alignment at once.

On locomotives new piston rods are sometimes nearly destroyed within forty-eight hours after they leave the shops. This is caused by the use of hemp that has gritty substance in it. So long as a piston remains in line there is little difficulty in keeping it tight with a good quality of fibrous packing which is entirely free from grit, but as soon as the glazed surface upon the rod is abraded or the parts get out of line it begins to cut and constant trouble may be expected.

The paper referred at some length to the very early use of metallic packing. A patent was taken by one Cartwright, November 19, 1797, in which he described flat matallic plates cut into segments, which were pressed against the piston-rod by steel springs in the shape of the letter, U. The first of which we have any authentic account of the pressure of the steam itself being used to hold the packing tight is in a patent to F. J. Johnson, February 10, 1863. This system has been developed by many subsequent inventors, and has proved to be highly satisfactory.

The present and most approved forms of metallic packing make use of this feature, and have a partial ball joint to allow of slight changes in the angle and positions of the piston-rod. A strong spring in one form or another is generally used to insure that the packing rings of soft metal remain in their position, bearing fairly against the rod. The substance of the soft metal rings has to be very carefully looked after. If lead or soft metal is used, grit will embed itself and wear away the rod, but when a proper mixture of anti-friction metal is obtained, it avoids this difficulty and shows great durability.

The cotton packing largely used in the steamers in New York waters for piston rod stuffing boxes was explained and drawn on the blackboard. It is by a recent improvement braided square and required but little compression to make it fit nicely when bent around the rod in the box. Much of it is now made of all cotton, the old core of square rubber being found to be of little account. The nature of cotton is to wear long and create a smooth surface of little friction. It is saturated with tallow and plumbago.

Mr. Sutton gave his experience with hemp packing for the piston head of a high pressure engine of some twelve inches diameter. It needed renewal every day or two days, but he liked it.

The President said modern improvements in boring and fitting had made elasticity far less necessary than of old in a packing for the body, or head, as some term it, of a piston. A perfect fit of metals together without any yielding was absolute perfection if the parts could be kept in this condition. Fulton's metallic packing, many years used and probably still used in large high pressure steamers on the Ohio River, was on this principle with simply peculiar means to make the fit. Soft metal rings were compressed by the follower of the piston and caused it to gush out till they just fitted; no elasticity was allowed anywhere. There was a patent on it, or, rather, on the use of thin copper or brass rings at the edges to keep the plastic metal from dragging out by the friction, but it had long since expired. Andrew Fulton, of Pittsburg, was the patentee, and used to supply it, and was very successful in getting the alloy just hard enough to serve properly.

The Michigan Fire.

The burning of the village of Bad Ax, the seat of Huron County, illustrates the awful suddenness of the assault of wild fire on most of the fated settlements and the completeness of the destruction wrought. A correspondent of an Eastern paper says:

It began to grow dark in the forenoon from smoke, and in a few hours the pitchy blackness was like that of a close cellar, so that it was impossible to see a foot. It was known that there were fires three miles south, but there was no thought of danger until suddenly there came a lurid glare, the flame and wind immediately followed, and in thirty minutes fifty-three of the fifty-five buildings in the place were in ashes. The courthouse was of brick, covered with slate, and there people went for protection. The building escaped destruction, and those within it were saved, although they suffered badly from heat. There were no lives lost here, but this was exceptional good fortune. Reports from some places are too horrible to read. Numbers of people flying from danger were overtaken and died in the roads, some perished miserably in wells and other places where they had sought safety, and in the terrible time a few women were taken with the pains of childbirth. Everywhere it is a sickening story of suffering and of roasting human flesh in every conceivable way. In some places the heat was almost incredibly intense, and the smoke was everywhere unendurable and caused many deaths by suffocation.

The work of destruction was very uneven. Some towns in the district escaped with a loss which seems trifling, while in others, apparently no more exposed, there are but a few scattering buildings left. The same was true of the villages, some strangely escaping, while others were strangely destroyed. In some fields the grass roots, and, it is said, the soil itself are burned so that it is impossible to tell whether the land was plowed or not, while in others near at hand crops of grain are left in the shock untouched.

A remarkable thing in the story of the calamity is the presence of mind that was everywhere shown. The people were accustomed to danger from fire, many of them had been through the similar experience of 1872, and there were fewer lives lost than might have been expected. There seems to have been but little panic and few threw their lives away. Nearly all sought to preserve themselves and property intelligently, to have done about the best that was possible and very much better than could have been expected. Domestic animals and fowls nearly all perished, and it is noted that they died in groups, each with its kind; rarely did cows, horses, or chickens die alone, but all sought the companionship of their kind. Great numbers of birds and insects took their way to the lake, and, overcome by the smoke no doubt, died and were found floating on the surface.

The Presidential Bullet.

In reviewing the case from an autopsical standpoint, it is quite easy to offer criticism. The stubborn facts of a *post-mortem* always stand out in bold relief against decisions rendered *ante mortem*. But it must be recollected that there were peculiar difficulties in the case. They are best appreciated by all who have had experience in the treatment of gunshot wounds. However greatly we may regret that, in view of the great public importance of the case, a correct opinion as to the course of the ball was not made at the beginning and was not proven at the end, it is quite difficult to see how the error could have been avoided. There were no symptoms during life to point to the locality of the ball. But, even at the worst, as proving that the surgeons never knew during the life of the patient where the ball was located, there is nothing to show that in consequence of that error the patient suffered. The ball itself, by being firmly encysted, became harmless, while the real cause of all the trouble had its origin seemingly in the comminution of the eleventh rib. It is a matter for much congratulation that the bullet was not found in a pus-cavity. Under such circumstances, even if it were impossible to remove the bullet, there would have been many who would have claimed that such an operation should have been attempted, or at least that the neglect to resort to such a procedure was indirectly the cause of the patient's death. But all doubts in such a direction are cleared up by the autopsy. On the supposition that the ball should have been extracted in any event, what have we not escaped? At least the wisdom of not cutting down upon the missile until the locality of the latter was clearly made out, cannot be gainsaid. As nearly two hours were consumed in finding the ball at the autopsy, what might have been the chances of extracting the missile during life?—*Medical Record.*

The St. Lawrence Tunnel Scheme.

Notice was recently made of a scheme for tunneling the St. Lawrence River at Montreal. It is now reported that the scheme is likely to be abandoned in favor of a bridge, the English member of the Tunnel Company having joined a railway company holding a charter for a bridge across the St. Lawrence near Lachine.

THE RAUB CENTRAL POWER LOCOMOTIVE.

[*Continued from first page.*]

the whole system of construction could lead to success; any improvement upon the original design, no matter how great, could not overcome the faults or disadvantages which were inherent in the system as a whole.

Dr. Raub, in order to definitely locate the center of gravity, has constructed his engine in such a manner that each half of the total structure, whether divided longitudinally or laterally, is an exact counterpart or duplicate of the other half, both as regards weight or measure; the consequence of this is that the center of gravity is in the intersection of the longitudinal and transverse center planes of the entire locomotive; and by placing his motive power in the central transverse vertical plane of the engine he has disposed the parts of his locomotive to the best advantage for economy and efficiency.

The engravings represent the invention so clearly as to require but little explanation. The whole engine rests upon an oblong platform which extends all around the structure, and which is made wider in the middle to support the engineer's cab, which will be as wide as the cabs now in use; at each side of the engine is a boiler extending longitudinally to the end of the locomotive, each boiler having a separate firebox, which is located in the cab. The boilers have ordinary flues, which terminate in a smoke chamber at the extreme ends of the locomotive, but instead of allowing the heat and gases to escape through smokestacks at the ends, as in the present locomotives, they are conducted through return flues of a larger size (as shown in Fig. 3) to an interior collecting smoke chamber, which thus collects the smoke and gases from both boilers, and allows them to escape through one common smokestack which stands above it. This collecting smoke chamber extends upward and downward vertically through the entire locomotive, and serves not only as a brace to the steam dome which surrounds its upper portion, but also gives an additional support and strength to the entire structure. The steam dome stands in the center of the locomotive, its axis being the exact center of the engine. It is stiffened by the collecting smoke-chamber which extends through it. A separate valved connection is made through this interior smoke-chamber for the steam as well as for the water in the boilers, so that both steam and water can circulate freely from one boiler to the other, or may be shut off if it is desired to use one boiler only. The steam cylinders are vertical, and placed outside the steam dome, their axes being in the vertical transverse plane extending through the center of gravity of the locomotive, and preferably placed as high as possible, so as to take the steam by means of pipes which receive their steam supply from a common opening at the highest point in the steam dome, the opening being closed by a throttle-valve operated in the usual manner. The steam chests are placed inside the dome as shown in Fig. 3.

The driving-wheels are situated equidistant from the center line, and upon them rests the whole platform, and in the center-line, and as near the rails as possible, is placed an intermediate driving shaft, to the cranks of which, on opposite sides of the locomotive, extend the connecting rods from the cross-heads of the piston rods above. The cranks of the two drivers on each side of this vertical connecting rod are connected in the usual manner by a horizontal driving rod, which, near its center, extends downward to the crank of the intermediate driving shaft and is connected with it. The driving rod is slotted in its center to allow the vertical connecting rod free play.

The eccentrics are placed upon the intermediate driving shaft, while the link motions are arranged on an auxiliary shaft vertically above it.

The locomotive may have horizontal cylinders, if they should be preferred. In that case they would be placed lower down in a line with the center of the driving wheels, but in the same central position.

At each end of the locomotive the frame rests upon a truck, but as the whole engine is evenly balanced upon and supported by the driving wheels, the object of the trucks is not so much to support any specific weight, as in other locomotives, as to serve as a guide over curves. Each end truck has one transverse axle with one pair of wheels and a frame which incloses the wheels and is connected by an arc-shaped guide piece, which is transversely guided in a fixed center box at the end of the locomotive.

The water tanks are below the boilers, openings being provided to allow the axles of the wheels to pass through. The fuel is carried in bunks arranged sideways and above the boilers.

A novel and ingenious plan is devised for feeding the boilers. The return flues being situated but a few inches below the water level, it is important that the level should be continually kept up. The inventor has, therefore, arranged a steam pump, which is worked by a lever connection with the main piston, and which injects into the boilers at each stroke of the piston the equivalent of water for the steam used.

These are the main features of this novel engine, which the inventor claims as the first locomotive built upon strictly scientific principles.

The advantages claimed for this new style of locomotive, and to which Dr. Raub has given the appropriate name of central power locomotives, are numerous.

This engine has no dead weight, therefore its whole power can be utilized for drawing freight; and it is claimed that a central power locomotive of any given size will do more work than another locomotive of the same size under the same conditions. The heat is better utilized, as it is led back through the boiler by means of the return flues, and the fuel will be more fully consumed than it is now. The collecting smoke chamber, which extends upward through the steam dome, serves to superheat the steam, consequently dry steam will be obtained, and the steam chests being inside the dome, no loss of steam from condensation will take place.* Should an accident happen to one of the boilers, the connection between the two may be interrupted, and the remaining boiler will be sufficient to propel the train to the next station, thus preventing blocks on the road and delays to traffic.

It is claimed that a train may be run at a much higher rate of speed with this engine and with much more safety than now, owing to the balanced driving wheels and the peculiar relation of the parts; and there is less danger of breaking the driving rods and less strain upon the track.

A separate tender will not be required, as both water and fuel are carried upon the locomotive itself; and, furthermore, turn-tables with their necessary attendance will become superfluous, since the locomotive is a perfect double-ender, and runs in either direction with equal efficacy and without any damaging effect to the gearing.

We understand that Dr. Raub is now making arrangements to build several locomotives according to his new system of different patterns and sizes, in order to practically test their merits and superiority and to ascertain the actual percentage of saving in running them.

The doctor has for many years been identified with several large Western roads, and is well known as a prominent and able railroad engineer.

New Railway Ventilating Apparatus.

The system of ventilating cars devised by Mr. Andrew J. Chase, of Boston, was put to a test on a car on the Boston and Albany road, Sept. 12, which is thus described by the Boston *Herald*:

"The 11 o'clock express train for New York was taken. Accompanying Mr. Chase was Mr. William B. Lindsay, assistant in the chemical department of the Massachusetts Institute of Technology, and Mr. Adams, the master car-builder of the Boston and Albany Railroad.

"Mr. Lindsay went for the purpose of measuring the velocity and volume of the air coming into the car by the supply pipes, and the velocity and volume of the vitiated air expelled, while the train was in rapid motion. The following is a brief description of the apparatus used in this system. There are two general principles involved in it: One, the supply of fresh air, freed from dust, cinders, etc.; the other, the expulsion of the foul air generated by the lungs and bodies of the occupants of the car. The air, as the train passes rapidly onward, is caught by a kind of scoop, or mouth, and is forced, cinders and all, downward through a pipe into a reservoir, where it strikes the water contained therein with sufficient force to be driven through it. After being thus cleansed and cooled the air is forced, by the pressure of the descending column, upward through another pipe or funnel, and discharged into the body of the car. This air, being pure and cool, naturally gravitates to the bottom of the car, displacing the warmer vitiated air, which then ascends to the top of the car, where it is got rid of by an ingenious device. This consists of two long pipes or tunnels laid upon the outside of the car, on each side of the monitor top. These tunnels are jacketed at both ends by a larger pipe, having a kind of bell mouth, to better gather in the air. Through these outer bell-mouth tubes—that is, the rear ones—the external air rushes with a velocity proportioned to the momentum of the car.

"This air, by its rapid movement, serves to siphon or pump the vitiated air out of the car, the tunnel used being connected with the interior of the car by small siphon pipes through which foul air is thus withdrawn. There are valves at both ends of the tunnels, which act automatically, the ones in front being closed by the pressure of the atmosphere, when the car is put in motion, while the rear ones are opened by the same pressure being exerted through the bell-mouthed jackets. The trip to Worcester showed how well the apparatus worked. The air in the car was kept sweet and pure, and it was absolutely free from cinders, dust being out of the question, as the recent rains had laid it. The trial was made under some disadvantages, the principal being that the induction pipes were of small caliber, and therefore the supply of air was, to some extent, limited. This, however, proved no defect in the system, but rather showed that any amount of air desired could be obtained by the enlargement of the induction pipes to the proportions desired. As it was, however, the day being cool and cloudy, the supply of air was ample to keep the atmosphere of the car fresh and clean. It may be stated that, by this system, in the hot summer weather, not only could the air of the car be kept pure and free from dust and cinders, but it could be cooled to a delightful temperature by the use of ice in the reservoir, or what would, perhaps, be better, ice and water combined.

"The following is the result of Mr. Lindsay's tests, as given by himself:

"'The velocity of the air entering through the ventilating pipes and also of that passing out through the exit flues was taken at several different times. The mean of these results thus obtained gives, I think, a fair determination of the amount of pure air entering and vitiated air leaving the car.

"'Mean of several determinations of the velocity of the air entering the car by the ventilator pipes, 1,243 feet per minute.

"'Mean of several determinations of the velocity of vitiated air leaving the car by exit pipes, 768 feet per minute.

"'Mean amount of air entering by ventilator pipes, five inches in diameter (two in number), per minute, 340 6 cubic feet.

"'Mean amount of vitiated air leaving by exit pipes, three inches in diameter (twelve in number), supposing the same velocity in each, per minute, 451 6 cubic feet.

"'A passenger car of ordinary size has a capacity of about 3,500 cubic feet. According to the above results, a volume of air equal to the cubical capacity of the car enters it in about ten minutes, when running at ordinary express speed. This air, moreover is free from all dust and cinders, in fact, clean, which is not the condition of that admitted by the usual method of ventilation. There is a very noticeable difference between the quality of the air in the car ventilated by this method and the ordinary passenger car.'"

Under Water Lamps.

A new method of illuminating the tanks at the Royal Aquarium, Westminster, was lately shown by means of the "Faure" electric battery, and which, so far as it went, was of a successful character. The lights shown were, to the number of six, submerged in the tank at the foot of the west staircase with excellent effect, showing up every fish and plant with great distinctness—a result impossible to attain under the old system of gas illumination. One of the great advantages of the electric over the gas lighting system is that the fish do not seem to mind in the least the close proximity of the incandescent lamps, while at the same time they do not suffer from the noxious emanations evolved during the combustion of gas. Under Mr. Faure's system a steady light of almost any intensity can be obtained, while the engines, which can be run without cessation during the whole of the twenty-four hours of the day, effect a great saving by their power of storing the electric energy, while at the same time they obviate the danger of a sudden accidental extinction of the other light employed. The electricity used for the lighting of the tank was generated in Woolwich and carried down to the aquarium, where it arrived but a short time before it was used.

Wind Power for Electric Lighting.

In an address delivered before one of the sections of the British Association, at York, Sir W. Thomson spoke of the utility of wind power as of possible service in electric lighting. He said that cheap windmills, in connection with dynamo-electric machines and Faure's batteries, would supply a great want. A Faure cell, containing 20 kilos of lead and minium, charged, and employed to excite Swan's lamps, would give 60 candle hours—that is, an aggregate light of 60 candles for one hour, or the light of one candle during 60 hours. The charging of such a cell could be done, with good dynamo economy, in any time from six to twelve hours, or more; and the charge might be drawn off, very economically, in any time of from five hours to a week or more. As calms do not often last above three or four days at a time, Sir W. Thomson argues that a five days' storage capacity would, in general, be sufficient. One of the 20-kilo cells already mentioned, charged at any time when the windmill works for five or six hours, could be used six hours a day for five days, giving a 2 candle light. Thus 32 cells would be required to give the light of four burners of London 16-candle gas. The probable cost of dynamo machine and accumulator (which we may take at £250 in this case) would not, in Sir W. Thomson's opinion, be fatal to the plan here sketched out, if the windmill could be obtained at anything like the cost of a steam engine of equal power. Sir W. Thomson confesses, however, that windmills are very costly machines; and without inventions not yet made, could not be economically used to give power for storing up electricity in Faure cells or in any other manner.

A Portable Electric Lamp.

Recently, while the mechanical section of the British Association were discussing the means of using the electric light in coal mines, Mr. Swan, inventor of the "Swan lamp," made a remarkable statement. He produced an electric lamp of two candle power, quite detached from any wire, and portable, which could be kept lighted for six hours by a two cell Faure secondary battery. The weight of the battery would not exceed ten pounds, and to charge it afresh it would only be necessary "to place it for a time in connection with the wires of a dynamo near the pit's mouth." The battery and lamp need never leave the pit. Sir J. Hawkshaw greatly approved this lamp, and well he might. The germ of a portable and handy electric lamp, unconnected with any wire, and fed at intervals only as an oil lamp is, must lie in that rude specimen shown.

Fans in a Hospital.

A large hospital at Madras, India, is ventilated by means of a system of fans operated by steam power. The machinery is simple, the hundred fans presenting an area of 2,050 square feet, being swung by a line of steel wire about 1,700 feet in length. The fans swing together with a steady sweep of seven or eight feet, and work smoothly and silently. The long swing and uniform motion insure the desired movement and change of air without risk of draughts

A NEW DYNAMO-ELECTRIC MACHINE.

We give an engraving of a new continuous-current dynamo-electric machine, recently perfected by Mr. Clinton M. Ball, of Troy, N.Y. This inventor has been engaged during some years past in building machines similar in type to the alternating current machine of Hefner-Alteneck (recently described in the SCIENTIFIC AMERICAN SUPPLEMENT), especially in respect to the absence therein of solid metal parts in the armature, the latter being constituted in the form of a disk composed of a series of coils without iron cores, arranged and adapted to be moved in a magnetic field consisting of a series of poles of alternately opposite polarity on the same side of the disk, and facing opposite sides of the disk.

Mr. Ball has perfected several forms of continuous-current machines of this general type, and from among them we have selected two forms, which we illustrate. These machines have been operated with entire success at Troy; and samples of the machine are either already installed at the Paris Exhibition of Electricity, or are on their way to that destination, forming a part of the joint exhibit made by the "White House Mills" and Mr. Ball.

The bipolar machine, Fig. 1, reproduces the effects of the well-known Gramme machine, over which it possesses important advantages. Its special peculiarities and advantages may be briefly summed up as follows: The armature is composed of coils, six in number, each of which occupies a sector of the disk of 60°. These coils are made self-supporting in the disk, without iron cores or metallic parts other than the wire of which they are composed, and are connected in a continuous circuit. The commutator plates are six in number and constitute the terminals of offshoots from the junctions between two contiguous coils. These commutator plates are usually disposed spirally about the axis of the arbor of the machine so as to show at opposite ends an angular displacement from axial parallelism of 30°. From this it results that during rotation a pair of diametrically opposite coils in the amature are by-circuited during one twelfth of a revolution at the neutral point of the machine, and this effect recurs successively through the entire series of coils. It will be understood that an important advantage is gained by this arrangement, inasmuch as the resistance of the inactive coils of the armature is thereby eliminated from the internal circuit of the machine. This machine, used as a generator, presents striking and powerful effects with small expenditure of power. It may be used as a very perfect form of an electro-magnet motor. It runs without serious sparking at the commutator, and is simple and compact in construction. A further noticeable feature, which exists furthermore in all machines of this type, is the absence of any noticeable external magnetic field when running.

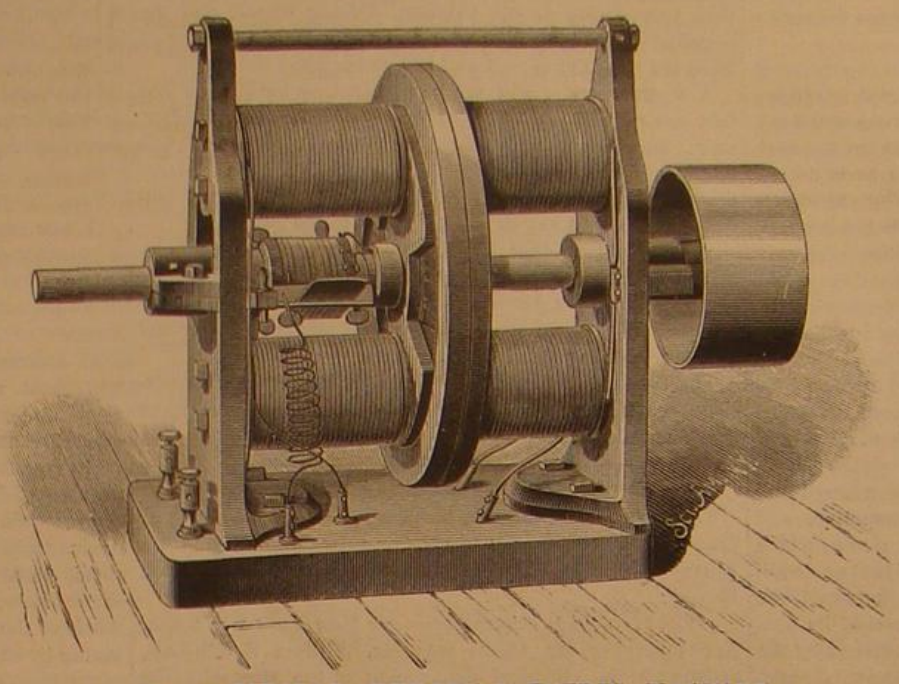


Fig. 1.—BIPOLAR DYNAMO-ELECTRIC MACHINE.

The other machine, Fig. 2, is a compound multipolar continuous-current machine, embodying characteristics of fundamental arrangement which distinguish it from all others; while, as before stated, in some of its theoretical aspects it resembles the machine of Hefner-Alteneck described in the article in the SUPPLEMENT.

The machine represented in the engraving, it will be noticed, has only six opposite pairs of poles in the field system. The continuous current armature system of the machine has eight elements, and the commutator twenty-four plates. The armature is otherwise composed in two sections or layers, the major section of which is utilized through a commutator or contact rings of ordinary construction for doing work upon the external circuit, while the continuous-current section maintains the magnetism of the field.

In this machine, developed and constructed long before the publication of any descriptions of Hefner-Alteneck's machine, the currents are commutated continuously, somewhat as in his machine, the commutator connections being so made that while the contact brushes remain in a fixed position, the currents are brought to them from the consequent electrical poles of the armature—the consequent points, during rotation, assuming successively different positions in relation to the field, and completing the cycle of changes during half of a revolution of the armature. During this time, furthermore, the line bisecting the armature and marking the consequent electrical points, has twice traveled over the complete circuit of the field in advance of rotation. In the case of a machine having more poles in the field than armature elements, the movement of this line would be retrograde; however, if the multiple of half the number of field poles into the number of armature elements remained the same, the number of changes would be the same in either case.

It will be seen that this machine differs from that of Hefner-Alteneck in respect to the proportion of armature elements to the number of poles of the magnetic field—the Ball machine, having a larger number of armature elements than of field poles, while his has a less number. The arrangement selected by Mr. Ball is more favorable to a simplification of details of construction without detriment to the efficiency of the machine.

At a speed of rotation of 950 to 1,000 per minute, and with an expenditure of 5½ to 6 horse power, this machine has proved capable of maintaining a series of ten to twelve arc lights of good power. The machine weighs only 850 lb.

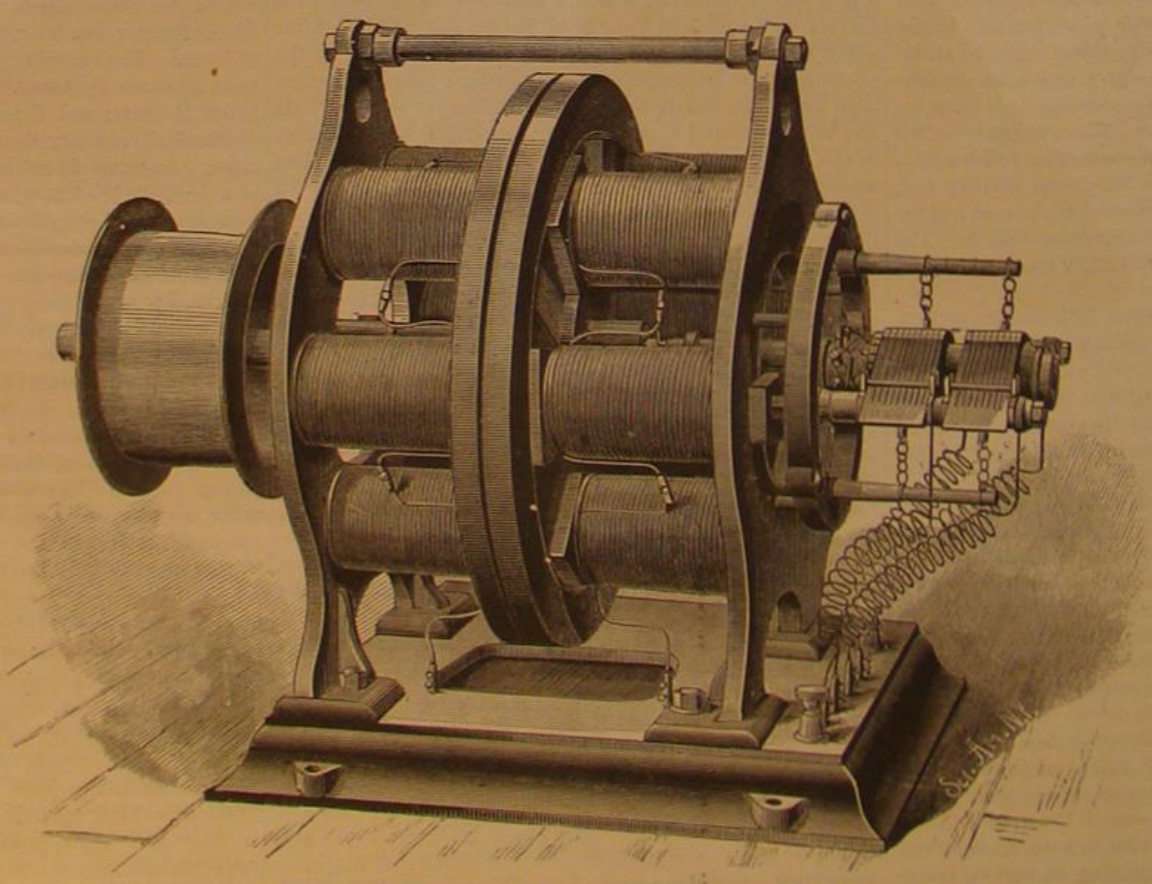


Fig. 2.—COMPOUND MULTIPOLAR CONTINUOUS-CURRENT MACHINE.

RECENT INVENTIONS.

Mr. Samuel B. Jenks, of Grand Rapids, Mich., has patented an improved electric belt for medical or therapeutical purposes. The invention consists in an electrode for an electric belt, having a sponge fastened in a cup-shaped button on the belt.

An improved adjustable notching cutter has been patented by Mr. Philander H. Elwell, of Cincinnati, O. This invention relates to an improvement on the die or cutter usually employed to form the re-entrant angles or corners in envelope blanks, and is applicable to every description of envelope, each bit being for this purpose composed of an angular-piece of steel, one of whose leaves or limbs is perforated to receive a screw bolt having at its mid-length an eye that engages over another bolt, which is made square in the middle to receive a wrench.

Mr. Frank H. Carr, of Bancroft, Mich., has patented an improved device for coupling cars automatically and releasing or detaching them safely and conveniently.

An improved incubator has been patented by Mr. Joseph Colson, of Brentwood, N. Y. The object of this invention is to utilize to the best advantage the heat developed by the flame of the lamp by which the incubator is warmed.

An improved electric gas-lighting device has been patented by Mr. George J. Murdock, of Binghamton, N. Y. It consists in a sliding valve or cut-off controlling the supply of gas to the burner, which valve is attached to the armature of an induction coil contained in a casing and supported on the end of a hollow arm, through which the gas passes before reaching the burner. Wires lead from the poles of the coil to the opposite sides of the slot of the burner, and when the circuit is closed the gas valve or cut-off is opened, permitting the gas to pass to the burner, when it is ignited by the spark caused by the interruption of the circuit.

Mr. Ivan Carlier, of Hot Springs, Ark., has patented improvements in absorption ammonia ice machines for the purpose of preventing steam or vapor from being mixed with the ammonia gas which is produced in this machine, and for avoiding an undue pressure in the ammonia boiler. The invention consists in combining a smaller boiler with the main liquor ammonia boiler, these two boilers being connected by top and bottom tubes.

Mr. Fredrick E. McKinley, of Wellington, Kan., has patented an improved school desk and seat. The invention consists in combining an ink stand socket with a desk having apertures and a stationary bar that supports as well as pivots it.

An improved harness saddle has been patented by Mr. James H. Carrick, of Traer, Iowa. The yoke is widened at the lower part, and provided with flanged side edges, forming chambers for receiving side straps, in combination with the skirts, terret, screws, and nut plates, and carrying loops.

An improved folding basket has been patented by Mr. James H. Dennis, of Newark, N. J. The object of this invention is to construct baskets in such a manner that they can be folded into small space for convenience in transportation.

Messrs John Kienzy and Charles F. Davis, of Bridgeport, Conn., have patented an improved faucet which consists in a tube bent downward at the outer end, and provided at its inner end with a valve seat, on which a valve fits, attached to a screw spindle contained in a cylindrical inclined arm of the main tube.

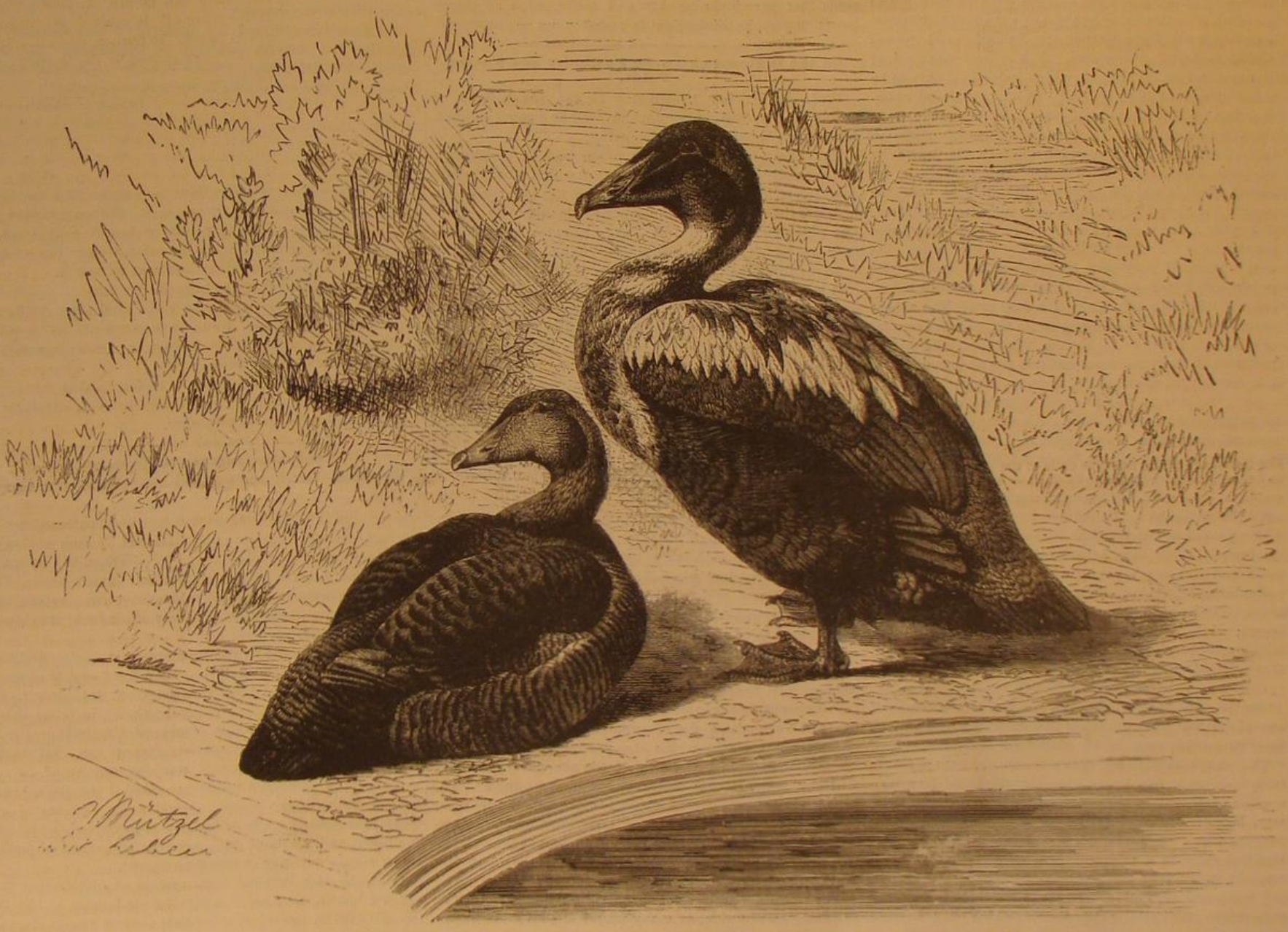
An improvement in the treatment of furnace slag has been patented by Mr. Alexander D. Elbers, of Hoboken, N. J. This invention has for its object the rapid and cheap conversion of fluid slag and its solidification into such shapes as to materially increase its utilization. The inventor allows the fluid slag to spread swiftly in the revolving gutter, which, by preference, is made in adjustable sections and of iron or steel plates, into which it flows by a spout which is made movable so as to direct the course of the flow. The apparatus, to which the gutter is fastened, is best constructed in the form of a so-called "carrousel," which can be quickly turned, and the size of the apparatus will depend on the quantity of slag which is to be run into the gutter. After the apparatus is set in motion, the first layer of the slag, as it flows from the trough into the revolving gutter, will almost instantly become chilled by contact cooling with the bottom and sides of the gutter, while the subsequent layers have to be mainly solidified by the rapid air circulation on their surface. As the liquid slag unites or welds readily with the underlying already solidified but still very hot slag, a weld of all the layers as they accrue during rotation is to be expected.

A glove buttoner, by which a glove may be buttoned without stretching or tearing the button hole or twisting off the button, has been patented by Mr. Nathaniel Pyles, of Westport, Mo. This glove buttoner is provided with a broad slotted hook having its inner portion grooved out to fit the periphery of a button, whereby the button may be rigidly held in a horizontal position while the button hole is being passed over the end of the buttoner.

An improved sound transmitter has been patented by Mr. Henry B. Porter, of Chicago, Ill. This invention relates to that class of telephone transmitters in which the undulations of the electric current in the wire are controlled by the varying pressure of a conducting surface on a piece of carbon, which variations of pressure are controlled by the vibrations of a diaphragm, and which current is made through the contact faces.

THE EIDER DUCKS.

The eider duck (*Somateria mollissima*) is widely celebrated on account of the exquisitely soft and bright down which the parent plucks from its breast and lays over the eggs during the process of incubation. Taking these nests is a regular business on the northern coasts of Norway and Scotland, but is not devoid of risk on account of the precipitous localities in which the eider duck often breeds. The nest is made of fine seaweeds, and, after the mother bird has laid her complement of eggs, she covers them with the soft down, adding to the heap daily until she completely hides the eggs from view. The plan usually adopted is to remove both eggs and down, when the female lays another set of eggs and covers them with fresh down. These are again taken, and then the male is obliged to give his help by taking down from his own breast and supplying the place of that which was stolen. The down of the male bird is pale colored, and as soon as it is seen in the nests the eggs and down are left untouched in order to keep up the breed. The eider is a shy, retiring bird, placing its nest on islands and rocks projecting well into the sea. It is an admirable diver, its legs being set very far back, and obtains much of its food by gathering it under water. The bird lays from five to six eggs, of a pale green color. There are generally two broods in the year.



EIDER DUCKS.

Trichinæ in Man.

For some thirty years subsequent to the first description of the capsule by Hilton, and some twenty-five years after the identification of the parasite itself in man, the same were looked upon as mere harmless curiosities, and that, although Leidy discovered the parasite in the flesh of swine in 1847, still it was not until 1860 that the connection was established between them, appearing, as they had, in two totally different species (men and swine). The honor of this important discovery belongs to Dr. Zenker, of Dresden, Germany. The disease was discovered in a servant girl, admitted as a typhus patient to the City Hospital in Dresden. She died, and her flesh was found to be completely infested with trichinæ. Leuckart's and other experiments have shown that a temperature of 140 degrees Fahrenheit is necessary to securely render trichinæ inert. Direct heat applied to the slides holding specimens of trichinous pork, by means of the Schultz heating table, has demonstrated under the microscope that a temperature of 50 degrees centigrade (122 degrees Fahrenheit) is necessary to the certain death of the trichinæ. Leisering's experiments with trichinous pork, made up into sausage meat and cooked twenty minutes, gave positive results when fed to one rabbit and negative by another. He sums up his experiment as follows:

1. Trichinæ are killed by long continued salting of infected meat, and also by subjecting the same for twenty-four hours to the action of smoke in a heated chamber.

2. They are not killed by means of cold smoking for a period of three days, and it also appears that twenty minutes cooking freshly prepared sausage meat is sufficient to kill them in all cases.

The various kinds of cooking, however, are quite different in their effects on trichinous pork. Frying and broiling are most efficient, roasting coming next. Boiling coagulates the albumen on the outer surface, and allows the heat to penetrate less readily; it should be kept up, therefore, for at least two hours for large pieces of meat. Whether boiled, broiled, or fried, pork should always be thoroughly cooked. Practically speaking, the cooking, salting, and hot smoking which pork in its various forms receives in the United States must be, in the vast majority of cases, sufficient to kill the trichinæ and prevent infection of the person consuming the meat. Everything like those reported in Germany are unknown here, and trichiniasis in a fatal form is undoubtedly a rare disease. In the vicinity of the great pork packing establishments near Boston the "spare-ribs," containing the intercostal muscles, are very largely bought and eaten by the people near by, and trichiniasis among them has not in a single case been reported, so far as I have been able to learn. The cuts being thin and well cooked any trichinæ in them are quite certain to be killed. Even when trichinæ are introduced into the intestinal canals, too, they are sometimes expelled by diarrhea, and the invasion of the system by a small number does no harm.—*American Microscopical Journal.*

M. H. TOUSSAINT (*Comptes Rendus*) finds that no contagious malady possesses a greater virulence than tuberculosis, the virus resisting and preserving its efficacy at temperatures which destroy the bacteria of splenic fever. The infection takes place as easily by ingestion as by inoculation.

Worms in Fishes.

Several communications have been received lately asking whether the small white worms infesting black bass are injurious to those who may eat the fish.

Such parasites are very common in fish, and the best authorities say that they are harmless to man; indeed Italian epicures regard certain species occurring in sea fish as a great delicacy. Of this class apparently are the white or transparent round worms which our correspondents find in the bass of the Susquehanna. They are known as *Hematodes*. Another group of fish parasites, *Cestodes*, resemble ordinary tape worms, but do not flourish in the human organism. The *Trematodes*, or flukes, and *Acanthocephalis*, two other groups of fish parasites, are too small to attract the attention of any but microscopists.

In an article on this subject in *Forest and Stream*, some months since, Mr. Frederic W. True, of the Smithsonian Institution, said that the salmon harbors at various times no less than sixteen different kinds of parasitic worms, or at least so many sorts have been discovered, and undoubtedly many others remain unknown. Four species are tape worms, and four round worms; the rest belong to the other groups above mentioned. The yellow perch has been a favorite hunting ground for the helminthologist, and he has already brought to light twenty-three species. The pike (*Esox lucius*) carries about with him at least twenty kinds. The parasites of our trout have escaped attention to a great degree, and it is credited with only one kind, but the European saibling plays host for five tape worms and three or four other worms. But one species is known to infest our shad, namely, the round worm, *Agamonema capsularia*, Diesing, although the German maifish (*Alosa vulgaris*), a close relative, carries at least seven. It must not be gathered from these facts that our fishes are more favored than those of other parts of the globe, but only that the parasites have been less carefully studied.

It was the shad worm (*Agamonema capsularia*) which caused some excitement among the fishermen in a certain part of New Jersey a few years ago, where it was found in great numbers. All anxiety was removed, however, by Dr. Leidy, of Philadelphia, the only American helminthologist whose observations have been at all extensive, who pointed out the harmless character of the animal.

The carp, lately introduced from Germany by Prof. Baird, undoubtedly brings with it some of the twelve parasitic worms which make its life unhappy in its native waters. Every new animal thus introduced in this way adds more than one name to the faunal list.

Mr. True has in his possession an undescribed tape-worm which infests the herring of the great lakes. It is not content to live in the intestines of the fish, but at a certain season in its development must needs bore into the flesh, pro-

ducing ugly marks and quite injuring the fish for sale, much to the disgust of the fishermen. It would appear from this that these worms are interesting not only zoologically but economically. In this and some other cases it is a matter of dollars and cents.

Orange Culture in Syria.

Some very interesting notes on this subject are given in a recent consular report from Beyrout. From this we learn that the two districts in which oranges are the most plentiful are those of Jaffa and Sidon. The orange trade began to assume considerable proportions some forty years ago, when the new government of Egypt took shape, and it is now one of the most profitable industries in the two towns above mentioned. Unfortunately the inhabitants, allured by first gains, commenced planting gardens and expending money beyond their resources, the result of which has been that, in spite of all remunerations for small outlays, their improvidence has placed most of them in the power of moneylenders, who continue to advance at interest of 15 to 20 per cent. However, a company has lately been formed in Jaffa to negotiate loans with orange cultivators, and if its operations be carried on fairly we may expect an extension of horticulture, with benefit alike to the company and the borrowers. At the present moment Jaffa possesses some 340 gardens, averaging from 2,000 to 2,500 trees in each. The crop of fruit from these may be put down at about 34,000,000.

A garden costs from 40,000f. to 50,000f., and brings in 4,000f. to 5,000f. per annum. For several miles round Jaffa extends a fertile plain on which water is always to be found at a depth of 40 ft. or 50 ft. With capital and enterprise much of this might be planted, and the orange trade doubled in a short time. The present system of irrigation is that of small wells, from which the water is drawn by mules; but experiments have proved that very little engineering skill would be required in order to turn the streams of the river Andjab, some four miles from the town, over the plain. The land near Jaffa would then be cheapened in proportion as the value of that freshly watered rose. At present unplanted land close to Jaffa able to support 2,000 trees is worth 2,000f. to 3,000f.; but at two or three hours' distance it will fetch only 5f. to 6f. a deunum. The export is carried on chiefly by sailing boats for Egypt and Constantinople, and by steamers for Russia, Trieste, and Marseilles. Exportation in cases is a comparatively recent introduction, which has given considerable impulse to business with Europe. The orange gardens of Sidon are cultivated on the same principle as those of Jaffa. An acre of land at Sidon is generally valued at from 6,000f. to 7,000f., and is capable of bringing in an income of about 600f. The exportation begins in September, and is at first almost exclusively directed to Russia, till the winter closes the Black Sea ports, when it is continued to Trieste and Egypt. European cargoes are packed in paper and close cases, the rest are sent in open crates. Each case contains some 300 oranges or lemons, and last year's export is reckoned at 20,000 cases, all of which fetched very high prices, especially lemons, in Russia. The average prices are for 1,000 lemons 150 to 170 piasters; while for 1,250 oranges, reckoned as a trade 1,000, the cultivator receives 70 to 80 piasters.

Vegetation in Oil.

Some time ago Herr Von Tieghem noticed in a bottle of olive oil that was often uncorked in a room in which various kinds of mould were being cultivated several flocks of mycelia, or spawn of fungi, partly attached, partly not. He found there were two kinds, one of which could be grown on slices of potato in moist air. Returning to the subject lately, he put into olive oil fragments of stems, roots, or leaves, or whole plants, or seeds saturated with water, and submitted them to a temperature of about 25 deg. C. in an oven. In a few days the pieces were covered abundantly with mycelium vegetation, forming a continuous layer of considerable thickness. The spores which had become attached in air were thus vigorously developed in the oil. For this vegetation oil is necessary. The same species of plants inserted in water did not become covered with mycelium. In a vessel half filled with water and half with oil, and containing a piece of stem or root in both liquids, the portion in water remained sterile, while that in oil was covered largely with mycelium. On inverting the piece so that the part formerly in water was in oil, and conversely, the mycelium already developed died, and the previously sterile part grew mycelium. Mycelium flocks detached from the plants and sown in oil developed very slowly, probably because they had too little water at their disposal. No fructification was observed, and the nature of the mycelium could not be determined. These mycelia do not develop in linseed or rapeseed oil. When grown in olive oil and put in either of the others they soon die and disappear.

Some Effects of Heat and Light on Vegetation.

A curious modification of the normal structure of plant stems has been observed by M. Prillieux on making the temperature of the ground about the plant higher than that of the air above. Beans and pumpkins gave the best results. The seeds were placed in earth in a large dish, in which was inserted part of a brass rod bent at a right angle and having a gas flame applied to its horizontal end. The chamber was moist and cold. The seeds germinated well; but on coming above ground the plants acquired a peculiar shape; they grew but little in length and became unusually thick, the latter growth involving much tension in the surface layers, so that deep rifts before long appeared (mostly transverse) and made further growth impossible. M. Prillieux found the enlargement traceable mainly to an increase, not of the number, but of the volume of cells in the interior (cells of the cortical tissue and the pith). The excessive growth of these cells occurred not only in the cell wall, but in the nucleus, which was often multiplied. The excess of temperature of the ground over the air was about 10 deg. Again, the view adopted by the older botanists that light is either without effect on germination, or has an adverse effect, fails to harmonize with some results lately arrived at by Herr Stebler, in the case of many seeds of agricultural importance, such as varieties of meadow grass (*poa*), the germination of which he finds to be favored considerably more by light than by heat. Thus, with two groups of 400 seeds each of *Poa memoralis*, in one experiment, there germinated in light 62 per cent, and in darkness 3 per cent. Similarly with *Poa pratensis*—in light, 59 per cent; in darkness, 7 per cent, and so on. Sunlight being a very variable force difficult of determination, experiments were further made with gaslight, and with the same result—that light favors the germination of certain seeds, especially grasses, and that these germinate either not at all, or very scantily, in darkness. The fact was verified by Herr Stebler in quite a series of seeds, *Festuca*, *Cynosurus*, *Alopecurus*, etc. In the case of seeds that germinate quickly and easily, such as clover, beans, or peas, he thinks light is probably not advantageous.

On the Difference between Fusibility and Fusing Point.

Prof. A. Ledebur contributes to the *Metalarbeiter* an article of practical importance as well as general interest, from which we abstract the following:

The term "fusibility" is one much used in metallurgy, and generally means the temperature at which a body passes from the solid into the liquid state, and the lower this temperature the more fusible the substance is said to be. Thus ice, which melts at 0° C. (32° Fahr.) is more easily fusible than tin, which melts at 230° C. (446° Fahr.), and the latter is more fusible than lead, which melts at 325° C. (617° Fahr.). The term fusibility can also be employed in a different sense, and it seems to me that the other is more sensible and logical. Fusibility may refer to the *quantity* of heat instead of the *degree* of heat required to raise it from the ordinary temperature, or, say, from 0° C. to its melting point, and then fuse it. The smaller the quantity of heat required the more fusible the substance, because less fuel is needed to melt it. This very relation between fusibility, in the latter sense, and the consumption of fuel, which is an important factor in calculating the cost of fusion, is of such importance that I take the liberty of entering somewhat more into details.

The temperature of fusion bears no direct ratio to the consumption of fuel, for it is only necessary, when the melting point is very high, to have fuel of high pyrometric heating power (producing a higher temperature). Thus, coked or charred fuel generally gives a hotter fire than the raw fuel. Gases, which burn easily and require a smaller excess of atmospheric air than the material would that they are made of, give a still higher temperature.

The less the quantity of products of combustion, in proportion to the quantity of heat produced, the higher the temperature; hence the advantages of warming the air used (increasing the amount of heat without increasing the products of combustion), also of employing pure oxygen instead of atmospheric air (by which the products of combustion are greatly lessened by removal of the nitrogen of the air), whereby such intense temperatures are attained. The higher the temperature at which a body melts the more we are obliged to take advantage of these facts without necessarily increasing the consumption of fuel; but the more infusible it is, in the other sense of the word, the more fuel will be required to melt it.

The two different ideas of fusibility do not proceed with even step side by side, as many would at first thought suppose. To convert one kilo of ice at 0° C. into water at the same temperature, requires 79 units of heat, while only 15 units are necessary to heat a kilo of lead from 0° C. up to its melting point and fuse it. Lead, then, although it melts at 325° higher than ice is five times more fusible—that is to say, it only takes one-fifth as much fuel to melt a given quantity of lead as it does to melt an equal weight of ice.

From this it follows, that a knowledge of the quantity of heat necessary to melt the metals and their alloys—their fusibility in the narrower sense—is quite as important, both practically and theoretically, as a knowledge of the temperature at which they fuse. This quantity depends upon three factors: the specific heat, the temperature at which it melts, and the latent heat of fusion; it is $=(s\times t)+l$, in which $s=$ specific heat, $t=$melting point, and $l=$latent heat. These values are not accurately known for all the metals; specific heats vary with the temperature, and have generally been determined accurately only for temperatures below the boiling point of water; and the latent heat of but few metals is known at all.

It is, however, comparatively easy to ascertain this, and thus obtain a measure of its fusibility, by simply melting the metal and pouring it into a known quantity of water, the temperature of which was accurately measured, both before and after, with a thermometer graduated to one-fifth or one-tenth of a degree, and afterwards drying and weighing the metal which was poured into the water.

For this experiment the vessel employed is made of thin sheet copper or brass, holding a few quarts and surrounded by a poor conductor of heat (flannel or a stagnant stratum of air obtained by putting this vessel within a larger one). Within this copper vessel is a smaller one, full of holes, to receive the melted metal, so that it can be easily taken out and weighed. There is also a spatula of copper or brass for stirring after the metal is poured in. The metallic vessels and spatula are weighed, and the weight multiplied by the specific heat of copper or brass (0·095), and the product added to the weight of the water used.

The amount of heat requisite to raise the metal from 0° C. to its melting point, and fuse it, may be represented by W, and we have the formula:

$$W=s\times t_2+\frac{V(t_2-t_1)}{G}$$

in which V is the weight of the water plus the product of the weight of metal multiplied by its specific heat.

G = weight of metal.

s = specific heat of the metal below 100° C.

t = temperature of the water before the metal was poured in.

t_2 = temperature of the water after pouring it in.

The most difficult point is to tell when the metal is just melted and not over heated. Pure metals may be allowed to cool until a crust begins to form, and then poured in, but for alloys this is not applicable. For those which melt below 300° C., the temperature at the time of pouring can be taken with a thermometer.

The author determined the quantity of heat necessary to melt zinc, tin, bismuth, and lead by experiment. He also calculated it from their known specific heats and latent heats. The two are shown in the following table:

	Found.	Calculated.
Zinc	62 units.	71 units.
Tin	26 "	27 "
Bismuth	18 "	22 "
Lead	14 "	16 "

He also examined several alloys, and found that an alloy of 90 per cent lead and 10 per cent antimony melted at 240° C., and required but 13·6 units of heat to melt it, while an alloy of tin and antimony in the same proportions melted at 236° C., yet required 28 units of heat to melt it.

It will be noticed that the quantity of heat necessary for the fusion of an alloy cannot be calculated when we know this for each constituent, any more than one can tell at what temperature an alloy will melt from a knowledge of the melting points of its constituents.

Of the simple metals lead is the easiest fusible, requiring but half as much heat to melt it as tin does, although its melting point is nearly 100° higher.

Sulphur Fumes for Cholera.

In a former issue, says the *Indian Tea Gazette*, we referred to a system of disinfection advocated by Dr. Tuson, and stated how admirably suited it was to the requirements of tea factories. A report recently published by Surgeon-Major J. W. Johnston, on cholera in the 3d Ghurkas, at Candahar, in July and August, 1879, bears out Dr. Tuson's views. The following extract from the *Englishman* on this subject, and on the question of the infectiousness of cholera, may prove of interest to our readers:

"Cholera appeared in the detachment at Abdul Rahman, and Dr. Johnston immediately applied for a supply of disinfectants. Carbolic acid was furnished, but not sulphur. On the 19th July, however, a large supply of the latter article was allowed, and a thorough process of disinfection of both accouterments and buildings was carried out that night. Among the measures adopted was the burning of two or three seers of powdered sulphur in each of the huts, tents, etc., occupied by the troops, as well as the lighting of sulphur fires outside. The village was reoccupied the following night, and, although the regiment continued to suffer, no fresh case occurred in this detachment.

"On the 23d July the same system of disinfection was carried out in the case of a detachment located at Mir Dil Khan's garden, the result being that cholera ceased at once.

"Similar results followed the use of sulphur in the 25th N. I. Cholera broke out on the 8th July and continued till the 11th August, with increasing virulence and in spite of shifting of camps. Sulphur disinfection was then carried out, and after this only one sipahi and four camp followers were attacked. The history of these cases is interesting. The sipahi had been seen on the 10th carrying some of the clothes of a man who had died of cholera. He was attacked on the 13th. The four followers were dooly bearers who had been employed in carrying cholera patients a day or two after the disinfection. On the appearance of one cholera case in G-4 Field Artillery, the same system was adopted, at Dr. Johnston's suggestion, and no other case occurred.

"The bearing of these facts on the question of the infectiousness of cholera is so obvious, that possibly men committed to the opposite theory may be tempted to under-estimate their importance. In weighing evidence of the efficacy of a remedy or a preventive, however, all preconceptions as to the etiology of a disease must be laid aside. Let those who hold that cholera is not infectious console themselves, if they please, with some new theory of the mode of action of sulphur fumes. But common sense protests against their closing their eyes to palpable facts."

RAILWAY GARDENING.—The Boston and Maine Company now allows its station agents $10 a year each with which to buy seeds, plants, etc., and offers prizes of $50, $30, and $20 to the agent whose stations are best kept and present the neatest and most attractive appearance.

Expansion of Cement and Concrete.

Opinions of authorities differ much as to the behavior of cement in setting. An examination of extensive concrete walls, such as those of the New Victoria Docks, discloses a number of vertical cracks, which seem to indicate that a contraction of the mass has taken place. From the experiments made by Messrs. Dyckerhoff, it would appear that expansion and not contraction had taken place. In Mr. Henry Faija's little book, "Portland Cement for Users," which we lately noticed, two tables giving the results of experiments by Messrs. Dyckerhoff on a prism of cement of ten centimeters in length and five centimeters square, lying in water, are introduced. These tests show the amount of expansion in twelve varieties of cement from one week to twelve months old. Mixed with three parts of sand, the expansion is much diminished, and for architectural works, the results need not cause any serious apprehensions. Mr. Faija's remarks point to a possible contraction during the action of setting, which, however, is afterward replaced by a slight expansion.

This expansion or contraction is not so great that architects or engineers may feel any distrust of the value of cement concrete. It is, in fact, so slight that in practice, as Mr. Faija says, it may be disregarded, and we think it useful to quote the latter gentleman's observation on the experiments: "Ignoring, therefore, Messrs. Dyckerhoff's experiments (although they may have a theoretical value) in practice, when laying any large space, such as a courtyard or a length of footway with a concrete paving, it is advisable to lay it in sections, separating each by thin wooden battens. These battens may be removed in a few days, or when the concrete is thoroughly set and hard, and their space filled up with a similar concrete to that already laid; by this means there will be no danger of the appearance of the work being spoiled by the cracking of the concrete." For the walls of buildings this advice becomes of less importance, if the concrete is filled up in frames or panels, as we have more than once hinted; besides which, the occurrence at intervals of doors and windows, etc., would relieve any large surface.

Where finished surfaces have to be made, Mr. Faija deprecates the practice of putting a differently proportioned concrete as a finishing coat. It is nearly sure to crack or peel off. It is preferable to make the concrete of a finer kind, and work the face up with a trowel or float. Thus treated, the surface may be made to have the appearance of rough-cast, or a smoother finish if desired. The crushing strength of concrete seems to have been repeatedly made the subject of experiment; yet architects and engineers, in applying the ordinary weights given in tables, seem to think that the same results ought to be reached in building everywhere, whereas those tests have only reference to a small cube of an inch each way. A one-inch cube of cement will bear a great deal more than a small pillar of it twice or three times the height and of the same base.—*Building News.*

Influence of Barometric Pressure on the Discharge of Water from Springs.

BY BALDWIN LATHAM, M. INST. C.E., F.G.S., F.M.S., ETC.

The author of this paper, read before Section C (Geology), British Association meeting, York, mentioned that it was alleged, by some of the long-established millers on the chalk streams, that they were able to foretell the appearance of rainfall from a sensible increase in the volume of water flowing down the stream before the period of rainfall. He had, therefore, undertaken a series of observations to investigate the phenomena; and he found, in setting up gauges on the Bourne flow in the Caterham Valley, near Croydon, in the spring of this year (1881), and selecting periods when there was no rain to vitiate the results, that whenever there was a rapid fall in the barometer there was a corresponding increase in the volume of water flowing, and with a rise of the barometer there was a diminution in the flow. The fluctuations in the flow of the Croydon Bourne due to barometric pressure had at one period exceeded half a million gallons per day. The gaugings of deep wells also confirmed these observations; for where there was a large amount of water held by capillarity in the strata above the water line, at that period of the year when the wells became sensitive and the flow from the strata was sluggish, a fall in the barometer coincided with a rise in the water line, and under conditions of high barometric pressure the water line was lowered. Percolating gauges also gave similar evidence, for after percolation had ceased and the filter was apparently dry, a rapid fall of the barometer occurring, a small quantity of water passed from the percolating gauges. The conclusion arrived at was, that atmospheric pressure exercises a marked influence upon the escape of water from springs. The increase in the flow of the water was attributed to the expansion and escape of the gases held by the water under low barometric pressure, which cause the water to escape more freely, while with high barometric pressure there was a condensation of the gases, which led to a retardation in the flow.

Soap Bubble Balloons.

M. Delon, of Paris, produces miniature balloons by means of ordinary gas conducted through a caoutchouc tube and clay pipe to glycerine soap solution. A small disk of thin paper, with fine wire from its center to a little paper car with aeronaut figures, is connected to the bubble when it begins to swell, the disk being attached by capillarity to the part where the drop forms. The detached bubble rises with its car.

Electricity and Ballooning.

Soon after the announcement of Faure's new accumulator of electricity the idea was thrown out by Mr. Martin Tupper in this country that storage batteries could be employed with advantage in propelling balloons. Power and not levitation was, in Mr. Tupper's opinion, the true key to the attainment of aerial travel. French aeronauts have also given their attention to the subject, and at the recent meeting of the French Academy of Sciences M. Gaston Tissandier made a communication on it. The true solution of the problem, if it be feasible at all, appears to us to lie not in the exclusive use of levitation or electric power, but in a proper combination of both principles. This plan is that which M. Tissandier contemplates, and he points out that a propeller driven by electricity possesses advantages over other methods of movement. For example, it requires no fire, which is a dangerous element in a balloon inflated with hydrogen gas; it has a constant weight and gives off no products of combustion, and is readily manipulated.

M. Tissandier prepared a small balloon, pointed at the ends, 11 feet long by about 4½ feet in diameter. Its volume was 484 gallons, and when filled with pure hydrogen gas it had an ascending force of about 4½ pounds. A Trouvé motor of the Siemens type weighing nearly 8 ounces was fixed to the lower part of the balloon and connected to a double-bladed screw of 18 inches diameter. With the aid of a Planté secondary battery weighing nearly 3 pounds, the screw was driven at the rate of 6½ turns per second, and propelled the balloon through the air at a speed of over 3 feet per second during a space of 40 minutes. With two secondary elements weighing 1¼ pounds, and a screw of 21 inches diameter, a speed of 6½ feet per second was maintained during 10 minutes. With three elements the speed was about 10 feet per second. M. Tissandier also measured the work done by the little dynamo-electric motor, and found it to be about 314 foot pounds with a single element and a speed of 5 turns per second; and with three elements it is about 7 foot pounds. He estimates that a dynamo-electric motor of 5 cwt. with 17 cwt. of secondary batteries will yield 6 horse power of work. This weight could be raised by a hydrogen charged balloon of 3,900 cubic yards volume, and similar to that employed in 1852 by M. Giffard, and in 1872 by M. Dupuy de Lôme. It would be 131 feet long by 43 feet in diameter at the middle, and its ascending force would be about 3½ tons. With all its appurtenances it would weigh from 19 cwt. to 22 cwt., and there would remain from 1 ton to 2 tons for ballast and voyagers. In calm weather it would have a speed of from 12 to 15 miles per hour, and it would be able to deviate from the line of a wind.

It is true that this result could only be obtained during a limited time, but the conditions would be greatly improved by lighter batteries and possibly by the use of M. Faure's accumulators. While upon this subject we may also mention that M. Trouvé has tried his electrically propelled boat in the upper lake of the Bois de Boulogne with a Trouvé motor and a four-bladed screw about a foot in diameter. Twelve Bunsen cells of Ruhmkorff's pattern propelled the boat, containing three persons, at a speed of 10 feet per second, but this rate fell off at the end of three hours to about 9 feet per second, and at the end of five hours to 8 feet per second.—*Engineering.*

Improvement in the Manufacture of Parabolic Mirrors.

A very ingenious method of manufacturing parabolic reflecting surfaces has been invented by M. Latchinoff, who has described the process fully, says *Engineering*, in our Russian contemporary, *L'Electricité*. It is based on the fact that all points of the free surface of a liquid turning round a vertical axis acquire a constant angular velocity and take a parabolic form. If, then, the liquid is put into a vessel which is rotated round a vertical axis it will form a hollow shell of parabolic section inside, and if the liquid is one which will solidify a rigid paraboloid will be obtained capable of being used as a reflector. M. Latchinoff, therefore, mounts a hemispherical vessel upon a vertical shaft carrying a pulley, and rotates it by an endless belt from a motor. Into this he pours a sufficient quantity of plaster of paris liquid or a solution of the mastic prepared by M. Mendelejeff. Fusible metals would serve the purpose, too, but they are apt to oxidize on the surface, and in cooling they tend to crystallize. The shape of the vessel need not necessarily be a hemisphere, but this form is convenient; and a glass cover should be added to it.

To regulate the thickness of the liquid shell a ring of wood is fixed within the bowl at a proper distance below the edge. This prevents the liquid rising above a certain height. Regularity of motion is most essential to the success of the operation, and hence a steam engine is not adapted to drive it; but a small Gramme or Siemens dynamo-electric machine actuated by a Thomson or a Tchikoleff battery will answer well. Three or four cells will suffice, and the speed can be regulated by resistance placed in circuit. With a Deprez or Helmholtz regulator any kind of battery may be used. An angular speed of a turn per second is quite sufficient for the purpose; and the axis ought to be verticalized by means of a spirit level, and fixed so as to be free from shake or jar. The liquid should be one which solidifies slowly, say in an hour, and without shrinking much in bulk. The shells thus prepared can be made reflective by electrotyping with nickel, silver, or iron, which, when prepared in this way, oxidizes with difficulty, and being almost white will serve for a reflector if kept under glass.

The Chanoine Dam at Pittsburg.

Work upon this great undertaking—which has been described fully in these columns—is progressing with unusual rapidity, owing to the remarkably low stage of water in the Ohio River. The most difficult and hazardous portion of the work is now being vigorously prosecuted, namely, the digging for the foundations of the sill of the dam. This requires an excavation 556 feet long and 15 feet below the bed of the stream, and, of course, directly across the channel. To render this work possible an enormous coffer dam, 614 feet by 230 feet, was successfully constructed.

To fill the double walls of this coffer with clay an ingenious arrangement was devised by Superintendent Meredith. A line of 4-inch pipe, 1,800 feet long, led from a powerful centrifugal pump to the coffer. The pump was supplied with water and clay in proper proportions and delivered a 4-inch stream of mud into the coffer walls. The water draining off left the clay a compact, watertight mass just where it was wanted. The necessity for haste in the present stage of this work can be understood when it is stated that the coffer dam virtually blockades the Ohio, and that nearly every town and city along the Ohio and the Mississippi from Pittsburg to New Orleans, and including St. Louis, depends wholly or in part upon the river shipments of coal from Pittsburg. Until the coffer dam is removed the only passage way for steamers is between the completed lock walls of the dam, a space only 110 feet wide.

There are at present 10,000,000 bushels of coal loaded in barges, etc., at Pittsburg, and awaiting a favorable stage of water to start down the Ohio. To move this requires a fleet of 70 steamers and nearly 200 barges, and it is an open question whether even a small proportion can get through the lock wall space before the erratic river recedes again. Lieutenant W. M. Black, the United States officer in charge, is, however, pushing things rapidly, and by the use of the electric light doubles the working hours of the force of laborers employed, promising to raise the blockade by November 15.

Influence of Lime on Soils.

Professor E. W. Hilgard, in discussing the "Objects and Interpretation of Soil Analyses," gives, among other things, the following advantages resulting from an adequate supply of lime in soils:

1. A more rapid transformation of vegetable matter into active humus, which manifests itself by a dark or deep black tint of the soil.

2. The retention of such humus, against the oxidizing influences of hot climates; witness the high humus percentages of such soils, as against all others, in the Southern States.

3. Whether through the medium of this humus, or in a more direct manner, it renders adequate for profitable culture percentages of phosphoric acid and potash so small that in the case of deficiency or absence of lime the soil is practically sterile.

4. It tends to secure the proper maintenance of the conditions of nitrification, whereby the inert nitrogen of the soil is rendered available.

5. It exerts a most important physical action on the flocculation, and therefore on the tillability of the soil, as heretofore shown by Schloesing and by myself.

Professor Hilgard adds that in the majority of soils (excepting those that are extremely sandy) the lime percentage is greater in the subsoil than in the surface soil. This is doubtless, he explains, the result of the easy solubility of calcic carbonate in the soil water, which carries it downward and thus tends to deplete the surface soil. This fact is strikingly shown in the results of Loughridge's investigation on the composition of the several sediments. The efficacy of lime in preventing "running to weed" in fresh soils, and in flavoring the production of fruit, is conspicuously shown in a number of cases.

Magnets.

M. Trouvé finds that if three steel bars of the same length and size are magnetized, then demagnetized, and afterwards remagnetized, the magnetic power due to the first magnetization being represented by 2, 3, 4, the power of the second will be 4, 9, 16. He found it necessary to demagnetize very regularly. To magnetize the bars he placed them in two solenoids in juxtaposition, closed the magnetic circuit by means of two soft iron plates, and caused a current to pass from a battery of six Wollaston cells. He thus obtained magnets of great constancy. He states that straight magnets support twelve or fourteen times their weight; if the magnet be of horseshoe form it will support forty-eight or fifty-six times its own weight.

Expectancy of Life.

Insurance companies are aware of the credulous weakness of those whose lives they assure, and have therefore compiled numerous tables of expectancy of life for their own guidance, which are carefully referred to before a policy is granted. These tables have been the result of careful calculation, and seldom prove misleading. Of course, sudden and premature deaths, as well as lives unusually extended, occasionally occur; but the average expectancy of life of an ordinary man or woman is as follows: A person 1 year old may expect to live 39 years longer; of 10 years, 51; of 20 years, 41; 30 years, 34; of 40 years, 28; of 50 years, 21; of 60 years, 14; of 70 years, 9; of 80 years, 4.

Business and Personal.

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

Dr. Scott's Electric Hair Brush has given universal satisfaction whenever used. It is beautifully made, and is well worth the price as a brush without considering its electric qualities. Over 7,000 testimonials from prominent citizens can be seen at the New York Office, 842 Broadway.

Ajax Metals for Locomotive Boxes, Journal Bearings, etc. Sold in ingots or castings. See adv., p. 236.

61 Musical Bells. Box 471, Hyde Park, Mass.

For Sale.—One new Peck Lifter and Drop complete. Inquire of Bradley & Co., Syracuse, N. Y.

For Sale.—SCIENTIFIC AMERICAN from March 29, 1873, to July, 1881. Address P. K., 153 Shawmut Ave., Boston, Mass.

Magic Lanters and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

New Comb'd Milling and Gear Cutting Machines, large range. C. A. Condé & Co., Makers, Philadelphia, Pa.

Printing Presses with my Patented Card Drop print much quicker. ($7½ to $40.) Type, ink, cards, etc. Circulars free. Louis Frik, 244 Race St., Philadelphia.

A valuable article on the Treatment of Acute Rheumatism, by Alfred Stillé, M.D., will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 299. Anything from the pen of this eminent and experienced physician is interesting and instructive.

New Method of Graining, etc. J. J. Callow, Cleveland, O.

Inventor's Institute, Cooper Union, New York City. Permanent free exhibition of new machines, inventions, and patents. See advertisement page 252.

Foot Lathes, Fret Saws, 6c. 90 pp. E. Brown, Lowell, Mass.

"How to Keep Boilers Clean," and other valuable information for steam users and engineers. Book of sixty-four pages, published by Jas. F. Hotchkiss, 84 John St., New York, mailed free to any address.

Alden Crushers. Westinghouse Mach. Co., Pittsb'g, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Improved Skinner Portable Engines. Erie, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Peck's Patent Drop Press. See adv., page 204.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro. 234 Broadway, New York.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited. Erie, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 561 Jefferson St., Philadelphia, Pa.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 204.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 206.

Saw Mill Machinery. Stearns Mfg. Co. See p. 205.

Supplee Steam Engine. See adv. p. 204.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 221.

Safety Boilers. See Harrison Boiler Works adv., p. 222.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 221.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Ball's Variable Cut-off Engine. See adv., page 238.

Paragon School Desk Extension Slides. See adv. p. 237.

Brass & Copper in sheets, wire & blanks. See ad. p. 236.

The Twin Rotary Pump. See adv., p. 206.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 237.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Berryman Feed Water Heater. See illus. adv., p. 237.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 236.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 238.

New Economizer Portable Engine. See illus. adv. p. 236.

Sewing Machines and Gun Machinery in Variety. The Pratt & Whitney Co., Hartford, Conn.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 238.

The Sweetland Chuck. See illus. adv., p. 238.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 236.

For Machinists' Tools, see Whitcomb's adv., p. 238.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

(1) L. J. K. asks whether it would make any appreciable difference in the strength of an electro-magnet to inclose the coils in brass similar to the usual rubber covers. A. In a magnet of high resistance it would make a difference.

(2) A. A. B. writes: Please give the weight of the largest gun ever cast, also the size of shot and quantity of powder required? A. Several Armstrong 100-ton guns have been made: caliber 17·72 inches; powder charge, 551 pounds; weight of projectile (battery shell) 2,500 pounds; muzzle velocity 1,725 feet a second; total energy 41,333 foot pounds. A Woolwich gun of 160 tons has been projected. We have not heard of its completion.

(3) H. D. asks: 1. What is the meaning of resistance in speaking of wire? A. Electrical conductors of different sizes and different lengths offer a greater or less impediment to the free passage of electricity according as they are small or large, long or short, and it is assumed that the different conductors have a specific power of resisting the passage of the current. This is called resistance. 2. Why do they use thinner wire on long circuits both on line and coils? A. Experience has demonstrated that to obtain the full effects of the current on a given circuit, the helix in which the work is done must, in the matter of resistance, equal the line and battery. 3. I would like to know why telephone companies use such thin wire on main lines. A. Because the secondary current is employed, which does not require a heavy conductor. 4. Could not a piece of carbon be substituted for the convex platinum button in the Blake telephonic transmitter, as is done in the transmitter described in SCIENTIFIC AMERICAN, of March 19, 1881? A. Not with good results. 5. Which one do you think would be the easiest and most inexpensive one to make to be used with a bell telephone? Can a Hughes microphone be used on a short line in connection with a bell telephone? A. Use the Blake transmitter.

(4) W. K. F. asks: 1. What kind of saw band, mulay, sash, circle, or any kind of saw, requires the least power to saw a given amount of lumber? A. We recommend a circular saw mill, as being more simple and effective than either of the others. 2. What is the horse power required to saw on average 1,200 feet hard wood lumber per day (ten hours)? A. An 8 horse power engine would saw 1,200 feet in ten hours; but we recommend you to have not less than 10 horse power.

(5) L. D. D., Jr., asks (1) how to polish horn. A. Dress down with powdered pumice stone, two sizes (the finest last), and water. This may be applied on a wheel—horizontal or buff. Finish with whiting, or, for fine work, putty powder. 2. Is rain water the softest of all water (excepting distilled)? A. Yes.

(6) D. F. writes: I have a new kitchen floor which I wish to wax. Can you inform me how to make the wax? A. Two oz. of pearlash, 10 oz. of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates. Boiling water is now cautiously added to the mass, until no watery drops are distinguishable. The dish is again set on the fire, but its contents are not allowed to boil (otherwise myricin would separate out), 8 or 9 pints of water being added, little by little, with constant stirring. Coloring matter may be added if desired.

(7) E. E. H.—The following methods of tempering mill picks have proved very successful: 1. Take 2 gallons rain water, 1 oz. of corrosive sublimate, 1 of salammoniac, 1 of saltpeter, 1½ pints rock salt. The picks should be heated to a cherry red and cooled in the bath. The salt gives hardness, and the other ingredients toughness to the steel; and they will not break if they are left without drawing the temper. 2. After working the steel carefully, prepare a bath of lead heated to the boiling point, which will be indicated by a slight agitation of the surface. In it place the end of the pick to the depth of 1½ inches until heated to the temperature of the lead, then plunge immediately in clear cold water. The temper will be just right if the bath is at the temperature required. The principal requisites in making mill picks are: First, get good steel. Second, work it at a low heat; most blacksmiths injure steel by over heating. Third, heat for tempering without direct exposure to the fire. The lead bath acts merely as protection against the heat, which is almost always too great to temper well.

(8) O. R. M. writes: I am much annoyed with dandruff. Can you suggest a harmless and reliable remedy? A. Dandruff (*Pityriasis*) is a chronic inflammation of the skin, characterized by the production of minute white scales or scurf in excessive quantity. The affection is often very rebellious to treatment. Various preparations are sold which are claimed to be beneficial, and physicians sometimes prescribe tonic infusions, purgatives, and the application of sedative lotions. In obstinate cases an internal dose in which arsenic is the essential element is sometimes prescribed. The efficacy and safety of such measures are to be doubted. Probably the best plan is to keep the hair short and shampoo it frequently with a solution of borax in warm water, avoiding rough treatment, which has a tendency to increase the irritation.

(9) A. E. S. asks how to lay off a safety valve lever and place the weight so that the valve will blow off at a given pressure. A. Multiply the weight of the lever by the horizontal distance of its center of gravity from the fulcrum; the weight of the valve by its horizontal distance from the fulcrum; the area of the valve by the steam pressure and horizontal distance of the valve from the fulcrum. Add together the first two products, subtract their sum from the third product, and divide the difference by the weight of the ball.

(10) S. asks: How can I ebonize wood, and what kinds of wood are best adapted to this finish? A. Apple, pear, and walnut, if fine grained, may be ebonized by the following process: Boil in a glazed or enameled iron vessel with water, 4 oz. of ground gallnuts, 1 oz. of logwood chips, and ½ oz. each of green vitriol and crystals of verdigris. Filter while warm, and brush the wood over with this repeatedly. Dry and brush over with strong cold solution of acetate of iron and dry. Repeat this several times, and finally dry in an oven at a moderate temperature, and oil or varnish.

(11) E. G. T. asks: 1. Will not a wheel of one pound weight, revolving 100 times per second, be of the same value as a balance wheel as one weighing ten lb., revolving ten times per second? A. The regulating power of a fly wheel is as the weight into the square of the velocity. Hence supposing that in your two cases, the weight travels on the same radius, it will be as weight into the square of the revolutions, or 10,000 in first case and 1,000 in second case. 2. I have two magnets placed together so that their opposite poles correspond. They attract each other with a certain force. Now, if the poles of one of the magnets be reversed, will the magnets repel with the same force as they attracted before? A. The two forces are not the same, the repulsion being the smaller force. 3. I have some copper wire with which I wish to make an electromagnet. In which way will I get the most power, to wind all the wire on one magnet or to have two one half the wire on each? The current is to pass through the whole length of wire in either. A. The greatest force can be obtained from the single magnet under the conditions given.

(12) J. N. W. asks: What ingredients and quantities of each for pattern varnish? A. For pattern varnish cut 4 oz. of orange shellac in 1 pint of alcohol. If black varnish is desired add fine lampblack.

(13) C. L. W. asks: Will a mercurial barometer work as well in a room as it would out of doors? A. Yes.

(14) A. W. H. L. writes: We have recently moved in a house that is overrun with bed bugs and roaches, also ants. My wife has tried everything we have heard of, even wetting the cracks of the flooring with sulphuric acid, but it seems to have no effect on them. They are not in the furniture, as it is all new. A. Try oil of turpentine. It may be introduced into the cracks and crevices infested with the insects by means of a sewing machine oil can. A very small quantity of the liquid, if judiciously used, will suffice.

(15) J. J. asks: Can you tell me of some preparation to clean and polish brass that is exposed to heat, such as brass on a locomotive both in cab and outside? A. Clean the work with emery flour and a little refined paraffine oil; wipe and finish with cotton waste and a trace of oil.

(16) T. Q. asks how to make printer's rollers. I have made a few of them here, but they don't seem to have the proper amount of suction to make work look as nice as I have been accustomed to do in New York city. A. Best white glue, 1 lb.; concentrated glycerine, 1 lb. Soak the glue over night in just enough cold soft water to cover it. Put the softened glue in a fine cloth bag, gently press out excess of water, and melt the glue by heating it over a salt water bath. Then gradually stir in the glycerine and continue the heating, with occasional stirring, for several hours, or until as much of the water is expelled as possible. Cast in oiled brass moulds, and give the composition plenty of time to cool and harden properly before removing from the mould and inking. See that the ink is well spread before bringing the roller in contact with type. 2. Please let me know if the water used in heating the composition should be kept boiling? A. The water in the water bath should be kept boiling.

(17) R. H. B. asks: 1. Do all dynamo-electric machines require to be first charged with an electric battery before they will generate a current? A. No; the magnetism naturally residing in the iron of the field magnet is sufficient to start the current. 2. How is the candle power determined of any electric lamp or machine? A. By comparison with a standard candle in some sort of a photometer. 3. What work can be had that will give the desired information regarding ohms, volts, webers, ergien, or ergio, etc? I am making it a special study as far as I can. Have several good works, and keep getting SUPPLEMENTS, which, I think, will help me along, but have not got the right thing yet. A. Ganot's Physics and Prescott's Electricity are good works. 4. Is there any published work on electric motors? Can you send SUPPLEMENTS with illustrated articles on same? A. We know of no work especially devoted to electric motors. The SUPPLEMENT contains many articles on the subject. 5. I took an ordinary U magnet to a painter to have it repainted (red); he painted it, but, as it did not dry, he set it in the sun, but after about twenty trials, he said, by himself and other good painters (considered so), he gave it up as a bad job, and gave it to me still very sticky. What was the trouble? What is it magnet makers produce that bright, fine red with? A. The red varnish is made by mixing English or Chinese vermilion with alcoholic shellac varnish. 6. Is it not possible to see electricity? Is not the spark considered and calculated to be the electricity itself? A. Electricity is known only by its effects. The spark is one of them.

(18) N. P. H. asks: Which is best to use in a cylinder, a good oil or tallow? Will tallow or any animal grease injure the inside of a cylinder? A. Use good oil. Tallow as generally supplied to the market, contains an acid which attacks the metal.

(19) H. E. B. asks: How fast can an engine with 10 inch cylinder, 30 inches stroke, 60 lb. steam, be run with safety to run a circular saw 700 revolutions per minute; and what size of pulley on saw arbor would it require, pulley on engine being 96 inches in diameter and belt running direct? A. If well balanced and adjusted, 100 revolutions per minute. Diameter of pulley 13½ inches nearly.

(20) W. W. C. writes: 1. This town wishes to put in a system of water works. We can procure 99½ feet head. The spring is very large and distant some two miles. If we start with a large main, say 8 inch, and at one-half the distance reduce it one half, will not the force be greater, and the hydrants throw a higher stream? A. No. 2. What height of stream can we procure here from mouth of hydrant with a conical hose on nozzle? A. Much depends upon size, length, and course of pipes, but probably 68 to 76 feet. You are mistaken about the effect of reducing the main; it would be injurious rather than beneficial.

(21) T. K. asks: What quantity of cork would be required to sustain a man of average weight in the water? A. The steamboat law requires 6 lb. good block cork for life preservers.

(22) A. S. L. asks for the cheapest and best possible way of constructing, and the cost of, a reservoir with a capacity of 30,000 gallons of water. A. This will require a reservoir 16 feet square and 16 feet deep. Cost depends on nature of soil and position. Any good mason will advise you.

(23) J. A. asks if it is usual to give lead to the valves of express passenger engines, and if so, how much. Also the lead necessary for freight engines. A. Steam lead is generally one-eighth of an inch to three-sixteenths of an inch. All engines should have lead.

(24) J. N. H. writes: I have a cupola, 24 inches in diameter, with two tuyeres 5 inches in diameter. Would anything be gained if the tuyeres were set by one another, so as to give a spiral direction to the blast? A. We do not think the advantage would be appreciable except with a weak blast.

(25) F. W. H. asks what the meaning of the word "pitch" is in speaking of a propeller screw. A. The advance which would be made by the angle of the blade if turning in a solid.

(26) A. B. S. writes: In the SCIENTIFIC AMERICAN, No. 12, September 17, page 186, in answer to (5) J. A.'s inquiry, you told how to make tin look like crystals or like frost on windows in winter. May I ask if the same may be done on silver, and by what method? A. No; silver has not the peculiar crystalline structure of tin. Frosting is sometimes done by a revolving tool in a lathe. 2. How is the water and fire proof paint that we see on the cottages made? A. See Water-glass, page 16, No. 2, current volume.

(27) C. F. K. asks for some varnish, paint, or enameling process for covering a plate iron tank to protect it from the joint action of grease, alkali, and water. Or, again, what is the best mode of preventing corrosion under such circumstances? A. We know of no satisfactory coating that could be applied to the iron. The tank might be lined with thin sheet lead.

(28) C. S. G. writes: 1. I would like any information you can give in regard to nickel plating. I have a bicycle I would like to plate. A. Use ammonia nickel sulphate, three quarters of a pound to the gallon of soft water, for the plating bath. Cleanse the wire with hot potash and cyanide solutions and pumice stone, as directed in article on nickel plating, page 153, vol. xliii., and having connected it with the zinc pole of the battery, draw it slowly through the plating bath between nickel anodes (connected with the copper or carbon pole of the battery), and under rubber pulleys so arranged as to keep it immersed in the liquid. For details respecting the management of such baths see the article referred to. 2. Is there such a thing as waterproof glue? A. You will find good receipts for waterproof glue under Cements, page 2510, SUPPLEMENT, No. 158.

(29) J. N. M. asks: Is not a good injector more economical than a good pump, for a factory engine of uniform speed? In this particular instance the injector would be non-lifting. A. Under the conditions you name there is very little difference in economy between an injector and a pump with a good heater. But the injector has the advantage that you can feed the boiler when the engine is not running.

(30) J. L. L. writes: I have an item here which I think is worth space in your columns. I refer to a heat I took off in the Manhattan Foundry yesterday. It was a small heat of 6,000 pounds, which was taken off in one hour and twenty minutes, and was melted with 600 pounds of coke, which you will see was ten to one, and which is the best I have ever done or ever heard of being done, and I have worked at the business now almost seventeen years with good success. Our engine is a small donkey, which runs at 75 revolutions, while the fan runs 3,000 per minute. The fan is a No. 6 Sturtevant, and the furnace is only a 30 inch, with two tuyeres 2¼ by 7 inches, and our iron is all old scrap, and some of it has been melted a great many times. The amount of castings obtained from the heat was 5,536¼ pounds, which, I think, taking all into consideration, is worth notice. A. This is an excellent result, far above the average. But we have known (on a test) 13 pounds iron brought down to one pound anthracite coal. If coke had been mixed with the coal, or coke only used, a still better result could have been obtained. But this was from a cupola about 42 inches diameter.

(31) E. J. R. asks: What is pepsin, and how is it prepared? A. Pepsin is a nitrogenous substance existing in the gastric juice, and as a viscid matter in the peptic gland and on the walls of the stomachs of animals. The mucous membrane of the stomach (of the hog, sheep, or calf, killed fasting) is scraped, and macerated in cold water for twelve hours; the pepsin in the strained liquid is then precipitated by acetate of lead, the deposit washed once or twice by decantation, sulphureted hydrogen passed through the mixture of the deposit with a litttle water to remove the whole of the lead, and the filtered liquid evaporated to dryness at a temperature not exceeding 105° Fah. As met with in pharmacy the strength of pepsin varies greatly. It is often prepared by simply mixing with starch the thick liquid obtained on macerating the scraped stomach with water, and evaporating to dryness. The composition of pepsin is not positively known.

(32) J. M. asks how to proceed to ascertain the average rainfall. A. Take a quart bottle of uniform diameter, and graduate its liquid contents by a scale of tenths of an inch accurately engraved on the side; fit into the neck of the bottle a 40° funnel, the diameter (in inches) at the rim or widest part of which has been accurately ascertained; then diameter square ×0·7854= area in inches of the base of the inverted cone. Suspend the rain gauge in an upright and exposed position. Then, number of inches of rain collected in the bottle ÷time of exposure=average rainfall in inches. The gauge should of course be out of the reach of spattering water from surrounding objects, and in order to avoid great error through the spattering of the water from the funnel, the angle of the sides of the latter should not be greater than 40°. The neck of the funnel should be narrow, and due allowance must be made for evaporation. Readings should be taken if possible before as well as after a rainfall. The indications of this simple instrument are sufficiently accurate for all ordinary purposes.

(33) E. D. asks how to discover lead poison in water. A. Evaporate by gentle heat a small sample of the water nearly to dryness in a clean porcelain cup, moisten the residue with acetic acid, and add to a portion of it a few drops of strong hydrosulphuric acid—pure water saturated with the gas evolved by the action of dilute sulphuric acid on iron mono-sulphide; a black precipitate indicates lead. Add to another portion of the dilute acetic acid solution a little pure hydrochloric acid; a white precipitate, which redissolves on diluting with boiling water indicates lead. To the remainder of the solution add a few drops of dilute sulphuric acid, and let it stand for a time; a white heavy precipitate indicates lead.

(34) W. M. C. asks: Which will afford most power or do the most grinding, a twenty foot overshot wheel, or one twelve feet (overshot), if the same water be used on each per hour of running time? If any difference, state what. A. With the same quantity of water and same velocity, the power of the two wheels will be nearly directly in proportion to their diameter.

(35) H. S. writes: In your issue of the SCIENTIFIC AMERICAN, No. 6, vol. xiv., August 6, in your description of the sea lamprey, you state that it was and is now used for food. Will you please state in your paper what part of the lamprey is used for food and how it is dressed? A. The only part of the lamprey not used is the head. Lampreys are cooked in the same styles as the common eel, namely, fried, stewed, potted, devilled, and chowdered with potatoes and fat pork. A large part of the famous London eel pies are composed of the lamprey eel, and the substitute is considered by judges as a great improvement over that of the common eel. Lamprey eels cannot be smoked, as they contain so small a quantity of fatty material, but are excellent when pickled in salt or vinegar.

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

D. G.—No. 1. The powder consists chiefly of oxide and sulphide of iron. The latter probably carries a little silver and gold—it would require an assay to determine this. No. 2. Quartzose rock containing basic sulphides of copper and iron carbonate and silicate of copper and lead sulphide, (galena). Would probably assay high in silver. No. 3. Quartz with sulphides of iron, copper, and zinc—probably carries both gold and silver. No. 4. Silver-bearing quartz.—E. S. M.—Bituminous coal. —A. A. W.—It is ammonium nitrate.—S. G. S.—Fine white siliciouss and—used in the manufacture of glass and pottery, soluble glass, cements, and enamels, and for scouring purposes.—H. B. M.—A fragment of sandstone.—D. W.—Iron pyrites—iron sulphide.—J. B. S.—Ferruginous micaceous quartz rock containing a little hornblende.—W. H. B.—Partially decomposed feldspathic rock—of little value.—R. E. P.—An argillaceous limestone—might make a good cement.—B. G. U.—1, Red jasper. 2 and 3. Flint.—4. Lime carbonate. 5 and 7. Limonite—oxide of iron. 6. Limestone.

COMMUNICATIONS RECEIVED.

On the Electrical Theory of Comets, by C. S. B.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

September 13, 1881.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1869, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Aeronautic apparatus and regulator, E. De Jongh 246,872
Air for motive power, device for using compressed, L. Mékarski (r) 9,871
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CAUTION.

—*An attempt has been made to put so-called "Electro Magnetic" Brushes upon the market, but the Post-Office authorities at Washington have published the company as a fraud. We therefore caution the Public to be careful that "Dr. Scott's" name is on the box and "Electric" on the Brush. Ours is not wire, but a pure bristle Brush.*

DR. SCOTT'S ELECTRIC HAIR BRUSH.

A MARVELLOUS SUCCESS!!

NOW RECOMMENDED BY OUR BEST PHYSICIANS.

Which has won its way to Royal favor in England, been cordially indorsed by the Prince and Princess of Wales, and written upon by the Rt. Hon. W. E. Gladstone, is now brought to the notice of the American public. It cures by natural means, will always do good, never harm, and is a remedy lasting for many years. It should be used daily in place of the ordinary Hair Brush. The Brush Handle is made of a new odorless composition resembling ebony; a combination of substances PRODUCING A PERMANENT ELECTRO-MAGNETIC CURRENT WHICH ACTS IMMEDIATELY UPON THE HAIR GLANDS AND FOLLICLES. This power can always be tested by a silver compass which accompanies each Brush.

Facsimile of Brush.

IT IS WARRANTED TO

- Cure Nervous Headache in 5 Minutes!!
- Cure Bilious Headache in 5 Minutes!!
- Cure Neuralgia in 5 Minutes!!
- Prevent Falling Hair and Baldness!!
- Cure Dandruff and Diseases of the Scalp!!
- Promptly Arrests Premature Grayness!!
- Makes the Hair grow Long and Glossy!!
- Immediately Soothes the Weary Brain!!
- Money returned if not as represented!!

All dealers are authorized to refund the price if not as represented.

It rarely fails to produce a rapid growth of hair on bald heads, where the glands and follicles are not totally destroyed.

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[From Rev. Dr. Bridgeman.]

BROOKLYN.

'Gents:—I have never before given a testimonial, but am willing to encourage the use of an honest remedy. I am so pleased with your Hair Brush that I deem it my duty to write you recommending it most cordially. My hair, about a year since, commenced falling out, and I was rapidly becoming bald; but since using the Brush a thick growth of hair has made its appearance, quite equal to that which I had previous to its falling out. I have tried other remedies, but with no success. After this remarkable result I purchased one for my wife, who has been a great sufferer from headache, and she finds it a prompt and infallible remedy. A. C. Bridgeman, D.D."

Saratoga.

"I cheerfully testify to the merits of Dr. Scott's Electric Hair Brush. It cures my headaches within a few minutes. It is an excellent Hair Brush, well worth the price, aside from its curative powers." Jas. R. Chapman, Mayor.

"I would Not take $1,000 for my Brush

If I could not replace it. Its effect is marvellous." PLINY F. SMITH, 218 Fulton Street, N. Y.

Mr. Smith is a gentleman well known in this City as a Law Publisher, and also as a Director in several Public Institutions of New York.

Head Office "Domestic" Sewing Machine Co., New York.

DR. GEO. A. SCOTT—*Dear Sir:* Permit me to add the testimony of my wife to that of the many others who have been benefited by the use of your Electric Brush. She has for years been a sufferer from Neuralgia in an acute form, but since I obtained for her one of your Brushes, she has experienced entire relief. Please accept her sincere thanks. HENRY BARTLETT.

Over 7,000 similar Testimonials can be seen at our office.

ASK FOR DR. SCOTT'S BRUSH. TAKE NO OTHER. See that name is on the box.

A BEAUTIFUL BRUSH, LASTING FOR YEARS.

We will send it on trial, postpaid, on receipt of $3.00, which will be returned if not as represented.

Inclose 10 cents extra and we guarantee safe delivery into your hands; or will send it by express, C. O. D., at your expense, with privilege of opening and examining. But express-age adds considerably to your cost. Or request your nearest Druggist or Fancy Store to obtain one for you, and be sure Dr. Scott's name is on the Box.

Mention this Paper.

MONEY RETURNED IF NOT AS REPRESENTED.

As soon as you receive the Brush, if not well satisfied with your bargain, write us, and we will return the money. What can be fairer? The Proprietors of this Publication know Dr. Scott to be respectable and trustworthy, a Brush has been placed in the hands of Mayor Cooper and Postmaster James of New York, as a guarantee of good faith.

Remittances should be made payable to GEO. A. SCOTT, 842 Broadway, New York. They can be made in Checks, Drafts, Post Office Orders, Currency, or Stamps. LIBERAL DISCOUNT TO THE TRADE. **Agents Wanted in every Town.**

Send for a Circular of our Dr. Scott's Electric Flesh Brush.

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Inside Page, each insertion - - - 75 cents a line.
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(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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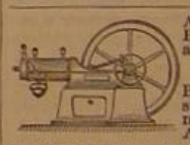

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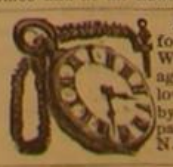

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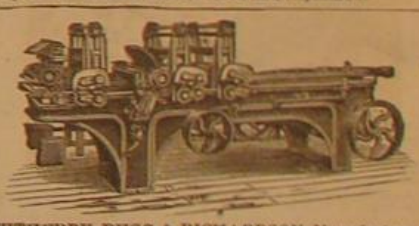

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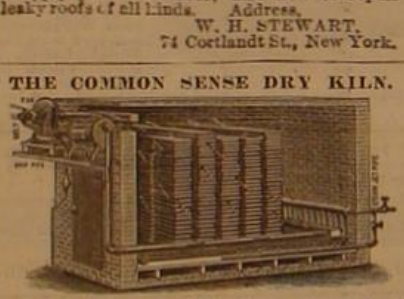

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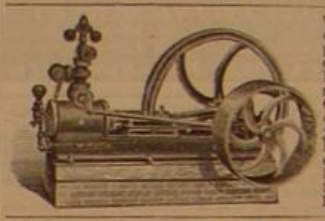

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