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Siphons.

At a recent meeting of the Polytechnic Association of the American Institute the president, Mr. T. D. Stetson, detailed some experiments which he had recently made.

The ordinary siphon, consisting of a simple bent tube, acts by the difference of length of the two columns of liquid. There is a tendency to form a vacuum at the top of the tube. The superior gravity of the longest raises the shorter column by the atmospheric pressure. The partial vacuum results in the liberation of the small quantity of air always contained in the water, and the formation of what is known as an air trap.

In attempting to avoid this difficulty by the use of a large vessel or air receiver some curious results were obtained.

The first object was to make a self-emptying air chamber. The plan adopted to accomplish this result was to carry both pipes into the air chamber, and take one to the very top, where it was turned over in such a way as to make a fall of water through the air space when the siphon was in operation. This plan would in all probability be successful in a perfectly constructed apparatus. In order, however, to observe the operation, Mr. Stetson had made the air chamber of glass, and he found himself unable to preserve a perfectly tight joint sufficiently long to determine the question definitely.

A siphon having a large chamber at the bend, into which one pipe enters at a much higher level than the other, he found developed, with just sufficient air inclosed, the very unexpected property of acting like a check valve. It opposes a greater resistance to the passage of water in one direction than in the other—the difference in resistance depending on the difference of area between the water surface in the chamber and that in the pipe entering at the highest level. In draining marshes on a large or small scale, in draining any area subject to tidal fluctuations or fluctuations from freshets, especially in connecting a cellar drain with the sewer where the sewer is liable to rise and make a back-flow under extraordinary circumstances, this offers a valuable means for opposing the return flow of the water. By properly proportioning the chamber to the pipe, the excess of head necessary to force the water through the wrong way could be made almost anything we please.

Mr. Sutton said that siphons are very interesting pieces of apparatus and work very curiously. In the early days in California, where capital was abundant but the means limited, siphons were often used to drain mines in the gravel, especially when they came to the bed rock, and tunnels would be necessary to drain the water off in the ordinary way from a rock basin. In such cases the siphons were used to take the water over the "rim of the bed rock."

These siphons almost always stopped working after a little, from an accumulation of air in the bend. They always stopped, in fact, save when they were put in by experienced men. The speaker then detailed an instance where he put in a siphon going over a rim of rock some 150 feet in length. The outside end was of iron pipe, but the inside end was rubber hose. As the works were carried further in, some 250 feet of rubber hose was added; the head being very small, there was but slight tendency to collapse. At each end a stop valve was placed, and at the highest point there was an air chamber. This was formed of an empty whisky cask, which was a thing easily got and adapted to the purpose. The cask and siphon were filled through a tunnel at the top, the valve on the top of the cask was then closed and the others opened, and the siphon would commence to work. It was necessary to have two valves, one at each end of the pipe, because at that time they could not buy in San Francisco a pump capable of filling the pipe. At night the whole was shut off, and in the morning it was started long enough before work began to properly reduce the water level. The air chamber would fill with air in about two hours, but just before it was supposed to be filled the valves were shut and the barrel filled up again with water through the tunnel.

ATTRACTIVE SUBURBAN RESIDENCES.

Very much has been done by our architects and builders during recent years to develop artistic individuality and home-like attractiveness in the construction and surroundings of suburban residences of the more expensive sort. Yet it is still too much the fashion to carry into semi-rural neighborhoods, where ground space is reasonably cheap, the unbroken blocks of houses characteristic of the city, and made necessary there by the high cost of land.

The outskirts of our cities, where garden and lawn spaces are not luxuries beyond the means of the moderately well-to-do, show a serious lack of dwellings intermediate in character between the city block and the detached residence, though the need of such homes must be wide and urgent. When the average business man seeks a home at a distance from the center of traffic, he does not want to find it in a row of houses which might as well have been planned for and set up in the heart of the city. Though unable to own or hire a detached house, he is not unwilling to pay for a reasonable amount of land not built upon, provided it is properly used to enhance the beauty and healthfulness of his home. For such reasons we are inclined to think that there is a large opportunity for capitalists and speculative builders to make good investments in dwellings of the class described, in many suburban localities made accessible to the business men of New York and other cities, by the increasing means of rapid transit everywhere prevailing.

The accompanying illustration, showing the elevation and grounds of a section of three villas, from a block of nine residences in Hanover, Germany, gives a good idea of what the suburban homes we have in mind might look like.

The second engraving shows the plans of the main floors, and the artistic manner in which the grounds are laid out. With such changes of plan as would be required to adapt them to the needs of American households, such dwellings, we believe, would sell readily or rent to desirable tenants at rates that would make them as profitable to the builder or owner as delightful to the occupants. In size the houses are well suited for the majority of well-to-do American families, such for example as make up a large part of the population of Brooklyn; and their architectural beauty speaks for itself. The cost of the houses need not be great;

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SUGGESTIONS IN ARCHITECTURE.—GROUP OF ORNAMENTAL VILLAS AND GROUNDS.

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THE SCIENTIFIC AMERICAN SUPPLEMENT

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PRINTING INK.

A few years ago the preparation of printing ink was considered a part of the printer's trade; now there are very few printers who have more than a remote idea as to the composition or preparation of the inks they use.

The manufacture of such inks has of late years developed into a distinct industry, employing hundreds of thousands of dollars capital, and turning out hundreds of tons of ink annually.

The basis of all ordinary printing inks, from the cheap poster and news to the finer lithographic and plate inks, is a varnish, prepared from oils, chiefly linseed, although nut oil is sometimes used, and rosin oil frequently introduced in the cheaper grades.

Where linseed oil is used this *varnish* is practically anhydride of linoleic acid, the fatty constituents of the oil—glycerine, palmatine, etc.—having been volatilized by heat. For the better class of inks old oil is preferred. It is usually purified by heating it for several hours by injected steam or otherwise, with oil of vitriol (sulphuric acid) diluted with about three times its weight of water. The acid solution having been drawn off the oil is washed by agitation with boiling water, and, after standing to allow the latter to separate, is run off into storing vessels. From these the oil is transferred to iron caldrons provided with stirring apparatus and covers. A moderate fire in a small furnace beneath gradually heats the oil, which only half fills the vessel (to prevent accident by foaming) and the stirring apparatus is set in motion. The moisture in the oil is gradually dissipated, and as the temperature approaches 570° Fah., an inflammable vapor or smoke begins to escape from the boiling oil; a scrap of burning paper secured in the cleft of a long stick is thrust into the smoke, which is thereby ignited. The fire below is drawn and smothered; the oil, or rather the gases given off by the oil, are allowed to blaze, the combustion being kept within bounds by partly covering the pot if necessary. Samples of the oil are taken out from time to time and tested by cooling a few drops on a plate of glass or tile. When the drops thus chilled glaze over quickly and draw out into strings of about half an inch between the fingers, the flame is extinguished by putting the cover tightly over the pot. The oil is then again heated over a moderate fire to the boiling point, and the heat and stirring kept up for several hours, small quantities of drier being introduced by some manufacturers.

Varnishes of several degrees of thickness—from greater or less boiling—are prepared in this way to satisfy the requirements of the different kinds or grades of ink, and to modify their consistence to suit the climate where used, thinner ink being required in cold than in warm climates.

For black letter-press ink the color and character are usually imparted to the varnish by the incorporation with it of lampblack or carbon black, Prussian blue, indigo, resin, and soap. The proportion of these vary according to the purpose for which the ink is intended. The following will serve as an illustration of the composition of a good letter-press ink: Varnish (prepared as above), 1 gallon; resin, 4 pounds; brown resin soap, 1½ pounds; purified lampblack, 5 pounds; Prussian blue and indigo, each 1¾ ounces.

In compounding the ink the resin is finely powdered and gradually stirred into the varnish, made hot enough to melt and dissolve it. The soap, previously cut into thin slices, dried, and rubbed into fine crumbs, is next introduced, a very little at a time, as the moisture it still retains is apt to occasion a violent commotion as it is driven out by contact with the hot varnish. The addition of soap to printing ink increases the sharpness of the print and tends to prevent smearing or clouding of the work. The mixture, after cooling somewhat, is poured over the lampblack, and finely powdered blue pigments placed in the bottom of a suitable vessel, and the whole is well stirred together and then ground in a paint mill until reduced to a very fine, smooth, and uniform paste.

The quality of such inks depends largely upon the thoroughness with which the pigments are incorporated with the paste by grinding.

Lithographic inks are simply very fine printing inks made somewhat more fluid than required for letter-press or cut work. The ink used for engraved or plate work is usually a heavy printing ink made with ivory black, or ivory and carbon blacks, instead of lampblack.

Colored printing inks are made from fine, clear linseed oil, boiled into a varnish as above described, and appropriate pigments. The pigments used are carmine, lakes, vermilion, red lead, Indian and Venetian reds, chrome yellow, chrome orange or red sienna, gallstone, Roman and yellow ochers, verdigris, indigo, Prussian blue, Antwerp blue, ultramarine, luster, umber, sepia, and various mixtures of these.

A very fine printing ink may be prepared without burning, and the risks attending boiling oil may be avoided, by using the following receipt: Balsam of capivi, 9 ounces; resin soap, dry, 3 ounces; lampblack, purified, 3 ounces; Prussian blue, 1¼ ounces; Indian red, ¾ ounce; creosote, 3 drops. Grind all together on a stone slab, with a muller, to a very smooth and uniform paste. Any of the colors above enumerated may be substituted for the lampblack and other pigments in the above formula to produce colored inks.

In Germany an ink, prepared as follows, has been used, and is said to yield a very clear and fine impression when properly prepared: Venice turpentine, 2¼ ounces; soap, in thick paste, 2½ ounces; olein, rectified, 1 ounce; carbon black, 1¼ ounces; Paris blue, ¼ ounce; oxalic acid, ⅛ ounce; water, ¼ ounce.

The three last ingredients are mixed into a paste. The turpentine and olein are mixed at a gentle heat, the soap and carbon then introduced, and, after cooling, the blue paste is added, the whole being ground beneath a muller to a very fine and smooth paste.

The following are patented inks: Colophonic tar, 14 pounds; lampblack, 3 pounds; indigo, 8 ounces; Indian red, 4 ounces; yellow resin soap, 1 pound.

The colophonic tar referred to is the residuum from the distillation of rosin for rosin oil.

Linseed oil, 40 gallons; litharge, 4 pounds; lead acetate, 2 pounds.

The oil is heated to about 600° Fah., for from forty-eight to sixty-five hours according to quality of varnish required, the lead salts being added as driers. To each gallon of this varnish, 4 pounds of gum copal is added and dissolved. For common news ink the proportions are as follows: Of the above varnish, 15 pounds; rosin, 10 pounds; soap, brown resin, 2 pounds; lampblack, 5½ pounds.

A fine ink, suitable for use with rubber type, is prepared from nigrosine, soluble, 1 ounce; glycerine, pure, 4½ ounces; soap, white curd, ¼ ounce; water, *q. s.*

The nigrosine, finely powdered, is mixed into a stiff paste with the water, hot, and after standing a few hours this is mixed with the glycerine and soap, and the paste rubbed down with a muller on a hot stone slab.

For colored inks of this description the nigrosine may be substituted by almost any of the soluble coal tar dyes.

THE PROBLEM OF HEALTHY WATER.

Much complaint has arisen within the last two months, in this city, about the quality of the Croton water. It was alleged that it had a fishy taste that was far from agreeable, and apprehensions were expressed that it might be unfit for use. The Board of Health promptly had it analyzed and published the results. They were reassuring, and the public were told that they could drink all they desired with impunity. While this assertion was made on the strength of the analysis, it was fortified by the fact that no disease had been traced to the Croton, although it had been complained of for several weeks before the publication of the analysis. The timely investigation seems to have quieted the alarm, and in this way probably considerable good was done. Whether it proved anything concerning the water is another question.

A chemist or scientific man who takes the position of a non-alarmist where he can at all conscientiously do so, does much better than one who raises the cry of danger on a small provocation. This last has been done recently at the meetings of a certain social science association in the matter of adulteration. A certain person gave a formidable category of substances used for the purpose. It did not matter to him that some of the adulterants were more expensive than the original substances; he put them down in his list just the same.

But the question we are thinking of is whether the analysis proved that the Croton water was good. Water analysis is simple enough in its practice, but what is the verdict as to its value? Where it is necessary to know if water can be used for a steam boiler the determination of its solid mineral constituents can be made close enough without trouble. Even in this determination of the total mineral matters there are difficulties as yet unsolved. After the water is evaporated to dryness the organic matter is disposed of by ignition. In this ignition, however, some of the nitrates and carbonates present will be decomposed, and cannot be restored to precisely their original state. No question on its face seems simpler and is so hard in reality. Still, it can be done closely enough for practical purposes.

A reliable determination of the character of the organic matter, which was the vital point in our case, is unknown. All authorities admit its difficulty. Those who have their own methods uphold them, but still consider it an intricate question. The total nitrogen and albuminoid nitrogen found by the methods used by Dr. Waller are of value to a limited extent only. Water of a most dangerous character might pass the ordeal of such an analysis much better than a safe fluid. The above tests in this case had a certain comparative value, as they were made in a regular series of Croton water analyses. It is from this point of view that they appear best. We do not doubt that on inquiry it would be found that it was their comparative value that the analyst would most insist on. It is easily conceivable that a water from the same source might acquire an additional amount of dangerous impurity and suffer a greater loss of innocuous organic substance at the same time. In such a case it would analyze better. It would have less organic matter and less nitrogen of both types. Yet it would be more dangerous, and the comparative value of the analysis would be *nil*.

The dreaded impurities are the fermentable substances and living organisms, or rather germs. Some years ago a simple test for urea, founded on its fermentation, appeared in our scientific journals. It was suggested as useful to distinguish contaminations of water with coal gas liquor and sewage respectively. Both these substances produce or contain ammonia, so that a test to distinguish the origin of that ammonia was very desirable. Here is a hint of what would be a grand achievement in water analysis; a reliable and practicable determination of the fermentable constituents. By the use of different reagents they might be distinguished from each other, just as the ammoniacal contamination due to gas liquor was distinguished from that due to sewage in the case just mentioned. Any animal or vegetable forms, too, might be classified into harmless and harmful ones. This would be the basis of a germ analysis.

The first of these suggestions may be carried out in the future, but so far it has not been realized. It is fraught with difficulties, among others the dilution in the water, and the easy destruction in laboratory operations of the substance.

The microscopic examination can, however, be even now conducted with some intelligibility, and might be made to yield valuable results.

Some authorities claim that a simple determination of oxygen required to oxidize the organic matter is enough. Others say the total organic matter is the essential thing. Some prescribe an analysis by combustion of the organic matter; others a determination of the two nitrogens or ammonias, total and albuminoid, in the wet way. "Where doctors disagree who shall decide?" says the proverb.

The problem is stated. A real valid method for the analysis of water is the want. The disagreement of experts among themselves proves that all must be dealing in uncertainties. Chemists would like nothing better than to see the vexed questions of their profession settled. They do not like uncertainties. They all wish to be positivists in science. In all the field of analytical chemistry there is hardly a more puzzling question than the above.

GEORGE STEPHENSON.

The centenary of the birth of George Stephenson, "the father of railways," was celebrated in England, June 9.

Stephenson was born at Wylam, eight miles from Newcastle-on-Tyne. His father was fireman at the near by colliery engine house. His mother was the daughter of a dyer. At eight years of age Stephenson herded cattle for a neighbor for a shilling a week, part of his duty being to shut the gates of the tramway from the pit, when the wagons passed, to keep the cows from straying. One of his early amusements was the modeling of an engine and winding machine like the one his father tended. At fourteen he was made assistant fireman, earning one shilling a day. Three years after he jumped his father's position and became engine man. At this time he could neither read nor write, but he knew his engine and critically studied its construction and working. About this period an old Scotch schoolmaster helped him to overcome the mystery of letters. At twenty-one he married, and after the birth of his son Robert, a year later, he removed to West Moor Colliery, Killingworth, where his wife soon died. For distraction in his bereavement he went to Montrose, Scotland, to superintend the working of a Boulton and Watts engine. He found the engine out of gear and the works choked, but soon had matters straightened and the machinery in proper working order. A year later his father was blinded by an accident; he was drawn in the militia for the Continental wars, and his prospects looked dark enough. To relieve his father's destitution and purchase exemption from army service used up his scanty savings, and he seriously contemplated emigration as his only chance for success in life.

The question of steam transit was becoming prominent during the early years of the century, and naturally enlisted the attention of Stephenson. The early locomotive makers contemplated engines for hauling wagons over common roads only; but Stephenson—thanks, no doubt, to his early observation of the advantages of rails while gate closer and cattle herder—foresaw that the road of the future must be a railroad, and planned his first locomotive accordingly.

In the fall of 1822 he constructed for the Hetton Colliery Company a short railroad, upon which, on the 18th of November, his locomotive hauled a load of sixty-four tons at the rate of four miles an hour. This demonstration of the feasibility of railways led at once to the Darlington and Stockton railway project, which won for Stephenson in Parliament and elsewhere the reputation of being a maniac leader of lunatics and fools. In spite of opposition the road was opened for traffic September 27, 1825, with Stephenson as engine driver.

The subsequent battle of the railway for leave to be, and of the locomotive for toleration after the railway was grudgingly accepted, is familiar history. No man ever fought a grander fight against popular and professional prejudice and ignorance, or developed in the fight a manlier character. His mental capacity rose with every great emergency, while his native shrewdness and solid sense ever kept him from undertaking the really impossible or impracticable, however extravagant or absurd his projects may have seemed to men of smaller capacity. What he knew he knew by personal mastery, not by hearsay; and without presumption or arrogance he was able by sterling intellectual power and suresightedness, backed by the hardest of hard work, to demonstrate the correctness of his ideas and to accomplish undertakings which involved the severest problems of railway engineering.

The moral of his life is clear, and should be pondered by every young mechanic. There is no condition in life, however hard or humble, which may not furnish the stepping stones to the most successful career. Had Stephenson been surrounded by wealth and educational privileges in early life, he might still have become a great man; but lacking his special experience as tramway gate tender and engine tender, dreary and discouraging as it may have seemed at the time, it is hardly possible that he would ever have been the pioneer of one of the most important and influential social and industrial movements of the race.

TWO RECENT BOILER EXPLOSIONS.

We give on another page an illustrated report of the recent explosion in New York harbor of the boiler of the steam tug Jacob Brandow on the 2d of June. The engineer, William R. Card, lost his life, and his son, John Card, the fireman, was badly scalded. The cause of the catastrophe is plainly shown in the report of our expert, namely, bad construction of the water leg of the boiler, from which leakage and corrosion ensued.

The boiler explosion which took place at the dye works of Messrs. Gaffney & Co., Philadelphia, on the 1st of June, resulting in the death of three persons and the destruction of buildings, has caused considerable comment among steam engineers. This boiler was one of a nest of three, was of the ordinary cylindrical type, 30 feet long, 36 inches diameter, with flat cast iron heads, having a large central man hole in the front head. The Hartford Boiler Inspection and Insurance Company had examined the boiler not long prior to the explosion, and pronounced it perfectly safe for the work and pressure required.

From the evidence before the coroner's jury it would seem the safety valves were set to blow off at 60 lb., and usually did blow at about that pressure, or not exceeding 62 lb. But precisely what the pressure was at the time of the explosion does not appear. The explosion lifted the boiler from its place and sent it like a rocket over into the next block, where it landed without particular injury to its shell.

The front cast iron head was found broken into several pieces, the lines of fracture radiating from the man hole. This seems to indicate that it was the weakness of the cast iron head that caused the mischief.

The testimony of several experts was introduced before the coroner's jury, showing that flat cast iron heads, although extensively used, are necessarily unsafe and dangerous, as they are apt to have hidden flaws; and one of the experts, Mr. Le Van, expressed the opinion that the two remaining boilers, which are of similar construction, are liable to blow up at any moment for the same reason, namely, cast iron heads. On this evidence the jury went the whole figure, and censured the Hartford Inspection Company in the strongest terms, declaring that its agents were negligent and incompetent when they inspected and certified that this boiler was safe.

We have in type for our next number a full report of this explosion, with engravings taken from photographs, which will very fully set forth the nature of the catastrophe, and perhaps afford some useful suggestions for the guidance of engineers and inspectors.

CONCENTRATING OR STORING UP ELECTRICITY.

Several years ago M. G. Planté, of France, made a secondary electrical battery, in which the electrical power of several ordinary cells could be concentrated or stored up within one cell, and the electrical force so gathered could be used when wanted. This battery consisted of two electrodes made of sheet lead, separated by strings of rubber, and placed in dilute sulphuric acid.

To charge this battery its poles were connected with an ordinary Bunsen or Daniell cell. During the operation of charging, one of the electrodes oxidizes, a brown coating of peroxide of lead soon showing itself thereon, and the metallic appearance disappears entirely; the other electrode also changes in appearance, its surface becoming covered with a powdery gray coating. When thus charged the secondary battery was capable of delivering an electric current of very much greater force than an ordinary cell of same size. This secondary battery is capable of charge and discharge indefinitely. M. Faure has lately improved upon the Planté battery, by painting the lead sheets with red lead. Simple as the improvement is, the resulting effects are quite remarkable, the storing capacity and delivery of the battery being greatly increased. The chemical action that takes place is substantially the same as in the original Planté battery.

It is stated that one of M. Faure's secondary batteries, weighing 165 pounds, is capable of delivering a force equal to one horse power during a period of one hour. If this is so it would bring the weight of an electromotor and battery of one horse power within a gross weight of 200 pounds, and suggests, as one of the possibilities of the new discovery, the production of a carriage propelled by electricity, convenient and economical in use.

For the benefit of those who desire to try this interesting electrical contrivance, we give on another page an illustration in explanation of some recent impromptu experiments on the subject lately made in our office. Any intelligent person who has at hand a few sheets of lead may readily construct the new battery.

Professor Sir William Thomson, of Glasgow University, who has lately experimented with these new batteries, mentions the use of one of the cells, weighing 18 pounds, which Professor George Buchanan took with him in his carriage and successfully employed in removing a tumor from a child's tongue by heating a platinum wire. To have accomplished the same effect by the ordinary electrical means would have required the setting up of several voltaic cells, and involved much inconvenience. Professor Thomson anticipates that this method of storing electricity will have many practical uses. He speaks as follows:

"The largest useful application is waiting just now for the Faure battery, and I hope that a very minimum time will be allowed to pass until the battery supplied for this application is to do for electric light what a water cistern in a house does for an inconstant water supply. A little battery of seven boxes suffices to give the incandescence in the Swan or Edison lights to the extent of one hundred candles for six hours without any perceptible diminution of brilliancy. Thus, instead of needing a gas engine or steam engine to be kept at work as long as the light is wanted, with the liability of the light failing at any moment through the slipping of the belt or any other breakdown or stoppage of the machinery, and instead of the wasteful inactivity during the hours of the day or night when the light is not needed, the engine may be kept going all day and stopped at night, or it may be kept going day and night, which undoubtedly will be the most economical plan when the electric light comes into general enough use.

"Another very important application of the accumulator is for the electric lighting of steamships. A dynamo-electric machine of very moderate magnitude and expense, driven by a belt from a drum on the main shaft, working through the twenty-four hours, will keep a Faure accumulator full, and thus, notwithstanding the irregularities of the speed of the engine at sea, or the occasional stoppages, the supply of electricity will always be ready to feed the Swan or Edison lamps in the engine rooms and cabins, or arc lights for the mast-head, and red and green side lamps, with more certainty and regularity than have yet been achieved in the gas supply for any house on *terra firma.*"

American Science Association.

The Thirtieth Annual Meeting of the American Association for the Advancement of Science will be held in Cincinnati, beginning August 17. It is expected that the changes in the constitution proposed at Boston last year will be ratified, and the association reorganized in eight sections of equal standing, each having its own presiding officer, secretary, and committee. The proposed divisions are:

Section A—Physics; Section B—Astronomy and Pure Mathematics; Section C—Chemistry, including its applications to Agriculture and the Arts; Section D—Mechanical Science; Section E—Geology and Geography; Section F—Biology; Section G—Anthropology; Section H—Economic Science and Statistics. Also, I—A Permanent Subsection of Microscopy.

Arrangements are to be made for excursions of the Anthropological section to some of the prehistoric mounds and relics in Ohio, including Fort Ancient, at Madisonville. The headquarters of the association and the offices of the local committee will be at Music Hall.

Through Railway Connection Under New York.

A company has been organized to connect by a tunnel railway the Hudson River Tunnel and the railroads which enter the city from the north and east by way of the Fourth Avenue improvement. The route will be from the outlet of the Hudson River Tunnel, under Wooster Street and University Place, to Fourteenth Street, thence by a curve under that street to Fourth Avenue, under which it will run to Forty-second Street. It is to be a double track road at least eighteen feet below the surface. The object is to carry freight and ultimately passengers under the city to New Jersey, so that cars may run direct from Boston or Montreal to New Orleans, Charleston, and other Southern cities without the annoyance and delay of a New York transfer.

Asbestos in the Black Hills.

Among the new discoveries made within the past few months is a large body of asbestos. This was discovered by Mr. T. B. Leavenworth, about six miles from Deadwood City. The croppings can be traced for nearly three hundred feet, while a large body of it has already been unearthed. Tests have been made which prove that this body of asbestos is equal to any yet discovered in America. It may be that this mineral will not come into immediate use, adds the *Pioneer*, but the day is not far distant when it will become an article of export from the Hills.

New Remedy for Baldness.

In cases of confirmed baldness the new remedy proposed is to remove the scalp, bit by bit, and substitute, by skin grafting, pieces of healthy scalp, taken from the heads of young persons. The success which has heretofore attended operations of this nature in cases of scalp wounds gives a promising outlook for this new mode of curing baldness; and perhaps the day is not far distant when the shining pates of our venerable fathers will bloom with the flowing locks of youth.

The Largest Grain Elevator.

The new elevator just completed near South Ferry, Brooklyn, is described as the largest in the country. It has been over a year in building, and has cost nearly $2,000,000. It has a storage capacity of 2,500,000 bushels, besides superior transfer facilities and dockage for half a dozen vessels, which can load at one time. The machinery is contained in an independent engine house and three enormous towers. The warehouse proper consists of a large number of separate fireproof stores.

MR. WILLIAM CLARK, who died at Philadelphia last week, in the 91st year of his age, was one of the oldest manufacturers of mathematical and nautical instruments in the country. He was born in England, and came to this country in 1820. Two of Mr. Clark's sons are engaged in the mathematical department of the Coast Survey Office at Washington.

ATTRACTIVE SUBURBAN RESIDENCES.

[*Continued from first page.*]

and the present price of building plots in good localities in Brooklyn is such as to justify the devotion of the space allowed for architectural effects and ornamental grounds. We call to mind the brow of the hill near Prospect Park, overlooking the Bay of New York, as a site particularly well adapted for this style of houses; and there is no end of equally suitable places in the upper part of New York and along the Hudson River.

All the buildings in the block from which our illustration was taken are in the same style of architecture, "Italian Renaissance," but no two are exactly alike. The designer, Professor H. Köhler, wisely abstaining from profuse or elaborate ornamentation, has secured a charming architectural effect by the elegant proportions and graceful arrangement of the parts of each and all the buildings.

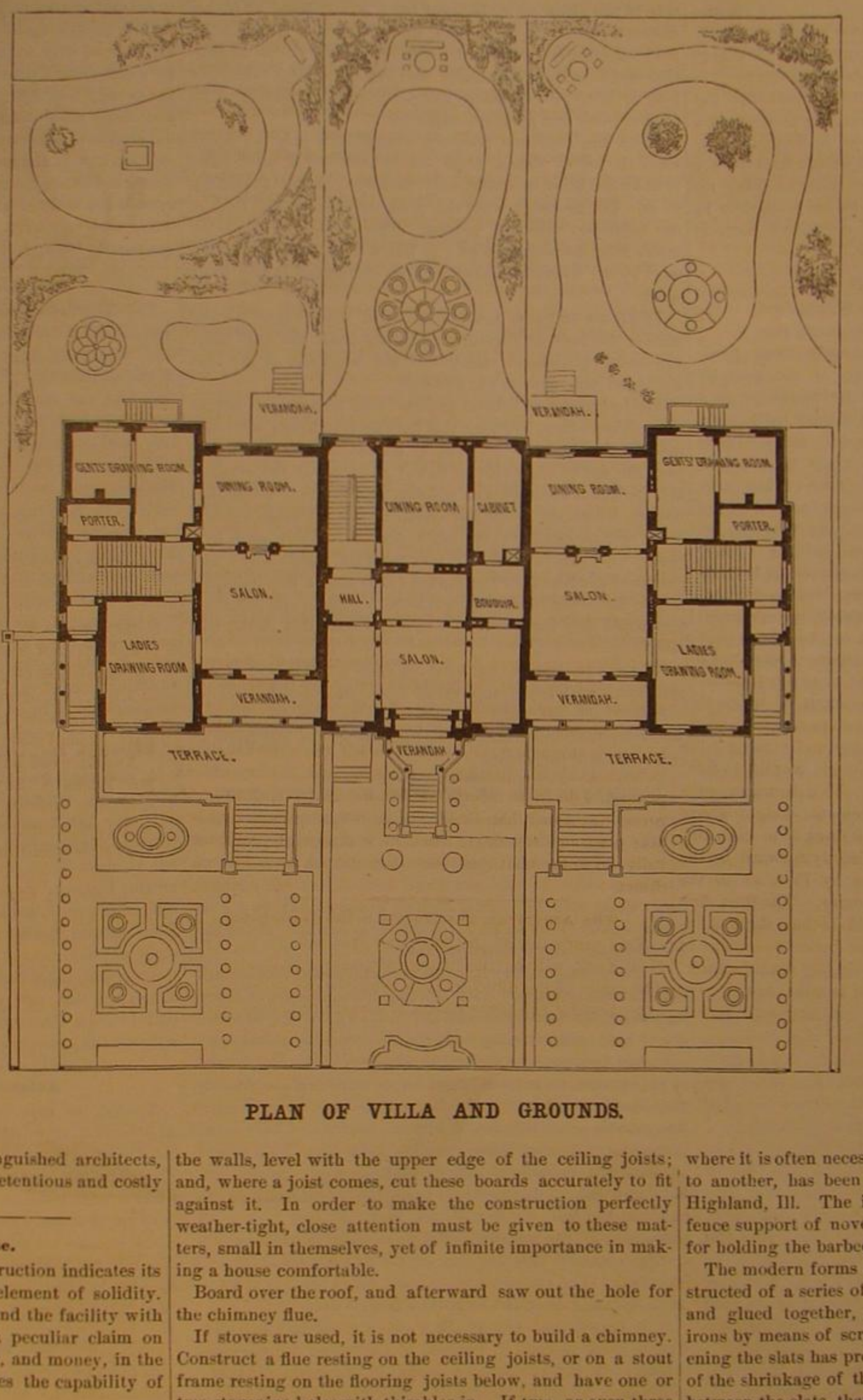
The houses shown are of brick covered with cement, painted of old ivory color, the sills, lintels, cornices, columns, etc., being of freestone. The crestings, capitals, rosettes, vases, balusters, medallions, and statuary are of terra-cotta, closely resembling the freestone in color. The chimneys are also of terra-cotta, with small caps, as heavy chimneys would have marred the architectural effect.

Our manufacturers of terra-cotta ornaments and architectural fittings are now supplying artistic wares in such abundance and at such prices that builders are able to produce almost any effect desired at comparatively small expense.

The cost of buildings like those we have chosen for illustration, might doubtless be diminished without injury to the architectural effect by substituting terra-cotta for the freestone trimmings, to a greater extent than are used in the Hanoverian structures above described.

We hope to learn that some capitalist or builder has taken a hint from our illustrations, re-engraved from our German contemporary the *Zeitschrift des Architecten und Ingenieur Vereins zu Hannover*, and have commenced a block of buildings after the plan shown in the perspective view, with a spacious ornamental court yard in front, after the manner illustrated.

The iron railing, the reader will observe, is a pattern so chaste and ornamental that it almost comes under the head of art work, and so in the details of the entire structure a degree of harmony is observable which does not characterize the works of some of our most distinguished architects, whose talents are employed on more pretentious and costly houses.



PLAN OF VILLA AND GROUNDS.

The Balloon House.

The name given to this mode of construction indicates its lightness and total want of any heavy element of solidity. Yet it undoubtedly possesses strength, and the facility with which it can be put together gives it a peculiar claim on the man who desires to save time, labor, and money, in the erection of a ready home which possesses the capability of being rendered comfortable.

Frame together at the angles a stout sill, say four by six inches, which has been bored on the under side with an auger at six places (at the four corners and midway of the length). Set this sill on six stout cedar posts, driven four feet into the ground.

Next, nail up, at each of the four corners, a pair of boards abutting each other; and, to strengthen these, temporarily nail on the inner angle of each pair of board blocks at a couple of feet apart. This done, and the height of the house being decided upon, chalk that height on the upper ends of these corner boards just erected. Set a piece of scantling, three inches thick by four inches wide, along from corner to corner of end, and nail the upright boards to it. Do the same at the other end. Now connect these two end pieces by similar pieces across the front and rear, halved down and spiked on the end pieces at their angle of meeting. Proceed to board up the four sides, nailing them securely at bottom and top. Measure off for the location of doors and windows, and nail up boards where their frames are to be secured. When the flooring of the joists is all in place, and the boarding of the walls all up, then fit in and nail the window and door frames in their places.

Meantime the roof may be constructed. Run the ceiling joists out two feet beyond the walls, nailing them on to the front and rear pieces, and spike the rafters to the sides of them, at their ends; also spiking the rafters to one another at their tops. Or, better still, saw off and nail them to a ridge board set on edge from gable to gable. This plan will secure the perfect uniformity of the roof throughout. Also, instead of spiking the lower ends of the rafters to the projecting ceiling joists, nail flooring boarding across these joists, out to their ends, and saw off the ends of the rafters, so as to fit down on this boarding, and spike them firmly down through it into the ceiling joists. This plan will effectually inclose the eaves without any further trouble. In the other case, the eaves will require to be boarded up under the ceiling joists.

Saw off all the projecting ends of the upright boards of the walls, level with the upper edge of the ceiling joists; and, where a joist comes, cut these boards accurately to fit against it. In order to make the construction perfectly weather-tight, close attention must be given to these matters, small in themselves, yet of infinite importance in making a house comfortable.

Board over the roof, and afterward saw out the hole for the chimney flue.

If stoves are used, it is not necessary to build a chimney. Construct a flue resting on the ceiling joists, or on a stout frame resting on the flooring joists below, and have one or two stovepipe holes with thimbles in. If two, or even three stovepipes enter it, the size of the flue may be sixteen by twelve inches. If but one is to be provided for, eight inches by twelve will be sufficient. The frame on which this flue stands may be five or six feet high, and be inclosed so as to form a closet or locker. Cover all the external joints of the boarding with slips two inches wide and an inch and a quarter thick, planing off their outer corners. Cover the inner joints with rough slips, and these will answer for furring whereon to nail the lathing for plastering.

These slips on both sides of the inch boarding tend to stiffen it very much. On the exterior they abut against a baseboard below, and a fascia board above.

The roof is usually shingled on rough boarding, and the exterior may be painted and sanded. The strips or battens, as well as the trimmings around doors and windows, may be of a darker tint, or even be a direct contrast.

In order to make these balloon houses warmer, they should be lined with thick brown paper on the inside of the boarding before the inside furring is nailed on.

A material called building paper is largely manufactured for this purpose, and may be had in any quantity in all the cities of the Union.

It may be advisable, in this as in other cheap modes of construction, instead of building chimney flues, to use terra cotta drain pipes for that purpose. These can often be had in the nearest village, brought home, and put up, when bricks or bricklayers to build a flue may prove a serious, if not insurmountable, want. Where it becomes necessary to make a continuation, two of these drain pipes can be joined together by basswood splints secured with wire, and then coating this connection with mortar of wood ashes, clay, and sand.—*N. W. Lumberman.*

RECENT INVENTIONS.

An improved plow sulky has been patented by Mr. Henry Weber, Jr., of Grand Meadow, Minn. This sulky is provided with improved adjusting and controlling devices.

Messrs. John A. Moore and James W. Brown, of Woodville, Tenn., have patented a fire-escape which can be converted into a door shutter, window blind, or ladder at will; it consists of a hinged frame from which the lazy-tongs are suspended, and within which they may be closed up by suitable devices to form a blind or shutter, said fire-escape frame being hinged to a door or window frame so as to swing outward and inward, after the manner of an ordinary blind or shutter.

Mr. Millard F. Lemonnier, of Ida Grove, Iowa, has patented a sieve for thrashing machines so constructed as to cause the air blast from the fan blower to act more effectively to clean the grain than sieves constructed in the ordinary manner. It consists of a board three-fourths of an inch in thickness, having holes from three-eighths to four-eighths of an inch in diameter formed through it, and having inclined grooves formed in its lower side at the sides of the holes toward the fan blower, by which the air blast is guided into and deflected through the holes.

Alice B. Wood, of Beaver Dam, Wis., has patented a corn popper formed of two hemispheres of wire work or netting, which are hinged to each other and are provided with a device for locking them together. One of the hemispheres is attached to a rod passing longitudinally through a wooden cylindrical handle, and is provided with an arm at the end for turning the rod so as to revolve the ball containing the corn.

An improvement in shirts has been patented by Mr. Julius Herzog, of New York city. The invention consists in a chest-protecting shield combined with a dress shirt, as a permanent portion thereof, and in a manner not to interfere with the work of starching and ironing the shirt bosom, and also to allow of unequal shrinkage of the material.

A portable wire stock-fence, suitable for temporarily inclosing large tracts of land in grazing districts, where it is often necessary to remove cattle from one pasture to another, has been patented by Mr. Charles S. Giger, of Highland, Ill. The improvement consists in a removable fence support of novel and peculiar construction, adapted for holding the barbed wires of a stock fence in position.

The modern forms of school seats and seat backs are constructed of a series of slats tongued and grooved to match and glued together, and secured to cross pieces or hinge irons by means of screws or otherwise. This means of fastening the slats has proved unsatisfactory, chiefly on account of the shrinkage of the wood, which leaves widening gaps between the slats that cannot be conveniently closed. Mr. Asbury Moore, of Sidney, Ohio, has patented an improvement intended to remedy this defect. This inventor inserts a rigid iron rod through the slats at each end of the seat and back, and applies a screw nut to the ends of the rods, for drawing the slats closer together to compensate for shrinkage. The rods are likewise attached to iron ribs by means of iron ties of peculiar construction.

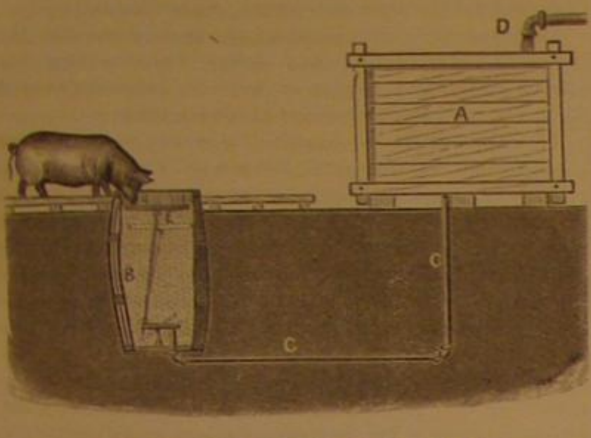
An improvement in metallic loops for holding a hame tug and trace together to prevent the buckle connecting the two from becoming disengaged, has been patented by Mr. Gerhard Freese, of Bloomington, Ill. It consists in a metal loop of quadrangular shape, slightly tapering or contracted at one end, and provided with lugs of peculiar arrangement on the inner sides for wedging and holding the tug.

Mr. Sylvester W. Sheldon, of New York city, has patented a barrel cover, so constructed as to be conveniently handled and kept in place upon a barrel while having their upper and lower sides level, so that they can be packed in small space for storage and transportation.

Mr. Thomas F. Dunn, of Saccarappa, Me., has patented a machine for making cotton batting, so constructed as to receive the cotton from two or more carding machines, press it into batting, and roll it into a lap or roll with paper or other suitable material interposed between the layers of batting.

NOVEL DEVICE FOR WATERING ANIMALS.

The device shown in the annexed cut furnishes a constant supply of clean water and prevents waste, and is therefore well adapted for watering animals, and especially hogs. A barrel, B, is sunk into the ground, and is connected with a tank, A, or a pond or water main, by a subterranean pipe, C, which projects a few inches into the bottom of the barrel. A pivoted gate or valve rests upon the end of this pipe, and the other end of the valve is connected with a float, E, which is so arranged that when the barrel is filled the end of the pipe, C, is closed by the action of the float; but as the animal begins to drink the level of the water in the barrel decreases, the float, E, falls with the water, and opens the valve at the end of the pipe, C, admitting fresh water from the tank until the barrel is again filled.



DEVICE FOR WATERING ANIMALS.

STEAM TUGBOAT EXPLOSION.

BY S. N. HARTWELL.

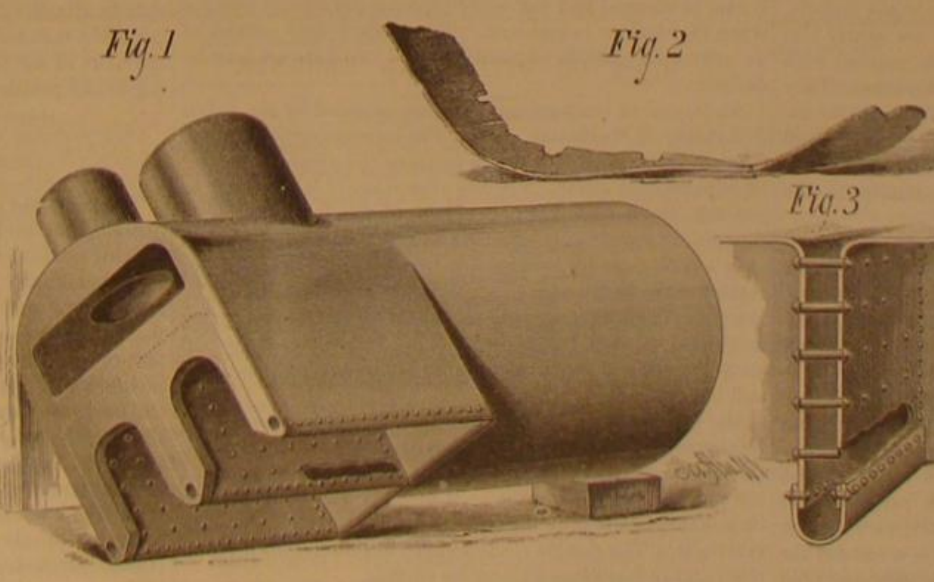
The sketches which I herewith submit are intended to illustrate the accident, if a blow-out may be so designated, that happened to the boiler of the steam tug Jacob Brandow, in the lower bay of New York, on the 2d of June. The perspective sketch (Fig. 1) represents the boiler lying on its side, which position has no reference to the effect of the blow-out, but it is so placed for the purpose of showing the location of the rupture and its relation to adjacent parts of the boiler. It will be seen that the boiler is of the double furnace tugboat type, a variation of the fire-box form common in the towing practice of this city and vicinity. Its principal dimensions are: Diameter, 7 feet; length, 15 feet; dome, 4 feet diameter by 5 feet high. Two furnaces, each 34½ by 72 inches horizontal measurement; height above grates, about 30 inches. There are 10 flues, 5 to each furnace, through which the gases pass directly forward to the smoke connection, whence they return by 75 tubes to the up-take (or front connection) and chimney. The flues first mentioned are to each furnace: one 12 inches, three 8 inches, and one 7 inches diameter. The boiler was made of five-sixteenth iron plates, by a reputable city manufacturer, in 1867, since when, about seventeen months ago, it was fitted with new furnace sides and put in thorough repair. The workmanship and material appear to be the best. No stamp indicating the tensile quality of the iron was observed, however, upon the plates. The steam pressure allowed by the government certificate is 65 pounds by the gauge; and there was one common lever safety valve, by which steam was supposed to escape when the limit of pressure was reached.

About 6:30 P.M. on the 2d of June, while steaming at the usual working pressure—something less than 65 lb.—a piece of one of the new sides blew out, apparently starting at the point *a*, Figs. 1 and 2, where the iron is now but about half its original thickness, namely 0·155 (originally 0·312). The sketch, Fig. 2, gives an idea of its proportion and present shape. At other points, as *b* and *c*, the thickness is respectively 0·185 and 0·165 inch. On the side, *e*, at the margin of the piece, is observed the peculiar defect called *star corrosion*, indicated by radiating lines at the stay holes. This condition is often found on the water side of stayed flat surfaces that have been subjected to a sufficient pressure to puff the plates between the stays, giving it the appearance (in less degree) of a mattress. This has the effect of opening the texture of the plate around the stay hole, which goes and comes as the pressure falls and rises; radial lines of corrosion are formed, deepening and widening toward the hole with each successive motion, till leaks and finally ruptures occur. When there is a considerable area of overloaded plate stayed insufficiently, one stay head pulls through, and the rest, being overpowered by a sudden accession of load, give way successively, and a sufficient body of water escapes, the reaction and expansion of which produces the phenomenon known as an explosion. In this case, however, the *star corrosion* may be considered as an indication rather than a cause of the weakness, for appearances indicate that the initial rupture was along the other margin of this piece, along the lap of the seam where a continuous groove had resulted from corrosion on the fire side of the plate, and having progressed faster, probably from unobserved leaks, gave way first. The sketch, Fig. 3, shows the construction of the parts on a larger scale. The leak that caused the corrosion of the fire side of the plate was probably only a sweating leak, which is the most dangerous because it is most likely to escape observation. If this had been a case of a dripping leak probably the surface below the seam would have suffered most, and perhaps have given way instead of that above the seam.

The effect of this blow-out was an opening of about half a square foot of area, through which the water was forced with terrific power, beginning at a theoretical velocity of about 100 feet per second and ending at something like half that, supposing that none of the free steam escaped from the steam room through the intervening water. Sixty cubic feet of water would thus escape in about two or three seconds, allowing for obstructions in the furnace, and everything movable would be driven before it, as was the case. The engineer, who was supposed to be in the fire room, made his way to the deck probably nearly dead, and was lost overboard. The fireman, his son, who was on the top of the boiler, in the act of shutting off the steam jet, was badly injured. The fire upon the starboard grates and coals in the fire room were blown against the woodwork abaft the engine and against the engine itself with a force sufficient to abrade the whitewash and paint with which these parts were ornamented. Government certificates and officers' licenses, that were duly posted according to law, were sadly defaced, but no serious damage was done to the boat, as would most likely have happened if the weak area had been of sufficient extent to have allowed of the instantaneous escape of the boiler contents.

The government certificate of inspection, which is the form approved February 11, 1880, expires on the 30th of July, 1881, indicating that about ten months had elapsed since the boiler was inspected. It shows, also, that the hull was built of wood in 1864, and that the boiler, *rebuilt* in 1880, was built in 1867, as stated above. Other memoranda in the certificate, are: one safety valve, one steam gauge, one low water gauge, one fusible plug, and three gauge cocks. The certificate was signed by Austin Joyce, Inspector of Hulls, and John K. Mathews, Inspector of Boilers.

Mr. William Tebo, the polite owner of the Brandow and a number of tugs beside her, offered every facility to the writer for obtaining the sketches and other memoranda embodied in this report, and being himself a practical engineer, indicated, by his personal attentions and sentiments expressed, a desire to inform his fellow engineers, through the press, just how it happened. A thorough reinspection is to take place in a few days, when he will promptly and cheerfully do to the boat just what the government inspectors direct.



BOILER EXPLOSION.

The American Institute's Semi-Centennial.

This year's fair of the American Institute, of the City of New York, will be the fiftieth of these useful exhibitions. The desire of the directors is to celebrate the occasion by an exceptionally full presentation of novel inventions, machinery, and industrial products. Their announcement of the "Semi-Centennial," on another page, we commend to the attention and co-operation of our inventors and manufacturers.

Telegraph Cables in Sewers.

An important experiment looking to the disuse of telegraph poles in cities is being made in Washington, D. C., by the Mutual Union Telegraph Company. Having received permission to run their wires through the common sewers of the city the company began the work of placing the wires June 6. The wires which are needed for the city service and for connection with lines outside the city are twisted cable form and covered with a non-conductor and waterproof coating. Outside the city limits these wires emerge from the sewers and join those placed upon poles. The cable made of the twisted wires is attached firmly to the arched roof or top of the sewer, and thus raised above all interference from water, except in case of floods. The cables are laid by men enveloped in rubber clothing and provided with safety lanterns, provision being made for conducting fresh air to the workmen by means of India-rubber tubes attached to their rubber suits. The wires are passed down through the man holes of the sewers.

VELOCIPEDE CARRIAGE.

The engraving shows a light and compact velocipede carriage of German invention, calculated for easy and comfortable riding and capable of carrying light baggage. The rider sits in an easy chair above the forward axle, and grasps the guiding handles attached to this axle. The feet rest upon pedals connected by rods with cranks on the rear axle. By the alternate movement of the pedals the carriage is propelled. A lantern is carried in front, and a canopy covers the head of the rider.

VELOCIPEDE CARRIAGE.

NEW INVENTIONS.

Mr. George W. Mason, of Sharon, Pa., has patented a composition of matter to be used for making artificial stone, and consisting of pitch made from gas-tar, cement, plaster of Paris, lime, ground cinders, ground ore, ground oyster shells, fine ashes, pulverized dry clay, dry sawdust, ground slate, ground stone, sand and pebbles, and molten brimstone.

An improved harvester guard finger has been patented by Mr. Elisha S. Snyder, of Snyder's Mills, West Va. The invention consists in a sectional guard finger constructed with two reversible plates, each having two cutting edges, the plates being arranged to engage with the sickle knives, and held in position by a removable top section provided with beveled edges, which may be utilized by inserting a sickle having inverted knives.

Mr. Charles A. Pennington, of Champaign, Ill., has patented an improvement in field corn huskers which consists in the peculiar construction of the revolving husking rolls, between which the cornstalks are forced and the ears husked, and in a revolving recessed wheel for feeding the stalks carrying the ears between the husking rolls. The machine is provided with a fender and guard for the stalks, for the purpose of holding and guiding them while the corn is being husked.

Mr. James H. Palm, of Lexington, O., has patented an improved device for raising and lowering the front end of a clevis pivoted to the forward end of a plow beam, whereby the plow can be made to plow deeper or shallower; it consists of a clevis having its opposite arms pivoted to a plow beam on each side near its forward end, and provided with a cross rod, to which a slotted tongue carrying a pin is hinged, the pin on the tongue engaging in a cam groove in a wheel provided with a crank shaft extending back parallel with the beam.

An improvement in shovel plow blades has been patented by Mr. Henry A. Ridley, of Newport, Ark. The object of this invention is to facilitate the enlargement and contraction of shovel-plow blades, as the character of the work to be done may require, and also to facilitate repairing the blades.

Mr. Jacob G. Walton, of Davilla, Texas, has patented an improved cotton planter having a vibrating agitator which is used in combination with a hopper.

THE tower clock of the First Presbyterian Church, Newark, N. J., lately stopped. The town time-keeper found in the wheels of the clock a tangled mass of hay, twine, grass, cotton, and feathers, amounting to nearly half a peck. A pair of birds had entered the tower through a hole in the dial and attempted to build a nest in the machinery of the clock. The slow revolution of the wheels tore their work to pieces, and they kept on reconstructing it until they stopped the wheels.

Rubber Nipples.

To enumerate different kinds of rubber nipples alone would be a weariness. Scores of kinds there are of all shapes, sizes, and colors, good, bad, and indifferent, and still new devices are daily added and the demand increases. Nipple making is among the most interesting of rubber specialties. When made by hand the operatives are always girls, as the work, though light and pleasant, need dexterous, rapid fingers.

The first step in the preparation of a first-class hand-made nipple is the material. It is commonly mixed sheet, either white, black, or maroon. "Lead gums" are but seldom used for black, because of their alleged poisonous qualities. The fine tracery of parallel lines that cover the surface of certain kinds of nipples, imparting a flesh-like grain, is called the "print," and is given to the mixed sheet before it is cut into nipple pieces.

A simple and inexpensive manner of producing this print is to have a metal plate upon the surface of which parallel grooves are marked. These grooves are clear cut and even, with no breaks, and of the same depth. From this rubber impression plates may be made, by placing a sheet of vulcanized rubber upon the metal plate, rubber side down, and curing in a steam press. The result will be a plate as good as the original, and capable of more wear and tear. Indeed, this new plate is, for practical use, far superior to the metal, for where the latter would unavoidably receive dents and abrasions which would soon obliterate the print, and in addition to this, would be so heavy as to be cumbersome in the extreme, the former may be hammered and knocked in all possible ways and yet show no abrasion, and, better still, is so light that it can be handled with the greatest ease.

After a sufficient number of impression plates have been prepared the mixed sheet for the nipples is cut into lengths that shall fit between the plates; each plate is wiped lightly with a brush dipped in talc, and a sheet of rubber is placed upon it. These sheets and impression plates are then placed in a compact pile and submitted to gentle pressure. In due time the unvulcanized mixed sheet takes from the impression plate the print, and after it is fully set it is ready to be cut into nipple pieces. When taken away from the pressure, the plates and mixed sheets seem to be one compact mass. They can, however, be separated if not left too long.

The condition of the print, although primarily depending upon the condition of the impression plate, may be materially injured by careless "stripping."

The printed sheets, after being stripped, if they have been stretched, are plunged into hot water, or otherwise heated, in order to shrink them, and then given to the nipple cutters. Several sheets may be cut at once, if brushed lightly with talc. The die should be very sharp, as otherwise the edge of the nipple piece will be rounded, and consequently harder to knit in the making.

The nipple pieces when cut are: for small nipples, nearly heart-shaped; for large, cone-shaped. In the former the seam extends from the bottom up one side and just over the crown, the other side being seamless; while in the latter the seam completely divides the nipple. Small nipples are therefore made in one piece, large nipples in two pieces. To cut large nipples two sheets are laid together with the print inside. The natural stickiness of the stock will hold these pieces together, which helps materially in the making up.

After the nipple pieces have been delivered to the makers, the next process is cementing. The pieces are neatly laid in piles, and then, by means of a small brush, painted with a cement made of mixed sheet dissolved in naphtha. They are then spread upon tin plates to dry. To facilitate the drying process, each nipple table has attached to it a small steam oven, so arranged that it may heat a number of tins, and yet cause little annoyance by its proximity to the makers.

The kit of tools for a nipple maker consists of a small slanting "case," in which are places for a certain number of nipple formers, two cement cups with brushes and "steeple tops," a small glass "naphtha well" set in the case, similar to an ink well, a naphtha brush, thumb cots for taking off nipples after being vulcanized—tin plates for drying—pans for packing, cleaning sponge, and set of nipple formers.

The small nipple formers are pear-shaped pieces of metal set upon iron pins. The large formers are simply hollow cones of metal or glass. The case has holes for small and "rests" for large formers. The rows are so arranged that their nearness to one another does not interfere with the most rapid work. By the side of each case is a rest for the tin, which is provided with a small adjustable clamp to hold it in position. Beneath this case are skeleton drawers, on which are set pans of talc for packing the nipples when finished.

After the nipple pieces, placed in the oven to dry, have become thoroughly warmed, and the solvent has so evaporated as to make the cement just right to knit well, the maker takes a former, dips it in the talc, places it in the center of a piece, draws the edges together, and, with a rapid pressing of the thumb nail against the two edges, closes effectually and neatly the gaping seam. The former with its half-made nipple is then returned to its place, and another former covered. In the same way the whole case is studded with pear-shaped rubber covered formers.

Next in order is the making of the flange at the lower end. For this purpose the cement brush is again brought into requisition, and the lower end cemented. When dry, the operator, with the right thumb, presses firmly on the lower edge with an upward motion. This turns it over a little, and, when continued around the stem, makes a small ring at the lower end of the nipple. A continuation of this brings out the flange. Large nipples are cemented, seamed, and flanged, and then turned inside out, as they were cut with the print within.

When finished, the nipples, formers, and all are packed in shallow pans half filled with talc. The packing in itself is quite an art, as there must be economy of space, and as a quick thrust must be given to each one, in order to force a little talc between the stems of the former and the nipple, to prevent the flange from adhering to the stem. When packed they are taken away to the heater, where, after being filled full of talc, the pan is loaded upon a car and run into the heater. The "chalk room," in which the nipple pans are filled, is provided with tables, under which are large bins. Below the level of the table tops are a set of sieves, and into these the pans of vulcanized nipples and talc are poured and sifted, each worker keeping her "heats" separate.

Taking the nipples off from the former is oftentimes very hard work. Especially is this true of small nipples. Then it is that the "cots" come in place and save many tender fingers from blistering. But after the knack of slipping them off has been learned, it is wonderfully easier. A short season of scouring in the cylinders is next in order, after which the nipples go to the potash boiler.

The punching of the holes in the crown of the nipple is done by hand. Small punchers are set in standards at each table. The nipple is placed upon the punch and hit firmly with a small wooden mallet. The rapidity with which many of the makers punch the nipples is surprising. For a finishing touch the girls take them again in hand, pack them in paper boxes, and the nipple is ready for market.

A curious part of the process of nipple making is the care the girls take of their finger nails. These before all other tools are a necessity. If brittle the utmost care in trimming is taken, and they are washed, scrubbed, and oiled with daily solicitude. A cracked nail is a calamity, as no seaming at all can be done until it is grown to the proper length.

Black nipples, after being washed frequently, have a grayish dirty tinge, which is removed by dipping them in a liquid black.

Nipples, instead of being always made by hand, as in the foregoing, are frequently "dipped;" that is, the former is plunged into a cement made of rubber dissolved in some solvent, and then dried. This being repeated until a suitable coating is obtained, when the flange is rolled as in other nipples. They are also made in moulds. Finger cots and other rubber articles of similar shape are cut, cemented, and made over formers in the same manner as nipples.—*Rubber Era.*

MISCELLANEOUS INVENTIONS.

Mr. William Slow, of New York city, has patented an improved strainer for the outlets of tubs and basins which can be removed from the washer of the outlet of a tank, tub, or basin, for the purpose of clearing it in case it becomes clogged. The invention consists in the combination with a washer having an internally-threaded neck, of a strainer having an externally threaded vertical flange capable of receiving a plug. It is readily removed by means of a small key or wrench furnished with it, when it can be cleaned and the waste pipe can be readily cleaned when the strainer is removed. The strainer may consist of an apertured plate, or of netting, or of two bars, as may be desired.

An improved tracheotome has been patented by Mr. Lewis J. Lyman, of Manhattan, Kan. The improvement relates to surgical instruments for use in opening the trachea in cases of membranous croup, or in any case when it is necessary to practice tracheotomy. The object of this invention is to provide for more easily effecting an entrance to the trachea than can be done by instruments heretofore in use, and for retaining the instrument in proper place after insertion. The invention consists in a blade of peculiar shape upon a spring arm fitted between two spring-holding arms that are formed with T-ends, and also in a catch for simultaneously securing and loosening the spring-arms.

Mr. Charles W. Posten, of Boone, Iowa, has patented an improved washing machine, which consists of a circular vessel formed of two cones united at their bases, and is provided with a shaft attached to the apex of each cone, and resting on suitable bearings in the sides of a tub or tank adapted to receive it. The double conical vessel has numerous perforations and indentations all over its surface.

An amusing toy bank for children has been patented by Mr. John Murray, of New York city. The invention consists in the combination, with the head that forms the body of the bank, of the tongue and the inclined and weighted pivoted bar carrying the tongue, whereby the weight of a penny placed upon the tongue will turn the pivoted bar and cause the tongue to pass into the head and drop the penny into the interior of the head.

An improved sash holder, patented by Mr. John H. Lynch, of Lowell, Mass., consists in a roller wheel pivoted in journals sliding horizontally in the lugs of a plate attached to the outer surface of one of the side rails of a sash, which wheel is pressed against the pulley stile of the window frame by a spring, and is provided on one of its sides with a ring of ratchet teeth, which engage with like teeth of a peripherically ratcheted wheel loosely mounted on the shaft of the rubber wheel, which ratchet wheel is acted upon by a spring pawl, that permits both the ratchet wheel and rubber wheel to rotate when the sash is being raised, but locks the ratchet wheel and the rubber wheel as soon as the sash is released, and thus holds it in place; but if force is exerted the rubber wheel is disengaged from the ratchet wheel and the rubber wheel can rotate, thus permitting the sash to descend.

An improved device for drying fruit and vegetables and evaporating liquids has been patented by Mr. John A. Warner, of Furnaceville, N. Y. The invention consists of two upright fixed cylinders placed concentrically one within the other, the outer cylinder having rollers fixed on its inner face in such a position as to form a disconnected spiral track for the outer ends of the evaporating trays, and the inner cylinder being provided around its outer face with a continuous spiral for the inner ends of the evaporating trays.

An improved draught equalizer has been patented by Mr. Albion Wheeler, of Ridgeway, Iowa. The invention consists of a novel arrangement of levers in combination with the tongue and stay or bed-rest of the machine.

An improvement in magnets for separating iron chips patented by Mr. George E. Bowers, of Fitchburg, Mass., consists of a magnet having a straight core and helices wound in opposite directions inclosed in a tube or hollow cylinder that is attached to one pole of the magnet, and also provided with a switch, whereby the direction of the current around a portion of the magnet can be reversed, so as to demagnetize the core and cylinder and thereby release the chips.

An improvement in storing compressed air or other gas in vessels has been patented by Mr. Alexander James, of Edinburgh, Scotland. The invention relates more particularly to a method and means for storing compressed air for motive power for locomotives or cars for railroads. The invention consists in a method of compressing air wherein the adhesive attraction of an absorbent material or materials is made to assist in reducing the volumes of gaseous bodies in confined spaces or inclosures.

Mr. Jabez Smith, of Sabula, Iowa, has patented a sling for throwing missiles, such as stones, bullets, etc., by hand, with considerable force. It consists in a band of rubber or other elastic material having a pocket to receive the missile in the middle, the ends of this elastic band or equivalent being attached to the ends of the prongs of a fork provided with a suitable handle.

An improved stove leg has been patented by Mr. William R. Fenerty, of Louisville, Ky. This invention consists in casting the lower edge of the stove with a downwardly-inclined flange having undercut projections on the inside thereof, in combination with the leg cast with a surrounding shoulder to support the weight of the stove, and with an upwardly inclined shank the side ends of which are beveled to correspond with the undercut projections, forming a dovetail therewith, the leg being also provided with a central stud for locking the leg to the flange of the stove.

An improved life-preserver has been patented by Mr. John Thompson, of Victoria, British Columbia, Canada. The invention consists of a series of floats so hinged to a belt that is to be fastened around the body that when not in use the floats hang perpendicularly from the belt, and when the device is in use the floats extend radially and at right angles from the belt and lock themselves in position.

An improved method of improving the appearance of furs, patented by Mr. Lucinius Havasy, of New York city, consists in attaching the tips or outer ends of feathers to the fur in such a manner that these feather tips will appear between the hairs of the fur, and will produce various effects, according to the position in which the fur is held.

Agricultural Notes.

LAWN GRASS.

The very best grass I have made use of for a lawn is unquestionably orchard grass. But then to make it effectual for this purpose no half-way measures should be practiced in preparing the ground, sowing the seed, and cutting the grass. The soil should be rich, in fine tilth, and free from weeds. The best preparation of it is to cultivate it in potatoes or some other hoed crop the preceding year. If this can be taken off in August, early or late, according to climate, the seed may be safely sown in that month, if not, leave it till the following spring, and then put it in as early as possible. Plow, harrow very fine, and level the ground. Then sow at least at the rate of four bushels per acre, so that the ground can be thickly stocked. If this is not done the grass forms tussocks, and these spoil the beauty of the lawn. Never sow clover or any other seed with this for a lawn, but one may do so with clover only for a field crop if desired, as both are ready at the same time to cut for hay, which, to have it tender and succulent, should be in the earliest of blossoming. After sowing brush the surface nicely and then roll. Cut the grass as often as it gets about four inches high. This keeps it from growing coarse, and makes a closer, firmer sod. This grass is the first to shoot up in the spring, and the last to turn brown in late autumn or during the winter. Ray grass, if treated in the above manner, comes next to orchard grass in making a superior lawn.—*Correspondence Country Gentleman.*

SOWING SEEDS.

In sowing grass and vegetable seeds remember Mr. Peter Henderson's caution about "firming the ground." By pressing the roots about the soil they germinate quicker and the young roots more readily take a firm hold upon the soil. The neglect of this process may cause the loss of the crop if the season should prove dry.

Correspondence.

The Wrongs of American Inventors.

To the Editor of the Scientific American:

I would respectfully direct your attention to the flagrant wrong done American inventors by foreign governments, in that any person can patent in those countries inventions of Americans, while our government protects these foreign inventors by refusing to grant a patent, only to the inventor himself.

Oftentimes the American inventor is poor, perhaps has spent years of time and all he could snatch from his daily pittance to get his American patent, and is too poor to patent at once his invention in foreign countries. The unscrupulous capitalist here or abroad, like a bird of prey, stands ready to seize the opportunity and reaps vast benefits, while the American receives nothing for his life-long efforts.

Every American inventor is bound by principles of self-protection to insist and demand that Congress shall right this matter and put the American on the same footing as the foreign inventor, and refuse to grant patents to foreign inventors until foreign governments shall by legal enactment destroy the custom of importing American inventions and despoiling poor American inventors. Let something be done in this matter to adjust this unfairness against the American.

GEORGE H. ENNIS.

Troy, N. Y., May, 1881.

[We think that if our correspondent will study the subject a little further he may reach a different conclusion: 1. In nearly all foreign countries the patent is granted only to the inventor—England is the chief exception. 2. With a little perseverance any inventor, even if poor, who holds a really good invention, can find partners who will be glad to pay the expenses of obtaining foreign patents. 3. We wish our correspondent would mention individually some of the unscrupulous capitalists he refers to. That many American inventions are manufactured abroad is true. But in general, where the inventor fails to share in the benefits, it is because he did not wish to take any steps to do so, but voluntarily abandoned the field to others. 4. The American inventor stands on the same footing as other inventors in nearly all countries where patents are granted. There is no unfairness, and the custom of "despoiling poor American inventors" is imaginary on the part of our correspondent.—EDS.]

The Tables of Regnault and Rankine.

To the Editor of the Scientific American:

On page 228 of the current volume of the SCIENTIFIC AMERICAN, in a brief memorandum referring to the last session of the American Society of Mechanical Engineers at Hartford, I am reported as stating that the tables of Regnault and of Rankine are not exact "under all conditions." The statement as printed does not at all convey the idea which it was intended to present.

My statement was in effect that Regnault's tables were the result of empirical (*i. e.*, experimental) work; that exactness was secured by extraordinary precaution in experiment and by graphically representing results, thus securing a correct statement of the law of variation of pressures with temperatures, and that formulas were then fitted to the case, which formulas very accurately represent that law. I further remarked than Rankine's formula so accurately states the law that its errors lie within the limits of the most exact observation.

I am correctly reported as endeavoring to impress upon engineers the importance of making their practice "depend upon observations derived from the actual conditions of the special cases in hand," as the SCIENTIFIC AMERICAN puts it.

R. H. THURSTON.

Hoboken, N. J., May 20, 1881.

Comet A 1881.

To the Editor of the Scientific American:

In the current issue of your valuable paper an article upon Swift's latest comet implies that no one else had seen the same, so far as known, but the discoverer. Permit me to say that I had the pleasure of securing two good observations of it on the mornings of May 3d and 4th (it being discovered on the morning of May 1st), and which at the time were the first observations reported to the discoverer, as he informed me, from other astronomers. Prof. Chandler, then at Portland, Maine, also secured observations of it and immediately issued an ephemeris. It was seen at the Harvard College Observatory, also at Dun Echt, Scotland. Yesterday I received from the president of the Boston Scientific Society observations and elements of the comet, made by M. Eugen Block, of the Observatory of Odessa, Russia.

Its position at discovery was 0 hour 0 minute R. A., 37° north declination. When first seen by me it was about 2° southeast of that point, which shows its direction and rate of motion. It is now invisible, but may become visible again upon the other side of the sun.

WILLIAM R. BROOKS.

Red House Observatory,
Phelps, N. Y., June 7, 1881.

DETAILS of the destruction of the British gun boat Doterl in the Straits of Magellan show that the condensing boiler exploded, and that the shock exploded a quantity of gun cotton stored in the forward magazine.

MECHANICAL INVENTIONS.

Mr. John D. Smith, of Fayetteville, N. C., has patented a screw for a carpenter's bench vise, which consists of a cylindrical wooden body and a metal rod coiled spirally around it and partly embedded in its surface.

An improved spring power motor for working sewing and other small machines has been patented by Mr. Truman H. Baldwin, of Baraboo, Wis. This motor attachment is adapted for imparting about twenty thousand revolutions at each winding to the shaft on which the balance wheel is mounted, and the inventor claims the winding may be effected with comparative ease by means of the lever. The motor is compact in form, and may be quickly attached to or detached from the sewing machine.

An improvement in water wheels, patented by Mr. Thomas B. Van Pelt, of Carterville, Mo., consists in the peculiar construction of two or more water wheels mounted on the same horizontal shaft, and revolving in a flume provided with stationary counter buckets or inclined plates secured to the inner face of the cylindrical flume between the buckets, and guiding the water, after having acted on a water wheel, to the next.

Mr. Alonzo J. Simmons, of Raysville, Ind., has patented an attachment for furnace doors, which consists in the combination of a perforated steam pipe arranged within the furnace near the door opening and connected with the steam space of the boiler, and a valve to regulate the admission of steam to the perforated portion of the steam pipe, the steam pipe being arranged to direct a sheet of steam across the furnace door opening to prevent the cooling of the furnace by the entrance of cold air.

Cost of Public Buildings.

An experienced architect and surveyor, on the 19th of February, 1879, prepared and presented to General Meigs, Quartermaster-General, the estimate which follows of the cost of various public and private buildings in this country, the comparison being by cubic feet, external dimensions:

Buildings.	Cubic Feet.	Total Cost.	Cost per Cubic Foot. Cents.
Sub-Treasury and Post Office, Boston, Mass.	2,671,338	$2,080,507	77.88
United States Branch Mint, San Francisco, Cal.	1,680,795	1,500,000	89 24
Custom and Court House and Post Office, Cairo, Ill.	444,276	271,081	61.00
Custom and Court House and Post Office, Columbia, S.C.	587,913	381,900	64.95
United States Building, Des Moines, Iowa	413,987	221,437	53.48
United States Building, Knoxville, Tenn	542,362	398,847	73.53
United States Building, Madison, Wis	541,483	329 389	60.83
United States Building, Ogdensburg, N. Y.	447,585	216,576	48 38
United States Building, Omaha, Neb	654,703	334,000	51.01
United States Building, Portland, Me	524,886	392,215	74.72
German Bank, 14th street, Newport, R. I.	600,000	475,000	79 1-6
Staats Zeitung, New York City	508,000	475,100	93 52
Western Union Telegraph, New York City	1,330,000	1,400,000	105.22
Masonic Temple, New York City	1,800,000	1,900,000	105.55
Centennial Building, Shepherd's, cor. 12th and Pa. ave., Washington, D. C.	931,728	246,073	26.41
Add to this the United States National Museum, Fireproof Building at Washington, D. C.	3,843,611	250,000	6½

Fireless Locomotives.

Improvements in detail have been made by M. Leon Francq, who lately read a paper on the subject before the French Association for the Advancement of Science, from which we glean the following particulars: The locomotive is provided with a tank containing water at a sufficiently high temperature (203° Cent., equal to 397° Fahr.) to produce the necessary quantity of steam for the journey. The water is heated at the starting point by means of a jet of steam at high pressure produced by a stationary boiler. As the boiling point increases with the pressure, it follows that, in a closed vessel, the greater the heat the higher the pressure attained. If the heating be effected by a jet of steam, as in the present case, the steam fills the space above the surface of the water, at the same time increasing the pressure. To apply this principle it is sufficient that the tank stand a pressure of from two to fifteen atmospheres (30 to 225 pounds per square inch). The steam from the stationary boiler fills three parts of the receiver and agitates the water sufficiently to distribute the heat uniformly. When an equilibrium of pressure between the boiler and the receiver is attained the cocks are turned off. The locomotive is then in running order, ebullition taking place directly communication is opened between the tank and the cylinders.

In practice the initial temperature may attain 200° Cent. (392° Fahr.), which corresponds to fifteen atmospheres or 225 pounds per square inch. The final pressure must be sufficient to take the train up the steepest gradient to be encountered. The tank or receiver is made of steel plates, and may contain over 1,800 liters (396 gallons). After leaving the receiver the steam passes into an intermediate chamber, which allows the steam to expand so as to enter the cylinders at a uniform pressure, independent of that in the tank or receiver. The exhaust steam is not utilized as in the ordinary locomotive, because there is no fire to urge, but escapes into an air condenser which is a closed cylindrical vessel traversed by more than 600 tubes open at both ends. The water of condensation passes into a tank, whence it is afterward withdrawn as feed water. The diameter of the cylinders is 23 centimeters (9 inches), and the length of stroke 25 centimeters (9⅞ inches), the working parts not differing from those of ordinary engines. The weight of the engine running light is 6¾ tons; and the tractive power is from 343 kilos (6¾ cwt.) to 1,031 kilos (1 ton), according to the pressure. In the event of an unusual resistance being encountered on the road it is sufficient to act, by a rod and lever, on the intermediate or equalizing chamber, so as to give a temporary increase of pressure on the pistons. At a speed of 12 kilometers (7½ miles) an hour, the wheels, which are 75 centimeters (1 foot 5½ inches) in diameter, make 86 revolutions a minute. With a stationary boiler of about 50 square meters (538 square feet) of heating surface, a working pressure may be maintained in the locomotive for seventeen or eighteen minutes. The consumption of fuel is found by experiment to be less for a given duty than is the case of ordinary locomotives. In a line of 10 kilometers (over 6 miles), the working expenses, including repairs and depreciation of stock, amounted to 45½ centimes per kilometer—say 7d. a mile run.

Nitric Acid.

This is one of the most important chemical agencies employed in the arts and manufacturing; agencies due to the property which it possesses of yielding very freely a notable proportion of its oxygen to substances having an affinity for the same, a property which renders it one of the most energetic of oxidizing agents. On this account, as well as because of its cheapness, its use for oxidizing purposes in the laboratory is very extensive.

Its property of energetically dissolving many of the common metals renders it useful in etching steel, copper, bronze, and the like. In the manufacture of sulphuric acid, it is introduced for the purpose of effecting the oxidation of the sulphurous acid given off in the burning of sulphur, or roasting of pyrites, to sulphuric acid. It has the property of yielding, with certain organic substances, what are called nitro-compounds, which are of great value in the arts. So, for example, nitro cellulose (gun cotton), nitro-glycerine, nitro-benzole, nitro-mannite, and a number of analogous products are found. Owing to its powerful oxidizing action, it acts powerfully upon coloring matters, and on this account has some important applications in dyeing. By prolonged treatment with nitric acid, starch, cellulose (wood fiber), and sugar, are converted into oxalic acid; very dilute acid converts starch into dextrine. The fact that it will not attack gold, while energetically dissolving nearly all the other metals, has long been taken advantage of in the arts, in assaying and metallurgy, to separate gold from silver and base metals.

Nitric acid is employed in the chemical industries in great quantities in the manufacture of an immense number of chemical products, in addition to those we have already named. Of these, some of the more important are: the preparation of picric acid from carbolic acid, naphthaline yellow from naphthaline; the manufacture of nitro-benzole, nitro-toluol, and phthalic acid; the preparation of nitrate of silver (lunar caustic), arsenic acid, fulminate of mercury, and, generally speaking, of the salts known as nitrates.

This acid is now manufactured chiefly from the nitrate of soda brought in great quantities from Chili and Peru, and is effected by decomposing this salt by sulphuric acid.—*Mining Journal.*

Spontaneous Combustion by Nitric Acid.

In consequence of the burning of a freight car during the fall of 1879, on one of the railways in Baden, which was suspected to have been caused by nitric acid, Professor R. Haas of Carlsruhe, was called upon by the government to report whether that acid could produce combustion or not. In the experiments made to solve this question the conditions which might be supposed to exist in freight cars containing nitric acid were imitated as far as possible. Small boxes of a capacity of 10 to 16 quarts were charged with variable proportions of hay, straw, tow, and blotting paper—all of which substances are used in packing—and placed within larger boxes, while the space between them was filled with hay or tow, to prevent too rapid a radiation of heat, because the experiments were to be conducted in the open air, and the outer box at the same time represented the walls of a railway car. The material contained in the inner box was now saturated with acid, and rather tightly compressed, so that when the cover was put on it was pretty well filled. At first reddish and afterwards whitish vapors were given off, finally a distinct smoke. On lifting the cover strongly glowing patches could be seen, which rapidly increased all through the contents, and which broke out in bright flames on access of free air or gentle fanning.

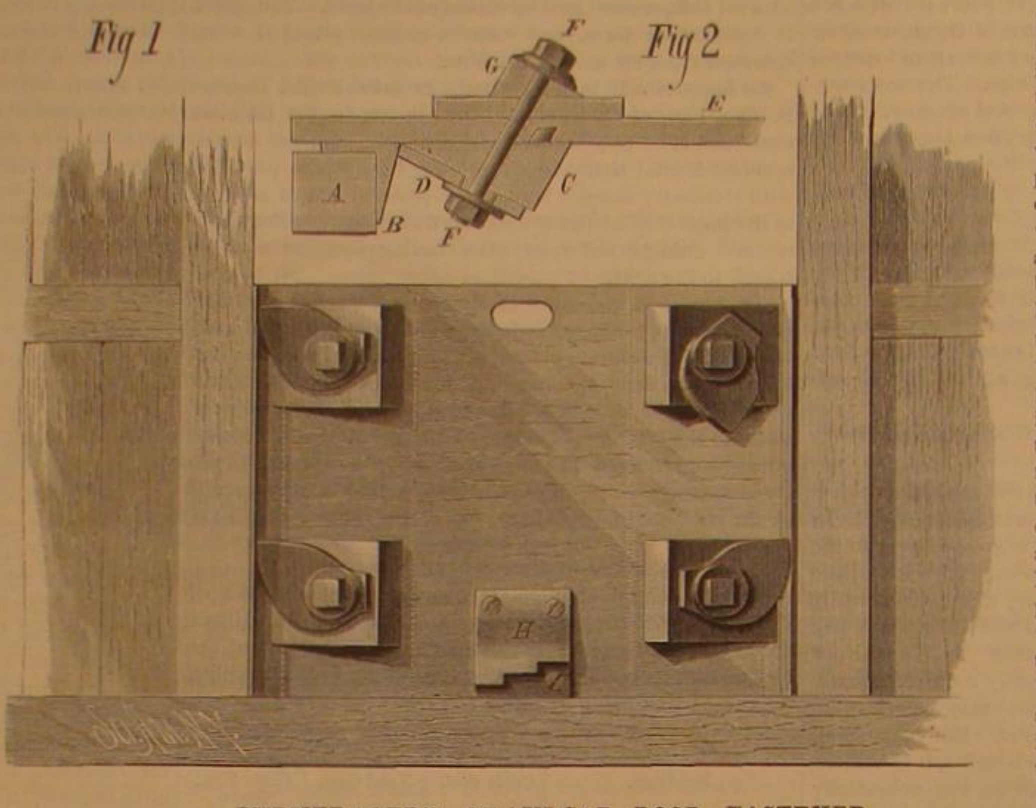
With red fuming acid, or with acid of specific gravity 1·48, these results were obtained very rapidly and within a few minutes. With ordinary acid, of specific gravity 1·395, it required somewhat more time, and the action was less energetic in the beginning; but, in three different trials, after about twenty minutes the same result was finally obtained, provided the material was packed tightly in the box and was thoroughly saturated in its successive layers.

It seems quite probable that even a weaker acid can produce the same result in larger bulk and during warm weather in a confined space which prevents rapid cooling. Hitherto it has often been doubted that spontaneous combustion could be caused under such circumstances, but the above experiments and results are certainly incontrovertible.

NEW FASTENER FOR GRAIN-CAR DOORS.

The great failing in grain car doors as ordinarily made is their liability to become loosened so as to allow grain to escape. When doors are nailed to compensate for defects in their fasteners, the doors soon become destroyed and the jambs or casings are permanently injured.

We give an engraving of a grain-car door fastening which remedies these defects and permits of fastening the door quickly and securely, and in such a manner as to avail of the jarring of the car to tighten the fastenings rather than loosen them. The inventor of this fastener has been for many years a shipper of grain, and being familiar with the defects of other doors, and knowing the requirements of the case, has devised the door shown in the illustration, which is believed to overcome all of the difficulties hitherto experienced, and to be capable of closing a car so that the grain cannot leak from the door; in fact, the greater the amount of jarring the more firmly does the door become fastened. The fastenings are upon the outside and in plain view, and the door can be loosened and lifted as easily as an ordinary gate is opened. It will be seen that its construction is inexpensive, and that it may be readily applied to old cars, not only furnishing a complete door, but also supplying a protector for the door jambs.



BURNTRAGER'S GRAIN-CAR DOOR FASTENER.

In the engraving, A is the door jamb, and B is a false jamb, made of angle iron and having its inner face beveled or inclined from within outward. C is a wedge-shaped block having on one face a projection on which a cam, D, is pivoted, and on the opposite face two projecting lugs, which enter corresponding inclined sockets in the door, E, to steady the blocks, C, in position.

On the inside of the door, E, are secured vertical panels or braces for strengthening it. The cams, D, are held in place by bolts, F, that pass diagonally through the block, C, door, E, and a wedge-shaped washer, G, which is on the inner face of the panel.

The cams, D, have their semicircular or rounded edges beveled to correspond with the bevel of the false jambs, B, so that when turned and forced down against the bevel of the false jambs, B, as shown in Fig. 1, the cams will draw the door outward and hold it firmly against the outer faces of the jambs. By striking up the cams the door is loosened, and can then be pried up for the removal of the grain from the car by inserting the end of a bar under one of the steps of the block, fixed centrally at the lower edge of the door, a suitable fulcrum being placed in position for the prying bar

It will be seen that the false jambs, B, and beveled edges of the cams, D, form opposite inclined planes, that will continue to bear the same relation to each other and together operate to hold the door tightly closed, however great may be the wear on them.

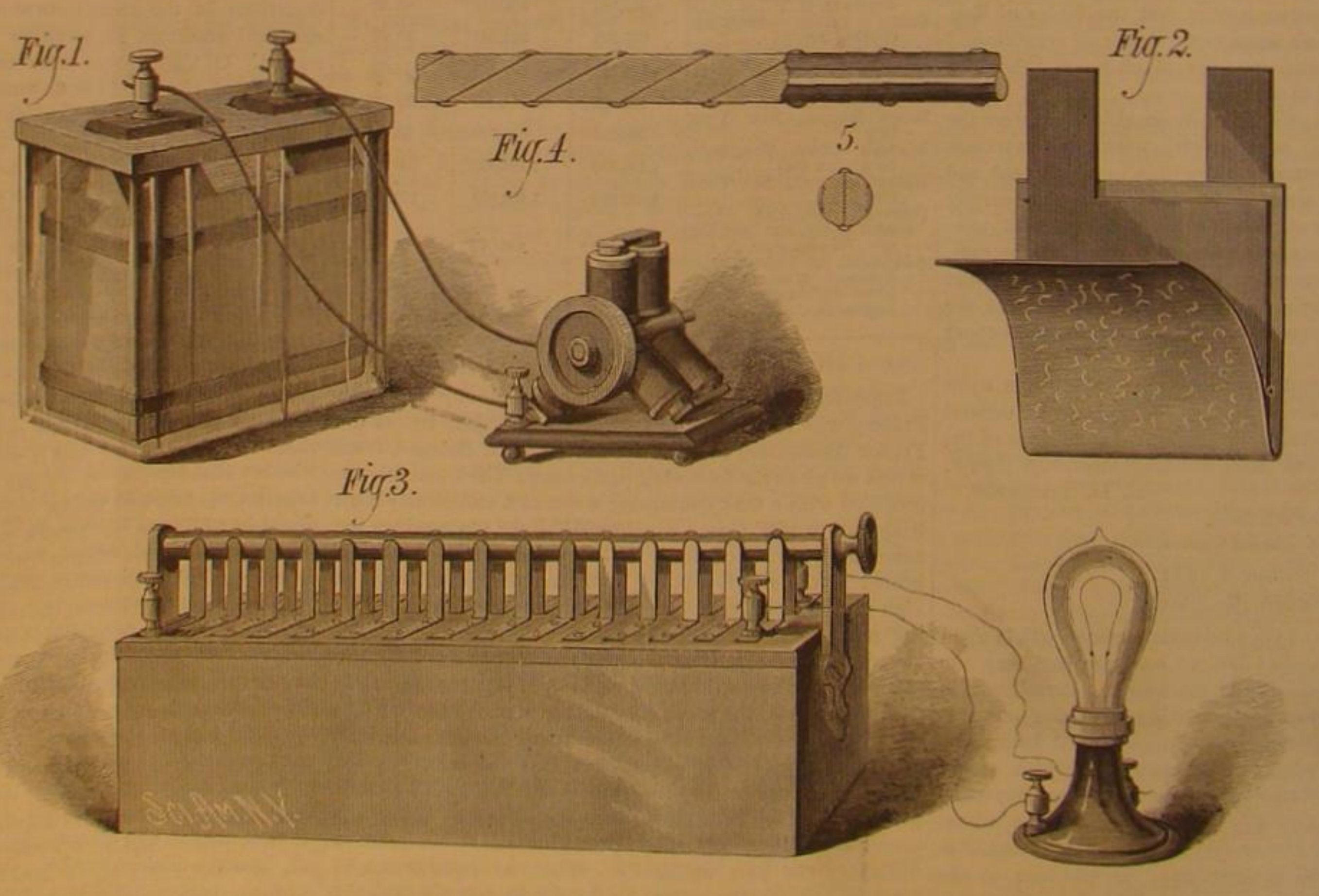
This invention was lately patented by Mr. Aaron Burntrager, of Mulberry, Ind., who may be addressed for further information.

STORING OF ELECTRICITY.

One of the latest and most interesting of electrical novelties is the improvement in the secondary battery of Gaston Planté, by M. Faure, which has been brought to the notice of the scientific world by the accounts of the transportation of a box of "electric energy" from Paris to Glasgow, for the purpose of having it submitted to Sir William Thomson, the eminent electrician, for tests and measurements. The results of this experiment have been pronounced wonderful, but no facts have yet been made public which afford a basis for an estimate as to the commercial value of the invention.

An extemporized Faure secondary battery of small dimensions has been in operation for several days in the office of the SCIENTIFIC AMERICAN, and although no extended tests have been made as yet, the results of the experiment are very promising. We give below an account of the experiment for the benefit of such of our readers as may desire to investigate the subject.

In attempting to follow M. Faure's plan of construction some difficulty was experienced in making the red lead remain in place during the rolling up of the two electrodes. Therefore the battery was constructed of square plates of lead, each having an ear projecting upward from one side, for attachment to a binding post. This plan succeeded very well, the flat plates having the advantage of retaining a great quantity of red lead and of being easily formed into a compact pile.



STORING ELECTRICITY.—THE NEW SECONDARY BATTERY.

Fig. 1 in the engraving shows a single pile operating a small electric motor. Fig. 2 shows the method of combining the plates. Fig. 3 shows how a battery may be arranged with a commutator for combining the elements for tension or quantity, and Figs. 4 and 5 are respectively longitudinal and transverse sections of the commutator.

The plates employed in the experimental battery were of pure lead foil, having the thickness of a postal card, a width of 7 inches, a height of 7½ inches, with an ear projecting from the top 1½ inches wide and 3 inches high. The total effective surface on both sides and edges of each plate is 100 square inches. Ten such plates are sufficient for a single element for ordinary uses, and such an element may be fairly charged by means of four gravity cells, but a stronger current is much quicker and more satisfactory. The method followed in building up these secondary elements was as follows:

After cutting out a sufficient number of lead plates, pieces of canton flannel, 15 inches long and 7½ inches wide, were cut, and finally as many sheets of blotting paper, 7½ inches square, as there were lead plates were provided.

The next step was to prepare a thick paint of red lead by mixing the dry pigment with water containing one-tenth of sulphuric acid. This paint had a consistency of paste, and was applied thickly to one side of the sheet of lead with a common flat paint brush. The canton flannel having been painted to within one-quarter inch of all its edges on the nap side, the lead was laid, painted side down upon the painted canton flannel, when the other side of the lead was painted and the cloth was neatly folded over the lead, completely enveloping it with the exception of the ear at the top, and projecting about one-quarter inch beyond all of the edges of the lead. The lead with its envelope was then laid upon a level board, and another plate was prepared in the same manner and placed over the first, with an intervening layer of blotting paper, and with the ear placed opposite the ear of the first. Other lead plates were added in the same way, with the interposed sheet of blotting paper and with the ears alternating in position, as indicated in Fig. 2. When ten plates had been placed together in this manner they were clamped together with two or three elastic bands, and the ears were brought together and passed through a slit in the wooden cover of the containing cell and bent down upon the top of the cover, as shown in Fig. 1. They were then pierced and traversed by the screw of a binding post which enters the wood. In this way each pole of the element was furnished with a binding post, and at the same time firmly secured to the cover. The cell was then partly or wholly filled with acidulated water—water 10 parts, sulphuric acid 1 part—and after the cloth and blotting paper had become saturated the element was connected with four gravity cells. In one hour the element had stored electricity sufficient to heat 1½ inches of fine platinum wire to redness, to work a magnet strongly, and to run at a high rate of speed for fifteen minutes a small electric motor, that requires at least ten gravity cells to operate it. After this preliminary experiment a number of the new secondary elements were prepared in the same way and charged separately with a dynamo-electric machine. One element of ten plates, after receiving the current from the dynamo, for ten minutes operated the small motor above referred to for something over three hours.

Another ten minutes' application of the current from the dynamo charged it, so that after eighteen hours of rest it yielded a current which seemed as strong as when it was first charged on the previous day; but a time test proved that it was incapable of running the motor for quite so long a time as when the current is used soon after storing. However, it proved that a large quantity of electricity could be stored and retained for a considerable time.

Six elements of ten plates each can be readily charged with the smallest current that can be obtained from a two light dynamo machine; that is, a current that will not support a single arc light will easily charge the number of elements, and they will readily support a single Reynier or Werdermann lamp.

For general experimental purposes the battery may be conveniently arranged as shown in Fig. 3. Each pole of each element is connected through the cover to a spring which is bent upward at right angles. The springs of the two opposite poles of the battery touch upon opposite sides of a commutator cylinder supported a short distance above the top of the box.

Two opposite sides of the commutator are provided with straight bars connecting all the springs on each side, so that the current from all of the positive electrodes may be taken from the binding post attached to the spring at the end of the series on one side, and the current from all of the negative electrodes may be taken from the binding post at the end of the series of springs on the opposite side. When the commutator is in this position the battery may be charged and a quantity current may be obtained from it. When a current of high intensity is required, the elements are connected in series by means of the diagonal wires running through the commutator cylinder and terminating in buttons arranged on a median line between the metal strips. With this device all that is necessary to connect the elements for intensity is to turn the commutator through a quarter of a revolution.

It is too early to speak with any degree of confidence in regard to the capabilities of this new battery, but it seems susceptible of a great number of very useful applications.

For general experimental work its advantages are obvious. For electric lighting on a small scale it appears practicable, since a larger secondary battery may be charged by a small battery during the night and day for use during the evening. For use in connection with small electric motors for domestic purposes it would seem to have another application. For galvano-cautery it may serve a good purpose, and there are a thousand uses requiring only a brief expenditure of considerable power which would allow a large margin of time for the accumulations of electricity, where this battery may be advantageously applied.

The action of the battery is thus described in one of the English journals: "When a current is passed into this cell the minium on one plate is reduced to metallic lead, that on the other is oxidized to a state of peroxide. These actions are reversed while the charged cell is discharging itself."

A Water Carrying Tortoise.

At a meeting of the California Academy of Sciences the other evening, a very fine specimen of the desert land tortoise, from Cajon Pass, San Bernardino County, in this State, was received. The specimen had been carefully prepared, and was as large as an ordinary bucket. The tortoise is a native of the arid regions of California and Arizona, and Prof. E. T. Cox, who was present, related a curious circumstance connected with it.

He found on dissecting one of them that it carried on each side a membrane, attached to the inner portion of the shell, in which was about a pint of clear water, the whole amount being about a quart. He was of opinion that this water was derived from the secretions of the giant barrel cactus, on which the tortoise feeds. This cactus contains a great deal of water.

The tortoise is found in sections of country where there is no water, and where there is no vegetation but the cactus. A traveler suffering from thirst could, in an emergency, supply himself with water by killing a tortoise. They are highly prized by Mexicans, who make from them a delicious soup. The foxes of the desert attack the tortoise and finally overcome it by dragging them at times for miles.

B. B. Redding said he would try to obtain a live one for the Academy, in order that its habits and peculiarities may be carefully observed and noted. He instanced being on the Gallapagos Islands in 1849, and assisting in the capture of 92 land tortoises, varying from 450 to 600 pounds in weight, which the vessel brought to San Francisco and sold for more money than the whole cargo of lumber netted at that time. They were two months on board the vessel, yet ate nothing, and those killed had in them considerable quantities of pure water. They live on the high lava rocks, which rise as mountains on the island, where there are no springs or streams, and the only dependence of animal life for water is necessarily upon the irregular and uncertain rain showers.

It may be mentioned that the tortoise are of different species, though they may have the same habit in respect of carrying water. The famous edible species of the coast of the Pacific and Indies, of which the headquarters is at Gallapagos Islands, is the *Testudo Indica*. They grow to five, six, and even seven hundred pounds or more. Those found in this State are smaller, and are the *Agassii* species, first described some years ago by Dr. J. G. Cooper, if we recollect aright. Those Mr. Redding describes from the Gallapagos were offered water while on the ship, but refused it. Yet when killed they all contained water. The place they inhabit is a dry one, lacking water. It may be that they go to the high places and obtain it from the vegetation, the same as our species does.—*Mining and Scientific Press.*

THE SLENDER DRAGON FLY.

There are many species of dragon flies, all similar in their habits. They are properly named, being among the most voracious and cruel of insects, and even in their preliminary stages they exhibit their predatory disposition. In their larval and pupal state they inhabit the water, and are found in most streams, propelling themselves along by a very simple apparatus. They breathe by means of the oxygen which is extracted from the water, the liquid passing into and out of their body through a gill at the end of the tail. After giving up its oxygen the water is violently expelled, thereby forcing the insect forward.

The lower lip is jointed and can be extended about an inch. When at rest it may be folded, and can be protruded and withdrawn. It is furnished with a pair of forceps at the end, so that it may be able to grasp objects. This creature remains for some ten or eleven months in the preliminary stages of existence before developing into the perfect insect.

Our engraving represents the slender dragon fly (*Lestes*). The male has a light gray encircling band around the middle part of the emerald-green body, the brown or black wing markings have almost a white edge, and it has two large pointed teeth at the inner edge of the clasping pincers.

The manner in which this species lay their eggs has been observed by Siebold, on the borders of a pond overgrown with rushes, and is shown in the engraving.

After the pairing the male clasps the female firmly by the neck and controls her movements. Both fly in this condition with outstretched bodies, lighting upon the water plants and appearing to be animated by one will. Frequently the male settles down on the top of one of the rushes; in this case the female curves her body, and placing the point of it behind the feet, pushes the sabre-formed egg-depositing instrument from out its horny sheath and presses it into the outer skin of the rush. As soon as this is done she creeps down the rush a single step, piercing another place with this apparatus, and continues to work in this manner, drawing the male after her, until the bottom of the rush is reached. Then both fly away to another rush and repeat the operation. Upon the stalks worked upon in this manner there may be perceived rows of whitish yellow spots. A strip of the skin of the rush is ripped up from the top to the bottom by this operation, but is pressed back again by the convex part of the apparatus after it is withdrawn. In almost every one of these pierced places an egg is found deposited in the back part of the roomy air cells of the rush, with its pointed dark-brown end crowded into the inner part of the principal crevice; the somewhat thicker rounded end is of a pale-yellow color and projects into the cell.

Sometimes no egg is found behind the pierced place in the rush; in this case it is probable that no time was given to the female to deposit one, for the male often flies up before the whole length of the stalk is traversed. Pairs of these insects have been observed upon the rushes which grow up out of the water. This does not prevent them from pursuing their accustomed way to the base of the plants. They both disappear under the surface of the water, having previously laid their four wings close together.

If the female betakes herself to the water the male quickly follows after, and she does not begin her work until he is quite surrounded by water. He bends the back part of his body into a position like that of the female, so that all the pairs that have been observed under water form a double curve with their bodies. A thin stratum of air clings to their bodies, their legs, and wings, which they use without doubt for breathing, for they will remain under water half an hour, for here as on the land they descend in the pond to the base of the rush. When they have reached the bottom they creep up the stalk again and fly away. It often happens that when one pair are alr dy upon a rush

SLENDER DRAGON FLY.

Minute Disease Organisms.

The organisms described by Pasteur as the origin of epidemics and contagious diseases are so minute and few compared with the multiplying swarms of bacteria, etc., pervading all generating solutions, that it becomes necessary to provide a means of eliminating the masses of infusoria from solutions to be studied under the microscope. These microzoa haunt even the clearest water at times. M. Certes suggests the use of osmic acid as a sure means of killing them without destroying their tissues. He dips a glass rod into the solution to be examined, and then into 1½ per cent solution of the acid; washing this in a narrow test tube of distilled water, it is easy to collect what is necessary.

Good bricks are unquestionably the best building material used. They come nearer to being fireproof than any other substance. Iron is treacherous and almost worthless in many places where it is used. A good oak pillar is far better as a support in case of fire than iron.

under the water another pair betake themselves to the water upon the same side of the rush. In this case the upper pair turn to the opposite side of the stalk, and thus they carry on their work unhindered. At the approach of an observer they fly away, apparently disturbed in their work, but when they are under water they can only be disquieted to a certain degree. If they are touched they clasp the stalk more firmly, and if still further disturbed they creep up the stalk more quickly than usual in order to fly away.

The pierced places in the stalk spread out into a brown spot under the water. The larva emerge from the pointed end of the egg.

Nearly all dragon flies are brilliantly colored, but the colors fade with their life, and in a few hours after death the most brilliant dragon fly will have faded to a blackish brown.—*Brehm's Animal Life.*

NATURAL HISTORY NOTES.

The Seventeen-Year Locust.—Professor C. V. Riley states in the *American Naturalist* that the present year will be marked by a quite extended appearance of this interesting insect, both a seventeen and a thirteen year brood simultaneously appearing. These two locusts agree in every respect except in the time required for their full development. The last simultaneous appearance of the two broods was in 1860, and their appearance the present year will doubtless give entomologists a chance to perfect their knowledge as to the geographical range of the insects. Pupæ have already been reported either near or upon the surface of the ground in several localities. The thirteen-year brood is by far the more extended, and occurs very generally throughout the Southern States, both east and west of the Mississippi.

Electrical Insects.—Entomologists inform us that a few insects are known which have the power, like the electrical eel (*Gymnotus*), of giving slight electrical shocks to those who handle them. Kirby and Spence, in their Entomology, describe one of these insects, the *Reduvius serratus*, known in the West Indies as the "wheel bug," and state it can communicate a shock to the person whose flesh it touches. Two instances of effects upon the human system resembling electric shocks, produced by insects, have been communicated to the Entomological Society by Mr. Yarrell: one mentioned in a letter from Lady de Grey, of Grobz, in which the shock was caused by a beetle, one of the *Elateridæ*, and extended from the hand to the elbow on suddenly touching the insect; the other caused by a large hairy lepidopterous caterpillar, picked up in South America by Captain Blakeney, R.N., who felt on touching it a sensation extending up his arm similar to an electric shock of such force that he lost the use of his arm for a time, and his life was even considered in danger by his medical attendant.

Growth of Plants in Oil.—M. Van Tieghem has quite recently discovered, and communicated to the *Bulletin* of the Botanical Society of France, the curious fact that many of the lower plants (Ascomycetes, Mucorini, etc.) can live and sometimes fruit very well when they develop in oil alone and far removed from all contact with the atmosphere. Unpurified oils are sown with a quantity of spores, and then, if a slightly moist substance be immersed in the oil, it becomes covered with vegetation. The common mould, *Penicillium glaucum*, among others, develops in oil and fructifies very well in the midst of the liquid, but to make the spores germinate requires the introduction of a small quantity of water at first. These plants germinate owing to the oxygen dissolved in the oil, and they possess the property of forming water at the expense of the elements of the oil. A species of yeast cultivated under such conditions has the property of extensively saponifying the oil in which it develops, without the disengagement of gases.

The Flora of Pompeii.—In 1851, the botanist Schouw published in his book, "Die Erde, die Pflanzen und der Mensch," some facts relating to the plants represented on the frescoes of Pompeii. In a recently published work by Professor Horace Comes, "Illustrazione delle Piante rappresentate nei dipinti Pompeiani," the author has passed in review no less than fifty species which are represented on the frescoes, and which he was enabled to identify, and twenty concerning which he is in doubt. Among the identified species are several that have never been mentioned by other writers on the subject; for example: *Althæa rosea* (holly hock), *Chrysanthemum coronarium*, *Lagenaria vulgaris* (calabash), and *Narcissus pseudo-narcissus* (daffodil). The *Althæa*, well enough known by the ancients to have a place on their frescoes, may well have been the "arborescent mallow" of which Theophrastus speaks, and which has been referred to *Lavatera arborea*, although its full growth is attained in a few months, according to the Greek author. *Narcissus pseudo-narcissus* corresponds in its emetic properties with the "Narcissus genus alterum herbaceum" of Pliny. The edible fungus, *Lactarius deliciosus*, is easily recognizable on the frescoes, and it is to this species, and not to a *Boletus* nor to *Russula integra*, that Pliny refers in the passage: "Fungorum lætissimi qui rubent," etc. (Hist. Nat., xxii., 23).

It appears from the frescoes that in the time of Pliny the naturalist, the Romans possessed through acclimatization, or at all events knew with certainty, plants foreign to Italy. Among these are the *Lagenaria*, cited above, the peach tree, *Acacia nilotica*, *Platanus orientalis* (plane tree), *Tamarix indica*, etc. One of the pictures represents the *Papyrus* and *Nelumbium speciosum*, along with the hippopotamus. *Morus nigra* (black mulberry) is among the plants recognized by Professor Comes, and this confirms the opinion of Fraas. The author has classed the plants in alphabetical order, and devoted to each one an article in which he recalls the principal passages of the authors and commentators who have referred to it. He believes the huakindos of Homer to have been *Gladiolus segetum*, and the hyacinthus of Pliny, *Iris germanica*.

A New American Fern.—The many lovers and collectors of ferns will be interested to know that another new species has recently been added to the list of the Pacific Coast forms. This time it is a *Cheilanthes*—a very beautiful species—and it has been named by Mr. G. E. Davenport (who describes and gives a very beautiful figure of it in the June number of the *Torrey Botanical Bulletin*), *C. Parishii*, in honor of its discoverer, Mr. W. F. Parish, of San Bernardino, Cal. It was detected in the crevices of rocks on a hill in San Diego county. Nothing definite is as yet known of its abundance, but Mr. Parish thinks that it is probably scarce, as he could find but two or three plants.

AGRICULTURAL INVENTIONS.

An improved sack or flexible receptacle for cotton, wool, and other substances, has been patented by Mr. Milledge B. Wever, of Johnston's Depot, S. C. The sack is attached to and envelops a jointed extensible frame that may be so adjusted as to distend it and support it in upright position, thus enabling it to be filled quickly and easily.

An improved stalk and weed roller and cutter has been patented by Mr. Henry H. Spencer, of Mound City, Ill. This machine is so constructed that the knives are at rest or have no reciprocating movement until, in the revolution of the cylinder, they arrive underneath the axle, when they are made, by cam-and-gear mechanism, to make a quick stroke, thus instantly severing the stalks or weeds upon which the whole weight of the machine is at that moment imposed. The knives are instantly retracted after such stroke by means of springs suitably arranged for the purpose.

Mr. Lewis Shepard, of Mace, Ind., has patented an improved harrow that can be conveniently adjusted to adapt it for various kinds of work. The harrow is made in two parts, each of which is made in the shape of what is known as the "A" harrow.

An improved hopple or device for confining the legs of horses or other grazing quadrupeds, so as to hamper their motion and thus restrain their wandering, has been patented by Mr. Charles J. Gustaveson, of Salt Lake City, Utah Ter.

How Hides are Taken Off and Salted.

In the abattoirs of this city the flayers of cattle use in taking off the hides a knife with a straight back and a keen edge, broad at the haft, but tapering up almost into a point at the end. The hoofs are first taken off at the first joint, a piece of the loose flesh at the throat cut out, an incision made in the neck, and the knife run down through the middle of the belly and the center of the lower side of the hair tail. The animal, which, up to this time, has been lying on its back, is inclined a little to one side, being supported in that position by a prop under the downwardly-inclining forequarter. Beginning at the neck, the flayer runs his knife carefully along until the hide is taken nearly off the side which is uppermost, then the animal is rolled over on that side and propped up as at the beginning, and the same flaying operation is repeated on the part which was downward at first. Next a wooden support, about four feet long, six inches deep, and two inches wide, having a large iron hook in the middle adapted to be fastened to a rope for hoisting purposes, is run through incisions made in the hind legs just above the first joint; the rope is adjusted to the hook, and the carcass lifted up by a windlass, when the projecting ends of the joist are supported by cross beams about nine feet from the floor, and the body hangs suspended therefrom. One of the workmen now grasps those portions of the hide which have been taken off the sides of the animal near the neck, and another takes a large butcher's cleaver, and using the back, not the edge of the instrument, by repeated blows frees the skin from the rest of the carcass, while it is pulled off by the first workman. Great care is exercised in the process of flaying, as the workmen are subject to a fine for each cut and score on the hide.

When freshly taken off the hide is worth about 8 cents per pound. In this state it is sold to the salters with the pates and tails on. The salters place them in beds of about 600 each. The floor of the salt room is generally cemented, and the bottom layer of the hides is laid with the hair side down; the salt is then sprinkled on the flesh side, and another layer is put down in like manner until the bed is complete. The hides are usually left in the salt from ten days to two weeks. The salt used must be of good quality and ground rather fine, as in case a lump of even the size of an egg is left upon the flesh side it will eat into the hair of the hide placed above it and very seriously detract from its value. It takes about 180 bushels of salt, worth from 32 cents to 35 cents per bushel, to each pack of 600 hides. When the hides are taken out of salt they are well shaken and folded, first doubled lengthwise, and then wrapped up in four or five folds. In some cases salters contract their hides to tanners by the month or year, and settlements are made at the end of each month on the basis of the average ruling price during that period. It is now, however, becoming customary for them to sell each lot to the tanner or dealer who will pay the highest figure at the time of delivery.

In some of the abattoirs where the butchers do not do their own salting, the salters hire the pens and make no charge to the slaughterers, but receive the hoofs of all the animals killed in lieu of other compensation. In the Jersey City abattoir the salters pay $1,000 per annum for each pen, affording accommodation for fifteen animals at a time.—*Shoe and Leather Reporter.*

Sugar from Rags.

The newspapers have lately taken up the subject of making sugar from rags, and some of them seem to regard it as a new invention. This, however, is by no means the case. It has been long known to chemists that if vegetable fiber, such as that of cotton, flax, etc., be submitted to the action of sulphuric acid, it is converted into soluble starch or dextrine, and this is readily convertible into sugar. The ordinary process of malting is simply a conversion of the starch of the barley into sugar by the agency of a ferment called "diastase," which is formed in the barley, and is so effective that only one five-hundredth part is sufficient to set up the action by which the insoluble starch is converted into dextrine, and then into sugar. This occurs when the grain of barley is sown in the ground, and is the natural operation by which the germ is fed; the germ having neither mouth nor stomach, cannot take solid food like the original starch granules which surround it in the seed; but when that starch is converted into sugar, the baby plant can absorb it, and continues to absorb it until its rootlets and first leaf are formed. By this time the sugar is all used up, but the plant is now able to obtain its nourishment from the ground by its root, and from the carbonic acid of the air by its green leaf or leaves.

Such is the ordinary life history, not only of the barley plant, but of all others. The starch is to the plant germ what the yolk and white of the egg are to the chick germ. If the sugar were ready formed in the seed it would be dissolved away at once by the water in the soil, and the germ would perish prematurely, but by the exquisite chemistry of nature the conversion of the insoluble starch into the soluble food of the germ goes on just so fast as the germ can use it, and thus the supply is kept up till the young plant can shift for itself. The maltster forces the natural process, and then kills the germ by roasting the seed when he has obtained the maximum amount of sugar.

Fruits also are sugar factories, in which is conducted the whole process of making sugar from rags, the fiber of the rags being represented by the fiber of the unripe fruit. Every boy who has struggled to eat an unripe apple or pear knows that the unwholesome luxury is what he calls "woody," as well as sour. The chemist describes it similarly. His technical name for the tough material is "woody fiber," under which name he includes nearly all the fibrous materials of the vegetable world, for they all have fundamentally a similar chemical composition. This woody fiber is made up of carbon and the elements of water. Starch and sugar are composed of the same elements, their differences of properties being due to differences of arrangement and proportions of the constituent elements. Thus the change of insoluble starch into dextrine, and dextrine into sugar, or the change of woody fiber into dextrine and sugar, are effected by very small modifications of chemical composition.

We all know that the unripe apple or pear is sour, or that it contains an acid as well as the woody matter. Now, this appears to act after the manner of the sulphuric acid that the chemist applies to the rags, but it acts more slowly and more effectively. The sweetest of pears are gathered when hard and quite unfit for eating, but by simply setting them aside and giving this acid time enough to do its work, the hard fibrous substance becomes converted into a delicious, sweet, juicy pulp.

The natural chemistry here has a great advantage over the artificial operation, seeing that the natural acid either becomes itself converted into sugar or combines with the basic substances in the fruit, forming wholesome salts. Not so the sulphuric acid of the chemist. He must get rid of this from his rag sugar; and herein lies the difficulty of the process. The writer tried the experiment more than twenty years ago, using lime for the purpose of removing the sulphuric acid, but found that in removing the sulphate of lime he lost much of the sugar which this solid absorbed, and from which it could only be removed by great dilution, and then not completely. To do this practically would cost so much that the rag sugar would be far dearer than that which nature beneficently manufactures by similarly, but more effectively, acting upon the fibers of the sugar cane or beet root.

There is little risk of the sugar trade being disturbed, or of the paper makers being deprived of their raw material, by the rivalry of rag sugar, though the chemist may display in a show glass some crystals that he has made from one of his own worn-out shirts.—*London Grocer.*

A Good Word for Cast Iron Stoves.

For some time Prof. Ira Remsen, of Johns Hopkins University, has been investigating for the National Board of Health, the alleged danger to health in apartments heated by hot air furnaces and cast iron stoves. The results of the investigation, Prof. Remsen tells the Baltimore *American*, "cannot well be given in a few words, but in general, it may be said that there is practically not much danger from carbonic oxide involved in the use of hot air furnaces and cast iron stoves."

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

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

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(1) F. M. E. asks for the composition of the inks used for stamp ribbons, such as are used on type writing machines. I have such a writer, but have not used it for two years, for the reason that I cannot re-ink the ribbons. A. Dissolve 1 oz. of best soluble nigrosine in 4 oz. of hot glycerine by triturating together in a hot mortar, and add ¼ oz. of soap previously made into a thick paste by triturating and macerating it with a small quantity of hot water. Rub this well into the ribbon.

(2) S. W. asks: What ingredient can be mixed with lime whitewash to prevent it turning yellow in rainy or damp weather when used on outside work? A. See answer to O. E. C., page 375 (40), current volume.

(3) W. L. S. asks for what purpose lampblack is used. Is it in demand, and what is the market value? A. It is extensively used in the preparation of various black paints, varnishes, japans, printing, marking, stenciling, and transfer inks. Address the dealer in paints and colors. See column of Business and Personal and Hints to Correspondents.

(4) B. W. B. asks how to make an ink that, when first written, cannot be seen, but when applied to heat it turns black. A. Use a dilute solution of chloride of cobalt (pure) in soft water. 2. Also an ink that after a certain time after it is written disappears. A. We cannot give you a receipt for such an ink. See Inks, in SUPPLEMENT, No. 158.

(5) H. G. F. asks for a remedy for mildew in sailcloth exposed to rain and sun. Something more potent than lime water, but not too expensive? A. Saturate the cloth with a strong hot solution of soap, press out excess of the liquid, and digest for six hours or more in a solution of alum 1 lb., in water 1 gallon. Rinse in plenty of clean water before drying. Acetate of lead is sometimes used instead of the alum.

(6) In answer to L. M. and others, C. M. says: The price of soap is regulated by the cost of materials employed, provided the manufacturer is fully competent in the art of soap making. My own experience is that a cotton seed oil soap costs 3¼ cents a pound for materials, and a pure tallow soap 4½ cents a pound.

(7) L. B. writes: I wish to stencil some letters and figures around an ordinary white opaque glass globe (for gas). What kind of paint can I use that will not run and will not wash off? A. Try good black japan varnish, thinned with turpentine if necessary.

(8) A. B. asks: 1. How much sulphuric acid, chalk, and water, or sulphuric acid, marble, and water, or sulphuric acid, bicarbonates of soda, and water is necessary to make ten square feet of carbonic acid gas? A. Under ordinary conditions of temperature and pressure ten cubic feet of carbonic acid gas will require, in practice, 3⅛ pounds of good chalk or marble, 4 pounds of sulphuric acid and 1¼ gallons of water: or 2¾ pounds of bicarbonate of soda, 1⅛ pounds of sulphuric acid, and about 3 quarts of water. 2. Does strong pressure hinder the development of the carbonic acid gas? A. The reaction by which the gas is produced takes place under pressure the same as when the materials are exposed in an open vessel. 3. What is the best elastic material to resist the action of the mineral acids? A. Vulcanized rubber.

(9) W. J. B. asks: Will the common type used in printing stand to be heated hot enough to print letters in gold on the leather covers of books without injury? A. With care, yes. 2. Will the recipe given to W. S. P., in No. 23, do for lettering cloth book backs? A. Yes.

(10) A. B. B. asks (1) for a receipt for making a cement for cementing stone to wood. A. Melt and mix together equal parts of pitch, gutta percha, and shellac. Use hot. See Cements in SUPPLEMENT, No. 157. 2. Of what is hydraulic cement made? A. It is prepared by strongly calcining an argillo-silicious limestone or by calcining an intimate mixture of finely-ground lime, or limestone, clay, and sand. See Gillmore's "Cements and Mortars." 3. What is used for making artificial marble for tops of stands, etc.? A. The materials used are lime, lime carbonate, barytes, zinc white, and waterglass. Some of the stone is hardened by immersing it in a strong solution of chloride of calcium. For minerals, see under appropriate heading.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

May 24, 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 one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. 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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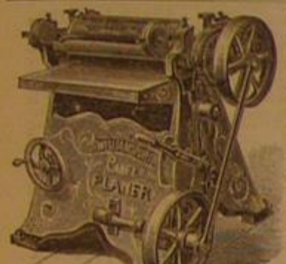

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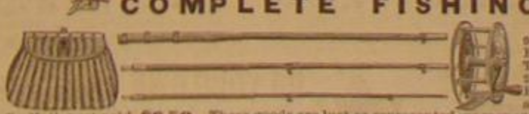

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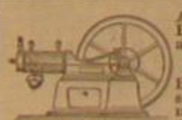

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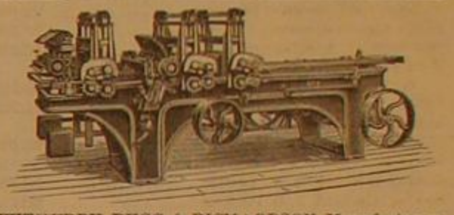

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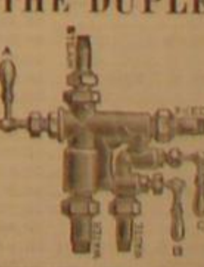

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