SCIENTIFIC AMERICAN

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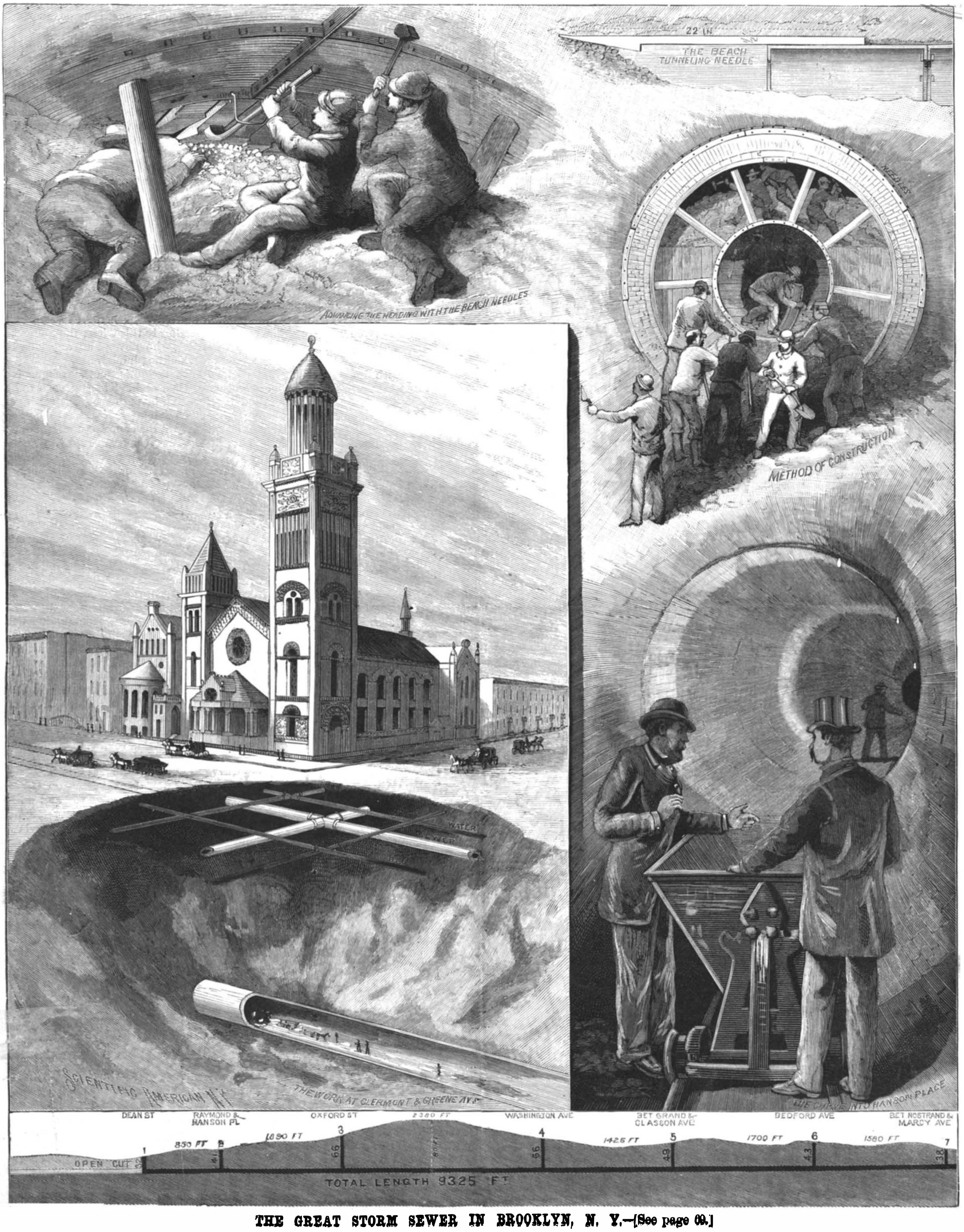

THE GREAT STORM SEWER IN BROOKLYN, N. Y.—[See page 69.]

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NEW YORK, SATURDAY, JANUARY 30, 1892.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending January 30, 1892.

Price 10 cents. For sale by all newsdealers.

NIAGARA FALLS AND BUFFALO.

After the completion of the great tunnel works now in progress at Niagara Falls, there will be nothing to hinder the rapid rise and growth of that interesting town into a great and wonderful city. Its dwellings and factories will be supplied with light, heat, and motive power at an extremely low cost, and useful industries of every kind ought there to flourish with unwonted vigor. Domestic life will be attended with many comforts and conveniences. The cook will only need to touch a button, and presto, her electrical stove will be in full operation, the pot will boil, the oven bake, the turkey roast, the pump move, the washing machine turn; while the electric refrigerator will freeze the water, preserve the meats, vegetables, milk, butter, eggs, and other supplies. No coal, no wood, no dust, no dirt, no oil, no gas. The lady of the house will be relieved of care. She presses a button, and every nook and corner of her dwelling glows with cheerful light. Touch another. and the electric fire glimmers in every room, diffusing genial warmth. The electric lift takes her up or down stairs in a jiffy. The telephone conveys her orders to market, and distributes her social commands among friends and neighbors. Niagara is in a fair way to become famous as the great electrical city of the world. At any rate it will possess, in a great degree, the means for economic electric generation and supply.

Near to Niagara, only twenty-five miles distant, is Buffalo, already a large and prosperous city, the head center of lake navigation. The simple extension of conductors over the short distance above mentioned will bring to the people of Buffalo a direct share in the economic and other advantages of the new and great enterprise. Light, heat and motive power for streets, vehicles, works, shops, factories, stores, churches, dwellings, can be supplied from the dynamos at Niagara, more economically, probably, than by any other means. Local steam engines may be dismissed; their occupation, for Buffalo, will be gone. Even the steam fire engines may retire. The electric pump will beat them out of sight.

We look toward Niagara and Buffalo with hopeful interest, expecting soon to witness there many novel applications of electricity for industrial, domestic and municipal purposes. In the latter category the promotion of the public health and the expulsion of diseases by electrical agencies seem to be among the reasonable possibilities of the near future.

PATENT TRICKS—OLD AND NEW.

Some time ago, under this heading, we briefly explained some of the methods practiced by sharpers upon unsuspecting patentees, for whose benefit we will now repeat our remarks and make a few additions.

When an inventor receives a patent, his name is immortalized in the *Official Gazette*, and he immediately becomes the object of attack from a horde of hungry aspirants for money, among whom are ex-clerks, patent brokers, and pretended legal lights of varying degrees. The patentee is deluged with circulars and letters from this class of gentry. Some write to inform him confidentially that his patent is good for nothing; but on receipt of a certain fee they will set it right and make it sound as a silver dollar. Others pleasantly inform the new-fledged inventor they have read his patent with great pleasure, consider it to be a very valuable invention. If properly introduced, much money can be soon realized. The State of Iowa, they say, is worth $50,000, Ohio $45,000, Pennsylvania $65,000, and so on. All that is necessary is to print some circulars and do a little blowing, which the broker generously offers to do on receipt from the inventor of ten to fifty dollars cash in advance. Another writes to say he has an actual offer of $10,000 for the patent for Canada, provided the patent is at once taken, which he will procure on receipt of the necessary money. It is almost needless to suggest these schemes are designed to fleece the inventor. The so-called patent sellers rarely effect a *bona fide* sale. They depend upon the advance fees obtained as above for a livelihood. Some of them have thus grown rich and prosperous.

These pretended sellers try to make it appear they are reliable by giving respectable references, and cite names of patentees for whom they purport to have sold patents. One mode of procuring these references is as follows: They write the patentee they have a customer who will buy a county right in Minnesota for $500, and pay by deeding 25 acres of land in Arkansas, really worth $1,000, but the parties are so anxious to obtain the patent right they are willing to let the land go, and take the right, in settlement, provided $50 cash is paid and a mortgage is given for $500. This done, the patent broker closes the transaction, receives the $50 cash, which is the full value of the land, also receives a mortgage for $500, together with the patent deed. At the same time the broker is careful to obtain a written certificate from the inventor stating, "I take pleasure in saying that X. Y. Z. & Co. have sold a patent right for me, at my price, and on terms satisfactory, and I recommend them," etc. In this way references are secured which make quite an impressive show on circulars, while the inventor is so ashamed of having been so easily duped, he keeps mum.

One of the latest tricks is the following: The patentee receives a letter from A. & B. asking for how much he will sell his patent for such and such a State. He replies, giving a price, say $5,000. The patentee soon after receives another letter from X. Y. Z., saying that A. & B. write they have corresponded with you, and now say they have decided to purchase the patent on the terms named, provided the title and claims are found to be correct. To ascertain this, they require that X. Y. Z. shall examine and report upon the patent, otherwise A. & B. will not purchase; that if the patentee wishes to complete the sale, he must remit fifty dollars to pay for the examination, which is a work independent of the sale, and must be independently paid. The inventor sends the money; a report is made adverse to the patentee, no purchase is made, none was ever intended.

A new edition of the same class of swindles is worked by a gang of confederates as follows:

One of the swindlers writes to the patentee asking if the patent has been disposed of. If not, he would like to correspond with a view to purchase or manufacture. Reply is made that the patent is for sale. Then comes another letter from the swindler, saying substantially, "We have examined the invention very carefully, and if you will furnish us with an opinion or report as to the scope and validity of your patent we will, if same is satisfactory, make you an offer either for purchase or license on royalty. Our proposition will be based entirely on the nature of the opinion or report. If you have not already a reliable opinion, we recommend D. & Co. (Diddlem), as moderate in charges for this class of work. Such patent rights as we buy must be bought at once, and it will therefore pay you to furnish the report without delay." The inventor then writes to the other members of the gang, Diddlem & Co., by whom the inventor is requested to send $50 or $100 cash and the desired report will be furnished. Unsuspecting inventors easily fall victims to this trick; the money is paid, and the tricksters, who never had any idea of buying the patent, divide the plunder.

The patent insurance dodge is another scheme for relieving inventors of their cash. This purports to be a corporation for insuring inventors against infringements. By paying eight dollars cash within 30 days of the issuance of the patent, the concern undertakes to insure the patentee for one year against any infringement of his patent by other people, besides giving advice and services for which other lawyers charge anywhere from $250 to $10,000. There is less chance of infringement during this period than that the inventor will be struck by lightning in winter. This is simply a scheme to do the inventor out of $8.

A French trick played with much success on American inventors is the following: The new patentee receives by mail, from Paris, a flaming ornamental document of provisional membership, which looks as if it came officially from the president of the famous Academy of Sciences, with a letter informing Monsieur le John Smith, of Snuffkinsville, Arkansas, Republique des Etats Unis, that the Academy has observed with pleasure his invention for planting seeds, so important for agriculture; in view of which they have voted to confer upon M. le Smith the honorable distinction of membership in the Academy. M. le Smith will have the goodness to remit to the treasurer the nominal sum of fifty francs—ten dollars—to defray the cost of the parchment, framing, boxing, and transportation of the diploma. These tricksters are said to draw considerable money from the United States.

Such are a few of the adroit schemes now in vogue for swindling "innocent" inventors.

Bills have been introduced in Congress to protect innocent purchasers of patents, *i. e.*, infringers. Might it not also be well for somebody to formulate a law to protect innocent inventors?

Annual Meeting of the American Society of Civil Engineers.

The American Society of Civil Engineers held its annual meeting on Wednesday and Thursday, January 20 and 21. The afternoon was devoted to the general business of the society. In the evening valuable papers on the Elevated Railroads of St. Louis, the great Weehawken passenger elevator, and other subjects were read.

On Thursday an excursion was made to the above elevator and viaduct. The reservoir and high service tower of the Hackensack Water Company were also visited and examined. The party then proceeded by steamer to the Brooklyn Navy Yard. Here by the courtesy of Captain Henry Erben, U. S. N., the engineers were permitted to examine the cruisers Maine and Cincinnati, and the armored ship Miantonomoh, as well as the large engines being built for the Cincinnati and Raleigh. The docks were also examined. In the evening a reception was given at the house of the society, 127 East 23d Street, New York, where at 21:30 o'clock by the society's timepiece an elegant collation was served, followed by a number of speeches, which were enthusiastically applauded. The ses[illegible]ns of the society were largely attended by mem[illegible] guests.

POSITION OF THE PLANETS IN FEBRUARY.

VENUS

is evening star. She is the gem of the star-lit February sky, and is seen under most favorable conditions, coming toward us, thus increasing her diameter, and oscillating eastward from the sun, thus lengthening her stay above the horizon. Though less of her illumined disk is turned to the earth as she advances in her course, the loss is more than counterbalanced by her greater diameter, and her brilliancy steadily increases. To complete the list of her attractions, she is moving northward, and, when the month closes, her declination is 7° 28′ north.

The most interesting event on the February record is the close conjunction of Venus and Jupiter on the 6th at 5 h. 8 m. A. M., when Venus is only 1′ south of Jupiter. A minute of arc is a tiny bit of sky, and the planets would seem to make an appulse, or touch each other, if we could see them, but they are below the horizon at the time of the conjunction. Observers will, therefore, have to be contented with a view of the planetary rivals on the evenings of the 5th and 6th, when they are near together, and form a charming celestial picture. On Friday, the 5th, at 7 h. P. M., Venus is 21′ of arc west of Jupiter, a space about equal to two-thirds of the diameter of the moon. On Saturday, the 6th, at 7 h. P. M., Venus is 40′ east of Jupiter, showing that the conjunction has occurred, and that the planets have changed places, and are receding from each other. The planets set about 8 o'clock on the evening of the 5th, and the distance between them will lessen as long as they are visible. The conjunction will be visible with the aid of a telescope to observers far enough east of us to trace the planets above the horizon at the time of the conjunction at Greenwich, for instance, where it occurs at 10 h. A. M.

The conjunction comes near being an occultation, a very rare occurrence between two planets, of which there are few instances on record. The moon occults every month all the stars and planets that lie in her pathway. Planets sometimes occult stars, but a planet occulting a planet, or even coming as near as Venus does to Jupiter, is a phenomenon to be remembered for a lifetime. Observers on this portion of the earth's domain will greatly regret that our celestial neighbors did not choose a more favorable hour for the exhibition, and give us an occultation instead of a conjunction.

The right ascension of Venus on the 1st is 23 h. 7 m., her declination is 7° 4′ south, her diameter is 13″.0, and she is in the constellation Aquarius.

Venus sets on the 1st at 7 h. 51 m. P. M. On the 29th she sets at 8 h. 55 m. P. M.

JUPITER

is evening star. His course in that role is nearly finished, for he is drawing near the sun and will soon become eclipsed in the sunbeams. He sets about an hour later than the sun when the month closes. Observers in January watched with eager interest the approach of Venus and Jupiter. They will watch with greater enthusiasm during the present month the conjunction of the bright planets, or what can be seen of it, and their subsequent recession from each other, so that at the close of the month they are 20° apart. A remarkable coincidence intensifies the importance of this rare phenomenon. Venus and Jupiter were in conjunction on July 20, 1859, at 10 h. 38 m. P. M., Venus being 1′ south of Jupiter. The distance between the planets was exactly the same as in the present case, although their position in regard to the sun was entirely different.

The moon makes two conjunctions with Jupiter in February. The two-days-old crescent is in conjunction with Jupiter on the 1st at 3 h. 36 m. A. M., being 3° 42′ south. The one-day-old crescent is in conjunction with Jupiter on the 28th, at 11 h. 40 m. P. M., being 3° 19′ south.

The right ascension of Jupiter on the 1st is 23 h. 24 m., his declination is 5° 8′ south, his diameter is 33″.0, and he is in the constellation Aquarius.

Jupiter sets on the 1st at 8 h. 59 m. P. M. On the 29th he sets at 6 h. 59 m. P. M.

SATURN

is morning star. He is now coming into notice as the bright star in the east, rising about 8 o'clock on the middle of the month, and may be found about 19° northwest of Spica.

The moon is in conjunction with Saturn on the 15th, at 10 h. 54 m. A. M., being 1° 40′ north.

The right ascension of Saturn on the 1st is 12 h. 3 m., his declination is 2° 20′ north, his diameter is 17″.8, and he is the constellation Virgo.

Saturn rises on the 1st at 9 h. 3 m. P. M. On the 29th he rises at 7 h. 5 m. P. M.

MARS

is morning star. Observers who wish to obtain a glimpse of the ruddy star, soon to play an important part in celestial economy, will find him on the 1st 3° southeast of Beta Scorpii, rising about half past 2 o'clock. An opera glass will bring him into the field of view.

The moon is in conjunction with Mars on the 22d, at 2 h. 21 m. A. M., being 2° 39′ south. The conjunction occurs very near the time when Mars rises.

The right ascension of Mars on the 1st is 16 h. 12 m., his declination is 20° 33′ south, his diameter is 6″.2, and he is in the constellation Scorpio.

Mars rises on the 1st at 2 h. 38 m. A. M. On the 29th he rises at 2 h. 11 m. A. M.

MERCURY

is morning star. His course is uneventful as he makes his way from western elongation to superior conjunction with the sun.

The right ascension of Mercury on the 1st is 19 h. 37 m., his declination is 22° 19′ south, his diameter is 5″.6, and he is in the constellation Sagittarius.

Mercury rises on the 1st at 6 h. 6 m. A. M. On the 29th he rises at 6 h. 36 m.

NEPTUNE

is evening star. Observers will look for him 2½° northwest of Aldebaran, his position changing little during the month. A good telescope is required to obtain a good view of him, though he has been seen with the aid of an opera glass by a practiced observer.

The right ascension of Neptune on the 1st is 4 h. 19 m., his declination is 19° 48′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 2 h. 41 m. A. M. On the 29th he sets at 0 h. 51 m. A M.

URANUS

is morning star. His right ascension on the 1st is 14 h. 15 m., his declination is 13° 4′ south, his diameter is 3″.6, and he is in the constellation Virgo.

Uranus rises on the 1st at 0 h. 14 m. A. M. On the 29th he rises at 10 h. 19 m. P. M.

Venus, Jupiter, and Neptune are evening stars at the close of the month.

Mercury, Saturn, Mars, and Uranus are morning stars.

The Aluminum Light.

A very intense light, such as is required for photographic or occasionally for medical purposes, may, as is well known, be readily obtained by burning magnesium ribbon, which has, however, the disadvantage of being somewhat expensive. An excellent substitute has been found by a French chemist, M. Villon, in aluminum, which is about a third of the price of magnesium, and which may be utilized in the same manner by burning it in a spirit lamp, or, if a flame of much more intense brilliancy is required, in a coal, gas, or spirit flame supplied with a jet of oxygen. In these it burns without emitting fumes, in which respect it is superior to magnesium. The light given by aluminum has a high actinic power—nearly as high, indeed, as that of magnesium. The most convenient way of obtaining a very intense light, according to M. Villon, is to use a lamp provided with a jet of oxygen at the center of its flame, into which powdered aluminum mixed with a quarter of its weight of lycopodium and a twentieth of its weight of nitrate of ammonium can be projected by means of a tube furnished with an air ball. This gives an exceedingly intense light, without smoke. A mixture of aluminum powder with chlorate of potash and sugar can be ignited, giving an intense light, by means of gun cotton, but is somewhat dangerous. Probably the best plan, says the *Lancet*, for medical photography, or for laryngoscopic and auroscopic and other demonstrations, would be to burn a ribbon of aluminum in an ordinary spirit lamp. Of course, if oxygen and an oxy-hydrogen, or an oxy-alcoholic, lamp were at hand, a much more intense light could be obtained.

An Inventor Elevated to a Peerage.

If ever a peerage is the fit reward for scientific eminence, says *The Builder*, London, never was that distinction better bestowed than on Sir William Thomson, president of the Royal Society, on whom the British Queen has just conferred the title. The days are past when a man could say with Bacon, "I have taken all knowledge to be my province;" nor is it now possible even to so take all science, but Sir Wm. Thomson may justly claim to have taken all physical science as his province, and there are few who can rival him in any one branch of it. Go where you will, we find traces of his restless activity. Every telegraph office is stocked with instruments of his invention; a large part of London is lighted by dynamo machines which are modifications of one of his; and in the test rooms of all the installations in the world the most accurate instruments are his also. We go to sea, and we find the means of taking soundings without stopping the ship, designed by Sir William Thomson; we arrive in port, and find the height and time of the tides predicted by Sir William Thomson's tidal clock. Perhaps we are interested in questions of speculative science—the age of the earth, the constitution of matter and the size of its ultimate molecules, the origin of life on the earth and its probable duration; none of these questions can be adequately discussed without mention of his name, and on some of them he is the only authority. In collaboration with Professor Tait he has written what is generally accepted as *the* text book on natural philosophy, and some of the most brilliant mathematical investigations we have ever seen are due to him. When the history of science in the nineteenth century comes to be written, three names will stand out pre-eminent, those of Faraday, Darwin, and Sir William Thomson.

Mineral Production of the United States for 1891.

A recent number of the *Engineering and Mining Journal* presents the official returns of production during 1890 and 1891 of nearly all the important minerals and metals, and a comprehensive statement of the sources of production, the occurrence of the minerals, the uses and values of their products, and in many cases the stocks of metal on hand at the close of the year.

These statistics have been compiled with the greatest possible care, neither labor nor expense being spared to secure accuracy in every particular.

The statistical reports given would form a book of about 450 pages.

We make the following abstracts: There have been no discoveries of great bonanzas, no mining "booms," during the year 1891, but the mining industry never was more prosperous, and its prosperity never before was founded on so substantial a basis. Large investments have been made in mining, and for the most part with prudence. Under competent and honest management these investments are making highly satisfactory returns. The dividends declared by mining companies during the year 1891 were much greater than for many years past, and represent a better return on the money actually invested than ever before in the history of mining in this country.

The immense increase during 1891 in production of most of the metals has been a surprise. Copper in particular will, as usual, astonish the trade. The consumption of metals increases steadily, as might be expected from the growing wealth and prosperity of the country. Almost the only article which has fallen off has been steel rails, and with it pig iron. In this instance the financial condition of the railroads was the cause; while where consumption is made up of the purchases in small and various forms by the people at large, it steadily increases unless checked by very high prices. During the year 1891 prices were generally low and the people prosperous; they consequently purchased freely.

Nothing more forcibly demonstrates the absurdity of our barbarous system of weights and measures than the compilation of statistics. We have tons of 2,240 pounds, of 2,000 pounds, and the metric ton of 2,204½ pounds, or 1,000 kilos, to say nothing of the other special tons used in certain industries. We have ounces troy and avoirdupois, and grains and grammes, with innumerable other weights. It is indeed high time that all civilized countries adopt the single metric standard of weights and measures—in which case the statistics compiled in one country will be available for comparison elsewhere without necessitating the laborious recalculation from one system into the other.

MINERAL PRODUCTION OF THE UNITED STATES IN 1890 AND 1891.

	1890.	1891.
Gold, ounces	1,588,880	1,620,000
Silver, ounces	54,500,000	58,000,000
Pig Iron, tons of 2,000 lb	10,307,028	8,976,000
Steel Rails, tons of 2,240 lb	2,095,996	1,090,000
Copper, lb	264,920,000	292,620,000
Lead, tons of 2,000 lb	181,494	205,488
Zinc, tons of 2,000 lb	66,342	76,500
Nickel, lb	200,332	144,841
Quicksilver, flasks	22,926	21,022
Aluminum, lb	94,881	163,820
Tin, lb	....	123,366
Antimony Ore, tons of 2,240 lb	....	700
Anthracite Coal, tons of 2,240 lb	38,006,483	42,839,799
Bituminous Coal, tons of 2,240 lb	93,000,000	98,000,000
Phosphate Rock, tons of 2,000 lb	637,000	659,731
Salt, bbls. of 280 lb	9,727,697	10,229,691
Bromine, lb	310,000	415,000
Pyrites, tons of 2,000 lb	109,431	122,438
Sulphur, tons of 2,000 lb	....	1,200

The iron industry suffered a severe "set-back" during the past year, when the make of pig iron declined from 10,307,028 tons of 2,000 pounds, in 1890, to 8,976,000 in 1891, these figures being obtained from official returns made throughout the year. This heavy falling off was caused chiefly by the decline in the make of steel rails from 2,095,996 tons of 2,240 pounds in 1890 to 1,090,000 tons in 1891—a decline due partly to the poverty of the railroads and partly to the comparatively high price established by the steel rail association.

In phosphate rock, in pyrites, in salt, in aluminum, in copper, lead and zinc there has been a very considerable increase in output, while tin, antimony ore and sulphur enter the list with modest but promising beginnings.

THE Venezuela, belonging to the Red D Line, is the first vessel built under the provisions of the postal subsidy act of the last Congress. She has been tested under the supervision of a naval board and made 15¼ knots average on a four-hour trip. The board reports that she complies with the government requirements.

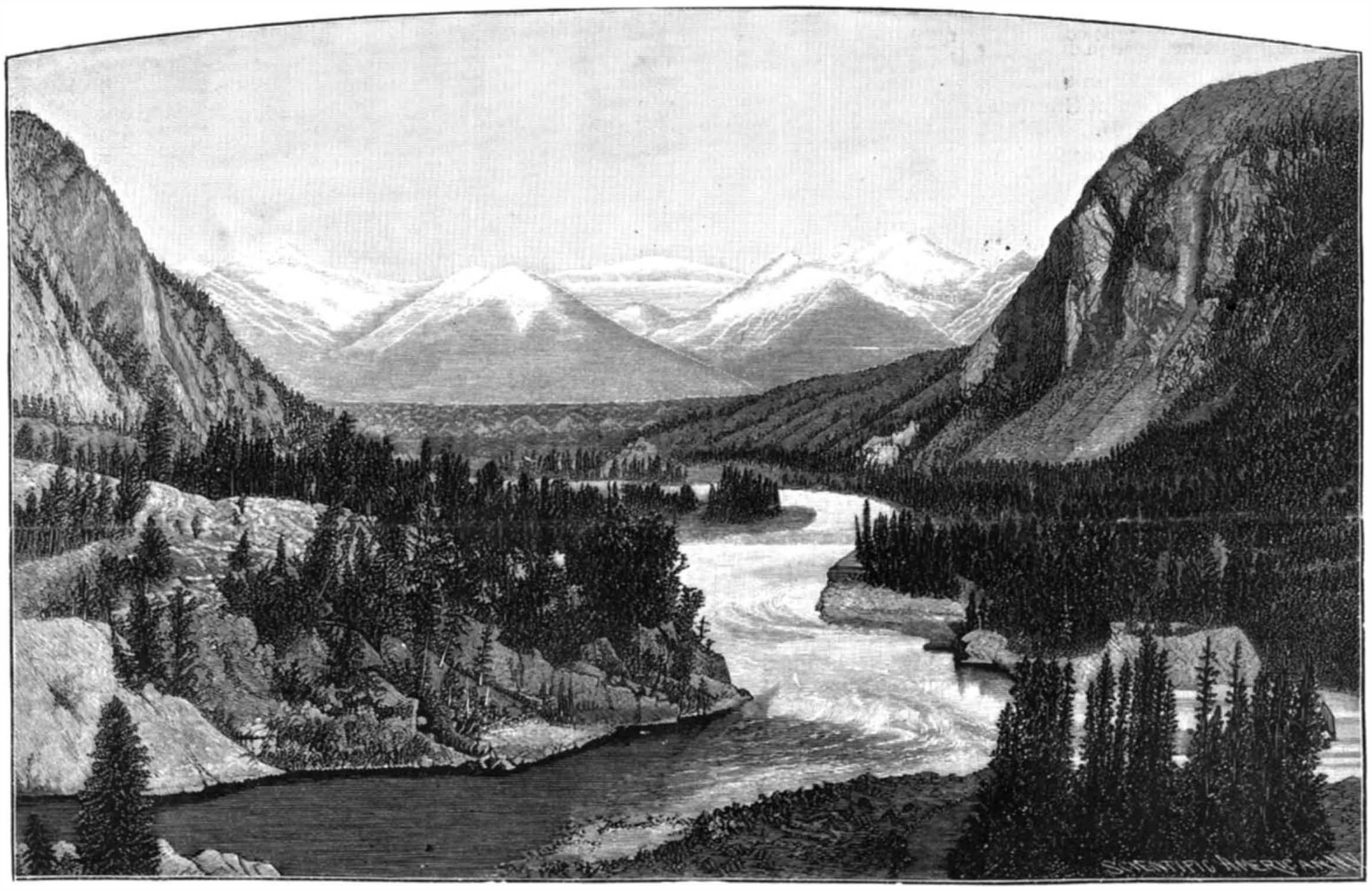
The Incandescent Lamp as a Test for Stability.

It was used recently by Mons. F. Leconte at the Institut des Sciences de Gand. He required to verify the stability of the stone supports which rest upon the foundations in the Laboratory of Physics there. Upon one of these supports he placed a telescope, and upon the other a Khotinsky lamp, and he made such dispositions and arrangements that the vibrations of the filament could readily be observed through the telescope. He waited about ten minutes until there was complete repose, and then gave several sharp taps upon the floor of the laboratory, noting the number of seconds taken by the filament in again coming to the state of rest. The usual mercury tests were entirely incompetent to show vibrations which the incandescent lamp readily responded to. With a little care this test of stability might be made of a quantitative nature, and thus its usefulness would be greatly enhanced.

LOWER BOW PARK, BANFF.

Throughout long stretches of travel over the Canadian Pacific Railway the scenery is flat and unattractive; but as from the eastward we approach the Rockies, many scenes of extraordinary grandeur are presented to the view. The neighborhood of Banff, where healing hot springs are found, is especially rich in river and mountain wonders. We give for an example a prospect at Lower Bow Park, where the river passes between two towering masses of granite; dense forests in the distance, above which rise to enormous heights the snow-capped heads of western giants, bewildering in number and furrowed with glistening glaciers of immense extent. How the railway was ever carried through so many and such dangerous defiles as this region presents is the wonderment of every traveler.

The Canadian Pacific Railway may be said to extend in one continuous line from Halifax, on the Atlantic, to Vancouver, on the Pacific, a distance of about 3,650 miles, being the longest line of railway under one organization in the world.



CANADIAN PACIFIC RAILWAY—LOWER BOW PARK, BANFF.

Action of Superheated Steam on Clay.

Mr. E. Meyer, of Berlin, claims to have devised a process whereby hydrate of alumina may be obtained directly from silicates of alumina or clay. The process is said to be based on the hitherto unknown property possessed by superheated steam of exerting a decomposing action upon silicates of alumina (inclusive of those combined with iron or ferro-silicates) or clay, in such a manner that the metallic substances (such as alumina, oxide of iron, lime, and alkalies) which they contain become converted, with separation of silicic acid, into water-soluble hydrates. The superheated steam acts upon the materials, which must be in a state of division, with equal effect whether the said materials are in a dry or a wet condition. The present process consists in bringing superheated steam (preferably heated by means of red hot iron surfaces) into intimate contact with finely divided silicate of alumina or clay, dissolving the hydrates formed and obtaining the hydrate of alumina therefrom by precipitation.

Manufacture of Kid Gloves.

The first thing to do is, of course, to remove the hair from the raw skins, and for this purpose lime is used, they being immersed from a fortnight to three weeks in pits containing water and lime. The skins are constantly turned and shifted about by workmen armed with long iron tongs, and when taken out it is found that the lime has loosened the cuticle of the skin, thus rendering the removal of the hair a more easy matter. From the lime pits the skins are taken to the unhairing room, where they are stretched on a sort of wooden block, and are scraped with a blunt two-handled knife. This removes the hair. They are now taken in hand by the "flesher," who cuts off the tail, the head piece, and such portions of adipose matter as may still adhere to the skin. The waste is useful for the manufacture of glue and gelatine, the hair removed by the former process being used for mortar and for felt making.

The skins now pass on to the "scudder," who removes any hair that may have hitherto escaped the knives of the previous operators. They are next left to soak in clear water, to remove all traces of the lime, and from thence they undergo a process of artificial fermentation, called by the French "mise en confit"—that is to say, they are placed in a mixture of warm water and bran, which not only removes any fleshy impurity from the skins, but also renders them soft and supple. Kid skins are not tanned like ordinary leather, such as used for making boots or harness, by means of oak bark, but are immersed in a large revolving "drum," which contains a mixture composed of yolk of eggs, wheaten flower, alum and salt; and so enormous is the consumption of the former ingredient that at one factory in Chaumont no fewer than 4,000 eggs are needed every day. The skins are allowed to remain in this costly paste for rather more than an hour, the drum being kept revolving by means of machinery.

They are next taken out, and removed to the cellars for the night, and from thence are conveyed on the following day to the drying room, where they are subjected to a temperature varying from 140° to 160°. The attendants in this room are clad in a garb similar to that of the peasantry of India, so intense is that heat; but they manage, nevertheless, to enjoy good health, and sometimes even to increase in weight. Each skin is hung separately on hooks, and thus they dry very quickly. This process leaves them somewhat hard, and they are next "seasoned" or "sammied" with cold water, and then stretched backward and forward over upright knives, shaped like a half moon. After being wetted again they are "shaved," a process requiring great dexterity. This is accomplished by means of specially constructed knives which remove the under flesh. The skins are now coated with a composition of flour, oil, and yolk of eggs, which make them soft and pliable. They are then conveyed to the dyehouse, being by this time ready for the preliminary operations of dyeing.

Before being dyed the skins are trodden under foot for several hours in water. This process throws out of them anything which would be opposed to the action of the dye. Having been rinsed, the skins are now moistened with more yolk of eggs, and are allowed to rest a day before they are dyed by the workmen, who, taking a brush dipped in ammonia, spread it over the skins, and then apply several coatings of the dye. For skins that are dyed on both sides of course another process is employed. The workmen place the skins in a large vat, and while treading them down pour in the coloring liquid. Those that are intended for black gloves show, after their first dip in the dye, a bluish tinge, but this is worked off until the skins present a brilliant and perfect black. This process is called "lustering," and is done by passing a sponge over the skins, which have been dipped in a mixture of oil and soap. They are then stretched over rolls of flannel until quite dry.

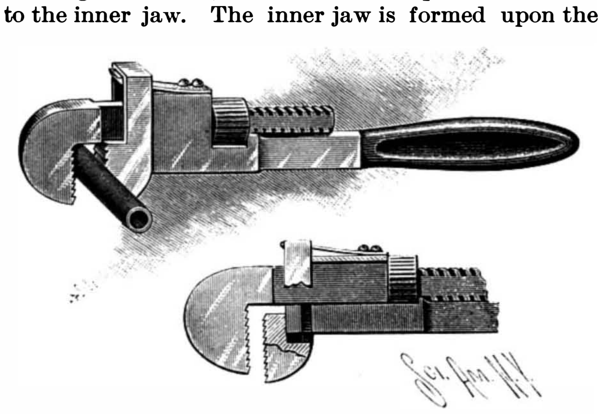
The skins which have been dyed are now subjected to a process known as "grounding," the object of which is to remove all roughness, and render them thinner and more supple. They are next sorted according to their quality and size, and are passed on to the cutters, who cut them into the several detached parts of gloves. This operation may seem to the unskilled very easy, but it requires great judgment, for the workman has to allow for the natural stretch of the skin. The finished skins having been selected and mapped out by the sorters are put over a frame looking like a deformed glove. These frames are so made that they represent the whole glove laid out unsewn. The gloves, with the thumbs duly fitted and put together, are placed in a press, after which they are sent to be punched by means of machinery. The cuttings left by the punching machine are picked with scissors by girls who are called "raffleuses," while those employed making the "fourchettes," or side pieces for the fingers, which are also cut out by the bunch, are called "fourchettiers." It is, of course, necessary that the "fourchettes" should match exactly with the other parts, and for this purpose "sorters" are employed to choose them. The edges of the gloves are refolded by machinery, and are then ready for sewing. In France the work of stitching is done mostly by hand, although there are some very ingenious machines invented to perform this operation. One firm alone employs no fewer than 4,500 women and girls for this branch.

The fastenings are now attached by means of rivets, which are hammered by the girls called "riveuses." The glove has now been sewn and furnished with buttons. It only remains to straighten it by placing it on a glove stick. The gloves are then arranged in dozens, and being enveloped in paper bands are packed in card boxes ready to be dispatched from the factory.

IT has been decided to work the Liverpool Elevated Railway by electricity, using motor cars, instead of separate locomotives. The line is six miles long, and the generating station is being erected near the middle of the railway. There are several opening bridges, and the structure is composed entirely of iron and steel, spanning for the most part the existing dock railway, which will thus be left free for the goods traffic of the docks.

AN IMPROVED PIPE WRENCH.

The illustration represents a strong and convenient wrench, consisting of but few parts, which can be quickly and readily separated, and any one part duplicated if necessary. It has been patented by Mr. John Ryan, of No. 347 East Thirtieth Street, New York City. The body part of the wrench has an integral strap with a rectangular opening in which slides an adjusting bar, on the outer end of which is formed the outer jaw of the wrench. The inner end of the adjusting bar is provided with teeth engaged by a nut located on the bar and entering a recess of the handle bar, the turning of the nut moving the adjusting bar out or in to bring the outer jaw in the desired position relative to the inner jaw. The inner jaw is formed upon the



RYAN'S PIPE WRENCH.

lower outer edge of the projecting portion of a separate piece or strap having a slight vertical movement on the outer end of the handle bar, to which it is attached by means of shallow side tongues on the handle bar fitting similar grooves in the sides of the strap. The strap extends above the strap of the handle bar, and a spring attached to the latter, engaging the under side of the top portion of the strap carrying the lower jaw, limits the movement of the latter, returning it to normal position when any applied strain ceases. When the jaws are adjusted upon and the wrench is operated to turn a pipe, the inner jaw has a slight sliding movement designed to increase its hold, the jaw being restored to its normal position as the wrench is carried backward to obtain another hold.

Mobile as a Coal Port.

There is soon to be a great demand for coal shipments from Southern ports, and all the indications point to Mobile as the chief supplying port, owing to its proximity to the great coal fields of Alabama.

Competition between Mobile's three railroads, and eventually between the rivers and railroads, will give Mobile the cheapest coal.

The rivers are obstructed just below the coal measures, and while boats of coal are run down occasionally during high water, this method of freighting the coal is not yet safe or reliable. By the construction of a short independent railroad of about twenty miles length, from the coal fields to the Alabama or Warrior river, good safe boat navigation could be had for ten months in the year; then, with suitable coal barges, coal could be loaded near the mines and brought down to Mobile and carried on to Cuba and all Gulf ports without transfer if desired. By this method coal could be brought to Mobile to cost not exceeding $1.50 per ton.

"Sorrel Sue."

At Batesville, Ark., a recent shooting affray brought into notice a woman known as "Sorrel Sue." She always appeared in public riding a sorrel horse. It was believed she belonged to a gang who stole horses.

A surgeon who was summoned to attend one of her admirers, who had been wounded in the row, mistook his way and wandered into Sue's cabin. Before he could be hustled out he saw things which roused his suspicions. These he reported to Sheriff Timcoe, who, with a posse, managed to surround the den of horse thieves, capturing Sue and two of her gang. He found that Sue had applied the means of bleaching her own hair to that of her horses. When the posse entered, they found a horse enveloped in a jacket made of rubber coats, being treated to a sulphur vapor bath. The appliances were very ingenious, and worked very well. A black or bay horse would be stolen and run into the bleachery. After its color was changed and its mane and tail trimmed, the disguise became so pronounced that without any great risk the animal could be taken in daylight through the very district from which it had been stolen. It was Sue's business to not only superintend the bleaching, but also to ride the animal out of the country.—*The Spokesman.*

Crystals in Sugar Cane.

It has often been said, and in some instances by those who were considered good authority, that sugar cane at times contained actual sugar crystals. As in plant life, ordinarily, no crystals are discovered, even where the juices, by subsequent concentration, will yield crystals, it seems fair to infer that normal sugar cane never contains any crystals of sugar. Mr. J. B. Avequin, a French chemist, resident in New Orleans some forty years ago, was one of the first careful investigators of sugar cane, and he seems to have arrived at the conclusion that sugar contained actual crystals of sugar. The literature of sugar, and especially of sugar cane, was very limited at that time, and Mr. Avequin reported his analyses of normal cane juice, indicating that it contained about 14 per cent of sugar, he not then being, seemingly, aware of the fact that the sugar content of sound sugar cane might vary from 10 to 20 per cent.

The whole matter has been brought to our attention within a few days by observing crystals of sugar on the butt ends of the recently cut canes. A careful and repeated inspection showed the crystals to be there beyond any doubt. They glistened in the sunlight in an unmistakable manner, and suggested the truth of the old hypothesis.

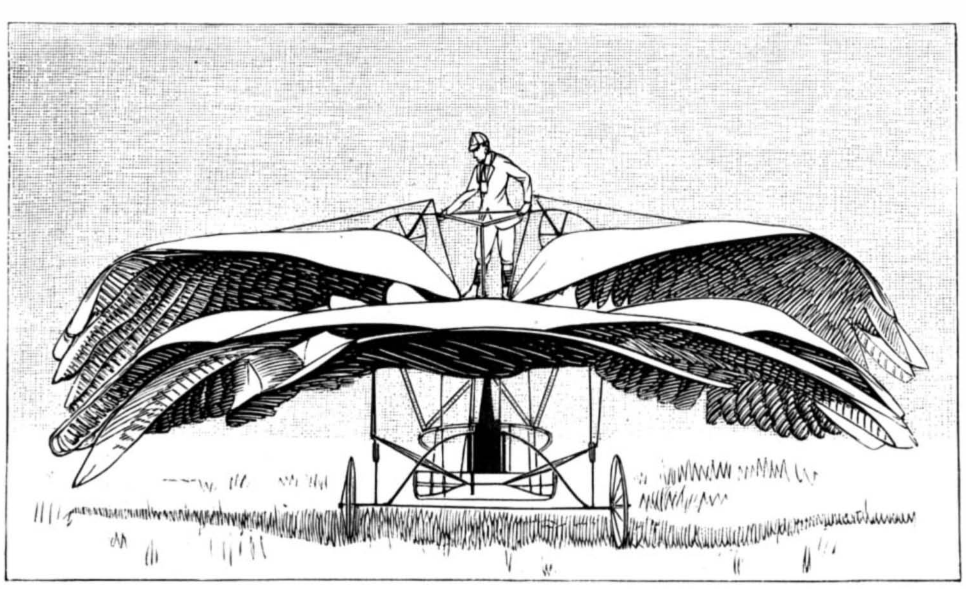
The truth, however, seems to lie in a different direction. The canes observed were of exceptionally high saccharine content, and recently cut in dry weather, the juices exuding at the cut end evaporated so quickly, owing to the dry weather, that these crystals of sugar were formed, where under ordinary circumstances fermentation would have set in and the ends of the cane have become sour.—*La. Planter.*

Drainage of the City of Mexico.

The drainage of the valley of Mexico has proved to be a difficult work. Messrs. Reed & Campbell have been obliged to notify the government of impossibility of carrying out the tunnel for the drainage of the valley of Mexico under the terms of the contract, in consequence of the amount of water being so far in excess of anything that was contemplated. This, however, will not interfere with the ultimate success of the undertaking. The tunnel works are still being carried vigorously forward by Messrs. Reed & Campbell as agents for the government, pending the arrangement of a new contract, the terms of which the government are at present considering. The completion of the tunnel will take longer than was anticipated, but of the ultimate success of the undertaking there is little reason to have any apprehension.

A FLYING MACHINE.

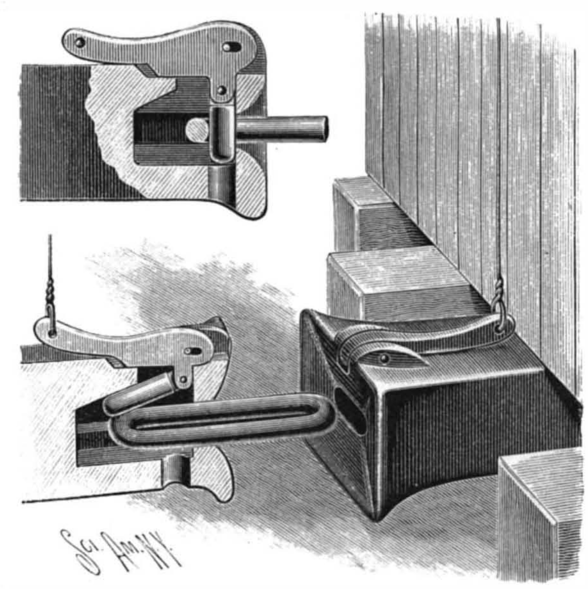
We give a representation of the machine intended for aerial transit which Mr. Edward P. Frost, of West Wratting Hall, Cambridgeshire, has invented. The Council of the Aeronautical Society, including Mr. James Glaisher, recently, on the invitation of Mr. Frost, paid a visit to West Wratting and inspected the machine. It may be said that Mr. Frost only waits for a sufficiently light engine which will supply the necessary motive power, and this Mr. Maxim has nearly invented. Mr. Frost, with about twenty-five years of study and work, found a natural material at once as tough as leather, very strong, very light, flexible, and capable of taking any form of bend required to build up the feathers. The huge "tones," so to speak, of the wings of the machine were made in the same way, and to precisely correspond to each natural tone, and the artificial feathers were fixed on to their respective tones as nearly as possible in the position of the natural feathers, which are each and all set at varying angles to the tone. The machine is devised and constructed with perfect imitation of the arrangement of every feather in the wing of a crow, the bird selected as its model. The dimensions are 30 ft. from tip to tip of the large wings. The whole weight is about 650 lb.—*London Daily Graphic.*



THE FROST FLYING MACHINE.

AN IMPROVED CAR COUPLING.

A simple, secure, and easily operated car coupling, one adapted to couple automatically, while the uncoupling may be effected from the platform or roof of the car, is shown in the accompanying illustration. It has been patented by Mr. Samuel G. Trine, of Pierre, South Dakota. There is a longitudinal chamber in the drawhead to allow the link to enter far enough for engagement by a pendent locking pin, shoulders being formed on the inside of the throat or entrance to the



TRINE'S CAR COUPLING.

chamber. At the sides of a central longitudinal slot in the top of the drawhead are ears in which is fulcrumed a lever of special form, as shown, having a jointed connection with a short locking pin. The perforation in the lever through which the fulcrum bolt is passed is slightly elongated, permitting the adjustment of the pin to hold a link projected from one drawhead, in position to enter the drawhead of an approaching car, the top of the pin then engaging a top rear portion of the chamber, and the under side of the link lying upon the lower shoulder at the throat opening. As the link thus held enters an approaching drawhead, the pendent pin therein is swung rearwardly until it slides over the link end and falls into locked connection with the shoulders and link end, provided the lever is in horizontal position, as shown in one of the views, the balancing of the link in extended position, and the latitude of motion of the pin, being so provided for that a locked engagement in both drawheads will always be effected. The lever is connected at its inner end with an upright rod extending to the car roof, to permit the ready uncoupling of cars therefrom, and grooves on the inside of the ears and an aperture in the lower wall of the drawhead, just behind the shoulders at the throat opening, permit the use of an ordinary coupling pin with the usual form of link, should the improved device be broken or in any way disabled. An automatic coupling is thus obtained substantially from the old link and pin, and the device is self-uncoupling in case of derailment of the engine or similar accident, and can be uncoupled from the engine.

Wood Pavements in London.

Some time ago Mr. William Weaver, chief engineer and surveyor for Kensington, published a report on the streets under his charge. These streets aggregate about 84 miles in length, and are paved with wood, asphalt, pitching flints, macadam, and gravel. Of the main streets, all, with the exception of about 1,000 square yards of asphalt, are paved with wood laid on a foundation of 6 in. of Portland cement concrete.

Upward of 200,000 square yards of wood have been laid in all, and the varieties used include fir, beech, vale, and jarrah. The best results obtained were with creosoted deal blocks 9 in. long, 3 in. wide, and 5 in. deep, laid on 6 in. of concrete. They are generally spaced with open joints 3/8 in. wide, filled with asphalt to a depth of 1/4 in. to 1/2 in., the remainder fronted with Portland cement. Sometimes the blocks are laid with close joints, and if the weather is dry when this is done, good results are obtained.

Small Wire Manufacture.

Referring to an article on this subject in the SCIENTIFIC AMERICAN of January 9, 1892, a correspondent writes that the Washburn & Moen Mfg. Co., of Worcester, Mass., are making absolutely perfect diamond dies producing copper wire as fine as two one-thousandths of an inch, by a special process, which is patented.

Correspondence.

Cleaning Gauge Glasses.

To the Editor of the Scientific American:

As the question of cleaning gauge glasses came up again by R. S. G., query No. 3788, I will tell you the way I clean them, which is quite novel, and very seldom one is any the worse for being cleaned. The idea is original with me, and as I have never seen it in print, perhaps it may be new. So you can give your many readers the benefit of it.

I take a piece of strong twine somewhat more than twice the length of the gauge glass; in the middle of the twine I tie a small bunch of waste, enough to fill the tube fairly tight, being careful the waste is clear from gritty or hard substances, then blow one end of the string through the tube so the knot or waste comes to the other end of glass. That end I insert in a basin of water and pull the knot through the tube (that draws the water after it), then reverse tube and pull it through again, and so on until I have thoroughly cleaned the glass. I have never had one to break after being cleaned in this way. If the tube is oily or unusually incrusted, I use a little silverine on the waste, which acts like a charm.

Asbury Park, N. J.

Kites without Tails.

To the Editor of the Scientific American:

The article on "The Texas Rain Making Experiments" appearing in the SCIENTIFIC AMERICAN of Jan. 2, 1892, from the *Texas Farm and Ranch*, presents wonderfully correct copies of some of the photographs made by the party, but the letterpress accompanying is far from facts.

As stated, "Illustration No. 3 shows one of the many fruitless attempts to fly kites without sufficient tails. It shows Prof. Myers, kite expert, paying out the cord, while the kite is making a vigorous plunge for the earth."

As a matter of fact, this kite shown was not built by me, nor after my designs, and I never saw it flown, and when this photograph was taken (because of the unusual novelty of catching a kite "on the fly" in the act of diving), I was at another camp, a mile away, operating with balloons. The conspicuous deviation from truth in this case indicates a perverting tendency in the reporter's narrative, and his ignorance of facts relating to the flight of kites independent of tails is startling. The Smithsonian Institution at Washington, D. C., contains a large collection of Japanese or Chinese kites to be flown without tails, all of which I have handled, and from which even the critical reporter aforesaid could learn something. A properly constructed kite no more needs a tail than a comet does.

CARL E. MYERS,
Aeronautic Engineer.

Balloon Farm, Frankfort, N. Y.

A New Mode of Keeping Cool the Interior of Guns.

To the Editor of the Scientific American:

It is not the powder pressure that destroys well constructed guns, but we must look to the heat developed by the powder explosion and friction of the projectile. The distribution of the heat loosens the molecules of the metal, the inner part is heated very rapidly, while the outer part remains cool. Metal will expand proportionally to the degree of heat. Therefore, if the interior of the gun cannot expand outwardly, it must do so inwardly. Thereby the bore of the cannon becomes smaller, and a compression of the interior metal takes place.

By a careful examination of a cannon, after ten or a dozen rounds have been fired, it will be found that the inner parts have been compressed, while the outer parts are stretched. In order to mantain a reliable piece of ordnance and prevent disaster, the molecules of the metal must not be disturbed by heating one part while the other part remains cool. Practical experience has taught us that a steel ingot, after having cooled down, on reheating it in a furnace, the expansion of the exterior body, by the quicker heating thereof, will bring about multitudes of cracks in its inner body that will make such ingot unfit for reducing between rolls into reliable bars or rails.

I can see no other remedy for this evil than to use, in combination with gunpowder, a shell or shells filled with non-combustible liquefied gas, to be liberated in the same moment when the projectile leaves the muzzle of the gun, thereby absorbing the heat and preventing it from penetrating the metal to any disastrous depth.

CAPT. FRANK CANE.

34 Ogden Ave., Chicago, Jan. 2, 1892.

ACCORDING to a new regulation made by the Secretary of the Navy, ships of and above five thousand tons displacement will be classed as first rates; those of and above three thousand, but below five thousand, tons displacement as second rates; those of one thousand and above, but below three thousand, tons displacement as third rates; and all those of less than one thousand tons displacement as fourth rates.

Choice of Occupation.

Every year in thousands of families, as the boys attain the age when they are supposed to have finished their school education, the important question arises. What shall be the future occupation of the boy? The question is not so easily answered, and whenever the choice of occupation has been made without full consideration, it is too often found that the selection has been made without reference to the physical and mental fitness of the boy for the chosen field. The wish of the boy is very seldom consulted, and though young yet and without mature experience, it seems but fair that his preferences should be taken into respectful consideration. Parents frequently make the mistake at this important juncture of choosing occupations for their boys for which the boys' physical system is ill adapted. Weakly boys with narrow chests should never be put at indoor occupations. Some trade that will keep them in the open air is better suited for such. Then, again, too many parents look upon all trades as something beneath them, and erroneously teach their boys that it is more respectable to enter one of the professions or even to go into clerking for a livelihood. All mechanical trades need to be recruited from the intelligent classes, and the condition of mechanics can only be elevated when accessions to their ranks come from well educated, respectable, honest, self-respecting people. Too many boys are annually consigned to other occupations, for which they are not fitted, to the great damage of themselves and of society, and in which, after a long and one-sided struggle for mere existence, which is getting year by year more and more precarious and difficult, they are finally left a stranded wreck, with the consciousness that the mistake in choosing their occupation has been the main cause of their misery and distress.

Most of this is due to the false pride and prejudice against a mechanical trade, which would have offered a good field for the wrecked boy by intelligence, industry, and perseverance to have become a man able to support himself and family and useful to society. Who can doubt the truth of this? If we look about us, we cannot fail to see that in all occupations the standards of requirements have been raised, and particularly in those employments which are not included in the mechanical branches much more is now expected from applicants for positions than formerly. Look at the increasing numbers of those who are studying for the law, the ministry, or the medical profession. Count the numbers of doctors, lawyers, and ministers who can barely eke out an existence. Scrutinize the advertising columns of any of our newspapers and see the overwhelming numbers of those who seek employment, having nothing to offer but willing hands and feet, ordinary intelligence, and very little education. Just look at the army of clerks and so-called bookkeepers constantly offering their services; indeed, it would be more truthful to say begging for employment at anything that offers. These are the direct consequences of an overcrowding in those employments which do not require knowledge of any mechanical trade. It is not so bad where these boys have parents with means who can help them, but when they have nothing but what they can earn, it would be well if our cry of alarm were heeded and false pride and prejudice were made to give way to the true interests of the boy.

On the other hand see how intelligent, well trained mechanics progress. It is not necessary here to cite examples of living men, who, after having thoroughly learned a mechanical trade, have by industry, economy, brains, and force of character lifted themselves into enviable positions of business success, honor, trust, and wealth. There are plenty who, from small beginnings, have attained success. All work is honorable and ennobling, and those who, probably being idlers themselves, profess to look upon the mechanic with disdain, and would, if they could, deny him equal rights, should remember that idlers are always superfluous in this world's economy, but that the good mechanic is constantly in demand, as he is the one who lays the real foundation of all business success, and that his industry is an absolute necessity to the capitalists. If these people who turn up their noses at the mechanic allege as a reason for their exclusiveness that the mechanic is lacking in refinement, they should be told that it is partly due to the fact that those who deem themselves more refined have scrupulously withdrawn their refining influences from the mechanic by not associating with him. But the mechanic is not excluded from true culture, and one can find as many true gentlemen of culture and refinement among mechanics as among the so-called professional classes, indeed often one searches in vain for refinement among the latter.

Much depends upon the quality of the material which enters the mechanical trades, and if many of those who now make the mistake of studying an unprofitable profession should learn a trade instead and determine to lead a refined life, it will not be long before even this somewhat imaginary reproach is taken away. It is not necessary either to go from one extreme to the other, and that all should rush into the trades, nor that the other great mistake be made of thinking that one mechanical trade is more honorable than another and that every boy must pick out what seems to him to be a little more elevated a trade. We plead for the proper training of boys in the mechanical trades, for their thoroughly mastering the whole trade and not one branch of it. All mechanical trades offer a good livelihood, steady employment, and fortune for those who have the patience, perseverance, and industry to find it. Learn a trade! In this connection we may say that the question why boys do not properly and thoroughly learn a trade in these days has been partly answered by an old employer, who gives what, in his opinion, are the reasons. He says that boys nowadays are different from what they were when he was a boy. In those good old times they came to learn as much as possible, now to earn all the money they can. Then apprentices were the children of comparatively well-to-do people, who took pains to bring their children up properly and were more solicitous, by having their sons properly instructed and by making good mechanics of them, to make them independent of the world. Now apprentices come mostly from the poorer classes and are expected to bring as much wages home as possible, so as to help support the family. They only look for the immediate present, regardless of the future. The first question an apprentice asks is how much he is to get a week; he thinks only of his earning capacity and not of the time it takes to instruct him, nor of the materials he spoils. The next question generally is, what hours he will have to work.

Then again in the olden time the master or foreman generally helped his instruction along by an occasional whipping, and many a good master workman to-day gratefully remembers the wholesome chastisement that made a man of him. Those days are passed, and Solomon's wise saying that he who spares the rod spoils the child is forgotten. The result is that employers now endeavor only to get as much work out of boys as they can, and take no interest in teaching them anything; in fact, boys in workshops nowadays are looked upon as so many necessary evils. When the employer ceases to be looked upon and respected as a teacher and educator, and only as an employer, there is an end of any hope for the proper instruction of boys in any mechanical trade. The labor and trade unions are much to be blamed for this state of things in their unwise attacks on the apprenticeship system. Times have changed, and with them old methods have passed away. We doubt very much if the newer methods are really an improvement. Time will tell.—*The Leather Manufacturer.*

Improvements in Distilling Oils.

At a recent meeting of the Royal Scottish Society of Arts, John Laing, F.I.C., Edinburgh, described three methods by which mineral oils could be "cracked up" into lighter products. The first of these was effected by a still so arranged that the oil was continuously being distilled into itself until the required density was obtained. He showed that radiant heat was a powerful agent in breaking down oil vapors, and could be utilized by passing the gases as they left the still through a superheater at a high temperature, placed between the still and the condenser. He also detailed his method for distilling under pressure, by means of which a hold was kept of all the condensible gases until liquefied. In this arrangement a relief tank was interposed between the pressure valve and the condenser, into which the gases escaped as they came from the still, and here the pressure got distributed over such a large area that it was practically reduced to *nil*, the oil running to the receiver at ordinary atmospheric pressure. Mr. Laing likewise brought forward a new form of still—which he has just invented—for the purpose of preventing oils being broken down, as in distilling for lubricating oils and paraffin wax. This still was so constructed that the non-conducting heavy residues which were continually forming under distillation were continuously being removed from the source of heat. The still, being fed by a ball cock arrangement, was always at the same level, and as the fires required no forcing to overcome the heavy residues as at present, a great economy of heat was effected; while oils of higher gravity and greater viscosity were produced, and a longer life was secured to the working plant.

Liniment.

Dr. Geo. Flory, in the *Physio-Medical Journal*, gives a formula for a liniment which he thinks is very efficient:

R.	Oil sassafras,	
	Oil organum,	
	Oil cajeput., aa	℥ j.
	Tinc. capsicum,	
	Tinc. lobelia sem., aa	℥ ss.
	Pyle's pearline	℥ ij.
	Aqua ammonia	℥ ss.
	Aqua pura, q. s	Oj.
M.		

Place the pearline in your container, add the aqua ammonia, shake until the pearline is thoroughly dissolved, then add the tinctures and oils, shake until they are emulsified, then add the aqua pura, and it is ready for use.

THE MAIN INTERSECTING SEWER OF THE CITY OF BROOKLYN, N. Y.

The city of Brooklyn is on the verge of completing an intersecting sewer of large dimensions for the purpose of relieving what is known as the flooded district of Brooklyn from the effects of heavy rainfalls. The drainage district whence the water is derived comprises about 1,300 acres. During storms the first rush of water as it reaches the low districts and finds the mouth of the sewers perhaps closed by tidal water, backs up, throws off the manhole covers in the lower streets and floods both streets and houses. To do away with this trouble, the present structure, known as the main relief sewer, has been built. It is carried across the drainage area, intercepting about two-thirds of the surface water falling on the district. Its course runs through Greene Avenue, Fourth Avenue and Butler Street, and meets the head of the Gowanus canal. The regular street sewers are to be connected to it in such a way as to deliver storm water only to it. In this way the surface water during heavy rains from two-thirds of the area will be effectually provided for; and from their points of intersection with the relief sewer, only the normal amount of drainage will pass on toward the regular outlets.

The principal portion of the sewer is circular in section, starting with a diameter of 10 feet and 12 inch wall, and enlarging successively to a diameter of 12, 14, and 15 feet with 16 inch walls, except where in some places a 28 inch side wall has been introduced. Of this circular portion, there are 11,400 lineal feet, of which over 9,000 feet were laid by tunneling, and as shown in our sectional drawing, part of it is far under ground. At its end however it is near the surface, and there the section changes to an approximate rectangle, whose bottom is an invert arch of long radius, and which is covered by regular I beam and brick arch construction. At its end it delivers into a silt basin, and through twenty pipes of 36 inch diameter each into the canal. The silt basin is trapped, although such would seem hardly necessary, as the pipes are 8 feet under the tide level. The basin is 60 feet long and 84 feet wide. Its bottom is about 8 feet below the bottom of the sewer, and the pipe outlets are on the level of its bottom. Arrangements are provided for the use of screens, if desired, for separating solid material, and unquestionably if silt finds its way there, a large portion of it will be deposited by subsidence.

Our drawings refer more particularly to the tunnel portion of the structure, which was built by the use of the pilot tube under the well known Anderson method of construction, formerly employed on the Hudson River tunnel. The pilot tube of sheet iron, circular in section, and 5 feet 6 inches in diameter, and occupying the center of the tunnel area, was kept about 30 feet in advance of the completed excavation. From its exterior radical braces were employed to support the shell plates and wooden lagging.

The large tunnel was cut as nearly as possible to the true size desired, and for most of the sections two-inch plank were laid on the bottom of the circle, determining the extrados of a portion of the invert. On the bottom curves thus described the brick were laid; next ribs of T iron, bent to a radius slightly less than that of the brickwork, were set up and supported by radial braces from the pilot tube, while over the top of the arch and against the earth a curved shell plating or shield of iron, which covered from one-third to one-half the extrados of the upper arch, was placed and bolted together and was held in position by other radial braces from the pilot tube. The sections of the shell plating were twelve inches long in the direction of the axis of the tunnel.

Narrow lagging boards were laid upon the iron ribs and were carried up at one time far enough to allow the mason to conveniently lay brick behind them. When he had reached their top, more boards were put in place and more brick laid. In this way the brick tube was completed until a space of but two feet was left to be filled in by the key bricks. To support the brick in this place, short boards two feet long, passing between the last lagging boards, which were rabbeted to receive them, fitted like the sliding lid of a box. They were inserted by the mason, who, after putting one of them in place, laid in the key bricks to cover it, closing that much of the arch. He then would slide in a second board, lay the key brick corresponding to it, and thus would work, board by board, toward the face of the sewer. The iron plates were left in position; the false work of course was removed as the work progressed.

One of the interesting features of this work, which facilitated the rapid construction of the tunnel and at the same time protected the workmen against the caving in of the earth at the heading, was the use of the Beach system of tunneling needles, which is clearly illustrated in one of our engravings. This system was patented June 8, 1869, No. 91,071, by Alfred E. Beach, of the SCIENTIFIC AMERICAN, New York. It consists of a series of iron sheet bars or needles arranged to slide in juxtaposition upon the exterior of the front end of the constructed tunnel; each needle is moved forward independently from within the tunnel. The front end of each needle has a cutttng edge. In operation the needles are driven forward separately into the earth, which forms a support for their front ends, while their rear ends are supported on the exterior of the completed tunnel, thus forming a temporary protecting roof or shield, which permits the safe removal of a sufficient width of the earth of the heading to allow the insertion of a new section of the iron plates that compose the outer wall of the tunnel. This system, substantially, was successfully used the year before last (1890) in boring the large 25 foot tunnel, 1,560 feet long, for the new double-track railway line at King's Cross Station, London.

Our illustrations show also various interesting features of the work, the section of ground under which the tunnel passes, and its course near a church on the corner of Greene and Clermont Avenue, illustrating vividly the depth of the sewer and what the engineer has accomplished.

The connections with the existing sewers which lie far above its level is to be thus managed. Manholes are carried up from it to the street level. Sweeping side connections are made from these manholes to the sewers. Where the connection is made a flagstone is to be laid diagonally across the sewer on the lower side of the connection, so as to be approximately a tangent to the side connection. The bottom of this flagstone will be, as nearly as possible, at the level of the ordinary surface of water maintained by the sewer in actual service. On the occasion of a rain storm, any water rising above this level will be deflected into the side outlet and thence to the manholes of the intersecting sewer. This will give it a fall in some places of many feet, as will be evident by inspection of the sectional drawing of the course of the tunnel. Stone paving is accordingly placed over the invert beneath the receiving manholes, to prevent the fall of water from wearing away the bottom.

The work was in charge of Mr. L. Russell Clapp and Mr. David Brower, Assistant City Engineers, under charge of Mr. Robert Van Buren, City Engineer. The main tunnel was built by the firm of Hart, Anderson & Barr. The terminal portions of the sewer were built by Daniel J. Creem. As yet the existing sewers are not connected to it, but before long the entire work will be completed and ready for the spring and summer storms of the present year.

As regards the size of the sewer, it is believed to be the third largest of the working sewers of the world. The city of Washington has a sewer 20 feet in diameter, and the great sewer of the city of Paris is 18 feet high and 17 feet wide; the present structure forms a good third to these. The Cloaca Maxima, built by the Romans, contains three arches and occupies a total cross area of 30 by 15 feet.

Enlistment of Boys in the U. S. Naval Service.

The Secretary of the Navy has recently issued the following information:

Boys between the ages of fourteen and seventeen years may, with the consent of their parents or guardians, be enlisted to serve in the navy until they shall arrive at the age of twenty-one years.

No minor under the age of fourteen years, no insane or intoxicated person, and no deserter from the naval or military service of the United States can be enlisted.

Boys enlisted for the navel service must be of robust frame, intelligent, of perfectly sound and healthy constitution, free from any physical defects or malformation, and not subject to fits.

Their height and measure must be as follows:

Age.	Height not less than—	Weight not less than—	Chest measurement, breathing naturally, not less than—
Fourteen years..........	4 ft. 9 in.	70 pounds.	26 inches.
Fifteen years..........	4 " 11 "	80 "	27 "
Sixteen years..........	5 " 1 "	90 "	28 "

They must be able to read and write.

In special cases, where the boy shows a general intelligence and is otherwise qualified, he may be enlisted, notwithstanding his reading and writing are imperfect.

Each boy presenting himself for enlistment must be accompanied by his father, or by his mother in case the father be deceased, or by his legally appointed guardian in case he has neither father nor mother living, and the parent or guardian presenting the boy must sign the prescribed "consent, declaration, and oath" which forms part of the Shipping Articles.

In cases where parents or guardians may, by reason of distance, infirmity, or other causes, be unable to appear at the place of enlistment, they will, on written application to the Commanding Officer of either of the ships upon which enlistments are made, be furnished with the printed form of "consent, declaration, and oath," in duplicate, by executing which the enlistments will be perfected, should the boys be accepted by the Board of Examining Officers.

No allowance will be made for traveling expenses, whether accepted or not.

The Board of Examining Officers will consist of the Commanding Officer, a Line Officer, and the Senior Medical Officer of the vessel.

All boys enlisting as apprentices must voluntarily sign an agreement to serve in the navy until twenty-one years of age, which agreement must, before being signed, be carefully read and explained to each boy by the Recruiting Officer.

Boys who have been convicted of crime cannot be enlisted.

All boys enlisted will be rated 3d class apprentices, and receive $9 per month.

Deserving boys will be rated 2d class apprentices and receive $10 per month after having served six months in a cruising ship, and 1st class apprentices, at $11 per month, after having served one year in said ships.

Properly qualified apprentices will be rated seamen apprentices, 2d class, and receive $19 per month, after having served one year in cruising vessels of war; and seamen apprentices, 1st class, at $24 per month, after two years' service in said cruisers.

All apprentices receive one ration per day.

When first received on board of a training ship apprentices will be furnished, free of cost, with an outfit of clothing not exceeding in value the sum of forty-five dollars.

This outfit of clothing is furnished upon the supposition that the apprentice will serve during his minority, and therefore, if during his minority he is discharged at his own request, or at the request of his parents or friends, the value of this outfit of clothing must be refunded.

Boys enlisted to serve until twenty-one years of age will not be permitted to allot any part of their pay to parents or guardians until they shall have been transferred to general cruising ships.

Apprentices will be transferred to fill vacancies in sea-going vessels as they become proficient.

Upon the expiration of the enlistment of an apprentice, he will, if recommended, receive an honorable discharge, and upon re-enlistment within three months from the date of honorable discharge he will receive three months' extra pay of his rating when discharged, a continuous-service certificate, and an addition of one dollar per month to his pay.

Apprentices will be under the immediate supervision of the Bureau of Navigation, Navy Department, and applicants for enlistment may be made to the chief of that bureau, or to the Commanding Officer of either of the following named ships, viz.: U. S. S. Richmond, Coaster's Harbor Island, near Newport, R. I.; U. S. S. Minnesota, foot of West 50th Street, North River, New York City; U. S. S. Wabash, Navy Yard, Boston, Mass.; U. S. S. St. Louis, Navy Yard, League Island, Philadelphia, Pa.; U. S. S. Dale, Navy Yard, Washington, D. C.; U. S. S. Michigan, Erie, Pa., or during her cruise upon the lakes, and such other vessels as may from time to time be designated for this service.

Apprentices will be sent to the Training Station at Coaster's Harbor Island as soon after enlistment as practicable.

Fast Compound Locomotives.

On a recent run by a Baldwin compound on the Baltimore & Ohio, hauling a "Royal Blue" train from Philadelphia to Canton, on December 22, 1891, the time, including one stop at Wilmington and a slow-down at the Susquehanna bridge, requiring three minutes in crossing, was 101 minutes for 91·6 miles. A similar run was made on the 20th with six Pullman coaches. An observer on the train judged that the engine could have hauled two more cars with equal ease. The fact that the engine made at times a speed as great as 67 miles per hour goes to show that there is no serious defect in compounds at high speed. A record has been obtained from this engine in one instance of a speed of 77 miles per hour, but the details of the run were not gathered. In another case a ten-wheel passenger and freight engine, with 62 inch wheels and 26 inch stroke, made 72 miles per hour. The 10 wheeler made for the Master Mechanics' Association Committee, with 72 inch wheels, hauled a fast train on the Baltimore & Ohio, and made up time with 11 coaches, and traveled 8·6 miles in 9 minutes over a grade of 42·6 feet per mile.—*Railroad Gazette.*

Costs of Making Pig Iron.

The following statement concerning the cost of making pig iron in England and the United States is given by *The Engineer*, London.

	U. S.	England.
Coke used per ton pig.....	2,500 lb.	2.500 lb.
Cost of same at oven.........	2.25 dols.	4.00 dols.
Selling price pig No. 3....	13.50 dols.	9.75 dols.
Percentage cost of coke to ton pig...	16⅔	41

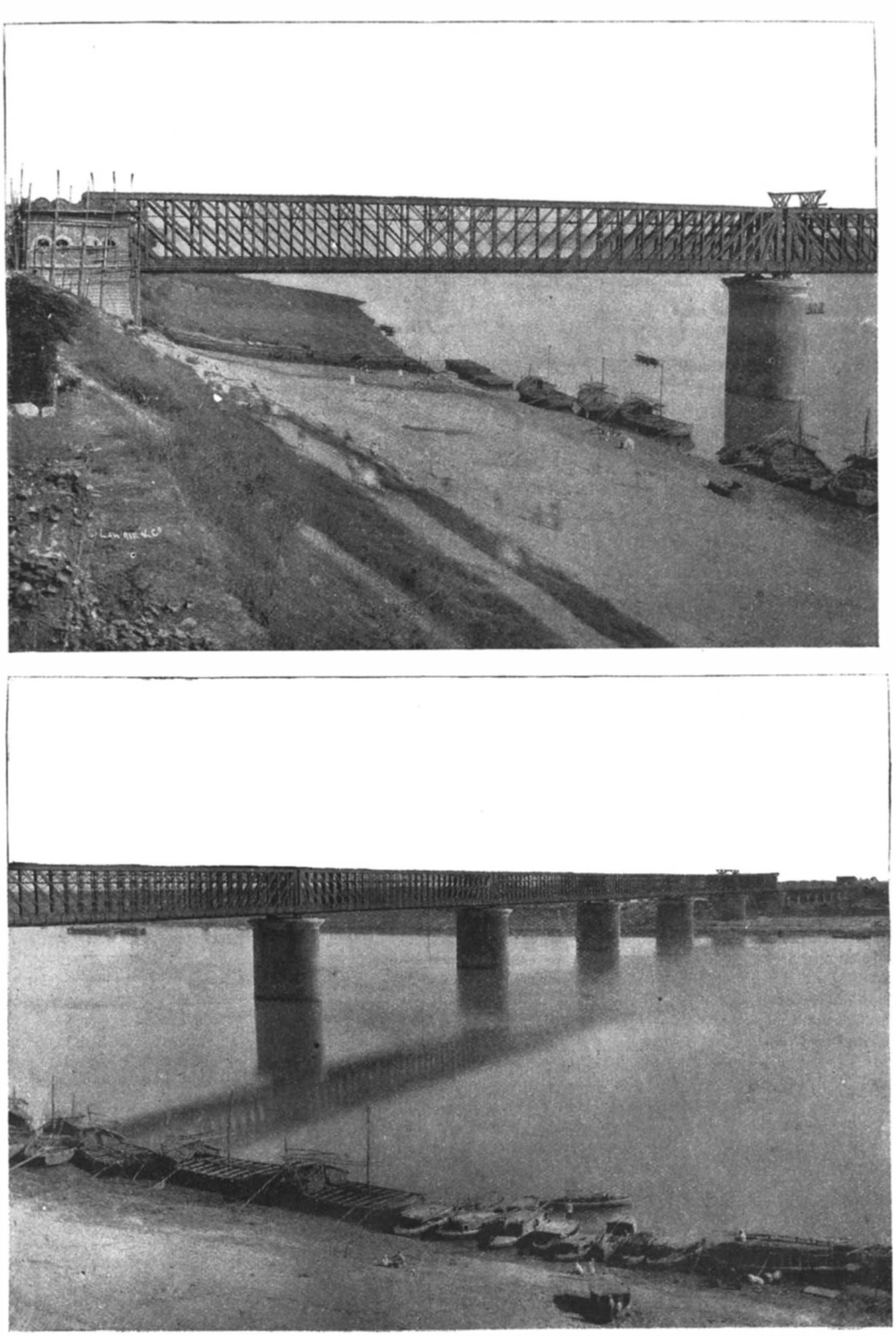
Assuming 1¼ tons as the equivalent to the 22 cwt. of the English practice, 13.50 dols. as the price of pig iron at Pittsburg as against 39s. in England, Connellsville coke 1.75 dols. f.o.b. cars and Durham 14s., the figures stand as in the preceding table. These figures are of course an approximation.

RAILWAY BRIDGE OVER THE GANGES, INDIA.

The accompanying illustrations show the Oude and Rohilkund Railway Company's bridge over the Ganges, at Benares, India. The line crosses the Ganges by three other bridges, one between Chaudausi and Aligarh, another at Cawnpore, and a third at Balawali, the bridge shown being the largest and finest of them all. It was opened to traffic in October, 1887, having been five years and eight months in process of construction. The work was done wholly under the direction of Mr. H. B. Hederstedt, chief engineer of the railway, and the work at Benares was in charge of Mr. F. T. G. Walton, as resident engineer. The details of the steel and iron work of the bridge proper were worked out in England, and the material sent out. The bridge is 3,568 ft. long, the rails 78 ft. and the top of the girders 110 ft. above low water. The greatest depth of the foundations, at pier 4, is 141 ft. below low water. It has seven large girders, 355½ ft. long each, and nine small ones, 113 ft. 8 in. each. The piers carrying the large girders are elliptical, 65 ft. long and 28 ft. broad at the base or foundation block, which was formed with three chambers for excavation in sinking them, making a group of three wells connected in one. Each foundation block was commenced in an iron caisson, varying in height for the different piers, that for pier 3 being 50 ft. high and passing through 30 ft. of water before its sinking was commenced. The wells were all built upon wrought iron ke bs made in the locomotive workshops in Lucknow.

The Ganges River at this point is 3,000 ft. wide, with a bed of pure sand, the depth of water in cold weather months being about 37 ft., and rising during the floods to 92 ft., with a velocity of about 20 ft. per second. The bridge is adapted for both rail and cart traffic, the girders being sufficiently strong to support pathways 5 ft. wide on cantilevers, and the space between the girders being laid with ballast, providing a roadway 20 ft. wide at rail level, to be used as a common cartway.

For the photographs from which our views are made we are indebted to Mr. R. Mac Cred, chief clerk in the engineer's office during the construction of the bridge.



THE NEW RAILWAY BRIDGE OVER THE RIVER GANGES, INDIA.

Protecting Iron.

In France it is stated that M. H. Bertrand has devised a modification of the Bower-Barff process, by which magnetic oxide is formed on iron to protect it. The process consists in depositing, by one or other of the galvano-plastic methods, a metal susceptible of volatilization at about 1,000 deg. C. After being coated with this metal the articles are placed in a furnace and heated to 1,000 deg. C. Notwithstanding the envelope, the iron articles become oxidized, but without permitting th oxygen to accumulate in sufficient quantity to form sesquioxide of iron. At the same time the oxygen is enabled to penetrate in such quantity as to form magnetic oxide, and in four or five minutes the process is complete.

Electric Lights for Horses.

Mr. F. B. Stewart, manager of Messrs. Thomson & Taylor, Bombay, has just completed a most ingeniously arranged electrical installation for H. H. the Gaekwar of Baroda. It consists of two incandescent lamps, which are to be worn in the head gear of H. H.'s carriage horses. The light in each of the little glass globes is equal to ten candle power, and the electric current which supplies it is conveyed by two wires, which are connected with six dry accumulators concealed beneath the coachman's seat and pass along the traces, thence up the bridle to the globes, the wires being so strongly yet neatly covered as to be in no way a source of danger to the animals carrying the lamps. —*Indian Engineer.*

Proceedings Engineers' Club of Philadelphia, October, 1891.

This number is devoted jointly to the discussion of the railroad problems of rapid transit and of rail joints. Of the latter, four new forms are submitted.

Mr. Carl Hering submits an illustrated description of a portable photometer, designed and used by him for measuring street lights and illumination in general. The instrument consists of a light wooden tube 4 inches square, about 3 feet long, and open at both ends, containing the usual screen with grease spot and mirrors, and a small electric lamp fixed to a sliding rod, and adjustable at any desired distance from the screen.

The lamp was a small 4 volt incandescent lamp of about one candle power, requiring a current slightly less than an ampere. The accumulators consisted of two cells placed in a wooden box provided with a shoulder strap, which enabled the operator to carry it at his side. The weight of the box with accumulators was about 20 pounds.

Other papers presented are "Notes on Mississippi River Discharge Observations," by Mr. John J. Hoopes, an "Iron Sewer Templet," by Mr. H. B. Hirshm, "An Account of a Photographic Survey," by Mr. Charles H. Haupt, and "Roads," by M. Thomas G. Janvier.

Roman Hydraulic Works in Africa.

At the last meeting of the Academie des Inscriptions et Belles-Lettres, a paper was read by M. Rene de la Blanchere upon the means adopted by the Romans to cultivate their African colonies, which were more densely peopled and more fertile than the same parts of Africa are at the present time. M. De la Blanchere asserts that the absence of water was not the chief obstacle, as a great part of the colony had a plentiful supply, but that the difficulty was to regulate the supply, owing to nearly all the rain falling in a period of a few weeks. In order to obviate this the Romans covered their African province with a network of hydraulic works, which M. De la Blanchere has been studying for the last ten years. The main principle which was observed in the creation and adaptation of these works was that no portion of the water was left to itself, all that fell, from the summit of the mountains to the level of the sea, being, so to speak, captured and distributed methodically. In the smallest ravines there were dams of stones constructed to keep back the water, and at the entrance to each of the large valleys there was a system of works which insured not only regularity of irrigation, but the slow and gradual passage of the water. M. De la Blanchere adduced as a type of this distribution the Enfida, a country on the borders of the Zengitana and Bizacium, describing it in detail, and demonstrating that the same system prevailed not only in Mauritania, but in the whole of Roman Africa, where vestiges of it are to be found in all directions. The Romans were several centuries in arriving at a complete result, the most flourishing period being the third century of the Christian era. After that, civil wars—and, above all, the wars of religion—led to the decadence and destruction of these works, the destruction being completed by the Arab invasion and the disafforesting of the mountains.

Economy of Gas Engines.

Some extension in the use of Dowson's gas for use in gas engines has been made, and Messrs. Crossley & Co. have now a large number of engines using this gas; in one mill alone 200 horse power in gas engines is worked by means of Dowson's gas. When it is remembered that this mode of obtaining motive power is much less costly than the same power from steam engines, it is very remarkable that its use is not extended even more rapidly. We recently made a trial run with a Cycle gas engine worked with this gas, at the Uxbridge water works, and found that the consumption of coke and anthracite coal was only 1·67 lb. per horse power in water lifted, and only a little over 1 lb. per indicated horse power.

Bee Poison for Rheumatism.

Experiments on bee stings as an antidote for rheumatism have already been noted in our columns. (See SCIENTIFIC AMERICAN, vol. 63, No. 11.) One of our old subscribers, Mr. Aaron Miller, has written us to the effect that he has virtually found the sting of bees an antidote to very severe rheumatic pains to which he was subject. Although seventy-four years of age, he voluntarily submitted to stinging, and found it quite efficacious. In one case two days passed after the stinging before the cure seemed to be effected, but the rheumatism almost disappeared for several months after the infliction of a stinging on the eyebrows and left hand.

GENERAL MONTGOMERY CUNNINGHAM MEIGS.

The National Academy of Sciences has been called to mourn its first loss this year by the death of General Montgomery C. Meigs, "perhaps the foremost scientific soldier in the United States," who succumbed to the prevalent epidemic of influenza at his home in Washington, D. C., on the morning of January 2.

This distinguished officer was of illustrious ancestry. His father was Dr. Charles Delucena Meigs, one of the ablest physicians of Philadelphia and long professor of obstetrics and the diseases of women and children at Jefferson Medical College, in its palmiest days. His grandfather was a classmate of Noah Webster and Oliver Wolcott, at Yale College, and a famous educator in his time, being the first professor and acting president of the University of Georgia. Still more remote among his ancestors was Return Jonathan Meigs, postmaster general during the administrations of Presidents Madison and Monroe. Col. Meigs, father of the preceding, commanded a regiment under General Anthony Wayne at the capture of Stony Point.

The origin of Colonel Meigs' name is of peculiar interest. His father, when a young man, was very attentive to a fair Quakeress, who resided in the vicinity of Middletown, Conn., but he was unsuccessful in his suit, and repeatedly rejected with, "Nay, Jonathan, I respect thee much; but I cannot marry thee." But on his last visit, as he slowly mounted his horse, the relenting lady beckoned to him to stop, saying: "Return, Jonathan! return, Jonathan!" These, the happiest words he had ever heard, he gave as a name to his firstborn son. The fourth of that name is to-day a resident of Washington City.

General Meigs' mother was Mary Montgomery, a daughter of William Montgomery, who was born in Eglington, N. J., and of the same distinguished Scotch family of which General Richard Montgomery, the hero of Quebec, was so conspicuous a representative. Thus on both sides his ancestry was of the best that America possesses.

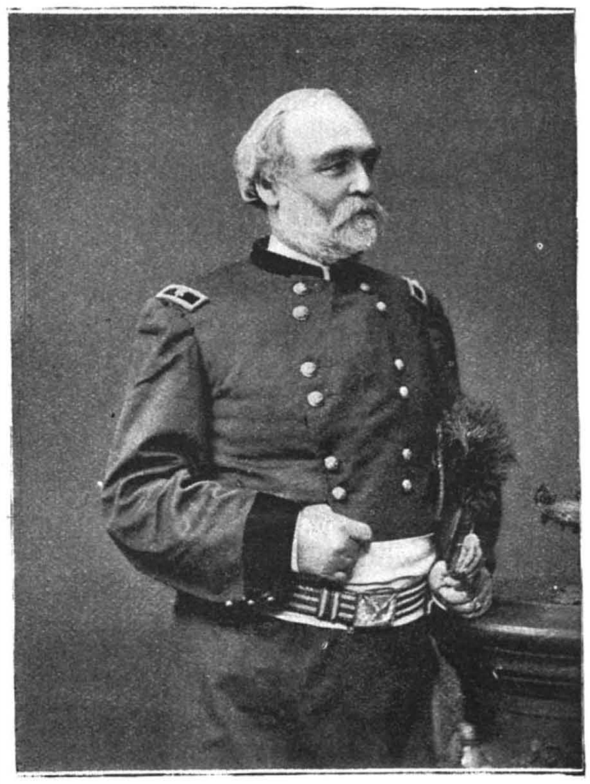
He was born in Augusta, Ga., on May 3, 1816, where his father was then studying medicine. A year later he removed with his parents to Philadelphia, and there studied for a time at the University of Pennsylvania, but, receiving an appointment to the U. S. Military Academy at West Point, was graduated at this institution in 1836. He became second lieutenant in the first artillery, but resigned on July 31, 1837, to accept the rank of brevet second lieutenant in the corps of engineers on August 1, 1837.

His first engineering work was in the repairing of Fort Mifflin, on the Delaware River, and subsequently he was occupied in the building of Fort Delaware, and in the improvement of harbors in the Delaware River and Bay, also on other similar work for short periods of time at various places along the Atlantic coast. He became first lieutenant on July 7, 1838.

In 1841 he became superintending engineer, with charge of the construction of Forts Wayne, Porter, Niagara, and Ontario, and so continued until 1849, when he was called to Washington, and spent a year in the office of the engineer corps there; but, in 1850, returned to his work of superintending engineer, with charge of the building of Fort Montgomery, at the outlet of Lake Champlain. In November, 1852, he returned to Washington, under orders to take charge of designing and constructing the Potomac aqueduct. His plans having been accepted by Congress, he constructed that work, including the Cabin John and Rock Creek bridges. His work on this piece of engineering gave him a high name as an engineer. He was advanced to the rank of captain of engineers in March, 1853, having served for fourteen years in the next lower grade. His other work included the superintending of the construction of the wings of the capitol and of its windows and of the halls of Congress, also of the extension of U. S. general post office in Washington, and of the completion of Fort Madison, in Annapolis, Md.

During the autumn of 1860 he was sent to Florida, to take charge of the construction of Fort Jefferson, at Tortugas, but returned to Washington in time to be present at the inauguration of President Lincoln, under whose orders he planned and accompanied as its engineer the expedition for the relief and re-enforcement of Fort Pickens at Pensacola, Fla., then threatened by the forces of the Confederate States. He rescued Fort Pickens and saved the important harbor of Pensacola from falling into the hands of the Southern troops. This was the first active effort on the part of President Lincoln to stop the tide of Confederate aggressions which were sweeping from the control of the United States the Southern military posts and harbors.

He returned to Washington, and, on May 14, was promoted to colonel of the eleventh infantry, and a day



GENERAL MONTGOMERY CUNNINGHAM MEIGS.

later was made quartermaster-general of the U. S. army, with the rank of brigadier-general, which place he held until his retirement in 1882.

Of his long and able services during the civil war only the briefest summary is possible. His duties consisted in directing the equipment and supply of the armies in the field, generally from headquarters in Washington, although he was present at the battle of Bull Run in July, 1861, and during 1863 and 1864 was specially engaged in providing transportation and supplies for the forces at Chattanooga, being present during the investment and bombardment of that city and the subsequent battle in November, 1863. During the overland campaign of General Grant, in 1864, he had personal charge of the base of supplies of the Army of the Potomac at Fredericksburg and Belleplaine. During the threatened invasion of Washington, in July, 1864, he commanded a brigade of quartermaster's men and other troops.

Subsequently he visited Savannah, Ga., with Edwin M. Stanton, Secretary of War, when that place was captured by the armies under General Sherman, in order to supply and refit the armies with the necessary supplies, also shipping to their proper destination the captured stores. Still later he met General Sherman at Goldsboro, N. C., where he refitted the armies with everything needed, including "a new canvas cover for every wagon."

Only on two occasions during the entire civil war did the armies of the North suffer for the want of supplies. The first of these was subsequent to the check at Chickamauga, where for some time the men were obliged to live on short rations, and many animals perished on account of General Rosecrans having lost his line of communications. The second was during General Sherman's famous march to the sea. Concerning this General Meigs wrote: "On taking Savannah, General Sherman found it impossible at once to open the river, whose channels had been during four years laboriously obliterated by the enemy. A fleet with supplies from the quartermaster's department was waiting at the mouth of the river for the opening of navigation, in order to satisfy the wants of the army. This being detained some days, a few animals perished in the Southern Savannah." For these and other services he was breveted major-general in the regular army on July 5, 1864.

At the close of the civil war he returned to the administrative duties of the quartermaster-general's office in Washington, and in connection with these he inspected the workings of the department under his control in Texas and the Southwest in 1869–70, in California and Arizona in 1871–2, the Western posts and railroad routes in 1872, and in California and Columbia in 1873–4. He visited Europe in 1867–8 for his health, and again in 1875–6 on special service, to study the constitution and government of the armies abroad, and was then made a member of the commission for the reform and reorganization of the army in 1876.

General Meigs also served on the board appointed to prepare plans and specifications for the war department building erected in Washington in 1866, and the building for the U. S. National Museum in 1876, also in 1878 he submitted a plan for the Hall of Records in Washington.

He was retired in February, 1882, being then sixty-two years of age, and at that time called attention to the fact that, during his administration, the quartermaster's department had applied to the wants of the army supplies valued at over $1,956,616,000, and that this vast sum was used with less loss and waste from accident and from fraud than had ever before attended the expenditure of such an amount of money.

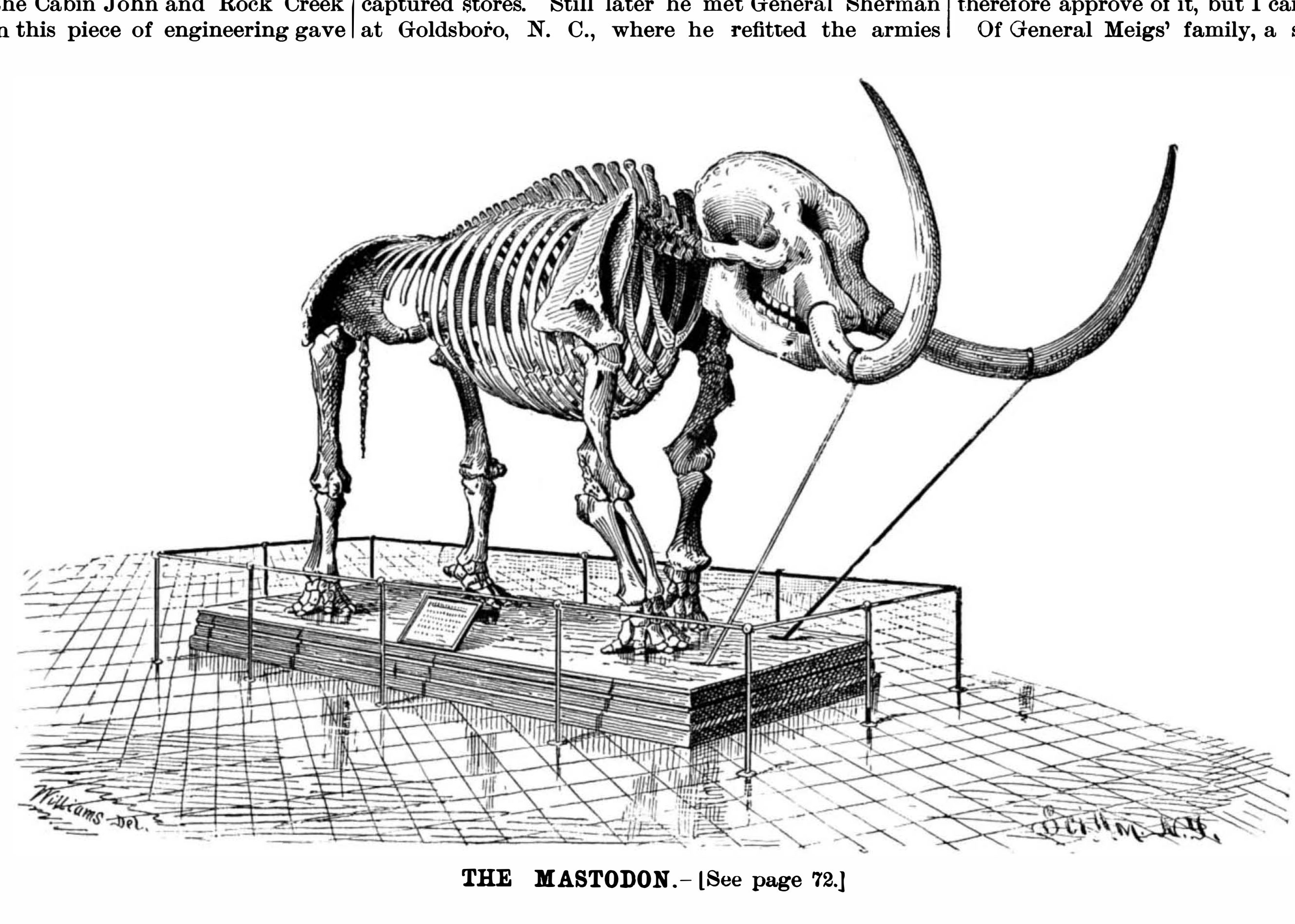
In August, 1882, Congress appropriated money for the erection of a new fireproof building of brick and metal for the Pension Bureau, at Washington, with the condition that it should be erected under his supervision. This occupied his attention until its completion in 1887. Since then he has lived in retirement at his home in Washington.

He was a regent of the Smithsonian Institution, and in 1865 he was chosen a member of the National Academy of Sciences, an honor accorded to him in consideration of his great ability displayed as chief of the quartermaster's department. He took considerable interest in science, and was a member of other scientific organizations in Washington and elsewhere.

General Meigs was held in high esteem by his military associates, and it is told that when General Sherman was the commanding officer of the U. S. army, a report from the Quartermaster's Department, in General Meigs' handwriting, was submitted to him. It received the following indorsement: "The handwriting of this report is that of General Meigs, and I therefore approve of it, but I cannot read it."

Of General Meigs' family, a son, who attained the rank of lieutenant in the engineers, was killed in a reconnoissance during the civil war, in Virginia; and a second son follows the profession of civil engineering, in Keokuk, Iowa. He had likewise two daughters, one of whom married Colonel J. A. Taylor, of the U. S. army, and the second is the wife of Archibald Forbes, the famous war correspondent.

His funeral took place on the morning of January 5, and he was buried at Arlington, that beautiful home for the dead, where so many of the distinguished heroes of the civil war are buried. From St. John's Church to the cemetery his remains were escorted by a detail of soldiers from the Washing-



THE MASTODON.–[See page 72.]

ton barracks, commanded by the senior officer present. His pall-bearers were: General John M. Schofield, the ranking officer of the U. S. army; General Thomas L. Casey, chief of the U. S. engineers; General Holabird, General Horatio C. Wright, and Colonel Vincent, representing the army; Professor Samuel P. Langley, representing the National Academy of Sciences; and Dr. J. C. Welling, representing the Smithsonian Institution. M. B.

THE MASTODON.

The recent discovery of the lower end of the tusk of a mastodon, broken and fragmentary, in the excavation made for the Harlem ship canal, now in process of completion, brings to our minds very forcibly the great changes our island has undergone since that distant time when this huge *proboscidian* was a denizen of Westchester county, and the untenanted wilderness stretched to the waters of New York bay. Before the Indian canoe crossed the Hudson, rippling beneath the noiseless maneuver of the paddle of its stealthy occupant, the trumpet of this great "tusker" resounded along the shores of the beautiful river and its waters were invaded by its massive frame. The mastodon has become the most popularized monster of prehistoric times, and speculation as to his contemporaneity with man in the earliest days of man's existence on this earth lends to this late announcement of his presence on Manhattan island a different and higher interest.

The example given in our illustration is to be seen at the American Museum of Natural History in this city, and altogether may be regarded as the most instructive and impressive specimen of the mastodon now on exhibition in this country. In looking at him the spectator is struck by the great size of the bones, the immense head, with its broad surfaces, the formidable tusks and the powerful crested teeth. Between the forelegs of this specimen, which was taken out of a peaty morass near Newburg, lies the butt end of the huge tusk which the U. S. engineers have unearthed from the east end of Dykman's creek, where Broadway crosses the ship canal, at about 231st street. The teeth of the mastodon have served as the most important elements in making specific distinctions in this animal, and the name mastodon, meaning *nipple tooth*, is derived from the mammæ-like tubercles which unite to form their transverse crests. The mastodon's systematic position is among the proboscidian ungulates, and, like the elephant, it belongs to the uneven-toed groups of ungulate mammals (perissodactyls). Its most striking peculiarity is the horizontal succession of its teeth. Six teeth or molars appear in succession, the latter pressing forward from the back of the jaw and replacing their dislodged predecessors. In this series the first teeth are smaller and provided with fewer crests or transverse ridges, while their successors are larger and possess more ridges. A great deal of variety obtains in the construction of these teeth, and as the scheme, given hereafter, for the separation of the nine American species shows, the variations are extreme. Besides the horizontal succession which holds good for most species, in one, *M. oliroticus*, there seems also to have existed a vertical succession; that is, in the first three of the molar horizontal series there has been a replacement of these from below upward by other teeth displacing them, exactly as the milk teeth in the human species are dislodged by their subcutaneous successors. These have hence been designated as premolars, the true molars being the fourth, fifth, and sixth teeth in the horizontal succession. In other cases or species this vertical movement seems limited to the first tooth of the series, and in most it has not been observed or determined at all.

The mastodon we may believe for the most part ground his food by an up and down motion, somewhat reversing the sideways munching of the common elephant, though in the species where the valleys between the ridges are reduced there seems little reason to suppose that the ordinary left to right motion was entirely abandoned. The canine teeth in the mastodon and elephant are represented by the great outward-curving tusks in the upper jaw, and by smaller deciduous spikes projecting from the lower jaw. These latter are not always present. The head of the mastodon is enormously developed by a cancellated open bone structure, and upon the broad surfaces thus prepared the powerful muscles of the neck found attachment. These latter were required for the support of the huge tusks, thrown so far outward beyond the center of gravity of the head as to require these powerful and restraining bonds for their elevation. The skull of the elephant is much shorter and more columnar in appearance than in the mastodon, and is particularly distinguished by the reduced and shortened under jaw, which contrasts with the elongated symphysis of the mastodon. The mastodon, enjoying, like the elephant, a very limited range of motion of its head, was provided with a similar trunk, whose flexibility was an ample substitute for this restriction, and by which it supplied itself with food and water.

There are many anatomical peculiarities in the mastodon, and it has been remarked that it may have been able, from the construction of its fore limbs, to throw its legs up and stride over bushes, etc. (pronation), in a manner not permissible to the elephant, a rather unnecessary assumption, as the elephant is not so limited in this respect. The mastodon has a continental range, and its widely distributed remains over Asia, from India to Siberia, its representatives in South America, and its almost universal presence in North America, prove the elasticity of its adaptation to a variety of conditions. Its bones are usually found in or below peat, and underneath forest beds, and it seems often to have perished by sinking beneath the yielding surfaces of marshes, or to have actually drowned in waterways, and to have become entombed by the accumulation above it of vegetation, muck, and alluvial drift. It lived late after the glacial epoch, and traces a long ancestry back to the middle tertiaries. Its contemporaneity with man has often been discussed, and there seems no good reason to suppose that the American aborigine was not acquainted with this great beast. Dr. Koch's celebrated report to the St. Louis Academy of Science may be recalled:

"In the year 1839," says this explorer, "I discovered and disinterred in Gasconade county, Mo., at a spot in the bottom of the Bombeuse river, bones sufficiently well preserved to enable me to decide positively that they belonged to the *Mastodon giganteus* (?) The greater portion of the bones had been more or less burned by fire. The fire had extended but a few feet beyond the space occupied by the animal before its destruction, and there was more than sufficient evidence on the spot that the fire had not been an accidental one, but, on the contrary, that it had been kindled by human agency, and, according to all appearance, with the design of killing the huge creature, which had been found mired in the mud and in an entirely helpless condition. . . . It seemed that the burning of the victim and the hurling of rocks at it had not satisfied the destroyers, for I found also among the ashes bones and rocks, several arrow heads, a stone spear head, and some stone axes."

Dr. Koch also found arrow heads underneath the skeleton of a mastodon (*Missourium*).

We have elsewhere remarked (*American Antiquarian*) that the mere fact of the association of the remains of extinct animals with human relics does not necessarily establish a fabulous antiquity for the latter unless accompanied by geological evidence pointing to such a conclusion. The mastodon may have lingered on to comparatively recent times, and comparatively recent men may have intercepted and destroyed helpless individuals. The beds in the alluvial bottoms of the Bombeuse and Pomme de Terre rivers, as quoted by Dr. Koch, offer no indisputable indications of great age. Dr. Koch's discovery certainly affords grounds for such a presumption, but at the best that alone.

We subjoin the following important diagnosis of the mastodon species of North America, prepared by Prof. Cope:

I.

Intermediate molars with not more than three crests.

α Crests acute, transverse.

β Valleys uninterrupted.

Last superior molar with three crests and a heel; crests low, not serrate, *M. proavus.*

Last superior molar with four crests and a heel; crests elevated, not serrate, *M. oliroticus.*

$\beta\beta$ Valleys interrupted.

Edge of crest tuberculate, *M. serrideus.*

$\alpha\alpha$ Crests transverse, composed of conic lobes.

β Valleys (?) uninterrupted.

Last inferior molar narrow, with four crests; no accessory tubercles, *M. shepardi.*

$\beta\beta$ Valleys interrupted.

Last inferior molar with four crests and a heel; symphysis short, smaller size, *M. euhypodon.*

Last inferior molar with four crests and a cingulum; symphysis longer, medium size, *M. productus.*

Last inferior molar with five crests and a heel; symphysis very long, largest size, *M. augustideus.*

$\alpha\alpha\alpha$ Crests broken into conic lobes; those of opposite sides alternating.

Last inferior molar narrow, supporting four crests and a heel, *M. obscurus.*

II.

Intermediate molars, with four transverse crests.

A long symphysis, *M. campester.*

A short symphysis, *M. ninificus.*

L. P. G.

Rock Drilling on the Mississippi.

The electric drilling at Rock Island was done under the terms of a contract made with the government of the United States by F. B. Badt, Western manager of the Thomson-Van Depoele Electric Mining Company. The government, which owns Rock Island, where it has established the largest arsenal in the country, has for some time been engaged in the work of deepening a portion of the southern channel of the Mississippi, which here flows from east to west. This is done with the twofold purpose of securing a more plentiful supply of water power, which is used at the shops on the island, and to provide a navigable channel at Moline, which has heretofore been debarred by shallow water from sharing in the commerce of the nation's greatest river. A coffer-dam has been erected at the head of the island at a cost of $25,000 or $30,000, and the government is now deepening a channel four hundred feet wide to the extent of four feet: that is, it is doing so as fast as the congressional appropriations will allow. The coffer-dam is not, of course, absolutely water-tight, and it may be mentioned here, as an interesting fact, that much trouble is caused by muskrats, who do considerable damage by burrowing under the dam. The watchmen are paid premiums for shooting the troublesome little animals.

The particular portion of the work on which electricity was employed is a strip of limestone rock about 600 feet long and of an average width of fifty feet. The remainder of the rock is a much softer sandstone, and can be profitably drilled by hand. It has been shown, however, that electric power only costs about half as much as hand drilling in the harder rock. Nine drills were used on the work. Eight of these were mounted on weighted tripods in the usual manner, while one, somewhat larger in size, was mounted on a carriage, and wheeled about on a temporary track. The machines used were the regular Van Depoele reciprocating drills, which have heretofore been described in this journal.

Current was obtained from a generating plant installed in a temporary power house erected on the island. This building was an addition to a rough pumping station put up by the government for the purpose of clearing the bed of the river from water coming from leaks in the water-dam and from springs. This pumping engine is of the vertical type, and was built in the government shops, being rated at 25 horse power. It was utilized in driving the generators, steam being furnished by a 40 horse power boiler. The government gave the use of the engine and boiler, when not used for pumping, as a part of the contract. The generating plant consisted of two Thomson-Houston dynamos, with revolving brushes, one of 20 and the other of 10 kilowatts capacity. The arc lights were rigged up near the drills to enable the work to be carried on after dark. An incandescent circuit served to furnish light for the interior of the power house, which was adequately supplied with suitable switches and measuring instruments.

It was found convenient to utilize the dynamos and circuit of the drilling plant to explode the dynamite with which the holes were charged.—*Western Electrician.*

Preparation of Rice.

The milling of rice, briefly stated, embraces the following processes:

1. The "screening" or second thrashing gives the rough rice or "paddy" designed to remove trash, stalks and foreign particles.

2. The removal of the outer husk by the "milling stones."

3. The separation of the chaff and other substances by the "screen blower" and "chaff fan."

4. The removal of the yellow cuticle of the grain by pestling in mortars, which is the most laborious and expensive of the several processes.

5. The separation of the rice bran from the rice grain by sifting, and the separation of the small and large grain of rice by the "brush screen."

6. Polishing, which is accomplished by a horizontal revolving drum, covered with leather and surmounted by a cylinder of wire gauze.

The friction by the constant rubbing of the grains of rice against each other and against the drum produces the "rice polish," otherwise called rice dust or rice flour, which is not rice bran, but a part of the grain itself worn by attrition.

Don't Turn the Exhaust into the Sewer.

Steam should never be put into a brick or cement sewer, as it has an injurious effect on the same, causing disintegration and collapse within a very short time; neither should it be led into a brick chimney, for the same reasons. In some places it is the practice of engineers to turn the exhaust from pump or small engine into the sewers, but this is bad practice, and, we believe, an illegal act in some cities, for it will not only destroy the sewers, but the heat of the steam makes the malarial gases more active, while at the same time it produces a certain amount of pressure that will force the gas back into buildings through the water traps commonly in use. In these traps there is seldom more than three inches of water, and very little pressure is necessary to force the gas through them. Wherever gas is forced back through buildings in this or a similar manner, the death rate in that locality will certainly be greatly increased.—*The Stationary Engineer.*

An Antiseptic Adhesive Pomade.

The following is employed in the Hopital Saint-André, in place of adhesive straps, to keep the protective dressings in close apposition to the skin:

R.	Oxide of zinc	gr. x.
	Chloride of zinc	gr. xlv.
	Gelatin	ℨ x.
	Water	℥ ij.

It is also found very serviceable in dressing wounds of the face.

RECENTLY PATENTED INVENTIONS.

Engineering.

VESSEL TRANSPORTING APPARATUS.—Christopher Bruhl, Brooklyn, N. Y. This invention provides, in suitable connection with a land railway, a dock carriage for receiving and floating a vessel, a pneumatic float or platform beneath the carriage, pumps to empty the float of water, and auxiliary mechanism to adjust the float and carriage to the level of the railway. The apparatus is designed to afford the means of transporting vessels overland from one water way to another, lifting them bodily and moving them while afloat, without injurious strains on the vessel or its cargo, the dock carriage being large enough to hold water sufficient to float the largest vessel.

CUT-OFF VALVE.—Daniel B. Kenney, Detroit, Mich. This is designed to be a simple and durable device, very effective and automatic in operation, and more especially designed for use on natural gas mains and pipes to automatically shut off the gas supply after the pressure has once gone down. The casing has inlet and outlet ports and a valve therefor, set and released by cam projections, in connection with a diaphragm having a stem with a head on its lower end separably engaged by the upper end of the valve when the latter is raised, whereby when the diaphragm moves the stem downward the valve will be disconnected from the head by the cam projections and will fall, means being also provided for raising the valve to engage it with the stem.

ELECTRIC INSULATOR FOR BOILERS.—Peter Decker, Norwalk, Conn. Excessive oxidation of the interior of boilers, with which quick-speed engines are directly connected by the steam and feed water pipes, is frequently attributed to currents of electricity pervading the water, and generated by the friction of the working parts of the engine. This invention is designed to provide a thorough insulation for the prevention of such action, an insulating joint being located between opposing coupling flanges on the pipe sections, a sleeve of non-conducting material on each bolt body, and a washer of non-conducting material under each head and nut on the bolts.

Railway Appliances.

FREIGHT SHIFTING BUFFER.—Clayland Tilden, Jersey City, N. J. This is an improved device for shifting freight upon gondola and flat cars, as in cases of beams of wood or iron which have been shifted out of place. In connection with a framework is a butting block with which a buffing head has a hinged or pivotal connection, there being means for elevating the buffing head, while a fixed buffing surface is attached to the block above the head. In operation the car is pushed toward the butting block arranged in its path, and the load is brought into gradual engagement with a buffing surface, whereby the load will be trued up without having to be handled by laborers for this purpose.

Mechanical Appliances.

CHAIN POWER.—Milo E. Smith, Brady Island, Neb. This is a simple and convenient device for transmitting a continuous motion to an endless chain to adapt it for driving any sort of machinery. A reciprocating bar is held to move parallel with the chain members, a sliding frame moving in the same plane with the bar, the frame having flanged pulleys arranged opposite the chain, and oppositely arranged elbow latches pivoted in the sliding frame having notched ends to engage the chain, there being a link connection between the elbow latches and the bar.

TUBE SCRAPER.—Philip Eckenroth, Jr., Philadelphia, Pa. The body of this scraper has shoulders on its opposite edges near its front end, cutters having bent arms being pivoted at their bends to the body, with their inner ends abutting against the shoulders, while a lever pivoted to the body in the rear of the pivotal points engages the arms to simultaneously operate them. In use the scraper is secured to a handle and pushed through a boiler tube in the ordinary way, the cutters being adjustable to fit any tube, and means being provided for increasing the power of the scraper at particular points where heavy scale is met with, where a sudden shock or blow may be made to loosen the scale, and enable it to be readily removed.

MECHANICAL MOVEMENT.—Russel C. Lee ham, Trinidad, Col. This invention relates to mechanical movements in which a reciprocating motion is changed to a rotary one, and is designed to be simple and durable in construction, avoiding dead center positions and reducing friction to a minimum, while being readily applicable to all kinds of machines. The invention consists of arms secured on a driving shaft and adapted to be engaged by an upper and lower set of abutments held on the reciprocating crosshead, there being also a reversible double lug arranged between the abutments of the crosshead.

HAIR TREATING MACHINE.—Junius A. Murphy, New Orleans, La. Machinery for treating horse hair and similar fibers is greatly improved by this invention, the machine picking and forming the hair into a lap with uniformity and economy, the lap being in proper form to enable the combing frames, to which the air is subsequently subjected, to effectively tease and comb it. The invention provides a novel feed mechanism and feed regulator for the picker, and a novel arrangement of the picker cylinder and the hopper to which it delivers, while there is also introduced a novel improvement in the forming of the lap and in the reeling of it.

Agricultural.

FERTILIZER DISTRIBUTER.—Thaddeus N. L. Anderson and Willie Boatner, Centreville, Miss. The distributing hopper, suspended by a strap from the shoulder, has a screen located near its upper end, and a slide valve where the spout joins the hopper below, a stirrer journaled in the hopper extending below the slide valve, while a handle lever extends upward from a spring-pressed lever fulcrumed on the outer face of the hopper and connected with the valve, a gauge bar secured to the lever limiting the throw of the valve. The fertilizer is dropped by pulling upward on the handle rod as one walks over the ground with the device, the valve being set to distribute a certain amount to the acre, the fertilizer being practically sifted and prevented from clogging.

CULTIVATOR AND HARROW.—James S. Hickman, Hickman, Ill. This is a combination machine which may be used to cultivate one, two, three, four or more rows, the invention providing a simple, novel and easily operated construction of supporting and guiding devices and parts to be removed and replaced to convert the machine into a harrow or cultivator frame. It has adjustable front and rear axle sections and separate devices for operating them, with locking devices for their connection, so that they may be operated together or separately, while the cultivator teeth are partly supported to run close to the row, other teeth running centrally between the rows and, in use as a harrow, such of the teeth as would interfere with the growing rows are removable.

Miscellaneous.

CASH REGISTER.—Charles Gibbs, New York City. Within a suitable casing a shaft carries two loosely mounted disks, one having a scale in cents and the other a scale in dollars, there being teeth on the periphery of the dollar disk and pins on the peripheries of both disks, in combination with a laterally shifting pinion meshing with the teeth of the dollar disk and adapted for engagement with the pin of the cent disk, while an actuating mechanism connects one disk with the key. The machine also has various other novel features, all the movements being positive and there being no springs in the actuating mechanism, the machine being designed to afford an accurate account of receipts in dollars and cents, while cards of information or advertisement may be conveniently displayed in the casing.

AIR SHIP.—James C. Walker, Waco, Texas. This ship has stationary vertical cylinders opening entirely through it and provided with lifting wind wheels in their upper ends, while horizontal cylinders provided with propeller wind wheels are arranged in a horizontal framework having pointed ends. The ends and sides of the cabin are to be covered with canvas, woven wire, or wood wicker work, and a light tubular construction is to be used throughout, to afford the greatest possible strength consistent with the least weight, any suitable motor being employed which furnishes high power with little weight.

INKSTAND.—William J. Sawyer, London, England. This inkstand has a horizontal closed collapsible containing vessel connected by a flexible tube with an open dipping well, in combination with a supporting cradle carried and rendered vertically adjustable by pairs of levers, the dipping well and reservoir being adjustable relatively as to height. The improvement prevents contact of the air with the bulk of the ink, preventing the thickening of the ink and the taking place of physical changes, while maintaining a practically constant quantity of ink in a small well in which the pen is dipped.

EYEGLASSES.—Charles Lembke, New York City. Combined with the eyeglass frame are clips supported by it and nose pieces secured to the clips by a pivotal connection, clamping screws being provided in addition to the pivots for maintaining the nose pieces in adjusted position. The invention relates to eyeglasses in which the nose pieces are pivotally supported from the frame to adjust themselves to the nose of the wearer, and provides for readily securing the nose pieces in the adjusted position, thus maintaining them permanently in proper adjustment.

MEASURING VESSEL.—William C. Hocking, Sheffield, Iowa. This is a measure open at top and bottom, its interior capacity equal to the standard measure it represents, and only to be filled when its open bottom rests on an independent surface, as the bottom of a paper bag or sack resting on a floor or table. It has on its upper end a fixed shelving or inclined side handle of feed board character, the outer end of which forms a hand grip.

INVALID BED.—Carl Olsen, Long Island City, N. Y. The frame of the bedstead provided by this invention may be easily taken apart and packed into a small compass, or the bed frame may be removed from the head board and foot board and applied to a bedstead of any other form, the bed being extremely convenient for use in a sick room and also adapted for use as an ordinary bed. The bed is provided with different adjustments to fit it for its especial use and the invention covers various novel combinations and arrangements of parts.

CHILDREN'S CARRIAGE BRAKE.—Augustus E. Scharff, Tacoma, Washington. This improved brake mechanism is applicable to any hand-pushed vehicle, and particularly to baby coaches having four wheels. Combined with a brake beam carrying brake shoes is a retractile spring normally maintaining the beam out of contact with the carriage wheels, a chain or cord connected with a rotatable handle bar and winding thereon being connected with the brake beam, to apply the brake by the turning of the handle bar.

KNITTED FABRIC.—Max Gernshym, Brooklyn, N. Y. This fabric is formed with a series of tubular knitted courses, each partly formed by plain loops to form a ribbed back and partly by transferred loops to produce an ornamental front, the fabric being made in continuous tubular form and afterward cut up and trimmed to form jackets and other garments, of which part is plain and the rest in design, making fine goods of a rich appearance at the same cost as ordinary plain goods. The invention relates to a former patented invention of the same inventor.

PAPER BAG.—Charles W. Fishel, Aspen, Col. This is a cheap and easily fastened bag, to hold groceries, fruits, and other articles which do not sift. It is formed of a rectangular paper sheet, two of whose diagonally opposite corners are folded on converging lines and lapped and pasted, another corner being folded and parted over the lapped portion to form the narrow end of the bag, while the extremity of the remaining corner portion is folded and pasted upon a transverse string, which is thus made a permanent attachment of the mouth-closing flap.

CUFF HOLDER.—James J. Culley, San Francisco, Cal. A plate having a keeper is adapted to be secured in a sleeve, a base plate with an offset projecting over the keeper, while a plate or strip pivoted to the base plate has a cuff stud at one end and at its other end a tongue engaging the keeper, a spring having one end secured to the pivoted strip and its other end engaging the offset of the base plate. This device is designed to secure the cuff to the coat sleeve, so that it may always be held in the right position.

GARMENT DRAUGHTING PATTERN.—Bertha Musse, New York City. This is an adjustable pattern of simple and convenient style which may be accurately fitted to people of different sizes in the making of sacks, basques, waists, and analogous garments. The various parts of the pattern are preferably made of sheet metal, and the pattern may be given any desired contour, according to the garment to be cut, the different pieces being sectionally formed, overlapping, and having a sliding connection with each other.

BREECH LOADING BOLT GUN.—William D. Forbes, Morristown, N. J. This improvement has more particular reference to the devices for imparting motion to and locking the breech block, and for locking the extractor upon the cartridge shell in withdrawing the latter. Combined with the frame or receiver and breech bolt with a rotary handle having a crank pin is a connecting rod connecting the crank pin with the breech bolt, a laterally moving cartridge extractor, and a device carried by the connecting rod to lock the extractor upon the cartridge shell during the rearward movement of the breech bolt.

SKATE.—Thomas H. McQuown, Biggsville, Ill. This skate has a sole plate whose rear end is secured to the runner, while an adjusting device is arranged between the front end of the sole plate and the runner, whereby provision is made for adjusting the sole plate to fit differently shaped shoe soles, in such manner as to give the toe a firm rest, at the same time preventing pulling on the heel.

BOTTLING APPARATUS.—Amalia M. Donally, New York City. Combined with a compression mechanism is a flexible filling tube adapted to enter a cask or like receptacle independent of the apparatus, a vent tube connected with the filling tube also entering the cask, with other novel features, the machine being designed for manipulation by a single attendant, and its construction being such that a series of bottles of irregular size may be filled as readily as a series of regular sizes, the supply of liquid being cut off from any one or from the entire number of bottles being filled, at the option of the operator.

FORMER FOR BERRY CRATES.—Charles S. Andrews, Wilmington, N. C. This crate former consists of a crate-shaped skeleton metallic frame with a hollow spindle, whereby the body is adapted to be mounted on and revolved by a shaft, seats or recesses being formed in the outer face of the body adapted to form seats for the slat sections of the crate, with means for holding these sections to the body. By the use of this improvement crates are designed to be made at a small cost and very much quicker than they can ordinarily be produced. The entire crate may be made on the former, the longitudinal and transverse slats being nailed together and the brads or nails clinched on the former.

WEATHER BOARD.—Robert Sword, Kemnay, Manitoba, Canada. This is an improved drop siding weather boarding strip or plank, having its upper and outside edge chamfered in a concave plane, with the curve of the chamfer approaching the inner side of the board more closely at a line some distance from the edge than it does at the edge, and having its lower edge recessed upon the inside, whereby the shrinkage of the boards is made to tighten the joint between them, and preventing the opening of cracks from the shrinkage of the lumber.

PORTABLE SCAFFOLD.—John Harper, London, England. In an upright framing, with corner posts erected on a wheeled base and braced together, the posts having racks and guides, is a cage or platform adapted to be moved up and down the guides, toothed gearing engaging with the racks and coupled by worm gear, the whole being operated by a single hand lever. This scaffolding is entirely self-contained, and is made in sections, being more particularly adapted for use in repairing and decorating or cleaning buildings, as well as for construction purposes.

SIDE APRON FOR VEHICLES.—Thomas H. Joyce, Unionville, N. Y. This invention provides an apron at each side of the seat, and extending to the body of the vehicle, to protect the occupants from side draughts, the aprons being so hung as to be independent of the lap robe, etc., and capable of being conveniently and quickly carried rearward, so as not to interfere with getting in or out. The frame for attaching the apron consists of an attaching bar and a supporting bar having a lower flexible end and a spring-controlled upper end, the frames being designed to be lengthened or shortened as desired.

KNOB ATTACHMENT.—Johan Matheson, Christiania, Norway. A divisible handle is provided by this invention, both parts of which, when connected, will reach through the catch for the latch bolt, whereby a more solid connection and a better guidance for the handle may be obtained, an internally-threaded sleeve fitting upon the outer part of the handle and bearing against a shoulder on the inner part of the handle, there being a detachable connection between the sleeve and the inner part of the handle.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE SCIENTIFIC AMERICAN CYCLOPEDIA OF RECEIPTS, NOTES AND QUERIES. Pp. 680. 8vo. Munn & Co., New York. 1892. Price $5 cloth, $6 sheep, $6.50 half roan.

This splendid work contains a careful compilation of the most useful receipts and replies given in the Notes and Queries of correspondents as published in the SCIENTIFIC AMERICAN during the past fifty years; together with many valuable and important additions. Over twelve thousand selected receipts are here collected; nearly every branch of the useful arts being represented. It is by far the most comprehensive volume of the kind ever placed before the public. The work may be regarded as the product of the studies and practical experience of the ablest chemists and workers in all parts of the world; the information given being of the highest value, arranged and condensed in concise form, convenient for ready use. Almost every inquiry that can be thought of, relating to formulæ used in the various manufacturing industries, will here be found answered. Instructions for working many different processes in the arts are given. Many of the principal substances and raw materials used in manufacturing operations are defined and described. No pains have been spared to render this collateral information trustworthy. Those who are engaged in any branch of industry probably will find in this book much that is of practical value in their respective callings. Those who are in search of independent business or employment relating to the home manufacture of salable articles will find in it hundreds of most excellent suggestions.

THE ARCHITECT'S AND BUILDER'S POCKET BOOK. By Frank Eugene Kidder, C.E. Pp. 900. 500 illustrations. New York. 1892. John Wiley & Sons. Full leather, gilt. Price $4.

The original aim of the author was to produce a reference pocket book which should be to the architect and builder what Trautwine is to the engineer or Haswell to the mechanic. The author has succeeded admirably, and it would be a difficult matter to find as much useful information in the same compass. The work treats of mensuration, geometry, trigonometry, the strength and stability of foundations, walls, buttresses, arches, beams, floors, roofs, etc. The present or ninth edition will doubtless be well received by the profession, owing to the great development of the use of steel in building construction. Great attention is given to the strength of steel and the methods of using it. A glossary of technical terms, ancient and modern, adds greatly to the usefulness of the work. The arrangement of the book is admirable and hundreds of illustrations serve to make the book an indispensable companion for the architect.

SYSTEMATIC MINERALOGY BASED ON A NATURAL CLASSIFICATION. By Thomas Sterry Hunt, M.A., LL.D. The Scientific Publishing Co., New York. 1891. Pp. xvii, 391. Price $5.

Prof. Hunt, in his preface, states that forty-six years ago he began the study of mineralogy under Charles Upham Shepard. This work is the outcome of a long lifework in chemistry, mineralogy, and geology. The author has won a wide reputation for possessing opinions of his own and the courage of those opinions. His division of the whole mineral world into orders, families, genera, and species, as in natural history proper, is ingenious and plausible. The book is well worthy of study, and indicates the mind of a thoroughly independent thinker, but it must be also remembered it is the work of a thoroughly equipped scientist of recognized standing.

THE WORKING AND MANAGEMENT OF AN ENGLISH RAILWAY. By George Findlay. London: Whittaker & Co. and George Bell & Sons. New York: Macmillan & Co. 1891. Pp. viii, 354. Price $1.50.

The author of this book is the general manager of the London and Northwestern Railway, and is, therefore, eminently qualified as an authority of this subject. The treatment which the subject receives, as was to have been anticipated, is decidedly insular, but it is of much value as showing how our transatlantic neighbors conduct their great systems of crowded railroads. The interlocking and signaling system is given space, the perfection of which, at least as regards results, has long been conceded in the care of English roads. The use of the railroad for military defense is given at some length. The book is very good reading for all interested in railroads in this country as being suggestive of what may be done to improve our service and increase safety on our roads.

ROBERT FULTON: HIS LIFE AND ITS RESULTS. By Robert H. Thurston. New York: Dodd, Mead & Co. 1891. Pp. 194. Price 75 cents. Illustrated.

This book is of the series devoted to "Makers of America." Prof. Thurston tells in good style the oft-told tale of Fulton's work, his energy and perseverance under disappointment and discouragement. As opening, the story of steam in early times is told. The work closes with chapters of the advanced marine engineering of to-day and the outlook. This is affirmed to be slow and gradual improvement in speed and accommodation. The limit of speed for vessels of ordinary sizes he believes is nearly reached.

THE ENGINE RUNNER'S CATECHISM. A Sequel to the STEAM ENGINE CATECHISM. By Robert Grimshaw, M.E. New York: John Wiley & Sons. 1891. Illustrated. Pp. 366. Price $2.

This very practical little work, written in the author's well known vein, attacks the problems of the working engineer's occupation. It tells of the features, erecting, and adjusting of special makes of engines by prominent makers, the adjustment of the cut-off, shipping and receiving, erecting foundations, valve setting, and many other details of the running of stationary engines. It contains a number of very pertinent and useful cuts.

A B C OF THE SWEDISH SYSTEM OF EDUCATIONAL GYMNASTICS. By Hartvig Nissen. Philadelphia and London: F. A. Davis. 1891. Pp. vii, 107. Illustrated. Price 75 cents.

This manual opens with a short treatise in question and answer form, upon the end and objects of this simple system of calisthenics. The meanings of the different words of command are included also. Then come five days' order of work, designed to be so repeated as to cover a course of thirty-three weeks. Numerous illustrations of the positions are given. The work is intended for school use, but it is obvious that there is room in the household for such work.

ANNUAL REPORT OF THE NEW YORK FOREST COMMISSION FOR THE YEAR ENDING DEC. 31, 1890. Albany. 1891. Pp. 324.

To those interested in forestry and the preservation of our woods, and notably of the Adirondack forest, this report will be very welcome. It contains, besides the interesting general report of the commission, notes of court decisions and a catalogue of land papers in general, referring to forest preserves of the State of New York.

TABLES FOR THE DETERMINATION OF MINERALS BY PHYSICAL PROPERTIES, ASCERTAINABLE WITH THE AID OF A FEW FIELD INSTRUMENTS. By Persifor Frazer. Philadelphia: J. B. Lippincott Co. Pp. ix, 115. Price $2.

These tables are based upon Prof. Dr. Abin Weisbach's system of determinative mineralogy. The minerals are classified into three groups: I. Those with metallic luster, II. those with submetallic and nonmetallic luster, but colored streak, and III. those with non-metallic luster and white or light gray streak. These are next subdivided by color of mineral, color of streak, and hardness, and the final distinctions are based, in addition to the above, on hardness, tenacity, crystalline system, etc. The general blowpipe and acid tests of each mineral are given in concise form. The work will be of use and interest to many students of this fascinating science.

☞ Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(3940) M. R. C. asks: Will any article that will float placed in a running stream travel any faster than the water it is placed in, provided there is nothing to impede the travel of either? A. The water does not move with the same velocity in all parts of its section, in a running stream, the central portion always running the fastest. This produces a whirling or rolling motion, caused by friction on the bottom and sides, that extends to the surface and center. This inequality of motion may accelerate or retard any particles of matter floating upon the surface, according to their location from the center of the stream, but will generally have a less velocity than the mean velocity of the stream, although apparently moving faster than the water nearer the sides. If the article sets deep in the water, it will move faster than the surface water, being pushed ahead by the greater velocity of the water beneath.

(3941) F. C. F. asks: What form of boiler is best adapted with ordinary firing to burn (pine) cord wood, boiler 35 horse power? Is electricity considered more economical as a power conveyor than other methods where the bulk of power will be used not further than 500 feet from stations? What is next in economy? A. A flue boiler or one with very large tubes is best for wood fire. From a power plant already in operation a wire rope cable is the cheapest method of transmission for 500 feet. Electric transmission is the cheapest for long distance, and is also cheapest where a plant is to be located for transmission only, and is so used to a considerable extent for the utilization of water power otherwise not available.

(3942) J. D. asks: 1. In building a dynamo or motor, is it necessary to have the iron disks of the armature insulated from the shaft if they are insulated from each other? A. They should be insulated from the shaft. 2. Are not some dynamo armature cores made by running the disks on a thread on the shaft? A. We think not.

(3943) W. S. writes: I have a resistance column similar to the one described in SCIENTIFIC AMERICAN of September 14, 1889. I now want to make a galvanometer like the one described in SCIENTIFIC AMERICAN of September 21, 1889. Now I wish to know if I could wind it with two coils, one of no resistance and one of ten ohms, and use the resistance column with it if more resistance be required. A. Galvanometers are frequently made and used in the way mentioned.

(3944) Ring Temper says: Can you tell of any method to test the heat of lead used for tempering small steel rings? The best way to heat the lead kettle so as to get uniform heat, said kettle about 14 inches diameter and 16 inches deep? A good practical treatise on case-hardening and tempering? (I already have Brandt's.) A. A pyrometer may be used, but, for the temperature required for hardening, it is less reliable than the eye. For best work with the eye, the furnace should be placed in a moderately dark place, or so shaded that the eye can judge with uniformity of the degree of heat required. The lead pot should be set in brick work in a recess so as to exclude any light from the furnace coming to the eyes. Furnace should be large enough to insure a uniformity of heat without frequent disturbance of the fire by redressing. Have no special work on lead bath.

(3945) J. H. J. asks: How is phosphoric acid H_3PO_4 made? How is sulphurous anhydride SO_2 in a liquid state best prepared? If crystallized boracic acid H_3BO_3 be heated, boracic anhydride B_2O_3 will be obtained. What is the reaction? Can you tell me how blackboard crayons for school use are prepared? A. Phosphoric acid is prepared by burning phosphorus in a current of air, dissolving the phosphoric oxide in water and evaporating to dryness. Liquid sulphurous oxide is made by pumping the perfectly dry gas into a receiver. It liquefies also at 0° F., at the atmospheric pressure. The reaction you ask for is this: $2\ (H_3BO_3) = B_2O_3 + 3\ H_2O$. For blackboard slating use 1 gallon alcohol (95 per cent), 1 pound shellac, 8 ounces ivory black, 5 ounces flour emery, 4 ounces ultramarine blue. Make perfect solution of the alcohol and shellac before adding the other articles. Shake thoroughly. Apply rapidly. Three coats.

(3946) L. O. W. asks: What is the kallitype developer, its composition? I have a receipt for the production of the kallitype process of photography, but it is, however (to my mental conception), very obscure. The developer given is such: No. 1 arg. nitr.—Natrium. cit.—Potassa bichrom., water ammo.

No. 2.	Kallitype developer	℥ss
	Natrium. cit	ʒjj
	Water	℥xx

The printed paper is to be developed in solution No. 1. What, then, is No. 2 for? Then again a third solution is applied, *i. e.*:

Sodæ citr	ʒj
Aqua ammon	ʒjj
Water	℈jj

A. No. 1 is the silver developing solution, No. 2 is a clearing solution, to dissolve out the iron salts unacted upon by light. No. 3 is used also as a clearing solution to dissolve out the unacted upon silver salts. The process has been modified by combining in the sensitizing solution the silver salt and developing the image with a solution of borax and water. See particulars in SCIENTIFIC AMERICAN SUPPLEMENT, No. 815, page 13022.

(3947) J. C. A. asks whether more coal will be required to heat a greenhouse 245 feet long, by steam, with the boiler at one end than if it is at the center of house. A. There should be no difference as to the gross amount of heat imparted to the greenhouse, but it might make a great difference in the uniformity of distribution of the heat. The position of the greenhouse in regard to the direction of the cold winds, in a house as long as stated, will make a great difference in reference to the position of the boiler, which, for best effect, should be placed at the end most exposed to cold winds. Otherwise a central position on the northerly side is the best practice.

(3948) D. D. D. asks: Is bituminous coal or anthracite penetrable by air under heavy pressure? If so, under what pressure? Will air under pressure escape through where hydrogen gas will? What rocks and minerals are airproof under very heavy pressure, say one to two thousand pounds to the square inch, and what natural or chemical preparations or compounds, such as paints and varnishes, are impervious to air under very heavy pressure? A. There are very few rocks or minerals that if solid, are not practically impervious. The solid coal beds hold gas and water. The sandstone and limestones pass air and water under various pressures. Even cast iron is not gas proof under 2,000 pounds pressure per square inch. Rubber and varnishes will go far to render the surface of porous stone impervious to air, gases and water, but will finally flow into the stone and become porous under great pressure.

(3949) J. R. S. asks: What is the best material to use in repairing fire boxes of locomotive boilers, copper or steel plate, where the fire box is made of steel? Please tell me which is the best to use and your reasons, also what is the idea in putting copper liners under the tubes in the fire box. Would they not do as well without copper liners? A. Always use the same material that the boiler is made from for patches. Soft steel plate is the best. The difference in expansion and contraction by change of temperature will make copper patches leaky. Copper ferules or liners are but little used. They were supposed to make a more perfect joint and preserve the end of the tube from burning out by their better conductivity of heat from the end of the tube to the water inside.

(3950) W. C. G. writes: 1. I am trying to coat corks to make them acid proof. What can I use in liquid form that will penetrate enough and will not be removed when putting in the bottle. Must not be injurious or poisonous. A. Heat the corks in melted paraffin wax. The only objection to this process is that it makes them slippery, and if the neck of the bottle is not cylindrical, they will sometimes rise and fall out. 2. Also how can I make a cheap hard grease-proof article resembling marble, or earthenware, not requiring heat, to mould in forms? Must be a cheap composition and have a smooth surface. A. Hydraulic cement and water, plaster of Paris and water, or a mixture of oxide of zinc and strong solution of zinc chloride might answer your purpose.

(3951) E. T. S. asks how to clean wall paper. I have a large hall that I wish to clean. The hall is 100 by 50 feet. The paper is in good shape, only soiled by dust. A. There is no better way of cleaning papered walls than to wipe them down with soft cotton cloths, better by hand, but can be done with a long handled brush to remove the loose dust and then go over with a cloth tied over the brush. For stains use fresh bread crumbs.

(3952) J. B. M. asks: Can you give any information respecting the manufacture of aerated bread? I believe it is a patent process, if so, could you give the address of the patentee? A. Aerated bread was made by a patented process, but the patent has expired. It consisted in charging the dough with carbonic acid gas under pressure and then baking. The use of yeast or ferment was thus avoided.

(3953) C. W. C. says: I have heard it argued considerably whether ice freezes from the top or bottom. Which is correct? Also where can I get a chemical motor with sufficient power to run a sewing machine, or better two of them. A. Ice commences to form on the surface always in still water. Anchor ice is sometimes formed on the rough bottom in swift running water, in very cold weather. We have no information of the manufacture or sale of chemical motors.

(3954) G. E. S. says: We have more or less cold water pipes (iron) throughout the mill, used for hydraulic pulp machines, we are annoyed by the sweat and drip from these pipes. What can they be coated with on the outside to keep them from sweating and dripping? A. The sweating and dripping from the pipes is caused by the contact of the moist warm air in mill with the cold pipe. The only remedy is protection by a non-conducting substance, and may be any of the felting material in use. Hair felt 1 inch thick, covered with thick paper, is very effective; or if thought cheaper, box the pipes and fill with sawdust. Make the boxes to have not less than 1 inch clearance on inside between box and pipe.

(3955) F. S. B. asks how the valve or link motion of the English locomotives is operated. They do not have any reversing lever, and how is it locomotive-makers in this country do not adopt the same systems? A. The English locomotives have the regular link valve gear, with various modifications and reversing lever. The Stephenson valve gear is much used in England and the United States. Our locomotive builders do not go backward. The best valve gears are found on American locomotives.

(3956) G.—The duty on lenses is 45 per cent of their invoiced value. Goods are sold cheaper in England, because the expense of labor is less. A lens may be imported as a tool of trade by a photographer, he carrying it with him, without paying duty.

(3957) J. A. H. writes: On page 386 of December 19 number of SCIENTIFIC AMERICAN there is an article headed "Intense Cold." What is the meaning of absolute zero? A. Absolute zero is the point at which the kinetic motion of the molecules of matter, to which is due what is ordinarily termed heat, ceases, and when the molecules come into permanent contact with each other. It is placed at −273° C. or −459° F.

(3958) T. V. M. asks: 1. Could a submarine torpedo boat (100×20, cigar shape) be run 42 hours by an electric storage battery, there being fluid to fill the cells on board the ship? A. The boat could be run 42 hours with a sufficient number of cells. Extra fluid would not be required, as there is no sensible waste of the fluid. 2. What is the greatest speed and the longest time of an electric storage battery running a boat, and also what is the expense? A. We have no record of the longest time and greatest speed. The possible time would depend on the carrying capacity of the boat, while the speed would be subject to the same limitations as those of steam-propelled boats. The expense depends on the method of using the power, the cost of running the prime motor, and other conditions.

(3959) S. W. T. says: I have a steam gauge that comes back to the pin when steam is down, and when it is exposed to frost and a fire is started, the hand will gradually rise, sometimes to 20 lb., sometimes to 60 lb. Then in a few minutes after the frost is all gone the hand will come back to the pin, and start up all right when steam is up. Please give me a good arithmetical rule by which I can determine the distance apart for screwed stay bolts, and the diameter of stay bolts. A. The pipe connections to a steam gauge should never be allowed to freeze or have water in them when exposed to frost. When water is frozen in the connecting pipe, the gauge hand will move by the expansion of the air above or next to the diaphragm by the change of temperature in the boiler room before steam is made, and when the ice melts in the pipe the hand will move back as described. Sometimes when the water has accumulated to a great an amount, the gauge diaphragm or spring (if a Bourdon) will burst. An air cock should always be placed so as to draw off all water from the gauge when liable to freeze. The usual practice for water leg stay bolts is, for distance, 6 in. to 5 in., according to the pressure and thickness of the iron. For the size of the bolt, square of the distance multiplied by the pressure, and product divided by 4,000 equals the area of the bolt, and for a given sized bolt $\sqrt{\dfrac{4{,}000 \text{ by area}}{\text{pressure}}}$ = distance apart center to center.

(3960) E. S. writes: 1. I wish to wind the dynamo described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 600, as a shunt machine. What size and how much should be used on F. M. to give the proper resistance? A. Consult the description of the Edison dynamo in SCIENTIFIC AMERICAN, vol. lxv., page 66, for points on shunt-wound machines. The field magnet should have 14 times the resistance of the armature. 2. Is not the core of iron wire more efficient than the one of iron washers? A. There is little or no difference. 3. To settle an argument, the meaning of the term ampere hour? A. A current of 1 ampere for 1 hour; ½ ampere for 2 hours; 1-100 ampere for 100 hours. It is the equivalent of 1 ampere of current flowing through a conductor for 1 hour. 4. Would not the machine become more efficient if soft malleable iron were used for the field magnets? A. No. 5. If the dynamo were supplied with a current of 60 volts and 10 amperes, the machine being made exactly as described, would it develop one horse power, or should any changes be made in magnets and elsewhere, and what should they be? A. It would probably develop ¾ of a horse power. 6. What proportions as regards pressure and amperage in electric currents have been found to be the most destructive to animal life? A. Currents of any amperage available commercially with the highest E. M.F.

(3961) P. J. H. asks: 1. What is an automatic cut-off? A. An automatic cut-off is one controlled by the engine or any irregularity in its work, and is made variable by the mechanism of the valve gear. 2. What is a variable cut-off? A. A variable cut-off is a regulating device to make any required fixed cut-off on ordinary valves by varying the position of the riding valve by means of an adjusting spindle projecting outside of the steam chest. 3. A tank of water with a 20 foot head has a one inch pipe 4 inches long screwed in its bottom; what is the discharge per second? Three of my friends have tried it. One makes it 11 gals. per second. Another 28 gals. per second. The third has it at 160 gals. per second. I respectfully submit my way of working it out, which I am told is Haswells' rule. Multiply the square root of 64·333, and the depth of the center of the opening from the surface of the water, by the area of the opening in square feet, and this product by the coefficient for the opening. The whole product will give the discharge in cubic feet per second. Multiply this by 7·48 for the number of gals. per second. A. The rule is correct, but your figuring is defective. You should use the area of a 1 in. pipe instead of a square inch, or 0·00545, and a coefficient of 0·77. We make the discharge 11¼ gals. per second.

(3962) E. R. H. writes: Can you give me any information on the following question through your columns? If the law of physics that "the sum of all the energy in the universe remains the same, though it may undergo changes," is true, what becomes of the energy in this case? A spring is bent and the ends confined together; it is then immersed in acid and dissolved. Are not the resulting substances and conditions the same as if the spring had been immersed without being bent? A. In compressing the spring, work is done upon it and it becomes heated. This heat and any heating of the surrounding air, etc., represents the work. On standing, it quickly cools. Then, on resuming its former shape against a resistance its temperature falls, because it is doing work, and this cooling, together with the cooling of the surrounding air, represents the work done. The cooling and heating are so slight as not ordinarily perceptible. If a rubber band is held between the lips and stretched with the hand, the changes of temperature due to work done upon it, or work done by it, can be easily perceived.

(3963) G. A. S. says: I will be very glad to have you enlighten me as to the cause which makes the little table move and answer questions when using the game called "Ouija, or talking board." A. The hands. Hands off, no go.

(3964) P. W. asks: 1. What is the fluid for a carbon and zinc battery? A. Although the formula for this fluid has been given repeatedly in these columns, we repeat it. Dissolve bichromate of potash or bichromate of soda in warm water, to saturation, then after the solution has cooled add slowly sulphuric acid until the amount equals in volume about ⅛ or 1-10 that of the bichromate solution. Finally add a small quantity of bisulphate of mercury, say 1 drachm, to every gallon of solution to keep the zinc amalgamated. 2. Will solder stick to the copper on electric carbons? A. Yes. 3. What is the difference between the copper on an electric carbon and one paraffined and electroplated with copper? A. When the end of the carbon is soaked in paraffin, either before or after plating, it prevents the corrosion of the copper.

(3965) J. P. R. writes: A contends that there is but one specimen of the banana fruit brought to the United States that has seed, and that none of the other varieties have seed. Take the Aspinwall banana for instance. B says they have seed; B says that most, if not all, the bananas brought to the United States have seed, and that if you cut fruit lengthwise through the center, the rows of dark specks you see are the seed, capable of producing trees if properly propagated. A. Prof. Howard, of the Department of Agriculture, to whom we referred the above, says: So far as is known, none of the cultivated bananas have seed. The wild plant is the only one which has fertile seed. The question as to whether a wild variety exists in the Western Hemisphere is disputed, although there is some evidence that one existed in New Mexico before the conquest and in South America before settlement. There is no doubt, however, of the introduction of the cultivated plant from the Canaries into San Domingo in 1516, from which point it was introduced into the other West India Islands and the mainland.

(3966) W. C. F. writes: I have just completed a motor which you described in a back number of your most valuable paper, and which I find also in "Experimental Science" by Hopkins, and on first trial it started off nicely. I had to make my own battery jars also, which I accomplished by using some one-half gallon bottles that I had. I cut them off very nice and even by first taking one of those cheap glass cutters, such as can be had at any hardware store for 15 cents, and first scored around tops of bottles where I desired, then tied a stout cord previously soaked in alcohol around each bottle at the scored mark, then lighted the cord, at the same time revolving the bottle slowly until the cord had burned off, then by dropping a drop of cold water on the mark, the tops would come off smooth and clean. I mention the above facts that you may enlighten some one seeking like information. About my motor I want to tell you that I first built it according to directions in "Experimental Science" until I got as far as the armature and discovered that it was quite difficult to wind the sections smooth and also get the same amount of wire in each. So I tried my hand at substituting an armature of the same size, number of sections, etc., but of the Siemens, I think that is what you call it. I made it after your directions for the armature of eight-light dynamos, SUPPLEMENT, No. 600, but instead of cutting slots or nicks in the end washers, as you suggest, I took a piece of hard rubber one-eighth inch thick and cut a circular piece large enough to allow of a notch being cut around edge, into which I wound the sections. I found it was much easier to do this than to get the small pieces of hard rubber in as you direct, as they would work loose in winding. I hope this may also help to simplify the work for some one who may try his hand.

(3967) E. A. H. asks how to clean an old mercury bottle. A. Use sand and a little water; shake continuously until coating is removed.

(3968) J. D. writes: 1. I have made the dynamo described in "Experimental Science," page 487. I put the switch at the side for convenience, but the connections are the same as in illustration. The brushes are made with a movable arm, and connected up with No. 14 wire, the field magnet being connected to binding posts with No. 16 wire, which is a continuance of the wire they are wound with. I have a separate driving wheel to furnish motive power, and I can work it, making 2,000 to 2,500 revs. per minute. As a motor it works well any way at all, but rather better as a shunt machine; this seems as if the connections must be all right. The armature is the Siemens H type, wound with No. 18 wire. As a dynamo separately excited from a battery it works well; as a shunt machine without the battery it works well, but when connected up as shown in "Experimental Science," it will not give any current at all. A. Try shifting the terminals of the field magnet. 2. What is the amperage of this dynamo going at the above rate of speed? A. Probably two or three amperes. 3. Ought this dynamo to give current enough to run the simple motor, No. 641, as an experiment, showing the conversion of power into electricity and *vice versa?* A. Yes. 4. How do the hand power dynamo (as a motor with a drum armature), the Parkhurst motor and the simple motor compare with each other? I mean which is the best and most economical to run a sewing machine. A. We do not advise a drum armature for the hand power dynamo; with a suitable battery, there is little difference. 5. Is the battery described with the Parkhurst motor the same as the "Experimental Science" one with 10 cells? How long would such a battery last after being charged? What is the amperage of such a battery with 6 pint cells? A. The batteries referred to are different. They run continuously for a few hours only, say 4 or 5. The amperage would vary from 12 down to one or two. 6. Would the simple motor be more powerful than the others, if core of armature is made of iron rings, with paper washers between, and a projection of iron between every coil, thus bringing the two magnets within one-sixteenth of an inch of each other, or thereabouts, also to have a cast iron field with more iron in the center? A. Yes.

(3969) W. N. B. writes: I have constructed a telegraph instrument by taking two five-sixteenths inch carriage bolts for the cores of the magnets, wound on them enough No. 30 silk-covered magnet wire to make them 20 ohms. The bottom ends of the two bolts are connected with a flat piece of iron and the whole fastened to a wooden base. For the armature I used a small piece of flat iron attached to an iron sounder bar. The magnets are connected with each other properly. The wire from one of the magnets is attached to a brass screw under the key (a wooden key). Another brass screw is put through the key and rests on the one underneath. A wire from the battery is attached to the screw in the key; the other wire from the battery is connected with the wire from the other magnet. The instrument works well on one, two or three cells of battery alone, but when it is connected with a 20 ohm Bunnell instrument on a short line, 3 cells of battery, it don't work well enough to read from it. Where is the trouble why it will not work with other instruments? A. The resistance of your sounder magnets is rather high for a short line. The reason why your instruments will not work with the Bunnell instrument in the circuit is that the latter increases the resistance of the line to such an extent as to reduce the current below that required for working the instruments. Your remedy is more battery or less resistance. The rule is to have the total resistance of the outside circuit equal to the resistance of the battery. In your case the outside resistance is three or four times that of the battery.

(3970) I. J. A. asks: 1. What kind of metal is used in making magnets? A. For permanent magnets tool steel, chrome steel, machinery steel, and case-hardened cast iron have been used. For electromagnets wrought iron is generally used. Low steel is beginning to be used to some extent for this purpose. 2. Would cast iron do? A. It answers a purpose for dynamos and motors. 3. Would wrought iron do? A. For electro-magnets. 4. Do they cover the metal before winding? If so, with what? A. Yes, with cotton cloth, adhesive tape or paper. Sometimes a few heavy coats of varnish are made to answer. 5. What kind of metal does the armature want to be made of? A. The softest wrought iron in the shape of thin insulated plates or wire. 6. How much No. 18 cotton-covered magnet wire ought to be wound on the magnet to make a good one for alarms? A. A good rule is to make the winding equal in depth to the diameter of the core, *i. e.*, make the outside diameter of the coil three times that of the core.

(3971) E. D. F. asks: 1. Is the Serpollet instantaneous steam boiler, described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 664, suitable for a vertical main engine of 4 inch stroke, same diameter, running at 300 revolutions? If so, what would be the dimensions and best kind of tube? Have any improvements been made on it since the description referred to? Could I use it with the Lucigen burner? What is the best material, diameter and pitch for a propeller for a boat, using the above engine and boiler, 21 feet long, 4 feet 2 inches beam and 21 inches draught, and built with very fine lines for high speed? About what speed ought to be got with it? How strong an arc light will a dynamo driven by above engine furnish? What number of volts and amperes should the dynamo be wound to furnish? A. The Serpollet boiler is not in use in the United States to our knowledge. It is a French invention. It belongs to the class of jet feed boilers, that have not been a success for continuous work. It clogs by the use of ordinary water. Your engine should give about 5 horse power and ample for your boat for a speed of 8 miles per hour. Wheel should be 3 blades and 20 inch diameter, 30 inch pitch. The engine should run a dynamo giving 80 volts 12 amperes or for three or four arc lights.

(3972) J. W. M. asks: 1. In winding the motor described in SUPPLEMENT, No. 641, with finer wire (Nos. 24 and 30) to adapt it to the Edison circuit, does it require a greater number of layers and convolutions than with No. 16 and 18 wire, as in specifications? A. The space now occupied by the coarse wire should be filled with fine wire. The resistance of the machine must be greatly increased to adapt it to the Edison circuit. 2. How can the current be reversed in the armature or field magnet without reversing it in both? A. This can be done by means of ordinary reversing switches. 3. Can carbon candles, such as are used in the Edison arc lamp, be utilized in the bichromate plunge battery described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 792? A. Yes.

(3973) S. A. D. asks how many times the fixing bath for the dry plates, the toning bath and the fixing bath for the prints can be used. Also how can sensitized paper be prepared so as to use it after the time stated on the package? I have a quantity which has printed on "to be used three months after date;" the date is July 28, 1891. A. It is advisable to mix a fresh fixing bath for each batch of plates developed, but if sulphurous acid is added to the bath by the trade name of acid sulphite, it will keep the bath clear and enable it to be used several times, provided fresh hypo is occasionally added. The combined fixing and toning bath should be used only once for each batch of prints, otherwise the prints will turn yellow and tone very slowly. One grain of gold is capable of toning prints equal in area to a sheet of paper 18 x 22 inches. The paper may keep longer if retained in a perfectly dry receptacle. Three months is as long as the manufacturers guarantee it.

(3974) J. V. W. asks how to oxidize silver. A. Dip it in a warm, freshly made solution of potassium sulphide. We refer you to the "Scientific American Cyclopedia of Receipts, Notes and Queries" for 8 or 10 other processes.

(3975) M. S. C. asks: Do you know of any process by which Mushet's steel can be hardened and at the same time retain its strength. A. Mushet's steel is self-hardening. You can do nothing to improve it when properly worked at a low red heat and cooled in the air. If it has been injured by overheating, cut off the spoiled part and try again.

(3976) H. D. M. asks: If the speed of an electric car can be increased from eight to sixteen miles per hour, how much more power will it take? A. The power must be quadrupled.

(3977) R. M. C. says: The water of my driven well contains small particles of sand. The pump discharges about ten gallons of water a minute. Can you inform me as to what is the best method to filter the water free from sand? I have tied cloth bags over the discharge pipe with but partial success, as some of the sand works its way through, and in addition a strong back pressure is given to the pump. An ordinary filter quickly overflows. Possibly you may know of some kind of cloth filter or other method which will collect the sand. (About a spoonful of sand to 100 gallons.) A. We can only recommend pumping into a tank large enough to allow the sand to settle by the slow movement of the water across its length. For the quantity that you state a mere trough a foot in diameter and depth and 5 or 6 feet long, with the water flowing into one end and out at the other, should allow of complete settlement of the sand, which could be occasionally cleaned out. Any filter of ordinary size will soon clog. We suggest also that the drive pipe strainer is too coarse. It might well pay to put down a new drive pipe with an extra fine strainer.

(3978) D. B. asks: Into how small parts is silver separated when dissolved by an acid? A. No one knows. The size of the molecule has been approximately calculated, but into the molecule of silver nitrate the silver enters as an atom, or as several atoms it may be. If a drop of water was magnified to the size of the earth, the molecules, it is calculated, would in size be somewhere between fine shot and cricket balls. The atom is still smaller—how much so, no one knows.

(3979) M. E. W. says: I have a range, with a hot water pipe for a bath room. The pipe in the range becomes stopped with scale of lime. What will remove it, or prevent it forming? A. There is no easy way to clear a range pipe of incrustation. A strong solution of caustic soda (3 or 4 pounds of caustic) put into the circulation will soften and break up the scale; but it will largely settle in the water-back, and can only be cleaned out by taking out the water-back. The plumber should know what is best to do. Frequent use of the caustic soda will keep the pipes clear, but with the necessity of cleaning out the water-back each time.

(3980) C. C. P. asks if it is practical to melt iron for foundry purposes with petroleum oil for fuel. If so, what appliances are necessary, and how much oil will it take to melt a ton of iron? And will it make the iron hot enough for light castings? Do you know of any mould for casting sash weights that can be used for any number of weights? A. An oil cupola is a possibility; but we do not know of any in use. Reverberatory furnaces are fired by fuel gas from oil and natural gas. We know of nothing better than a sand mould for cast iron. Possibly some of our readers can enlighten us on this subject.

(3981) W. C. Iron Works says: We want to put a tank, to hold about 2¼ barrels, over our office and bathroom. We drink both cistern (rain) and clear creek water from water works. What will be the best and cheapest stuff that will make an effective cistern? We have thought of galvanized iron, about same kind as oil companies use for their oil barrels, holding about 50 gallons, and have thought of a wooden cistern lined with sheet zinc, same as put under stoves. Which would be best? Would either material injure or poison a person drinking the water? A. For your comfort and health we recommend a stave cistern of cedar, if possible; if not, of good clear pine, open at the top and well hooped. When ready, brush the entire inner surface with hot paraffine, then go over the surface with a large hot iron, hot enough to drive the paraffine well into the wood without burning or discoloring the paraffine. If this is neatly done, and the tank cleaned occasionally, you will have no complaint in regard to sanitary condition of the water. Zinc in contact with water in a tank for drinking purposes is not recommended. It is a source of poison, and does not improve the taste of the water.

(3982) F. L. H. asks: 1. How much saccharated pepsin will be required to digest 1 lb. of pork which is 60 per cent or more composed of fat? A. Pepsin is rated by its power of digesting coagulated albumen. One part of saccharated pepsin in 500 parts water, with 7½ parts hydrochloric acid, should digest 50 parts hard boiled egg albumen in a state of fine division. Pancreatin is especially useful with fat. As the relative digestibility of hard boiled eggs and pork is not far from the same, the above might be taken for the ratio desired. 2. Where can I obtain water glass? The drug stores do not seem to handle it, and say they have never heard of it. Is it sold under a chemical name? A. It is sold by all large drug stores as silicate of soda. Surgeons use it on bandages. 3. What combination of chemical, that is, aniline, colors, will make a chestnut brown, or are there any vegetable colors that will produce the same color, and that are not poisonous to any extent? A. Aniline brown or the juice of walnut husks will produce a brown color.

(3983) G. A. M. asks: 1. What is the number of amperes required by a 16 candle power 50 volt Sawyer-Man lamp? A. One-half ampere. 2. The size of fine wire used in the cut-outs? A. The size depends on the length. You can purchase it of any desired resistance from the dealers. 3. Is there any danger of burning out the cut-outs with a lamp in circuit? A. It is possible in case the lamp is short-circuited. 4. Could No. 36 copper wire be used in place of a lamp? If so, the number of feet? A. Yes. It will require about 12 feet.

(3984) O. W. asks: 1. Will a gravity battery work any better if the blue vitriol is pulverized? A. It will not. 2. What is the approximate number of batteries to be added for each one-half mile of line and each instrument on a telegraph line? A. The resistance of the battery should be equal to that of the line, with the instrument included. 3. Can you give me the electromotive force of a telegraph line tested with a galvanometer (made with a compass) when the needle is standing at 80°? A. The data are insufficient to permit of a reply. 4. In lining the boxes for a large plunge battery described in Hopkins' "Experimental Science," how thick should the gutta percha be? A. 1-16 inch or more. 5. In making carbon plates described in "Experimental Science," to be used in the large plunge battery, how many times should they be boiled and recarbonized to get the required density? A. Two or three times. 6. Would a sheet iron box do to carbonize the same? A. Yes. 7. Could you get the required heat from cook stove? A. Yes.

(3985) J. E. B.—The sample of rock is pyrite (sulphide of iron, FeS_2), valuable for making sulphuric acid by oxidation of SO_2 (sulphurous acid gas) into SO_3, and hydration into H_2SO_4, by means of nitrous and nitric oxides; in short, the old method pure and simple. Its availability depends on its quantity and position. At present sulphuric acid makers are using sulphur, and though a greater profit is obtained by using iron pyrite, it is not as yet extensively employed.

(3986) W. M. V. asks the proper way to test a vacuum gauge to find whether the needle indicates correctly. A. In the absence of any means of producing a vacuum other than by means of your condenser, you can make an accurate test by the use of a siphon mercury gauge with its long leg connected with the vacuum gauge pipe and removing the cap from the short leg. Place a stop cock in the connecting pipe, use the float rod in the same manner as for pressure, only the movement of the rod will be down instead of up. Mark the position when there is no vacuum, and tally with the gauge, as the vacuum forms on starting the engine. If two small glass tubes 3 or 4 feet long can be obtained and cemented into a short U shaped iron pipe, and one leg attached to the vacuum gauge pipe, and the tube filled nearly half full of mercury by pouring into the open leg, you will have a very convenient and accurate test gauge, requiring only an exact measurement of the difference in the height of the column of mercury in each leg for comparison with the vacuum gauge.

The St. C. E. C. Co. ask how to stick labels on tinned plate.—E. K. asks how to cement bone.—G. M. asks how to make Roman candles, with red stars.—H. W. K. asks how to alloy gold.—C. P. asks how to fix drawings in pencil or chalk.—E. O. H. asks how to clean marble.—S. L. B. asks how to make blue prints.—W. S. asks for simple sirup for making pop corn balls, also how to tan skins.—A. W. asks how to make soldering fluid.—A. D. asks how to make perfumery.—A. H. R. asks how to make printer's varnish.—J. V. asks how to make rubber stamp.—J. S. F. asks for a waterproof cement to fasten metal caps to glass.—C. W. P. asks for a petroleum-resisting cement.—D. G. M. asks how the oxalic acid ink remover is made.—H. L. B. asks for a depilatory.—J. F. G. asks how to make cider and vinegar.—H. G. asks for receipts for staining wood.—E. O. asks for a soap powder.—D. M. asks how to remove fly specks.—R. S. B. asks how to etch on cutlery.—D. M. asks for a cement for walks.—J. H. S. asks how to make a soap which will float.

Answers to all of the above queries will be found in the "Scientific American Cyclopedia of Receipts, Notes and Queries," to which our correspondents are referred. The advertisement of this book is printed in another column. A new circular is now ready.

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January 19, 1892.

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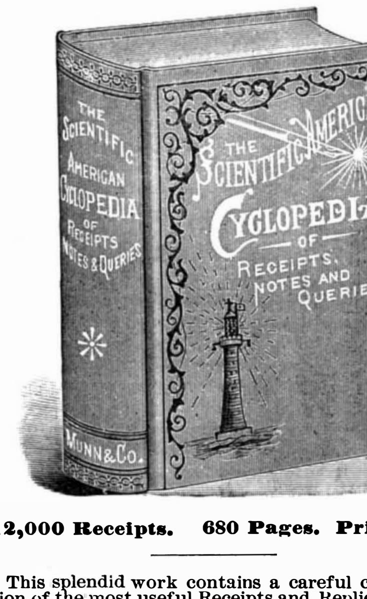

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