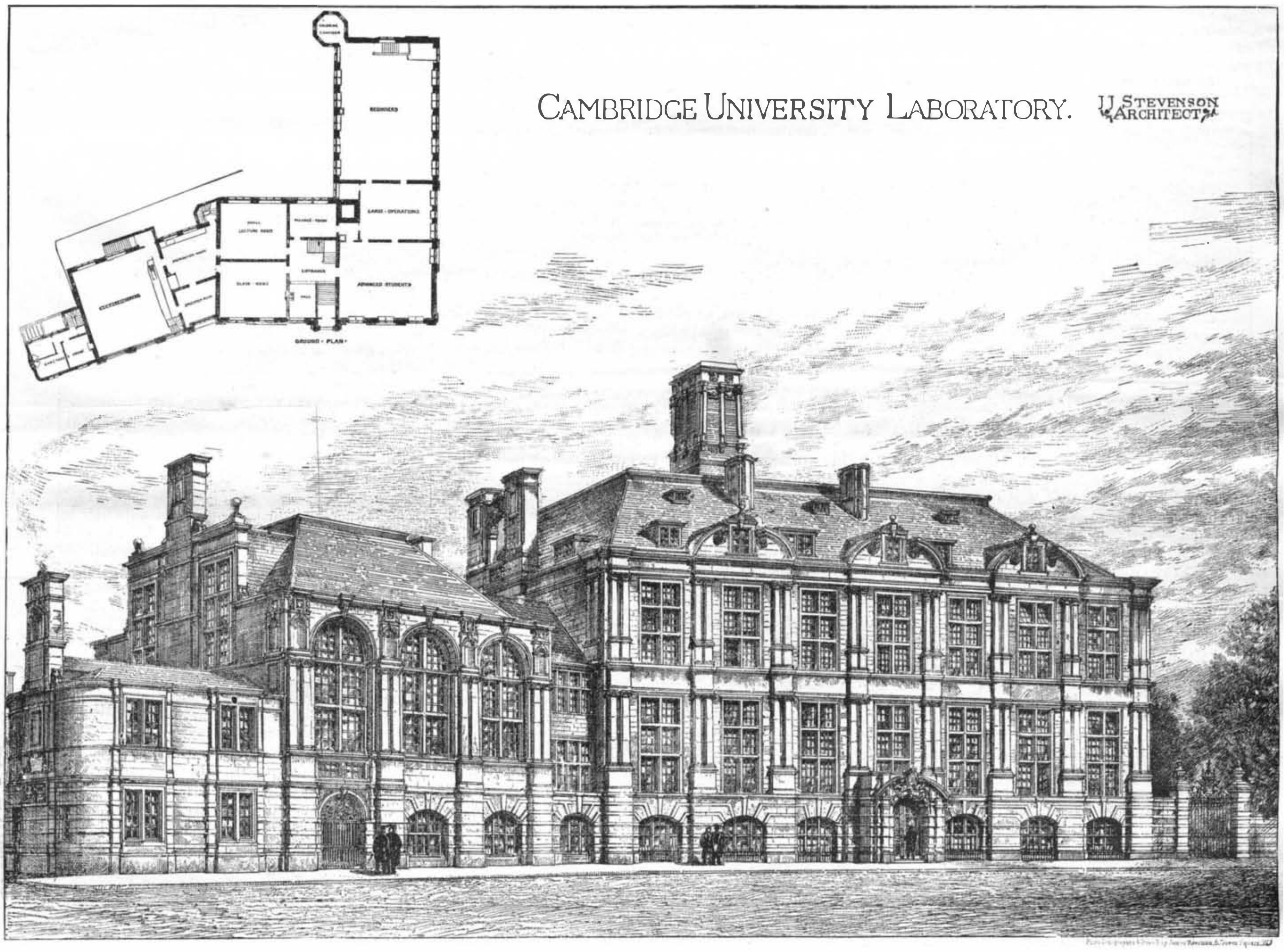
NEW CHEMICAL LABORATORY, CAMBRIDGE UNIVERSITY.

We give this week an illustration of the design for the new Chemical Laboratory of Cambridge University which has been approved by the Senate. The site is in Pembroke Street, opposite the Master's Lodge, and the new building of Pembroke College, on part of the frontage of the old Botanic Garden, and on the site of the Perse Almshouses, now removed, which has recently been acquired by the University for this purpose with the consent of the Charity Commissioners. The remainder of the Botanic Garden frontage to Pembroke Street it is proposed to occupy by the Sedgwick Memorial Museum of Geology. The broken line of frontage has necessitated a corresponding irregularity in the building, which could not have been avoided without loss of valuable space, and which, perhaps, recalls the interest and picturesqueness of old buildings in which such irregularities were not uncommon.

The building consists of a basement well raised out of the ground, occupied by store rooms, engine house, etc., and two smaller laboratories. The main building has two lofty stories above the basement, the central



parts divided into mezzanines. The wing, stretching backward, has one story only above the basement. Provision is made for 150 students working at one time. A second story above this one would give places for 75 more. The principal requirements of a laboratory are ample light and good ventilation. The latter is provided for by the tall chimney or extracting shaft, which, though it carries off the fumes of the furnaces and of the boilers for steam engines and heating, will not, it is hoped, emit any visible smoke, else it might be better without any attempt at architectural ornament. Good lighting is provided by large windows carried square to the ceiling, divided by mullions and transoms with painted wooden sashes and bars, metal being liable to be affected by chemical fumes.

Complicated arrangements for ventilation have been avoided, as being often ineffective and certainly costly. The same large chimney, without any divisions in it, serves for air extractor, ventilator, and for the boiler fires, their heat supplying the necessary motive power, while an extra production of gases from the experiments, which might occasionally occur, is provided for by opening the windows on each side of the room and making a cross draught. A draught closet for operations giving rise to noxious fumes, formed of glazed framework, is provided in each window, with a flue in the wall in which the draught is stimulated by a gas jet, and larger "stink closets" are provided beside the chimney and in the turret at the angle of the large laboratory. This laboratory has been long in contemplation, and the best arrangements for it been studied and worked out by Professors Liveing and Dewar. The principal English and Continental laboratories recently erected have been visited, and their arrangements laid under contribution, with the view of adopting those which have proved successful in practice. The style of architecture adopted is the form of Classic with mullioned windows characteristic of some of the old Cambridge buildings, such as St. Katherine's Hall and the third court of St. John's College, which, while continuing Cambridge traditions, is well suited for the purposes of the building. The view from which our illustration was taken is in the Royal Academy Exhibition this year. Mr. John J. Stevenson is the architect.—*Building News.*

The Post Office in Japan.

In no country of the world is the postal organization more wonderful than in Japan—the chief marvel being that, till about a dozen years ago, there was no regular government institution of posts in the country. In 1871, when Japan awakened like a giant from her long sleep of exclusiveness, and set to work to accomplish changes of every sort, she resolved to establish the European postal system; and with such astonishing zeal has she done her work that within ten years the British, American, and French post offices, which had been established at all the open ports, were closed. foreign nations being satisfied with the thoroughness of the Japanese postal system. In that short period mail routes had been organized over 36,000 miles; mail trains and steamers, post vans, and runners were all enlisted; 3,927 post offices and 7,439 letter boxes had been established; money order offices and post office savings banks were in full operation; 7,500 persons were employed on the regular staff; stamps, stamped envelopes, post cards, and newspaper wrappers were issued at the same rate as our own, letter postage to any part of the empire being at the rate of 1d., and post cards ½d., while within the limits of the city of Tokio these postages are respectively only half price. Where the post office had thus started at full swing it is needless to say that the telegraph was not forgotten, and by 1880 it was in full working order over a distance of about 10,000 miles, and giving employment to about 15,000 persons.—*Cassell's Family Magazine.*

The Health of College Girls.

The investigations which have been conducted by the Massachusetts Bureau of Labor have resulted in some interesting facts regarding the health of female students. The commonly accepted opinion that mental labor, if at all severe or long continued, is prejudicial to health, is here refuted by statistics derived from various sources.

In one case, of 705 returns made, it was found that 78 per cent of the women graduates heard from were in good health. Upon entering college, the health of 20 per cent was below par. After graduation, impaired health was found in only 17 per cent, showing that the physical condition of the student became improved under the restrictions and requirements of college life.

Those whose health was not good suffered chiefly from nervous diseases. It was also found that girls from the country do not make as good a showing as regards health as those who were natives of cities. Although these statistics are looked upon by the advocates of higher education of women as conclusive evidence, we cannot admit that they are sufficiently large or complete to convey much weight. The variation in physical condition, before and after the acquirement of a collegiate education, was only 3 per cent. This fact, which is the one from which any conclusion can be drawn, might be the result of improved hygienic surroundings, both mental and physical, making the effect of study itself wholly negative in character.—*N. E. Medical Monthly.*

Removal of Incrustations from Water Mains by Dilute Acids and Soda.

A successful attempt was made last year in Leipzig to remove by chemical means the incrustation that coated the interior of the force main from the pumping station to the reservoir. The main is 390 millimeters wide (about 15⅜ inches) and 4·55 kilometers long, and the incrustation was from 13 to 24 millimeters thick, and in places thicker still. The operations lasted from the 7th of March to the 11th of May, and during that period at intervals the pipe was filled with dilute hydrochloric acid eight times, with soda solution three times, and with a solution of chloride of lime once, being washed out thoroughly with water between the successive applications. It was stated that the incrustation was entirely removed, and the practical effect of the cleaning was indicated by the pressure gauge, there being a decrease of from 1·8 to 2 atmospheres pressure at pumps.

The Manufacture of Plate Glass by Natural Gas.

The expression "French plate glass" leads one to think that foreign nations make all of this kind of glass. That is far from being the fact. There are in the United States four works for making plate glass. One is located at New Albany, Ind., one at Jefferson, Ind., one at Crystal City, Mo., and the one described in this paper at Creighton, Pa. Plate glass is made by casting and afterward polishing. The pots in which the materials are melted and the glass made are of great capacity, and require heavy and convenient machinery for pouring. The casting is done on a heavy metal slab, larger than the largest sheet of glass produced, and this slab rests on a car which runs on tracks leading from the melting furnaces to the annealing rooms. A large iron roller, running on strips of iron at each side of this table, presses the molten glass into a sheet as the workmen pour it in front of the moving roller. The thickness of these strips of iron, on which the roller rolls, determines the thickness of the plate of glass. While the glass is yet hot it is thrust into an annealing oven, where the temperature is gradually lowered for several days until it is cold. The surface of the glass is now very rough and uneven, and, though it is translucent, it is not transparent. In this form it is used for skylights, and for places where strength and light are required without transparency. After the plate comes from the oven, it is firmly fixed upon a large rotating table or platform, which revolves quite rapidly. Over its surface two disks rotate and revolve in such a manner that they cover the entire surface of the glass at each rotation of the platform. The attending workmen throw common river sand upon the surface of the glass, which is kept constantly wet by small streams of water. This process grinds off the rough exterior, after which it is ground with emery, on machines of similar construction. Beginning with coarse emery, they gradually change the grade until the finest powder is used to finish the grinding. After the grinding is complete, the surface is polished by rouge on machines constructed on the very best principles for making perfect surfaces.

From the time the glass leaves the annealing ovens until it is perfectly polished, the workmen examine it, from time to time, for any flaws, bubbles, or defects, as grains of annulled sand. Only those large plates which are free from defects of any kind are polished entire. When a flaw is discovered in a large plate of glass, the plate is cut into smaller ones of marketable dimensions. This branch of the trade requires trained and skillful workmen who have good judgment. After the glass has been properly polished and cut into required sizes, it is boxed ready for shipment. The manufacturers insure large plates of glass, for which the buyer has to pay. This makes the purchase without risk to the purchaser.

The works of the "Pittsburg Plate Glass Company" are located at Creighton, about twenty miles above Pittsburg on the west bank of the Allegheny River. There are about eight or nine acres covered with buildings, along a side track of the West Pennsylvania R. R., which are used for the various purposes of manufacture, storehouses, furnaces, casting houses, stables, offices, etc. One of the buildings, 650 feet long by 160 feet wide, is the casting house. It contains sixty ovens for annealing glass and two furnaces for melting. Each annealing furnace is over forty feet long by nearly twenty in width. Each melting furnace contains fourteen pots. The apparatus for casting consists of two iron tables, seven inches thick and 19 feet long by 14 feet wide; two iron rollers, thirty inches in diameter and 15 feet long. These tables are on carriages which move on a track which reaches every furnace, and is nearly one mile in aggregate length. There are also cranes, tongs, ladles, and pulleys, which are most conveniently arranged for rapid work. The first building in which the plates of glass meet machinery driven by steam is the grinding house. This building is over 200 feet long by 80 feet wide. There are eight rotary grinding machines in this building. Each machine requires forty horse power, and all are driven by two double vertical engines. There is a second grinding department, which contains two machines of the latest French pattern. These machines require one hundred and twenty horse power, and do most excellent work rapidly.

The glass is smoothed in a building about 100 feet by 200 feet. In this house there are twenty smoothing machines, which require the power of two engines of forty horse power each to drive them. Next in order is the polishing house. This is the same in size as the smoothing house. There are sixteen polishing machines, each eleven by twenty feet, driven by two engines of over eight hundred horse power.

The company make their own melting pots, and in this building a steam engine of thirty horse power grinds and mixes clay. There is a department where plate glass mirrors are made, and this requires the help of a large engine to drive machinery for beveling the edges of plates of glass. This department has proved a perfect success, and many beautiful mirrors are made here, ranging in price from $1 to $500.

There is also a large foundry and machine shop, where all the machines used in the "plant" are made or repaired; and a shop for making boxes, where an engine runs saws and planers. The company employs three hundred and forty-five men, forty-five boys, and fifteen women and girls. They have lately built a steam dredge for collecting sand from the bottom of the river for grinding glass. Three million bushels of sand are required each year for grinding purposes alone. The white sand from which the glass is made is shipped from McVeytown, Pa. The amount of glass cast each month is 95,000 square feet. About 3 per cent of this is used for skylights; the rest is polished, making an output of 70,000 feet of polished glass per month, after allowance is made for cutting and breakage.

The novel feature about these vast works—where engines aggregating nearly 1,500 horse power are fed by steam, and sixty annealing ovens and two melting furnaces require fuel—is the entire absence of coal and the use of natural gas in its stead.

The company owns two gas wells, which are about 1,150 feet deep, and they are now running their entire works with a little over one-half the production of one well. The pressure at the well is 260 pounds per square inch. This pressure is reduced at the well to 120 pounds, and, as the line works wide open, the pressure in the regulator, at the works, is lowered to 80 pounds. The pressure is still further reduced before it enters the furnaces. The pipe which conveys the gas to the works is four inches in diameter. The surplus gas is used in the town for heating and lighting, and as they are able to consume but a small quantity of this, compared with the supply, a tube, high in the air, sends out a large flame which lights up the surrounding country. For domestic purposes this fuel has no equal, and it has no superior for manufacturing. The steel works in Pittsburg use natural gas entirely, melting steel easily with the intense heat produced.

Glass made by this fuel is decidedly superior to that made by the use of coal. No coloring material can get into the melting pots, and the flame of the burning gas is free from impurities which would injure the quality of the glass. Several inches of this glass, when seen through from edge to edge, show no appreciable color. This is the most apparent advantage gained, but there are others of no less importance.

The control which the workmen have over the heat in the melting furnaces, and especially in the annealing ovens, enables them to make glass of great durability and strength.

At present the company are in a flourishing condition, and have all they can do to supply the demand for goods. They make glass cheaper than any other plant in this country, and can compete with either the French or the English, inasmuch as their fuel costs them practically nothing; the gas used taking the place of three thousand bushels of coal per day.

How to Make a Glycerine Barometer.

BY J. ASHER.

In 1876 I improved Babinet's barometer by substituting glycerine for water. It is constructed in the following manner: A bottle about a quarter filled with glycerine, colored red with magenta or crimson aniline, has a glass tube of about the diameter of a pencil passing airtight through the cork, which is inserted airtight into the bottle. The lower end of the tube dips beneath the surface of the glycerine. The bottle is made to contain compressed air by blowing into the upper end of the tube. On removing the mouth, part of the glycerine will rise in the tube until the weight of the liquid column in the tube and the atmosphere balance the internal air pressure on the surface of the glycerine. The column in the tube will tend to rise when the pressure of the atmosphere diminishes or the temperature of the compressed air rises, and to fall when the atmospheric pressure increases or the temperature of the compressed air diminishes. So far as the variation in the height of the column is due to changes in atmospheric pressure, the column moves in the opposite direction from that in a mercurial barometer.

It will now be seen that it is desirable to eliminate from the reading of the barometer scale the effect due to a change in temperature. I simultaneously observe the reading of my barometer and a thermometer at hand. I next find the difference between the readings, calling that of the thermometer the minuend. The difference is regarded as the relative pressure of the atmosphere at the time of observation. The divisions on my instrument are one-fourth of an inch apart, and the length of the tube above the bottle is 25 inches. It seems better to have 100 divisions than any other number. These divisions bear no relation to those on mercurial and aneroid barometers. Each instrument is intended to be compared with itself to indicate a relative pressure of the atmosphere. In my instrument the degrees are marked and numbered with a pen on a strip of paper obtained from a ribbon roll; this is pasted upon a neat wooden case behind the tube. The case has a recess into which the bottle is let. A neat piece of wood, of the proper shape, secures the bottle, while leaving it almost entirely in view. Two small wire staples secure the tube to the scale. If desirable, a paper scale may be pasted upon the tube, thus dispensing with a case.

Of course, it is liable to be broken when thus constructed. The use of a thermometer is scarcely necessary if the barometer is kept in a cellar or any place where the temperature is nearly uniform.

With a tube 3 or 4 feet long, the bottle may be buried in a large box of dry sawdust, or any other poor conductor of heat, in a finely divided state. The instrument will then give fair results without using either a thermometer or a cellar.

The advantage of using glycerine instead of water, as used by the French scientist Babinet, is that glycerine scarcely evaporates; besides, it will not freeze except at a very low temperature, and if a minute quantity of water be present, it never becomes solid.

A thin glass tube, 4 feet long, can be bought for 10 cents at the drug stores in cities. The glycerine and magenta will cost less than 5 cents. By making an ornamental case one may, with a little ingenuity, produce a beautiful instrument. It will foretell fair, changeable, and stormy weather as well as a mercurial barometer costing thirty times as much. One evening I noticed that the column of glycerine had risen about three inches within a few hours, not a cloud was to be seen, and the day had been very fine. Next morning there was a heavy rain.

The upper end of the tube should be loosely filled with cotton to keep out the dust. After having forced air into the instrument, it should not be allowed to approach a horizontal position, for the compressed air may blow the column out of the tube; if this does not happen, a large air bubble may separate the column, and render the instrument useless. No particular dimensions are requisite for either the bottle or the tube. My bottle is about 4 inches long and an inch square. The magenta is used merely to render the column more readily visible. Other colors may be used, but this is the most beautiful.

Were farmers provided with these simple and useful instruments, they would most likely be the means of saving grain in harvest, as storms could often be foretold.

Phosphate Deposits of South Carolina.

A member of a New York firm who has just received an order for dredges for use in excavating phosphate in South Carolina reports that industry as especially prosperous, and that 500,000 tons of this material is now being dug up as against 350,000 tons in 1883. The phosphate rock bed of South Carolina now supplies the world with the chief part of all the phosphate of lime used in the manufacture of commercial fertilizers, and this industry was unknown there until 1868. The greatest length of this phosphate rock bed is about seventy miles and its greatest width about thirty miles, the city of Charleston being about the center of the most accessible deposits. It crops out at the surface in many places, and is found distributed over large areas at the bottom of many of the rivers. It is mined in three ways—by open quarrying and digging in the land; by dredging and grappling with powerful steam machines in deep water; by hand picking and with tongs in shallow streams. Its average price is about $6 a ton, and the State levies a tax of one dollar a ton on all that is shipped, making it an important item of revenue. These phosphates are the remains of a very ancient animal life, and fragments are brought up not only representing the tapir, horse, elephant, and mastodon, but amphibious ones, such as the seal, dugong, walrus, etc.

A 500 Pound Pressure Engine.

On July 21 the screw yacht Salamander, which has just been built by Messrs. Schlesinger, Davis & Co., of Wallsend-on-Tyne, proceeded to sea for a preliminary trial trip. The dimensions of the yacht are as follows: Length, 120 feet; breadth, 20 feet; depth, 10 feet 6 inches; tonnage, 211 y.m. She has a sharp clipper stem, with an enlarged salamander for a figurehead, and a square yacht stern. A long deck house is placed amidships, containing a deck saloon, and forward is another saloon, which will be arranged for the accommodation of ladies. The engines are of the Perkins triple-expansion type, working at a pressure of 500 pounds per square inch. The cylinders are $7\frac{3}{4}$ inches, $15\frac{1}{8}$ inches, and $22\frac{7}{8}$ inches diameter, by 15 inches stroke, and will work at about 140 revolutions per minute. After several trials on the mile the average speed obtained was nearly nine knots per hour. The yacht has been built to the order of Mr. Frederick Power, of London.

Paper for Wrapping up Silver.

Six parts of caustic soda are dissolved in water until the hydrometer shows 20° B. To this solution are added four parts of oxide of zinc, and boiled until dissolved. Sufficient water must next be added to reduce the solution to 10° B. Next dip paper or calico into this solution and dry. This wrapping will very effectually preserve silver articles from being blackened by sulphureted hydrogen, which, as is well known, is contained in the atmosphere of all large cities.

Scientia.

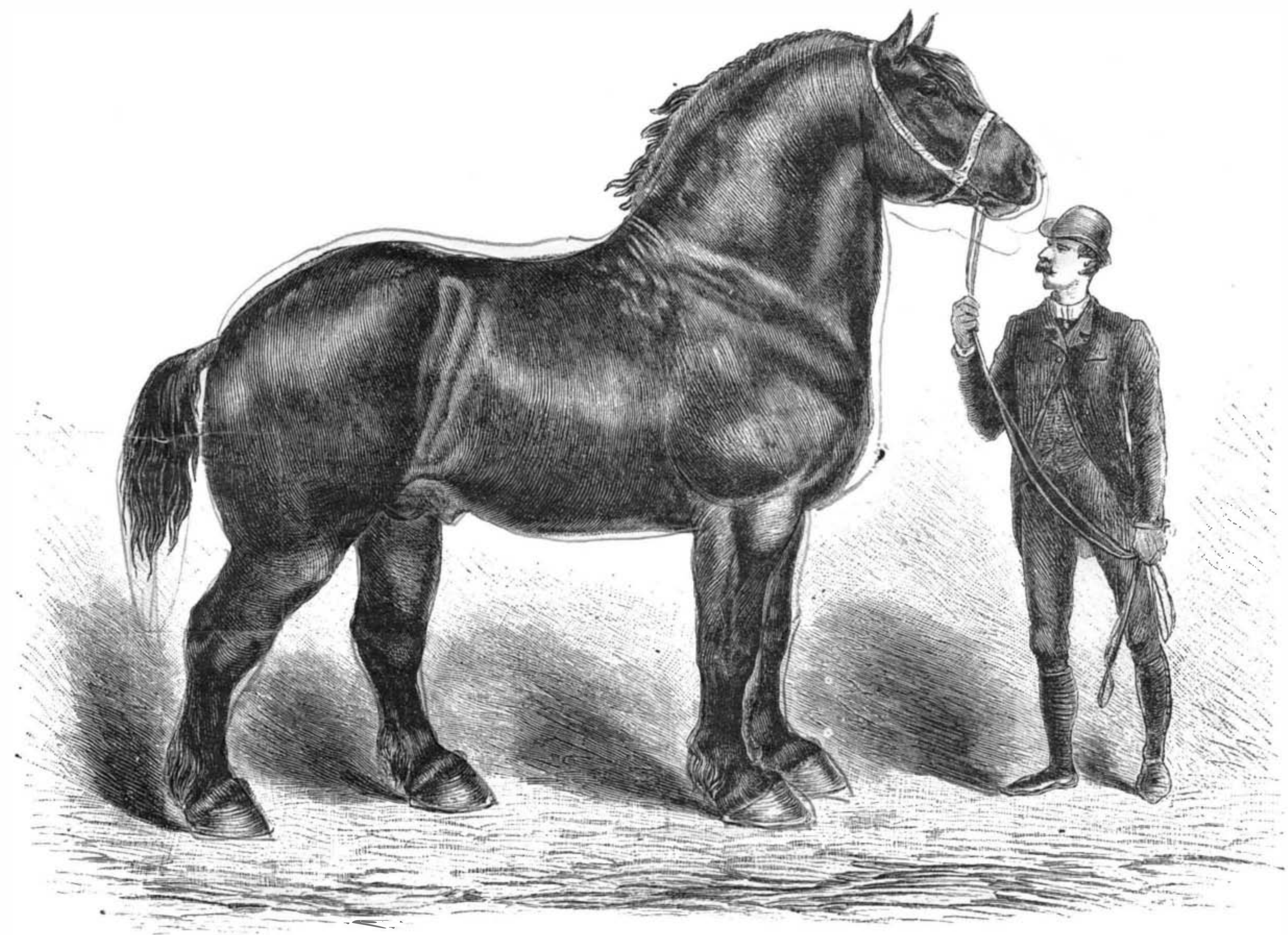
A new scientific association, comprising a small number of very distinguished members, has been formed in Paris under the name of "Scientia." The object of the association is primarily the promotion of scientific knowledge, but the members have taken advantage of the present smallness of their number to give to their meetings something of a social character, and enliven them with a dinner, at which, as with many clubs which meet only occasionally, some eminent person is usually present as a guest. At the last of these meetings, as we learn from *Le Genie Civil*, the guest of the evening was General de Nansouty, the originator of the plan for establishing an observatory on the top of the Pic du Midi, about which we have already had something to say. This mountain constitutes a somewhat isolated spur of the Pyrenees, and rises to a height of more than seven thousand feet above the sea. Although not high enough to reach the limit of perpetual snow, the top of the Pic du Midi is exposed to terrible winds, and in winter is buried in snows which make the ascent to it impracticable.

Nevertheless General de Nansouty, who had been strongly impressed with the value of the mountain, commanding, as it dces, the great southern plain of France, as a site for a meteorological station, resolved to attempt a thing that the mountaineers said was impossible, and to pass a winter in a hut at the very summit of the peak. He collected materials, and during the summer constructed a little cabin, which he stocked with provisions and instruments, and put in communication with the outer world by means of a telegraph wire. Before the winter fairly set in, he established himself in his little hut, and there, cut off by the snow from either rescue or retreat, he stayed until spring opened again the way down to the plain. In spite of cold, hunger, and loneliness, he pursued his observations and kept his records, fortifying himself under adversity, as M. Tissandier said in introducing him to the club, by remembering that he was a soldier, bound by his profession not to yield to any force which he had not tried his strength against and found irresistible. Like a soldier, too, the General remembered, through all his privations, to gain what advantage he could for the benefit of the poor people about him, and used his telegraph to send word to the farmers on the plains when the melting of the snow on the peak showed an inundation would soon follow below. After a few winters spent in this manner, a permanent and well-equipped station was, as our readers know, built in place of the little cabin, and a staff of observers established there; and within a short time M. Raphael Bischoffsheim has promised to build an astronomical observatory by the side of the meteorological station. If this promise is carried out, the astronomical observatory of the Pic du Midi will probably soon become as useful to science in its own way as the meteorological observatory. The experience of every year shows more clearly the advantages of placing astronomical observatories, particularly those equipped with powerful telescopes, on the tops of mountains. The one thing essential to the use of high powers in the telescope is a clear atmosphere, and, pure as we think our atmosphere is in clear nights, its transparency is so far inferior to that of the air about mountain tops that, seen from the latter, the atmosphere of the plain always appears filled with haze, which certain conditions of sunlight show to be due to perpetual clouds of dust, kept by gravitation in the lower regions of the air.—*American Architect.*

A BELGIAN HORSE.

Admirers of the paintings of Rubens and other Dutch masters are astonished at the peculiar shape of some of the horses represented, and attribute it to the fancy or peculiarity of the painters. This is by no means the case, for these masters only painted true and exact pictures of the horses of their country, one of which is shown in the annexed cut, taken from the *Illustrirte Zeitung*. The horse represented in the cut was raised in Belgium by a peasant, and lately imported into Germany. This horse is about 6 feet high, and weighs 1,800 pounds. It is said to be the strongest horse in the world, but we have no particulars of his performances. Notwithstanding its size and weight, it can be used very well for carting, pulling heavy loads, etc., and is more active than might be expected.

About 25,000 horses are exported yearly from Belgium, most of which are raised by small farmers.



THE STRONGEST HORSE IN THE WORLD.

Two Singular Lunatics.

The Morristown *Jerseyman* tells of a lunatic at the Morris Plains Asylum who was mute for five years. Even the physcians thought he had lost the power of speech. One day two of his fingers were mangled in a washing machine. To the astonishment of everybody who heard him he exclaimed: "By the great and jumping Moses, a devil is better than an inventor." That was three years ago, and he has not spoken since. Another patient, a boy in the same institution, is a lightning calculator. The most intricate problems are solved by him in fractions of a minute. The boy believes that his head is filled with little blocks with figures upon them, and they instantly fall into different positions and work out the problems. He thinks his brain, in fact, is a multiplication table. His insanity seems pardonable, for only a few sane men can compete with him as a mathematician. Every day he soaks his head in water to prevent the blocks from rattling, and occasionally he begs for oil to put into his ears, so that the imaginary squares will slip upon each other more easily.

Oleomargarine Legislation.

Certain farmers and buttermen in New York succeeded in getting a law passed in 1884 designed to suppress the manufacture of oleomargarine. Sec. 6 reads as follows:

Sec. 6.—"No person shall manufacture out of any oleaginous substance or substances, or any compound of the same, other than that produced from unadulterated milk, or of cream from the same, any article designed to take the place of butter or cheese produced from pure, unadulterated milk or cream of the same, or shall sell, or offer for sale, the same as an article of food. This provision shall not apply to pure skim milk cheese, made from pure skim milk."

It was provided that the violator of this section should be punished by a fine of not less than $100 nor more than $500, or not less than six months or more than one year's imprisonment, or both such fine and imprisonment, for the first offense, and by imprisonment for one year for each subsequent offense.

The court of appeals, the court of highest resort, decided, June 16, 1885, that the law attempted to prohibit the sale of any articles intended to take the place of butter, thus preventing competition and placing a ban upon progress and invention; that invaded the rights both of persons and property, guaranteed by the constitution; that the sale of a substitute for any article of manufacture is a legitimate business, which, if carried on without deception, cannot be arbitrarily suppressed; and that the act in question was not aimed at deception, but went further, and created a monopoly destructive of rights protected by the constitution both of the State and of the United States. In effect, the decision declared lawful the manufacture and sale of oleomargarine when it is offered in market under its true name, and not as an adulterated form of butter, and when it is shown to be composed of pure ingredients.

Artesian Well in Moscow.

This well was opened on the 1st of January, 1885. Boring was begun in 1865, but in 1871 the boring tool broke at the depth of 1,512 feet, and all efforts to extricate it were useless. In 1876 the work was abandoned. In the mean time, however, the water filled the bore to within 40 feet of the surface, and as it was found that this height remained constant, a new plan was adopted. A gallery was excavated from the bank of the Jaonsa River to the well at a level low enough to permit the water to run into a reservoir at the other end. The gallery runs through limestone strata, is 1,400 feet long, and has a fall of 4½ feet. The water is pure, cold (8° R.), and flows abundantly, the daily supply being 770,500 gallons; this is nearly half the whole quantity of water supplied to the city of Moscow. This well ranks among the largest in Europe.