Completion of the Great Bridge across the Niagara River.

The great international bridge across Niagara River from Buffalo to Fort Erie, in Canada, has b en lately completed. The Buffalo *Commercial Advertiser* furnishes the following interesting description:

"To state the fact roughly but plainly, the entire length of the bridge is about three quarters of a mile. But more in detail the length is as follows: In the main river, 1,800 feet; over Squaw Island, 1,300 feet (trestle work), and over Black Rock Harbor, 450 feet. The entire length of the superstructure in the main river is 1,890 feet; in Black Rock Harbor, 440 feet. There are nine spans in the portion on the main river and three in the Black Rock Harbor: four of 190 feet in the clear, and three of 240 in the clear. Over the main river also are two draw openings, of 160 feet each; total length of draw girder, 362 feet. In Black Rock Harbor are two draw openings of 90 feet each, and one fixed span 220 feet in length. In the main river are eight piers and two abutments; and in the harbor, two piers and two abutments. The abutments are 40 feet long by 30 wide at the bridge seat level. Over the bridge is laid a track for railroads, and a common sidewalk for foot passengers. The piers and the abutments are built of sandstone from Georgeown and Acton, Canada, and from Berea, near Cleveland, Ohio.

The iron of the superstructure was from the Phœnixville Iron Company's Works, Phœnixville, Pa. The first caisson was launched on the 13th of July, 1870, and work progressed steadily up to the time of completion. It must be remembered that the current of the river, at the point where the bridge is located, runs from five and a half to ten miles an hour, according to the state of the wind. This was throughout one of the greatest difficulties encountered, and frequently retarded progress. Then, too, the depth of water varies from twelve to forty-five feet. The ice in winter, some may think, would damage the bridge in course of time, but the ice breakers afforded ample protection, and cut to pieces blue ice two feet thick with comparative ease. Another remarkable thing connected with the history of the bridge is that, during the whole course of the work, not a single life has been lost. The workmen have, many of them, often been exposed to dangers, but always have escaped.

The respective weights of the different spans over the river are as follows: 190 feet, 130 tuns; 240 feet, 208 tuns; 362 feet draw, 353 tuns; and the entire quantity of iron used in the whole bridge amounts to upward of 2,000 tuns. At the request of Captain Tyler, the English Government Inspector of Railways, who visited the bridge in November, 1871, on behalf of the Englishshareholders, one of the spans of 190 feet was loaded with 210 tuns of iron rails, equally distributed over the floor beams (a weight greater than that of a continuous train of locomotives covering the span), and left in that condition for three days. This test was highly satisfactory, the deflection being found to be only about one inch, and the truss returning exactly to its former condition on the removal of the load.

The bridge has been leased, to the various railroads which will cross it, for twenty years. The roads are the Grand Trunk, the Great Western, the Canada Southern, the New York Central, the Erie, and the New York, West Shore and Chicago. Most of these railroads have already constructed their approaches to the bridge, and will commence sending trains across at as early a day as possible. The original plan contemplated a carriage way, but this was abandoned for the reasons that, as the bridge was three quarters of a mile long and so many trains were to cross it, there would very seldom be a chance for carriages to cross without interfering with the trains.

The entire cost of the bridge, in round numbers, is not less than $1,500,000. Of its practical benefits we leave the reader to judge, merely stating in conclusion that it supplies a want long felt by the different railroads which have for so many years been obliged to cross the Niagara River on the steamer International.

New Comets.

The present year is marked by the discovery of quite a number of new comets, and the re-observations of others previously noted but since invisible. Particularly is this the case in comparison with 1872, when only one of these vagrant bodies, and that a fragment of Biela's comet, was seen. Up to the current date seven have been observed, which were found as follows: No. 1 on the 3d of April, by Stephan at Marseilles. This comet is identical with No. 2 of 1867, originally discovered by Tempel. The second body is a new one, and of short period, and was noted by Tempel on July 3 at Milan. Another new comet was observed by Breolly at Marseilles on August 20, and a fifth, of considerable brilliancy, passing southwardly, by Paul Henry at Paris, on the 23d of the same month. On September 1, Stephan, of Marseilles, obtained feeble views of Brorsen's, and on the 3d of Faye's, comets. Another new discovery was made on November 10 by Le Verrier at Paris, of a comet which has a slight motion to the southwest, and the last new arrival has been found on November 11 by the Vienna Academy of Sciences.

Professor Kirkwood suggests that persons having the use of comet seekers will do good service to astronomy by searching for these wandering celestials at the present time. It may be added, as an incentive, that the Vienna Academy offers a gold medal for every new discovery.

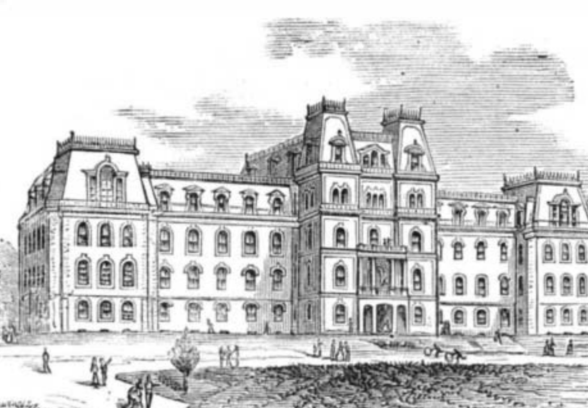
PARDEE HALL AND ITS FOUNDER.

We recently noted the formal donation, by Mr. Ario Pardee, of a large and handsome edifice to Lafayette College, at Easton, Pa. The building, which has been named Pardee Hall, is to be used as the scientific department of the institution. We give herewith an engraving of the structure, and a portrait of its liberal founder. The edifice, to the erection and fitting up of which $250,000 has been devoted, is situated on an elevated knoll in the eastern portion of the college grounds. It has a total frontage of 256 feet, and its main building is five stories high, and extends back for a distance of 61 feet. On each side are lateral wings, 61 feet in length and 31 in width, joining which, at their extremities, are cross wings, 42 feet front by 82 feet in depth.

MR. A. PARDEE, FOUNDER OF PARDEE HALL.

The architectural effect is quite imposing, the handsome mansard roof and two turrets giving a massive appearance to the whole. The material used in construction is Trenton brown stone, with light Ohio sandstone trimmings.

The first floor contains metallurgical lecture rooms and private laboratories, apartments for the study of blowpipe analysis, assaying, ore dressing, and similar branches. Extraordinary facilities are afforded for instruction in the science of mining, there being, among other interesting objects, a complete model of coal mine plant operated by steam, from which the functions of all the different machines and processes can be seen at a glance.



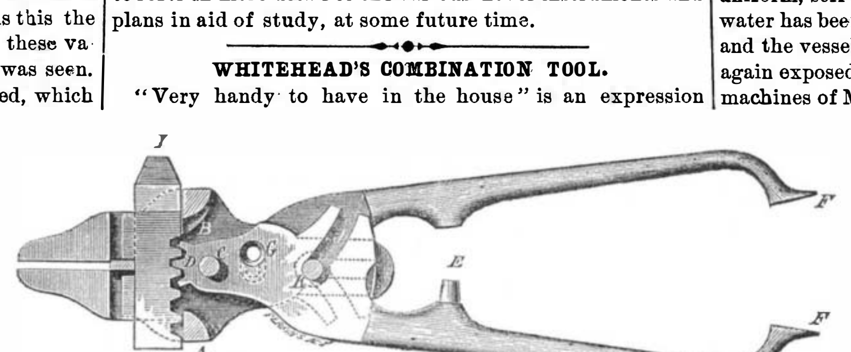
PARDEE HALL, LAFAYETTE COLLEGE, EASTON, PA.

The second story is devoted to geological and mineralogical cabinets, which are arranged to adjoin a spacious lecture hall. Valuable collections of specimens relating to the sciences of mineralogy and geology have been provided, together with necessary apparatus, books, etc. The third floor contains the cabinets and lecture rooms for the classes in the various branches of engineering, and the two upper stories are fitted up with every requisite for the study of chemistry.

The contemplated supply of apparatus has not been placed in the building, so that we shall probably find it necessary to refer in more detail to the various novel instruments and plans in aid of study, at some future time.

WHITEHEAD'S COMBINATION TOOL.

"Very handy to have in the house" is an expression which may be unhesitatingly applied in reference to the useful little invention depicted in our engraving. It is a small tool chest compressed into a single implement which may be readily carried in one's pocket.



There is a double flanged frame or casing, A, which is connected by supports, B. Pivoted at C are the handles which, at their rounded ends, have teeth, D. On a projection on one of the handles is a punch, E, and at their ends are longitudinally projecting pieces, F, the inner extremities of which serve as calipers and the outer ends as the points of a pair of dividers. Both handles are provided with conical holes, G, corresponding to similar apertures in the frame. These are not placed centrally above each other, but some distance to the right and left of the longitudinal axis of the tool, so that the sides of the orifices act, on closing after opening the handles for the admission of a wire, like shears, cutting the same at the point desired. Two straight shanks, H, are wedged transversely into the frame, and slide on the guiding supports. Their lower sides are supplied with a series of teeth which gear into teeth, D. Attached to the shanks, and at right angles, are jaws which act as pliers. One of the shanks is also provided with a steel blade, I, which serves as a screwdriver. The curved slots, J, correspond with longitudinal slots in the frame which guide the connecting bolt, K. The latter is formed in square shape so far as it moves in the lower guide slot, and at its upper end is threaded and provided with a thumbscrew; when the thumbscrew is loose, and the handles are opened and closed, the bolt, K, is caused by the slots, J, to traverse in the longitudinal slots of the frame, and to produce a parallel movement of the jaws and their application as pliers. By tightening the thumbscrew the jaws may be set and used as a hand vise. The tool may be made of malleable iron, steel or any other suitable material.

It was patented June 10, 1873, through the Scientific American Patent Agency, by Mr. H. B. Whitehead, of Holly Springs, Marshall county, Miss.

Ice-Making Machinery at the Vienna Exposition.

The making of ice by artificial means is a matter of rapidly increasing importance, not only on account of the increase it affords in our domestic comforts, but also on account of its usefulness in many manufacturing branches. The ice-making machine has already been of great service in breweries, as it renders the brewer independent of the supply of natural ice, while the ice machine may also be used for the direct cooling of the air and the wort. Besides, ice made artificially by machinery is colder and therefore harder than natural ice, a fact which has clearly been proved by experiments lately made, when equal weights of both artificially and naturally produced ice were placed in warm water of equal temperature, the result being that the artificial ice took more than twice the time for melting that was required by the natural ice.

At Vienna were exhibited three ice-making machines, one by Messrs. Siebe and West, of Lambeth, London, one by Messrs. Vaas and Littman, of Halle on-the-Saale, and a third by the *Actien-Gesellschaft für Fabrication von Eismaschinen*, formerly Oscar Kropff and Co., of Nordhausen, Prussia. The principle applied in Messrs. Siebe and West's machine consists of the production of a cold temperature by means of the evaporation of ether, and of the continued use of the same ether without any significant loss. The machine consists of a refrigerator, a condenser, an air pump, and an icemaking box. The machine works in the following manner: As soon as the air pump is put in motion, the ether in the cooling vessel evaporates, and, of course, absorbs heat from the tubes by which the cooling vessel is traversed. The ether vapor thus produced is forced by the air pump into the condenser, where, under the combined influence of the pressure and the cooling action of the water circulating through the condenser, it resumes the liquid form and returns through a small tube to the refrigerator, in order to be there again changed into gas.

This process is continued with the use of the same ether as long as the machine is kept working. The great cold produced in the cooling vessel acts on the fresh water to be frozen in the ice box by means of a current of salt water introduced into the tubes which pass through. The temperature of the salt water decreases quickly on its way through the refrigerator on account of heat being absorbed from it by the ether changing into gas, and it then circulates, with a temperature considerably below the freezing point in the ice box, round a number of iron or copper vessels filled with the fresh water to be frozen into ice. The salt water, the temperature of which increases again by coming into contact with the vessels containing the fresh water, is taken back to the refrigerator, where its temperature is again reduced. The process of freezing is thus uniform, self-regulating, and uninterrupted, until the fresh water has been changed into ice. The latter is then removed, and the vessels are filled again with fresh water, and are again exposed to the cooling of the brine current. These machines of Messrs. Siebe and West's are now constructed like horizontal steam engines; they are exceedingly simple and compact, and have a steam engine attached, or may be worked from an existing shaft. The ice is made in single cakes, weighing between 8 pounds and 100 pounds, according to the size of the machine. If these cakes are placed one upon the other, they freeze together, so that blocks of any size may be formed. It is stated by Messrs. Siebe and West that they can produce from 10 pounds to 30 pounds of ice with their machines for two cents, and that one pound of coal produces between 3 pounds and 10 pounds of ice. The time taken in removing the ice and refilling the freezing vessels for the next operation occupies from 30 to 60 minutes. Messrs. Siebe and West state further that a temperature of 50 degrees below zero Fah. has been obtained with this apparatus, and that from 50,000 to 500,000 cubic feet of air may be cooled per hour to 30 degrees Fah., or a smaller body of air to a lower temperature. The ice made by this machine at the Vienna Exposition was beautifully clear and