tude of the animal to which it belonged—this being only a portion of a bone which, when complete, is presumed to have been 7½ to 8 feet long, and formed part of a leg fully 12 feet in length. These remains have been pronounced by Professor Marsh of Yale College to belong to the cretaceous period, and to be those of a new and gigantic species of *Dinosaur*—the largest ever discovered, and the largest known land animal; he names it *Titanosaurus montanus*, and estimates the creature, when alive, to have been fully sixty feet long, and when standing erect on its hind legs, after the custom of *Dinosaurs*, to feed on the foliage of the mountain forests, to have been eighty-five feet high.

With the *Titanosaurus* were found other *Dinosaurs*, one not larger than a cat (*Nanosaurus*), also the remains of a turtle, an almost perfect crocodile's head, with teeth, and several procælian vertebræ. Of these Professor Marsh says, in his address before the American Association, at Nashville, Tenn.: "The beds of the Rocky Mountain Wealden have just provided us with a genuine 'missing link'—a saurian *Diplosaurus*, with essentially the skull and teeth of a modern crocodile, and the vertebræ of its predecessor from the Trias. This peculiar reptile clearly represents an important stage in the progressive series, and evidently one soon after the separation of the crocodile branch from the main stem."

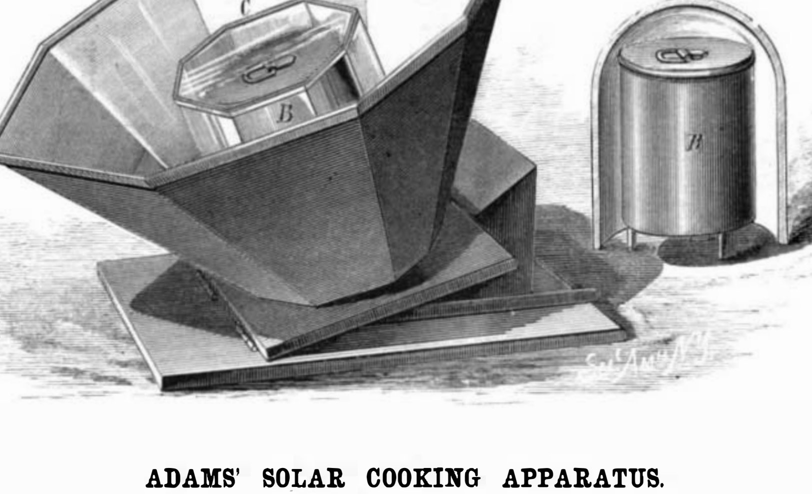
The sketch (made on the spot by a correspondent of the London *Graphic*) on page 375 represents the bones after they had been freed from their rocky surroundings, before being packed and forwarded to the Yale Museum. These excavations have been carried on by Professor Lakes since March of last year, with all the eager interest of a Layard disinterring Nineveh, or of a Schliemann exhuming Troy.

COOKING BY SOLAR HEAT.

To the Editor of the Scientific American:

I send you a short account of my experiments, made in Bombay, on the utilization of solar heat for cooking. The accompanying engraving will give an idea of the principle of the cooking apparatus. It consists of a conical reflector, A, made of wood and lined with common silvered sheet glass. Inside there is placed a copper cylindrical vessel, B, covered by a glass cover, C. The cooking vessel is raised about four inches from the bottom, and the glass cover is five inches longer than the vessel, and two inches wider, which leaves an interval of four inches of hot air under the boiler and one inch all round and at the top. The wedge under the apparatus is to keep it inclined, so that the rays of the sun may fall perpendicularly on the boiler. Glass being diathermanous to the direct or reflected rays of the sun, and non-diathermanous to obscure heat, the rays penetrate the glass, and, striking on the vessel, become transformed into obscure heat, when they are retained by the glass. The glass cover over the boiler is made octagonal, because, in that form, common window glass can be used. Of course a glass dome, such as is used for covering clocks or statuettes, would be better, and, equally, of course, a copper reflector electroplated with silver would be better than my reflector; but both of these articles are made octagonal in order that cheap material may be employed. The position of the apparatus requires to be changed about every half hour, to face the sun in its apparent course from east to west. The rations of seven soldiers, consisting of meat and vegetables, are thoroughly cooked by it in two hours, in January, the coldest month of the year in Bombay, and the men declare the food to be cooked much better than in the ordinary manner. Several people in Bombay and in the Deccan have tried it, and always with success. If the steam be retained the dish is a stew or a boil; if it be allowed to escape the food is baked. The reflector is two feet four inches in diameter. The intensity of the heat is increased by increasing the diameter of the reflector. One advantage of this apparatus is that the food will keep hot for a long time after the apparatus has been withdrawn from the solar rays. I withdrew it at 4 P. M., brought it into a room, and threw a railway rug over it. At 8 P. M., when it was uncovered, the metal vessel was too hot to be handled by the bare hand. I have a letter from a Surgeon General in the service, which informs me that he cooked a leg of mutton in it, and that it "kept hot for four hours" after having been removed from the air.

I am getting one made six feet in diameter, which will differ from that represented in the engraving by consisting of fourteen flat glasses instead of eight, and by having an angle of 45° until it is on a level with the middle of the vessel, and thence upward an angle of about 60°, by which arrangement the whole of the rays reflected from the silvered glass will fall on the lower half. Besides cooking food, I am making a series of experiments for heating steam boilers by concentrating the rays of the sun upon them.



ADAMS' SOLAR COOKING APPARATUS.

For this purpose I use a combination of flat mirrors, of common sheet glass, silvered, fixed in rectangular frames so as to concentrate the solar rays to a focus at a distance of 20 feet. The focus is about 2 feet in diameter. The plan is on the same principle as that of Archimedes, by which he burned the Roman fleet, which, under Marcellus, was blockading Syracuse—the same plan as that suggested by Anthemius of Tralles in the problems by which he proved the exploit of Archimedes to be possible; and as that suggested by Kircher, and in 1747 adopted by Buffon. With 72 pieces of silvered sheet glass, each 15x10½ inches, at midday, in the month of May, a focus was formed, at a distance of 20 feet, of a temperature above 1,088° Fah. I arrived at that estimate as follows: 18 glasses raised the mercury in the thermometer to 360°; 36 glasses raised it to over 644°, when the mercury entered into ebullition, and consequently any further rise could not be registered. The ebullition of the mercury was very violent. Placing the temperature produced by the 36 glasses at 644°, the boiling point of mercury, and deducting 100° as the initial temperature of the atmosphere (the thermometer was in the shade), there remain 544° produced by 36 glasses. The focus from the remaining 36 glasses was then added, making 72 glasses; and I think it may be inferred that the temperature was then above 1,088°. Every kind of wood placed in this focus was instantly ignited, without being, as in Buffon's experiment, previously smeared with tar and shreds of wool. A solid cylinder of water, 18x8 inches, contained in a vertical copper vessel, provided with a steam pipe, was then placed in the focus, and it boiled in exactly 20 minutes. The ebullition was exceedingly violent. In January last I made another experiment with 198 glasses, each 15x10½ inches, fixed in 10 rectangular frames. A copper boiler containing 9 gallons of cold water was placed in the focus at 9:25 A.M. It commenced to boil in exactly 30 minutes. It was allowed to boil for exactly 1 hour, and at 10:55 the focus was turned off, when 3¾ gallons of water were found to have been evaporated.

My next experiment will be made with about 500 of these glasses, fixed in 20 rectangular frames, each 6 feet by about 4 feet. The focus will be about 2 feet in diameter, and (according to the calculation made on the basis of the results of the experiment with 72 glasses) the temperature will be over 7,616° Fah. The objects of that experiment will be to ascertain how soon after sunrise the water can be provoked to boil, the pressure that can be obtained in a given period, and the quantity of water that can be vaporized in a given time. Other experiments will be made, such as exposing different metals to the focus, etc. The boiler that will be used on that occasion is a vertical boiler, 2 feet 7 inches high and 16 inches in diameter, with an annular cylinder of water 3 inches in diameter up to half its height. It is made of beaten copper, ¼ inch thick, which will stand any pressure that can be produced in a boiler of those dimensions. It is provided with a steam pipe, a steam gauge, and a safety valve, and with no other fittings. The 20 frames will stand in two rows of 10 each, the second row on a platform 6 feet 6 inches high, forming a segment of a circle of 40 feet in diameter.

As there is no limit whatever to the number of these mirrors that can be used at once, there is none to the intensity of heat that can be produced, and consequently no limit to the force of the steam that can be generated. The cost of the reflecting material is next to nothing, and it is almost everlasting. There is no mechanical difficulty in keeping the focus on the boiler from soon after sunrise to a little before sunset.

I am aware of the force of the objection that the solar rays are sometimes intercepted by clouds, even in India; but as an auxiliary to the ordinary boilers, I believe that solar heat could be used so as to save at least 25 per cent of coal throughout the year by my plan. As coal in the seaports of India is never under 30 shillings per ton, and double that rate in the interior, such a saving would be exceedingly important. There are many other purposes to which it could be applied besides driving steam machinery or cooking food, such as distilling and rectifying spirits, etc. At Aden, for example, the sun always shines, and potable water is only obtained by distilling it from salt water.

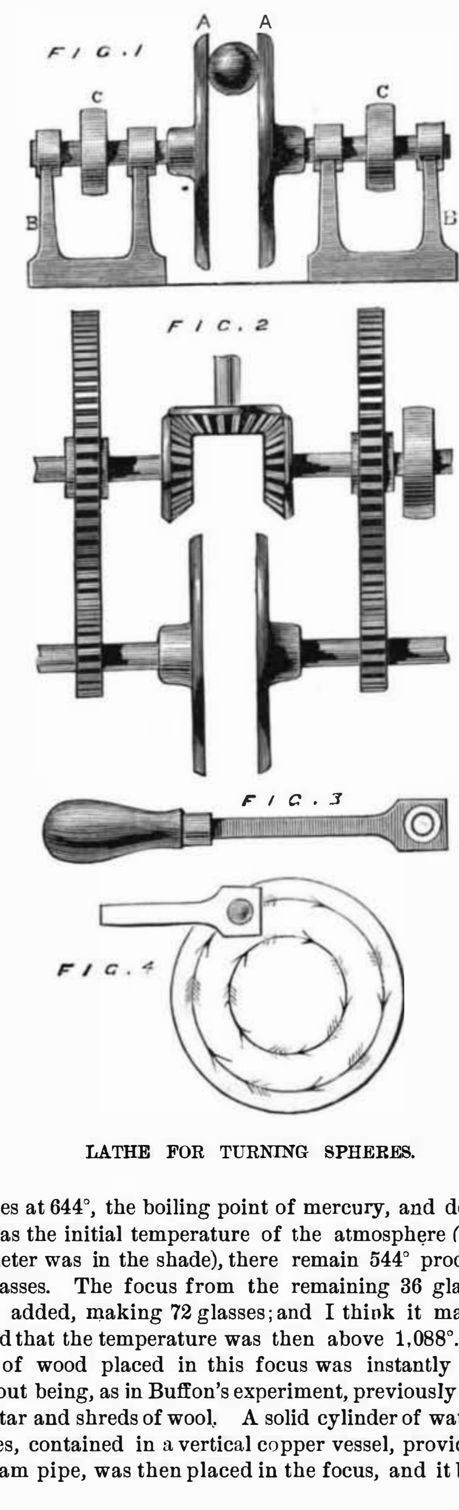
I shall be very glad to have any expression from your readers upon the subject, especially upon the result of the experiment that I have described.

W. ADAMS.

Bombay, India.

PRODUCING ACCURATE SPHERES.

An ingenious method of grinding perfect spheres was first proposed by the late Mr. H. Guy. It is especially applicable to hard materials, such as steel, glass, etc. Its principle is based on the fact that the section of a true sphere at any part is always a circle. In its application to the tools shown in the accompanying illustrations, the balls are first turned in the ordinary manner as correctly as possible, and a trifle larger than the required finished size. Mr. Guy's apparatus consists of two beechwood disks (A, Fig. 1), face to face, and attached to two lathe spindles and headstocks, B. The distance of these disks from each other is capable of nice adjustment by a screw or other suitable arrangement. On the spindles may be keyed two equal pulleys, C, over which a band passes from the power, crossed on one and open on the other; thus the two disks are driven in opposite directions with equal velocities. For a sphere of 1 in. diameter, Mr. Guy recommended disks of 10 in. diameter, and making about 400 revolutions per minute.



LATHE FOR TURNING SPHERES.

Mr. Wm. Granger, in a communication to the *English Mechanic*, proposes a modification of the apparatus, shown in Fig. 2, in which a more uniform motion is obtained by using small toothed wheels, and three bevel wheels to reverse the direction. The grinder is shown in Fig. 3, and is made of a piece of flat copper or brass with a conical hole through it, large enough to allow about one fourth of the sphere to project on the small side. The thickness of the grinder may be about ¼ in. diameter of the spheres, and the hole should be reamed to an angle of about 25°. It is important that the amount of bearing surface in the grinder should be narrow; about 1-16 inch for a 1 inch sphere is quite sufficient.

The rough sphere and the grinder are placed between the revolving disks, the former being tightly gripped between them; oil and emery powder are supplied to the grinder, and holding the latter in the hand, the ball should be made to traverse uniformly all around the disks, as in Fig. 4. Care should be taken to prevent the ball from stopping between the disks, as this would grind facets upon it. As the operation proceeds, finer emery must be used, and the sphere tried from time to time in a ring gauge of the required size. For precise work the finishing is done with disks covered with buff leather, and crocus is used instead of emery. The grinders must frequently be trued up with the reamer, as they soon wear out of shape.

Portrait of Prof. Henry.

WE are indebted to F. Gutekunst, the well-known photographer, 712 Arch Street, Philadelphia, Pa., for a fine photographic likeness of the late Professor Joseph Henry. It is one of the last, and we are not sure but it is the very last one for which this distinguished scientist sat.