

his experiment. He did it in the following way :

On the point of an upright needle he laid horizontally a fine steel bar, which could turn to the right and left like the magnetic needle in a compass-box. Then he fastened a small metallic ball on each end of the steel bar. The balls were of the same weight, for this reason the steel bar was attracted by the earth with the same force at both ends; it therefore remained horizontal like the beam of a balance, when the same weight is lying in each of the scales. By this the attractive force of the earth was not suspended, it is true; but it was balanced by the equality of the weights. Thus the earth's attractive power was rendered ineffective for the disturbance of his apparatus.

Next he placed two large and very heavy metallic balls at the ends of the steel bar, not, however, touching them. The attractive force of the large balls began now to tell; it so attracted the small ones that they were drawn quite near to the large balls. When, then, the observer, by a gentle push, removed the small balls from their resting-place, the large ones were seen to draw them back again. But as the latter could not stop if once started, they crossed their resting-place, and began to vibrate near the large balls in the same manner as a pendulum does, when acted upon by the attractive force of the earth. Of course this force was exceedingly small, compared with that of the earth; and for that reason the vibrations of this pendulum were by far slower than a common one. This could not be otherwise; and from the slowness of a vibration, or from the small number of vibrations in a day, Cavendish computed the real weight of the earth.

Such an experiment, however, is always connected with extraordinary difficulties. The least expansion of the bar, or the unequal expansion or contraction of the balls, caused by a change of temperature, would vitiate the result; besides, the experiment must be made in a room surrounded on all sides by masses equal in weight. Moreover, the observer must not be stationed in the immediate neighborhood, lest this might exercise attractive force, and by that a disturbance. Finally,

the air around us must not be set in motion, lest it might derange the pendulum; and lastly, it is necessary not only to determine the size and weight of the balls, but also to obtain a spherical to the utmost perfection; and also to take care that the centre of gravity of the balls be at the same time the centre of magnitude.

In order to remove all these difficulties, unusual precautions and extraordinary expenses were necessary. Reich, a naturalist in Freiberg, took infinite pains for the removal of these obstacles. To his observations and computations we owe the result he transmitted to us, viz.: that the mass total of the earth is nearly five and a half times heavier than a ball of water of the same size; or, in scientific language: The mean density of the earth is nearly five and a half times that of water. Thence results the real weight of the earth as being nearly fourteen quintillions of pounds. From this, again, it follows that the matter of the earth grows denser the nearer the centre; consequently it cannot be a hollow sphere.

If we consider, that from the earth's surface to its centre there is a distance of 3,956 miles, and that, with all our excavations, no one has yet penetrated even five miles, we have reason to be proud of investigations which, at least in part, disclose to man the unexplorable depths of the earth.

In our next number, we will commence for our young readers, a series of short papers on the "Wonders of Astronomy." No science to which man has directed attention, is comparable to the study of Astronomy.

CHRISTMAS TIME.

J. K. F.

WHEN I was very young my god-mother made me a present, as a Christmas-box, of a little book. It was a simple but very beautiful story about a little child that was lost and abandoned and that found a home—a father, a mother, sisters and brothers in the humble hut of a good and pious woodsman. It was a touching story such as can touch the heart of the child. It was such a story as could bring a tear