of the Aluminium Company of America, and R. H. Heilman, fellow of the Mellon Institute of Industrial Research, of their search amongst the aluminium compounds for a material which would withstand temperatures of the order of 1000° C. and at such temperatures have a low heat conductivity. They find that aluminium monohydrate, bauxite monohydrate, and a waste product from the extraction of pure aluminium material from bauxite are the most promising materials, and that their heat conductivities, which all increase with rise of temperature, are in the ratios of 15 : 9 : 6. The latter is cheap but heavy, the bauxite monohydrate is less expensive than the aluminium monohydrate, but will not stand such high temperatures as the latter. If the heat insulating material is required in brick form and not as a powder, the authors find that bauxite monohydrate, with certain additions to increase its strength at high temperatures and decrease its shrinkage, is best, and blocks of this material 12 in. by 36 in. and of various thicknesses are now on the market.

**Distance Thermometers.**—In an illustrated pamphlet of 40 pages, Messrs. Negretti and Zambra discuss the relative merits of gas, vapour, and liquid thermometers for use at a distance from the observing station, and come to the conclusion that mercury in steel thermometers with dial scales are the most serviceable. The errors to which such thermometers are subject are considered, and conclusions are drawn as to the best methods of eliminating them. The capillary tube connecting the bulb to the Bourdon tube which carries the pointer has its bore reduced to 0·005 in., so that the error due to it may in most cases be neglected. Fatigue of the Bourdon tube material has been overcome by the use of a special steel and a section which distributes the stress in the material more uniformly.

## Astronomical Topics.

**The Leonid Meteors.**—A Science Service bulletin, dated Nov. 16, reports a fairly active shower of these meteors in the early hours of Nov. 16, observed by seven students of Columbia College, Dubuque, Iowa, under the direction of Rev. J. Theobald, professor of mathematics. In spite of a slight haze, 289 meteors were observed in six hours; the maximum rate of fall was 90 per hour at 4.45 A.M. (that is, 10.45 U.T.). These meteors came about eighteen hours before the slightly less active shower observed in England by Mr. Prentice and Mr. King.

Drs. Johnstone Stoney and Downing, in their work on the return of the meteors in 1899, introduced the terms "ortho-Leonids" and "clino-Leonids"; the former are a comparatively compact clump, which are seen only in the years round about the comet's perihelion-passage. Since the earth takes only five or six hours to traverse the ortho-stream (Olivier, "Meteors", p. 36), one or other, or perhaps both, of the displays described above must have belonged to the clino-Leonids; these are scattered around the whole of the long elliptical orbit, but more thickly in the neighbourhood of the comet. When the ortho-stream is entered, the hourly rate sometimes goes up to thousands. Even in the comparatively poor displays of thirty-three years ago, 800 meteors were recorded in a few hours, both in 1898 and in 1901.

Father O'Connor reports that arrangements were made at the Stonyhurst College Observatory to keep the sky under observation during the nights of Nov. 15–18. Rain or clouds prevailed almost the whole time, but it cleared up somewhat about 4.0 A.M. on the morning of Nov. 17. "Between 4.15 A.M. and 6.0 A.M. I observed 13 Leonids, of which four, observed at 4.32, 5.2, 5.3, and 5.42, were considerably brighter than first magnitude stars. The one at 5.3 in particular was exceedingly bright, and distinctly illuminated the surrounding country."

**The Mass of Saturn's Ring.**—H. Slouka contributes a paper to *Scientia* for August in which he traces the history of investigations on Saturn's ring, beginning with Galileo's well-known anagram announcing the triple nature of the farthest planet. Next comes Cassini's detection of the great gap in the ring, and Laplace's investigation of its stability. Bessel was the first to make any attempt to determine the mass of the ring, which he did from the observed motion of the apse of Titan's orbit: he gave the two values 1/213 and 1/118 of Saturn's mass; both are now known to be much too large, and his revision made things worse instead of better. Clerk-Maxwell, after proving that the rings must be composed of cosmic dust, made an estimate of the number and size of the particles, from which he deduced the very low value 1/50,000,000 for its mass. Tisserand, from the motion of the apse of Mimas, found the large value 1/620; Meyer revised Tisserand's work, using improved values of the constants; he first gave 1/1960, but reduced this later to 1/26,700. H. Struve's exhaustive researches on Saturn's system are well known; he found it impossible to assign an accurate value for the ring's mass; he proved that it could not exceed 1/314, but regarded 1/26,700 as more probable.

The estimate which H. Slouka considers the most reliable was made by Louis Bell from a study of its albedo, based on the photographs taken by Wood in 1916 in light of different wave-lengths; he deduced that the thickness of the rings does not exceed 15 km., and is still less in the less luminous regions; he gave 1/1,000,000 as a maximum value of the mass.

The general conclusion is that an exact determination of the mass is impossible, but that most of the gravitational determinations are much too high. The research is made more difficult by the fact that the polar flattening of Saturn acts on the satellites in the same manner as the ring, but with much greater effect.

**Theories of the Birth of the Planetary System.**—Most upholders of the tidal theory postulate that another sun made a near approach to our own, and that its immense tidal action caused a filament of matter to leave the sun, which afterwards broke up into the different planets. Dr. H. Jeffreys suggested, a year or two ago, that an actual collision of the two suns would give a better explanation of some features of the solar system. A report by Science Service, Washington, D.C., dated Oct. 27, describes a lecture given to the Washington Academy of Sciences and the Society of Sigma Xi, by Prof. Willem de Sitter. He prefers the collision theory to the purely tidal one, on the ground that it gives an easier explanation of the rotations of the sun and planets. He supposes that in addition to the matter of the planets there was a large amount of diffused gas expelled from the sun. Much of this was later reabsorbed by the sun, but it had in the meantime acquired moment of momentum from the other star, which it imparted to the sun in the form of rotation. The gaseous medium also helped to make the planetary orbits more circular.