

It consists of a step-up transformer, condensers, spark-gap, and transformer, and is arranged to work off 100-200, and 200-240 volts alternating currents, with periodicities of 50-60. Bull. 40 S gives a list of second-hand electro-medical apparatus, including X-ray sets and accessories, all of which are guaranteed to be in first-rate working order, and show considerable reductions in price over similar new apparatus.

WE are indebted to a correspondent for the suggestion that the name of Dr. Henry Charlton Bastian, F.R.S., who died on November 17, 1915, should be added to the "Calendar of Scientific Pioneers." Bastian was not only a pioneer in neurology, but was also well known as a supporter of the doctrine of "heterogenesis," and for his investigations regarding the origin of life.

Our Astronomical Column.

THE DECEMBER METEORS.—Mr. W. F. Denning writes:—"This event is anticipated with unusual interest this year on account of the brilliant and abundant display observed in 1920. Early in the morning of December 13 meteors were observed to be falling at the rate of about five per minute, and several observers who were not regular meteoric students were attracted to watch the spectacle on account of its special character. The probability, therefore, that another rich return may take place this year renders it necessary that the sky should be attentively watched from about December 10 to December 13. The meteors are moderately swift and the radiant point is close to the star α Geminorum at the time of maximum, but, like the Perseids of August, the Geminids exhibit a radiant point which moves eastward at the rate of about 1° per day. The shower certainly begins early in December, if not late in November, but there appear to be few traces of it left after the middle of December.

"The Geminids have no cometary connection so far as we know, but it is highly probable that this system had its derivation from a comet which either belongs to a past, or the present, age, and probably having a long period of revolution."

THE ORIGIN OF COMETS.—The question whether the comets of long period belong to the solar system or are visitors from outside has been debated in recent years by many astronomers. Prof. G. Armellini contributes another paper on the subject to the September issue of *Scientia*. He points out the insufficiency for this purpose of the method of special perturbations, since this would have to be carried to an impracticable length before it could decide the character of an orbit at a great distance from the sun. Moreover, some who have used the method have failed to take the origin at the centre of gravity of the solar system, the result of this neglect being an apparent oscillation of the orbit from ellipse to hyperbola in a period of twelve years owing to the displacement of the sun by Jupiter.

Prof. Armellini introduces a new argument in favour of the origin of comets within the solar system, asserting that the combined attraction of the stellar system would tend to give closed orbits even to those comets the paths of which are hyperbolic while near the sun. The stellar attraction would be absolutely negligible in the region of space over which ordinary computations have extended, but might become sensible near the aphelia of the long-period comets. The author appears to assert that the stellar attraction would in all cases reinforce that of the sun; this, however, seems not to be the case. The resultant stellar action would evidently be very nearly constant both in magnitude and direction within the region of space in question; hence it would strengthen the sun's

action on one side, but weaken it on the other. Unfortunately, our knowledge of the stellar masses is insufficient to form any estimate of the direction in which the resultant acts.

Prof. Armellini appears to make an illegitimate assumption in treating the stellar action as directly proportional to the distance from the centre of gravity of the star-sphere. This law would hold inside a homogeneous sphere, but not in a sphere where the empty regions enormously exceed those occupied by matter.

OBSERVATIONS OF MARS AT FLAGSTAFF.—The observations of Mars carried on for so many years at Flagstaff, Arizona, by the late Prof. Percival Lowell, are still being continued. This is fortunate, for the climate and the excellent 24-inch refractor by Alvan Clark are both well suited to the work. Bulletin No. 83 of the observatory describes the observations made in 1920 by G. H. Hamilton, and reproduces nine drawings made on dates between March 8 and May 26. These dates converted into the Martian Calendar (N. hemisphere), would correspond with July 8 and August 18.

The interesting feature of the opposition was the unusual number of white markings near the east and west limbs, which generally dispersed, or diminished in size, on the central meridian. As they appeared both over desert and dusky regions, and as the canals could be faintly seen through them, it is concluded that they were cloud or mist rather than ground frost. Even the Syrtis Major, usually so prominent, was sometimes almost lost in mist. From the fact that similar drawings were made in 1903 it is suggested that the phenomenon may occur at the same calendar date in each Martian year, but is clearly visible from the earth only once in fifteen years. Attention is also directed to the fact that these whitish areas are not surrounded by dusky borders, as they would be if the theory were true that explains the canals as the boundaries of regions of different tone, showing up more distinctly from the effect of contrast. The absence of the dusky border also supports the objective reality of the dark border round the polar cap.

It was also noted that some of the dusky regions looked unusually dark after they had been cloud-covered, suggesting growth of vegetation after rain. Altogether the observations support the view that there is more "weather" on Mars than has recently been thought probable. However, Mr. Hamilton quotes some similar observations made by Sir Norman Lockyer in the last century, from which Sir Norman concluded that the seasonal changes of Mars are very intense.