and the solution warmed for a short time upon the water-bath. The alkaline solution is afterwards placed in a flask connected with a condenser and fitted with a dropping funnel. Dilute sulphuric acid is now allowed to slowly drop into the liquid, which is maintained at the boiling temperature. Under these circumstances an aqueous solution of hydrazoic acid distils over. The distillate is allowed to flow into a solution of silver nitrate, when the silver salt, silver azoate, N_3Ag, is precipitated. The silver salt is afterwards dried at 60°–70°, at which temperature no danger attends the operation, and decomposed by sulphuric acid diluted with eight times its volume of water, when hydrazoic acid gas is liberated, contaminated with only a trace of moisture. It appears that the aqueous solution of the free acid is almost as explosive as the silver and mercury salts. Upon one occasion, when attempting to fuse the drawn out end of a tube containing about 2 c.c. of a 27 per cent. solution, Dr. Curtius had a very narrow escape of serious injury, the whole exploding with a fearful detonation, and shattering the glass tube into dust. Several of the azoates explode when a beam of coloured light is thrown upon them; thus barium azoate, BaN_6, explodes when exposed to a strong green light, as does also the still more explosive silver azoate. A concentrated solution of hydrazoic acid appears to be able to dissolve gold, with formation of a red solution of gold azoate.

THE additions to the Zoological Society's Gardens during the past week include a Rhesus Monkey (*Macacus rhesus* ♀) from India, presented by Mr. Charles E. Flower; an Azara's Fox (*Canis azaræ* ♂) from South America, presented by Mr. H. M. Dodington; an Alligator (*Alligator mississippiensis*) from the Mississippi, presented by Mr. A. Schafer; two Black-faced Spider Monkeys (*Ateles ater* ♀ ♀) from Peru, deposited.

OUR ASTRONOMICAL COLUMN.

THE ROTATION OF VENUS.—M. Perrotin, the Director of Nice Observatory, presented a note on the rotation of the planet Venus, at the meeting of the Paris Academy held on October 27. The observations described in the note were undertaken for the purpose of testing the conclusions recently arrived at by Signor Schiaparelli. They extend from May 15 to October 4. In the interval the planet has been observed on 74 days, and 61 maps made of its appearance. The whole of the observed facts leads M. Perrotin to the following conclusions:—

(1) The rotation of the planet is very slow, and is made in such a way that the relative position of the spots and terminator do not experience any notable change during many days.

(2) The time of rotation of the planet does not differ from its sidereal period of revolution (about 225 days) more than thirty days. My observations will easily accommodate themselves, however, to a rotation of which the period is from 195 to 225 days.

(3) The axis of rotation of the planet is almost perpendicular to the plane of its orbit. The displacement of the white region observed at the northern edge indicates that the difference does not exceed 15°, as was admitted by Schiaparelli.

These conclusions, therefore, support those deduced by Schiaparelli from an extended discussion of all the observations of the planet.

SPECTRUM OF THE ZODIACAL LIGHT.—Prof. C. Michie Smith has published a series of observations made at Madras of the spectrum of the zodiacal light (Proc. Roy. Soc. Edinburgh, April 7, 1890). He used a spectroscope specially designed for observing and photographing this spectrum, and records:—"In all my observations, which have been carried on at intervals since 1875, the spectrum has appeared continuous and free from bright lines except during the spring of 1883, and even then the lines were not seen with sufficient distinctness to make their existence certain. The estimated position of the supposed line, wave-length 558, differs but little from that of the auroral line (wave-length 556·7) which was observed by Angström in the zodiacal light spectrum in 1867. He was, however, observing at Upsala, where the auroral spectrum can often be seen in almost all parts of the sky, even when the aurora itself cannot be detected. . . . There would seem to be very little risk of obtaining the auroral spectrum in Madras, and I think that if the bright line seen was real, and not imaginary, it must have been due to the zodiacal light"

These observations indicate a periodic appearance of the 558 line in the zodiacal light spectrum. They also support the idea that the origin of the line is the first fluting of manganese at λ 5576.

D'ARREST'S COMET.—This faint comet (*d* 1890), re-discovered by Mr. Barnard on the 6th ult., may be observed near the following positions:—

Ephemeris for Greenwich Midnight.

1890.	R.A. h. m. s.	Decl. °
Nov. 8	21 24 31	−27 13·0
12	39 15	26 40·3
16	53 32	26 1·4

THE INSTITUTION OF MECHANICAL ENGINEERS.

ON Wednesday and Thursday evenings of last week, the 29th and 30 ult., a general meeting of the Institution of Mechanical Engineers was held. The chief business was the reading and discussion of the following two papers: on tube-frame goods waggons of light weight and large capacity, and their effect upon the working expenses of railways, by Mr. M. R. Jefferds, of London; and on milling cutters, by Mr. George Addy, of Sheffield.

Mr. Jefferds is an American engineer who has come over to this country with a view to introduce the tube-frame waggon into England. It should be explained that the tube-frame differs from the ordinary frame of an English railway truck chiefly in the fact that, in place of the timber sole-bars with which we are acquainted, there are used eight wrought-iron tubes, $2\frac{7}{8}$ inches in diameter, each pair forming one sole-bar, and suitably connected and supported by malleable cast-iron parts. The boldness with which these castings are used in a structure upon which so much depends bears testimony to the superiority of American foundry practice and to the courage of American designers in perhaps about equal proportions. Certainly no Great George Street engineer would venture upon putting annealed castings in such a position; and, if he did, he would, no doubt, meet with disaster. The tube-frame waggons have, however, been largely built and extensively used in America, and we understand from Mr. Jefferds that there is no reason to think that the castings are not suitable for the work.

The interest in the paper, to judge by the channel into which the discussion was turned, did not centre so much in the constructive details of the waggon described as it did upon the general policy of the American as against the English methods of handling railway freight. In the United States, as most people know, they go upon the principle of having large goods waggons, some even as long as 40 feet and capable of carrying 40 tons. These, however, would be of extreme dimensions, the more usual length being 32 to 34 feet, with a carrying capacity of 30 to 32 tons—that is, American tons of 2000 pounds to the ton. These waggons are mounted on a pair of bogies, each having four wheels. Our own goods trucks are something about 20 feet long, and are mounted on wheels with axles which are fixed with their axes parallel to the ends of the trucks. The English truck will carry 10 tons, and weighs, according to Mr. Jefferds, 8 tons. Mr. Jefferds is, however, a little out here. No doubt some 10-ton trucks weigh 8 tons, but Mr. Williamson, of the Great Western Railway, and Mr. T. Hurrey Riches, of the Taff Vale Railway, state the average weight of their 10-ton trucks to be 5 tons 5 hundredweight and 4 tons 17 hundredweight respectively. Still, making every allowance for errors of this nature, and the possibility of Mr. Jefferds having placed his case in the most favourable light, there is no doubt but that the Americans carry their merchandise over their railways with a far lower proportion of tare to paying load than is the case in England. It has been notorious for years that American railway rates are far below those of this country. We will, however, let Mr. Jefferds speak for himself by making selections from his paper, merely first pointing out the great importance of this question upon our national well-being.

The supremacy of Great Britain—indeed her existence as a Power—is founded upon cheap ocean carriage. We can carry goods across the sea at a lower price than any other people.