November 6, he glimpsed the spot in its entirety, and describes it as of a pinkish colour. The following and south following part of the spot had quite a dark and definite outline.

On October 31 the red spot was seen with the 16-inch refractor at the Goodsell Observatory, Northfield, U.S.A. It was not a difficult object, though the colour is stated as being very faint. "The S. side of the spot and a belt of similar tint appeared to merge into one another without the slightest change in intensity of colour."

On November 23 I observed the spot with an 8½-inch reflector belonging to my friend, Mr. J. Harvey Jones, of Bristol; but the night was not very good. The red spot was faintly seen, and must have been central at about 11h. 25m. Other details were also noticed as follows:—

A faint, narrow, dark belt, like an irregular pencil-line, on the equator. A similar belt running from about the *p.* end of the red spot to W. limb of the planet. The shouldering of the S. equatorial belt N. of the ends of the red spot was distinctly seen, though that part N. of the *p.* end was very faint. The *f.* shoulder shows a much more gentle slope than formerly. Numerous reddish spots were seen on the N. side of the N. equatorial belt. These were large and conspicuous, as were a series of bright spots *p.* and S. of the red spot. A remarkably brilliant spot on the N. side of N. equatorial belt was central at 10h. exactly.

The general appearance of the planet betokened a more disturbed condition than usual, the belts being full of irregularities.

The great size, durableness, and special character of the red spot have naturally attracted much discussion, and a number of theories have been broached to explain the nature of the spot, and to account for its long endurance. Some writers have regarded it as part of the solid material of Jupiter, but this theory is practically negatived by the fact that it has shown an irregularity of motion. Unless we admit that the rotation period of Jupiter is extremely variable, and has experienced considerable retardation in recent years, we cannot allow that the red spot forms a portion of the sphere. Others believe the spot to represent a condensation of material floating or suspended above the surface of the planet, and that variations of motion and tint are impressed upon it by the action of the Jovian atmosphere, which is constantly in a state of turmoil. Another idea has been mooted to the effect that the spot may possibly be an opening in the atmosphere, through which the surface of Jupiter has been exposed, and that the recent feebleness of the object is occasioned by the filling in of the cavity with highly reflective vapours.

The Rev. E. Ledger remarks that at one time he felt inclined to believe that the permanency of the spot "seemed to indicate that it might be something which, while coagulating or solidifying, in some way caused a gap or break in the cloudy regions above it, or by its cooling condensed the vapours incumbent upon it, and thus increased its own visibility; in fact, that we might be watching in it the gradual formation of a huge continent upon Jupiter."

The theory has also been advanced that the spot was originally formed by ejecta from a volcanic region immediately underlying it, but it must be admitted that no hypothesis appears to be entirely satisfactory in its application, and certainly we cannot regard any one of them as capable of being definitely proved. In a word, it must be avowed that though we have become familiar with the red spot, its motion, shape, and variable tints, during observation extending over more than fifteen years, we are yet far from understanding the mystery it involves. Its production was doubtless the outcome of the energy and activity prevailing above, and possibly on, the planet's surface, but in what particular way the spot was generated it is impossible to say. Nor is the specific date of its first apparition known; it may be a modern resuscitation of the spot which delighted Hooke and Cassini about two centuries ago, or it may only have been initiated into existence just before those memorable nights in July, 1878, when it exhibited an intensely red colour, and struck observers, instantly, as being a most anomalous feature.

But though the spot forms an unsolved mystery, it will continue to be watched with interest by telescopic observers, who will much regret if its present faintness is but the prelude to final dissolution. It can be justly said that no planetary marking visible in modern times has encouraged as much observation, and incited the same amount of interest as the familiar "red spot on Jupiter." Possibly the further study of this remarkable formation may yet enhance our knowledge of the physical condition of the "giant planet," and throw some light upon the singular variations so rife upon his expansive surface.

W. F. DENNING.

THE PREPARATION AND PROPERTIES OF FREE HYDROXYLAMINE.

A CONSIDERABLY improved method of isolating hydroxylamine is described by Prof. Brühl, of Heidelberg, in the current *Berichte*, by which a tolerably large quantity of the pure substance may be prepared without danger in a short space of time, and which may therefore be of general interest on account of its suitability for lecture and demonstration purposes. It may be remembered that M. Lobry de Bruyn, who first isolated solid hydroxylamine two years ago (*vide* NATURE, vol. xlv. p. 20), prepared it from a mixed solution of the hydrochloride and of sodium methylate in methyl alcohol. This solution, after removal of the precipitated common salt, was first concentrated over a water bath, under the diminished pressure of 100 m.m., and afterwards subjected to fractional distillation over a flame at the still lower pressure of 40 m.m. A continuous fractionating vacuum-apparatus was considered unsuitable, and the change of receivers could only be conveniently effected by temporarily arresting the distillation. This mode of operating frequently led to violent explosive decomposition of the heated hydroxylamine, and, moreover, the yield rarely exceeded 17 per cent. of the theoretical. Prof. Brühl, desiring to obtain a considerable quantity of the pure base for spectrometric purposes, has been led to devise the following much more convenient method:—

The methyl alcohol solution is first separated from the precipitated salt, and then immediately transferred to a slightly modified form of the well-known apparatus of Prof. Brühl for fractional distillation *in vacuo*. This apparatus consists essentially of a distilling flask, provided with thermometer and entrance tube furnished with tap, a condenser, and a receiving arrangement which provides for the repeated and rapid change of receiver without impairing the vacuum and without arresting the distillation. This receiving arrangement consists of a short but wide cylinder of stout glass, into which the end of the condensing tube is introduced through a tubulus fitted with bored caoutchouc stopper; inside the cylinder is a circular stand carrying six receiving tubes, which are capable of rotation by means of a rod passing, gas-tight, through a tubulus and its caoutchouc stopper in the top of the cylinder, and terminating in a handle outside. By suitable manipulation of the handle, each of the six receivers may be brought beneath the end of the condensing tube in turn while the distillation is proceeding. The distillation of the methyl alcohol solution contained in the distilling flask is effected by reducing the pressure to the lowest possible amount, and supplying the necessary heat by immersing the flask in a bath of hot water. On

account of the explosive character of hydroxylamine, it is dangerous to employ even a small naked flame, which is liable to effect local superheating. The temperature of explosive decomposition lies in the neighbourhood of 130°; by uninterrupted distillation in the manner indicated, and at a pressure not exceeding 22 m.m., the hydroxylamine passes over entirely at a temperature of 56–57°, and by maintaining the water bath at only a few degrees superior to this temperature all danger of explosion is avoided. The methyl alcohol is practically entirely removed by the pump. Instead of leading the distillate through a warmed condenser, as recommended by M. de Bruyn, a practice which materially diminishes the yield by decomposition of a portion of the product, Prof. Brühl finds it much more advantageous to feed the condenser with a constant supply of iced water; for although the melting point of hydroxylamine is 33°, it does not resolidify even at temperatures only a few degrees above zero, so that stoppage of the condensing tube does not occur. It solidifies instantly, however, in contact with a vessel immersed in ice and salt. The cylinder containing the receivers is therefore immersed in such a mixture, so that each drop of hydroxylamine solidifies the moment it enters the receiver. The hydroxylamine thus obtained in one operation is substantially pure. From thirty grams of the hydrochloride about ten grams of the base may be obtained in one hour, a yield of 66 per cent. of the theoretical, which is four times that obtained by the method of M. de Bruyn. In the case of hydroxylamine becoming a commercial preparation, on account of its extraordinarily great antiseptic power, it would be quite easy, by introducing suitable additional condensers, to recover the whole of the methyl alcohol employed.

The pure white crystalline hydroxylamine melts according to the mode of heating and the size of the containing tube at 32–34°, and its boiling point for a pressure of 22 m.m. is 56–57°. It may actually be cooled below 0° without solidifying, if allowed to remain at rest; but, like most other substances which exhibit the property of superfusion, it solidifies the moment it is agitated. In the solid state it does not appear to be liable to decomposition. Even in the liquid state at 0° indications of decomposition have not been observed. At 10°, however, bubbles commenced to form in the liquid, and at 20° a continuous evolution of gas, mainly nitrogen, occurs, becoming more and more violent as the temperature rises, until sudden explosion takes place. Hence in a warm summer hydroxlamine cannot be preserved in sealed glass tubes. Thus a specimen, after keeping for eight days in July, was found to be no longer capable of solidification even at −6°, although there was sufficient of the base left undecomposed to explode with a certain amount of violence upon heating, less, however, than in the case of freshly-prepared hydroxylamine. When just prepared one drop warmed in a test tube over a flame explodes with a report equal to that of a gun-shot. It is suggested that hydroxylamine might be safely preserved in metallic vessels, for it appears likely that the notable action of the liquid upon glass causes the commencement of the decomposition.

At the temperature of 23·5° the relative density of pure liquid hydroxylamine is 1·2044. Its refractive index at the same temperature varies from 1·4375 for light of the wave-length of the red lithium line to 1·4514 for light corresponding to the blue hydrogen line Hγ. The substance thus exhibits a small refractive power and a surprisingly small dispersion. Indeed, its molecular dispersion is about the same as was found by Prof. Brühl for nitrogen itself in triethylamine, so that the atom of oxygen and the three atoms of hydrogen would appear to exert no dispersive action if the same value for nitrogen be assumed to be equally operative. The only possible explanation is that the nitrogen here united to oxygen and hydrogen possesses a lower spectrometric constant than when attached to carbon in triethylamine. From a systematic study of the spectrometric constants of the free base, and of the methyl derivative $CH_3NH.OH$ prepared by his assistant Dr. Kjellin, an account of which was given in the Notes of NATURE of November 9, Prof. Brühl has been enabled to prove two important facts. The first is that the constitution of hydroxylamine can be none other than H_2N-O-H. The second is that the molecular refraction and dispersion of the nitrogen present in these compounds is the same as that of the nitrogen in ammonia gas, much lower than that of the nitrogen in triethylamine, and that the probable values of these constants of nitrogen linked in this manner, for sodium light, are respectively 2·495 and 0·072. This addition to our knowledge of the spectrometric constants of nitrogen will be of invaluable aid in unravelling the intricate subject of the constitution of the class of nitrogenous organic substances known as "oxims," a subject upon which Prof. Brühl is now concentrating his attention. A. E. TUTTON.

NOTES.

IT is with much regret that we announce the death of Baron von Bülow, at Kiel. Von Bülow's Observatory, better known, perhaps, as Bothkamp Observatory, was the first in Germany devoted to astro-physical researches, and it stands as a splendid monument to his interest in astronomy. By his death astronomical physics has lost one of its most enthusiastic supporters.

THE meeting of the Vienna Academy of Sciences was adjourned on November 16, as an expression of regard for Dr. Alexander von Bach, who died on November 12.

THE memorial to Sir Richard Owen is to take the form of a full-length marble statue, executed by Mr. Thomas Brock, and placed in the Natural History Museum, South Kensington.

A BOTANICAL section has been added to the Zoological Station at Naples, with a small laboratory for algological studies and researches in vegetable physiology.

DR. OSWALD KRUCH has been appointed to the Conservatorship of the Royal Botanical Institute of Rome, recently resigned by Dr. A. Terracciano.

A REUTER'S telegram from Montreal announces that the worst earthquake ever experienced in Canada occurred there at noon on November 27. As far as has been ascertained, no lives were lost, but considerable damage has been done to property, and the walls of many buildings have been cracked.

A SEVERE earthquake was felt at Peshawur, and other places in the Punjab, about nine o'clock on the morning of November 5, but fortunately no very serious damage was done. The wave apparently extended over a large area, including the Tamrud plain and Nowshera.

AN international Photographic Exhibition will take place at Milan from May until October next year. There will be a section for professional photography, another for amateur photography, and a third for technical and industrial applications of photography.

THE Department of Science and Art has received, through the Foreign Office, a dispatch from her Majesty's Minister in Chili calling attention to an exhibition which it is proposed to hold next year at Santiago, dealing with the subjects of mining and metallurgy. The exhibition will be opened in the second