therefore necessary to employ the substitution of an amidic group with a nitroxyl in a convenient dinitrotoluidine. Of these latter, three were suitable for leading to the necessary transformation. An additional result obtained by these authors was the production of 60 per cent. of one of the dinitrotoluidines, of which previously it had been only possible to obtain 20 per cent. from the material employed. The paper also describes the properties of a considerable number of the corresponding dinitrotoluene halogen compounds.

A PAPER by Dr. S. Brodetsky, on the longitudinal initial motion and forced oscillations of a disturbed aeroplane, appears in the *Aeronautical Journal* for October–December, 1916 (No. 80). The main conclusion is that "the ideal aeroplane is one that combines the following characteristics: large velocity, small angle of attack, small ratio area/load, small tail fairly far behind the main plane, and considerable margin of stability." The practical man will probably say that this is what common sense would predict, but it is interesting to see how these conclusions follow mathematically from a few simple assumptions, and the history of modern aviation shows that they have not always been acted upon. As in the case of a balance, the increase of one virtue involves the decrease of another, and we have to make a compromise; examples of this will be found in the paper. Fortunately stability and speed go together, and the disturbing elements, in all probability, will be gradually eliminated in the case of rapid machines. Then will come the problem of combining comparatively low speed with sufficient stability: a question of design, as in the case of a bicycle. Prof. G. H. Bryan has contributed an interesting introduction.

IN the Journal of the Franklin Institute for December last Mr. I. Langmuir describes a new form of exhaust pump for the production of high vacua, which he proposes to call the "condensation pump." It may be constructed of metal or of glass. The metal form of the pump consists of a tall cylindrical vessel containing a shallow pool of mercury, which is heated electrically and gives off mercury vapour. The upward stream of vapour is concentrated towards the centre of the vessel by an inverted funnel, and on issuing from the funnel strikes the under surface of a bell-shaped deflector, which sends it downwards along the outer walls of the upper portion of the containing vessel. The space above the bell is in communication with the vessel to be exhausted, and the moving mercury vapour drags along with it the gas from this vessel. The outer wall of the containing vessel along which the mixture passes is cooled by an outer water-jacket, and the mercury vapour is condensed on it, and runs down into the pool at the bottom of the vessel. The gas continues its motion, and is taken from the lower part of the vessel by an auxiliary pump giving a pressure of 200 to 600 bars. A pump of this form, 7 cm. in diameter, exhausts 3000 c.c. of gas per second, and will reduce the pressure to 10^{-5} bar (1 atmosphere $= 10^6$ bar).

A COPY of the "List of Publications of the Carnegie Institution of Washington," issued on December 1 last, has been received. Copies of each publication, except the monthly issues of the "Index Medicus," are sent gratuitously to a carefully selected list of the greater libraries of the world, while the remainder of the edition is offered for sale at a price sufficient only to cover the cost of publication and the carriage to purchasers. Persons desiring price lists or descriptive lists as issued may have them by applying to the Carnegie Institution of Washington. The catalogue received contains both price and descriptive lists, and the latter is a most useful guide to the character and precise contents of each of the volumes indexed, so that would-be purchasers may know exactly the kind of book they are ordering.

MR. LEONARD HUXLEY, who, it will be remembered, was his father's biographer, has written for early publication by Messrs. Smith, Elder and Co. "The Life and Letters of Sir J. D. Hooker, O.M., G.C.S.I."—a work which is sure to be of interest to very many readers of NATURE. It will be illustrated by photogravures and be in two volumes.

A SECOND and much enlarged edition in two volumes of Mr. A. Marshall's "Explosives: their Manufacture, Properties, Tests, and History," is to be brought out by Messrs. J. and A. Churchill. The first volume, containing a portrait of the Prime Minister, to whom the work is dedicated, will be published almost immediately. The work as originally published was reviewed in NATURE of June 3, 1915, and the author contributed an additional chapter, under the title of "The Nature of Explosives," to our issue of February 3, 1916.

OUR ASTRONOMICAL COLUMN.

ECLIPSES OF JUPITER'S SATELLITES.—In Harvard Circular No. 198 Prof. E. C. Pickering directs attention to the need for continued observations of the eclipses of Jupiter's satellites. He points out that the observations are easy and interesting, and such as can readily be undertaken by amateurs. While the probable error of a photometric determination of the time of an eclipse is about 2 seconds, the average deviation from the time computed by the tables of Prof. Sampson is about 7 seconds. These deviations appear to be real, and a possible explanation is that the apparent diameter of the planet, and therefore of its shadow, varies with the cloudiness of the Jovian atmosphere. Several independent observations tending to confirm large deviations from theory would thus be valuable.

PECULIAR STELLAR SPECTRA.—In a paper read at the nineteenth meeting of the American Astronomical Society Miss Cannon directed attention to some of the peculiar spectra which had been noted in the preparation of the New Draper Catalogue (*Popular Astronomy*, vol. xxiv., p. 656). It appears that while less than one-fifth of one per cent. of the 218,000 stars which have been classified fall outside the classes B, A, F, G, K, M, many stars which may be classed in these divisions show abnormal features. In all classes some stars have been found which show lines of unusual intensity; thus several hundred additional stars have been found to show the silicon lines λ 4128 and λ 4131, or the strontium line λ 4077, stronger than normal. The latter group is of special interest, as λ 4077 was the first line shown by Adams to be related in intensity to the absolute magnitudes of the stars. In C.P.D. -59° 3038, mag. 7·2, a line near λ 3869, which may be a reversal of a well-known nebular line, has been found to be very strong. Real changes in the spectra of several stars have also been observed; thus in η Carinæ, as photographed in 1895, the hydrogen lines were stronger, and other bright lines fainter, than on the more recent plates. An extreme case of variation is R. Scuti, which ranges from G5 at maximum to Mb at minimum. The only new type of spectrum which has been found is that exhibited by the very red star B.D. $+43^\circ$·53, the spectrum consisting entirely of light near the region of H_α, and the colour-index amounting to 5·4 magnitudes. This and

S Cephei, which has a similar spectrum, are the two reddest stars known at the present time.

THE TOTAL SOLAR ECLIPSE OF 1916, FEBRUARY 3.—A summary of the results of observations of this eclipse made at Tucacas, Venezuela, by an expedition from Cordoba, has been given by Prof. C. D. Perrine (*Monthly Notices*, R.A.S., vol. lxxvii., p. 65). The morning of the eclipse was unpromising, with heavy rain, but conditions improved to such an extent that there was only a slight haze during totality. The corona was of the intermediate type, somewhat resembling that of 1898, and the negatives show streamers to a distance of one and a half solar diameters. Five groups of prominences appeared at the bases of the four principal wings of the corona, and a series of well-marked hoods surrounded the prominences in the south-west quadrant. Photographs of the coronal spectrum were obtained with the prismatic camera, and with a slit spectrograph, but none of them show any trace of gaseous radiation. Good records of the chromospheric spectrum at the beginning and end of totality were secured, and these will give valuable data relating to the heights of different vapours in comparison with previous results. The photometric plates show that at the beginning of totality the total light of the prominences and chromosphere was greater than that emitted by the corona proper.

PARIS ACADEMY OF SCIENCES.

PROGRAMME OF PRIZES FOR 1918.

MATHEMATICS.—The Poncelet prize (2000 francs), to the author, French or other nationality, of the work most useful to the progress of pure mathematics; Francœur prize (1000 francs), for discoveries or works useful to the progress of pure or applied mathematics.

Mechanics.—The Montyon prize (700 francs), for the invention or improvement of instruments useful to the progress of agriculture, the mechanical arts, and the practical and speculative sciences; the Fourneyron prize (1000 francs), question for 1918: the theoretical and experimental study of ball bearings; question set for 1916 and carried on to 1918: important improvements in motors used in aviation; the Boileau prize (1300 francs), for researches concerning the motion of fluids contributing to the progress of hydraulics—these researches, if theoretical, must be verified by the results of experiment or observation; Henri de Parville prize (1500 francs), for original work in mechanics.

Astronomy.—The Lalande prize (540 francs), for the most interesting observation or memoir most useful to the progress of astronomy; Benjamin Valz prize (460 francs), for work in astronomy, conforming to the same conditions as the Lalande prize; the Janssen prize (gold medal), to the author of a work or discovery in physical astronomy; Pierre Guzman prize (100,000 francs), to anyone (without distinction of nationality) who finds a means of communicating with a celestial body—*i.e.* to make a signal to the body and receive a reply. (The planet Mars is excluded.)

Geography.—The Delalande-Guérineau prize (1000 francs), for services to France or to science; the Gay prize (1500 francs), subject proposed for 1918: recent progress in geodesy; the Tchihatchef prize (3000 francs), for recompense or assistance of naturalists of any nationality distinguished in the exploration of the Asiatic continent or the adjacent islands, especially the less known regions—the explorations may be in any branch of natural, physical, or mathematical science; the Binoux prize (2000 francs), for work on geography or navigation.

Navigation.—The prize of 6000 francs for work increasing the efficiency of the French naval forces; the Plumey prize (4000 francs), for improvements in steam-engines or for any other invention contributing to the progress of steam navigation.

Physics.—The La Caze prize (10,000 francs), without restriction of nationality, for the best work in physics (the prize cannot be divided); the Hébert prize (1000 francs), to the author of the best treatise or most useful discovery in popularising or using electricity; the Hughes prize (2500 francs), to recompense the author of an original discovery in physical science, especially electricity and magnetism or their applications; the Danton foundation (1500 francs), for the encouragement of researches relating to radiant phenomena; the Victor Raulin prize (1500 francs) (limited to Frenchmen), for facilitating the publication of works relating to meteorology and the physics of the globe.

Chemistry.—The Montyon prize (unhealthy occupations) (a prize of 2500 francs, a mention of 1500 francs), for the discovery of a means of rendering some mechanical art less unhealthy; the Jecker prize (10,000 francs), for work most useful to the progress of organic chemistry; the La Caze prize (10,000 francs), for the best work in chemistry (open to foreigners and cannot be divided); the Cahours foundation (3000 francs), for the encouragement of young chemists of promise; the Houzeau prize (700 francs), similar conditions to the Cahours foundation.

Mineralogy and Geology.—The Cuvier prize (1500 francs), for the most remarkable work in mineralogy and geology.

Botany.—The Desmazières prize (1600 francs), to the French or foreign author of the best publication during the year on cryptogams; the Montagne prize (1500 francs), for important discoveries or work on the cellular plants; the de Coincy prize (900 francs), to the author of a work on phanerogams, to be written in Latin or French.

Anatomy and Zoology.—The da Gama Machado prize (1200 francs), for the best memoirs on the colour of animals, including man, and its origin in the animal kingdom; the Savigny foundation (1500 francs), for the assistance of young travelling zoologists, not receiving grants from the Government, and who occupy themselves more especially with the invertebrates of Egypt and Syria; the Jean Thore prize (200 francs), for a memoir on the habits or anatomy of a species of European insect.

Medicine and Surgery.—The Montyon prize (three prizes of 2500 francs, three honourable mentions of 1500 francs, citations), for improvements in medicine or surgery; the Barbier prize (2000 francs), for a valuable discovery in surgical, medical, or pharmaceutical science, or in botany in relation to the art of healing; the Bréant prize (100,000 francs), to the discoverer of a means of curing Asiatic cholera or of the causes of this disease (failing the award of the capital sum, the interest will be given as a prize for contributions to our knowledge of cholera or any other epidemic disease); the Godard prize (1000 francs), for the best memoir on the anatomy, physiology, and pathology of the genito-urinary organs; the Mège prize (10,000 francs), to the author who continues and completes the essay of Dr. Mège on the causes which have retarded or favoured the progress of medicine, from antiquity to the present time; the Bellion prize (1400 francs), for work or discoveries especially profitable to the health of man; the Baron Larrey prize (750 francs), for the best work presented to the academy in the course of the year, by a doctor or