general statement that every symbol or sign introduced at a different level to the rest involves extra spacing, although this objection does not apply to the use of the ordinary indices and suffixes, or to the use of two lines to represent fractions in a line consisting entirely of formulæ. The use of a bar over a square root is objectionable, but we would suggest that the proposal always to use Roman or Greek *i* for the root of -1 is scarcely necessary, as the bar can be omitted in this case without ambiguity. The use of fractions in the middle of a line of letterpress produces an unsightly result. While agreeing with the suggestion that the small numerical fractions which are usually cast as single pieces of type can often be used with advantage, it should be noticed that "thirds" are not easy to distinguish from "eighths," and the solidus notation may often be used to overcome this difficulty. The avoidance of letters with bars or dots placed above them, to which much importance is attached, is a change which may often present difficulty, and it is doubtful how far the proposal to substitute dashes in the fluxional notation will be found practical in view of the frequent use of dashes for other purposes. There is, however, no reason why the raised dots should not be placed after instead of over the letters, while inverted commas offer another new opening, hitherto neglected. We should like to see "exp." included in the list of suggestions. But if writers of papers are sometimes to blame, printers have an awkward way of beginning a formula at the end of one line of letterpress and continuing it in the next line, even when the author has not done so. And we think the printers might at least take on themselves the responsibility of removing the bars over square roots. When, however, a paper refers to the rigid dynamics of aeroplane motions, the number of symbols required is so great that violation of every rule becomes inevitable.

IN the second part of vol. iv. of the Science Reports of the University of Sendai, Prof. K. Honda describes a balance which allows the effect of temperature on any chemical change involving loss of material by evaporation or dissociation to be followed readily. The beam of the balance is a silica glass tube from one end of which a small platinum or magnesia vessel to contain the specimen is suspended, within an electrical heating coil enclosed in turn in a Dewar vacuum vessel. The other end of the beam is pulled down by a spiral spring, the pull of which can be adjusted to suit the specimen used. The movement of the beam is observed by means of a mirror attached to it and a telescope and scale, a deflection of a millimetre corresponding to about half a milligram. The temperature of the specimen is observed by means of a thermo junction, and is raised about a degree per minute. Curves showing the loss of water of crystallisation of two sulphates, the dissociation of a carbonate, and the change of chromic oxide with temperature are given.

"RED BOOK" No. 198 of the British Fire Prevention Committee contains the report of a fire test with three window openings filled with wired glass. These were subjected to the committee's standard 60-minute test at temperatures reaching up to 1600° F., followed by the application of water under pressure. The usual test size of glazed panels is about 2 ft. by 2 ft., but one of the panels under test in this case measured about 3 ft. by 2 ft. The classification of temporary protection (Class B) under the committee's standards has been accorded for this glazing to this larger size. Partial protection (Class A) has already been obtained for wired glazing by the same makers (Messrs. Pilkington Brothers, Ltd., St. Helens), both for regulation sizes and for a panel measuring about 4 ft. by 1 ft. In the present tests, in the case of two of the panels, neither fire nor water had passed through the glazing at the conclusion of the test, and the glazing remained in position after the application of water. In the third panel (two lights) fire had not passed through the glazing, but on the application of water the glazing in the lower light was perforated at the top portion, and some water came through. In this case also the glazing was in position after the application of water.

MR. JAMES HORSFALL, late chief draughtsman of the Canadian Pacific Railway, suggests an improvement in the design of locomotive coupling and connecting rods. Such rods are subject to reversal of stresses due to the alternate push and pull, and also in the bending due to the action of centrifugal force. The effects of the latter may be reduced considerably by prolonging the rods beyond the pins and attaching balance weights to the extensions so formed. By suitably adjusting the proportions, the bending moment at the middle of the rod may be made zero, and the maximum bending moment on the rod will be much less than in the same rod unbalanced. Mr. Horsfall says that, as the result of very numerous experiments with rods of various kinds, he is convinced that the best way to avoid danger from the breakage of coupling and connecting rods is to counterbalance them in the manner suggested.

OUR ASTRONOMICAL COLUMN.

COMET 1915*d* (MELLISH).—The discovery of a second comet during the present year by Mr. J. E. Mellish, Madison, Wis., U.S.A., was announced last Thursday in a telegram from Copenhagen. On September 6, at 22h. 9·1m., the comet's position was α 5h. 30·2m., δ 8° 50′ (approx. 8° south of γ Geminorum). No information was supplied regarding the direction or rate of the comet's motion, or of its magnitude.

SATURN.—Dr. Percival Lowell, in a letter to M. Flammarion (*L'Astronomie*, August, 1915), describes observations made at Flagstaff during last spring. Photographs were secured on March 12, when the ring system was practically at maximum apparent breadth. Cassini's division appeared continuous. With the planet thus framed in its rings a new determination of the aplatissement has been possible, giving the value 1/9·18

RADIAL VELOCITY, MAGNITUDE, AND SPECTRAL TYPE.—Mr. C. D. Perrine has published (*Astrophysical Journal*, vol. xli., pp. 396–99) the results of further analysis of the data in Campbell's lists of radial velocities. Dividing the stars into two groups according to magnitude, drawing the line at 3.0m., he finds a decided increase of the mean radial velocity for the fainter group; this also holds for the stars of each

spectral type separately (except only the A stars), and the effect appears to be more marked in the later types. Further, the highest known velocities are found in the vicinity of the Milky Way. It is conjectured that the effect may be due to the operation of a resisting medium on stellar bodies differing in size and density, or the closer proximity of the fainter stars to a "source of general gravitational action." In either case the Milky Way would be deeply concerned.

In another note in the same journal Mr. Perrine analyses the spectral distribution of the stars of large radial velocity, finding the maximum mean values among the faint stars of classes F and G.

VOLCANIC DUST VEILS AND CLIMATIC VARIATIONS.—Fluctuations in the observed intensity of the solar radiation have been interpreted during the past ten years or so as traceable to the screening effects of the enormous quantities of dust poured into the upper atmosphere during notable volcanic eruptions; thus it has been a small step to the wider hypothesis that volcanic dust has been a possibly important factor in the production of past climatic changes. This hypothesis is tested by Mr. Henryk Arctowski in a paper communicated to the New York Academy of Sciences (Ann., Vol. xxvi., pp. 149–174, June, 1915). Previous work on temperature records had led him to the conclusion that a general rise in the temperature of the atmosphere was probably due to an increase in the solar constant itself. From a re-examination of temperature curves, chiefly showing departures from monthly means, paying special attention to the epochs of the Krakatoa (1883) and Katmai (1912) eruptions, as well as the year 1902, which was marked by intense vulcanism in both hemispheres, he now concludes that the short-period variations of temperature have nothing in common with the presence or absence of volcanic dust veils, although minor secondary modifications of the temperature curve may sometimes be traced to this cause. He finds that the sun-spot variation does appear to have an influence on atmospheric temperature, and, moreover, presumes, but does not explain, the existence of a correlation between the temperature changes and frequency of volcanic eruptions.

THE AURORA BOREALIS.—An illustrated account was given in NATURE, August 7, 1913, of the photographic observations made by Prof. Carl Stormer, in collaboration with M. Bernt I. Birkeland, in the spring of 1913. These observers were stationed at Bossekop and Store Korsnes respectively. They secured a great wealth of parallax material which will require a long time for reduction. However, one-sixth having been finished, Prof. Stormer has published a preliminary report ("Terres. Mag. and Atmos. Elec.," vol. xx., No. 1). Some six hundred measures of altitude have been worked out, most of the measured points lying between 90 and 130 km. above the earth's surface; none come out appreciably lower than 90 km., whilst the highest reaches 230 km. From a mere inspection of the diagram the mean height appears to be about 120 km.; thus the lower limit is fairly well marked. The spatial relations of a number of auroral curtains have been worked out in detail. In one case this information has been used in conjunction with magnetograms from the Haldde Observatory, to obtain an idea of the nature of the aurora. The curves show that the magnetic effect due to the passage of the particular auroral feature had components directed N.W. and upwards. On the assumption that the display was caused by electric corpuscles travelling towards the earth, Ampère's rule indicates that the observed deflections would result from the motion of particles carrying a positive charge.

AMERICAN HYDROIDS.[1]

MR. NUTTING may be congratulated on the completion of the third part of his great monograph on American Hydroids. He has a generous conception of America, and includes in his list such species as *Silicularia hemispherica* from S. Tierra del Fuego and *S. repens* from Kerguelen. It is therefore almost a monograph of the hydroids of the world, and will be regarded as the most important work of reference on the group that has yet been published. Those who are specially interested in Cœlenterata will probably be gratified to find that Mr. Nutting has taken a conservative attitude as regards species, and that, notwithstanding the many temptations to which he has been exposed in the course of his vast labour in this field, he has added very few new species to those already recognised. It is a much easier method—and a particularly attractive one in the preparation of a standard treatise on systematic zoology—to make new species when difficulties arise than to exercise the skill and patience that is required to place doubtful specimens in their proper specific groups, and we may regard it as a sign of Mr. Nutting's knowledge and thoroughness that the list of species is not a longer one.

The method adopted in dealing with the species is to select a specimen regarded by the author as typical, to give in a footnote the locality from which the specimen came, and then to describe it in detail. There is much to be said for this method in dealing with the systematics of Cœlenterata, because it gives the systematist a fixed point, as it were, around which the variants may be grouped, but it seems to us that to that description of a type some statement should be added of the principal variations observed by the author in the species under consideration in order that future workers in the group may find that some of the difficulties they are sure to meet with in using the monograph as a standard work of reference have been anticipated by a recognised authority.

The author has evidently taken infinite pains to collect from all available sources specimens of American hydroids for study and description, and his reference lists at the head of each species are extraordinarily complete and accurate. Our thanks are due to him for a very valuable work. S. J. H.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Board of Education informs us that the regulations and syllabuses which governed the examinations in science and technology held in 1915 will continue in force for 1916. In the prefatory note to the volume of regulations and syllabuses for examinations in science and technology, 1915, the Board announced its intention to discontinue those examinations at a date to be afterwards announced. The Board now gives notice that after 1916 it will no longer hold lower general examinations in any subjects of science and technology. The higher general examinations will for the present be continued.

THE prospectus for the forthcoming session of the Belfast Technical Institute has now been published. An interesting departure is the indication by an asterisk prefixed to the name of the members of the permanent staff who are at present serving in the Army or Navy, or who are engaged on war service. The number of asterisks is excellent testimony to the

[1] "American Hydroids." Part III. The Campanularidæ and the Bonneviellidæ. Smithsonian Institution. Special Bulletin. Pp. 126+70 text figures+27 plates. Washington, 1915.