der Erde." The second volume, dealing with salt in Asia, Africa, America, and Oceania, appeared recently, and the first volume, which will be concerned with Europe, is in the press.

THE prominence now given to geometrical and machine drawing in the curricula of schools and colleges has led to an increased demand for trustworthy mathematical drawing instruments. The recent catalogue, with its numerous illustrations, published by Mr. W. H. Harling, of Finsbury Pavement, London, showing the instruments he is prepared to supply, may be commended to the attention of teachers and students. In it they will find particulars concerning a great variety of instruments designed to meet every want.

OUR ASTRONOMICAL COLUMN.

COMET 1906*e* (KOPFF).—In addition to those published by Herr M. Ebell, elliptic elements have been calculated for the orbit of Kopff's comet by Messrs. Crawford and Champreux, and are published in No. 100 of the Lick Observatory Bulletins. They are as follows:—

Elements.

T = 1906 May 2·0877 G.M.T.
Epoch = 1906 Sept. 5·67091 ,,

M = 18° 41′ 54″·6
ω = 19 28 44·9
Ω = 263 45 23·6 } 1906·0
i = 8 44 09·8

log *q* = 0·230114
log *e* = 9·716356
log *a* = 0·549258
μ = 532″·255
Period = 6·66633 years

The first decimal place of the period is determinate, and as this agrees with Herr Ebell's, who gave 6·617 years, it may be taken as fairly established. An ephemeris which accompanies the elements gives the following positions for the remainder of this month:—

Ephemeris (12*h*. *G.M.T.*).

1906	α (true) h. m.	δ (true) ° ′	1906	α (true) h. m.	δ (true) ° ′
Oct. 17·5	22 28	5 3	Oct. 25·5	22 30	4 30
21·5	22 29	4 45	29·5	22 32	4 17

JUPITER'S SEVENTH SATELLITE.—From a telegram from Prof. Pickering to the Kiel Centralstelle, published in No. 4123 of the *Astronomische Nachrichten*, we learn that Jupiter's seventh satellite was re-observed by Prof. Perrine at the Lick Observatory on September 25. The position-angle and distance at 1906 September 25·9962 were 119°·1 and 2578″ respectively.

OBSERVATIONS OF VARIABLE STARS.—Bulletin No. 8 of the Laws Observatory, University of Missouri, contains the results of some variable-star observations made at the observatory during 1905–6. A grant of five hundred dollars from the Gould fund of the National Academy of Sciences has enabled the director, Prof. F. H. Seares, to engage an assistant observer, Mr. E. S. Haynes, for this work with gratifying results.

The star B.D. + 55°·2817 has been shown to be a variable of the continuous variation type, with a range of 0·4 magnitude and a period of 5·4 days. Observations of V Lacertæ, V Vulpeculæ, and 108.1905 Capricorni are also recorded. In the case of the last-named, the rise to maximum is very rapid, an increase of 1·5 magnitudes taking place in $1\frac{3}{4}$ hours, and the observations show that this star is probably not of the Algol type.

SUN-SPOT SPECTRA OBSERVATIONS.—In No. 2, vol. xxiv., of the *Astrophysical Journal*, Mr. W. M. Mitchell, of Princeton Observatory, records the results of his sun-spot spectra observations made during the period October, 1905, to May, 1906. Mr. Mitchell found that during the more recent observations the number of "weakened" lines in the spot spectra has increased considerably; many lines previously recorded as "reversed" are now "weakened," and new lines of the latter type are recorded. A suggestion that this change may be a result of the passing of the sun-spot maximum awaits the confirmation of further observations. Numerous cases of abnormal "reversals" are referred to in the paper. From the observations of reversed lines Mr. Mitchell deduces a temperature for the gases producing these lines of 4700°, and a further deduction gives 0·38 as the ratio of the sun-spot radiation to the radiation from the unaffected photosphere. The spectrum and construction of the chromosphere are also discussed at some length.

CONDENSATION NUCLEI.[1]

PROF. Barus has written more upon the subject of condensation nuclei than any other physicist. In the present memoir, as in those which have preceded it, he arrives at conclusions which are not in agreement with the work of others who have investigated the properties of ions and nuclei. If his investigations are to be trusted, the determinations which have hitherto been made of the charge carried by the ions by means of the condensation method must be regarded as quite untrustworthy. The matter is of sufficient importance, therefore, to justify an examination of Prof. Barus's methods.

The first three chapters, and the greater part of the sixth and concluding chapter, are concerned with experiments upon the production of clouds by the sudden expansion of dust-free air initially saturated with water vapour, the air in most cases being exposed to the action of X-rays or radium. As described by Prof. Barus, the phenomena are exceedingly complicated and irregular. This is not surprising, however, being largely a result of complication in the experimental conditions.

The expansion was brought about by suddenly opening communication between the "fog chamber" and another much larger, partially exhausted vessel, a measured fall of pressure being thus produced. By means of the coronas formed, an estimate was obtained of the size, and hence indirectly of the number of the drops; filtered air was then re-admitted to bring the pressure back to that of the atmosphere. This method of effecting the expansion is not a suitable one for investigations of the kind attempted. For the rate of fall of pressure must diminish as the expansion approaches completion; it is probable that with a suitable width of connecting tube no great error will be introduced into the measurement of the least expansion required to produce a cloud (*i.e.* that the expansion may be made practically adiabatic), but it is unlikely that the maximum degree of supersaturation resulting from expansions greater than this approaches at all closely to that calculated from the pressure fall. For the condensation on the nuclei which first come into action will, by reducing the amount of vapour remaining uncondensed and by the heat set free, prevent the full supersaturation corresponding to the pressure fall from being attained. The larger the number of easily caught nuclei, the more will the maximum supersaturation attained fall short of the theoretical. The method is thus not a suitable one for obtaining information about the number of nuclei corresponding to various degrees of efficiency.

If we produce a cloud in dust-free air upon nuclei which require a high degree of supersaturation to make water condense upon them, the drops which are formed, if caused to evaporate by compression of the air, appear to leave behind nuclei requiring only a slight supersaturation to make water condense upon them. Unless these are removed before expansions large enough to catch the original nuclei are again attempted confusion is sure to follow. The result of neglecting this precaution is not merely that these residual nuclei give rise to drops as well as those under investigation, but unless the apparatus is such as gives exceedingly efficient expansion the supersaturation necessary for the capture of the nuclei under investigation may not be attained, the number of drops produced being thus too small in contrast to what might at first sight be expected. The experiments of Prof. Barus's investigation were performed under conditions which made this effect

1 "The Nucleation of the Uncontaminated Atmosphere." By Prof. Carl Barus. Pp. 152. (Published by the Carnegie Institution of Washington January, 1906.)