ENGINEERING units of measurement form the subject of a pamphlet which has just been produced by Mr. J. Ramsay, of the Glasgow and West of Scotland Technical College. The greater part of the thirty-six pages consists of definitions of the quantities and symbols which more commonly occur in engineering, and in each case the author gives both British and metrical units, together with the connection between them. Several useful tables are given at the end. The value of the pamphlet will be appreciated when it is remembered that students of engineering in this country are compelled to use both British and metrical systems of measurement, a condition which tends to produce much mental confusion and hinders progress. While most of the author's explanations are good, we do not think that his remarks on pp. 8 and 9 regarding weight, mass, and gravitational and dynamical units of force are sufficiently clear; but few writers have succeeded in producing absolutely convincing statements when they take, as the present author does, the British gravitation unit of force as the force with which the earth attracts a pound weight at the sea-level at Greenwich, and also a unit of mass of 32·2 lb. The publishers of the pamphlet are Messrs. John Smith and Son, Glasgow, and the price is 1s. net.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN SEPTEMBER:—

Sept. 1. 16h. 0m. Mars in conjunction with Moon (Mars 1° 4′ S.).
2. 17h. 0m. Saturn in conjunction with Moon (Saturn 1° 14′ N.).
3. 9h. 2m. to 9h. 50m. Moon occults ξ′ Ceti (mag. 4·5).
7. Maximum of Mira Ceti (mag. 3·3–8·5).
10. Saturn. Major axis of outer ring = 45·31″, Minor axis = 10·00″.
15. 12h. 5m. Minimum of Algol (β Persei).
16. 22h. 0m. Mercury at greatest elongation (26° 34′ E.).
18. 8h. 54m. Minimum of Algol (β Persei).
23. 22h. 0m. Mars at opposition to the Sun.
,, 15h. 3m. Uranus in conjunction with Moon (Uranus 2° 35′ N.).
,, 3h. 39m. to 4h. 53m. Moon occults σ Sagittarii (mag. 2·1).
28. 15h. 0m. Mars in conjunction with Moon (Mars 0° 9′ N.).
30. oh. 0m. Saturn in conjunction with Moon (Saturn 1° 8′ N.).

THE SOUTH POLAR SPOT ON MARS.—With regard to the recent observation by M. Jonckheere, Dr. Lohse records in No. 4348 of the *Astronomische Nachrichten* (p. 61) that he observed the bright patch which has detached itself from the polar snow-cap on August 8. The position of the spot, in areographical coordinates, was:—longitude, 304·5°; latitude, −74·5°. A measure of the south polar spot gave a diameter of about 30°.

COMET 1909*b* (PERRINE, 1896 VII.).—The position of comet 1909*b*, according to the ephemeris given in No. 4348 of the *Astronomische Nachrichten*, on September 3 will be α (1910·0) = 1h. 12·9m., δ = +46° 24·8′, whilst that on September 15 will be α = 2h. 0m., δ = +51° 32·9′. Thus we see the comet is passing from Andromeda to Perseus, and on September 9 will pass about half a degree north of ν Persei; at the same time it is approaching both the earth and the sun, and is now about one magnitude brighter than when re-discovered.

THE ORBITS OF CERTAIN SPECTROSCOPIC BINARIES.—Nos. 15 and 17, vol. i., of the Publications of the Allegheny Observatory deal, respectively, with the orbits of the spectroscopic binaries π^4 Orionis and ζ^1 Lyræ. The former is discussed by Mr. R. H. Baker on the basis of thirty-six spectrograms obtained with the single-prism Mellon spectrograph. The orbit is nearly circular, the eccentricity, in the final elements, being given as 0·027 ± 0·013, and the length of the semi-major axis is 3,393,000 km.; the amplitude of the velocity-variation is 51·8 km., and the period is 9·5 days. The spectrum is of the helium type, but does not show the spectra of both components. Mr. F. C. Jordan finds, from the discussion of sixty-four plates, that the orbit of ζ^1 Lyræ is circular and the period is 4·29991 days; the amplitude of the variation is 102·48 km.

Mr. Jordan has also observed four of the stars in Taurus which Prof. Boss suggested belonged to a group having a common movement. He finds (Publication No. 16) that two of the four stars, Piazzi 234 and Bradley 716, give results in accordance with the idea that they belong to a cluster; the other two, 51 Tauri and ι Tauri, appear to have variable velocities.

THE BOLIDE OF APRIL 20 AS OBSERVED IN FRANCE.—The August number of the *Bulletin de la Société astronomique de France* contains a number of drawings and descriptions (pp. 357–61) of the remarkable meteor seen on April 20 at about 10 p.m. This meteor traversed Ursa Major, leaving behind it a train which lasted for about two minutes as a naked-eye object, according to M. Quénisset, and could be seen for five minutes with a prismatic binocular. The train moved in an east-and-west direction, and developed a condensation, which is shown by some observers as being at one side of a break in the train, and by others, M. Quénisset among them, as a bright loop. The brightness of the meteor was about equal to that of Venus at its brightest, whilst that of the train was comparable with the brightness of the Milky Way.

MATERIA MEDICA AMONG THE ZULUS.

IN the July number of the Annals of the Natal Government Museum, Father A. T. Bryant, a competent observer of native life and author of a valuable dictionary of the tribal language, has for the first time collected materials for the study of Zulu materia medica and the methods of the local medicine-man. He records some 240 Zulu plants used in medicine, giving what the people believe to be their properties and the modes in which they are administered to the patient. Here, as among other savage races, the medicine-man was a personage originally distinct from the diviner or so-called witch-doctor; but their functions tend occasionally to overlap, the medicine-man dealing largely in magic and charms, while the witch-doctor makes himself familiar with curative herbs, though his real business is to indicate or "smell out" the agency which is supposed to have caused the illness.

The Kafir medical man has no knowledge of pathology. He knows as much of anatomy as can be learned from cutting up cattle for food; but the nervous system is a complete mystery to him, and though he has observed that the blood runs through the body, he does not associate its circulation with the beating of the heart. He works by the examination of symptoms, though he is ignorant of their cause, treating paraplegia, for instance, by local applications, and not connecting its occurrence with any brain disease. His occasional successes seem to be generally due to the influence of suggestion, by exciting the feeling of confidence or imagination which summons into action the remarkable recuperative powers of the patient. In his profession medicine and magic constitute a single art, and he is called upon to combat, not only the disease which has actually shown itself in the system, but also the machinations and forms of the black art which are believed to have induced it.

Like most savages, the Zulu is unusually susceptible to new diseases, though he is hardened against those which are old. Father Bryant gives interesting details of the more common diseases and their popular treatment. He records a form of disease, believed not to be known to medical science, resulting from an intestinal parasite developing into a species of beetle. The local form of phthisis seems to be different from that of Europe, the former setting in at the bottom, the latter at the top, of the lung. The medicine-man deals largely in blood-letting, poulticing, the use of ointments, the clyster and

the emetic. He knows many of our standard remedies, while of others equally accessible to him he is ignorant. Thus he uses indigenous species of Nephrodium for the relief of tape-worm, and croton as a purgative, but it is apparently from the white man that he has learned that the *Ipomoea purpurea* has qualities analogous to jalap, and though castor-oil is used for dressing hides he is not aware of its medicinal value. But he undoubtedly is acquainted with a great number of simples, mostly vegetable; and Father Bryant believes that the further investigation, and in particular the chemical examination, of many of the drugs which he names will in all probability add valuable remedies to our pharmacopœia. Dr. E. Warren, curator of the museum, promises that his department will provide all possible assistance in material and information to any competent chemist who is prepared to undertake such an inquiry.

AMERICAN INVERTEBRATES.

BULLETIN No. 63 of the United States National Museum is devoted to a monographic revision, by Mr. F. E. Blaisdell, of the beetles of the Eleodine section of the family Tenebrionidæ inhabiting the United States, Lower California, and the adjacent islands. The memoir includes 534 pages of text and thirteen plates.

In No. 2 of the Leland Stanford Junior Publications of the University of California Prof. F. M. Macfarland describes in considerable detail the anatomy of the opisthobranchiate molluscs obtained during the Brauner-Agassiz expedition to Brazil in 1899. The collection, although small, adds seven to the list of Brazilian species of the group; and since little was previously known with regard to the structure of the opisthobranchs of the district, the opportunity was taken of studying this as minutely as the amount of material permitted. A number of diagrammatic figures of the radula in different genera is given.

The feather-stars, or ophiurids, of the San Diego region form the subject of vol. vi., No. 3, of the University of California Publications in Zoology. The author, Mr. J. F. McClendon, began his investigation in the hope that a taxonomic and biological study of the local members of the group might facilitate work in which it was important to know the breeding-seasons and habitats of different species, but, unfortunately, he could not remain long enough to obtain all the data desired. It is believed, however, that the height of the breeding-season for most of the species is in the spring, although individuals full of apparently unripe eggs were taken in spring.

A number of new fossil echinoderms from the Cretaceous and Tertiary Ripley beds of Mississippi are described and figured by Mr. A. W. Slocum in vol. iv., No. 1, of the Geological Publications of the Field Museum, Chicago.

The re-arrangement of the large collection of graptolites which for many years has been in course of formation in the U.S. National Museum has afforded to Mr. R. S. Bassler the opportunity of revising the species of the dendroid group from the Niagaran Dolomite of Hamilton, Ontario, and the results of his studies are published, with a large number of illustrations, in Bulletin No. 65 of the museum.

THE SEVEN STYLES OF CRYSTAL ARCHITECTURE.[1]

THE proverbial importance of the number seven is once more illustrated in regard to the systems of symmetry exhibited by solid matter in its most perfectly organised form, the crystalline. For there are seven such systems or styles of architecture of crystals, just as there are seven distinct notes in the musical octave, and seven chemical elements in the octave or period of Newlands and Mendeléeff, the eighth or octaval note or element being but a repetition on a higher scale of the first.

A crystal appeals to us in two distinct ways, first compelling our admiration for its beautifully regular exterior shape, and next impressing us with the fact of its internal homogeneity, expressed in the cases of transparent crystals by its perfect limpidity, and the obvious similarity throughout its internal structure. As it is with human nature at its best, the external appearance is but the expression of the internal character.

The purpose of this discourse is not so much to dilate upon the seven geometrical systems of crystals as to show how they are occasioned by differences in the internal structure, and to demonstrate this internal structure in an ocular manner, unfolding at the same time some interesting phases of recent investigation.

To the Greeks, whose wonderfully perfect knowledge of geometry we are ever admiring, the cube was the emblem of perfection, for like the Holy City, lying "foursquare," described in the inimitable language of the book of Revelation, "The length and the breadth and the height of it are equal." Moreover, even when we have added that all the angles are right angles, these are not the only perfections of the cube, for they carry with them, when the internal structure is developed to its highest possibility, no fewer than twenty-two elements (thirteen axes and nine planes) of symmetry.

At the other extreme is the seventh, the triclinic, system, in which the symmetry is at its minimum, neither planes nor axes of symmetry being developed, but merely parallelism of faces, sometimes described as symmetry about a centre, and in which there are no right angles and there is no equality among adjacent edges. Between these two extremes of maximum and minimum symmetry we have the five systems known as the hexagonal, tetragonal, trigonal, rhombic, and monoclinic, possessing, respectively, 14, 10, 8, 6, and 2 elements of symmetry. All crystals do not possess the full symmetry of their system, each system being subdivisible into classes possessing a definite number of the possible elements. Altogether there are thirty-two such classes, and their definite recognition we owe to the genius of von Lang and Story Maskelyne.

The characteristic property possessed in common by all crystals is that the exterior form consists of and is defined by truly plane faces, inclined, in accordance with one of the thirty-two classes of symmetry, at specific angles which are characteristic of the substance. This has only been proved to be an absolute fact within the last few years, although asserted by Haüy so long ago as the year 1783; for the numerous cases of so-called "isomorphous" salts, the first of which were discovered by Mitscherlich in the year 1820, were for long believed to be exceptions, and until the year 1890 no actual evidence one way or the other was forthcoming. But it was eventually shown that the crystals of the members of an isomorphous series did differ, both in their angles and in all their other crystallographic and physical properties, although in the cases of the angles the differences were very small. Moreover, the differences were shown to obey a simple but very interesting law, namely, that they were functions of the atomic weight of the chemical elements of the same family group the interchange of which gives rise to the series.

All crystals possess one other obvious property, that of homogeneity, and we now know that it is the character of the homogeneous substance which determines the external form. There are no fewer than 230 different kinds of homogeneous structures, neither more nor less, the elucidation of which we owe to the independent recent labours of Schönflies, von Fedorow, and Barlow; and it is a significant fact that the whole of them fall naturally into the thirty-two classes of crystals, leaving no class unaccounted for. Of these 230 modes of regular repetition in space fourteen are the space-lattices long ago revealed to us by Bravais, and all recent investigation concurs in indicating two facts, first, that it is the space-lattice which determines the crystal system, and second that it is the arrangement of the chemical molecules which is represented by the space-lattice. Each cell of the space-lattice corresponds to a molecule. The structure is certainly not solid throughout, however, part only being matter, and the rest æther-filled space, the relative proportions and the shape of the material portion being as yet unknown. We limit ourselves, therefore, to considering each molecule as a point, and we draw the lattice as a network of three systems of parallel lines, parallel to the directions of the three principal crystal edges, analogous, according to the system of symmetry, to

[1] Summary of evening discourse delivered before the British Association at Winnipeg on August 26 by Dr. A. E. H. Tutton, F.R.S.