

between the limits of 100 and about 180 or 200 km. radius. Confirmation of the existence of a "Silent Region" was therefore once more obtained. Also, the times which the sound waves took to reach various distances are in most cases longer than they would be for normal propagation through the surface air.

The accuracy of the time standard of the average non-scientific observer is not likely to be high, but when the British observations are classified with reference to apparent velocities of propagation, there appears to be some evidence that these tend to group themselves about points corresponding to velocities of 257, 335, 370, and 508 metres per second. The second group corresponds very closely to propagation through the surface layers of air, due allowance being made for temperature and wind. In view of the uncertainty as to the accuracy of the observed times, it is doubtful whether the observations of the third group are to be regarded as truly distinct from those of the second, but it is just possible that this velocity is to be explained by the assistance of a strong northeasterly wind, and, though there is no actual measurement, it is not improbable that such a wind may have existed somewhere about the three- or four-kilometre level. At a height of one kilometre the mean wind over south-east England was north-easterly 15 m/s, and at a height of two kilometres E.N.E. about the same velocity. A *ballon sonde* reaching 9 km. indicated a resultant drift for the whole trajectory from about N.N.W., and a cirrus cloud observation obtained in Holland indicated an apparent velocity equivalent to 33 m/s from W.N.W. at a height of 10 km.

Of special interest are the first and fourth groups with velocities centring at 257 and 508 m/s respectively. Five of the seven observations indicating the latter velocity were made at very considerable distances from Oldebroek, namely at Newcastle, Bolton-le-Moors, Skipton-in-Craven, Northallerton, and Guernsey. Prof. E. van Everdingen is of opinion that such observations and the proven existence of the "Silent Region" afford very strong evidence of the co-operation of the hydrogen atmosphere. The view that the appearance of silent regions is to be ascribed to a change in the constitution of the atmosphere at great heights was put forward by Von dem Borne in 1910. Making certain assumptions as to the constitution at great heights, he calculated that the shortest possible distance at which sound rays, curved back by this high atmosphere, could reach the surface was 114 km., the ray becoming horizontal at a height of 75 km. Actually no case of so short a distance has yet been found. In 1915 van Everdingen, taking Wegener's hypothesis as to the occurrence of geocoronium in the atmosphere and his percentage values as to constitution, showed that it gave no better a result. On testing various hypotheses, the best results appeared to indicate a percentage of hydrogen at surface level of 0.0001.

In addition to the observations discussed above collectively, certain special observations were made in this country. The Acoustical Research Section of the Signals Experimental Establishment contributed most valuable records obtained by means of hot wire microphones at Woolwich and at Biggin Hill, Kent. These were described and discussed in detail by Major W. S. Tucker in a paper to the Royal Society of Arts on November 29. In the case of the Biggin Hill record he attributes the first effect (indicating a velocity of nearly four times that of sound in air) to propagation through the water and the ground.

At Eskdalemuir Observatory at 17 h. 29 m. G.M.T. a small upward movement of about one-thirtieth of a millibar on the microbarograph record was followed about 13 minutes later by an approximately equal

one in the opposite direction. On the traces of the other instruments, including the seismographs, no evidence of an explosion effect is to be found. Mr. J. J. Shaw (West Bromwich) could also find no evidence on his seismograms, but stated that at the critical time many thousands of pedestrians and heavy vehicular traffic (the returning crowd from a football match) were passing his house.

The collected observations of the various European countries are now being investigated by Prof. van Everdingen of the Dutch Meteorological Service.

University and Educational Intelligence.

AMONG University Extension agencies the Summer School plays an increasingly important part. This year eleven universities and university colleges in Great Britain were responsible for at least fifteen summer schools, not counting those organised by joint committees for tutorial classes in connexion with the Workers' Educational Association. In the United States, summer courses are provided in numbers and on a scale far in excess of anything that has been attempted elsewhere. The Bureau of Education, Washington, has published a Bulletin on the subject (1922, No. 31) in which are shown the student enrolments in last year's summer schools of the twenty-seven universities and colleges which sent representatives to the meeting of the Association of Summer School Directors. The largest were: Columbia 11,809, Chicago 6458, California 6176, Wisconsin 4547. Fourteen other institutions had enrolments exceeding 1000 each. On the other hand, many of the best known, including Yale, Princeton, Vassar, and Brown, do not receive summer students: Yale experimented with the system for three years and then gave it up. Some of the most conservative colleges, while not undertaking summer schools of the ordinary type, have opened their doors in the summer for conferences and for special classes designed to establish contact with industrial workers. Many hesitate, as do universities in this country, to increase their commitments in this direction for fear of financial difficulties. State universities regard the matter in a different light, and find that this and other forms of extension work help to justify in the eyes of the taxpayers their large demands on the public purse. In general the courses are devoted principally to the liberal arts and sciences and to education, but some schools of law, medicine and dentistry offer courses which count for their degrees, and in a few institutions engineering and architecture courses are provided.

FROM the Royal Technical College, Glasgow, we have received a copy of their annual report on the work of the session 1921-22. Owing to the cessation of special classes held at the request of the Ministry of Labour under their "Interrupted Apprenticeships" Scheme, the number of students was slightly lower than in 1920-21, but compared with 1913-14 the year's enrolment shows an increase of 150 per cent. The research work carried on in the college is extending rapidly in volume and importance, especially in chemistry, metallurgy, and engineering. Much of it is undertaken at the instance of industrial research associations by the associations' own workers under the supervision and guidance of the professors concerned. The course for the diploma in chemistry, recently extended from three to four years, includes in its final year three months devoted to experimental inquiry, on which a thesis is required to be written. This plan has been an unqualified success, the report says, from an educational point of view, and some of the theses presented last year were of such intrinsic

value as to warrant publication. In more than a hundred centres in the surrounding counties affiliated continuation classes in science and technology were conducted by education authorities: nearly all evening students entering the college, except those from a considerable distance, present qualifications gained in such affiliated classes. The school of pharmacy is now thoroughly established, and several students are preparing for the B.Sc. degree in pharmacy of the University of Glasgow.

RECENT developments in the Swedish national school system are described in an article by Prof. Hänniger of the Landskrona Training College in the November number of *School Life*—an official journal of the United States Bureau of Education. In 1919 the Government prescribed for use in the folk-schools a new instruction plan, the outstanding feature of which is "home and community study," involving lessons based on direct observation of the environment of home and school and linking the observed facts with geography, nature-study, history, drawing, and sloyd. About the same time were established two-year continuation schools with a total of 360 hours of instruction, directed in the main on practical lines, and including citizenship and the mother-tongue, and either a craft or natural history, sloyd, and horticulture. These schools are to be obligatory after 1924. Apprentice schools with two-year curricula, for which the continuation schools serve as a preparation, may be made compulsory at the option of the local community. In the apprentice schools the instruction comprises 6 to 12 hours per week during 8 or 9 months of the year. Beyond it is an optional crafts school with a one-year course. In a report just issued by a Grand School Commission proposals are made for substituting for the existing dual system (folk-school and *realskola*) a common foundation school to be attended by children of all classes for six years, leading to a middle school with a four-year course, to be followed by a three-year "gymnasium."

HIGHWAY Engineering and Highway Transport Education problems were discussed at a conference held at Washington on October 26-28, under the auspices of the United States Highway Education Board. Between 1910 and 1922 the number of motor vehicles increased 2000 per cent. (to ten and a half millions), while the increase in funds for road building was only 400 per cent. Neither highway construction nor highway transport education have kept pace with the stupendous increase in automobile traffic. The trend in the colleges at present is towards a system whereby certain fundamental courses covering about 5 semester hours in highway engineering are required of all civil engineering students, while an equal amount of optional supplementary highway instruction in the subject is offered for intending specialists.

It is announced in the *British Medical Journal* that the University of Paris has received two gifts of 100,000 francs each from Madame Edouard Nathan. The first of these is to be applied to the improvement of the scientific laboratories of the University, and to the promotion of research work. The second is to be set apart for the purpose of making loans to impecunious students of the University to enable them to continue their studies.

THE *Chemiker Zeitung* of October 28 reports that Prof. Pfeiffer, of the Technische Hochschule, Karlsruhe, has been appointed Director of the "Josefine und Eduard von Portheim-Stiftung für Wissenschaft und Kunst" in Heidelberg, and will direct the Chemical Research Institute of this Fund.

Societies and Academies.

LONDON.

Physical Society, December 8.—Dr. Alexander Russell, in the chair.—G. Shearer: The relation between molecular and crystal symmetry as shown by X-ray crystal analysis. By X-ray analysis the number of molecules associated with the unit cell is determined. The symmetry number for each of the 32 crystal classes is shown to mean the minimum number of asymmetric molecules necessary in the unit cell to satisfy the symmetry conditions. The symmetry number is the actual number of molecules in the cell when the molecule is asymmetric; if the molecule possesses symmetry, this symmetry appears also in the crystal, and the number of molecules in the unit cell is obtained by dividing the symmetry number of the crystal by the symmetry number of the molecule.—E. A. Owen and G. D. Preston: Modification of the powder method of determining the structure of metal crystals. Plates of aluminium, iron, copper, lead, and magnesium have been examined by means of the Bragg X-ray spectrometer, employing radiation direct from a molybdenum anti-cathode. The maxima in the spectra are sufficiently intense to measure with accuracy, and the crystalline structure of the materials examined are readily determined.—A. B. Wood: The cathode ray oscillograph. The instrument is of the low-voltage type, in which a hot cathode is employed as a source of the electron current. This low-voltage type of oscillograph is much more sensitive than the high-voltage cold-cathode type of M. Dufour. There are various methods of focussing the cathode-ray stream, and it has been proposed to have an external (*i.e.* outside the vacuum) photographic film. Ordinary gelatin-coated roll films or plates are unsuitable, owing to the marked absorption of the cathode-rays by the gelatin. The best results have been obtained with Schumann plates containing calcium tungstate. This material phosphoresces with a light rich in ultraviolet, and consequently the secondary luminous effect on the Schumann plate is very great. Mechanical, electrostatic, and electromagnetic methods are described for generating a time-axis on the records.—R. Webb: A low-voltage cathode ray oscillograph. The instrument is designed to work at 300 volts. The cathode consists of a hot platinum filament coated with certain oxides, and formed into a circle coaxial with the path of the rays. It is protected from bombardment by positive rays, which would disintegrate it, by a screen in which is cut a circular hole slightly less in diameter than the filament. It has a life of about 200 hours. The anode is a platinum tube through which the rays pass. The deflecting fields are electrostatic, and are provided by two pairs of plates at right angles. The bulb is in the form of a conical flask, the cathode being at the narrow end so that the rays impinge on the flat bottom, which is coated inside with fluorescent matter. The luminous trace of the rays can be seen from outside through the bottom of the flask.

Royal Meteorological Society, December 20.—Dr. C. Chree, president, in the chair.—C. J. P. Cave and R. A. Watson Watt: The study of radiotelegraphic atmospherics in relation to meteorology. Results obtained in 1915, at the Meteorological Office Radio Station, Aldershot. Radiotelegraphic direction finding on atmospherics was introduced as a means of locating thunderstorms, and successful observations were made, with the co-operation of the Admiralty coast stations, on storms as near as five miles to an observing station, and on other storms 1000 miles distant. The first thunderstorm thus located, and