In the space available, only brief extracts from the statistics can be quoted. Of the sixth-form population the proportion of boys taking mathematics and science only was 57 per cent in maintained grammar schools, 56 per cent in direct-grant schools, but only 46 per cent in other independent schools recognized as efficient. The corresponding figures for girls were 22, 23 and 17 per cent. Mixed arts and science courses were more frequently taken by girls (about 10 per cent of sixth formers) than by boys, where the figure was of the order of 5 per cent. The persistence of the differential in favour of arts subjects among the independent schools is of some interest.

As regards graduate grammar school teachers of science subjects, contrary to general belief, the proportion of graduates with first-class honours is higher than among teachers of arts subjects: 10·2 and 10·6 per cent in maintained and direct-grant schools respectively, as against 8·6 and 8·8 per cent in arts subjects. On the other hand, however, the proportion of those who have neither first- nor second-class honours is much higher among science teachers than among their arts colleagues (49·3 and 51·6 per cent as against 28·6 and 40·8 per cent). Among the grammar school graduate teachers, therefore, the second-class graduate is most common on the arts side; the third-class graduate or pass degree man on the science side.

Among the teaching profession as a whole, the proportion of graduates is slowly rising, 30·5 per cent of men and 12·6 per cent of women teachers held degrees in 1962, against 25·2 per cent and 10·7 per cent in 1953. What is alarming, however, is the age structure of graduate teachers; 43 per cent of graduate teachers of mathematics are over 45, as against only 33 per cent of other graduate teachers.

## THE RESEARCH COUNCIL OF ALBERTA

THE forty-third annual report of the Research Council of Alberta, covering the year 1962, includes a list of publications, 1958–62, and details of staff and of membership of advisory committees*.

A research and development project of direct industrial significance is the pipe-line transport of solid materials, which is under investigation in both the Petroleum and Coal Divisions. In the Petroleum Division particular attention is directed to the flow of capsules in a liquid stream, while in the Coal Division the transport of slugs of a coal–water paste in an oil stream is being studied. Pipe-line transportation could go far towards solving the problems of long freight hauls and small local markets which face most Western Canadian producers, and other commodities which might be so transported are sulphur, wood pulp and grain. The Geology Division is studying the production of iron from Clear Hills iron ore which promises to produce iron powder of high quality for powder metallurgy from an abundant but low-grade material. The Coal Division is also investigating the production of active carbons and the chemical structure of humic acids, while the Natural Gas Division is investigating types of high-temperature burners suitable for chemical processing. About one-fifth of the research effort of the Council is devoted to such industrial programmes, including almost the entire programme of the Industrial Engineering Services Division. It is anticipated that the proportion will increase as the industrialization of the Province becomes more diversified and less limited to the production of raw materials.

Mapping and evaluation of resources are conducted primarily by the Geology, Ground-water, and Soils Divisions, and to a lesser extent by the Coal Division. A helicopter survey has proved very successful in the Geology Division in obtaining preliminary information on an area of some 30,000 square miles in north-western Alberta. A six-year programme to be completed next year by the Soils Division will provide a report on the soil resources of about 85 million acres of northern Alberta. The Ground-water Division is exploring for ground-water supplies in areas throughout Alberta and is making geological and hydrological studies for several large drainage areas. Mapping and survey projects constitute about 25 per cent of the Council's programme.

Almost half the activities of the Council are represented by long-range research projects, the remainder, including various co-operative investigations with other agencies, such as the highway research programme (which includes studies of physico-chemical aspects of soil behaviour, the evaluation of pavement behaviour and hydraulic studies), the hail studies programme, which attempts to elucidate the processes leading to the development of hail-storms and to the formation of hail, and the watershed research programme of the Eastern Rockies Forest Conservation Board.

* Research Council of Alberta. Forty-third Annual Report, 1962. Pp. 74. (Report No. 83.) (Edmonton: Research Council of Alberta, 1963.)

## NUTATIONAL MOTION OF THE EARTH'S AXIS

By NIKOLAI POPOV

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THERE is a close relationship between the shape of the Earth, its inner structure and its rotation. Therefore it is possible to obtain results concerning the rotation of the Earth by making certain assumptions about its inner structure and drawing on some data furnished by investigations of astral motion. If, on the other hand, we have data on the Earth's rotation obtained by astronomical observations, we can solve the inverse problem, that is, we can obtain some idea of the Earth's inner structure. The Poltava Observatory has detected the nutation of the terrestrial axis predicted by the theory of the rotation of the Earth having a liquid core.

The Earth's diurnal motion is very complicated, since several perturbations different in magnitude and period are superimposed in this case. Thus, the Earth's axis changes its position in space because of the attraction of both Moon and Sun. As a result, the terrestrial axis describes a cone with a period of some 26,000 years. Changes in the positions of the orbits of the Earth and Moon give rise to periodical oscillations of the terrestrial axis known as nutation oscillations. The nutation of the Earth's rotation axis in space is composed of several oscillations with different periods and amplitudes. The largest of these oscillations (known as the main term of nutation) has a period of approximately 19 years and an amplitude of 9·218 sec of arc. The other nutation terms have shorter periods and very small amplitudes.