As we have now a really democratic President of the Board of Education, who has a genuine zeal for education and a fervent desire that all who are capable of benefiting from it shall have the means of enjoying its advantages, we may hope that steps will be taken to place our universities and technical institutions upon a satisfactory financial footing. In an address delivered in September last to the Associated Educational Societies of Manchester, on "Educational Reform," recently issued in pamphlet form, Mr. Fisher surveyed the whole field of education, and directed attention to the great increase in the number of universities now existing in England and Wales, comprising twelve, including the ancient universities of Oxford and Cambridge. Mr. Fisher characterised these as in the forefront of European learning, and said they need not fear comparison with the most famous universities of the Continent in respect either of the quality of their contributions to the advance of knowledge or of the adequacy and power of their teaching. The ten more modern universities, which are largely subsidised by the State, have not yet received an equipment at all adequate to modern needs, and are nowhere supported by so large a body of students as they deserve. Attention was directed to a comparison between Lancashire and Scotland, with a similar population. In the former there are two universities, in the latter five, with, in the case of Scotland, a body of undergraduates five times as numerous as that of the Universities of Manchester and Liverpool combined.

The place and function of the secondary school in its relation to the university were also discussed by Mr. Fisher. While the number of such schools has greatly increased, there being nearly 1000 in receipt of education grants, there is in many areas very inadequate provision, to the great detriment of the children residing therein. There are too many early leavers and too low a percentage of pupils who reach matriculation standard. Much needs to be done before the secondary schools can reach a proper level. Better salaries must be offered to the teachers and an adequate scale of pensions arranged. More encouragement must be offered to induce a higher standard of work, and so enable the universities to reach a higher plane of teaching. More and better provision is needed in the way of maintenance scholarships enabling capable, though poor, children to travel along the broad highway unimpeded from the elementary school to the university. Whilst the work of the elementary school has much improved of late it can never do its full work until the leaving age is made compulsory up to fourteen at least, and provision then made for a liberal, continued education within working hours for those entering industry up to eighteen years of age.

One point which has been overlooked in recent discussions is that of the need for improvement of the scales of salaries of teachers in universities and technical institutions if competent instructors are to be maintained. A meeting of teachers engaged in the technical institutes, junior technical and trades schools of London and the neighbouring counties was held on Saturday last to consider this question. Special emphasis was laid by several speakers on the fact that men and women of attainments similar to those of teachers in technical institutions can obtain much higher salaries in industry or in secondary schools than are paid in the technical institutions. A resolution declaring that the present rates of salaries paid to both day and evening teachers in technical institutions are totally inadequate, and urging the education authorities to take immediate steps to establish satisfactory scales of salaries for all teachers, was carried unanimously. A further resolution requesting the Government to allocate special grants, similar to those given in the case of secondary and elementary schools, for improving the salaries of teachers in technical institutions was also adopted. It was agreed that the London Branch of the Association of Teachers in Technical Institutions, by whom the meeting was organised, should request the County Councils of London and the Home Counties to receive deputations for the purpose of placing the views of the meeting before them.

MAGNETIC SURVEY OF NEW ZEALAND.[1]

IN the observational work recorded in the publication referred to below Dr. Farr had much assistance from Mr. Skey, who succeeded him as director of the Christchurch Magnetic Observatory when Dr. Farr became professor of physics at Canterbury College, while Mr. D. B. MacLeod took an active part in the discussion of results. The observational work extended over the years 1899 to 1909, in the course of which 334 stations were occupied, including forty-four in the Southern Islands, Chathams, and West Coast Sounds. The instruments, a unifilar magnetometer and dip circle—the former once used by the North American Boundary Commission, and by the Jackson-Harmsworth Polar Expedition—were lent by the old Kew Committee of the Royal Society.

Particulars are given of the position of each station, the date or dates of observation, the values of the declination, dip, east and north components, horizontal, vertical, and total forces. Owing to the long period covered by the observations, considerable importance attaches to the secular change corrections necessary to reduce the data to a common epoch. These were based on the magnetograph data obtained at Christchurch from 1901 onwards, and on observations at repeat stations. Following the example afforded by Rücker and Thorpe's survey of the British Isles, New Zealand was divided into ten overlapping districts. These were bounded by parallels of latitude, the limits of three successive ones being, for instance, 38° and 40° S., 39° and 41° S., and 40° and 42° S. Assuming the change in any element within any one district a linear function of the latitude and longitude, the rates of change with latitude and longitude were deduced in the first instance by the method of least squares. A process of smoothing was then applied, to secure continuity in passing from one district to the next.

The general nature of the results is best seen by consulting the maps. The great length of New Zealand from north to south necessitates two maps for each element, one for the North Island, the other for the South Island. The latter, it should be noticed, is described as the "Middle Island" in the charts principally devoted to the North Island, a memory of the time when the small island, now known as Stewart Island, was called the South Island. In the case of the declination, starting at the extreme north of the North Island, we have the isogonal of 14° 0′ E., sloping from N.W. to S.E. Near the south of the North Island, and north of the South Island, the isogonal of 15° 50′ runs nearly due east and west, while to the extreme south of the South Island the isogonal of 17° 10′ slopes from N.E. to S.W. The isoclinals and lines of equal horizontal force, on the other hand, have a nearly parallel trend from extreme north to south. The dip ranges from under 60° S. to over 71° S., and the horizontal force from 0·275 C.G.S. in the extreme north to 0·200 C.G.S. in Stewart Island.

Other maps deal with the northerly, east, and vertical components, and the total force. The two last

[1] "A Magnetic Survey of the Dominion of New Zealand and Some of the Outlying Islands for the Epoch June 30, 1903." By Dr. C. Coleridge Farr. Pp. 64+2, with 18 maps. (Wellington: John Mackay, Government Printer, 1916.)

show the local disturbing forces, which are discussed in pp. 28–31. Amongst the largest disturbances are those in Stewart Island and near Invercargill and Dunedin. Prof. Marshall contributes in pp. 63–64 some remarks on the geological character of the disturbed regions. His conclusion is that "while in each case of magnetic irregularity it is possible to point to some unusual geological feature, these are in no instance the most marked feature of that kind in the country, and those localities where such feature is most pronounced show no unusual magnetic characters." As Dr. Farr says himself, there is room for considerable further observational work in the disturbed districts.

Two supplementary pages give particulars of observations made in March and April, 1916, at ten of Dr. Farr's stations by Mr. W. C. Parkinson, once of Greenwich and Eskdalemuir Observatories, now observing for the Carnegie Institution of Washington. These serve a useful purpose in showing the changes that have occurred since the epoch of the survey.

Transport is still a serious difficulty in parts of New Zealand, and the work had to be carried on in the spare time which his other important duties left at Dr. Farr's disposal. He is to be congratulated on having brought to a satisfactory conclusion an arduous piece of work, which adds substantially to our knowledge of terrestrial magnetism in the southern hemisphere. It is satisfactory to notice that the work had the active support of the New Zealand Government, and that the printing was done, and satisfactorily done, at the Government Press. C. CHREE.

PARASITES OF CROPS AND CATTLE.

VERY striking data as to the extent of the loss of crops occasioned by diseases of parasitic origin are contained in the paper on economic mycology read by Prof. M. C. Potter at the Newcastle meeting of the British Association (1916), and since published in the Journal of the Royal Horticultural Society (vol. xlii., parts ii. and iii.). In the year 1891 the loss to the German Empire upon the total cereal crops was estimated at more than 20 millions sterling, an amount nearly equal to one-third of the total value of the crop. In the same season (1890–91) the loss due to rust of wheat in Australia was estimated at 2½ millions. The case of potatoes is even more notorious. In Germany the loss due to disease of the potato crop amounted in one year to 30 millions, and in our own country it is computed that, on the average, the crop is reduced by disease by at least one-third. It is estimated that in Northumberland and Durham about half the crop of swedes and turnips is destroyed in average years by parasite attacks. Losses of timber also are very serious, and probably amount to one-third of the whole. Other crops, such as tea, rubber, hops, and every kind of fruit, greenhouse, and garden crops, all pay a heavy toll to fungus diseases. A plea is entered for greater encouragement by botanists to the prosecution of research in phyto-pathology and for the wider treatment of the fungi in ordinary botanical courses, especially from the point of view of their work in Nature. The scope of the problems awaiting solution in this field is abundantly illustrated, and appreciation is expressed of the increased attention and support given to it in recent years by Government departments and other institutions, although further provision is still urgently necessary.

A report on investigations into the cause of worm nodules (*Onchocerca gibsoni*) in cattle by Messrs. C. G. Dickinson and G. F. Hill has been issued as a Bulletin (C. 9341) by the Government of the Commonwealth of Australia. Two series of experiments were carried out in the Northern Territory with calves from nodule-free districts of Victoria. Calves grazing on high, dry ground along with infected cattle became infected within eight months of arrival, whereas similar nodule-free calves did not become infected during the same period when enclosed in an open pen with concrete floor within 30 yards of a paddock within which affected cattle were depastured, although exposed to the attacks of winged and apterous Arthropoda. The results, while not revealing an intermediary host of the parasite causing Onchocerciasis in cattle, have definitely excluded certain species that were regarded as possible vectors, namely, *Lyperosia exigua, Stomoxys calcitrans, Tabanus mastersi, T. nigritarsis, Boophilus australis,* and any purely aquatic forms other than those possibly found in the bore-water. Various common species of mosquito, it is thought, may also be excluded. Wild swamp buffaloes were not affected, whereas wild Zebu cattle and domestic cattle grazing on the same country are invariably affected.

LIGHT AND VISION.[1]

THE old Greek philosophers who did so much thinking and so little experimenting had queer ideas about light and vision. Empedokles, who died about 420 B.C., considered it necessary to record the fact that darkness is not a real thing, but privation of light; and that the moon shines with reflected light, but he thought that the sun is the primary fire of the light of the sky reflected in a crystalline spheroid. Democritus, who died about 370 B.C., held that vision was to be explained by emanations or exceedingly thin husks or films which were continually being detached or thrown off from the surface of bodies, and that they penetrated into the sense-organs through fine passages or pores. We admit this in the case of taste and of smell. These ghost-like forms or images were called *eidola* (εἴδωλα), whence we have the word idol (a very different kind of image from those considered in optical books), and were supposed to be ever passing from the object to the moist and receptive surface of the eye straight into the mind. Aristotle, who died about 325 B.C., seems to have objected to some of the earlier theories. He scarcely alludes to light and vision in "De Physica," but there is some reason to suppose that a treatise by him on optics has been lost. More than two centuries later Lucretius, the scientific poet, discussed the theory at great length in the fourth book of "De Natura Rerum." He used the expression *simulacra quasi membranae,* resemblances like films, peeled off from the upper surface of things, flying hither and thither on one side and the other through the air. *Simulacra* was also used for ghosts, and he goes on to explain how they terrify us in sleep. He also attempted to explain the action of curved mirrors, of the distance of the image behind a mirror, and why the theory does not work in the dark.

The schoolmen in the Middle Ages tried to follow Aristotle as closely as they could, but matter and form probably did not mean to them what they meant to Aristotle or to us. The *eidolon* was still used, but the expression had lost its materialistic signification. At the end of the sixteenth century men began to shake off dogmas of authority, to think for themselves, and to follow inductive lines of reasoning.

We may perhaps flatter ourselves that in our branch of applied optics we are not trammelled by fundamental theory, and that if the corpuscular hypothesis of light came back again into fashion next week to replace the undulatory theory, as the electron has pushed aside the

[1] From the presidential address delivered before the Illuminating Engineering Society on December 18, 1917, by A. P. Trotter.