in which this trajectory appears as a circle of radius 73,500 km., and the motion along the circumference increases from 5 to 95 km./sec.

The tendency of prominences to form long horizontal streamers connecting one with another, or curving down towards the chromosphere, is familiar to all who have observed these objects. Mr. Pettit has found that motion takes place along these narrow filaments, which represent, therefore, stream-lines of luminous gas, and these lines often appear to converge towards "centres of attraction" in the chromosphere. The large prominence of May 29, 1919, afforded rich

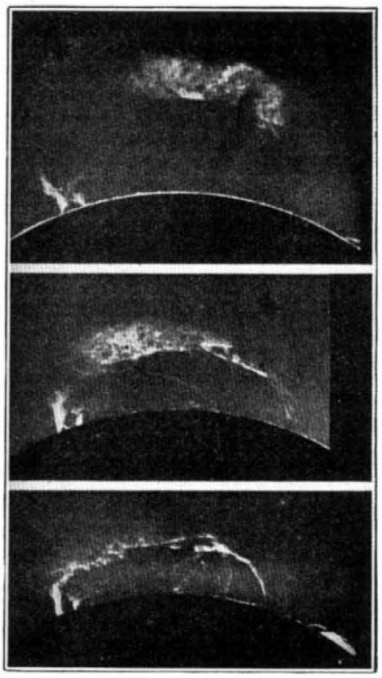

FIG. 1.—The great prominence of May 29, 1919.
Scale: *a*. 1 mm. = 18,652 km.; *b* and *c*. 1 mm. = 16,832 km.
From "The Forms and Motions of the Solar Prominences."

materials for a detailed study of these movements. One of the illustrations is here reproduced (Fig. 1).

As regards the supposed attraction of sunspots for prominences, Mr. Pettit finds many examples of knots in streamers, or the streamers themselves, moving inwards towards a spot-region, and a few in the reverse direction. Previous observations at Kodaikanal showed a predominance of outward movements.[2] That these filaments or knots actually enter the umbræ of spots remains uncertain, and no case is recorded of an entire prominence being thus swallowed up. The streamers of the great prominence of May 1919, although they converge towards a sunspot, would appear to fall short of it by about 4° of latitude (Fig. 7), and at a later stage (Fig. 8) they seem to be repelled from the spot. Other "centres of attraction" for prominence streamers are shown to exist in regions remote from spots, and there is evidence that this attraction is felt far out into the coronal region.

The question whether gravity plays a part in the descent of matter in the streamers is investigated,

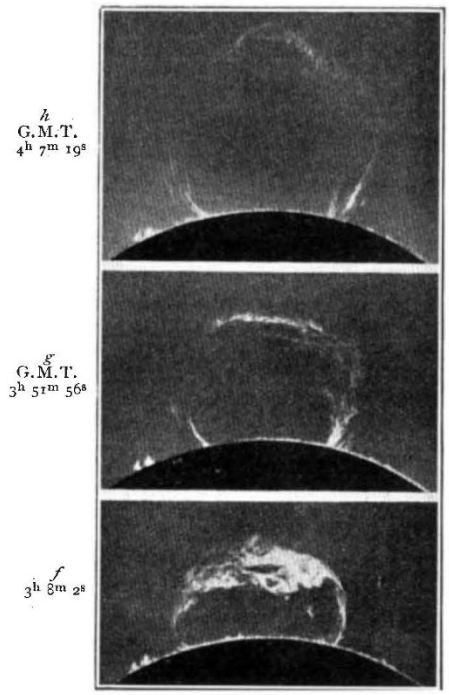

FIG. 2.—The prominence of July 15, 1919.
Scale: 1 mm. = 19,144 km.
From "The Forms and Motions of the Solar Prominences."

and it is found that, in general, velocities are in the neighbourhood of one-third to one-fourth of that which gravity ought to give them. The velocity of ascent in the eruptive prominences seldom exceeds 400 km./sec., although line-displacements have been recorded which indicate much higher speeds.

The memoir concludes with a theoretical discussion of the nature of the repulsive force acting on prominences. Radiation pressure is rejected as inadequate, and the periodic ejection of showers of electrons from a disturbed area in the photosphere is suggested tentatively. J. EVERSHED.

[2] Monthly Notices of the Royal Astronomical Society, 73, 422.

Industrial Fatigue.

THE fifth annual Report of the Industrial Fatigue Research Board (H.M. Stationery Office, Price 1s. 9d.) has recently been issued. Its contents are nearly equally divided between six articles contributed by the Board's principal investigators and the report proper describing the Board's activities during 1924. Perhaps the most striking development in that period has been in the direction of the increasing laboratory research work, now conducted for the Board in the Universities of Oxford, Cambridge, London, Glasgow, and Manchester, and concerned with accuracy of movement, muscular skill, repetitive work, weight-carrying, dynamic and static muscular effort, rest pauses, etc. The human factors relevant to accident causation, ventilation, illumination, and the like are also being studied. Research into vocational guidance has been undertaken in collaboration with the National Institute of Industrial Psychology, and into the design of machinery in conjunction with the Department of Scientific and Industrial Research. Three reports of specific investigations were published by the Board during 1924,

dealing with rest pauses, repetitive work, and posture; and two other reports have been issued, one presenting a synopsis of the results of the Board's previous investigations in various industries, and the other describing the uses and limitations of statistical methods in such research.

Those who are unacquainted with these and with the twenty-four earlier reports of the Board will obtain an excellent idea of the Board's invaluable work by a study of this annual report. The special contributions by Mr. Wyatt, Miss May Smith, Mr. Farmer, Miss Newbold, Dr. Vernon, and Mr. Weston concern learning curves in industry, exceptional work curves, differential tests in relation to proneness to accidents, sickness statistics, the significance of output, and the value of personal evidence in the investigation of industrial efficiency. These well illustrate the various problems and difficulties with which the Board is confronted. The numerous investigations and committees of the Board, and the extremely interesting and lucid language of the annual report, bear testimony to the devotion, ability, and organising power of its secretary, Mr. D. R. Wilson.

The survey, with which the Report concludes, of the past activities and of the present position of the Board is especially noteworthy. Stress is there laid on the fact that such indications "as emerge from the investigations undertaken by the Board and the National Institute of Industrial Psychology are surely worthy of serious attention on the part of industry, if only for the reason that, from the very method of their assessment, strong evidence exists that they will benefit the employer no less than the workman." It is surely lamentable, then, to read on pp. 16 and 17 of the Report that the Jute Spinners and Manufacturers' Association recently declined "to participate in any inquiry or even to afford facilities for a preliminary survey" by the Board in that industry, although the Board had been expressly invited by the Jute Trade Board to undertake an investigation into the effects of fatigue, and the workers desired that it should be carried out.

Rothamsted Experimental Station.

OPENING OF THE PLANT-PATHOLOGY LABORATORIES.

THE annual meeting of the subscribers to the Society for extending the Rothamsted Experiments was held on Thursday, June 18, when at the invitation of Lord Clinton, chairman of the Lawes Agricultural Trust, about sixty members and visitors attended.

In the morning the experimental fields were inspected. As for some years past the total number of plots has exceeded 500, it is usual to select for the annual inspection a limited set illustrating one or two special points. On the present occasion a series was chosen to illustrate certain contrasts between modern and early methods of planning field experiments. Lawes' and Gilbert's early field experiments were laid out on the parallel strip system, the best known example being the classical Broadbalk field which has grown wheat every year since 1843. The strip system was simple and straightforward, and adequately showed up the large differences in yield between the various manurial dressings, especially when the experiment was repeated over a large number of years to eliminate the variable effect of season. The next stage was the "chess-board" plan in which the parallel strips of plots receiving different manures were crossed at right angles by strips of other manures. This method was adopted in the Hoos field permanent barley experiments commenced in 1852, and the arrangement permits of a greater number of comparisons between given manures, alone, and in various combinations.

Many of the broad generalisations, now an integral part of farming practice, were developed from the Broadbalk and Hoos experiments. These two fields are still giving exceedingly valuable information, but they are not suitably arranged to provide definite answers to many modern problems, in the majority of which the maximum difference expected between control and treated plots is a few bushels of corn or hundredweights of roots. It therefore becomes essential to reduce the experimental error as much as possible. The first step is to have a considerable number of small plots under each treatment, and to harvest each plot separately. Further, in order to allow for the inherent variation of fertility in the land, the results are examined by statistical methods devised specially for this purpose. It is an essential condition of such an examination that the plots should be distributed not systematically but at random. From the viewpoint of visitors this complicated system is perhaps not so striking as the older plots, but it has the great advantage of giving a reasonably accurate result in a fairly short period of time. As an illustration of the method, the visitors were shown the experiments on the effect of varying the amount and time of application of nitrogenous top-dressings to the oat crop.

After lunch, Lord Clinton in a short address referred to the close touch now maintained between agricultural research institutes and modern farming problems, and to the facilities for the fundamental study of plant diseases now available at Rothamsted. Sir John Russell then gave a brief account of the type of problem that would be investigated in the new laboratories, and also directed attention to the economic importance of such work.

Lord Bledisloe expressed his pleasure at being invited to perform the opening ceremony of the new plant-pathology laboratories, because they were erected during the period when he was chairman of the Lawes Trust. In reviewing the history of the Station, he was impressed by the rapid application to farm practice of the results obtained by Lawes and Gilbert. As a result the wheat production increased in twelve years from an average of 22 bushels to 32 bushels per acre. He was further impressed by the loss sustained by farmers due to pests of various kinds attacking the crops. Although it was not easy to arrive at an accurate estimate of such losses, the most reliable figures put it at no less than 10 per cent. of the total value of crops in Great Britain. It was evident that the Ministry of Agriculture, in defraying the cost of erection and equipment of the extensive new plant-pathology laboratories at Rothamsted, were alive to the importance of research work in plant diseases. He had great hopes that effective preventive and remedial measures would soon be developed as a result of the facilities now provided.

At the conclusion of the address Sir Thomas Middleton moved a hearty vote of thanks to Lord Bledisloe, who afterwards unlocked the door of the new building. Members of the entomological and mycological departments then conducted the visitors around the laboratories. In addition to a range of research laboratories, there are a number of rooms for special operations, such as pure culture and constant temperature work, and a separate building fitted up for use as an insectory.