

Three new sections have been organized within the Laboratory during the year: (1) a luminous paint section for the development of luminized equipment for operational use by the Armed Services; (2) a separate section for the repair and construction of electrical instruments; (3) a section known as the "planning unit" now follows the progress of all work through the Laboratory and prepares weekly work-sheets with a priority denoted against each item of work. The planning section is an efficiency unit made necessary by the very large number of widely-assorted items of work which have come to the Dominion Physical Laboratory from the Armed Services, New Zealand industries, and Government Departments.

Certain optical-grinding machines were made available to the Laboratory this year by the Director of Scientific Development, and a small optical workshop is in process of being built up to supplement the general instrument-making facilities already existing.

PHYSICAL TESTING AND ELECTRICAL LABORATORIES

The following investigational work has occupied the attention of these laboratories this year:—

(a) *Pyrometric Furnace Controls*.—There has been a demand in New Zealand for controlling pyrometers for maintaining furnace temperatures constant. Last year isolated instruments were produced for industry, but as the demand grew it became necessary to make a group of twenty-four of these instruments to cover the requirements of the Air Department and Munitions Controller. The object has been to produce a reliable and accurate instrument which can be set to control any temperature up to 1,000° C. Problems have arisen in the behaviour of these instruments, and the design has been gradually modified to incorporate improvements. The Laboratory installs and services each instrument, and the results to date have given great satisfaction to factory-managers.

(b) *Repair of X-ray Tubes*.—The supply position of X-ray tubes for medical purposes led the Wellington Hospital to approach the Laboratory regarding the possibility of repairing X-ray tubes which have lost vacuum. The problem was given careful consideration and equipment built which enabled the tubes to be evacuated while being heated. Two tubes have been repaired and are awaiting the checking of their characteristics before being put into service.

(c) *Linen Flax: Quality and Yield of Fibre*.—The object has been to follow up any line of physical investigation that might lead to an improvement in the quality and amount of fibre being produced in New Zealand. The matter has been rendered difficult, since the work is best carried out close to a linen-flax factory and it has not always been possible to spare key personnel to be absent for very long from the Laboratory. The main factors which contribute to a high grading of fibre are strength, cleanness, freedom from disease, softness, and uniformity. An impact-testing machine was built to determine the strength of fibre, and a comparison of New Zealand and Irish retted fibre showed that the former was not lacking in strength. The cleanness of the fibre was judged by microscope observations, and it was in this respect that New Zealand fibre appeared to contain a great deal of adhering non-fibrous tissue. This observation was later supported by reports from Great Britain, and attention was subsequently devoted to a study of the retting process using the microscope. These investigations are still proceeding. The effect of moisture on the strength of fibre has been determined, and experiments are being made to moisten rapidly flax which is too dry to scutch and to measure the effect of moistening on the yield of fibre from the scutcher. The results to date indicate that fibre having a low moisture content will give a higher yield when moistened by the rapid method that has been developed. The ultimate object of all physical and chemical tests on flax fibre is to obtain a means of judging the spinning-quality of fibre without having to resort to spinning trials. A very extensive programme along these lines is being undertaken in Great Britain, the results of which are awaited in New Zealand, more especially since there is no suitable spinning-equipment here which would enable similar trials to be made.

(d) *Refrigerator Efficiency Determination*.—A special type of flow-meter has been built to measure the flow of refrigerant liquid in a completely-enclosed system, and by means of this it is intended to compare the cooling produced by a determined flow of refrigerant. This will lead to a study of the efficiency of various types of refrigeration equipment and may help to improve existing designs.

(e) *Repair of Mercury-in-steel Thermometers*.—A large number of this type of thermometer came to the Laboratory for repair, and great difficulty was experienced in effecting repairs rapidly. This led to an investigation to determine the most effective routine method of overcoming the various defects which arise in these instruments. Several instruments have been successfully repaired as a result of the investigation.

(f) *Dimensional Changes of Traceline Paper for Map Reproduction*.—Difficulties have been experienced by the Government Printing Office in the offset printing of maps using several colour processes owing to the dimensional changes that occur with certain tracing-papers from which the colour process is done. The Laboratory has made linear measurements of dimensional changes on samples of cellulose acetate, colluloid, and linen-backed papers caused by changes of atmospheric humidity. From these results certain papers have had to be rejected as unsuitable for such work. This branch of the work is expected to be increased considerably during the coming year, and comprehensive equipment is being designed and constructed.

(g) *Mould on Inner Wall Surfaces of New Zealand Houses*.—It was discovered early in 1943 that mould had a very much greater tendency to develop in a humid atmosphere on surfaces which had been papered by the accepted trade method than on unpapered surfaces. This aspect of the problem was then taken up by the Plant Diseases Division. The problem of reducing the tendency for moisture to condense on the inner wall surface by altering the existing wall structure or wall materials remained for the Dominion Physical Laboratory to investigate, and this work is still proceeding.