

(2) PHYSICAL AND ELECTRICAL LABORATORIES

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

- (a) *Pyrometric Control*.—An instrument has been developed which after two months' trial can be said to be a successful pyrometric control for furnace work. The principle of operation is not original, but the details of design are such as to offer improvement over commercial instruments of the same type. The basis of the design is that whereby a narrow beam of light falling on a photo cell is intercepted by the deflecting needle of a galvanometer connected to a thermocouple placed in the furnace. With slight alteration the instrument can be made to control any temperature covered by commercial thermocouple wire to an accuracy of ± 0.3 per cent. All parts of the equipment except the photo cell and mercury relay can be made in a workshop possessing moderate equipment. A description of the instrument is being written for publication in the *New Zealand Journal of Science and Technology*.
- (b) *Chromium-plating of Gauges and Tools*.—Apart from the value of chromium-plating as a decorative and protective coating, it now has a wide application to many forms of tools and machine parts on account of its hardness and wear-resisting properties. An investigation was therefore made into the process known as "hard chrome-plating" with a view to making first-hand information on the plating of dies, tools, and gauges available to New Zealand industry. A circular is being prepared for issue to the various industries likely to be interested, and the results of the investigation are also being published in the *New Zealand Journal of Science and Technology*.
- (c) *Surface Metallizing of Mirrors*.—So much instrument repair and construction work done in the Laboratory workshops has necessitated the preparation of good surface mirrors that it was necessary to set up equipment for the manufacture of such surfaces by vacuum sputtering or evaporation. This has absorbed no little time of the Physical Laboratory staff, and equipment has been developed for the routine manufacture of surface metallic mirrors.
- (d) *High-speed Thrust Bearing*.—An investigation was made for the Public Works Department into possible physical causes of the failure of a thrust bearing on a large turbine electric generator recently brought into the country from overseas. The investigation related to the surface finish of the bearing and to its warping when heated. Largely as a result of the conclusions arrived at, the trouble has been rectified.
- (e) *Measurement of Low Illumination*.—The testing of personnel for their suitability for night vision in anti-aircraft, &c., work is carried out by various methods, and it was necessary to develop these methods in New Zealand in order to obtain reliable and absolute estimations of candle-powers as low as 0.001 ft. candle. The equipment in use by the Armed Services was calibrated by means of a special photometric arrangement.
- (f) *Repair of Lightning-arrestors*.—Large porcelain lightning-arrestors were damaged at various substations during the severe June earthquakes, but these were found to be capable of repair, provided a metal-to-porcelain soldered joint could be made. An investigation is proceeding to determine the best method of obtaining a silver or copper deposit on porcelain to which solder will adhere strongly.
- (g) *Mould on Wallboard*.—Trouble has occurred in New Zealand houses due to mould growth on the interior surfaces of walls and ceilings. Investigations are proceeding to determine whether any specific material is responsible for the rapid appearance of the mould and whether the type of wall structure is such as to induce condensation of moisture on the interior wall surfaces.
- (h) *Linen-flax Industry*.—Problems of a physical nature are present for investigation in this industry. A member of the Laboratory has been placed on the Linen Flax Technical Advisory Committee, and it is hoped that the Dominion Physical Laboratory can help in the development of better processing equipment. To date the Laboratory has helped in setting up thermometric equipment for analysing the temperature conditions in retting-tanks, a method of measuring the strength of the flax fibre has been developed, and portable vulcanizing equipment for repairing certain rubber belts *in situ* is being made up.

In addition to the above investigational work, a very considerable portion of the Laboratory's time has been taken up with the calibration of instruments and the testing of materials. Approximately one hundred and eight instruments of all types have been calibrated this year and forty items of materials testing have been dealt with.

(3) THE METROLOGY LABORATORY

This laboratory has been equipped this year for all types of precise linear measurement. The work has been almost wholly routine, in that the measurement of some thousands of gauges and tools for the munitions industry has proceeded steadily. Most of these measurements are made to an accuracy between 0.002 in. and 0.0001 in. The new laboratory rooms are being air-conditioned, so that all measurements are made at the International Standard temperature of 68° F.