

## The National Physical Laboratory

### Report for 1937

THE report of the work carried out at the National Physical Laboratory during the year 1937 shows marked activity in each of the seven departments into which its field of operations has been divided and also in connexion with the special work of the William Froude Laboratory on the propulsion of ships\*. One aspect of the report which should not be lost sight of in its perusal is the indication, which is implicit on practically every page, of the value of the assistance it can give to industry both in the results of its own wide programme of research and also in its readiness to undertake special investigations on behalf of manufacturers. This should be more widely known and appreciated as the scope of their work and the amount of scientific data accumulated place the staff in a quite unique position to offer advice and help.

In the Physics Department, investigations on the thermal conductivity of several gases, liquids, and solids have been proceeding. These have included a survey of published data regarding the thermal and electrical conductivities of iron and steel with results which have indicated the direction of the further investigations which are being undertaken. Research has been carried on in connexion with the thermal insulation of buildings, refrigeration, and properties of metals at high temperatures. The investigation which has been proceeding on the International Temperature Scale is now completed and the report summarizes its results in relation to the standard platinum, 10 per cent rhodium-platinum thermocouple used in the region between 660° and 1063° C. and the conditions which limit its accuracy. The Radiology Section, among many other investigations, continued the study referred to in the previous report on the fatigue failure of metals. The examination of annealed mild steel has been completed and has shown that when the applied stress is such as ultimately to produce fracture, severe fragmentation of the crystallites occurs and increases up to the point of fracture. Where fragmentation has already been carried to an advanced stage by severe cold work, it has been found that, provided the stress applied is below that necessary to produce eventual fracture, no further structural change occurs.

The value of the work of the Electrical Department has received recognition by the acceptance of the results of the investigations on units and standards. Also a new clock has been devised and constructed at the Laboratory which is of such a high degree of accuracy that its error is but a fraction of a second in a year. This has been attained by mounting the quartz ring oscillator on three fixed points as supports located at the nodes of the vibrating ring. This provides a more robust form of construction which makes it practically independent of mechanical vibrations and changes of level and so constitutes it a practical instrument for use in astronomical observatories, in radio-telegraphy, etc. In addition to the clock made for the National

Physical Laboratory, one has also been made for the Royal Observatory, Greenwich, and two are being made for the Australian Government for use in connexion with radio communication. The work on visual characteristics has led to a number of interesting results, some of which are of direct importance in photometry and in practical problems of lighting. A paper published by the Department gives a full account of the work done on non-foveal vision, the visual conditions which supervene when the sensitivity of the eye is reduced by the presence of a source of high intensity in the field of view. In relation to the detection of objects in an artificially lighted street, the relative merits of lights of different spectral distributions have been studied. This work, in progress, is on the lines of ascertaining the average time taken by different observers to detect models of a person or a dog introduced into a film projection under conditions simulating those existing in typical carriage-ways.

Among the new researches commenced during the year in the Engineering Department is an investigation on the welded construction of pressure vessels. Developments in chemical engineering have led to a big increase in the use of liquefied gases, and for transport it is of considerable importance that, without sacrificing the necessary margin of safety, any improvements which result in reduction of weight should be investigated. Other new researches deal with the surface finish of steel strip—a matter of special importance to the aircraft industry—experimental work on the properties, in particular the variation of liquid density and of vapour pressure with change of temperature, of the gases propane and butane, and also an investigation into the silencing of motor cycles.

The use of cast materials for engine crankshafts is a recent unexpected development. In co-operation with the Institution of Automobile Engineers, the British Cast Iron Research Association and five interested firms, one steel material and four irons were fully investigated and the conclusion of the inquiry is recorded. These materials were subjected to static, hardness, and impact tests and also to a comprehensive series of fatigue tests involving bending, torsion, and combined bending and torsion. Metallurgical examination included chemical analysis and microstructure. Under the combined fatigue stresses these cast metals exhibited characteristics sharply dividing them from the ductile wrought steels. The results have been published separately and give a lead as to the wide possibilities of application of these cast metals in the field of engineering.

The Aerodynamics Department has been working at high pressure particularly in connexion with development work on new types of aircraft. The analysis of turbulent flow by determination of the turbulent energy in various frequency bands has been continued. So far as this work has gone, it has proved of exceptional interest, and the agreement found with the modern theory of turbulence indicates that there is every hope of understanding turbulent

\* The National Physical Laboratory: Report for the year 1937. Pp. iv+150. (London: H.M. Stationery Office, 1938.) 2s. 6d. net.

phenomena much more fully in the near future. Airscrew research has been carried out in co-operation with the Royal Aircraft Establishment on full-scale airscrew performance in the 24-ft. wind tunnel there. On the subject of 'flutter derivatives' it is hoped that some light will be thrown by the results of measurements of the instantaneous air forces acting on oscillating aerofoils by an apparatus which is under development.

Among the researches carried out at the William Froude Laboratory was one for the Herring Industry Board and the Coal Utilisation Council concerning the herring drifter, and it was shown that the form of hull in use at present can be so improved as to give a 40 per cent reduction in power for a speed of 9 knots, with a definite improvement in seaworthiness as shown by tests in rough water. In the Alfred

Yarrow Tank it is proposed to replace the wave making apparatus which after twenty-one years service is badly deteriorated. The new equipment will be of 12 b.h.p. instead of 7 b.h.p. and will, by being run from a separate electric supply, be able to give a longer test. Numerous researches have been carried out on screw propellers and in several cases the results have been published. Other researches have been in connexion with the shape of ship bows, natural frequency relative to ship vibration, and the effects of helm action on propulsive efficiency. For a special tug, a programme of research on a pair of paddle wheels will shortly be put into operation.

These are but a selection of the activities which are treated in the report, in which particulars of the several papers published by each of the departments are given.

## Nutritional Surveys of Inland Australia

### Problems of Child Nutrition

**F**EW of the various national nutrition committees appointed following the recommendations of the League of Nations have brought more enthusiasm and resource to their task than the Commonwealth of Australia's Advisory Council on Nutrition. Its recently published fourth report provides ample evidence not only of painstaking endeavour to arrive at a true assessment of the nutritional state of white children living in urban and rural districts of Australia, but also of the need for devising means whereby the revealed deficiencies may be corrected.

Dr. F. W. Clements, who is engaged on a three-year programme of surveys designed to cover a large section of the interior mainly beyond the railway system, presents his preliminary findings for certain inland areas of Queensland, New South Wales and Victoria. Of the children examined in New South Wales, 23.7 per cent showed signs of unsatisfactory nutrition; in Queensland the figure was 18.8 per cent, and in Victoria, 13.3 per cent. Amongst pre-school children of Melbourne examined during the same period, the corresponding percentage was as high as 21.7. Although the numbers examined were necessarily small, there is no reason to suppose that they were in any way selected or unrepresentative of the prevailing conditions. The Council, therefore, finds itself faced with two distinct problems, the undernourished child of the city, and the undernourished child of the remoter outback districts.

Chief consideration has been given to the occurrence of rickets and nutritional anæmia, the incidence of both of which was found to be considerable. In Victoria, for example, a high incidence of anæmia among pre-school children was discovered, boys apparently being more prone to develop the symptoms than girls; and the conclusion is reached that the average hæmoglobin level in children of the Queensland outback is distinctly lower than that of children living in the cities of Scotland. A careful watch for scurvy was unrewarded save for one doubtful case of hypertrophic gingivitis. That fruit is rare may be gathered from one of those touches of significant

observation which make this whole report of unusual interest. At a backwood's race meeting the author purchased from a wandering salesman a dozen small shrivelled apples at a cost of 2½d. each. Fresh tomatoes are also a luxury, but potatoes and pumpkin are largely eaten. Further inquiry into the circumstances of those children found to be suffering from rickets, elicited the fact that they were accustomed to a low intake of protective foods, little milk and no cod liver oil. It is reported, too, that in several towns no milk is available for the feeding of children in infancy.

The section on the Mount Isa communities is perhaps the most interesting in the report. Here, two almost distinct towns have grown up around the Mount Isa lead-silver mines. At the mine site the enterprising company has built for its employees comfortable houses adequately planned and situated amid sylvan surroundings. Rent is reasonable, electricity is free, and many other advantages play an important part in maintaining a sense of citizenship. On the town side, on the other hand, are to be seen shacks improvised from carbide drums, kerosene tins and hessian, where a shiftless and improvident population has no incentive to maintain a decent standard of living. The following reflects the difference in condition, and it is to be noted that the parents of children suffering from rickets in the Mines School were all new arrivals to the district and had been long unemployed.

<i>Deficiency Diseases</i>	<i>Town School</i>	<i>Mines School</i>
Nutritional anæmia	12.0 per cent	3.4 per cent
Active Rickets	17.0 "	10.3 "
Chronic infections	4.0 "	1.7 "

In view of their importance and bearing on similar problems being investigated in other parts of the Empire, it is to be hoped that these Australian results will be placed on permanent record and be made easily available to all who are engaged on nutrition survey work.