National Physical Laboratory, Teddington.

INSPECTION BY THE GENERAL BOARD.

ON Friday, June 24, the General Board of the National Physical Laboratory made its annual inspection of the laboratory. A large number of visitors representative of scientific and technical institutions, Government departments, and industrial organisations were present and were received by Sir Ernest Rutherford, president of the Royal Society and chairman of the General Board of the Laboratory, Sir Richard Glazebrook, chairman of the Executive Committee, and Sir Joseph Petavel.

The varied nature of the work of the laboratory was well illustrated by a large number of interesting exhibits.

On the new whirling arm in the Aeronautics Department, measurements were being made of the rolling moments at a steady rate of turning of a model Bristol Fighter aeroplane. With the whirling arm stationary a definite moment about the axis of flight can be impressed on the model by means of a spiral spring situated inside it. The resulting displacement effects a separation of the primary and secondary coils of one of two similar electromagnets, the other of which is mounted in the control room. Their primaries are connected in series while their secondary voltages are opposed, so that the displacement produces an out-of-balance current which is indicated by a galvanometer. The speed of the whirling arm can then be adjusted until the galvanometer deflexion is zero, when the air moment at that speed is equal to the impressed moment.

In one of the wind tunnels an investigation of the conditions under which wing flutter may occur was in progress. Points on a selected chord of the wing section are connected by light spring-controlled wires to pivoted levers carrying small mirrors and by suitable optical arrangements their vibrations are recorded on sensitised paper. Permanent magnified records are thus obtained and the vibrations of the wind under various conditions can be directly compared.

The Engineering Department exhibited apparatus for the electrical integration of wind pressure. The apparatus consists of a number of capsule diaphragms arranged in groups, each of the latter being connected to a Pitot tube. The expansion of any group is magnified by a lever the free end of which carries a brush sliding over a potentiometer wire. For each group a determination is made of the potential difference between the brush and one end of the wire, and by previous calibration the corresponding wind pressure can be derived. The experimental arrangements are such that if a number of units are attached to a structure, the sum of their potential differences is proportional to the mean wind pressure on the structure. Of interest also was a motor trailer equipped for experimental work in connexion with the wear of road surfaces. An adjustable rear axle permits wheels of varying size from 18 inches to 40 inches diameter to be fitted. Motion of the rear springs is transmitted to recording apparatus in the cab by means of a pivoted lever and bowden wire. To the coupling is fitted a traction dynamometer, the motion of which is transmitted to the recording apparatus by oil impulses on a plunger in the cab. Determinations are made of the tractive resistance and spring deflexions of the trailer, and of the horizontal and vertical movements of the road surface when the trailer is made to negotiate obstacles of various sizes.

The Metallurgy Department showed apparatus developed for the preparation of beryllium of high purity with the view of eliminating if possible the lack of ductility hitherto associated with this metal. Iodine and beryllium produced otherwise are introduced by a side tube into a glass vessel in which is sealed a tungsten wire which can be heated electrically. The apparatus is exhausted and heated in a furnace until beryllium iodide is formed. At this point the tungsten wire is heated up until a temperature is reached at which the vapour pressure of the solid beryllium is less than its partial pressure in the gaseous phase, when solid beryllium is deposited on the wire.

A method was also demonstrated of determining the surface tension of molten metals by means of bubbles formed on the ends of two concentric silica tubes, the ends of which are ground in the same horizontal plane, dipping in the metal. The alundum crucible containing the metal and the two tubes are surrounded by an airtight furnace through which hydrogen is passed. By means of a special reservoir and valves, bubbles of hydrogen can be blown on either tube, the pressure required being indicated by a manometer. From these pressures and the dimensions of the orifices the surface tension can be calculated.

In the Metrology Department was exhibited an ingenious method of determining the cross-section of very fine quartz fibres which, owing to diffraction effects, do not lend themselves to direct measurement by projection methods. The fibre is mounted horizontally and can be loaded at its mid-point with small milligram riders. A magnified image of the fibre is projected on to a screen, and from the length and displacement of this image under different loads its extension and the forces acting along its axis can be computed. From these data and the known value of Young's modulus for quartz, the cross-section of the fibre can be readily determined.

Of interest also was a sensitive tilting level for the accurate testing of surface plates. Two fixed horizontal rods, on which the level can slide, bridge the specimen, and the level is racked down until its ball feet rest on a parallel block placed on the surface and moved to successive positions. An image of the bubble thrown on a scale by a semi-silvered glass plate indicates any departure from flatness, which can be computed from the radius of curvature of the level and the size of the block to one hundred thousandth of an inch.

For work in connexion with the international temperature scale a new valve-controlled high-frequency furnace capable of melting up to two kilograms of palladium by the eddy currents generated in the metal has been installed in the Physics Department. The oscillating circuit containing the furnace is included in the anode circuit of two air-cooled silica valves connected in parallel and each dissipating 8 kilowatts. The furnace can be exhausted and temperatures are measured by means of an optical pyrometer.

For gas analysis an apparatus utilising high frequency vibrations has been developed. A piezo-electric quartz crystal maintained in vibration by an oscillatory circuit is used to generate high-frequency sound waves in the gas mixture and stationary waves are formed by means of a movable reflector. When

the reflector is identified with a node, resonance occurs between the gas and the crystal, which manifests itself by a large increase in the current in the maintaining circuit after the manner described by Pierce. Measurement of the wave-length then affords a measure of the composition of the gas mixture.

A demonstration was given of the determination of flame temperatures by spectrum line reversal. An image of the bead of a Pointolite lamp was focussed through a flame on to the slit of a spectroscope. When sodium was introduced into the flame the sodium lines were visible either as bright or dark lines superimposed on a continuous spectrum according as the flame temperature was greater or less than that of the bead. By careful adjustment of the temperature of the latter the sodium lines could be made to disappear. The temperature of the flame was then determined by measuring that of the bead with an optical pyrometer.

In the Optics Division a photo-electric spectrophotometer of general utility was exhibited, and its use for the measurement of ultra-violet absorption was demonstrated. Two monochromators in series are utilised to effect spectroscopic purification of the light from a mercury vapour lamp. The radiation then passes into a photo-electric cell fitted with a quartz window, and the photo-electric current can be measured by either a Lindemann or a Compton electrometer.

In the Electrotechnics Department was to be seen a non-reactive high resistance for use in high voltage alternating current work involving the measurement of very small power factors. Essentially it consists of a number of vertical glass tubes through which tap water can flow, arranged in parallel, and so disposed that two of them which carry the current to be measured are encircled by the remainder. The latter screen the inner tubes, thereby reducing their capacity to earth and the consequent phase error in the current.

The Electrical Standards Division showed new apparatus for building up standard telephonic frequencies. Between the prongs of a tuning-fork controlled by a seconds pendulum is an iron-cored bobbin which is included in the anode circuit of a multivibrator of the same frequency as the fork. By means of a selector circuit loosely coupled to the multivibrator, successive harmonics of the impulse can be picked off.

In the Photometry Division experiments were in progress to determine the effect of a glaring source of light on the ability of the eye to detect brightness differences. An observer seated in a totally enclosed cabinet views a field of uniform brightness except for a circular central spot the brightness of which can be varied until it is no longer visible to the observer. Under glare conditions a circular spot of very high brightness is included in the field. The least difference of brightness detectable with and without glare can then be determined.

The Wireless Division exhibited an installation for investigating the distribution of current in a vertical cage aerial and for determining whether its variation is sinusoidal under transmitting and receiving conditions. Small ammeters are fixed at convenient intervals inside the aerial in order not to affect the capacity of the latter and are viewed from the ground by means of a telescope.

At intervals during the inspection, demonstrations were given in the William Froude Tank to indicate the manner in which measurements are made of the characteristics and behaviour of model sea-going vessels.

The Edinburgh Meeting of the Society of Chemical Industry.

A DISTINCT biochemical tendency was noticeable in the contributions brought before the annual meeting of the Society of Chemical Industry, held at Edinburgh on July 4-9 at the invitation of the Edinburgh and East of Scotland Section of the Society. In his interesting presidential address, entitled "Chemistry in the Progress of Medicine," Mr. P. H. Carr stressed the importance of a close co-operation between academic laboratories, research institutions, and industrial establishments in the search for new remedial agents, and of an equally effective liaison between the chemist, the physiologist, and the physician in elucidating the relation between chemical constitution and therapeutic properties. The body hormones are to be regarded as ideal specific drugs, the detailed study of which should do much to illuminate this problem.

Although many such agents are undergoing investigation at the present time, it can be claimed only in two or three instances that the hormone has been isolated as a pure chemical individual. Adrenaline, the active principle of the suprarenal gland which plays an important part in regulating the blood pressure, has been synthesised both in the laboratory and the factory. Recently also, a similar advance has been made by Harington and Barger in the artificial preparation of thyroxine of the thyroid gland; 5 mgm. to 10 mgm. of this perfectly definite substance may increase the metabolic rate of the human body by so much as 45 per cent. over a period of 14 days. Histamine, another fully characterised substance which has been shown to influence the circulation and respiration, is also apparently produced for functional purposes in the body.

It is possible that such substances are altered and elaborated in various ways in the body before being able to exert the physiological effects which are attributed to them. In general, although the action of a therapeutic agent is probably determined by its chemical constitution, the body mechanism plays an important part in the resultant chemical changes. It appears that the most effective chemotherapeutic agents act through the formation of a depôt from which they are automatically released as required: depôt formation, mechanism of release, and activity in great dilution are indicated as the likely desiderata of chemotherapeutic compounds.

"Most of the bacterial and parasitic diseases, as well as others due to defective functioning, await chemotherapeutic investigation. Chemotherapy is but one of the frontiers of scientific medicine, but it may well prove to be the most important. Certainly this will be so if, in the end, we learn how to stimulate at will the chemical processes of bodily defence, and thus to meet every eventuality, or to prepare substances comparable in activity and specificity with diphtheria antitoxin. Progress lies in the direction of biochemistry and more effective working contact between individuals in chemistry, bacteriology, physiology, and clinical medicine. We need to multiply a hundred times discoveries like those relating to the oxidation and reduction phenomena in the tissues, to the constitution of glutathione and of thyroxine. As these results become known, and with the fuller development of experimental technique, we need bold hypotheses like that of Ehrlich so as to open up new avenues of thought and work."

At a joint meeting with the Biochemical Society