The National Physical Laboratory, Teddington.

ANNUAL VISITATION.

ON Tuesday, June 23, the annual visitation by the General Board of the National Physical Laboratory took place. In accordance with custom a number of members of scientific and technical societies and institutions, government departments and industrial organisations, were also invited to the Laboratory, which was open for inspection. The visitors were received in the new Aerodynamics Building by Sir Charles Sherrington, president of the Royal Society and chairman of the General Board, Sir Arthur Schuster, and the Director of the Laboratory, Sir Joseph Petavel. Prior to the visitation the new entrance to the Laboratory, in Queen's Road, was formally opened by Sir Charles Sherrington.

Referring to the general development of the Laboratory, Sir Charles remarked that it is now twenty-five years since the Laboratory came into being, and in that period it has come to occupy an all-important place in the national organisation for the advancement of science. This rapid growth is a testimony of the energy and ability of the first Director, Sir Richard Glazebrook. With the further expansion under his successor, Sir Joseph Petavel, arose the demand for new roadways. Their construction was begun in 1922, and the projected development included the improvement of the approaches to existing buildings and the reconstruction of the entrance from Queen's Road. It is gratifying that the new roads have been named Kelvin Avenue and Rayleigh Avenue. The service which the late Lord Rayleigh rendered to this institution cannot be overstated, and forms an abiding part of its high tradition.

An extensive series of exhibits had been arranged to illustrate the general character of the work of the Laboratory.

In one of the seven-foot wind channels in the Aerodynamics Department was a model for investigating the performance of the autogyro, a machine representing an innovation in aeroplane design. This machine differs from the orthodox type in that it has no wings, their place being taken by an airscrew on an axis which is nearly vertical. The machine is equipped with a motor and propeller as usual, and the motion of the air past the vertical screw as the machine gathers speed causes it to rotate and to lift the machine from the ground. It is claimed by the inventor of this machine (which is being developed in Spain) that an almost vertical landing is possible and that it will not stall.

In the four-foot wind channel was exhibited an apparatus for investigating rapid fluctuations of wind velocity, such as occur in the eddy region behind an obstacle placed in the channel. Owing to lag, ordinary anemometers cannot follow these variations, and the possibility of using hot wire anemometers for the purpose is being explored. A hot platinum wire forms one arm of a Wheatstone's bridge, and changes in wind velocity affect its resistance, disturbing the balance of the bridge. The corresponding variations in the current are shown by an Einthoven galvanometer. With the finest platinum wire one-thousandth of an inch in diameter, fluctuations of 2 or 3 per second are faithfully recorded.

In the Engineering Department an interesting exhibit was an instrument for recording the vibrations of structures. In this an arm carrying a small stylus is so pivoted on a frame that it responds to very minute vibrations of the frame. Supported by means of springs is a system possessing large inertia compared with the vibrating portion and carrying a smoked glass plate, on which the vibrations of the stylus are recorded. The stylus magnifies the vibrations twenty times, and a further magnification of fifty times is obtained by optical projection. A testing machine for big-end bearings of petrol engines was also shown. This work has been undertaken in connexion with the development of high-power light-weight internal combustion engines.

Other exhibits included apparatus for investigating the impact strength of chains and for examining the stress set up in pipe sockets due to caulking. In this connexion it has been shown that for some time after caulking there is a definite slow reduction in caulking stress, indicated by a gradual reduction of the outside diameter of the socket.

The Department of Metallurgy and Chemistry displayed specimens of light alloys which had been treated for the removal of occluded gases. One of the defects of aluminium alloy cast in sand is "pinholing" due to the presence of these gases, the degree of occlusion of which is affected by the rate of solidification. If the alloy is cast in a metal mould, solidification is rapid and the gases are retained in solution.

There were also shown examples of the pure metals manganese, chromium, and iron, prepared in the Laboratory. Pure iron and chromium are produced by electrolysis from an aqueous solution of their salts. Pure manganese is prepared by distillation from the commercially pure mineral in a high frequency induction furnace in vacuum, which is also used in the preparation of pure alloys of these materials. Special refractory crucibles made from pure magnesia and alumina were produced for this purpose. A further exhibit showed beryllium obtained by the electrolysis of fused beryllium salts. The metal has a high degree of purity and is produced by slowly withdrawing the cathode, thus forming a rod which is afterwards melted in the induction furnace already mentioned.

The Chemistry Section displayed apparatus for determining the viscosity of molten glass. The glass is contained in a platinum crucible in an electric furnace, and is withdrawn adhering to a fine platinum wire moving at a definite rate, the temperature of the furnace being observed with an optical pyrometer. The viscosity is obtained from the weight of glass adhering to the wire.

In the William Froude National Tank there was shown the apparatus for the investigation of the movements of a lifeboat on a slip-way during launching. As the boat traverses the slip-way, the progress of its bow and stern are recorded electrically after each fall of 6 inches. The conditions under which the tests are being conducted include varying slip declivity and friction, smooth and stormy water, and different states of the tide. An exhibit of popular interest was a wax model of H.M.S. *Victory*. This was ballasted and towed from the travelling carriage of the tank so as to simulate the course which a sailing ship would take under sail, and its leeway could be measured. The apparatus for determining the resistance and running angle of flying boat hulls in motion prior to taking off was also shown.

In the Metrology Department were a number of exhibits dealing with high precision measurements, and comprising standards and measurements of mass and length, measurements of volume, and the testing of hydrometers, barometers, and chronometers.

Another exhibit was a new form of cadmium lamp

recently invented by M. Hamy which contains no internal electrodes. It is stated that the spectrum from this is identical with that from the Michelson cadmium lamp, which in the past has been used for experiments on the use of a wave-length of light as a fundamental unit of length. The comparison of a 6-in. and a 36-in. Fabry-Perot étalon illustrated how, by stepping up, lengths of the order of a metre and over can be measured accurately in terms of the ultimate unit.

The apparatus for silvering the plates used in interferometry methods of measurement was shown. The glass plate forms the anode of a vacuum vessel, and the cathode, of silver, is hung above it. The silver film is deposited on to the plate by the passage of an electric discharge. Films from 1 to 2 millionths of an inch in thickness can be obtained by this method.

In the workshop was a machine for facilitating the accurate lapping of pivots. In this the work in progress is magnified by projection, and the operator can compare the magnified image with an outline drawing, on the same scale, of the required profile.

The Physics Department was responsible for a large number of exhibits. Among them was an apparatus for the determination of the effect of humidity on the mobility of ions. A heated platinum wire mounted in an insulated metal tube is used for the production of the ions, which are drawn to the outer tube by the application of an electric field, the thermionic current being measured in the usual manner by means of an electrometer. The experiments are conducted at atmospheric pressure, and the humidity of the air surrounding the heated filaments can be adjusted. Another interesting exhibit was an apparatus for the determination of the heat loss from bare pipes. A graphite rod extending from end to end of a long iron pipe is heated electrically and the energy dissipated in it is measured. The corresponding temperatures at various points along the pipe are measured by thermocouples.

In the Sound Section was an apparatus for the photographing of sound waves. The passage of an electric spark across a short gap produces a single spherical sound pulse, the shadow of which is afterwards photographed under the illumination of a second spark. By using this apparatus in conjunction with sectional models of buildings, the acoustic properties of the latter can be determined.

The purity of the sounds produced by electrical apparatus used in acoustical work depends upon the wave-form of the electrical oscillations. A cathode ray oscillograph for the study of the latter was shown, the spot describing a circle on the fluorescent screen when the oscillations are sinusoidal.

Among the exhibits of the Radiology Section were Laue photographs of diamonds used as pivot bearings. In this connexion it has been found that the direction of the cleavage plane of the diamond with reference to the bearing surface is of great importance.

In the Optics Section were shown a flicker photometer for heterochromatic photometry and a spectrophotometric equipment using unpolarised light. In the latter, the absorbing optical parts are reduced to a minimum and measurements are made by a Lummer-Brodhun contrast field. As a result the instrument is very efficient at low illuminations. It possesses two collimators, and the light from the two sources is brought to approximate equality by means of rotating sector discs, the final balance being obtained by means of a wedge in the path of one of the beams.

In the Electrotechnics Department, Alternating Current Division, a recently constructed power-measuring apparatus was on view, including a precision electrostatic wattmeter. Another exhibit consisted of the calibration of a 10,000 kilowatt 3-phase wattmeter operating at 6600 volts. This calibration is carried out by the employment of a fictitious load method in which the pressure and current coils are separately excited. In the Direct Current Division was shown a 5000 volt direct current set, for tests on equipment connected with railway electrification. In particular, it has been used for the testing of impregnated timber designed to protect railway workers from shock through accidental contact with the live rail.

The exhibits of the Photometry Division included the apparatus for the standardisation of electric incandescent lamps in terms of the international candle and for the measurement of mean spherical candle power. In the experimental illumination building, demonstrations of the use of the daylight-factor meter—an instrument for the direct measurement of the proportions of the total external daylight reaching various points in a room—were in progress.

In the Wireless Division was an oscillograph used for analysing the wave-form of a valve oscillator and amplifier. A condenser in the grid circuit of an oscillator discharges linearly through a diode, and the discharge can be synchronised with the oscillations to be measured. The actual wave-form is traced out by the spot on the fluorescent screen of a cathode ray oscillograph. Another interesting feature was an apparatus for the measurement of the intensity of the field from a distant radio transmitting station.

A number of piezo-electric quartz resonators and oscillators for the purpose of radio frequency standardisation were shown in the Electrical Measurements and Standards Department. These oscillators form extremely constant sources of radio frequencies and are capable of controlling the output of valve generators. Another exhibit was a standard sonometer for the measurement of audio frequencies. The apparatus is very simple in principle. It consists of a phosphor-bronze wire loaded with a heavy weight. The wire passes between the poles of an electro-magnet and carries the current the frequency of which is under measurement. A sliding bridge with rack and pinion enables the free frequency of the wire to be brought into synchronism with that of the source. A pointer indicates the frequency directly. Various scales corresponding to modes of vibration in one, two, three, five, and ten loops, are used. The total range is from 100 to 10,000 cycles per second, with an accuracy throughout of 1 in 1000.

Glacier Lassitude.

ON the Mount Everest Expedition, 1924, a peculiar condition of prostration and lassitude was experienced by its members whilst crossing ice under certain conditions. The appearance of this fatigue was found to coincide with the presence of a hot sun and a still air: this combination of conditions led to a saturation of the stratum of air on the glacier with moisture, so that the loss of heat from the body was interfered with. The effect was not due to altitude alone, since the lassitude disappeared the moment the observers left the glacier, and was not experienced in the early morning or late evening.

The explanation of this effect given by Major Hingston has been confirmed by some experiments undertaken by Leonard Hill and A. Campbell (*Lancet*, 1925, vol. i. p. 939). The authors examined the