ELECTRICAL ENGINEERING AT THE UNIVERSITY OF SHEFFIELD

NEW LABORATORIES

THE new laboratories of the Department of Electrical Engineering in the University of Sheffield were officially opened by Sir Harold Bishop (director of engineering, B.B.C.) on June 28. Speaking at the ceremony, Sir Harold referred to the problems facing the universities in their efforts to meet the growing needs of industry. "Whatever may be the answer to these problems," Sir Harold said, "the rate of expansion in the electrical industry (and I would remind you that the value of the exports of that industry are now greater than that of any other industry in this country) is clearly limited by the rate at which the supply of trained scientists and technologists can be increased." The new laboratories will, it is hoped, make a useful contribution by providing facilities for a substantial increase in the number of students of electrical engineering in the University of Sheffield.

The laboratories are accommodated in the applied science buildings facing St. George's Square. In addition to space previously occupied by the Electrical Engineering Department in these buildings, further space became available by the transfer of the Department of Civil Engineering, and most of the Department of Mechanical Engineering, into a new engineering building which was opened in 1955. In this way the floor area of the laboratories has been almost doubled, and the original laboratories, as well as the new laboratories, have been completely refurnished and re-equipped.

Four of the laboratories are used for heavy-current work, three mainly for machines, and the other for transformers, rectifiers and other static apparatus. One of the machines laboratories is the Edgar Allen Laboratory and is devoted to research in electrical machinery and related topics. A very comprehensive range of machines and other apparatus is available. A mono-rail and a small mobile gantry provide for the movement of heavy equipment. However, many of the smaller machine-sets are mounted on wheels, which gives great flexibility in use.

There are two large laboratories used mainly for undergraduate experiments in measurements, electric circuits and electronics. A small photometric laboratory with photometric bench, integrating-cube and other illumination test apparatus is available. In the standards laboratory a complete inner room has been built of aluminium-faced plywood to form a complete metal screen, with properly filtered incoming supplies. This is used for precision measurements, and is equipped with d.c. and a.c. potentiometers, bridges, and standards of resistance, inductance and capacitance.

The electronics laboratory and the microwave laboratory are used entirely for research. The former contains high-vacuum equipment generously given to the Department by the Metropolitan-Vickers Electrical Co., Ltd., while the latter is equipped with oscillators, wave-guide test-benches and other apparatus for experimental work in the microwave and decimetric frequency bands.

The Department also has two workshops, one of which is used by postgraduate students, and a battery-room housing a 200-V., 900 amp.-hr. centre-tapped lead–acid battery which supplies the 3-wire d.c. system throughout the Department. The charging equipment consists of a motor generator, a booster-balancer set and metal-rectifiers.

The electric power supplies in the laboratories have been designed to give the greatest possible flexibility consistent with reliability and safety. The light-current laboratories are generously provided with 3-pin, 13-amp. switch-sockets for both 240 V. single-phase a.c. and with 5-amp. and 15-amp. switch sockets for 200 V. d.c. These supplies meet most needs in these rooms, but each laboratory is also equipped with at least one four-wire, 30-amp. experimental terminal board, fed from a socket on the main switchgear cubicle in the large machines laboratory. This provides for interconnexion between laboratories and for special supplies if required. The 240-V. a.c. supply for these laboratories is taken from a 415-V., 3-phase and neutral, ring-main which has been installed for the general supply to the whole building. The direct current is supplied from the battery already mentioned.

In the four heavy-current laboratories a rather special system of distribution is used. The normal supplies available in these laboratories are: 415 V., 3-phase and neutral; 230 V., 3-phase and neutral; and 200 V., 3-wire d.c. (100/0/100), from the battery. With the exception of the Edgar Allen Research Laboratory, which has separate 415-V. and d.c. supplies, the main control for all the supplies to these laboratories is by isolaters and splitters located within the main cubicle in the large machines laboratory. Adjacent to this is the 415/230 V., 3-phase, 100-kVA. autotransformer, which also has 110-V. tappings taken to a socket on the cubicle.

The three supplies are not fed direct to the machines, except to a few of the largest, but are connected to a special cubicle in each laboratory. Each incoming supply to these is controlled by a fuse-switch, feeding a number of 4-pole sockets all separately fused. Four-core flexibles are used, with a shielded plug on each end, to connect these sockets to others which are connected to outlet or experimental points distributed around the laboratory. In addition, each cubicle has two sockets connected to corresponding sockets on the main cubicle in the large machines laboratory, where any inter-laboratory connexion can be made.

At the experimental terminal boards the four cables terminate in switch-fuses connected to insulated terminals (four colours). The terminal boards have doors with locks for access to fuses, and each is provided with an independent 13-amp. switch-socket for 240-V. a.c. supplies to oscilloscopes, portable lamps and other test apparatus. The connexions have been made systematically, so that not only is the phase-sequence correct at every set of terminals, but also the red terminal is always connected to the 'red' line, and when interconnexion is made between experimental points, the two sets of terminals are connected in the proper order. The cubicle in the large machines laboratory serves its own system within that laboratory as well as acting as the focal point to which all the others are connected. It has 60-amp. plugs and sockets, and so has the Edgar Allen Research Laboratory. The others have 30-amp. circuits. Wherever possible, the wiring is carried in surface trunking and is easy of access.

With the exception of the photometry and standards laboratories, which have tungsten filament lighting, the laboratories are very adequately lit by fluorescent lamps. These are switched in groups of three or six, fed from 3-phase a.c., with 3-pole switches, so eliminating stroboscopic effects and reducing the number of wall switches.

The University surveyor was responsible for the design and supervision of the alterations and additions, the electrical consultants being Hoare, Lea and Partners. The main buildings and fittings contractors were Geo. Longden and Son, Ltd., and the electrical contractors were the Yorkshire Electricity Board. The special experimental panels and cubicles were designed and manufactured by Field and Grant, Ltd. (Birmingham).

INTERNATIONAL TIN RESEARCH COUNCIL

TWENTY-FIFTH ANNIVERSARY

By Dr. ERNEST S. HEDGES

Director

To celebrate its twenty-fifth anniversary the International Tin Research Council invited visitors to the open days held at the Tin Research Institute, Greenford, Middlesex, on July 10 and 11. The Institute was built in 1938 to house the Council's headquarters and research laboratories, but after the War extensions were necessary and new laboratories were opened by H.R.H. the Duke of Gloucester in 1951. This had the effect of doubling the accommodation. The staff of the Institute comprises about twenty graduates and forty-five assistants, including maintenance and services. The present director has served the Council during the twenty-five years of its existence.

During the open days approximately six hundred people visited the Institute, among them many well-known scientists, technologists and industrialists. The full tour of the laboratories was designed to show the main developments which have resulted from the Institute's research work. The general scheme followed wherever practicable throughout the laboratories was to show the actual experimental equipment employed on investigations, pilot or full-scale plant for operating the technique developed from it, and commercially produced samples illustrating the final product.

An example of this treatment was to be seen in the Electroplating Department. Work having as its aim the production of electrodeposits of new tin alloys was initiated on a beaker scale in the first laboratory, developed on a 10-gallon scale in the second laboratory and brought to practical success on a 200-gallon scale in the third. Among the practical achievements of the Institute presented in this way was a considerable range of metallic coatings containing tin. The decorative and corrosion-resistant electroplate of tin–nickel alloy (66 per cent tin) was shown as a finish on an electric toaster, a table lamp, drawing instruments, spoons, chemical balance weights, slides of trombones and pistons of trumpets. Speculum (a tin–copper alloy containing 42 per cent tin) was seen upon a lamp, a fruit bowl and a reflector. Tin–zinc alloy (75 per cent tin) was shown on undercarriage parts of aircraft, radio chassis and motor-car accessories. This alloy coating has gained wide acceptance as a corrosion-resistant finish for steel. A recent development in this department which attracted much attention was the electrodeposition of 'bright' tin. This is a process for producing, without mechanical polishing, a pure tin coating having a mirror-like reflexion. Bright tin was demonstrated on a radio chassis stamped from unpolished steel sheet.

In a suite of laboratories specially designed for hot-tinning, the hot-dip tinning of steel and cast iron was demonstrated on such objects as frying pans. After tinning, these were immediately centrifuged in equipment designed at the Institute to remove excess of the still molten tin, leaving a bright and flawless surface. Tinned cast-iron meat mincers showed the great improvement in surface brightness and smoothness brought about by the use of new techniques worked out in this laboratory. Adjoining laboratories displayed equipment designed for the study of electrolytic tinplate produced under controlled conditions, including 'flow-brightening' by momentarily melting the surface. The many testing procedures which have emanated from this laboratory for assessing tin coatings quantitatively and qualitatively were also demonstrated.

The Metallurgical Department showed stages in the roller-welding of steel strip to aluminium–tin alloy strip so as to form composite strip, from which half cylindrical bearing shells for high-duty internal combustion engines can be formed by pressing and subsequent machining. This new type of bearing, which is now in commercial production, is already being used in tens of thousands of road vehicles. The continuous casting of bronze rod was a demonstration of much interest. The rod, produced at about 12 in. a minute, is remarkable for its high quality and accuracy to gauge diameter. The machine, which was expressly designed at the Institute to be of simple and inexpensive construction, has been adopted by many firms in Europe.

The Corrosion Department had exhibits to illustrate the advantages of each type of tin and tin-alloy coating under specific conditions of usage. The remarkable permanence of tin–nickel coatings under severe conditions, such as industrial atmospheres, impressed many visitors. The structure of surface films on tin and tin alloys is also a subject of study in this laboratory, using techniques by which the films are removed intact from the metal on which they form: several specimens of such films were on show.

Organo–tin compounds are among the most recent studies of the Institute and perhaps the one for which the brightest future seems to be in store. Certain of these compounds, containing a tin atom linked to three carbon atoms, are remarkably toxic to fungi. A practical demonstration was afforded by two timbers recently removed from a damp mine where they had been for more than three years: the untreated timber was crumbling away while the timber treated with a trialkyl–tin compound was unaffected