BRITISH STEEL CASTINGS RESEARCH ASSOCIATION

NEW RESEARCH STATION

THE new Research Station of the British Steel Castings Research Association in Sheffield was opened on June 4 by Sir Harry Jephcott, chairman of the Council of Scientific and Industrial Research. The Station comprises an experimental foundry, laboratories and offices and is built on a site which is conveniently disposed in relation to the centre of the city and the main-line railway stations. The present buildings, which provide 12,500 sq. ft. of accommodation, occupy somewhat less than half a 2-acre site, leaving plenty of space for future expansion. The total cost of the buildings and equipment has been £93,000 and the Association is now provided with much-improved facilities for experimental work, which has previously been carried out in limited temporary accommodation and in the works of member firms.

The experimental foundry occupies an area of 90 ft. by 40 ft. and is large enough and sufficiently equipped to permit foundry processes to be investigated on a scale reasonably comparable with industrial practice. It is served by a 3-ton overhead-travel crane, operated electrically and controlled from the floor, and provision has been made for all essential foundry operations. Modern sand preparation plant is installed and, in addition to facilities for hand moulding and core making, there is a simultaneous jolt-squeeze moulding machine, a core blower and a shell moulding machine.

The main steel-making furnace is of 6-cwt. capacity and is a graphite resistor rod furnace, basic lined and operating at 225 kilowatts (single phase), a type of melting unit little known in Britain but popular on the Continent. This is suitable for pilot-plant scale steelmaking research. A smaller high-frequency furnace of the spark-gap type, with 30-lb. capacity, is also installed. The provisions for cleaning castings, welding and heat treatment are adequate for the largest size casting which can be made from the steelmaking furnace.

Grouped around the experimental foundry in two single-story bays are the machine shop and laboratories. The machine shop is fully equipped for pattern making and for the construction of special research equipment. The laboratories are devoted to metallurgy, mechanical testing, chemical analysis and the study of sands and refractories. The metallurgical laboratory houses two projection microscopes and two bench microscopes and also contains X-ray diffraction apparatus and a microphotometer. The latter equipment is being applied to a study of foundry dusts as well as to studies of sands and refractories and general metallurgical problems. Provision is also made for thermal analysis, and a dilatometer and equipment for the measurement of the hardenability of steels are under construction. The test house contains a 50-ton tensile testing machine and a combined Izod–Charpy impact machine with ancillaries for testing at sub-zero temperatures. Vickers and Brinell hardness machines and special equipment for the testing of miniature tensile specimens complete the equipment in this section.

The chemical laboratory is equipped for routine chemical analysis including semi-micro methods. Absorptiometric techniques of analysis are in use, and special equipment is provided for flame photometry and for the determination of hydrogen in steel. The sand and refractories laboratory houses equipment for the evaluation and control of foundry moulding materials, including a petrological microscope and a *p*H meter. Equipment for the differential thermal analysis of clays and the determination of refractoriness of sands, clays and refractories is under construction.

Offices for the research staff and space for storage are provided at one end of the foundry bay. A separate building contains a laboratory which is concerned with problems of industrial health. This work is primarily concerned with the assessment and control of airborne dust in foundries. The laboratory is provided with a dust tunnel in which known dust concentrations simulating foundry atmospheres can be generated and maintained for the calibration and comparison of dust sampling instruments. Provision has also been made for measurements of the efficiency of dust collecting equipment. Portable equipment is also available for a study of noise-levels and for analysis of the frequency distribution of noise.

A further single-story building houses the administrative offices and the library and information section, together with rooms for ciné photography and document copying. The Association makes considerable use of film for the dissemination of the results of its work, and the conference room, which can seat forty, is equipped for film projection.

The staff of the Association now totals forty-nine, of whom eleven are senior graduate investigators. In addition, four bursars are maintained at universities.

The occasion of the opening of the Station was marked by a special luncheon, which was attended by the Lord Mayor of Sheffield, the Master Cutler (Sir Peter Roberts, M.P.) and representatives of the University of Sheffield, the Department of Scientific and Industrial Research and member firms of the Association. In proposing the toast of the Association, Sir Harry Jephcott paid tribute to the design and layout of the Research Station. Mentioning the fact that 80 per cent of the industry were members of the Association, he urged the remaining 20 per cent also to join since, in his view, the work of the Association with its new facilities would undoubtedly make a material contribution to the technical efficiency of its members. He urged the Association to include in its programme an adequate proportion of fundamental research, which was always in the long run the best investment in research. He also stressed the importance of maintaining close contact with the universities and hoped that the Association, now that it had acquired its own laboratories, would not give up its practice of maintaining university bursars.

Replying to the toast, Mr. Kain, chairman of the Council of the Association, traced the origin of the Association, which had taken over the steel foundry work formerly carried on by the now extinct Steel Castings Division of the British Iron and Steel Research Association and the Research and Development Division of the British Steel Founders' Association, and paid tribute to those who had co-operated in its formation. He acknowledged also the assistance

which the Association received from the directors and staff of member firms on advisory and other committees. He stressed the need for qualified staff in the industry to apply the results of the Association's work and hoped that the Association would be able to play some part in providing facilities for education and training for nominees of members. Finally, he welcomed the representatives of the City and University of Sheffield.

After the official opening, the Association held a series of open days for the benefit of staff from member firms and others closely associated with the industry. In all, approximately 450 visitors have inspected the Research Station during the first and subsequent open days. A. H. Sully

BRITISH CAST IRON RESEARCH ASSOCIATION

OPEN DAYS

THE British Cast Iron Research Association, Alvechurch, Birmingham, held two open days on July 3 and 4, the first day being set aside for representatives of member firms, and the second day for visitors from other research associations, Government laboratories, trade associations, universities, technical colleges and institutions.

The new experimental melting station was opened by the president of the Association, Mr. J. J. Sheehan, on July 3. It covers an area of 5,000 sq. ft. and is fully equipped with oil-fired crucible furnaces, a 5-ton S. W. L. electric travelling crane, sand preparation and moulding equipment. In addition, it is furnished with four 'Efco' electric high-frequency melting furnaces of 10, 5, 2 and 1 cwt. capacity. Cupola furnaces, including facilities for both hot-blast and cold-blast melting, will be provided eventually, and will permit melting under both acid and basic conditions in a water-cooled melting zone. The annexe to the station is equipped for rough grinding, shot-blasting, heat-treatment, coremaking, and for carrying out small experimental melts. The equipment here includes a 30-kW. high-frequency vacuum melting furnace made by the National Research Corporation of Cambridge, Massachusetts, with a melting capacity of 30 lb.

Experimental investigations on view included the majority of the work in progress under the current research programme. Several investigations on the soundness of iron castings were illustrated and included the effect of physical variables and composition on the soundness of grey cast iron; solidification sequences in iron castings, and the soundness of nodular iron castings.

Aspects illustrative of the work on malleable cast iron included investigations on 'inverse' greyness in unannealed malleable castings, the influence of graphitization on decarburization, and a study of the nucleation of the melt by counting the eutectic cell size. Factors influencing the chilling tendency of cast iron and work on the solidification mechanism of white cast irons were also exhibited.

An effort is being made to provide data to enable cast iron to be used for steam engineering applications at temperatures above 450° F., the current temperature limit. Growth tests are being carried out up to 600° C. and the battery of creep testing machines recently installed will permit creep tests to be made on materials evaluated on the basis of these growth tests. Further work on mechanical properties refers to the correlation of composition and structure of high-phosphorus materials, based on the eutectic cell size concept. Other investigations under this heading include a scrutiny of the form of the stress/strain curve for grey cast irons; the influence of testing conditions and composition on the properties of pearlitic nodular cast irons; the influence of arsenic and phosphorus on the high-temperature tensile properties of these materials, and the influence of understressing on their properties in the normalized state.

A display was shown to illustrate the corrosion-resistance of ordinary and high-alloy cast irons in various media. Other work in this field covers the application of cathodic protection to prevent severe pitting attack in cast iron propellers, and the mechanism of the corrosion attack on cast iron diesel engine waterways in the presence of antifreeze solutions.

A recent project undertaken by the Association concerns an attempt to utilize low-phosphorus native ores by providing means of dephosphorization, and work shown included experiments with the oxygen top-blowing process. Equipment is available for the determination of gaseous elements in cast iron, using vacuum fusion and vacuum heating techniques. Certain of these elements are of significance in the study of pin-holing of iron castings, in the origination of enamelling defects, and in the graphitization of malleable cast iron. An investigation is in progress on the causes of the premature failure of ingot moulds, in association with the manufacturers of ingot moulds and bottom plates.

Current research on foundry moulding and core sands includes high-temperature testing, using a high-frequency oscillator to determine load/deformation characteristics at high temperatures; the testing and properties of CO_2 process sand moulds and the properties of bonded sand in the green state.

Routine methods of examination and analysis were demonstrated in the chemical and spectrographic laboratories, and in the sands, metallographic and mechanical testing laboratories. Work was also exhibited to illustrate some of the investigations undertaken by the Development Department which, of course, is chiefly concerned with giving advice to member firms on the numerous technical problems that arise in the course of production.

Experimental work on the occurrence of sub-surface blow-holes in association with manganese sulphide segregations was shown, and work on dry sliding and lubricated wear at high and low local pressures. A further exhibit gave the results of an investigation into the failure of certain heavy section castings due to abnormal forms of graphite, associated with the presence of traces of such elements as lead, tellurium, selenium and bismuth.

The work of the Foundry Atmospheres Section was illustrated by a display showing the pattern of formation, dispersal and control of dust in the foundry, together with dust sampling equipment. Some of the equipment developed for local dust control was also shown and included external dust control arrangements for pedestal grinders, a wet spray collar for bars used in de-coring difficult castings, a ventilated wire handbrush and wet spray type of grit and dust arrester for cupola furnaces.