a better understanding has been reached of the chemical groups of the fur molecule which take part in the reaction. As a result, there is a prospect of the early development of a reliable test for the degree of carrotting of fur.

In the field of technological research, the staff of the Association is engaged in studying the different processes in the manufacture of felt from both wool and fur. Felting of these animal fibres is carried out in an acid medium, sulphuric and phosphoric acids being normally used for the purpose. Arising from work carried out by the Association in the industry, recommendations for the control of acid additions have been made and have been adopted with advantage by a number of member firms.

Further research projects of immediate benefit to the industry cover other processes such as dyeing and proofing. With the occupation of the new laboratories and the increase in staff thus made possible, widening of the scope of the programme is envisaged.

The building houses a chemistry laboratory; physics laboratory; dark room for optical and photographic work; and a testing laboratory for operations at controlled temperature and humidity. The addition of a technological block for carrying out small-scale industrial operations has been planned, and an early start on this project is expected.

Although the industry is not a large one and most of the firms are of the small 'family' type, it makes a useful contribution to the national economy. It is gratifying to note that the hatters' fur manufacturers, who supply the raw material for the fur felt section, are solidly in support of the research association, and that the majority of hat felt manufacturers in Great Britain are members, while manufacturers of machinery and dyestuffs and ancillary trades are strongly represented.

BATTERSEA LABORATORIES OF THE BRITISH IRON AND STEEL RESEARCH ASSOCIATION

THE British Iron and Steel Research Association celebrated the third anniversary of the official opening of its Physics Laboratories at 140 Battersea Park Road, London, S.W.11, by holding 'open days' on November 9 and 10. The laboratories were originally opened by Lord Rayleigh on October 22, 1947 (see *Nature*, **160**, 684; 1947). The 'open days' were planned to indicate that during these three years a number of researches have led to results either having direct practical application in the steel industry or throwing light on the fundamental problems connected with iron- and steel-making and therefore of indirect value. The general plan of the Research Association under its director, Sir Charles Goodeve, is to have six Divisions (Iron Making, Steel Making, Steel Castings, Mechanical Working, Plant Engineering and Metallurgy) directly concerned with the six main groups of processes in the industry, and two Departments, Physics and Chemistry, which serve the requirements of all the six divisions. The laboratories at Battersea house the whole of the Physics Department (under M. W. Thring), a part of the Chemistry Department (under Dr. J. Pearson) and the Electrical Engineering Section of the Plant Engineering Division (under H. H. Mardon).

Physics Department

A booklet entitled "Physics in the Iron and Steel Industry" describes the work of the Battersea laboratories of the Research Association and also contains short accounts from seven big steel companies of the use of physics in their laboratories. These accounts show how the increase of efficiency and reduction of wastage in an industry causes a steady growth in the reliance upon accurate instruments for measurement, control and investigation of untoward occurrences. For this reason also, one of the five sections of the Physics Department is entirely devoted to the development of new instruments for the industry.

The physics of the various phenomena occurring in the manufacture and use of iron and steel provides the field for the work of the remaining four sections. It is clear that the present tendency among many physicists to regard the atomic nucleus as the only region of the universe which contains new and unrevealed general laws is far from justified, and much fundamental work of the greatest interest is being done already on the physics of the strength and plastic deformation of metals. Other phenomena of equal interest to the physicist are freezing and crystal growth under various types of cooling and with various impurities in the main element, the way in which atoms find their new positions in a transformation, the mixing of two fluids, heat transfer by convection from a gas jet, luminous radiation, the production of fine droplets by fluid impingement, the movement of a liquid under the impact of a gas jet, and splashing.

The following general ideas run through much of the work described: (1) the attempt to develop equipment for observing phenomena while they are occurring rather than relying on freezing them for subsequent study, and for probing inside complex systems to measure the physical conditions; (2) the application of methods of planning experiments which have been largely developed by the agriculturists to steel-industry investigations both in the laboratory and in the works; (3) the linking together of experiment and theory based on suitable simplifying assumptions; (4) the use of model techniques for studying systems of too great geometrical complexity for a fully mathematical treatment; (5) the application of physical techniques developed for quite other purposes to solve problems of the steel industry.

In the General Physics Section (J. Savage) the physics of the freezing of steel moving relative to a water-cooled mould surface has been intensively studied with the view of providing the fundamental background to the continuous casting of steel, a process which is just coming within the range of practical industrial operation. Measurements have been made of the friction between a 2½-in. diameter mould and the freezing metal, the heat transfer through the mould and the variations in surface quality at different rates of casting and different steel superheat temperatures. In this connexion, also, a vacuum apparatus incorporating an Andrade balance has been built to study the plastic flow of steel at temperatures between the A_3 point and the melting point. The flow-rate has so far been evaluated for one steel from 950° to 1,400° C. over a range of stress of 80–280 kgm./cm.^{2}. This Section has also applied the Geiger counter to the X-ray diffraction observation of transformations in steel while they occur, and to fluorescence analysis, and has developed a high-magnification, high-temperature microscope.

The Instrument Section (S. S. Carlisle) has developed two instruments which are already in use in the industry, a sensitive differential pressure meter giving an electrical signal suitable for remote indication and automatic control of furnace pressures, and a wire-drawing die profilometer which enables the wear on a die to be observed to very fine limits. A fully automatic instrument is now in the laboratory. Two other interesting applications of physical principles are the meters which measure the width of a 16-in. strip with an accuracy of 0·01 in. although the strip moves laterally by 0·125 in., and the thickness of steel plates from one side by measuring the magnetic saturation flux density.

The Heat and Thermodynamics Section (R. Mayorcas) has worked on the measurement of temperature and radiation from liquid and solid steel, the inside surface of furnace walls and gases. Methods of measuring surface temperatures have been developed which avoid errors due to variations in surface emissivity by the use of reflecting caps, while a neat and compact furnace gives a source of radiation, 3 in. diameter and up to 1,750° C., which is very nearly a full radiator. A calorimeter instrument measures the sensible heat content of flame gases for the construction of partial heat balances. The Section has also taken a considerable part in the flame radiation trials carried out in Holland jointly with Dutch and French scientific workers (see *Nature*, August 12, p. 255).

Rather more than half the work of the Aerodynamics Section (M. P. Newby) has been devoted to problems of gas and air flow, mixing and impingement on refractories in the open-hearth furnace. The flow resistances and flow patterns have been studied with cold-air models and on a full-scale furnace operated with cold air, and a special technique has been developed for measuring mixing patterns by the use of carbon dioxide and methane as tracers the presence of which is detected by the infra-red gas analyser. A new type of Pitot tube giving a relatively high Reynolds number for a low velocity has been developed for use in furnaces; the shape of orifices to give a constant coefficient at low Reynolds numbers and the flow of gas and steel in the sideblown converter have been studied.

The Mathematics Section (H. Herne) devotes about equal fractions of its energies to the attempt to provide a theoretical background to experimental work in the British Iron and Steel Research Association and to statistical design of experiments and evaluation of results. The blast furnace and the open-hearth furnace have been studied in both ways; in the former case the theory relates to the heat balance in stages, and in the open-hearth furnace to the details of heat transfer. A six-variable two-level factorial trial has been planned for an open-hearth furnace and executed by a steelworks, giving significant results for five of the variables. The solidification and stresses in castings have been calculated by numerical means. Another interesting theoretical study relates to traffic analysis in steelworks and ore-handling ports.

Chemistry Department

The work carried out in the laboratories (under J. H. E. Jeffes) at Battersea which form part of the Chemistry Department is mainly fundamental research work on the physical chemistry of the processes which are used in the iron- and steel-making industry. At the present moment researches are in progress on the following topics: (1) the rate and mechanism of the reduction by hydrogen of thin films of iron oxides on pure iron; (2) the equilibrium conditions of phosphorus in solution in liquid iron in contact with a solid lime and tetracalcium-phosphate pair at various oxygen potentials; (3) the partition of sulphur between gas and slags under various conditions of slag composition and oxygen potential; (4) the stabilities of various sulphides at high temperatures using radioactive sulphur; (5) the heats of formation and high-temperature heat contents of slag components; (6) the construction of a vacuum fusion apparatus for the determination of gaseous substances dissolved in steel samples, etc.

Plant Engineering Division

A control device has been developed for application to a hot-strip mill in order to compensate for the increase in finished thickness which occurs from front to back of a long strip of steel. The screwdown motors in a tandem mill are operated intermittently according to a preset programme based on previous strip measurements. All presetting and control is effected at a power-level consistent with the use of standard post-office equipment, resulting in compactness, cheapness and reliability.

Another strip gauge control, originating with the Mechanical Working Division, uses the mill itself to measure the strip thickness and modulates reel tension as the output signal. The Plant Engineering Division has devised the closed loop, and it is shown that the output is expressible as a sixth-order differential equation.

A novel method for cleaning industrial gases, such as blast furnace gas or flue gas, uses water sprays of a controlled size thrown from the periphery of a series of rapidly rotating disks arranged in the centre of the pipe along which the dirty gas is passed. This gives a high degree of dust removal with the minimum expenditure of energy and water.

A small-scale cleaner having a capacity of 6,000 cu. ft./hr. mounted in a mobile laboratory truck for convenience in doing trials at steelworks, and a larger unit to treat 100,000 cu. ft./hr., were on view. In the latter machine the five disks of 16 in. diameter are rotated at 5,000 r.p.m. by a 2-h.p. steam turbine. The water drops have an initial speed of 300 ft./sec. and a size of 100 microns. This dense mist of drops is thrown across the dirty gas stream as it passes through an annular space surrounding the disks. The machine is about to be installed in a steelworks for trial under production conditions.

Dynamic stresses in gantry girders such as occur when a crane picks up a heavy load are being studied with strain gauges. Steelworks crane cabs are being improved in several ways; for example, master controllers have been completely redesigned to give near spacing. These now have vertical handles moved radially instead of the 'tramway' controller motion usually adopted, and maintenance inspection and replacement of contact assemblies can be made without detaching any wiring from the controllers. The driver will be seated in a special seat based on one designed for the Admiralty to ergonomic principles by the Department of Human Anatomy, Oxford, and Messrs. Fairey Marine, Ltd., and the controllers will be grouped around the driver for optimum ease and accuracy of working. The new controllers and cab lay-outs will be in line with the new specification of the British Iron and Steel Research Association for heavy-duty electric overhead cranes.

A rotary chart translator enables a large number of circular charts to be re-recorded on a single strip chart with a reduced time base to facilitate a detailed study of blast-furnace blowing requirements. A 48-way recorder enables temperatures at different points in ingot moulds after teeming to be studied.

TECHNICAL BOOKS AND INFORMATION

THE Scottish Branch of Aslib held a conference in the Mitchell Library, Glasgow, on October 6. The conference was opened by Mr. C. A. Oakley, who spoke on this occasion as the author of several technical books, and not in his official capacity as regional controller for Scotland of the Board of Trade. He regretted that Glasgow has a reputation as a 'tough' city, largely due to certain books written about it, and said that he had written "The Second City" in answer. Mr. Oakley went on to suggest that this unsavoury reputation is a factor in the problem of bringing new industries to Scotland. There is no difficulty in persuading managers to come and live in the Glasgow area; but the charge-hand type of worker has taken his idea of the city from news and books. Describing his own experience, Mr. Oakley said that too frequently an author of technical books has to meet the cost of publication, and it is rare that this type of book produces substantial royalties. It may take ten years to collect the material, and technical books are better if they are written slowly over a period of years rather than tackled and finished in a few months.

Mr. James Fergusson, Keeper of the Records of Scotland, outlined the history and care of the records of Scotland and stressed that the live, active interest of the people is necessary to solve the problems facing Register House.

Sir James French, speaking on "Books in Industry", said that books should be available for self-education, and advocated numerous well-distributed collections of technical works. He suggested that money for this would be well spent, and could well be saved by reducing the school-leaving age to thirteen. His experience over many years has proved that youths at thirteen are ready and willing to leave school, and gain more from an earlier apprenticeship to a trade than from an enforced attendance at school, which bores them and wastes their time. Sir James said that even the most modern books are in some degree historical and that "pioneers of industry spend their lives hunting in unknown forests for which there are no guide books, until they themselves may write them".

The next speaker, Mr. W. A. Beck, superintendent for Scotland of H.M. Stationery Office, outlined the publications available and described the various classes of papers published. The last paper, by Mr. S. Weinberg, research manager of Messrs. G. and J. Weir, Ltd., was on "The Attitude of the Research Worker to Technical Information". He quoted Sir Alfred Egerton, giving the present rate of publication of scientific papers as approximately one million, ninety per cent of which are only written to publicize their author's existence. There is no easy solution, because a publication giving arbitrary results might well have a value in the experimental techniques described. Too often the librarian regards the research worker as an individual pursuing a certain line of inquiry for a particular project. Ninety per cent of his reading time must be allocated for routine 'keeping abreast', but reading time for a specialized job cannot be arbitrarily decided. Mr. Weinberg said that it is useless for the research worker to attempt to examine more than one-tenth of one per cent of published material, which works out at twenty to twenty-five papers or articles a week. Of these, one-tenth may be of immediate interest, and a fraction of wider interest. In this connexion, it was stressed that editors cannot pay too much attention to the 'contents' page. Selection of material should always be the responsibility of the research worker and should not be left to the librarian, although the latter can usefully do the routine work of abstracting after the initial selection. From experience, Mr. Weinberg regretted that the emphasis in abstracts is on results, which are often of less use than the operational techniques and the experimental results prior to analysis.

Mr. Weinberg put forward a plea for discrimination on the part of editors and secretaries of learned societies, and he hoped that the advantages of personal publicity would be reduced in such a manner as to discourage all but the better papers. Repetition should either be avoided or clearly indicated. Until it is possible to dial the number of the information required and see it flashed on a screen, the bringing together of the librarian and research worker on a personal basis is most likely at this stage to produce beneficial results.

MILK RECORDING AND BREEDING OF DAIRY CATTLE

SINCE most of the important statutory activities of the Milk Marketing Board were taken over by the Ministry of Food at the beginning of the Second World War, and have not yet been restored to it, a good deal of the energies and the not inconsiderable financial resources of the Board have been of recent years devoted to the milk recording and breeding movement, with the ultimate objective of improving milk yields per cow and also milk quality. Dr. Joseph Edwards, head of the Production Division of the Milk Marketing Board, in an address to the Farmers' Club at a meeting in London on October 2, gave a valuable account of the extensive progress made in three fields: milk recording (National Milk Records) since the Milk Marketing Board took over this scheme from the Ministry of Agriculture in 1943; the development since 1947 of the Milk Marketing Board Bureau of Records; and artificial insemination of dairy cows which, following the pioneer work started in 1942 at the experimental centres at Cambridge and Reading, was taken up on a commercial scale by the Board in 1945.

In the first of these fields, the number of recorded herds has gone up from just over 4,000 to more than 24,000; about twenty per cent of the dairy cows in England and Wales are now recorded for yield. Some progress has also been made in recording butterfat percentage; about seven per cent of dairy cows are now in the scheme. All recorded cows are identified by ear-marking, itself no inconsiderable task. As regards development since 1947 of the Bureau of Records, this Bureau publishes annually a report and analysis of the figures obtained from the National Milk Records, a publication of real value to most of