plicated by the thermal instability of the tar), the study afforded much information on the constitution of the principal chemical types. In the discussion, Dr. R. J. Morley (Carbonization Department, National Coal Board) pointed out that the constitution of the tar described resembles that of a vertical retort tar, while Dr. H. Bondy (Coalite and Chemical Products, Ltd., Chesterfield) remarked on the differences between this tar and that obtained by the coalite process. Two remarkable features of the tar are that it contains a disproportionate amount of high-boiling phenols and of high-boiling neutral oils.

Utilization of the By-Products from New Carbonizing Processes

Only one paper was read at the final technical session. It was a contribution by J. L. Sabatier (Charbonnages de France, Houillères du Bassin de Lorraine) entitled "Industrial Treatment of Low-Temperature Carbonization Tars". In M. Sabatier's absence, the paper was presented by J. M. Deruelle of the same organization. This paper described the industrial-scale refining of tars obtained from French experimental carbonization plants operating in the temperature-range 500°–700° C. The treatment is conventional and consists of a primary distillation into selected fractions which are further refined by extraction, crystallization or further distillation. The tar yields 10 per cent of phenolic compounds, 60 per cent of oils and 30 per cent of pitch. The principal phenolic bodies produced for marketing are phenol, mixed *m*- and *p*-cresols and 1-2-4, 1-2-5, and 1-3-5 xylenols. Market development is still in progress and will undoubtedly lead to more exhaustive refining of the tar.

In the discussion of the low-temperature tars described, the ease with which the tars may be oxidized to form resinous and pitch-like materials was emphasized, and this was related to earlier papers on the oxidation of coal. This brought out the importance of investigating carbonization techniques in which the heat for carbonization is introduced by methods other than partial combustion of the coal and char in the carbonizing vessel.

Dr. D. McNeil (Coal Tar Research Association) emphasized that the by-products from fluidized carbonization must be the subject of intensive research and that outlets differing from those for conventional tars must be developed.

In his closing address, Dr. Bronowski summarized the discussions and drew some general conclusions. He pointed out that the coal industry, like other traditional industries, is still reluctant to adopt multi-stage processes. The basic cost of handling the raw material in and out of a plant is now so high, however, that an additional stage adds relatively little to the cost of a process. It is essential to base new stages and processes on a scientific study of the fundamental mechanisms by which the chemical and physical properties of coal are changed. The conference showed that all the nations taking part had reached much the same point in these fundamental studies; but they were not all equal in their readiness to take these scientific findings to the pilot scale and to develop them into industrial processes. If we are to benefit from the advances in coal science, we must now concentrate a major effort on development.

The conference was followed by an open day on Friday, June 29, when about 360 guests viewed the experimental work of the Establishment.

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

REPORT FOR 1955

ALTHOUGH much work had already been done by an interim organization, the European Organization for Nuclear Research (C.E.R.N.) came formally into being only in September 1954. The first annual report, covering the period to the end of 1955*, describes in some detail the substantial progress which has been made. It will be recalled that there are twelve member States: Belgium, Denmark, France, the German Federal Republic, Great Britain, Greece, Italy, the Netherlands, Norway, Sweden, Switzerland and Yugoslavia. Each pays contributions roughly according to its national income, the proportions ranging from 23·8 per cent by France and the United Kingdom to 1·79 per cent by Norway. The main aim is to produce those major experimental facilities for pure nuclear research which are too costly for many, if not all, of the member States to provide for themselves, and the present programme includes the design and construction of a 25-GeV. proton synchrotron and a 600-MeV. synchrocyclotron. The governing body is the Council, composed of delegates of member States and assisted by a scientific policy committee with eight members, selected for their qualifications without regard for nationality. A finance committee, with national representation, guides the financial administration.

The present president of the Council is Sir Ben Lockspeiser, and the director-general is Prof. C. J. Bakker, who succeeded Prof. F. Bloch in September 1955 on the latter's return to Stanford University, California. Prof. Bakker's leading collaborators are J. B. Adams (proton synchrotron), W. Gentner (synchrocyclotron), L. Kowarski (scientific and technical services), P. Preiswerk (sites and buildings), C. Møller (theoretical physics) and J. Richemond (administration). The laboratories are under construction on a site provided by Switzerland, at Meyrin, near Geneva. Most of the staff are working in temporary laboratories in Geneva, although a few have already moved to Meyrin. The theoretical physicists are at present centred in Copenhagen. Much of the design of the accelerators and buildings had been established under the interim organization, and the period under review has been occupied in pursuing these plans. The original programme called for the completion of the synchrocyclotron during 1957 and the proton synchrotron during 1960. It is expected to be maintained.

Proton Synchrotron. The main parameters of the large machine were settled at the end of 1954, and no important alterations have been made since. The radius will be 100 m., and the magnet will consist of a hundred separate units with a total weight of steel of 3,200 tons. Protons will be injected at 50 MeV. from a linear accelerator, and the final energy will be 25 GeV. at the maximum magnetic field of 12,000 gauss. The principle of alternating gradient (or 'strong focusing') will be used, each magnet unit having focusing and defocusing portions. This system is now well understood, following much theoretical and experimental work at the Organization and at the Brookhaven National Laboratory in the United States, where a similar machine is being built.

* European Organization for Nuclear Research, C.E.R.N. First Annual Report. Pp. vi+66. (Geneva: C.E.R.N., 1955.)

These two projects, which were the first of their kind, are in roughly comparable states of progress, and there has been close collaboration between the two groups. For example, a large electron model, a major project in itself, was built at Brookhaven as an analogue of a large alternating-gradient machine, and the results obtained with it have benefited both projects. There has been interchange of staff between the two laboratories.

The magnet units have to be very accurately made to a design which takes much careful work to establish, and the magnet at Geneva is now completely designed; several full-scale models of individual magnet units were made in order to arrive at a satisfactory solution of the many difficult problems. At the time when the report was written the magnet had not been ordered; but it was expected that tenders would be invited early in 1956. The 50-MeV. injector accelerator is already being manufactured, to a design similar to that of the proton linear accelerator under construction for Harwell. Design of the building and foundations for the proton synchrotron is a major problem. The large magnet ring has to be maintained in a circle and on a plane to within an accuracy of a few tenths of a millimetre, since particle instability is easily induced by misalignment errors when alternating gradient focusing is used. Little was known about such small earth movements over long periods, and prolonged tests were made with an experimental section of ring building, together with much accurate survey work. A method has been adopted whereby a heavy concrete ring is supported by eighty concrete pillars embedded in the rock which lies some distance below the surface. Construction of the ring building is now well advanced, and excavations for the laboratories and experimental hall have been made. The ring building will be mounded over with earth for radiation shielding, and heavy adjustable concrete walls, with beam channels, will be used for separating the experimental hall from the accelerator.

Synchrocyclotron. Most of the design of the 600-MeV. synchrocyclotron had been completed under the interim organization, with Prof. Bakker leading the design team. The magnet, with a pole diameter of 5 m. and containing 2,500 tons of steel, is under construction and was due for completion in August this year. The radio-frequency accelerating system is the most difficult problem in such a large synchrocyclotron. The system adopted is similar electrically to that evolved in Berkeley, California, for the conversion of the 184-in. synchrocyclotron there. The system at Geneva, however, is quite new mechanically, and the tuning-fork type of variable condenser is machined from a solid block of aluminium alloy. This system is also under construction, as are most of the auxiliary pieces of equipment for the accelerator. The heavy fixed shielding-walls have been built, and progress is being made rapidly on the remainder of the building work. Some of the staff of the Synchrocyclotron Division have been working in other laboratories, notably in the Universities of Liverpool and of Upsala, to gain experience of nuclear research with synchrocyclotrons in time for the commissioning of the machine at Geneva.

Other activities. The Scientific and Technical Services Division has been concerned with setting up electronics and mechanical workshops, instrumentation for nuclear research with the accelerators, and library and information services. A limited programme of cosmic-ray research has been started, to help the instrumentation activities to get under way. Design work on buildings had been pursued actively long before the final Organization was set up, and building work was started in 1954. At the end of 1955, 115,000 m.^{3} of earth had been excavated, and 11,000 m.^{3} of reinforced concrete had been set. The Organization has set up its own administrative machinery with its own staff and salary structure, terms of appointment, etc. The total number of staff employed at the end of 1955 was 286, of whom 108 were working on the proton synchrotron, thirty-two on the synchrocyclotron, forty-four on scientific and technical services, six on site and buildings, thirteen on theory, and fifty-nine on administration. These numbers will increase as the work develops. Detailed figures are given for expenditure during 1955, the total being about 18·8 million Swiss francs, or just over £1·5 million. The total expenditure for the first seven-year period is now estimated to be 197 million Swiss francs, plus an allowance of 10 per cent for contingencies.

The report, which is excellently written and produced, shows that the European Organization for Nuclear Research has made very good progress during its short existence so far. It is very encouraging that a co-operative project of such complexity, involving many countries, can be developed so effectively and smoothly. The value of the Organization to science generally, and to scientific progress in the member nations in particular, should more than repay all the effort and expense.

T. G. PICKAVANCE

COMMONWEALTH OBSERVATORY, CANBERRA

REPORT FOR 1955

THE Commonwealth Astronomer's report for 1955 on the Commonwealth Observatory, Canberra*, contains nine sections, the first of which, that dealing with time service and positional astronomy, includes an account of transit observations with the 3½-in. reversible transit circle, which gave 171 determinations of clock error on 170 nights. Other matters referred to are: time signals, which were sent out four times each day, the average correction for the transmitted signal being 29 m.sec.; clock comparisons, maintained as in previous years, reports of which are forwarded to the Bureau International de l'Heure as a contribution to the determination of variations in the Earth's rotation; propagation of radio signals; and lastly, declination of *FK*3 stars. As the Munich observers completed their series of measures of declinations of southern stars with the Munich vertical circle, the instrument has been returned to its native city.

Section 2 of the report covers astrophysical investigations and is divided into various parts, the first of which is concerned with fundamental photometry; Dr. S. C. B. Gascoigne, assisted in the later stages by Dr. W. Heintz, completed the work of comparing the light from a calibrated standard lamp and that from twelve bright stars. This work is further reported under the heading of variable stars, in which Dr. Gascoigne continued the photoelectric observations

* Commonwealth Observatory, Canberra. Report of the Commonwealth Astronomer for the Year 1955. Pp. 5. (Canberra: Government Printer, 1956.)