

volving very advanced skills in pattern-making and moulding. The importance of maintaining these skills is indicated by the adoption in recent years of such medieval methods as the lost wax process for producing jet engine parts which have to be cast to very accurate tolerances, and to their final dimensions, since they are frequently too hard to machine.

The experimental work on view included the study of the mechanism of blister formation on porcelain-enamelled cast iron, the gas originating the blister defect being removed during heating in a stream of argon and measured by an infra-red gas analyser. The application of strain gauge techniques to measure stresses set up in actual castings in service was illustrated. An important section related to work on white and chilled cast irons as used in the roll-making industry and referred to the effect of various conditions, composition and temperature, affecting the depth of chill.

Considerable advance was shown in the section on moulding and core sands tested at the elevated temperatures to which they are subjected in practice by induction heating, and the mechanism of the formation of defects due to sand failure was shown by a working model. A train for the production and casting of shell moulds of resin-bonded silica sand, about 5 mm. thick, was demonstrated, together with a newly devised arrangement for testing the material itself. Other work on moulding sands related to their effect on the shrinkage characteristics of the cast metal and on surface finish. The pore size of sand aggregates has been shown to affect heat transfer, mould permeability, gas flow during pouring and metal penetration.

The vacuum fusion method has been developed to yield quantitative information on the gases present in cast iron, especially oxygen and nitrogen, and the vacuum heating principle is used for the determination of hydrogen. Gamma-radiography was demonstrated for determining unsoundness in castings. The use of cathodic protection for cast iron pipe lines in aggressive soils and for propellers in sea-water was shown. In the analytical block a variety of demonstrations was in progress on chemical methods of examination and on spectrographic analysis, the latter including foundry slags.

Although no formal programme on the problem of brittle fracture has existed, since this problem mainly concerns the steels, a useful result has emerged from parallel studies of two aspects of the properties of ferritic nodular iron castings—properties at low temperatures and properties under impact. It appears that the ferritic nodular irons are better suited to resist the phenomenon of brittle fracture than many steels. Transition temperatures for ordinary ferritic nodular iron may be as low as -50°C ., and with specially chosen raw materials this could be reduced to -100°C .

The work of the Foundry Atmospheres Team has made considerable progress. The control of dust on practically every type of rotating wheel used for cleaning and grinding castings, many of which are common to a wide range of other industries, has been established, and some devices are in commercial production. A systematic study of the behaviour of dust-laden air streams at the knock-out, where castings are normally separated from their sand envelopes, has been begun. A satisfactory design of wet spark arrester for cupola furnaces has been evolved and will assist in dealing with external atmospheric pollution.

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BRITISH COLONIAL TERRITORIES REPORT FOR 1953-54

IF the proposals of the White Paper entitled "Re-organization of the Colonial Service" (Colonial No. 306. London: H.M.S.O., 1954; 4d. net) are implemented, the recently published report on "The Colonial Territories 1953-54"* may be the last survey to appear under that title. It is proposed to constitute from October 1, 1954, an Oversea Civil Service which will include all those officers now in the Colonial Service who have been selected for their present posts by the Secretary of State for the Colonies whether or not the territory in which they are serving attains self-government. Should the territory attain self-government, their conditions of service and pension rights will be safeguarded by formal agreement between the Government in the United Kingdom and the Government of the territory. When the new Service is in being, any offer of appointment will include a clear statement whether it carries membership of the Oversea Civil Service or whether the officer's contractual relationship will be solely with the territorial Government. Officers in either category will be expected to regard themselves as being in all respects responsible to the territorial governments under which they are serving.

The new form of Service is intended to safeguard the interests of existing officers as well as to overcome political difficulties or prejudices which are more fully indicated in the review of constitutional and administrative developments in "The Colonial Territories 1953-54" report than in introductory paragraphs of the White Paper. It is also intended to encourage qualified men and women to continue to come forward in a spirit of confidence, enthusiasm and partnership and to assist the social, economic and political progress of the overseas governments and peoples. The present decisions are not intended to exclude the constitution of a Commonwealth service or an overseas service directly employed by the British Government, but the Government has not yet reached any conclusions on the complicated administrative and constitutional, as well as financial, problems involved in such proposals.

Apart from providing a very convenient conspectus of the political, economic and financial, and social developments in the Colonial territories for prospective candidates for appointments in the Colonial Service, whether scientific or not, "The Colonial Territories 1953-54" is also of interest to the man of science as providing the background against which progress in Colonial research, for developments in education, in health and welfare, and in communications and industry in these territories are appropriately considered. In particular, the surveys of constitutional and of economic and financial developments should facilitate both responsible criticism of particular developments and a general understanding of the extent to which economic and social developments, as well as the application of the results of the research at present in progress, depend on education.

In all branches of education the expansion of facilities continued during 1953-54, and special stress is laid on the increased provision for training teachers, alike in Malaya, Singapore, and Hong Kong, in the larger West African territories (where in view of

* Colonial Office. The Colonial Territories 1953-54. (Cmd. 9169.) Pp. xii+196. (London: H.M. Stationery Office, 1954.) 6s. net.

the rapid expansion in primary education determined efforts are being made to maintain standards of efficiency), in Kenya and in Tanganyika. In Uganda, where the output of trained teachers is to be increased to about 1,150 by 1956, the British Government has allocated £8 million from the African Development Fund over the period 1953-60 to implement the recommendations of the de Bunsen Committee as well as £2 million for the development of technical education. In Northern Rhodesia, the establishment of a unified African teaching service was finally approved, and £1,250,000 was allocated from Colonial Development and Welfare Funds for the establishment of Rhodesia University College, the foundation stone of which was laid at Salisbury by the Queen Mother on July 13, 1953. During the academic year 1953-54 there were 3,639 full-time students at the three universities and four university colleges, and steps were taken during the year to strengthen the intimate relations between the Colonial institutions and other universities, particularly through a Colonial Development and Welfare grant to facilitate secondment of staff to the Colonial universities and colleges, and the extension of the Commonwealth Interchange Scheme to cover visits to and from Colonial institutions. Educational exchange was also assisted under the Fulbright Agreement, nineteen men and women from the Colonial territories receiving travel grants under this scheme for study or research in the United States, and thirteen American lecturers, research scholars or students being selected for attachment to Colonial universities. Of nearly eight thousand Colonial students in the United Kingdom and the Irish Republic at the end of 1953, 1,965 were scholarship holders, and the report again pays tribute to the work of the British Council in finding accommodation for these students. In higher technical education, the Nigerian College of Arts, Science and Technology had its first major entry of students. A Commission was appointed to make recommendations for the development of Fourah Bay College in relation to the educational requirements of Sierra Leone at all levels, and Major-General C. Bullard took up his post as first principal of the Royal Technical College of East Africa, Nairobi.

No widespread epidemic occurred during 1953, and available figures point to an almost universal fall in mortality-rates and a general rise in the expectation of life. Human trypanosomiasis is now fairly well under control in Africa but only as a result of constant vigilance and the maintenance of active control measures. In Fiji, where filariasis is very prevalent, an attempt was made at control by mass administration of 'Hetrazan' in conjunction with a campaign against the mosquito vector. Yaws is fast disappearing from closely settled areas, and the scientific application of insecticides eliminated relapsing fever from the Somaliland Protectorate. Tuberculosis, however, remains a grave problem, and while treatment with modern drugs and antibiotics has proved very effective, present facilities for diagnosis, treatment and control are inadequate. Spectacular progress has been made in the control of malaria and leprosy; but much research is still needed to elucidate the provocative factors in the epidemiology of kala-azar, of which three thousand cases were reported in Kenya up to the end of 1953.

The review states that the flow of recruits to the Colonial Medical Departments is insufficient, and although an increasing number of doctors of local origin are becoming available for service in their

own territories, recruits from the United Kingdom are urgently needed, particularly for Nigeria and the Pacific. On December 31, there were 230 scholarship holders and 595 other students from Colonial territories in the medical schools of the United Kingdom and the Irish Republic as well as 97 students of dentistry, most of whom were expected to return to work in their own countries, while considerable numbers of doctors are also being trained in the Universities of Malaya and Hong Kong and the University Colleges of the West Indies and Ibadan. Training schemes for medical auxiliaries remain an urgent priority, and although the number of Colonial student nurses in training in the United Kingdom continues to increase rapidly, recruitment of nursing sisters from the United Kingdom and Commonwealth countries was difficult and new appointments did not keep pace with resignations. The scheme for the provision of a panel of medical visitors to the African territories has proved a success, and it is hoped that the scheme will be continued and a similar scheme introduced in other areas.

Expenditure on development and welfare schemes and on research was again approximately £14 million. In addition, a loan of £2,390,000 for the development of the East African parts of Mombasa and Tanga was made from sterling Counterpart funds by the United States Government. Fifty-nine research schemes, estimated to cost £741,000, were approved during the year, thirty-one new appointments were made on Colonial Research Service terms and seven research studentships were awarded. The progress in research, which is summarized in the chapter on "Research and Surveys", is to be covered more fully in the subsequent report "Colonial Research 1953-54", and it will suffice here to note that the West African Government has agreed to set up a Permanent Standing Advisory Committee for Agricultural Research, and that the establishment of a Regional Research Centre in the West Indies is receiving attention. Most of the Colonial governments have now agreed to the establishment of a Colonial Road Research Station, though only a few to the establishment of research funds in the Colonial territories. Arrangements are now being made to establish a Colonial Road Research Section at the Road Research Laboratory, Harmondsworth, and also the proposed Advisory Committee. The West African Regional Standing Advisory Committee for Medical Research has been converted into a Council for Medical Research, and administrative measures are in hand for a similar organization in East Africa. The establishment of a new entomological research station in Benin Province of Nigeria will permit an intensive study for the first time of those species of tsetse which occur in the high forest belt. At the West Africa Rice Research Station in Sierra Leone good progress was made with investigations on the development of mangrove swamps for rice-growing. In Nigeria the sealing-off policy in combating swollen-shoot disease of cacao did not prove completely effective, and further research on the behaviour of the virus is being carried out at a sub-station of the West African Cacao Research Institute opened at Ibadan. Successful research on the use of copper sprays has led to a large-scale campaign in Nigeria for the control of black-pod disease of cacao. Arrangements are being made to open a sub-station of the West African Institute for Oil Palm Research in Sierra Leone; but although the Institute continued its work on the establishment, nutrition, breeding and

diseases of oil palms, lack of staff made its Plant Physiology Division inactive. Thirty-one new appointments were made to the Colonial Research Service and seven research studentships were awarded to train candidates for research appointments.

Recruitment of field staff for geodetic and topographic surveys kept just ahead of transfers and resignations; but thirty-two new appointments to the cartographic staff were offset by thirty-seven resignations dismissals or call-up to national service. Nevertheless, very satisfactory progress was made with geodetic surveys. The overseas scientific staff of the Colonial Geological Surveys increased from 190 to 197 during 1953, and although there were still some twenty vacant posts, satisfactory progress continued in all branches, including geological mapping, the investigation of mineral resources, and in the geological aspects of engineering and water-supply projects.

Besides the expenditure from Colonial Development and Welfare Funds, the United Kingdom contributed approximately £20,200,000 from the Vote for Colonial Services during 1953-54, and the present report sounds a warning note in respect of finance. While public expenditure has continued to rise, as well as the total of Colonial government general and development reserves in London, financial prospects in many territories are not encouraging. Revenues in Nigeria and the Gold Coast continued to rise sharply as a result of the steady increase in cocoa prices, but in Malaya revenue was 20 per cent lower than in 1952. Tanganyika's revenue fell by more than 10 per cent, mainly as a result of the fall in sisal prices, while those of North Borneo and Sarawak also fell. Generally, the picture has been one of a flattening-out of the curve of revenue increases.

While capital goods have been easier to obtain, though not cheaper, and capital expenditure and development are at present limited rather by shortages of administrative and technical staff, it is clear from this report that developments in future may no longer be able to count on an almost automatic increase in revenue. More governments are likely to be faced with deficiencies in the near future if the present trends of revenue and expenditure continue, and the report emphasizes that the increase in government commitments and costs since 1939, particularly in the maintenance of the expanded social services, makes any decline in revenue a cause of alarm.

HYDRAULICS RESEARCH STATION

REPORT FOR 1953

THE report for 1953 of the Hydraulics Research Board* describes work done during the year at the Hydraulics Research Station, Wallingford, and also in the field. It covers a range of activities, including investigations, mainly by models, into the design of harbours, jetties and other coastal works, beach surveys, special investigations arising from the east coast floods of January 31-February 1, 1953, and a preliminary study, based on charts and

* Department of Scientific and Industrial Research. Report of the Hydraulics Research Board with the Report of the Director of Hydraulics Research for the Year 1953. Pp. vi+58+8 plates+4 maps. (London: H.M.S.O., 1954.) 7s. 6d. net.

maps, of drainage and reclamation works in the Wash.

Two parties from the Research Station visited a number of places on the east coast of England from Margate to Scarborough during the four days February 3-6, their main objects being to examine the damage to sea defences and beaches and to take photographs, before repair works were started or the return to normal conditions had obliterated the effects of the storm on the beaches. Experiments carried out on a pilot model of the Thames Estuary, at the request of the Waverley Committee, showed that if the freshwater flow had been at its maximum value of 20,000 cusec. at Teddington Weir, instead of the low value of 2,600 cusec. actually existing at the time, the high-water level in London would have been increased by 9 in., a result in good agreement with previous estimates.

An example of work carried out for other countries of the British Commonwealth is that done on two models of Lyttleton Harbour, New Zealand. The object of the investigation is to assess the merits of various proposed designs of harbour extensions from the point of view of protection from waves, susceptibility to ranging and the amount of dredging required. The tests carried out so far have been designed to reproduce the existing conditions. On the larger model, that of the inner harbour, the distribution of wave heights throughout the harbour has been plotted for several wave periods, and the response at a given point as the period of the waves is varied has also been examined experimentally. Another overseas project was the design of a weir block to prevent waves passing up the discharge channel for cooling water at the thermal power station recently constructed at Dekhelia in Cyprus.

The facilities for research on models will be increased when the first stage of the main hall of the Station, which will have a floor area of 300 ft. by 200 ft., has been completed; work on this was proceeding during 1953, and it is hoped that it will be ready for use early in 1955. One of the models to be housed in it will be a large model of the Severn Estuary, on which the effects of the proposed Severn Barrage can be examined. In the meantime, preliminary experiments are being made on a pilot model, which is largely a replica of that built by Prof. A. H. Gibson.

An investigation of a somewhat different kind has been started on land reclamation and drainage in the Wash, at the request of the Ministry of Agriculture and Fisheries. While training works, constructed at various times during the past hundred and fifty years to improve the outfalls of the four principal rivers, have had the desired subsidiary effect of increasing the area available for reclamation, they have been less successful in achieving their primary object, because of deterioration of the estuaries to seaward of them. By treating the Wash as a whole, it is hoped to be able to design extensions to the training works which will improve the outfalls and also result in an additional fifty thousand acres of saltings becoming available for reclamation.

While most of the work described was undertaken in connexion with specific engineering projects, an item of more fundamental research was that carried out in the wave tank on the effect of a vertical wall on a beach in front of it. After the beach had become stable under the action of waves and tides, the wall was inserted in a position between the high-water mark and the highest point reached by the swash.