DESIGN OF PHYSICS RESEARCH LABORATORIES

ON November 27, the London and Home Counties Branch of the Institute of Physics held a symposium at the Royal Institution on "The Design of Physics Research Laboratories".

In his introductory remarks, Dr. J. S. Forrest (chairman) recalled that a similar discussion had been held by the Institute of Physics ten years ago (*J. Sci. Instr.*, **25**, 157; 1948). In the intervening decade, however, there has been intense activity in the building of new laboratories. Moreover, the character of the physics research laboratory is changing; the conventional laboratory with standard benches equipped with standard services and apparatus is no longer suitable for dealing with many of to-day's problems, which require large machines with the attendant erection and servicing facilities. Accordingly, the time was ripe for a further discussion to put on record the lessons learned during the past ten years and to present the views of architects and research directors responsible for the planning of modern laboratories.

A basic laboratory design which seems to fulfil modern needs, and which was referred to by several speakers, takes the form of a large central area, perhaps 60 ft. wide, with relatively small enclosed laboratories along the sides. The central area must have adequate head-room (more than 20 ft.) and it is therefore possible to provide a number of smaller enclosed laboratories or offices on a gallery over the ground floor laboratories (Fig. 1).

Prof. Basil Spence said he had been concerned with the design of university physics laboratories. Teaching laboratories had to cope with large numbers of students, but the requirements could be defined clearly. Research laboratories, on the other hand, must be extremely flexible in design, as the nature of the work which might be carried out in a few years time was unknown. He had even had to provide for the possibility of increasing the roof height in one project.

Dr. T. Emerson dealt with some problems in the planning of industrial research laboratories. He emphasized the importance of good team-work between the research director, the architect and the builder. The duties and responsibilities of the various parties should be clearly defined at the outset. The requirements for accommodation and services should be co-ordinated and all instructions passed to the architect by one person only, for example, the building supervisor, who might with advantage be the person responsible for the future maintenance of the finished building. The aim should be to construct an adequate building at reasonable cost with plenty of laboratory space to provide future flexibility, sufficient office accommodation, but no unnecessary frills.

A contribution by Charles S. Haines (read by Mr. D. T. R. Dighton) discussed recent trends in the design of American industrial research facilities. In the United States it is becoming common to put the research facilities on a rural site separate from the manufacturing plant. It is important to provide adequate space for future expansion and car parks, and some companies with research organizations of approximately one hundred persons are acquiring sites of more than 200 acres. The design of the buildings must proceed from the inside outwards. To prevent early obsolescence, modular planning is essential, a module being a "three-dimensional repetitive unit of functional space". The satisfactory width of the laboratory module (usually parallel to the exterior wall) may vary from 9 to 12 ft.; the length may be from 24 to 28 ft. Office modules of 5 ft. × 15 ft. will provide individual and group offices of 10, 15, 20 or 25 ft. × 15 ft. Factory-finished metal partitions are preferred for subdividing laboratories, and they should be designed so that room arrangements may be modified without moving the mechanical and electrical services. Air conditioning is desirable, and fume chambers may be required in physics as well as in chemistry laboratories. Many laboratories built in the period from 1949 to 1954 using cheap materials and poor construction are now beginning to deteriorate. Properly planned sound construction using lasting and easily maintained materials will prove to be more economical.

Mr. B. C. Fleming-Williams spoke on services and facilities from the user's point of view. The permanent services—water, gas and waste pipes, electric

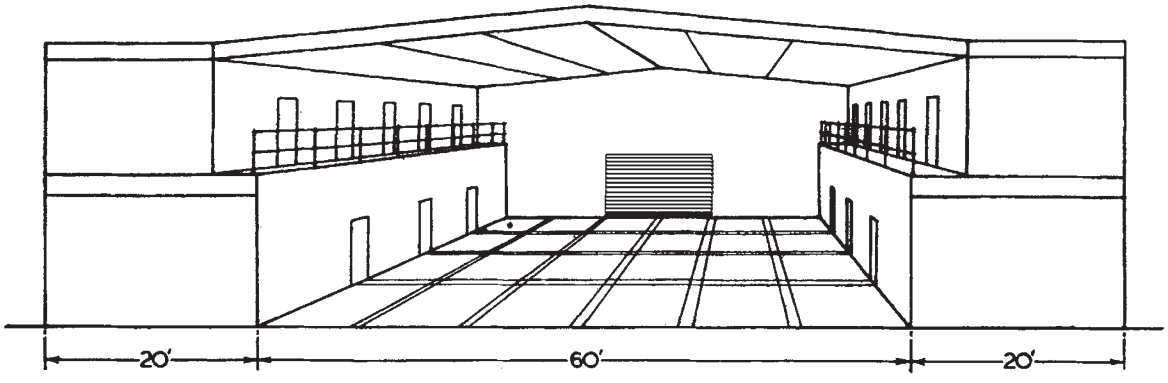

Fig. 1. A basic design for a physics research laboratory

power, lighting, heating and ventilation—should be based on a modular plan. Local supplies may sometimes be preferable to a permanent central installation. For example, direct current can conveniently be supplied from individual power packs instead of from a central battery. Similarly, vacuum requirements can usually be provided by bench pumps, and supplies of various gases from local cylinders. Facilities must be available, however, for the handling and storage of gas cylinders. An adequate and easily accessible duct system should always be installed to enable any central service to be provided at any point if it is found to be desirable in the future.

Mr. J. C. Cornwell discussed buildings and services from the point of view of the laboratory maintenance engineer. He pointed out that maintenance staffs in laboratories are more often concerned with alterations and additions to the buildings and facilities than with simply maintaining the original installation. When the laboratory is designed, provision should be made to facilitate building extensions and alterations to the services. In the choice of partitioning, sound transmission and ease of attachment of shelves are important considerations. Brick and some proprietary types of partitioning are satisfactory, but steel and glass are not. Floor surfaces and their cleaning merit particular attention. Floor ducts should be designed to minimize flooding. Fire protection should receive adequate consideration. Provision must be made for inflammable stores, radioactive sources, gas cylinders and bulky maintenance equipment.

Mr. R. G. Hopkinson spoke on the programme of research on the design of laboratories which is being carried out by the Nuffield Foundation Division for Architectural Studies in collaboration with the Building Research Station. Statistical studies have been made of the bench space and services required by laboratory workers. The work on laboratory lighting was carried out at the Building Research Station. From the determinations of minimum levels of natural and artificial lighting for the efficient performance of laboratory work, a design has been evolved which gives good day-lighting in a single-side lit laboratory. A model was used for assisting in the appraisal of the design (Musgrove, J., and Petherbridge, P., *Architect's J.*, **126**, 368; 1957).

In opening the discussion, Mr. D. A. Oliver suggested that two types of laboratory accommodation are generally required—'open space', costing about £2 per sq. ft., and 'better-class' laboratory accommodation costing about £4 10*s*. per sq. ft. The better-class accommodation should be kept free from noise, vibration and dirt; workshops and heavy machines should be in a separate building.

Other matters discussed were the advantages of air conditioning and electric floor warming in research laboratories; a method of providing a wide range of electricity supplies at the benches; and a colour-light staff location system which also functioned as a fire alarm.

In summing up the symposium, Prof. F. A. Vick said that the physicist must make up his own mind as to his requirements, but it is sometimes important that the outside of laboratory buildings should be in keeping with other adjacent buildings. The use of models could be a great help in planning laboratories. Workshops and equipment causing noise and vibration should be kept separate from the research laboratories and offices. The services should be very carefully designed bearing in mind the many points raised in the discussion, and detailed plans of the services properly colour-coded should be handed over with the building. The laboratory furniture should be designed as part of the building. He agreed that it is false economy to save money on the initial cost of the laboratory—taken over a number of years the capital cost of buildings is not usually a very important item in the research laboratory budget.

J. S. FORREST

COLOUR TELEVISION IN UNIVERSITY TEACHING

GUY'S HOSPITAL AND MEDICAL SCHOOL and the British Broadcasting Corporation collaborated to present a series of sixteen demonstrations, lasting more than two hours, which was relayed from Alexandra Palace to Western House, Great Portland Street, London, on the evening of November 19. Marconi's Wireless Telegraph Co., Ltd., provided a colour television projector and a 6 ft. × 4 ft. screen. Although this presentation had been organized for the staff of Guy's Hospital and the Medical School, a large number of representatives from other faculties in the University of London and from medical centres elsewhere were also present.

The purpose was to judge the technical quality of the British system and to consider whether the apparent and potential properties of colour television are sufficiently attractive to warrant a critical trial under practical conditions.

This venture was by no means a stunt. Repeated technical experiments in the research establishment of the Marconi Company at Chelmsford preceded further trials at Alexandra Palace by members of the staff at Guy's representing fourteen different departments. The B.B.C.'s production staff had to evolve new methods and to adapt their equipment to a considerable extent. For example, teaching demonstrations were found to require big close-ups, whereas existing techniques had naturally been designed to satisfy the demands of the theatrical producer. It may be of interest to note that this was the first occasion on which the B.B.C. has transmitted a continuous colour television programme of this length. Meticulous planning was necessary to enable the two cameras to move from one demonstration to the next in less than two minutes. That the presentations followed each other with quite extraordinary precision was the more remarkable as few of the busy physicians and lecturers had been able to attend more than one or two rehearsals. This is a point of importance, as it might be assumed that television techniques in medical teaching will exact undue demands upon the lecturer's time.

The general consensus of opinion was that the quality of definition and colour balance was well above reasonable expectation and most certainly made the use of colour television a practical possibility. It is still to be decided whether this method of communication should be further tested for its effectiveness by a series of critical experiments carried out against the background of university teaching. It was not possible on this occasion to draw any valid conclusions in this respect. The audience consisted of experienced teachers and not students, most of the demonstrations were enacted by senior lecturers, who would normally have been directing such work while