

Such a home, provided not only with lecture-rooms and laboratories, but also with meeting-places for societies, traders, and students, and especially with an adequate library, "would concentrate the efforts of all who are concerned with the manufacture or use of optical instruments." We have ourselves more than once advocated such a project, and it is to be hoped that those entrusted with the administration of the large public funds which are, and will be, we hope, more in the future, devoted to similar objects, will not, as in a scheme criticised in the report, take the line of least apparent resistance and relegate the establishment of an optical institute to the dim and distant future. Such a course would be, we assert, simply disastrous. It may not be inopportune to recall that the establishment of such an institute received, only a few months ago, the cordial approval of the present Prime Minister, who was doubtless influenced by his experience as Minister of Munitions.

Space does not permit us to dwell in detail on other valuable suggestions in the report, but there is one of great importance which may be mentioned in conclusion. We refer to the provision of suitable optical text-books, the translation, in the first instance, of suitable foreign books, and to the abstracting of important publications on technical optics.

NATIONAL INSTRUCTION IN TECHNICAL OPTICS.¹

SEVERAL attempts have been made during recent years to provide systematic training in technical optics, and a scheme prepared by the London County Council will be referred to in this report. But, before discussing the details of any proposals, it is advisable to form a clear conception of the requirements of the optical trade, and of the organisation of the teaching best adapted to promote the interests of that trade without regard to existing conditions, which no doubt will place some difficulties in the way of the immediate adoption of a thorough-going and satisfactory scheme.

It is necessary at the outset to emphasise one point which is of vital importance. If a perfect organisation for instruction and research in optics could instantaneously be called into being, some years would necessarily elapse before the trade would appreciably benefit by it, because that trade requires above everything a sufficient supply of men thoroughly trained in the scientific principles underlying the proper construction of optical appliances. Such men are not obtainable at the present moment; they will have to be trained, and this requires time. But the next few years are the years which will determine the future of the industries of the country. To avoid a delay which might prove fatal, it is essential that provision should be made at once to give the trade such assistance and advice as will ultimately be supplied by the body of trained men which, it is hoped, will be available in a few years.

This leads us to our first recommendation. Whatever scheme be adopted, it is essential that it should include the appointment of a highly qualified scientific man, who will be charged with the organisation and direction of the whole of the teaching. This man, to whom we shall refer as the "director"—whatever

title he may subsequently receive—ought to be appointed at once. Among the duties specially assigned to him in the preliminary period should be that of advising the trade in any difficulties they may encounter. A sufficient staff should be assigned to him for the purpose. The director should not be attached exclusively to any of the existing institutions.

A further need, which is urgent, is the supply of standard text-books dealing with those parts of optics which at present are greatly neglected in this country; this includes practically the whole of geometrical optics and a large part of technical optics. In our opinion, the quickest and most effective manner of dealing with this requirement is by publishing translations of existing foreign books and abstracts of important papers on the subject.

In defining the range of teaching to be provided, and forming an estimate of the number and type of the students who may avail themselves of the opportunities offered, we must keep in mind that the use of a knowledge of optics is not confined to those intending to enter the optical trade. The Army, the Navy, the Patent Office, and other Government departments employ optical experts. We are informed that the Royal Naval College habitually sends some of its ablest young officers to an optical firm, to be instructed in the principles and designs of range-finders, gun-sights, and other optical instruments. Medical men, bacteriologists, surveyors, and nautical men would also, in many cases, welcome instruction in special branches of optics. We may here refer to the School of Economics, an institution mainly devoted, as its name implies, to a highly specialised branch of knowledge, which derives its practical importance from its connection with matters affecting the welfare of the country. In these respects, it presents a certain analogy with the proposed school of optics. Experience in this case shows that the instruction given has attracted, from much wider circles than was originally contemplated, students desiring instruction in special departments of economics. It is, therefore, well not to take too narrow a view, but to look upon the practical application of optics as being one of the many points of contact between the industries and pure science. Any advance in its study will hence react beneficially on the advance of the science on which it is based.

We therefore look forward to the establishment of an optical institute which would concentrate the efforts of all who are concerned with the manufacture or use of optical instruments. It would bring together the several optical societies, which might find a home within its building; it would be the centre for the co-operation of the trade with students and teachers; it should contain a library with periodicals and books on optics.

The general direction of the courses of study should—as is the case in the scheme of the London County Council—be vested in an Advisory Council on which the trade, as well as the optical and learned societies, is represented. It has already been insisted upon that there should be a principal or director who is highly qualified on both the theoretical and the practical side, and who would be responsible to the Advisory Council. Full courses of instruction, in both day and evening classes, will be required. The day departments would consist mainly of youths between the ages of fifteen and twenty, who would receive general and technical instruction, including mathematics, physics, chemistry, and practical optical work.

The evening work would be adapted to the requirements—

- (1) Of students engaged in the trade during the daytime;
- (2) Of advanced students, some of whom would have

¹ Report approved by the Board of Scientific Societies of a Sub-Committee consisting of Mr. Conrad Beck, Mr. F. J. Cheshire, Mr. E. B. Knobel, Sir Philip Magnus, Prof. H. Jackson, and Prof. A. Schuster (chairman).

graduated in science, and would be preparing to occupy the position of managers in optical works;

(3) Of other persons interested in learning the scientific construction or use of optical instruments.

Provision should be made for research work not requiring a highly specialised or expensive plant. Special investigations might be referred to the National Physical Laboratory, or any other laboratory suitable for the purpose.

It is also worth considering whether a good journal or paper should not be published, devoted to scientific instruments and other matters concerned with optics.

We are aware of the difficulties which stand in the way of putting into immediate operation a scheme which would satisfy in a comprehensive manner all the above conditions. It will therefore be necessary to contemplate a transitional period leading up to what we ultimately hope to obtain.

In considering the provisional arrangements, regard must be had to the fact that already some very good work in the training of operatives of different classes is being done at the Northampton Polytechnic Institute, where a certain amount of modern machinery and apparatus has been provided, and young men and women are receiving useful training, the value of which has been recognised by the Government. We may also direct attention to the valuable research work being carried out in King's College, London, under the Glass Research Committee of the Institute of Chemistry. The instruction given at the Northampton Institute should, however, at once be supplemented by more advanced teaching in some convenient institution of university rank. Stress has already been laid on the immediate appointment of a principal or director, and there is no reason for delaying the formation of the Advisory Council. So soon as the preliminary work of organisation permits, plans should be prepared for a new building, which, in our opinion, is essential.

The scheme of the London County Council represents a carefully considered attempt to utilise and extend the teaching given in existing institutions, and to reconcile conflicting interests. Its object is, therefore, the same as that which we contemplate in the transitional period, and in its main features it seems to differ little from our proposals. It is not with the object of making any captious criticism, but merely to prevent possible misunderstanding, that we desire to point out what seem to us to be serious defects in the details of the scheme.

It is provided that the Imperial College of Science should institute a separate Department of Technical Optics, with a head who is also to exercise some undefined powers of general supervision over the whole scheme. Being a member of the staff of the Imperial College, he would presumably be appointed by the governing body of that institution, and primarily be responsible to it. He would have at the same time powers over the course of instruction at another institution that had no voice in his appointment. His relationship to the Advisory Council is not defined, and the proposal in its present form does not seem to us to be conducive to harmonious working. It also seems to perpetuate what, in our opinion, should only be a transitional stage. Our own proposal contemplates that the appointment of the Director of Studies should be primarily vested in whatever body is constituted as the main governing body.

Another fundamental defect of the scheme is implied in the wording defining the distribution of the work between the Imperial College and the Northampton Institute. Stress appears to be laid on post-graduate work conducted at the Imperial College, and research work is confined to that institution. If it be meant that

the normal course of instruction should begin with a degree course in pure science, and the higher technical teaching should only begin after such a course is completed, we must express our dissent from that view. There may be some cases, no doubt, where a graduate in science will turn his mind towards technical optics, and provision should be made for him; but the centre of gravity of the institution must be a course extending over two or three years, in which teaching in science is, *ab initio*, directed towards the necessities of its optical applications. As regards research work, the teachers in any institution which may be built, or during the transitional period at the Northampton Institute, should be of sufficient standing to be able to conduct research work, and though no expensive or elaborate plant need be supplied, and such research work need not form a prominent part of the activity of the institute, it is not advisable to lay down any hard-and-fast lines as to where researches are to be carried out. Special investigations, as has already been said, will probably be largely concentrated at the National Physical Laboratory, but they also should not necessarily be confined to any one place.

In conclusion, we may sum up the requirements which appear to us to require immediate attention:—

(1) The appointment of a supervising representative council.

(2) The appointment, under the proposed supervising council, of an administering director, with special duties during the transitional period, which will include advice to the trade and the organisation of the different parts of the curriculum.

(3) The translation of suitable works and the abstracting of other important publications on technical optics.

(4) Pending the erection of a suitable building, the organisation of day and evening courses at the Northampton Institute, and arrangements for higher instruction at some other institution of university rank.

The term "technical optics" throughout the report is intended to include the chemical composition and manufacture of glass.

The committee is willing to give further advice with respect to the selection of books for translating or abstracting, and any other matters connected with subjects referred to in the report.

NOTES.

WE notice with much regret the announcement of the death, at seventy-four years of age, of Prof. J. G. Darboux, permanent secretary of the Paris Academy of Sciences, professor of higher geometry at the Sorbonne, and a foreign member of the Royal Society.

THE following fifteen candidates have been selected by the council of the Royal Society to be recommended for election into the society: Dr. J. H. Ashworth, Mr. L. Bairstow, Prof. G. A. J. Cole, Mr. C. F. Cross, Dr. H. D. Dakin, Prof. A. S. Eve, Prof. H. Jackson, Prof. J. S. Macdonald, Prof. J. W. Nicholson, Dr. R. H. Pickard, Mr. C. T. Regan, Dr. R. Robertson, Dr. E. J. Russell, Mr. S. G. Shattock, and Prof. F. E. Weiss.

THE *Times* announces the death, on February 24, of Prof. Jules Courmont, professor of hygiene and deputy doyen of Lyons University.

MR. W. H. H. JESSOP, senior ophthalmic surgeon to St. Bartholomew's Hospital and president of the Ophthalmological Society of the United Kingdom, died on February 16 at the age of sixty-four. In 1885, soon