This question of the pressure of time upon the discussions is one of growing importance in connection with scientific congresses. On one hand it is essential to the success of such meetings that the programme should be open to a large number of papers, since otherwise it would not be possible to secure that extended view and free interchange of opinions and ideas which it is the object of such assemblies to promote. But, on the other hand, if there are many papers to be discussed, the difficulty of discussing them within the available limits of time becomes extreme. We observe with interest that an attempt has been made in connection with this convention to circumvent the difficulty by means of demonstration rooms. Two rooms were set apart in the buildings placed at the disposal of the committee for this purpose. In one of them—called the Members' Demonstration Room—the diagrams and apparatus illustrating papers were set up and maintained on exhibition during the whole period of the convention. It was thus possible for the members to study any particular paper at leisure, while the readers of the papers had the satisfaction of repeating their demonstrations to selected audiences.

The other demonstration room, which was open to the public, served sometimes for the fuller discussion of a paper which had been inadequately discussed in the meeting room, and at other times for the accommodation of impromptu demonstrations unconnected with the printed programme of proceedings. These seem both to have been useful expedients for minimising the inconvenience of deficient time for reading and discussion of papers at the set meetings, and probably would have been more effective for the purpose if the arrangement had been more commonly adopted, and therefore better understood. But the best demonstration room expedient is but a palliative, and the problem still remains to confront the organisers of scientific and other congresses how to get the work before them accomplished in the time at their disposal.

EXHIBITION OF OPTICAL AND GENERAL SCIENTIFIC INSTRUMENTS.

THE success achieved by the Optical Convention of 1905 was a guarantee of that of the second convention, of which an account is given in the preceding article. In connection with the convention an exhibition has been held which has been representative of every branch of applied optics. The committee of the convention has been deeply indebted to the Board of Education for the space in the South Kensington Museum galleries which has been placed at its disposal, and for the many facilities afforded, which have very greatly helped the success of the exhibition.

The exhibits have been divided into twenty classes corresponding to as many types of optical apparatus, and a very interesting loan collection was organised, consisting of apparatus of historical interest and special apparatus of which in many cases only one has been made. Arrangements were made so that in many cases visitors could have the advantage of demonstrations by the gentlemen who had designed and used such apparatus in their researches.

Among the most interesting of these were a set of gratings and similar apparatus belonging to the Royal Society, which were used by Fraunhofer in his researches on the spectroscope. A camera lucida belonging to the inventor, Dr. Wollaston, was lent by the master and fellows of Gonville and Caius College, Cambridge. Mr. T. H. Court lent a number of early microscopes, and Mr. Croft a number of very interesting photographs of interference and polarisation effects. The hon. secretary, Mr. J. W. Gordon, provided examples of many of the useful facilities which he has invented for microscopic workers. Messrs. Rheinberg gave demonstrations of the beautiful microspectroscopic method of colour photography, and Prof. Coker of the very different but equally beautiful method of studying the stresses in celluloid models of engineering structures by the use of polarised light. A very interesting small dividing engine for the production of diffraction gratings was shown by Mr. Pochin. In this a cast-iron screw has been adopted as being far superior to mild steel, which was found to be comparatively useless.

The Secretary of State for War has shown his interest in the exhibition by permitting an exhibit arranged by Major Williams of certain representative types of optical apparatus as used in the Army.

A number of thermostats, silica mercury-vapour lamp, and silica vessels for use in polarimetry were shown by Dr. T. Martin Lowry. The latter are especially useful for liquids which are liable to be altered by the alkali contained in ordinary glass.

The new gas and liquid refractometer of Messrs. Zeiss is an instrument of great sensitivity, being able to detect one part in 100,000 of salt in its solutions, while the convention has been able to welcome to its meetings Dr. von Rohr, of Jena, who has presented a paper on lenses of non-spherical curvature. Many members were glad to see the focometer and other apparatus and experiments of the president, notably the large quarter-wave plates made for the experiments of Prof. Coker.

The fact that the portion of the general catalogue descriptive of the apparatus of the firms participating in the exhibition occupies 350 pages is an indication of the hearty support which the industry has given to the convention.

The intention has been to make the catalogue valuable as a book of reference for some time to come to persons interested in optics, and also a medium for the assistance of the optical industry. For this purpose a large edition has been printed, and its distribution abroad, especially in the Colonies, is now under the consideration of a special committee. The editing has been done at the National Physical Laboratory, and Mr. E. H. Rayner and Dr. T. M. Lowry have been chairman and secretary of the catalogue committee, on the results of which they are to be congratulated, especially considering the short time available for its compilation. Attention may especially be directed to the introductions to many of the classes in the catalogue, which are very valuable epitomes of modern methods and apparatus in the most important branches of optics.

A sign of the times is the way in which the class devoted to illumination has been supported. Architects and engineers have now available not only accurate figures for the illumination required in different circumstances, but also values for the distribution of the illumination produced by the many reflectors of various types for use with gas and electric light. The use of special types of portable photometers now available for measuring the intensity of illumination leaves no loophole for the unsatisfactory and wasteful methods of illumination which have been commonly regarded as inevitable. In this connection the exhibits of Messrs. Holophane, Ltd., Messrs, William Sugg and Co., the Union Electric Co., Messrs. Everett Edgecumbe, the Adnil Electrical Co., and the Benjamin Electric Co. were a liberal educa-

tion to anyone specially interested in this important branch of optics.

Messrs. Adam Hilger showed many of the specialities requiring the highest skill of the optician, such as Echelon and Lummer Gehreke spectroscopes and quartz spectrographs. Among a fine series of surveying instruments, shown by Messrs. Casella, Negretti and Zambra, Ottway, Pillisher, and others, was a divided circle shown by Messrs. E. R. Watts and Son, the graduations of which have been investigated at Charlottenburg for the purpose of checking the accuracy of their dividing engine. The result is that the average error is not greater than half a second, and nowhere reaches two seconds, a notable achievement.

One of the most important commercial developments in optics in recent years has been the growing use of high-class photographic lenses. The intelligent user has discarded the rectilinear, and the production of anastigmat lenses of the highest quality has been encouraged by the rapid growth of kinematography. Anastigmats at very moderate prices were shown by Messrs. Aldis, by Messrs. R. and J. Beck, whose Isostigmar and Neostigmar series are notable as examples of a new and excellent type, by Messrs. Dallmeyer, and others.

In the meteorological section examples of Dines anemometers and the Dines-Shaw microbarograph were exhibited by Messrs. R. W. Munro and by Messrs. Negretti and Zambra, both inventions of the greatest importance.

It is impossible to give little more than the names of some of the seventy exhibitors in the most important classes. The fifty pages of the section dealing with microscopes contain short accounts of the chief products of Messrs. C. Baker, R. and J. Beck, Messrs. Pillisher, Reynolds and Branson, and W. Watson. Among the exhibitors of spectacles and ophthalmic apparatus were the Kryptok and Unibifocal Co., producing bifocal spectacle lenses of two different types, both requiring great skill in manufacture, and Messrs. G. Culver, Ltd., W. Gowlland, Raphaels, Reiner and Keeler, Ltd., and J. and H. Taylor, who had a large selection of interesting oculists' apparatus.

Beautiful examples of special cameras for process work, a type little known to the general user, were shown by Messrs Hunters, Ltd., and A. W. Penrose, Ltd. Modern types of projection apparatus were shown by Messrs. Hughes, Newton, and Reynolds and Branson. Among several interesting exhibits of the latter were projection apparatus suitable for use with ordinary microscopes, and also inexpensive apparatus for the projection of opaque objects, diagrams, &c., a type which might be more generally used for educational purposes and for the use of speakers at the meetings of scientific societies.

The catalogue committee decided to include in the catalogue descriptions of apparatus shown by firms unable to participate in the exhibition. There is, for instance, a very interesting account and illustration of large telescopes of 24 in. and 26 in. aperture, for the observatories at Santiago and Johannesburg, at present in course of erection in the factory of Sir Howard Grubb. Descriptions and illustrations are also given of other special apparatus made by the firm for many observatories in different parts of the world. To teachers and others the catalogue will be of value, and we would especially emphasise again the importance of many of the introductions, which contain valuable information in many branches of optics scarcely procurable from other sources. The catalogue is obtainable from the publishers, *The Electrician* Co., Salisbury Court, Fleet Street, E.C., for 1*s.* 4*d.* post free.

OPTICAL SCIENCE.[1]

INTRODUCTORY.

SEVEN years have elapsed since the first Optical Convention assembled in 1905, under the presidency of Dr. R. T. Glazebrook. Both that gathering and the second one, in which we are now met, witness to the efforts which are being made, not less by those concerned in the industries than by scientific men, to promote the progress of optical science and of optical trade. Like all other industries which depend on the application of scientific discoveries, the optical industry has felt the pressure of the times; and a widespread sense of need that science and manufacture must be associated in an alliance more intimate and more active than heretofore has been the moving cause of both conventions.

DEVELOPMENT.

Seven years is but a brief span in the development of an industry, or in the history of any science. It may well be that in the seven years which have fled since our first convention we have no obvious great discovery to chronicle. But if no optical invention of first magnitude, or discovery of fundamental importance, has been announced, it must not be assumed that there have been no advances. Progress there has been; progress solid and real, all along the line. No branch of physical science can in the present day remain stationary. The workers are too numerous; the rewards of success, whether in the joy of scientific discovery, or in fame, or wealth, are too alluring to permit stagnation. Moreover, the increase of knowledge, the mastery of principles over phenomena, the conquest of the forces of Nature, are cumulative. Every attempt at wider generalisations, even if unsuccessful in itself, provokes new researches, and extends the foundations for further advance. To this truth the science of optics furnishes no exception. The history of optics is scarred with the battles of rival theories, of which the end is not yet determined. It may, indeed, almost be taken as axiomatic that in all efforts to reach the unknown, to advance human knowledge, it is better to set before one's self some directive hypothesis than to work aimlessly. Every great pioneer in physical science has to frame conjectures, and to keep them, as it were, in a state of solution until either confirmed or disproven. He may even have half a dozen rival and mutually destructive hypotheses before him as he works. Truth is not infrequently reached by a process of exhaustion, by honestly following clues that ultimately prove false, since when they are proved to be false the path to truth has been more closely delimited than before. Even positive error in theory has been know to lead to new and valuable results; as when Euler, arguing from the false premiss that the human eye is achromatic, deduced the conclusion that it must therefore be possible to construct by optical means a lens that should be achromatic.

NEWTON AND HUYGENS.

The influence of Newton in science has been immense. His great genius, shown in his "Opticks" in the unravelling of the puzzle of the colours of the prismatic spectrum, and in his "Principia," in laying the foundation once for all of the laws of motion and of the doctrine of universal gravitation, won for him an almost idolatrous regard. We may recall Alexander Pope's couplet:—

> "Nature and Nature's laws lay hid in night:
> God said, 'Let Newton be,' and all was light."

Even his mistakes—and they were few—were accepted as dogmas, as when he pronounced the dispersive

[1] From the Presidential Address delivered before the Optical Convention on June 19 by Prof. Silvanus P. Thompson, F.R.S.