

The accompanying illustrations give some idea of the comparative results obtained with living organisms. Figs. 2 and 4 are illuminated by a concentric dark-ground illuminator, the most satisfactory method available for observing

living organisms by ordinary light, and Figs. 3 and 5 by a solid cone of ultra-violet light. The apparatus as figured is now in operation in the microscopical department at the National Institute for Medical Research.

Industrial Research Associations.

II.—BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION.

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THE Research Association for the non-ferrous metals industry had its inception during the recent conflict, when manufacturers, under the stern necessity of war demands, began to realise the need for fuller knowledge respecting the metals and alloys with which they had to deal. Preliminary meetings were held at the end of 1918 and during 1919, the attendance being well representative of the non-ferrous metals and allied industries, and included smelters, founders, metal rollers, tube manufacturers, wire drawers, and makers of every class of industrial alloys, including the precious metals. After some unforeseen delay the association was formally incorporated in January, 1920, with headquarters in Birmingham, the centre of the British non-ferrous metals industry.

The association seeks the membership not only of firms engaged solely in the non-ferrous metals industries, but also of firms which are substantial users or workers of non-ferrous metals and alloys, such as engineers, shipbuilders, railway companies, etc. It will be obvious that if there is to be effective development of research in this important national industry, the whole-hearted co-operation of every manufacturer and user of non-ferrous metals is essential.

Whilst the main object of the association is to carry on research, it also seeks to disseminate technical and scientific information relative to the production, treatment, manufacture, and uses of the non-ferrous metals and alloys. To this end a bureau of information has been started, thus supplying a long-felt need experienced by many manufacturers in this industry. Attempts are being made to make the bureau as comprehensive as possible, and already good work has been done.

With regard to the scientific aspects of the research work to be undertaken, no definite programme of research has yet been arranged, owing to the comparatively recent date of incorporation, but the council is dealing fully with the matter in the near future. Technical committees, representative of the various sections of the non-ferrous industry, have been appointed to review the field of research in each particular sphere and to report to a full council in due course.

It may be well, however, to indicate briefly in which directions intensive research appears to be most necessary for the future development of the industry. It is now generally recognised that, important and necessary as improvements in smelting

and other processes of metal production undoubtedly are, the most marked technical advance in the immediate future may be expected from a more complete study of the properties of metals and alloys, as influenced by thermal or mechanical treatment, and by the presence of foreign matter. This being so, the first duty of the association will be to initiate researches into the fundamental principles which underlie the working of metals and alloys. Whilst it is true that the past few decades have seen considerable progress in non-ferrous metallurgical research, a careful review of this work reveals the fact that existing knowledge respecting non-ferrous metals and alloys is far less exact and complete than that which is available in the case of iron and steel. This lack of more extensive knowledge was brought home to manufacturers by the claims made upon the industry during the war period, and has helped to emphasise the importance of systematic research to provide that new knowledge without which an industry cannot make progress.

More exact data are required in connection with the physical constants of most of the industrial metals, and the vexed problem of the cause of hardening under mechanical treatment still requires elucidation; also problems concerning the quality of hardness and methods of testing such.

Apart from the conduct of research into the constitution and properties of metals and alloys, the most pressing problems that await solution appear to be those connected with the melting, casting, and working of metals in works practice. Each stage of manufacture, from the raw material to the finished product, presents its own individual problems. Realising the importance of starting with a sound ingot, the Brass and Copper Tube Association, in co-operation with the Research Department, initiated in 1918 a research into the production of sound brass and copper castings, under the direction of Prof. Thos. Turner. This research, which was established in a temporary laboratory in Birmingham, has now been handed over to the British Non-Ferrous Metals Research Association. As the result of two years' work, results of practical value have been obtained, and a report will be issued to members shortly. Attention has been directed mainly to the important question of the inclusion of gases, a subject which has been brought more into prominence since the introduction of gas and oil melting furnaces.

The laboratory experiments have been repeated

on a commercial scale, with the aid of an electric crucible furnace, which proved to be the most satisfactory method of melting for investigation purposes.

The growing importance of aluminium as a commercial metal has led to the formation of a committee, on which the association is represented, to deal with the corrosion of aluminium and its alloys, and research will be started shortly.

The atmospheric corrosion of non-ferrous metals is also receiving attention, the association having recently taken over this research, which was initiated by the Institute of Metals as one of the researches into the general question of corrosion of non-ferrous metals and alloys. The prominence now being given to aluminium alloys for aero-engines and motor-car construction opens up a wide field for research to gain more exact knowledge on alloys now in use and the introduction of new alloys. Particularly do the problems of ageing and disintegration need further research. The modern requirements of engineering practice call for more extensive information on the non-ferrous industrial alloys which are now produced in such large quantities. Modern research has considerably extended our knowledge of the constitution of the brasses and bronzes, but there is still scope for research into the factors which govern the machining and engineering properties of these alloys. More complete investigation is necessary into the composition of engineering alloys to withstand comparatively high temperatures, and chemical engineers are diligently seeking for non-ferrous alloys that will resist the action of acid solutions and vapours.

In this connection the use of chromium as a constituent metal appears to offer a promising field of investigation; its addition to nickel has produced some valuable industrial alloys, especially for electrical and for acid resistance purposes, but research in this direction is by no means exhausted.

The class of white alloys, including bearing metals and type metals, has so far received little attention at the hands of scientific investigators. Little is known respecting the exact constitution of the various series of alloys of which bearing and type metals are usually composed. There seems to be little doubt that a thorough investigation of this important class of alloys would result in many compositions now in use being discarded. The whole subject of bearing metals requires investigation in the light of modern scientific knowledge, as much information, based on practice, is contradictory.

Rapid advances in steel metallurgy have been made in recent years by the introduction of new alloys of remarkable properties, many of which include in their composition non-ferrous metals such as chromium, vanadium, molybdenum, titanium, tungsten, etc., which only a few years ago were regarded as rare metals. The success which has attended the use of these rarer metals in steel should stimulate investigation with a view to their

wider use in the non-ferrous industry. At present practically nothing is known of the influence of these metals on the industrial non-ferrous alloys, with the exception, perhaps, of a few special alloys known as high-tenacity brasses and bronzes, which are very varied in composition and complex in character.

Research is also necessary in connection with the industrial alloys of the precious metals. Little work has yet been done on the mechanical properties of the various gold alloys of 9-carat standard, which constitute 50 per cent. of the jewelry manufactured at the present time. Further work is also required in connection with standard silver, especially on the exact cause and prevention of so-called fire-marks. Alloys to act as satisfactory substitutes for platinum are also required.

Such, in brief, are some of the problems that confront the non-ferrous metal industry, and will doubtless claim the early attention of its particular research association.

Research in connection with metal extraction processes will not, however, be neglected. The association is taking over the work of the Copper and Zinc Inquiry Committee which was especially appointed by the Research Department to review the field of research in relation to the production of these two important industrial metals. Other committees will doubtless be formed to deal with research in relation to the extraction processes of other non-ferrous metals of industrial importance.

The council of the association fully realises that the value of research work is often lost to the manufacturers because of its want of application; in the conduct of its research, therefore, every effort will be made to carry on the work in such a way as to enable the full value of its research investigations to be infused into works practice.

Another important matter which is claiming the attention of the association is the standardisation of non-ferrous alloys, a question which has been brought into some considerable prominence as the result of war conditions, and presents great possibilities of considerable import to the industry.

For the present the research work of the association will be carried out in the metallurgical laboratories of existing institutions and in the temporary laboratory of the association established at Birmingham. It is hoped, however, that when funds become available, permanent premises will be equipped for experimental work and research, and for the bureau and administrative purposes.

Each research decided upon by the council will probably be placed in charge of an expert in the particular subject chosen for investigation, whilst the general supervision of all the researches will be undertaken by the technical officer of the association, as required by the articles. This course appears to be the most satisfactory in view of the diversity of non-ferrous processes, metals, and alloys that require investigation.