financial arrangements have been made to carry out at the Rothamsted Experimental Station, an investigation of foul brood diseases of bees, which have hitherto caused considerable trouble and loss. Dr. H. L. A. Tarr has been appointed investigator. Dr. Tarr is a graduate of the University of British Columbia and McGill University, and since 1931 he has been working at bacteriological problems in the Biochemical School at the University of Cambridge. Foul brood diseases were investigated in England nearly fifty years ago by Cheshire and Cheyne, and in more recent years by workers in the United States, Canada and on the Continent, but in spite of all that has been done, little is known about the cause of the diseases and still less as to how to avoid or cure them. The bee keepers, through the British Bee Keepers Association, have now agreed to raise half the money necessary for the investigations, and the Agricultural Research Council has undertaken to contribute the other half. As a result, a sum of £500 a year is now available for the study of foul brood. It is hoped that the work will continue for a period of at least three years, starting early in March 1934 under the general direction of Dr. C. B. Williams, head of the Department of Entomology at Rothamsted, with the co-operation of Mr. D. M. T. Morland, apiarist. Some of the more purely bacteriological side of the work will be carried out at the Lister Institute in London. Rothamsted Experimental Station will be advised on the practical side of the work by a small expert committee of bee keepers. Further contributions towards the cost of the investigations will be welcome.

National Importance of Scientific Research

REVIEWING the organisation of industrial research in Great Britain and other countries in an article in the *Draughtsman* of December entitled "Research and Industry", Mr. G. Windred concludes that we are at present by no means in a leading position, due perhaps to the curtailment of research expenditure in almost every direction, consequent upon the reduction of Government expenditure and the unwillingness of commercial organisations to spend capital. Mr. Windred states that industry, as a whole, is not prepared to apply scientific research methods until their possibilities have been clearly demonstrated. "Such demonstration can be effected only with the aid of research experience which must involve considerable expenditure, such as other countries have in general been willing to provide". The author reminds us that in the various departments of pure science, Great Britain holds a premier position which must prove of great assistance in the work of applying scientific principles to industrial improvement, and pleads for increased opportunities for industrial research. Assuredly, in this era of world-wide industrial progress, we can no longer afford to suffer the accusation that, however important are our fundamental discoveries in pure science, we yield pride of place to others in their application.

PUBLIC interest in the national importance of scientific research has recently been stimulated in Germany by a series of publications which are intended to awaken all classes to a realisation of the material benefits involved, and to counteract the tendency for too stringent economy in scientific work. These publications, which are written in non-technical language, are sponsored by scientific and educational associations of high standing. In the United States there are said to be more than 1,500 well-established research organisations, and the expenditure of American industry in support of these research laboratories has been assessed for the year 1931 at no less than 235 million dollars. The activities of the Mellon Institute of Industrial Research of the University of Pittsburgh are too well known and appreciated in Great Britain to require more than a passing reference. As regards Russia, Mr. Windred has no doubt that the plans for scientific reconstruction in that country have the strongest scientific arguments in their favour. He devotes considerable attention to the work of the British Science Guild, which was founded in 1905 by Sir Norman Lockyer. The following statement, which the Guild has included in the announcement of its aims, objects and activities, is so manifestly pertinent to the conditions of to-day that it deserves the widest possible publicity: "The most urgent practical need to-day is the promotion of the spirit of unity among all classes through the alliance of Science, Invention and Labour, working as a single force for national development and common welfare. Science discovers; Invention applies; Industry produces. No nation can occupy a place in the van of modern civilisation unless the three legs of this tripod form strong and secure supports for all its constructive activities".

Recent Advances in Microscopy

MR. CONRAD BECK, in his presidential address to the Royal Microscopical Society on January 17, pointed out that the resolution of the microscope had reached at least 100,000 lines to the inch in the middle of last century, and this limit was extended by steady advances to nearly 140,000 by the end of the century, but the limit is now placed at a figure that is less than 1/300,000 in. In referring to dark ground illumination, he stated that while it was used with low and moderate powers almost from the time achromatic microscopes were first made, it is only in recent years that the refined apparatus required to use it with high power lenses has been produced. He remarked that this technique does not render differential staining less important and expressed his satisfaction that the Council of the Society has appointed a committee to study the stains and reagents used for microscopic research, and he suggested that, in addition to other matters, consideration should be given to the introduction of differential stains, particularly designed for dark ground illumination. As an example, he cited the anthrax bacillus which, stained with methylene blue, appears blood-red by dark ground, and hence there might be stains which would differentiate structure viewed by this means to a greater extent than can be done with transmitted light.

DARK ground illumination has not only doubled the resolution of the microscope, but also has more than doubled the visibility of small objects. The use of quartz lenses corrected for ultra-violet light involves photographing images, but as no direct method of focusing is satisfactory an indirect method has been devised. An object-glass was made suitable for visual observation with approximately the same focal length as the quartz lens and a perfect method of interchanging the two has been worked out. A slow motion fine adjustment that can be moved a definite amount with certainty to compensate for the small predetermined difference in focus, and capable of moving the lens with an accuracy of $\frac{1}{20}\mu$, is the chief factor in the success of the technique. In concluding, Mr. Beck referred to the high cost of the apparatus necessary and asked whether this type of work should not be carried on in endowed institutions, just as is modern astronomical work.

Boilers for Critical Pressure

A NOTABLE paper was read to the Institution of Electrical Engineers on February 15 by F. Ohlmüller on the Benson boiler and its development for use in power stations. Dr. Mark Benson came to Great Britain some years ago and with the help of the English Electric Co. carried out experiments on a 500 h.p. steam turbine built for the purpose of working with steam evaporating at the critical pressure (3,200 lb. per sq. in.). At this pressure the latent heat of water is zero. The water being heated to the critical temperature (706° F.) turns completely and instantaneously into steam. Unlike ordinary boilers there is no separation of steam from water. In the present design of the boiler, dry steam is produced with certainty in steel tubes. At the outset, many difficulties had to be overcome. The manufacturing rights are now the property of the Siemens-Schuckert Co. of Berlin. They have overcome the trouble experienced with the tubes at Rugby. They now manufacture tubular boilers for use both at the critical and at subcritical pressures. Tests showed that the burning out of the tubes was due to the precipitation of salts contained in the feed water on the parts of the tubes where the water changes into steam. This occurs in the zone where evaporation terminates and superheating begins. The remedy is to change the zone of deposit to a region of lower flue-gas temperature.

HITHERTO the pressure in steam boilers has been regarded as a constant dependent on its construction. The Benson boiler operates with high efficiency not only at the highest possible pressure and at lower pressures, but also with varying pressures, and this seems to open a new field of usefulness. In warships, for example, the fuel consumption must be low at cruising speeds but for temporary maximum speeds, amounting to a multiple of the cruising speed, the quantity of fuel consumed is of minor importance. For cruising purposes, therefore, a relatively low pressure of 300 lb. per sq. in. may be used, and by increasing the pressure, ten times the power output can be obtained. With merchant ships a uniform speed is usually required, but for manœuvring in ports and estuaries a variation of the boiler pressure offers the most economical means of varying the ship's speed. The Benson boiler seems very useful for many purposes. For stationary steam plants with widely variable load (peak load stations) and locomotives, it can be operated at pressures varying with the load. A cheap and simple turbine only is required and an approximately constant thermal efficiency at all loads is obtained. In erecting many generating stations, industrial plants and thermal stations, difficulties often arise owing to the uncertainty about the future load. With this new boiler an increase in the output whenever necessary can be obtained simply by raising the pressure of the steam, as the cost of adapting the turbine and piping to the new conditions is small.

Negro-Indian Crosses in Mexico

SPANISH settlers in Mexico and Central America appear to have taken an interest in the results of racial intermixture from early days. Several series of paintings in oils of seventeenth century date are in existence, of which each picture depicts a family of mixed breed, both parents and children, Spanish-Indian, Spanish-Negro and Indian-Negro, the characters being faithfully presented. The number of pictures in each series is usually five or six. One of the best is, or was, in the possession of the Hulse family, the tradition being that it was part of the dower of Dorothy Woodrow, who married the first baronet towards the end of the seventeenth century. The series was supposed to have been captured from the Spanish in a naval engagement; but some at least of the pictures obviously must be of later date. It is interesting to note that the evidence of cross-breeding as shown in physical characters is still to be observed in the descendants of these early admixtures.

A JOINT Mexican and Italian expedition which is now engaged in observation of the natives of the coast of Guerrero, southern Mexico, reports, according to a communication issued through Science Service, Washington, D.C., that not only do the inhabitants of this area show the traces of their descent from the Negro blood of colonial days in a complexion which is appreciably darker than that of the general run of the Indian population, but also the two communities of Indian and Negro blood hold aloof from one another, and show marked differences in temperament and custom. The natives themselves make use of no less than five terms to distinguish the degree to which the hair of the head shows the Negro character. The tight-kinked African hair is called 'cuculuxtle', an Aztec Indian word; hair tightly curled in ringlets, which shows a slight dilution of Negro blood, is 'chino'; the looser waves produced by a greater proportion of Indian blood is 'crespos'; and the 'pele quebrado', 'broken hair', is Indian hair which is only slightly waved.

Institute of Plant Industry, U.S.S.R.

A LIST of publications of the Institute of Plant Industry, U.S.S.R. from 1908 until 1931, compiled