

getting together are surprising. A good suggestion is no sooner made than capped by a better, and the saving in time and effort is almost incalculable.

The conference system also aids in putting useful results before the other wing of the research division and before the patent department. At each of our conferences are representatives of the other wing of the research division, charged with taking up any results immediately applicable, and a member of the legal department who takes care of any ideas worth patenting. This plan of conferences relieves the scientific men from responsibility for directing the attention of the works or of the patent department to useful patentable results.

So far as national welfare is concerned, in order to increase our stock of organised knowledge we need more teaching by professors and instructors in closer touch with industrial problems. So far as developing research men goes, the ideal instructor is probably an ex-professional research man, and, in many cases, one who has made a reputation or a fortune by his work along industrial lines. Another need is, of course, more research laboratories all along the line. The increase would naturally be among industrial organisations and the expense borne largely by manufacturing concerns, since it is they who reap the chief direct financial benefit.

Another great need is co-operation among the various branches of research: national, university, and industrial. There should be a free interchange of men between such laboratories, and each should be thoroughly familiar with the needs and problems of the other. One great benefit from this war, if it lasts sufficiently long, will be to force co-operation between different branches of research.

(3) *The Application of Organised Knowledge.*—The present national crisis brings home to us the crying needs of the nation in availing itself of the knowledge and ability at its command. Fifty thousand specialists, in applying scientific knowledge to practical problems, as well as scores of research laboratories, have offered their services to the nation. But problems requiring investigation are slow in being developed. Once they are formulated and given to the engineers of the country, few will remain unsolved very long.

It is for the engineer to apply the results of research to practical problems and to carry practical problems demanding general research back to the research laboratories. To the engineer every special problem requires a special application of fundamental principles. Is it too much to hope that the day is rapidly approaching when all great problems, particularly those of our national and State Governments, will be automatically placed in the hands of trained specialists? Not self-seeking politicians, or yet men with mere theories, but engineers with a real command of fundamental principles, men with an unbroken record of big achievements and no failures, men ever ready to stake their all on their ability to handle problems in their speciality.

Prof. Joseph Le Conte, in an address years ago, remarked that each of the great professions first attained high standing when it was taught as such in universities. When so taught, the professional men turned out are no longer quacks, but each has a real command of the fundamental principles in his chosen field of action. The basic relation is that any profession has standing in so far as its fundamental principles have been developed and applied. To retain standing, a profession must be continually increasing its stock of knowledge of fundamental principles through research. The engineer of standing in his profession must not be content with a mere working knowledge of rules of thumb, but must have a real command of basic prin-

ciples in his chosen field and in related fields. The illuminating engineer, for example, should not only know lighting, but also possess a working knowledge of the laws of vision and of geometrical and physical optics. So the great physician or constructional engineer has a command of his own field and an intimate acquaintance with related fields.

So also with research as a profession, the leaders have not only a taste for research and logical minds clearly to analyse and attack problems with thorough scientific knowledge, but also a knowledge of the principles of research; getting the most out of their own minds, avoiding side-issues, co-operating with their colleagues, and putting their most valuable results in permanent, readily available form. Research is one of the youngest of the professions, and one with a promising future, but let no one enter it without thorough knowledge or a full understanding of its aims and methods. With sufficient attention given to research and to its application, this nation with its great national resources should at once attain and retain a permanent lead among the nations of the earth.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR WILLIAM TATEM has given 25,000*l.* for a laboratory at the University College of South Wales, Cardiff.

WE notice with regret that Mr. Bonar Law announced in the House of Commons on October 19 that he feared it would be possible neither to pass the Education Bill this session, nor to give a day for the second reading, unless there was a prospect of passing the Bill. There is little substantial opposition to the essential clauses of Mr. Fisher's Bill, and all the provisions covered by them are "urgently demanded by, and connected with, the circumstances of the war," as Mr. Fisher has said. We trust that even yet the Government may be able to proceed with the Bill.

THE University of Bristol has again benefited from the generosity of the Bristol family of Wills and their interest in higher education. Mr. Henry H. Wills lately purchased the Royal Fort House and grounds, which immediately adjoin the University buildings. This historical house was built and decorated in the eighteenth century by a member of the Tyndale family, descendants of William Tyndale, translator of the Bible. The greater part of this property, as well as some adjoining land, has been conveyed by Mr. Wills to the University for future extensions. The property conveyed covers nine acres, which will give the University a total building area of about thirteen acres. Part of the new site has been marked out for the purpose of the department of physics, and another part for that of a residential college. It is proposed to retain the existing house as part of the group of buildings which will eventually occupy the site. It will be remembered that shortly before the war Mr. H. H. Wills, jointly with his brother, Mr. George A. Wills, placed a sum of more than 200,000*l.* in the hands of the University for the construction and endowment of buildings on another part of its site.

THE governors of the Huddersfield Technical College are appealing for public support to enable them to carry out a large extension of the existing buildings. For many years the college has been seriously overcrowded, whilst in some important branches of local industries, such as woollen carding and spinning, no provision whatever has been made for technical instruction. The chemical and engineering industries of the district are developing so quickly that the need for better accommodation at the Technical College has become very urgent. The scheme contemplates the

building and equipment of new departments for coal-tar colour chemistry and for dyeing; the addition to the textile department of new sections for (1) carding and spinning, and (2) cloth finishing, providing at the same time improved facilities for weaving and testing, along with a textile museum; the extension of the departments of mechanical and electrical engineering, especially as regards facilities for practical and experimental work. Space would thus become available for necessary extensions in other departments. To carry through these proposals it is estimated that a sum of 85,000*l.* will be required. The Technical College should then be in a position to deal adequately with the varied educational needs of the leading industries of the district, both for advanced teaching and for research. The principal donations promised to date are:—British Dyes, Ltd., 5000*l.*; Sir J. F. Ramsden, Bart., 3000*l.*; Mr. J. A. Brooke, 1000*l.*; Mr. J. E. Crowther, 1000*l.*; Messrs. Simon-Carves, Ltd., 1000*l.*; Messrs. Walter Sykes, Ltd., 1000*l.* Furthermore, the Huddersfield engineers have undertaken to provide the complete equipment of the new engineering section.

LAST February, by the passing of the Smith-Hughes Act, the United States embarked on a national scheme of State-aided vocational education. We learn from the *Scientific American* of August 25 that the Act is similar in its features to the Agricultural Extension Act of 1914. There is the same provision for increasing grants, beginning with 340,000*l.* in 1917, and rising to 1,440,000*l.* in 1925. The available money will be distributed among all States which agree to contribute sums equal to their share of the grants and to conform to the terms of the Act. The grant provides for the creation of three distinct funds, viz. for paying salaries of teachers, supervisors, or directors of agricultural subjects; for paying the salaries of teachers of trade, home economics, and industrial subjects; and for training the teachers and other educational workers concerned. The Act creates a Federal Board for Vocational Education, consisting of the Secretaries of Agriculture, Commerce, and Labour, the U.S. Commissioner of Education, and three other members, to be appointed by the President, of whom one is to represent manufacturing and commercial interests, one agricultural interests, and one labour interests. The board, besides administering the Act, will carry out investigations relating to vocational education, co-operating with the Departments of Agriculture and Commerce and the Bureau of Education. There has been some fear in the United States that the spread of vocational training may disturb the principle of compulsory general education. But every boy and girl will be required to get the same minimum amount of "book learning" as at present, and those who, under conditions now prevailing, would enter the trades and industries as unskilled labourers will, for the future, receive specialised training that will enable them to command higher wages and make them more useful members of society.

THE address delivered to the members of the United Tanners' Federation at the Leather Sellers' Hall, London, on July 17 last by Dr. Sadler, the Vice-Chancellor of the University of Leeds, deserves the serious consideration not only of the protagonists on classical *versus* scientific education, but also of all who are engaged in industries in which science is a prime factor. It puts with force and precision the necessity of an all-round general education in which science, broadly conceived, shall take its due place in the education of all classes of the people, and especially that it shall be made "a stimulating and energetic force in the education of every boy and girl in our secondary schools," and that whilst not claiming that science, as ordinarily understood, should have the last word in

settling our view of life, yet that it should be a powerful ingredient in the intellectual ferment which determines the final judgment. It insists that technical education must be preceded by a good general education, and that it "should include three elements—scientific discipline, a study of processes of manufacture, and the study of the relationships, moral and economic, which should be established between the employer and his subordinates and between the industry and the community as a whole." In short, the address conceives the possibility of such a training being itself the core of a liberal education. The importance of scientific research and of a much closer relationship between the industries and the scientific resources of the universities is strongly stressed. "The gulf between the practical man and the scientific investigator is not yet bridged. To span it will be a costly business." In no country is there need for a more intimate union, for the solution of the grave industrial and social problems which beset us, between those practically engaged therein and the patient, scientific investigator. We are "rich in shrewd experience, but almost barbarous," says Dr. Sadler, in our "conception of the service that science can render to practice."

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, October 8.—M. Camille Jordan in the chair.—E. Branly: The electrical conductivity of mica. A detailed account of experiments proving the conductivity of mica in thin sheets (0.003 mm.) when under the electromotive force of a single thermoelement (0.004 volt). A special method of testing the mica sheets for holes is described.—G. A. Boulenger: Considerations on the Permo-Triassic reptiles of the order of the Cotylosaurians.—W. H. Young: The theory of trigonometrical series.—M. Guilleminot: Dosimetry and X-radio-therapy in the services of the Army.—G. Sizes: The Pythagorean scale from the point of view of musical acoustics.—M. Guillery: The Brinell hardness test of metals. For this test it is necessary that the conditions, size of ball, total pressure, and duration of the pressure should be rigorously defined. The last condition, not fewer than five minutes, is practically impossible under works conditions where some 10,000 tests a day have to be carried out. The author has worked out a method by means of which the time is reduced from five minutes to two seconds, the imprint being the same as if working under the standard conditions. This is secured by working with an excess pressure above the standard 3000 kg., and a machine is figured and described by means of which the desired pressure is automatically realised; 600 tests per hour can be made with one machine, and data are given proving the accuracy of the results to be within one per cent. of the Brinell standard.—L. F. Navarro: The Flyde peak and Cañadas cirque of Teneriffe.—R. Anthony: The primitive embryonic circulation of the Teleostean fishes; study of the embryo of *Gasterosteus gymnurus*.—E. Bordage: The transformation phenomena of larval tissues in reserve tissues observed during the metamorphoses of insects.—MM. Baudisson and A. Marie: The spondylotherapy of asthenic and post-traumatic vasomotor or commotional troubles.

CAPE TOWN.

Royal Society of South Africa, August 15.—Dr. L. Crawford in the chair.—Sir Thomas Muir: Note on the resolvability of the minors of a compound determinant.—J. Moir: Colour and chemical constitution (part ii.): the spectra of the mixed phtaleins and of the sulphonephtaleins.