

wave-lengths vary between 411 and 470 $\mu\mu$, the employment of the same coefficient of refraction for all stars is inadmissible.

"MOCK SUNS."—From Mr. James F. Ronca we have received an account of the appearance of the phenomenon usually known as "mock suns," or "parhelia," which was observed by him at Eastbourne between 12.55 and 1.55 p.m. on September 10.

Mr. Ronca did not see the commencement of the apparition, but states that at 12.55 p.m. there was a slight haze, and some very thin clouds, distributed fairly uniformly over the sky, and, symmetrically described about the zenith, there was a brilliant circle of white light on the circumference of which lay the actual sun; two other points on this circle stood out as exceptionally brilliant spots. Then, with the sun as its centre, there was a much fainter, small circle, tangential to which there appeared a brilliantly coloured band intersecting the large circle at two points equidistant from the sun. This coloured curve could be traced only with difficulty beyond the confines of the large circle, but at the points of intersection with the latter the colours were of extraordinary brilliancy, the red in all cases being nearest the sun.

Mr. Ronca's account shows the phenomenon to have been of an extraordinary brilliancy, which was maintained for twenty minutes after he first saw it, and did not disappear finally until 1.55 p.m.

THE RELATION OF SCIENCE TO INDUSTRY AND COMMERCE.¹

THE subject of this paper is so comprehensive that there will be no difficulty in understanding that attention has been restricted to one or two aspects of it only, and chiefly (since the paper is written by one engaged in educational administration) to that relation which exists between the scientific and technical education provided at higher institutions in this country, and the after careers of students. Even that relation cannot be treated in anything like an exhaustive manner within the limits assigned to me. My attention was specially directed to this matter some eighteen months ago by an opportunity which presented itself of reading some 150 letters written by past students of universities or of institutions of university rank. The letters were representative of an entire body of students whose education had been assisted. They came from students, men and women, who had taken degrees or diplomas in varying numbers during each of the last fifteen years. Four months ago, when, at the invitation of the committee of this section, I undertook to read this paper, steps were taken to extend the field of information. Some five hundred letters of inquiry were addressed to teachers of repute at home, in France, Germany, and America; to representative firms of employers, mostly at home, some abroad; and to thirty of His Majesty's consuls in Europe, Asia, and the two Americas. There have been before me also the written views of the presidents of vast industrial and commercial concerns in the United States, views collected in 1903 when I visited America as a member of the Mosely Commission. On the whole, my letters of inquiries have been treated with much sympathy, and I have had to examine a very considerable body of evidence of all kinds. I owe a great debt of thanks to the many distinguished men of science, and to many well-known leaders of industry and commerce, who have so generously given attention to my inquiry and have been kind enough to give me their views, some of them at great length.

I have endeavoured in what follows to reflect as faithfully as I can the different sets of views, and to add to them some views and suggestions, the result of my own experience.

Evidence from 150 Graduates.

First, as to the views of the 150 past students. These students all belong to the class for whom the earning of a living is imperative, and in the main they represent Oxford and Cambridge, and the London institutions of university rank.

¹ A paper read before the Educational Science Section of the British Association at the Sheffield meeting, by Mr. R. Blair.

Among minor points made by them are these:—The engineers emphasise the need of workshop practice under commercial conditions, finding that their future is in danger of being marred by lack of "works" experience, and some of those who have become industrial chemists express the need for five years' training: three for degree and two for research. The view of the engineer students needs no elaboration, for nowadays there is almost universal agreement that some form of the "sandwich" system affords the best possible method of training. The views of the chemists will be referred to later.

The students also complain that posts are obtained not on merit, but through influence. This contention is pointedly illustrated by a university college professor, who states that he knows one man who holds a most important berth, and is undoubtedly a first-class man in every sense of the word. This man took his university training as a mechanical engineer, and graduated with first-class honours, and did this after having had works' training extending over some eight years. On leaving college the man approached every mechanical firm of importance in Scotland in the hopes of getting a start. He found it impossible to do so. Finally, *through influence*, he did manage to obtain a junior berth, and is now the head of an important concern.

The most striking feature of the present occupations of the students is that only 10 per cent. have found their way into industry or commerce; another 10 per cent. have entered the higher ranks of the Civil Service, including technical posts. Some half-dozen are in the Church; another half-dozen are practising medicine; the remainder have taken to teaching, and it is clear in a fair number of instances that selection of a profession was not a matter of choice, but one of necessity. Many a man, towards the end of his university career, discovers for the first time that he has nothing to offer in the industrial or commercial market in return for a salary. If he has no technical knowledge or skill, he is, so far as his education helps him, in the same position as a secondary schoolboy, even if he is not handicapped on account of his greater age. Of those, also, who possess technical knowledge or skill, such as students of engineering or chemistry, a good many find themselves offered terms which pride, or poverty, or both, forbid them to accept. With pride I have no concern and no sympathy. Poverty is a different affair. When a man has spent his last penny in completing his university career, and when there is also pressure from home, there is no real choice between teaching, which is obtainable at 2l. or 3l. a week, however inadequately equipped the man may be for this purpose, and an office or a workshop at anything from, say, 10s. to 30s. per week. Sometimes the factory, shop, or business-house offers nothing, and occasionally a premium is required. It will easily be understood that in such circumstances an appeal is made by the students for more help in finding posts for university honours men, who are not eligible for the Civil Service, and who do not care to turn schoolmasters, and it will not be difficult to appreciate that at the critical point in his career—the selection of a means of earning a livelihood—a man is apt to write harshly of some of the slackness of university life, and to complain, as one of the most successful of them has done, that he wanted to be made a chemist, but his university insisted on his wasting his time on Divinity and did not even ask for German!

Evidence from the Staffs of Universities and of Technical Institutions.

A great change in the relations of the university and the market has occurred during the last quarter of a century. The general advance in the standard of education has produced a larger sympathy on the part of the market for educational institutions and their products; and the movement in favour of technical education has widened the range of objects of university education and the social classes from which university students are drawn, and has perhaps compelled the universities to have regard to the diversities in the world's work and to the functions they should discharge in preparing their students to live. During the period referred to a large number of technical institutions have sprung up all over the United Kingdom, and within quite recent years there have been strong influences at work to bring about coordination, if not incorporation of

the greatest of the technical institutions with the universities within the area of which they have emerged. The danger in the process of amalgamation is that it may be premature. It may come about before the realisation of what each institution in its own way, and in its own time, has had to contribute to national problems, and before it has been fully recognised that the annexation of a technical school is not merely the end of a rival, but the beginning of a new public responsibility, and that in the result the vitality and, if you like, the harsh industrialism and commercialism of the technical institution may be too much submerged by "academic control."

The evidence placed at my disposal shows, on the whole, a tone of great hopefulness. The hopefulness of tone to which I have referred is common. It is displayed by the newest of the large municipal technical institutions in the heart of a great industrial centre, and by some of our oldest universities. It is becoming evident that the institutions are recognising that, however much the market, in its quest after cheapness, has failed to distinguish the real from the spurious article, the institutions have been without much blame for placing inefficient machines on the market. An eminent professor of chemistry tells me that his whole "professional life is strewn with examples of the unwillingness of industry and commerce, the State, and municipal authorities of this country to take advantage of the services of young men who have received the highest technical training as chemists." But, he adds, "there is a tolerably rapid improvement taking place," and "we who are urging the importance of employing these highly trained young men have to remember that there has been a great lot of poor stuff turned out from the universities and technical colleges, and that the British manufacturer has a good deal to say in his own defence."

Agriculture and Allied Industries.

It is in connection with the agricultural colleges that there appears to be the least difficulty in showing that the students have found posts in agriculture or in allied industries. The case of agriculture may be somewhat exceptional. There has been so much development in this industry in recent years that there was bound to be a considerable demand for trained men. Moreover, many of the young men who have undergone a course of training in agriculture have done so in order to fit themselves for farming, or otherwise dealing with land as land agents or farm managers, on their own account. Further, it has for a fair number of years now been obvious that study in the agricultural colleges had to be combined with practice on the farm. The agricultural colleges also report that there is a considerable demand for their students in various branches of foreign and colonial land development work, such as tea, coffee, cotton, and rubber planting, management and extension of irrigation colonies, forestry, stock farming, and so on. A certain number of students trained at agricultural colleges are in demand for commercial undertakings in businesses associated with agriculture. For example, the German Potash Syndicate has a number of men representing their interests in various parts of the world who were educated at one of our oldest agricultural colleges, and the Permanent Nitrate Committee and the Sulphate of Ammonia Committee have also appointed agents or representatives who have gone through a similar course of training. The principal of the college attributes this preference for men who have received a college education instead of those who have had a business training only to the fact that the work undertaken by these representatives combines a large propagandist element with ordinary business management.

In Ireland the State directly organises the application of scientific education and of scientific knowledge to agriculture and allied industries. The Department of Agriculture and the county committees alone take advantage of young men who have received the highest technical training in agriculture. Since 1903 some sixty or seventy men have passed through the faculty of agriculture in the Royal College of Science, and all have been employed by the department or by the county committees. Farmers in Ireland operate on too small a scale to warrant them in employing experts as is done by large industrial concerns. Those who want expert assistance can get it through the county committees, or, for special work, from the depart-

ment. In this way the faculty of agriculture is exerting a strong influence on agricultural practice. Leading farmers—those of the best education—make most use of the expert, and the smaller men follow them. In this way the influence of the Royal College of Science is far greater than is usually supposed to be the case. The college course fits men to take up the important positions of itinerant and special instructors, and the whole course has been designed specially for the one purpose. Moreover, the instructor and expert, after leaving college, are kept in touch with the work of the college and with that of instructors in other counties than their own or those adjacent. If the college taught, so to speak, in the air, and was not, as it is, part and parcel of a great organised system, it would do little good. No students of agriculture attend except those selected to become teachers and experts under the department and the local authorities. For such teachers and experts there is always a demand, since some of those who have been trained and who have worked as experts for a time leave—some to business, others go abroad to take up work as teachers or experts in the colonies.

In addition to this main work, the college trains experts in forestry, horticulture, and creamery management, and in these branches of Irish industry the trained men perform the same functions towards these industries as the agricultural expert does to agriculture proper. While no one who intends to become a farmer takes the Royal College of Science course—since this last would be out of all proportion to the capital invested in even the larger farms in Ireland—quite a number now attend shorter and less expensive courses at the Albert Agricultural College and elsewhere. There are thus other channels through which the higher technical training at the Royal College reaches those engaged in the agricultural industry, since these local colleges, stations, and winter schools are staffed by Royal College men who keep in touch with the central institution. The lesson which Ireland has to teach is that the faculty of agriculture in the Royal College of Science is part of a great organisation directly serving the interests of the agricultural industry, and not an independent institution pursuing knowledge for its own sake, or educating students without certainty of their profitable employment.

Engineering.

The evidence from the engineering colleges and institutions is also, on the whole, satisfactory. Here and there may be found somewhat doleful notes to the effect that the large majority of State departments and local authorities do not lay themselves out to take advantage of technically trained men, and in one case a view that has much popular currency has been put to me in fairly strong terms. It is to the effect that employers, especially those who have not very large and important undertakings, but who, nevertheless, would have their businesses improved by securing technically trained men, have an ignorant prejudice against such assistance. It is suggested as the possible explanation of their attitude that the employers fear that if they engaged men of greater attainments than themselves, they would simply be raising up possible opponents in their own line of business. There may be much truth in this view, which does not, of course, apply to first-class firms. But there is, I think, another worth full consideration: that the size of the business concern (the amount of capital sunk in it) has much to do with the employer's attitude. The employer does not possess the faith that will enable him to risk the addition of another salary to his working expenses; and no one, without a fair trial, is able to give him the mathematical demonstration which he seeks that the salary might often be saved merely out of the waste of materials which exists owing to the absence of scientific knowledge on the part of his men of the materials they are handling, and to their having to feel their way by experiments that are more in the nature of guesses. Such firms will be converted only by the example of others.

There is abundant evidence, however, that there is much less prejudice than formerly; that there is a growing tendency on the part of State and municipal authorities to secure for their services engineers who have received the highest training; and that this attitude is especially true of certain industries, the success of which depends absolutely upon highly competent, trained scientific experts, as,

for example, the steel industry. I suggest that the growth of this attitude corresponds generally in time with increased recognition on the part of the teaching institutions that engineers cannot be wholly made at college. The colleges have at length realised that the student must from the first learn the limitations of practical engineering, and that this can be done by the introduction of a practical atmosphere, and without sacrificing any of the physical principles of engineering already well taught at the colleges.

One of our ancient universities says, "We have not now much reason to be dissatisfied with the attitude of employers towards our (engineering) students." Several of the largest of the technical institutions say they have no difficulty in placing their best students, and one university college states that there is a standing demand as soon as the college year ends, from several of the heads of engineering establishments within the neighbourhood of the college for the best students. But these heads of firms demand the "best," and are willing to pay a living wage right off to youths who have never before been in works, and have only their college training as qualification. It is added that second- or third-rate men are in very little demand, and there is often a difficulty in not being able to recommend youths of sufficiently high standard to fill vacant posts. This case recalls other colleges where students (the "best," at all events) have no difficulty in securing places owing to the personal connection established between the heads of the neighbouring works and the head of the engineering department.

The return issued by the Appointments Board of the University of Cambridge in February of this year is specially interesting. This return shows that the number of candidates for the mechanical sciences tripos whose names appeared in the honours lists of the years 1894 to 1906 inclusive was 252, that the Board obtained information as to the posts held by 176 of these men; of the 176, only 23 were engaged in teaching, while 122 were engaged as engineers in some manufacturing or commercial concern or in the public service at home or abroad. The return is the more satisfactory in that 133 of the names belong to the years 1902 to 1906, and in that most of the men have to spend at least two years as probationers of some form in works before they can secure a definitive appointment of any kind.

It has been pointed out to me, both by professors and the heads of large engineering firms, that there is still a defect in the college training of young engineers which ought to be immediately remedied. The view is so well presented by one of the colleges that I give it *in extenso*. "There are certain defects in the average college training. I consider that the question of cost in design, and the commercial side generally, receive quite inadequate attention in most colleges. Practically all engineering firms exist for making profit. Modern competition makes economic design, good efficiency, and cheap upkeep absolutely imperative. The employer wants men who can in their designs give the most for the money. It is therefore insufficient to teach design on physical principles alone. Methods of production, ease of repair, depreciation, even conditions of transit in large machines, all these and more must be considered in effective design. Such limitations as these should, I think, be brought before the student in greater measure than they are attempted at present. This will tend to 'practicalise' the student while his mind is still formative."

Chemistry.

The case of chemistry is more difficult. There is, unfortunately, no room for doubt that the British chemical industry has suffered largely by foreign—chiefly German—competition; and possibly no section of British manufacturers has been so severely lectured as those in whose processes applied chemistry was capable of playing a large part. The chemical manufacturers were told to follow their German rivals by enlisting the assistance of the chemist trained in the scientific laboratories at our leading institutions, and that the industrial face of Great Britain would be changed. The manufacturer did not apparently grasp the meaning of the arguments or the appeal: he may possibly have comforted himself with the feeling that as things had been, so would they be; he may even have looked at the works that needed reconstruction,

at the state of the Patent Laws, at the character of the supplies of raw material, at labour, at capital, at agents, markets and means of transport, and may have come to the conclusion that the professorial lecturers understood none of these things; he may have chosen a chemist from an analyst's office or from a medical school, and have failed to discover that chemists were of any value. Whatever he did, and for whatever reason he did it, it has been stated in the papers before me that he did not give much heed to the scolding from the professorial chairs: he could not be persuaded that scientific education was essential to his business. And so in time the penalty had to be paid, and that, unfortunately, by many who had no choice in the matter. Perhaps, after all, the chemical manufacturer merited less odium than has been heaped on him. It is a human quality to believe in your fortifications until they are reduced to ruins at your feet. It may be true, also, that the chemical manufacturer was not tactfully wooed; and it certainly is true that under the name of chemist enough rubbish was supplied to him to break down his faith in the panacea. Twenty years ago the research chemist qualified for industrial work could scarcely be obtained from English laboratories. He had to be imported from Germany. The English schools turned out only analytical machines. The influence of a few well-known chemists and of the 1851 research scholarships has changed all this, but the manufacturer has not yet recovered from his early disappointment.

It is gratifying to find evidence of change. The public may not yet believe that "scientific activity is the real and solid basis of national prosperity," and all manufacturers may not yet be fully prepared to endorse the view that "industrial development is ultimately dependent on scientific development," or everywhere to demand chemists trained in *research* writ large, but they are learning or receiving lessons sometimes in ways not altogether creditable to British intelligence. One of our most distinguished chemists, and a man of large experience inside and outside of the college laboratory, says:—"I am very clearly of opinion that, with very few exceptions, the State and municipal authorities do not lay themselves out to take advantage of men from twenty to twenty-two years of age who have received the highest technical training as chemists. Municipal authorities require the services of men who have had a specialised training as chemical experts in connection with the working of the Food and Drugs Acts, and there is a tendency on their part to prefer the services of men who are willing to take underpaid positions. This does not conduce to the efficiency of the working of the Food and Drugs Acts, and the general community suffers in consequence of the lax administration of these Acts. Municipal authorities occasionally require the services of engineers and chemists in connection with municipal undertakings, as in gas and water supplies. As regards the chemists they employ in connection with such undertakings, I think, on the whole, the community is adequately served; the chemists employed, for example, in the manufacture of gas are, as a rule, well trained and competent to discharge their duties. As regards private employers, I am of the opinion that British manufacturers, as a body, are not yet fully sensible of the advantage which they might obtain by the employment of skilled chemists in manufactures in which chemistry plays a prominent part. There are, however, exceptions. Some of the best equipped works of this country—usually wealthy concerns—strive to keep in the forefront of industrial progress. We have in this country an increasing number of men of foreign extraction who are engaging in chemical manufacture, and it is significant to note that such employers are far more prone to enlist the services of expert chemists than are the rank and file of our own manufacturers. I think this is due to the circumstance that the advantages of a university training have come home to these people more directly than to our manufacturers, and they are more quick to perceive the material advantages of the application of the highest training in pure and applied science to their industries. I could give a number of illustrations of this fact by pointing to the existence of foreign firms who have secured for themselves in this country a pre-eminent position."

The statement as to the increasing number of men of

foreign extraction engaging in chemical manufacture in England who are far more prone to enlist the services of expert chemists than are the rank and file of our own manufacturers points a lesson which is well illustrated from two other quarters. The secretary of the Cambridge Appointments Board says (*Empire Review*, January, 1905):—"A feature of the lists of matriculations (at Cambridge) for the years 1880-95 is the recurrence of German names, with the note, 'Now assisting his father in business.' From this it would appear that the representatives, naturalised in England, of the nation which has, more than any other, astonished the world by its industrial progress, have deliberately chosen for their sons a University career as a preliminary to business life."

The other illustration comes from British business life. Only one letter from a British manufacturer emphasises the need of research, and that is signed by a chemical manufacturer with a German name. As to evidence of change, one of the largest technical institutions says:—"We are fairly sure of placing at once all the best men who have taken a graduating course in any branch of applied chemistry." Another technical institution—probably the largest—states:—"We have been unable, during the last three or four years, to meet all the demands upon us for trained chemists, and at this moment we are unable to make nomination to two or three most important posts for which trained chemists are required because all our men are satisfactorily placed." From one of our oldest universities comes the statement:—"There is no difficulty in placing chemists of the highest rank in first-rate technical posts. By highest rank I mean people with approximately fellowship standing and great originality." Sir William Ramsay writes:—"Some months ago I had the curiosity to pick out from my class-lists, back to about 1890, one hundred names of men (and women) whose subsequent history I know. The result was, roughly: 60 in industry (analysts, private or in works, managers, proprietors of works, &c.); 25 in teaching posts (assistants in universities or university colleges, schoolmasters and a few professors—about 6); and 15 given up (married women, men who have changed their profession or dead)." The most gratifying fact about this analysis is that it suggests that 60 per cent. of Sir William Ramsay's students are pursuing industrial chemistry for a living.

An examination of the after-careers of the 1851 exhibitioners reveals the following results. It will be remembered that science scholarships are awarded annually by the Commissioners of the 1851 Exhibition. The scholarships are awarded for research in the experimental and observational sciences bearing upon industries. The nomination of scholarship holders is made by the authorities of twenty universities and university colleges within the British Empire, and, with rare exceptions, these nominations are confirmed by the Commissioners. The scholarships are of the annual value of 150*l.* a year, and are ordinarily tenable for two years. Between 1891 and 1906 there were awarded 262 scholarships. Of the holders, 145 are now engaged as professors, assistant professors, lecturers, or assistants in science colleges or other educational institutions; 76 hold positions in manufacturing firms or in public departments, and the remainder may be conveniently classified thus: scholars recently retired, 6; continuing research in private capacity, 12; engaged in professional pursuits, 10; deceased, 6; occupations unknown, 3; no longer engaged in scientific work, 4, of whom 3 are ladies. I find on further analysis that, of 112 scholars whose branch of science was chemistry, 50 are, or have been, engaged in industrial chemistry.

I am not able to provide more statistical details. As a rule, universities, university colleges, and technical institutions have not kept records of the after-careers of their students, and until quite recently most of the universities (and some not yet) have not had any organised means of giving assistance to students who may be seeking posts at the end of their college career.

Looking at the matter quite broadly, I see no reason for believing that the number of highly trained chemists who find their way from colleges into industrial chemistry is anything else than insignificant, compared with similar figures for Germany or the United States of America.

The following facts may aid in understanding the conclusion of "insignificant" which I have reached. In 1904 and 1905 an average of 400 chemists received the doctor's diploma or the technical high school diploma in Germany; with the materials at my disposal I have been unable to convince myself that there were in 1908 300 students of all faculties of applied science taking a fourth-year day course in British universities and technical colleges.

For some of these results our system of degree-giving is denounced in no measured terms. An able university professor says:—"The fact is, the whole thing—university teaching of chemistry—is turned upside down. Much of our university work is simply good secondary work. A pass B.Sc. degree, for example, is about the standard of a school-leaving certificate in a civilised country. Universities lay down syllabuses, time-tables, hours of work, and spend a large proportion of their energies in examination grinding. They teach for examinations instead of teaching for the diffusion and advancement of scientific knowledge. When a man arrives at a university he has a 'curriculum,' in other words, simply a glorified school syllabus, laid out for him, and is promised a degree in three years if he is a good boy. They do not do that in Germany. We are not," he continues, "really quite so bad in this country as regards our so-called 'honours' degrees, but the centre of gravity is wrong for all that. . . . The centre of gravity of the English system is still in the examination hall, even though a good man does stay on for several years of research afterwards." Others, who have clearly devoted themselves to a study of the matter, demand a five years' course for the making of a chemist, three for degree and two for research.

One of the most thoughtful memoranda sent to me by a university professor shows:—"On entering the research laboratory the graduates are rarely independent thinkers, and their knowledge is essentially 'book knowledge.' When freed from the necessity to attend lectures or to work for examinations they seem to pass through a stage when they actually have to struggle to develop their resources, and often the students with the best degrees make the poorest research workers. . . . Again, the business faculties of the students at this stage are poor, and their knowledge of modern languages as applied to scientific or commercial work is quite inadequate. These are deficiencies which I have to make good in the research department. . . . Students at this stage are not qualified to take up positions of responsibility. The graduate of twenty-two has, however, many latent possibilities which may be successfully developed by a course of research work." The time spent by the graduates in research work in the university laboratory is from two to three years, and the average age of the students on leaving is twenty-four to twenty-five. "Taking an average case," the professor continues, "I can say that at the end of the first year the research student has commenced to think for himself, to anticipate difficulties, and to overcome them when encountered. He begins by suggesting new working methods, and finally proposes new topics of research. He has a working knowledge of scientific and technical French and German, knows the original literature of his special topic, and is generally conversant with modern research thought. His business style has also improved greatly. A considerable advance in these respects takes place during the next year, and in most cases a two years' course is sufficient to produce a man who has had a good education and who knows how to use it. It is my experience that when students with this training enter technical work they master the literature of their new subject very quickly and effectively. They seem to be able in a short time to form an estimate of the present position and future possibilities of the new subject and to bring their speculative faculties into play. I therefore regard the time spent at research as a necessary part of scientific training if university graduates are to enter the field of technical work, and men thus equipped make most valuable officials, even taking into account the fact that they have no previous experience in the supervision of workmen, and have generally no knowledge of chemical engineering." But the British parent does not care to afford to keep his sons at the university until they are

twenty-four to twenty-five years of age, especially as a period of probation has afterwards to be served in works, unless he sees that his money is going to be a good investment. And so we come back again to the manufacturer.

Other Subjects.

As to many of the other subjects in which the universities and higher technical institutions touch industry and commerce—architecture, biology, economics, and modern languages—there is little to be said on the side of the institutions. Biology is comparatively an unploughed field; the opportunities for economics are not yet fully developed. Railways, banks, insurance companies, and great business houses might, say the colleges, pay more attention to the really able economist. At the School of Economics a course of lectures in administrative subjects was arranged in the autumn of 1906 in order to equip officers for the higher appointments on the administrative staff of the Army and for the change of departmental services. This course is now annually attended by thirty officers selected for the purpose by the War Office. In order to provide the teaching required by candidates for the degree of B.Sc. in the faculty of economics and political science with honours in transport, the department of the school dealing with this subject has been developed. The lectures in this department, besides being open to students in the faculty, are attended by some 300 students engaged in railway administration. These students are drawn mainly from the staffs of the following railway companies:—the Great Western, the Great Eastern, the Great Northern, the London and South-Western, the Great Central, and the Metropolitan, their fees being in many cases paid for them by their companies. The lectures are also attended by members of the staffs of the other London railways, and occasionally by officials of Indian, colonial, and foreign railways, and other persons.

As for modern languages, it is alleged by the teaching institutions that the fundamental business attitude of England is entirely wrong. It will be seen later that this last view is amply confirmed from important and well-informed sources.

One further point of view of the colleges. Personality is by far the greatest factor; no amount of training can produce an exceptional man out of a man whose initial natural qualities are only second class.

VIEWS OF INDUSTRIAL AND COMMERCIAL FIRMS.

Answers to my inquiries have been received from a considerable number of large shipowners, from a few large shipbuilders, from nearly all the great railway companies, from a good many banking and insurance companies, from manufacturers of all kinds, and from employers' federations representing very large interests.

Elementary School Training.

Almost all explain their preference for elementary-school boys in such a way as to pay a well-deserved compliment, directly to the adaptability of the elementary-school boy, and indirectly to the existing system of elementary education. A good many speak in high terms of the value of evening schools, including technical institutes and schools of art. Banks and insurance companies almost invariably (but other firms as well) seek for the secondary-school product. There is some call for the man trained at the highest institutions, but this call is so much confined to firms the works or business of which require technical skill, that it is fully evident that the others do not yet feel the need for such men, nor know how to use them. There appears, also, with some frequency, the traditional fling at the public schools and at the universities.

Catch the boy as he leaves the elementary school, and induce him to attend evening classes; add to that the training of the workshop or the business house, and you have the fairly common plan of training those who will rise above the rank of "hands." From the best of these come the foremen; from those in turn the sub-managers are selected, and so on. It is interesting to see, however, that the possibility of a change is not unforeseen. "It happens," says one of our greatest industrial leaders, "that at the present moment all the men who fill the

positions of responsibility in our office come from elementary schools. Naturally, they belong to a period when secondary schools were not so accessible as now, and probably the same remark may not be applicable to their successors."

There is much dissatisfaction with the existing system in those trades or industries in which apprenticeship was once common. "Time off" is occasionally allowed to attend day technical classes. But there is evidence that such a plan of training would not be generally acceptable, and I am told by one representative of a large set of interests that "the whole question of the method of teaching boys their trade in and on the works, seems in need of reform, . . . it is hardly possible for anything to be done in this way except by some compulsory scheme affecting all employers"; and by a representative of another vast set of interests that "As a matter of fact, the whole question of technical education is so unavoidably mixed up with the apprenticeship question in such a form as to make it impossible to deal with one without the other. Furthermore, the apprenticeship question is so clouded by the conflicting interests of the various unions, the unsatisfactory state of the law as regards employers, and other difficulties, that nothing short of a far-reaching Parliamentary scheme is likely, so far as my experience goes, to materially alter the situation."

The markets call emphatically for the "practical" man. A view more sympathetic with higher education, and not altogether uncommon, may be stated thus:—A man with practical training alone can do much; a man with technical training alone can do little; a combination is, therefore, essential. If only one can be had, which would be regrettable, that must be the practical man.

While, as I have already said, employers generally express the highest appreciation of the value of evening schools, technical institutes, and schools of art, as supplementary to the workshop, the factory, and the office, there is a good sprinkling of severe criticism. It is alleged that the schools are not practical, and that teachers of art as well as of science display much ignorance of the manufacturing process and of the limitations imposed by materials, machinery, and generally of the conditions of work and organisation necessarily enforced in a commercial business. This is, of course, no new view. It has been expressed to me all over the three kingdoms, and I fear there is much truth in it. Part of the ignorance is due to the exclusiveness of the manufacturer, who dreads the theft of his secrets. But the impression left on the employers is partly the fault of the schools. It was one of the defects of the technical education movement that it was hasty and tumultuous. Schools were not graded. Teachers and institutes set up claims impossible of fulfilment, and the British public misunderstood. Hence the doing, unfortunately not yet ended, of much mischief, which has had to be repaired.

This is, perhaps, the best place to direct attention to one of the commonest features of the employers' views. They think that evening schools, technical institutes, and schools of art may help the individual pupil; it does not enter their minds that such schools may aid their industries.

I have devoted more attention to the elementary side of technical education than might, at first sight, appear necessary. My object has been to show what the employer thinks of what he comes most in contact with. His views in that respect may serve as a guide to the kind of appreciation he is likely to give to that of which he knows less.

Higher Education.

I am much disappointed to find that a works of a technical character and with a world-wide reputation, says, "The men technically trained up to 20-22 years of age employed by us are comparatively few in number, and are generally such as have had special introduction to us," and I am also much surprised to find a large and well-known firm of engine-makers saying, "We have never had any application from the universities." Another firm, the name of which is a household word, says, "There are no proper — schools" (naming an important and common article of commerce which forms the subject of large industrial works), "in this country such as are found on the Continent, so it would be difficult for us to get properly

trained men of 20 to 23 years of age straight from the university to fill the highest posts in our business." On the other hand, a professor of chemistry at a university, in which great stress is laid on the value of chemical research, says, "It is, perhaps, an index of the slender relationship between commercial chemistry and scientific work to state that although all the research done in my laboratory is in ———" (using exactly the same term as the firm), "I have never had a single inquiry for a chemist from a manufacturer producing or using these compounds." I hope to serve as a labour exchange between this laboratory and that factory.

There is, again, a common impression that the training in the universities and higher institutions is not sufficiently practical, and much fear is expressed that the university man would not care for the continuous and laborious routine of commercial life. A gigantic association in the north of England, with extensive business ramifications all over the world, and at the works of which considerable chemical knowledge and a general scientific training is necessary, says: For our works, the youths who come to us have had a public school or grammar school education of modern type. They are taken from school and sent to the works for twelve months, after which, if they show ability, it is arranged that they should take a three-years' day course at a technical school and obtain the degree of B.Sc. They then go to our own laboratory, and a training specially suitable to our requirements is given to them." They add, "Provided a youth appears to be energetic and not to have suffered materially from the defects often induced by such a course, we should upon the whole prefer a man who had been to a university. . . . For our best positions in the commercial departments we prefer boys of 18 or 19 from good public schools" (I think it is the Manchester Grammar School type which is in mind), "to those who are younger, and we are equally glad to have university men, provided they are energetic and fond of work. Our opinion of the usual result of a course at the university is that it is not calculated to induce this spirit. The length of the vacations, and the great freedom enjoyed by undergraduates, do not form a good preparation for the absolute tie, the long hours, and the very short holidays of a business life."

This particular view was written in the north of England. Whether true as a criticism of some phases of our university life and work, it represents too common a view to be omitted. It is not true of some of our largest technical institutions, and I cannot think that it is true of the younger universities. But it may serve to show these institutions what spade work they must undertake. Let me return to criticisms. A general manager of one of our great railway companies says, "We have in the past appointed a few university men, but it is not an experiment which we are repeating." On the other hand, the general manager of another large railway company says, "In my opinion, no man is fitted for the higher posts in the engineering world unless he has received a full university education, and it is a great advantage to a man in the industrial and commercial world if he has had, and has made proper use of, a university training." And again by another, "The university or other technical institute curriculum does not enter into our estimate of the fitness of the individual. It is certainly in favour of the lad who has enjoyed it, but it is, after all, only a means to an end, and unless it has been intelligently employed by the favoured student, the less fortunate lad with definite aim is not irremediably out of the running."

The head of a chemical manufacturing company, which employs university trained men, puts his views thus: "We invariably find that men who come to us with the highest technical qualifications, either from a technical institute or from the universities, require a considerable time before they are able to utilise their knowledge practically. An analyst, for example, will take some time before he recognises the fact that analyses must be done quickly and accurately, and that no mistake in analyses is permissible; with regard to experimental work, it is also some time before a university man can be got to distinguish between results which are likely to be of practical value and those of only theoretical interest. Some men acquire their experience very quickly, others very slowly or not at all."

One more quotation under this head. A consulting

engineer with a large practice, who employs twelve university or technical college trained men, in addition to a large technical staff of a lower grade, says, "I am a thorough believer in university and scientific training, but there is, no doubt, considerable difficulty in combining the university and practical training."

The general absence of replies of any importance from salesmen and merchants not manufacturers, may be taken as indication that the minds of business men of that type are not interested in the problems presented to them by my letters of inquiry. The opportunities for the propagandist commercial traveller and for the economist have still to be developed. But when the War Office and great railway companies make use of the School of Economics, other State and municipal departments and great corporations will, sooner or later, follow.

Finally, the industrial and commercial firms point out, as the colleges do, that other qualities than those which generally show in an academic career are necessary in the fields of commerce and industry. Those are the business or economic sense, alertness, capacity for work, loyalty to the firm's interests, push, perseverance, social qualities, including good manners towards clients, tact towards subordinates, and capacity to get the best out of them, and generally the power to control men and things. These qualities do not, as a rule, show early, and consequently firms should in their own interests make the basis of selection large and broad.

In concluding this section, let me say that many British manufacturers, especially those under younger management, are displaying their economic sense in a new and interesting direction. Firms manufacturing common commodities and employing thousands of hands have invited me to visit their works, and have shown me that not only do they employ scientifically trained engineers and chemists, but they employ public-school men as managers, they employ on their permanent staff doctors and dentists for the sake of their hands, they provide much for the social and economic welfare of their workers, and generally they show that they take as much interest in the human as in the other material which comes into their works; and they do this, not as philanthropists, but as business men. They find that in the interests of their business the human material, as much as the coal and the steel and the sugar and the flour, can respond with more efficiency to scientific and generally enlightened management.

WHAT THE CONSULS-GENERAL SAY.

It is impossible to ignore the unanimity of the story told by H.M. Consuls and the experience and earnestness and sense of responsibility of the men who tell it. The main question submitted to them was this:

It has been said from time to time that British firms (merchants, manufacturers, and so on) do not sufficiently apply scientific methods to the canvassing of the various markets of the world, and in particular that, as a rule, their travellers and agents do not know the language of those with whom they are dealing; that advertisements, prospectuses, and so on are published in English, with English weights, measures, and money terms; that British firms do not sufficiently study the needs of the markets; and that in general there is a want of activity and enterprise of the right kind. The answer is, "To a large extent, true." And this answer is so emphatic, so unanimous, and withal so moderately stated and so clearly expressed, that it is not possible to regard it as incredulous. The story is as follows.

Commercial Education.

British merchants and manufacturers (and British ship-owners) until about thirty years ago may be said to have had rather more than their share of the world's trade, and, comparatively speaking, made money so easily that they grew over-confident, relaxed their energies, and took little pains to improve their business methods as time went on and to learn from their competitors. It is only from about that time that they have begun gradually and slowly to realise—through the falling off of profits and through losing a share of the markets which they used to monopolise—that the traders and manufacturers of other countries, in particular those of Germany and of the

United States, have made up their minds to have, and have already succeeded in obtaining, a larger proportion of the world's trade than was previously left to them by Great Britain.

Our leading manufacturers are so strong, and their work of such excellence, that they can push themselves in any market; but it is not the same with other firms, and if these were to amalgamate they would acquire great strength. Cooperation is adopted in our shipping business with marked success, and should serve as an example for other industries.

The Britisher believes in competition and the survival of the fittest. The results, it is alleged, are a limited number of robust units and a mass of mediocrity which cannot resist foreign cooperation either in the home or foreign markets.

The great trouble is the lack of enterprise on the part of British firms in sending out travellers. Lamentation on this head is loud and frequent. Figures for two European countries are given to me. The first country is eminently suited for trade with England, more especially just now when the two countries have so much in common, and when "things English" are so much in vogue. The total number of commercial travellers' licences issued at "A" (the capital) during 1909 was 1203. During the same year 357 licences taken out at other towns were presented to the "A" police for visa. The 1203 licences were issued as follows:—to German commercial travellers, 605; to British, 142; to other nationalities, the remainder. Of the 357 the Germans had 146, the British 37; the remainder were distributed among various nationalities. The other country is also one which would also appear to be eminently suited for British trade. In the year 1908 (the figures for 1909 were not available) 7000 commercial travellers visited this country; 4700 were of German nationality, 1500 French, 61 represented Great Britain, the rest various.

In general, there is no complaint against the natural qualities of the British traveller; "a smart British business man accustomed to travel and deal with foreigners has no equal the wide world over, but, alas! there are too few of them." Another says:—"As regards the other qualities—push, activity, enterprise, and so on—they all seem to exist in such satisfying degrees in the British commercial man that if he direct his attention to rectifying the faults arising through this insular attitude, and the lack of commercial education which so narrows his outlook, the future would then look at least as hopeful as it does in any other country." A third maintains:—"There is no inherent quality in the Britisher which prevents his being able to compete successfully, not only in capturing new markets, but also in ousting his rivals who have been there before him. On the contrary, he possesses in as great a degree, if not in a greater, degree than any other nation just those qualities which eminently fit him for such work—endurance, perseverance, reliability (a very great adjunct), and concentration." And so on.

Until by scientific education the British realise that commerce means an intricate and complex organisation of intimately interconnected parts, they will lose many an opportunity, and their Consulates and Chambers of Commerce will be unable to do for them the work which could easily be done. Engineering, it is pointed out to me, is looked upon as a science, but commerce is not.

Metric Measures.

Failure to adopt the metric system places British manufacturers at a decided disadvantage. A French merchant, accustomed to one system of weights and measures, uniform and exact, resents receiving quotations from England in quantities which are absolutely mysterious to him. Circulars and price-lists, printed only in English with English weights, measures, and prices, are often sent to the Continent of Europe beautifully, even artistically, printed and illustrated; but they are of no practical use, as they are not understood by the persons for whose inspection they are intended. Only in cases where it is known that some member of the foreign firm is well acquainted with English, or has already dealt with English

firms, can any practical result be looked for by sending out English catalogues. Further, a good deal of delay and inconvenience is sometimes caused at the Custom House through the use of the English system of weights and measures, owing to the fact that all weights and measures have to be reduced to the metric system before the goods are cleared.

Foreigners will not buy goods simply because they are British. The man who wishes to sell and to increase the number of his clients must seek the goodwill and favour of the buyer, and not look to the buyer so much to accommodate himself to the ideas and business rules of the manufacturer. Enough stress cannot be laid on the vital importance of personal acquaintance with the country, the people, their customs, needs, weaknesses, likings, and prejudices; and also with the local methods of doing business—in short, with everything and anything that can and does affect the market.

In this connection I would like to recall what Lord Cromer said to Lord Reay's Committee on the Organisation of Oriental Studies in London: "It is quite possible for an Englishman to pass half his life in the East and never understand anything about Easterns."

Foreign Languages.

If the requirements, industrial and commercial, of any country are to be understood thoroughly, a knowledge of the language of that country is essential. One Consul says:—"I have seldom met a foreign traveller who does not speak one or two languages besides his own." Another says:—"I have very seldom, I might say almost never, met an English commercial traveller who knew a word of ——" (the language of the European country from which he writes). If I were at liberty to identify the individual, by naming the country, it would be seen that his statement, while appearing incredulous, would really appear to be highly credible. Another Consul says—others write to the same effect:—"Lastly, but perhaps first in importance, is the fact, which cannot be brought home too strongly to every young commercial man, viz. the absolute necessity of learning foreign languages. English, it is true, is spoken everywhere abroad, and although fresh business may possibly be secured in foreign countries by men who speak nothing but English, the circumstances are exceptional, and point to the fact that the goods are absolutely wanted and none others, and not to any special acumen on the part of the salesman. The majority of travellers, however, have goods to offer which are by no means unique, and in the sale of which they will have to compete very severely with rivals. The case of the man in this country (an extensive country, with large trade possibilities) who speaks nothing but English is too obvious to need any elaboration."

I will add but one further quotation:—"Until it is realised in the English system of education that modern languages are useful as means of communication between persons, and are not merely theoretical subjects in which a knowledge of grammatical rules results in the pupil being awarded a prize, they will probably continue to be handicapped." He adds, "I speak feelingly on this subject, as my own children have been able to converse comfortably in four or five languages, and after two or three years at a first-class school have since entirely forgotten how to use them, although two of the said languages are in their regular school course. I understand, for instance, that although when conversing they use the subjunctive mood naturally and correctly after certain conjunctions, they are unable to write out a list of all the conjunctions which govern the subjunctive, and consequently they are made to spend their time learning this and such-like rules instead of adding to their vocabulary as an infant does by daily practice."

The languages which these officers call upon the British traveller to learn are French, German, and Spanish. A knowledge of French will carry any commercial traveller through France, Belgium, Russia, Italy, and Switzerland, as well as through many parts of Germany. For Germany and Austria, German is necessary. Spanish is wanted for the Peninsula and the South American trade.

Let me repeat that the views set out above are not mine. They are those of His Majesty's Consuls at stations distributed over four continents.

THE PRESENT POSITION AND NEEDS.

I have now come to the last section of this paper. For fear of being misunderstood, let me say at once that I have no lack of respect for our ancient universities, and that any appearance of such in this paper is quite unintentional. It would, indeed, be difficult to exaggerate the share which our oldest universities have had in the formative life of this country, and the work of the past is still necessary. Universities must continue their detached work; they must pursue knowledge for its own sake or for the purely mental training it gives; they must continue to produce statesmen and churchmen and lawyers and doctors and schoolmasters, and they must educate the leisured classes. I would even go so far as to say that it is a national asset to have institutions setting the standard of efficiency and honour in national games. But the modern world needs something more, especially from the departments of applied science. The sympathy and support which these departments have received from the public have, to a large extent, been based on the belief that they would contribute to the success of national industry and commerce. The same holds true of the large technical institutions with day departments for young manhood. There is a public need, and in some cases a public demand. It is our object to increase the demand.

I have no magician's wand to offer as a means of revolutionising public opinion, and I should like to make clear that I have no thought of advocating mere imitation of German methods, which would be extremely foolish, if not disastrous. The industrial and commercial conditions and the character and traditions of the people of Britain and Germany are dissimilar. Again, the German universities endeavour to send out men ready to take their place immediately, not in the ranks, but as officers in the industrial and commercial armies. Further, the British system of education is so different that not to give heed to what exists would certainly court failure. Many useful lessons may, however, be gathered from a study of German methods; but possibly our most useful lessons are to be gathered from America, where the character of the people is more like our own, and where it is clearly realised that whatever training of the highest kind a man may have, he must still begin in the ranks and climb his way to the top. It has been said that British character and methods produce a few brilliant units and a mass of mediocrities. The surest road to success would probably be for the mass of mediocrities to adopt the methods of the brilliant units.

The normal attitude of the employers, if not of the public, may be expressed in three sentences:—(1) Only those value higher education who have felt the need for it. (2) The purely practical man can do much, the purely theoretical man can do little; a combination is therefore necessary. Should one quality only be obtainable, which would be regrettable, that quality should be the purely practical. (3) Teaching institutions may assist individuals to get on; they form no essential part of our industrial or commercial system.

For these three sentiments I suggest that we are all anxious to substitute three others:—(1) Setting aside exceptions, every man who achieves success must give so much time to fit himself for his work, whether the time is given in college under guidance and discipline or is expended in self-education. (2) In the end, and again getting aside exceptions, the man who has received the highest training in college under guidance and discipline will, other things being equal, achieve by far the greatest success. (3) The work of research and training carried on in technical school and university college is an integral part of any nation's successful industrial and commercial organisation.

Organisation and Management.

How is the substitution to be accomplished? The demand of the shareholders of an industrial or commercial concern for dividends forms a great stimulus to intelli-

gence and activity on the part of the staff. Without such stimulus in a technical school or faculty of applied science there is a tendency for things to become comfortable. I suggest the following:—

(1) The management of all technical institutions and departments of applied science should be put on a business footing. The ordinary governing bodies, as a rule, serve for ordinary governing purposes. The chief need is that of consultative committees attached to all specialised faculties or departments, such committees to be advisory and to be composed of industrial or commercial leaders or experts of the highest reputation. This is probably the best and surest means of enlisting the full sympathy of industrial and commercial leaders. The faculty or department, the curriculum and the examinations, would benefit by having its work and methods criticised sympathetically by experts of the first rank. Such a committee would form the surest medium of communication between the college and the workshop; and its formation would certainly be followed by a wide extension of the appreciation of the advantages of technical education, because the captains of industry would learn exactly the character of the work done in college and how in practice to utilise it.

The head of the teaching department and his staff would by this means gain easy access to factory and workshop, and bring back some of their atmosphere to the laboratory. On the examining committee of the engineering department of the Glasgow and West of Scotland Technical college are the engineering director of the Fairfield Shipbuilding and Engineering Co. and the engineering director of John Brown and Co., Clydebank Shipbuilding and Engineering Works. Such men would probably be generally recognised as the leaders in their particular profession on the Clyde. I understand that it is their practice to look in great detail through worked papers and designs, and to give the engineering department of the college the benefit of their criticisms. Employers, parents, and students cannot but have faith in the instruction given in an institution so aided. Let me make it quite clear that I am not advocating a mixed governing body, but an advisory committee of experts attached to each technical department. Governing bodies should consult such advisory committees before appointing the head of a department or even the principal of a college or technical institution. In the qualifications of principals and heads of departments it is customary to give too much consideration to academic status and too little to industrial experience and business capacity. Such a consultative body as I have referred to would act as a corrective in this respect.

(2) A connection should be maintained with old students and a record kept of their after-careers. One of the means of success of the American colleges is the list of after-careers of their students. It is almost incredible how little has been done in Britain in this respect. I hope parents and the public generally will develop a habit of asking for such a list.

(3) At each technical institution and university there should be an organisation to assist students in getting placed. The Blue-book recently issued by the Board of Education shows how much English universities have in the past neglected this aspect of their work, and how much there is still to be done to establish appointments committees or bureaus. I am not overlooking the fact that much excellent work has been done by individual professors and occasionally by the secretary or the principal. But this was unorganised. I am asking for an organisation. The manufacturer and the merchant have been denounced in no measured terms by representatives of learning for their short-sightedness in not applying scientific methods to manufacturing and business processes; could not the manufacturer and the business man retaliate that not only have university and technical college goods been of such various qualities that it was impossible to discriminate, but also that scientific principles—even common business empirical methods—have not been applied to the marketing of school and college products? It is a discredit to the universities and technical colleges that they have so long neglected this obvious means of assisting students, this obvious means of promoting the cause they proclaimed.

(4) A change in curriculum and in degree requirements. Let me read some remarks on American colleges which I wrote in 1904. "Again, there is, in each American institution, a considerable 'mortality' or shedding of students. Some students find their general preparation insufficient; some find the pace too great; others find their funds give out; and some are advised that they have made a bad selection. In such cases the American student accepts advice, and acts promptly. At every step a student's work is known, and the faculty—staff of professors in each department—every four months discuss fully a student's work. The middle of the third year is the critical point in a student's career. At this stage the requirements of the Institute of Technology demand a final decision as to choice of work. Fifteen men in one department were, at this point, recently advised to change their courses or to withdraw from the institute. I was informed that, as a rule, 25 per cent. of the civil engineering students drop off at the same stage. These numbers have to be added to those who have previously 'fallen by the way.' The greatest patience is extended to the students, and the best advice is offered to them; but in the interest of the individual, as of the standing of the institute and of its influence on industrial work, such shedding of students is regarded as inevitable, and is acquiesced in. It does not follow that the men are 'wasted.' As a rule they find employment of a lower character than they were aiming at; they change the directions of their careers, to their own great advantage, or they pursue a course of studies on the same lines at a secondary institution—a two-year course school."

It appears to me that such kind of advice and action is necessary in British teaching institutions, but it is hardly possible under existing conditions.

(5) Another means of bringing the college class-room and laboratory into closer connection with factory, workshop, and office would be more liberal provision of short, specialised courses suitable to the heads of firms or their successors. I am not referring to that provision of evening courses which is made in technical schools and schools of art, but to provision, whether day or evening, of advanced courses for industrial and commercial leaders or their successors in institutions which there could be no presumed loss of self-respect in attending. Such courses are provided at several colleges; they need multiplication. I know that a large number of able men obtain, at much expense, instruction through private agencies, because the best institutions do not appear to cater directly for their needs under suitable conditions.

(6) As to modern languages, three things are necessary for the majority of students:—(i) less the scholar's and more the utilitarian point of view; (ii) more concentration during the later school and college years; and (iii) speaking generally, a better class of teachers.

In conclusion, let me say that this preliminary study of a very large question has disclosed much hopefulness of the future. The obstacles which university and other highly trained men encounter in getting a footing in the industrial world are still formidable, and the breaking down of the barriers between our highest teaching institutions and commercial life forms a specially difficult task. But there is plenty of need for first-class men, and there is not much difficulty in getting the exceptionally good man placed. It is gratifying, too, to find that His Majesty's Consuls speak in the highest terms of the personal qualities of our foreign commercial travellers.

On the side of education, too, there is much hopefulness. A distinguished university writer not long ago stated that the object of university education "was not how to keep our trade, but how to keep our souls alive." Between such a representative of university education and the business man who inquires what is the money value of a degree there is little room for accommodation. But the writer did an injustice to the universities, and the facts as to the objects of university education are against him. It may be true that in the long view the keeping of our souls alive is the object of university education, but even the oldest of our universities are becoming conscious that the immediate condition of saving our souls alive is that of saving our trade.

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ROYAL SANITARY INSTITUTE.

THE twenty-fifth annual congress of the Royal Sanitary Institute, held at Brighton from September 5-10, was attended by upwards of 1200 members. To the address of the president, Sir John Cockburn, K.C.M.G., we have already referred (*NATURE*, September 8). Seeing that no fewer than sixty-three papers were printed *in extenso*, and many of them "taken as read" before discussion, it will be understood that it is impossible, within the limits of our space, to do more than glance at the general aspects of the work of the congress, endeavouring to indicate the drift of opinion on some of the more important questions which were raised. All problems relating to the health and physical well-being of the community are regarded as coming within the province of the Institute. In the Lecture to the Congress Dr. Arthur Newsholme set forth the now well-known statistics of diminishing birth-rate, and considered the arguments in favour of, and against, the present crusade against infant mortality. "Is it worth while to dilute our increase of population by 10 per cent. more of the most inferior kind?" The diminishing fertility-rate is as noticeable in the ranks of skilled artisans as it is in the ranks of the well-to-do. He concluded that it has not been proved that the inferiority of the offspring of the most fertile class, the unskilled, is due to inferiority of stock so much as to the unsatisfactory conditions into which they are born, and he strongly deprecated the attitude of that section of eugenicists whose pass-word is "Thou shalt not kill, but need'st not strive Officially to keep alive." The services of health visitors and the adoption of the Notification of Births Act are, the lecturer considered, the most hopeful agents and means whereby the death-rate of early life may be reduced.

The numerous papers and discussions we can but summarise under separate headings. *The Municipal Control of Tuberculosis*.—Compulsory notification of all cases was strongly advocated, and the removal of cases which cannot be nursed at home, without risk of spreading infection, to the empty wards of fever hospitals and small-pox hospitals; the risk of cross-infection being *nil* if suitable administrative measures be adopted. This system had its initiation in Brighton, so far as the use of hospitals is concerned, and its value has been thoroughly proved. Patients receive the educational treatment which gives them a practical understanding of the lives which, for the sake of other people, as well as for their own, they must henceforth lead. *Preventive Medicine in School Life*.—Much consideration was devoted to the work of the school medical officer, the administration of the Education Act of 1908 being, as everyone acknowledged, in a tentative and, in many respects, a very unsatisfactory phase. More financial support is needed. Inspection without school clinics is in many districts in which there is difficulty in obtaining treatment of very little use. The question of the periodical disinfection of school premises led to warnings regarding the danger of "sprinkling a little carbolic acid, and leaving the rest to Providence." There are, indeed, few subjects in which sanitary authorities themselves are more in need of education than in the use of disinfectants. Faulty drains are not reconstructed, nor are their dangers lessened by an antiseptic odour which allays the anxiety of the public. Several papers were read upon school planning, and opinion appeared to be universally in favour of the Derbyshire and Staffordshire type, which provides efficient cross-ventilation of every class-room. Cross-lighting must, however, be avoided as far as possible. Open-air schools on the lines of the Thackley (Bradford) school, in which each class-room has a verandah for fine weather, were commended. Rectangular class-rooms with more direct lighting and warming by the sun's rays are to be preferred to square rooms. Appliances for drying cloaks and shoes should be provided. The treatment of tuberculous children and of the pre-tubercular was brought forward by Dr. Broadbent, who strongly advocated teaching such children in the open air, and a modified curriculum. The X-ray treatment of ring-worm was approved; but the utmost caution is necessary at the present time, lest its unskillful application should throw it into disrepute. *Disease Carriers*.—Prob-