parison and collation of the results garnered in so many parts of the Empire.

(11) The council therefore proposes (*a*) that there should be established in London an Imperial Bureau of Anthropology; (*b*) that the bureau should be managed by a committee constituted of the Council of the Royal Anthropological Institute, and containing representatives of the Governments of the British Dominions, of the India and Colonial Offices, and of those Universities in Great Britain, in India and the Colonies and Dependencies of the Empire where anthropology is systematically studied.

(12) The council further proposes that in each of the British Dominions, in India and in the Crown Colonies, there should be established local committees on which the local university or universities and scientific associations should be represented: that these committees should maintain close touch with active workers, superintend the collection of anthropological data in accordance with the plans and methods formulated by the Central Committee and transmit them to the Imperial Bureau, where they would be collated, printed, and issued from time to time in suitable form.

(13) Too much cannot be said as to the importance from a scientific standpoint of such a scheme. The council thinks it is justified in urging that from the aspect of practical utility such a bureau would render most valuable service for many years to come to all who are engaged in the task of spreading civilisation, whether as servants of the Empire, as traders, or as missionaries and travellers.

(14) The council therefore asks for financial assistance to enable it to provide and equip the bureau with a well-trained and competent staff, and to publish as may be necessary the information collected by local committees with funds at their disposal, to enable them to employ trained investigators when desirable.

(15) The council estimates that for the first five years the cost of maintaining and equipping such a bureau would be

	Staff	Maintenance and Publication	Equipment	Total
	£	£	£	£
1st year ...	300	100	200	600
2nd year ...	300	150	50	500
3rd year ...	400	200	50	650
4th year ...	500	250	50	800
5th year ...	500	250	50	800

(16) The Council recognises the value and importance of the work which has already been accomplished by Government aid in Canada, Australia, India, in Southern Nigeria, Ceylon, and the Anglo-Egyptian Sudan, and desires very earnestly that this work should be carried on with greater continuity over a wider area in accordance with a uniform plan by standard methods of investigation which should be laid down by the Royal Anthropological Institute, the only scientific body which is entitled by its standing to speak with authority on such matters.

A. P. MAUDSLAY, *President.*
J. GRAY, *Hon. Treasurer.*
T. A. JOYCE, *Hon. Secretary.*
(*For the Council of the Royal Anthropological Institute.*)

TECHNICAL EDUCATION AND INDUSTRIES.[1]

THE widefelt need for drastic improvements in our systems of education makes the present period a critical one. We are on the verge of important changes which will probably be made by the Board of Education in its rules and regulations, and this naturally makes the present an anxious time to us as teachers. In addition, we are threatened with what may almost be called a revolt of the ratepayer, who is often far from realising fully the intimate relationship between industrial progress and technical education. Though this subject has been discussed almost *ad nauseam*, I propose to put before you some striking figures derived from the recently published Census of Production, of 1907.

The following tabular statement gives details of net output, number of salaried persons and wage-earners employed, and the net output per head of the nine leading industries already published in the summaries of the census, coal mining being omitted, as this is of a very different character from the other industries. The net output represents the value added to the raw material during the processes of manufacture. For purposes of comparison, I have added the percentages of salaried persons and wage-earners respectively in each industry. A glance at the table at once reveals the important fact that the net output per head broadly rises throughout with an increase of the percentage of salaried persons. Although this conclusion is derived from a comparison of different industries, we are probably safe in assuming that it will hold good in a similar way when applied to different branches of one and the same industry. This suggests that, within certain limits, the employment of a large number of skilled technologists will develop the industry into higher forms, which is accompanied by an increase of productivity. This must in course of time react on the prosperity of the country as a whole, and determine its position in the industrial struggle between the nations of the world.

SUMMARY FROM CENSUS OF PRODUCTION, 1907.

TRADE.	Net Annual Output.	Number of Persons Employed.			Percentage of Persons Employed.		Net Annual Output per head.
		Salaries.	Wages.	Total.	Salaries.	Wages.	
	£						
1. Engineering Factories (including Electric. Eng.)	49,425,000	33,384	416,924	455,561	7·3	92·7	108
2. Cotton Factories	46,941,000	12,391	560,478	572,869	2·2	97·8	82
3. Iron and Steel Factories (including Smelting, Foundry, Rolling)	30,948,000	14,064	248,161	262,225	5·4	94·6	118
4. Woollen and Worsted Factories	19,452,000	9,097	247,920	257,017	3·5	96·5	76
5. Shipbuilding Yards and Marine Engineering Works (Private Firms)	17,678,000	9,452	175,105	184,557	5·1	94·9	96
6. Railways (Construction, Repair, and Maintenance of Permanent Way, Plant and Rolling Stock.....	17,103,000	8,790	232,736	241,526	3·7	96·3	71
7. Bleaching, Dyeing, Printing, and Finishing Factories ...	10,369,000	6,154	96,457	102,611	6·0	94·0	101
8. Chemicals, Coal Tar Products, Drugs, and Perfumery Factories	9,464,000	5,981	45,107	51,008	11·7	88·3	185
9. Jute, Linen, and Hemp Factories	9,338,000	3,619	149,845	153,464	2·3	97·7	61
Average	—	—	—	—	4·5	95·5	93

Scientific Research in Industry.

Beaconsfield is credited with having once stated that the chemical trade of a country is a barometer of its prosperity, a statement for which we see there is some justifi-

[1] From the Presidential Address delivered before the Association of Teachers in Technical Institutions at the Southport Conference, June 5, by Mr. Barker North.

cation, considering that it heads the list in net output per head.

There are many problems that are awaiting solution, but these will only be solved by scientific methods applied by the technologist trained in research.

Although in 1907 we were employing, as compared with other English industries, a relatively high percentage of salaried persons in the chemical industries, a large proportion of whom would be technical chemists, it is when we inquire into the type of chemist employed that we find a remarkable difference from the practice adopted in Germany. In England, the work of our chemists is almost entirely of a more or less routine character, whereas the astounding number of research chemists employed forms a distinguishing feature of the German chemical industry. The suggestion recently made that we are incapable in this country of producing technological organic chemists, trained in research methods, is an absurd one; the fact is that the manufacturer, requiring an immediate turnover for his capital, does not, as a general rule, encourage the training of such men by demanding their assistance in the works. His policy, however, is a short-sighted one, as the following contrast of the chemical trades of England and Germany will show the valuable results accruing from the German method.

In 1907 the gross value of the output of the chemical trade in the United Kingdom was 23½ millions sterling, and of this amount a little more than one-third of a million represents the total value of the coal-tar dyestuffs. Germany in 1909 produced aniline colours alone equal to 15 millions sterling in value, approximately two-thirds of the whole of our chemical trade. The imports of coal-tar dyes into England in 1909 increased by 16 per cent., and in 1910 by 10 per cent. The irony of the whole situation is that we celebrated, a few years ago, the jubilee of Perkins's epoch-making discovery of the first aniline dye-stuff.

Ten years ago, practically all the indigo put on the market was of natural origin and supplied by British possessions, but certain German firms set out to capture the indigo market by the production of artificial indigo. In spite of the statement that the natural product possesses certain intrinsic valuable properties not possessed by the artificial variety, and despite the attempts of the English Government to bolster up the Indian indigo trade, in ten years the annual value of indigo imported into this country from India has fallen from a million sterling to less than 50,000*l*. Germany in 1909 exported to Asia alone, the home of the natural indigo, indigotin to the value of 1,900,000*l*. This again is now being followed up by the production of vat dyes, many of them products derived from artificial indigo. These colours being extremely fast, in many cases even to bleaching agents, may yet revolutionise our cotton-dyeing industry. We have not only lost our indigo trade, but in these developments our colour manufacturers are again allowing the German firms to forge ahead.

This forward movement is not confined to the colour trade alone, for the adoption of new processes of manufacture often reacts advantageously on older processes, creating an increasing demand for other products, notably in the heavy chemical trade. At one time Lancashire produced practically all the sulphuric acid of the world; some ten years ago about one million tons were said to be manufactured annually principally in this part of the country, whereas, according to the recent census, the total amount manufactured in the United Kingdom in 1907 was 473,000 tons. This is largely due to the commercial development in Germany and other countries of the "contact process" for the manufacture of sulphuric acid, the initiation of which is principally due to the demands created by the dyestuff industries. It is again interesting to note that the first patent for this process was taken out by Dr. Squires, an English chemist, though the process has been converted into a commercial success in other countries.

This is typical of the advancement and development which has been such a marked feature of the chemical trade of other countries. Examples might be multiplied to prove that in England we are engaged to a large extent in tinkering up the old processes of manufacture, whilst other countries avail themselves of new lines of thought and experiment. The great German industrial concerns, knowing the value of the scientific expert, will often wait for years for the final results of researches which they realise may ultimately revolutionise an industry, or may provide entirely new industries.

Germany has developed a scheme of practical education of the masses which will provide her industries with an army of well-trained workers, and at the same time she has developed to the highest pitch the scientific training of original technologists. It may be that we require more Dreadnoughts, but no number of battleships will prevent our being left far behind in the race of industrial progress if we continue to rest self-satisfied on the laurels of the past.

The more one inquires into the various suggestions that have been made for England's failure to take the lead in industrial developments, the more one is driven to the conclusion that lack of the spirit of organisation and system in both industrial and educational matters is the root of the evil.

In discussing reforms that are necessary in the work of our technical schools and universities, we have to recognise clearly that provision must be made for two distinct types of students, namely, (1) the rank and file of the industrial army; (2) the officers, who will have to organise and direct the work of the rank and file. The ideal principle which should govern the whole system is that the second type should be evolved from the first by means of natural selection. In the earlier years, the training of the two types may therefore be identical, and can be efficiently carried out by part-time instruction in technical schools, as far as possible in the daytime. With regard to higher technical work, this cannot be adequately dealt with in evening classes. We have a unique system of evening classes in this country, doing undoubtedly far better technical work than most people realise, but this system will have to be developed even further if we are to keep pace with the improvements which are bound to follow the increasing application of science to industry.

Higher technological instruction is at the present time given in some six or seven universities, a few university colleges, and many technical colleges and schools.

With respect to our day technical institutions, the following points may be urged in connection with the higher instruction given by them at present:—

(1) The students are too young at entry, and coming mostly direct from secondary schools at the age of fifteen or sixteen, during the first two years they are not old enough to appreciate the necessity for serious study, and have little sense of responsibility.

(2) The student when he has completed his three or four years' training is still without any practical experience such as is gained as an employee in a works. Through lack of this practical experience, he has often an inflated opinion of his own ability and immediate industrial value.

(3) It is only the occasional man who displays the ability requisite for the highest technological positions. Only a comparatively small percentage of those entering the day technical institutions finally display that initiative which is required in the trained technologist. The greater number are only suitable as routine men for second-rate positions, and would receive a more suitable training by entering works and attending evening classes. The explanation for this is that the day students are at present not being chosen by the process of natural selection.

(4) There are too many institutions at the present time all attempting the highest form of technical training in numerous branches, resulting under the existing conditions of selection and supply in small classes and in the unnecessary duplication of expensive equipment for the most advanced work.

(5) The small number of students in each institution does not justify the engagement of the numerous staff of specialists really necessary for the highest form of technological training.

All these defects will be remedied by drafting the most promising of evening students systematically into day courses, and by concentrating them for the highest class of work in specialised institutions, each of which could then afford the necessary elaborate equipment and specialist staff.