head, forequarters, barrel, and hindquarters. When either parent is of Aberdeen-Angus breed the offspring show the characteristic type of head and heavy, deep-fleshed forequarters. The body and hindquarters appear intermediate, but resemble most the dairy parents. From his results so far the author concludes that for the improvement of the beef qualities of dairy breeds the first-generation crosses show an increased value of the beef qualities in the forequarters without materially influencing the hindquarters.

(8) A few data are supplied as to the production of milk and butter-fat by some of the cross-breds. The results indicate that milk and fat production behave separately in inheritance. High milk production is dominant to low, but, unfortunately, a high fat percentage in the milk is recessive to a low fat percentage. The author supplies a useful bibliography and numerous illustrations.

SOME DEVELOPMENTS IN INDUSTRY DURING THE WAR.[1]

Mica.—The electrical industry has proved to be a great war industry. It is bound to become an even greater peace industry. Previous to the war Germany had established a predominant position in this industry, but this would not have been possible without the supplies of mica brought from India and other parts of the British Empire.

Mica is absolutely essential to the electrical industry, and the position of the British Empire in regard to mica supplies was, and is, far and away the strongest of any country in the world. India produces 50 per cent. of the world's supply of mica, and Canada 15 per cent. Germany within her own Empire obtained 10 per cent. of the world's supply, this being found in German East Africa. But, in spite of the overwhelming national advantages of our position at the outbreak of war, the mica market of the world was at the point of being transferred from London to Hamburg, thanks to the skill with which Germany had obtained a large measure of control of the Indian mines and the success with which she had captured the electrical industry. The Indian mica was either exported direct to Germany (she took 47,000 cwt. in 1913) or re-exported from this country to Germany, 50 per cent. of our total imports from India in that year being so re-exported.

The Indian mica can at present be exported to London only, and the mica in German East Africa is now being worked for, and obtained by, the Ministry of Munitions. Thanks to these measures, and to the necessities of war, the British electrical industry has taken the place previously held by Germany and Austria, and is now the first in the world.

The demands for mica for the electrical industry are bound to increase, and the expected developments of commercial aircraft, wireless telegraphy, and motor traction make it essential that the Empire's supplies of this vital raw material should be safeguarded. The electrical industry is bound to be of such importance to the future industrial development of this country that we cannot afford to take risks with the valuable raw material of mica, with which the Empire has been so bountifully endowed.

Tungsten.—Tungsten is essential to the manufacture of high-speed steel, and high-speed steel is a vital war material. Tungsten is also used in the manufacture of metallic filaments for electric lamps, in certain appliances for wireless and other electric uses, where to some extent it has taken the place of platinum, but its principal use is in the production of high-speed steel. Before the war the British Empire produced 40 per cent. of the wolfram-ore from which tungsten is made, but so successfully had Germany captured the trade that no British manufacturer was able to establish the industry in this country. Germany owed her great superiority in munitions production in the earlier stages of the war to the success with which she had captured the industry of tungsten production. All that has been changed. We are now able to produce all the high-speed steel needed for our own industries and to export at a reasonable price to our Allies. British manufacturers are now in a position to deal with all the British Empire production of ore, and could, if necessary, convert the whole world's output into tungsten metal or ferro-tungsten.

Ferro-chrome.—Ferro-chrome also is an essential material in the production of certain classes of steel. Alloyed with steel it acts as a toughener, and is used as chrome-steel for armour-piercing shells, in armour-plate, and for the wearing parts of aeroplane engines and gears in motor vehicles. For peace purposes it will be largely employed for such various purposes as motor parts, stainless cutlery, and rustless steel.

Before the war the United Kingdom production was practically negligible. We have now established at Newcastle-upon-Tyne a plant sufficient to meet our requirements for many years to come. Previously we imported our supplies from Norway, where it was produced by hydro-electric power. At Newcastle the power is obtained from the waste gases from coke-ovens, and the industry will be in the unique position of competing successfully with the cheap water-power of Scandinavia.

Spelter.—Spelter (or zinc, to give it its correct name) occupies the third place in point of importance amongst non-ferrous base metal. The world's consumption in 1913 was 1,012,000 tons, as compared with copper 1,044,000 tons and lead 1,196,000 tons. It is an essential material in industry in the making of a large number of domestic articles and in building construction. Its main uses are for galvanising or coating iron and steel to prevent rusting, and for mixing with other metals to form brass, gun-metals, and other alloys. It is also rolled into sheets for roofing and electrical purposes. The oxide of zinc forms, next to white lead, the most important pigment. It is an indispensable compound of manufactured rubber, and is extensively used for medicinal purposes.

The British Empire is fortunate in possessing in Australia practically unlimited supplies of zinc ore (concentrates), these being amongst the largest in the world. For reasons which it is not my present duty to examine, Germany obtained control of these important ore supplies. She imported from Australia a large portion of her supplies of zinc ore, and on these was able to extend her important zinc industries.

Our own position previous to the war was that we used annually 240,000 tons of spelter in various forms, of which 77 per cent. was imported—practically all from Germany, Belgium, and Holland—Germany being the largest exporter to this country sending us in 1913 1,500,000*l*. worth of spelter, besides smaller values of sheet-zinc, zinc oxide, and lithopone.

On the outbreak of war these supplies ceased, and we were faced at the same time with a tremendously increased demand for spelter to be used in the making of brass for fuses, cartridge-metal, and so on. Our immediate needs were principally met by imports from North America. The price bounded up from 23*l*. per ton to 120*l*. per ton. This figure led the U.S.A.

[1] From an address to the Industrial Reconstruction Council on Friday, November 29, 1918, by Mr. F. G. Kellaway, M.P., Parliamentary Secretary to the Ministry of Munitions.

smelters to erect new works, and by the middle of 1917 the price had come down to 50*l*.

The need for war purposes was thus met, but it was obviously dangerous to have to depend on outside sources to so great an extent for what was an essential material for war as well as for peace. The first step taken was to divert the stream of zinc concentrates which had flowed from Australia to Germany, and make them flow from Australia to this country. That has been done. These essential raw materials have been diverted—permanently, I believe—to this country. The raw material having been secured, steps were taken to increase the plant available for smelting the ore into metal and for the manufacture of zinc sheets, and the zinc smelters in this country were got together and arrangements made whereby their plants were doubled, and in some cases trebled. Unfortunately, before these extensions were completed the shipping position from Australia became so serious that all shipments of zinc ore from that quarter had to cease.

But that difficulty should soon disappear, and with the ore coming in freely, and labour and coal available for working the increased plants, the home production of spelter should reach 140,000 tons per annum, as against 32,000 tons before the war. The production of zinc oxide has also been encouraged, and on a war basis we are self-supporting, and there is no reason why we should not be self-supporting on a peace basis.

Potash.—Potash is essential for fertilisers and in certain industries, particularly dyes, drugs, and glass production. There are no known natural deposits in this country. Germany possesses large natural deposits, and we depended for our pre-war supplies of 30,000 tons per annum entirely on potash brought in from the Stassfurt mines. The war put an end to this source of supply, and it became necessary to find alternative sources. Investigation revealed the fact that 50,000 tons of potash were going to waste every year in the dust or fume from blast-furnace gases. The problem of collecting these dusts was a difficult one. The only known method was the Halberg-Beth system—a German invention. This was complicated, and required a large amount of steel and labour. The design has been modified to ensure greater trustworthiness, lower capital cost, and a small quantity of steel. Plants in hand and those in course of erection without these modifications should produce 18,000 tons of potash per annum. In addition, the Ministry has initiated an entirely new method of gas-cleaning for the collection of potash-bearing dust from blast-furnace gases. Two large-sized plants are being erected at two blast-furnace works which should produce about 1600 tons per annum. It is confidently hoped that, when these are working, similar plants will be extensively installed and a considerable increase in potash production obtained.

Magnetos.—Modern warfare, and a great part of modern transport and of modern industry, depend on the magneto. In the air it is an essential source of power and movement. The position of this country in 1914 in regard to the production of magnetos was very grave. Only one firm—Messrs. Thomson-Bennett Magnetos, Ltd., of Birmingham—was producing magnetos. Its output for 1913–14 was 1140 magnetos of a simple type. The Admiralty and the War Office endeavoured to meet our war requirements by importation, but by July, 1915, it had become evident that if we continued to depend on imported magnetos our war effort would be terribly hampered. The Admiralty then undertook to foster the supply of home-produced magnetos for all the fighting Services, and continued this work until it was taken over by the Ministry of Munitions in April, 1917.

The problems to be overcome were many and difficult. Suitable magnets were not obtainable in the British Isles, or the necessary hard rubber insulating material, or fine copper-enamelled wire, or oiled silk or paper for insulation. For the best quality enamelled wire we have still to depend to some extent on the U.S.A., and for oiled silk on Japanese fabric. But the progress made in providing these four essential materials at home has been wonderful. If we are not yet entirely self-supporting, we soon should be.

Instead of one firm producing only 1140 magnetos in a year, as was the case in 1914, we now have some fourteen firms producing 128,637 magnetos in a year. The monthly output at the beginning of the war was 100, the output for October last 18,000, that being the largest figure yet reached. It is not only that we are producing in quantity, which makes us independent of outside sources; the quality of the British magneto is also the highest in the world. It is lighter in weight and more trustworthy in service than the Bosch magnetos manufactured before the war, or than the latest examples found in captured German aeroplanes.

Ignition Plugs.—The ignition plug ranks with the magneto in importance, and it presented similar difficulties. The pre-war output of this country was insignificant. There were three firms manufacturing, and their total output for all purposes during 1914 was not more than 5000. To-day five firms in the country are producing mica plugs, and their output for the year ending October 31 last was 2,148,726. The October output was 303,449, as compared with a monthly output of 420 in 1914. It is gratifying to be able to state that the French, Italian, and American Services endeavoured to obtain British plugs. But there is room for further improvement in the design of mica sparking plugs for aircraft work. I think we can safely rely on our manufacturers not to rest and be thankful, but to make the British plug not only the best in the world—it is that already—but the best that science and mechanical skill can make.

Glass Industry.—This country very nearly lost the war owing to the fact that it was almost entirely dependent on Germany and Austria for scientific and optical glass, and to the backwardness of our glass industry taken as a whole. There were a few refreshing exceptions—firms which had kept the flag flying—but generally it is true to say that we were dependent on Germany and Austria for supplies essential to success in war and for a wide range of peace purposes.

Optical and Scientific Instruments.—Prior to the war the optical and scientific instrument industry in this country was in a lamentable condition, the trade having practically degenerated into a collection of middlemen who mainly sold instruments completely manufactured in foreign countries or bought in foreign parts and assembled them in this country. All that has been swept away by the bitter necessities of war. Our output has increased at least twenty times, and we are now self-supporting. Our pre-war output of optical glass amounted to about 10 per cent. of our peace requirements, the balance coming principally as to 60 per cent. from Germany and Austria and 30 per cent. from France. Our output has developed to such an extent that it is now in excess of that which can be absorbed by this country even under the most favourable conditions in peace-time, and we must look to the development of foreign markets, which previously were the monopoly of Zeiss, of Jena, for disposing of the balance of our home-produced supplies.

Dial-sights.—It is a humiliating admission to have to make, but it is a fact that at the outbreak of war a considerable part of our artillery was equipped with gun-sights exclusively manufactured in Germany. The sight is known as Dial-sight No. 7, and was patented by C. P. Goerz, of Berlin, both in Germany and this country. At the outbreak of war the War Office had already approached the British manufacturers—Messrs. Ross, of Clapham Common, and Messrs. Beck, of Kentish Town—but the position as regards these sights was exceedingly serious when the Ministry of Munitions was formed. The total deliveries to October, 1915, were 1362; the total deliveries to date entirely from home manufacturers are 21,000. The two firms I have mentioned were recently producing 250 per week. The sight is a beautiful and delicate piece of work, and its production in such numbers, and in a perfection which Germany never exceeded, is a triumph for British skill. It is, at any rate, a comfort to know that we no longer have to depend on potential enemies for the sighting of our magnificent artillery.

Scientific Glassware.—This can be divided into furnace-made and lamp-blown. Almost without exception, the furnace-made scientific glassware used in this country was, prior to the war, obtained from Germany and Austria. As regards lamp-blown scientific glassware, there existed a few small firms capable of executing repairs and making a limited number of articles of special design. Beyond this our requirements were met by supplies which originated in Austria and Germany. To show the developments made during the war, it is sufficient to state that, starting at practically nothing, the turnover of the scientific glassware industry is now equal to more than 600,000*l.* per annum. Within a short period, by careful and judicious treatment, this country should be independent of outside supplies.

Illuminating Glassware.—Prior to the war the whole of the glasses for miners' safety-lamps and oil-lamp chimneys were obtained from abroad, mainly from Germany and Austria. Seventy-five per cent. of the glass bulbs, tubing, and rod for electric lamps also came from Germany and Austria. Our dependence on Germany and Austria for the glass for our miners' safety-lamps very nearly landed us in disaster. The position was so serious that the Home Office was forced to relax the very stringent conditions which up to that time had been insisted upon with regard to the quality and dimensions of glasses for miners' safety-lamps. It was a serious thing to do, but there was no alternative, as it was impossible to obtain supplies of the necessary quality. The Home Office came to the Ministry of Munitions for assistance, and, notwithstanding the extraordinary difficulties met with, we are now producing sufficient supplies of the right quality.

As regards oil-lamp chimneys, before the war practically none were made in this country. The position has been greatly improved, but there is room for further improvements.

Then take the position of glass used in the manufacture of electric lamps. Before the war our output of bulbs for this purpose was approximately twelve millions per annum, and three out of every four of the electric light bulbs in use in this country were imported, principally from Germany and Austria. We are now manufacturing sufficient to meet our essential needs.

Then we come to the glass for domestic use, bottles and jars used as containers for foodstuffs and for preserving. Our production in 1914 for vacuum fruit jars alone was 22,317 dozen. In 1918 it was 83,333 dozen. We are now quite self-supporting.

Much more remains to be done by the provision of more efficient works and furnaces, the installation of the most modern machinery the development of potash production, the training of labour, scientific research, and Government organisation.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Francis Maitland Balfour studentship for research in biology, value 200*l.* a year for three years, has again been awarded to Mr. F. A. Potts, fellow of Trinity Hall, who was elected to it in 1913.

A GIFT of 20,000*l.* to the University of Chicago for the erection of an administration building is announced in *Science* from Mr. Andrew MacLeish, vice-president of the board of trustees of the University.

WE learn from the *British Medical Journal* that the medical university at Peking now being erected by the Rockefeller Foundation at a cost of 1,200,000*l.* will be opened not later than next October. Another medical university will be built at Shanghai.

A COURSE of six public lectures on "Physiology and National Needs," arranged in conjunction with the Imperial Studies Committee of the University of London, will be delivered at King's College, Strand, W.C. The lectures will be given on Wednesdays at 5.30 p.m. The first lecture will be by Prof. W. D. Halliburton on February 5 on "Physiology and the Food Problem," and succeedings lecturers will be Dr. M. S. Pembrey, Prof. F. G. Hopkins, Prof. A. Harden, Prof. D. Noel Paton, and Prof. A. Dendy.

ON January 2 last the joint session of the Headmasters' Conference and the Incorporated Association of Headmasters passed a series of resolutions which, if carried into effect, will go far to improve the position of science teaching in our schools, especially in the public and the preparatory schools. One of these ran as follows:—"That mathematics and natural science should be necessary subjects in the entrance scholarship examinations of public schools, in the First School Examination, and in the examinations for entrance in the Navy and the Army, provided that good work in other subjects should compensate for comparative weakness in mathematics and natural science, and *vice versa*." Unfortunately, an incomplete version of this resolution was published in the Press, including our issue of January 9 (p. 379), the words "and *vice versa*" being omitted. We are glad to be able to remove the disappointment of those who read the inaccurate reports.

AT the general meeting of the Association of Science Teachers, held on January 6 at University College, London, Prof. F. W. Oliver opened the conference on "The Relations between the School and the University in Regard to Science Teaching." He pointed out that, as a consequence of the improvement in the science teaching of schools, the Intermediate Examination is becoming the standard for many of them, and that this results in a repetition of work at the university, as the colleges do not realise that students are better equipped than formerly. In order to bring about greater co-operation between the schools and universities the teachers in both should have opportunities for meeting for the exchange of views on methods, curricula, etc. Prof. Oliver also suggested that the universities should provide special courses for school teachers to enable them to keep abreast of the advances made in the various branches of science. Prof. Weiss (Manchester) referred to the difficulty of co-ordinating the higher work in schools with the first year's course at the university, and suggested that, instead of specialising in one or two branches, the schools should aim at a more level standard in the general science teaching. If the general level of the school work were raised, the university would be able to remodel the first year's