inventions of English-speaking people. The bicycle and the aeroplane were devised on the soil of Britain.

It was Faraday, they should be made to confess, who laid the basis of electromagnetics, and therefore the foundations of that amazing industrial application of electricity as a mode of motion. It was Davy who showed the elemental character of the alkaline metals —a discovery of the greatest moment. They must be made to realise that Boyle, Cavendish, Watt, Stephenson, Leslie, Hutton, and Lyell, as well as John Hunter, Jenner, Simpson, and Lister, were Britons who made discoveries of the first importance. They must be forced to confess the supreme character of the work of Napier, the Herschels, Adams, Clerk-Maxwell, and Kelvin. We, on our part, always acknowledge the indebtedness of science to such Germans as Mayer, Helmholtz, and Ehrlich; whereas our enemies systematically conceal their immense indebtedness for the enunciation of first principles to men of the English-speaking race.

In regard to the splendid contributions to science of every kind made by the Italians and the French, the representatives of those nations must draw up their own lists, and they will not be short ones. The names they must contain suggest cardinal discoveries in every field of natural knowledge. It would be tedious to revert to the Italian Renaissance, because the names of the men of that epoch have become well known to anyone who knows anything at all of the story of the progress of science.

Eustachius, Malpighius, Borelli, Spallanzani, Galvani, Volta, and Avogadro in Italy; Lavoisier, Laplace, Lagrange, Montgolfier, Cuvier, Lamarck, Claude Bernard, Chevreul, and Pasteur in France, are names writ large in letters of gold across the azure of the firmament of European science. Not one of the following is German: Vesalius, Van't Hoff, Arrhenius, Helmont, Boerhaave, Mendeléeff, the Curies, Metchnikoff, and Pavlov.

Are the Germans grateful to us for what we have done in science? Do they realise, when they use railroads and steamers, dynamos and telephones, that they are all of British origination? They realise nothing of the kind. Not only are they not grateful for the benefits conferred on them by British science, but they have entered into a conspiracy of silence with regard to them.

Let us never forget that it was a German professor of physics who deliberately declared that German aircraft must destroy the tombs of Newton and of Faraday. He also included the tomb of Shakespeare, which was highly inconsistent with the widespread academic delusion that our and the world's greatest poet was a German.

D. FRASER HARRIS.

Halifax, Nova Scotia, September 30.

The Spectrum of Hydrogen.

THE writer has examined the four-line spectrum of hydrogen as produced in Geissler tubes with a 1 mm. capillary by alternating current of 15 milliamperes without inductance or capacity. The light was analysed by a glass prism monochromator, and the intensities measured by a photo-electric cell of quartz containing rubidium in an atmosphere of helium. The cell was calibrated in absolute units by a carbon filament lamp the energy distribution of which in different wave-lengths is that of a grey body in the visible spectrum.

The energy ratios of H_α, H_β, H_γ, H_δ were found to remain constant when the pressure exceeded three or four millimetres of mercury. At lower pressures the relative intensities of the lines of shorter wave-lengths increased. The effect is visually obvious in water-vapour which suppresses the many-line spectrum; this spectrum masks the effect when pure dry hydrogen is used.

The results lead to the conclusions that the four-line spectrum is due to the recombination of a $+H$ ion with an electron; that the method of ionisation of the H atom has no effect on the distribution of intensities, but that the mean free path of the luminous atom and the nature of the atoms with which it collides give a sufficient explanation of the intensity changes observed.

According to Bohr's theory, the mean free path of a luminous hydrogen atom should be shorter as the emitted wave-length decreases. The distance travelled by the atom while luminous may be called the length of the luminous streak, and at high pressures this exceeds the mean free path of the luminous atom for all wave-lengths, so that a change in pressure affects all lines in the same proportion. As the pressure is lowered, however, the mean free path will eventually exceed the length of the luminous streak for H_α, while remaining less for H_β, and so the ratio $H_\beta \div H_\alpha$ may be expected to increase, as is actually observed. At still lower pressures the intensity ratios should approach a constant value when all the mean free paths are greater than the corresponding luminous streaks.

Observation of such ratios will give the relative energies in different wave-lengths emitted by the hydrogen atom when undisturbed by collisions, and experiments of this kind are in progress.

A full account of this work will be published shortly.

R. T. BEATTY.

Queen's University, Belfast, October 18.

Origin of the Word "Blizzard."

THERE have been a number of communications on the earliest use of the word "blizzard," but thus far there has been no suggestion as to its origin. At first sight perhaps it might seem unlikely that the name of some objectionable person was adopted to describe the extremely disagreeable features of the north-westerly snowstorm of the States. We have, however, "boycott" and other words added to our vocabulary with just as much justification as the old settlers in the West would have had for introducing "blizzard."

In Amersham churchyard there is a tomb (now collapsing into the grave) of the Blizard family (Otto Bajer), and to this day, at the neighbouring village of Chalfont St. Giles, there resides a Blizard family. We are here in the heart of the Penn country, the Home of America. It seems highly probable that one or more members of the Blizard family of Buckinghamshire emigrated with the earliest settlers, and it needs no great stretch of the imagination to realise how the name could have been adopted in the slightly altered form "blizzard." I offer the suggestion to the world-wide readers of NATURE.

HY. HARRIES.

Meteorological Office, South Kensington,
October 24.

"PREPAREDNESS": THE AMERICAN WAY.

THE problem of organising a nation for war has had to be faced and partially solved by this country during the act of war. The war has led the Americans to tackle the same problem, with the advantage that they are at peace and at leisure to study it scientifically, with all our mistakes and their own difficulties in the supply

of munitions before their eyes. It should be instructive to see what conclusions have been reached by a people with a genius for reducing everything to machinery, from the production of motor-cars to education.

The first step, in a democracy, was to bring home to every citizen the importance of the problem. Some of us may have smiled at the picture of the President of the United States, clad in a straw hat, a navy-blue jacket, and cream-coloured duck trousers, marching at the head of a great "Preparedness" procession, and waving a flag with the best of them. But Mr. Wilson knew what he was about. The Americans are incomparable advertisers. No other device could have so instantly focussed the attention of the whole mass of heterogeneous populations between the two coasts. This having been effected, the plan evolved by the Naval Consulting Board's Committee on "Preparedness" was set out in a series of articles written by leading Government officials and business experts, and introduced by an open letter from the President himself. Which of the great political journals was entrusted with this weighty national publication? The shocking truth cannot be concealed that it was not to the editor of anything analogous to our *Times* that the President wrote his letter with full confidence that it would reach the people. It was to the *Scientific American*—as it might be our own *Engineering*—and there the articles appeared during the late spring of the present year.

They start with what seems to them an axiom, though it is still so difficult for many of our fire-eaters to realise it: "The one great lesson of the European conflict is that defence is not obtained to-day by fighting *men* alone, but by fighting *industries*. Behind every man in the firing line in Europe, from three to five persons are employed to supply him with food, ammunition, and other needs." Their experience of the first year of the war convinced them that the people will never reach the right point of view till they realise "what a mess we have made of our attempts to supply munitions to the Allies." So an article is devoted to the initial difficulties. A large firm in the West is instanced, which cheerfully took on a contract for 250,000 3-in. high-explosive shells.

It seemed a simple and profitable job. But the firm soon realised that by turning their plant—a first-class machine shop—on to it they might hope to accomplish it in eight months, and then it would only be one day's supply for *one* of the Allies. But so many difficulties intervened that after eighteen months they had only 130,000 shells accepted, which still had to be fitted with fuses and loaded and put through other processes. None had yet reached the battlefield.

Before production can be started an enormous number of measuring tools and gauges must be provided. The three famous firms engaged in this manufacture—the Brown and Sharp, the Pratt and Whitney, and the Greenfield concerns—found, on comparing estimates, that to produce 200,000 shells a day, the amount under contract for the Allies, would require in gauges and measuring tools alone an investment of from seventeen to twenty million dollars. Many of the best-known firms in the U.S. had been at work a year on the provision of this preliminary outfit without turning out sufficient finished product to be worth inspection. They have "made up their minds that if they are ever to be called on for the service of the nation they have to learn a great deal more about this business of making munitions, or in the event of war they would prove to be liabilities to the nation and not assets."

The plan worked out by the Naval Consulting Board is then expounded. It involves three steps:—

The first step consists in the taking of a complete census of the producing resources of the country, to be tabulated on a card index. This is to include an inventory of industrial manufacturing establishments which, it is thought, will cover eighty thousand firms.

The index will show the ground area, floor space, number of stories, housing accommodation, and possibility of increase in emergency; sources of heat, light, water, power; tool equipment idle in slack season; limits of precision in machine work, principal materials used and where purchased, and principal products manufactured; number of men, skilled and unskilled, number of toolmakers, of women, and of men who could be replaced by women; percentage of employees who are not American citizens; means of transport, trucking distance, and quality of street service to shipping point, trucks owned and hired, and shipping facilities by water.

The census is to cover the resources of the country in minerals and materials, with special stress on petroleum supplies and the utilisation of water-powers. To prepare it President Wilson invoked the aid of the five great engineering societies—civil, mechanical, mining, electrical, and chemical. In every State a member of each of the five societies has given his services gratuitously to form a board of five directors for the State, and under the supervision of these boards the 30,000 members of the societies have been at work. The Chambers of Commerce have given their aid, private firms have provided offices and furniture free of cost, and the newspapers have given advertisements and articles to boom the movement. It was expected that the bulk of the work would be completed by the end of May, 1916.

The second stage of the plan will consist in placing small educational orders for munitions with large numbers of selected firms annually in time of peace.

It is felt that while the Government must have its own factories distributed throughout the country to act as educational centres and clearing-houses, they would in any important war have to rely on privately owned plants. Everything connected with these orders will be done exactly as it would be were the order a war order of one hundred times the magnitude. The work will be educational. The purchasing department of the company will learn where to buy materials; the manufacturing department how to handle them and make the necessary jigs and tools; the inspection de-

partment will become familiar with Governmental inspection; the engineering department with Government blue-prints and specifications; the firm with Governmental methods of business; and the shipping department will know how to crate and ship the finished article.

The terms on which these contracts are to be made are significant. They are to be on a basis of cost plus a reasonable profit, or at a fixed dividend. There are to be no excess profits for anybody arising out of the national need, but the stockholders are to have a living wage, "since it is economically undesirable that the stockholders cease to have any dividend from their investment"! In this way will be prevented any suggestion of a profit-interest in war, of a munition lobby, of a section of the community having an interest in forcing the nation into war. If there is a war every person in the nation must accept his share of the national sacrifice and turn in and work in whatever place his ability can be best applied.

The third and final step in the programme is the enrolment of skilled labour in an "Industrial Reserve" in time of peace. Skilled mechanics in all lines of production must be kept from enrolment in the Army. Rather must bankers, clerks, shopkeepers, and professional men be sent. The skilled workers must be badged, and the only restriction imposed on them by the badge will be prevention of enlistment. Enrolment in the Industrial Reserve will be considered to carry with it honours equal to enrolment in the fighting forces.

It is claimed that this plan is a most democratic and American way of doing the job. It is cheap; it lays the ghost of a munitions trust, with its dangerous interest in provoking war; it safeguards labour from exploitation for excess profits; it educates the manufacturers; and it is not only an insurance against war, but it has great advantages in peace.

Direct organisation for peaceful competition is dealt with in another series of articles. The survey of national resources and their conservation includes significantly "our 22,000,000 children." These must be trained, not only in the schools, but in the vital years between fourteen and eighteen, the waste of which has recently been pointed out by Mr. Galsworthy in the Press and Lord Haldane in the House of Lords. The methods of intensive industrial efficiency which were coming into notice before the war must be continued and developed.

Other articles deal with the disposal of the finished products—the careful preparation of the ground in foreign markets by personal inquiries; by correspondence with consular agencies, chambers of commerce, and universities; by improved methods of packing and dispatch; and by cultivating the "human side of salesmanship." Some of the devices described under this last head would not commend themselves to British ideas, and are not perhaps very seriously urged. There is a thoroughgoing materialism in some of the utterances quoted which we could not accept. "Real immorality," says Prof. Carver, of the Economics Department of Harvard University, in a paper on the Conservation of Human Energy, "is nothing in the world except waste or dissipation of human energy. Real morality is nothing in the world except the economy and utilisation of human energy. The reason why it is better to tell the truth than to lie is because a community in which truth prevails will waste less energy than a community where lying prevails. . . . Honesty is one of the greatest labour-saving inventions ever devised. This may be said of any other form of morality which is genuine and not merely conventional."

There are things in our British life which we should not sell for all the markets in the world. But the treasuring of these ideals is not inconsistent with sane preparation to meet the tremendous competition we shall have to encounter in the material sphere at the conclusion of the war. What this preparation should be, in the opinion of President Wilson, is indicated in the letter addressed by him to the editor of the *Scientific American*, directing attention to the articles which have since appeared in that journal. We think it worth quoting in full:—

> It will be a signal service to our country to arouse it to a knowledge of the great possibilities that are open to it in the markets of the world. The door of opportunity swings wide before us. Through it we may, if we will, enter into rich fields of endeavour and success. In order to do this we must show an effectiveness in industrial practice which measures up to our best standards. We must avail ourselves of all that *science* can tell us in aid of industry, and must use all that *education* can contribute to train the artisan in the principles and practice of his work. Our industries must be self-reliant and courageous, because based upon certain knowledge of their task, and because supported by the efforts of citizens in the mills. If scientific research and the educated worker go hand in hand with *broad vision in finance* and with that keen *self-criticism* which is the manufacturer's first duty to himself, the fields will be few indeed in which American commerce may not hold, if it chooses, a primary place.

The significant thing about this letter is that there is in it no allusion to Protection. The President is for open operations by an industry relying on its own efficiency, not for trench warfare behind tariffs. Science, education, broad vision in finance, self-criticism—that is the programme. A nation which has imagination, courage, and honesty enough to depend on these can look forward without fear to whatever the future may have in store for it. J. C.

RHODODENDRONS AND LIME.

IN a note in NATURE of February 17, 1916 (vol. xcvi., p. 684), reference was made to Mr. Forrest's discovery of rhododendrons growing on limestone rocks in N.W. Yunnan. In this connection Lady Wheeler-Cuffe, writing from Maymyo, Upper Burma, informs the Editor that she found "a beautiful blush-white rhododendron growing actually wedged into a bare limestone crag on the very summit of Sindaung (6022 ft.), in the southern Shan States, a few years ago." Mr.