towards which the upper end points. If, however, it is vertical, and near the zenith, there is great danger. If its altitude is, for example, a mile, a bomb dropped would occupy 18 seconds in falling, if there were no air. Owing to the resistance of the latter, this time is greatly increased. It is only necessary to run at right angles to the apparent direction of the Zeppelin to be safe, even if one does not start until the bomb is dropped. This rule may be tested by standing under a telephone wire, which may be regarded as representing the path of the Zeppelin. A plumb-line will cover the wire only if the observer is exactly under the wire. No allowance is here made for the wind, which always carries the Zeppelin to leeward. It may be better, therefore, to stand so that the Zeppelin is partially covered by the edge of a house, a flagpole, or other vertical line. There is no danger unless the Zeppelin appears to ascend the line, remaining partially covered as it approaches the zenith. The same principles apply to aeroplanes. At sea, the vessel should take a course at right angles to the direction from which the Zeppelin comes. Of course these methods are useless if the Zeppelin cannot be seen owing to clouds or darkness, unless it is picked up by a searchlight.

E. C. PICKERING.

April 10.

## *DAYLIGHT AND DARKNESS.*

THE House of Commons adopted on Monday a resolution moved by Sir Henry Norman: "That, in view especially of the economy in fuel and its transport, that would be effected by shortening the hours of artificial lighting, this House would welcome a measure for the advancement of clock time by one hour during the summer months of this year." The daylight saving scheme put forward by the late Mr. W. Willett in 1907 has, therefore, now been approved by Parliament, and it is proposed to effect the change of time during the night of Saturday–Sunday, May 20–21. The normal Greenwich time is to be restored during the night of Saturday–Sunday, September 30–October 1. In supporting the motion on behalf of the Government, the Home Secretary, Mr. Herbert Samuel, said it was thought that the change could be effected without legislation by Order in Council, "since this is only a war measure adopted for war purposes." On account, however, of the existence of an Act which defines "hour" in any statute as Greenwich mean time in Great Britain, and Dublin mean time in Ireland, and also because, in conformity with this Act, there are fixed the hours in factories and workshops in which women and children are employed, while a number of other establishments, including licensed houses, are compelled by law to keep certain times, the law must be altered in order that the new time should have legal validity. A Bill is, therefore, necessary, and it was introduced in the House of Commons on Tuesday. There is little doubt that the measure will pass, and that from May 21 to October 1 the legal time will be that of Mid-Europe instead of Greenwich mean time.

The time of sunrise in London on Sunday, May 21, is given in the calendars as 4.2, but by the clocks it will be 5.2; and similarly, though the sun will set at 7.50, we shall call the hour 8.50. The actual time of morning high-water at London Bridge will be 4.12, but the clocks on shore will indicate 5.12; and there will be a like difference between tidal times and public times all around the coast. It will be no longer possible to speak of, say, a two o'clock tide to a navigator at a port, for this must mean Greenwich time to him, as tidal tables have to remain unaltered, whereas his two o'clock will be the landsman's three o'clock. For a large part of the population there will be two legal times from May 21 to October 1, and we shall be surprised if this confusion does not lead to serious mistakes and accidents.

All orders referring to lighting-up times, closing of parks and other places at dusk, burglary as distinct from larceny, and like matters determined by solar time, will need adjustment; in fact, Parliament has now to define legal time afresh. Lighting-up times will, we suppose, continue to be based upon Greenwich times, with the necessary differences for latitude and longitude, for they obviously cannot be determined by the meridian of Mid-Europe. On May 21, for example, the lighting-up time in London is 8.50, and at Liverpool 9.11, but in all cases an hour will have to be added to give the clock times of lighting-up. Here, again, the double standard of time-reckoning—one in calendars and tables, and another in daily use—will be most confusing.

The claims as to the great saving of expenditure on fuel for illumination to be effected by the daylight saving measure are, we believe, largely over-stated. For two months from the end of this month there will be no need for artificial lighting until 9 p.m. or later in any part of the British Isles; and in such places as Newcastle and Glasgow the lighting-up times will be nearer 10 p.m. than 9 p.m. during most of this period. Men of science, like other citizens, recognise the cheapness of using daylight; what they object to is the alteration of clocks, instead of alteration of habits, to induce reasonable use of daylight hours. Whatever time is indicated by the clocks, most people will not retire until an hour or two after the sun has gone and they have used artificial illumination for indoor rest or recreation. Though the clocks will indicate 10.30 when daylight occupations must end during June and July, we doubt greatly whether there will be much reduction of the habitual interval between the close of the outdoor life and the time of retiring.

The daylight saving principle is, in fact, unnecessary for at least half the period during which it is to be in force; and over a large part of the British Isles the hours of actual darkness are then so few that the amount of artificial illumination used cannot be greatly reduced by advancing clocks by one hour. Mr. Willett arrived at the 154 additional hours of daylight which his scheme was to give the country by reckoning an extra hour for each of the 154 days from April 15 to September 15, and our legislators, journalists, and commercial men base their conclusions as to the saving of fuel and light upon this estimate, which they apply to the whole country. If we

omit from the estimate June and July, when the amount of artificial illumination required is very small, and there is no real night, the 154 hours are reduced to 93; and for one-third of this number of days artisans who commence work at 6 a.m. will be given nearly an hour's additional darkness. During the cold and dark morning hours of September we shall expect definite complaints from early workers as to the disadvantages of the scheme to them. If their times are changed to 7 a.m. instead of 6 a.m., they will have to leave an hour later, and the whole purpose of the measure will be defeated.

In a letter to Sir Henry Norman, stating that the Government intended to give facilities for the discussion of his motion on daylight saving, Mr. Herbert Samuel, the Home Secretary, said: "In the House of Commons all interests are represented, and the Government would desire to ascertain its opinion on this question." We submit that the House of Commons is not essentially more competent to discuss the question than it is that of the eccentricity of the earth's orbit or of the obliquity of the ecliptic by which differences in the lengths of days are caused. In the debate in the House on Monday, few points of scientific significance were mentioned, and the matter was considered almost entirely from the point of view of public convenience and the marvellous economy—the amount of which varied with a member's eloquence and calculations—to be effected. It is urged that the views of men of science on social legislation have no greater authority than those of the general public; but, on the other hand, we may be permitted to reply that members of the House of Commons, chambers of commerce, county and borough councils, and like corporations do not understand the scientific aspects of their social measure, and that they, as well as enthusiastic writers in the daily Press, are attracted by a specious plan without regard for its natural significance. By scientific aspects we do not mean the interests of men of science, but the natural conditions of daylight and darkness in different latitudes and longitudes of these islands, and the consequences of a double time-standard. There can be no true discussion of the daylight saving scheme unless this side of the subject is presented as well as the social and economic arguments; and in Monday's debate in the House of Commons, it was left out of account almost entirely.

The fact that Germany has introduced the daylight saving scheme, and has naturally been followed by Austria and Holland, is not a reason why we should adopt it, but the reverse. It is now announced that in Denmark, Sweden, and Norway the same plan is to become effective on May 15 and to extend to September 30, though what advantages the lands of the midnight sun can derive from a daylight saving scheme in summer months are difficult to discover. Germany probably decreed the change of time because we refused to do so, and for us to imitate her now is not complimentary to our national intelligence. The case is different with France, on account of our close relations with that country and because the French time-standard is that of the Greenwich meridian; but the committee of the French Senate appointed to examine the proposal of the Chamber of Deputies has not yet reported in favour of it, and the paper by M. Lallemand of which a summary was given in last week's NATURE adduces cogent reasons against it. As the adoption of Greenwich time by our Ally was a manifestation of the *entente cordiale*, it seems undesirable now to abandon this common standard and use German time unless France wishes to make the change with us.

Most of the foregoing points, with others, were mentioned in an article in NATURE of April 27 referred to by Mr. H. W. M. Willett in a letter which appears in our correspondence columns this week. The intention of the article was to state precisely some of the chief objections to the principle of daylight saving by seasonal changes of the national time-standard. Scientific men think that this standard, like others, should be invariable; advocates of the daylight saving scheme wish the standard to oscillate and to believe that 11 a.m. is noon for five months of the year. Agricultural, engineering, and building trades adapt their hours to the sun, and workers on tidal waters with the tides; but as the tendency of city life is towards lateness of rising and retiring, and as habits are difficult to alter, they are to be counteracted by putting forward the hands of timepieces by one hour during the summer months.

Whether the change may be justified on the grounds of social expediency is not a matter upon which men of science can express an authoritative opinion; but the natural objections and difficulties remain unaltered whatever legislative action is taken. To the fact that for a large part of the population of our islands the daylight saving principle is unnecessary, Mr. Willett's reply that they would not suffer is scarcely sufficient justification for the change. He offers no solution of the difficulties as regards the differences of times in calendars and tide-tables in comparison with the altered civil times, though in a maritime nation such as ours this is a most important point. As to artisans who have to be in the works at 6 a.m., and therefore to rise about 5 a.m., Mr. Willett will find that when longitude is considered, as well as the period of dawn, many thousands of workers will, throughout September, on account of having to rise at what is 4 a.m. Greenwich time, have to rise in the dark instead of in daylight as hitherto. If fuel and light saved in the evening are used in the morning, it is difficult to see how substantial economy can be gained in these cases.

A scientific journal is not concerned with the expediency of a measure, and the facts of Nature are, of course, not affected by social legislation. Whether men of science support or oppose the daylight saving scheme may be of little conse-

quence; but they are, at any rate, best able to understand its meaning, and to distinguish between promise and performance. It remains for the general public to arrive at the same state of knowledge by experience.

## GERMAN METALLURGY AND BRITISH METHODS.

MUCH attention has been devoted in the Press recently to the strong position of the German metallurgical industries, both before the war, and now after a year and three-quarters of stress. It is not too much to say that apart from this metallurgical industrial foundation, the war would have ended in three months. The growth of modern German metallurgy is due largely to two causes, and these are closely connected in origin and result. They are trade combinations, such as are represented by the "Stahlwerksverband," and scientific management and control. As we have said, these are closely associated, for apart from large undertakings, with regular output, there can be no large laboratories, with highly trained and reasonably remunerated scientific staffs. On the other hand, apart from scientific direction the success of large combinations, such as Krupp's, would be impossible. The tendency of the war appears to have been in the direction of unifying and standardising many of our metallurgical industries, and this tendency is likely to continue when peace is proclaimed.

At present, owing to the war, there is a considerable demand for metallurgists in this country, and more particularly for such as have had a few years' works experience in addition to college training. Hitherto, the supply of such men has roughly met the demand, but the number trained has been wholly inadequate to the real needs of the country. The crux of the question is the want of recognition on the part of manufacturers of the value of scientific knowledge in their businesses. Three results may be expected from the work of a properly trained metallurgist, namely, greater uniformity, economy, and originality. But the system adopted in many British establishments, and particularly in those of moderate size, will never yield satisfactory results. A young man straight from college is appointed at a salary of perhaps 120*l.* per annum, placed in a small, ill-ventilated room, supplied with the minimum of apparatus, and kept on routine analyses. No prospect is held out to him of regular advancement, or of profit sharing. He sees office boys, who have had nothing spent on their education, promoted to be secretaries and general managers, because they come into personal contact with the directors; while he remains unseen and unknown to the powers that be.

Some public-school boys and university trained men are, from weakness of character, unfit for positions of responsibility. But the great majority of them are of a different type, and form the very best of our young manhood, as we see in other directions alike in peace and war. The position of the scientifically trained man in our metal works is very unsatisfactory. He has no trade union to protect his interests, and no professional body which is strong enough to fix a reasonable scale of remuneration. If our metallurgical industries are to be carried on successfully after the war many more properly trained metallurgists will be required. Capable men will only be attracted if suitable inducements are offered; otherwise they will naturally drift into other employments. In the midland counties, for example, the bright son of a local resident can be trained, at the expense of the State, to become an elementary schoolmaster; he will work twenty-five hours per week, and receive a pension. Or he may decide to study metallurgy, in which case he must spend at least 300*l.* on fees and maintenance, and devote three years to study. He will then get no higher stipend than the schoolmaster, no pension, and be expected to work about fifty hours weekly.

In Germany the value of scientific training has been long recognised. If we are to retain our position after the war it will be by development of industrial undertakings which are conducted on a large and comprehensive scale. Such employers alone can, as a general rule, utilise the best scientific training, or adequately remunerate and recognise their properly trained assistants. A man who has been trained on broad scientific lines is not merely capable of conducting, or superintending, accurate analyses. If he is treated as a confidential adviser, like a doctor or a lawyer, his abilities will have free scope. It is by such men that we can hope rightly to direct the large metallurgical operations which will be more than ever necessary in this country after the war.

T. T.

## A MARKET-GARDEN RESEARCH STATION.[1]

FEW people other than those connected with the trade know of the extent and importance of the market-growing industry in this country. The general public is so accustomed to imposing statistics of imported fruit and vegetables that it is apt to ignore the not unsatisfactory fact that a large proportion of the market produce consumed in this country is home-grown. Still less does the public realise the extent of the capital and the skill and enterprise of the growers engaged in this industry. Although it may be regarded as lying beyond the scope of this severely practical first report of the work of the research station recently established by the growers in the Lea valley, we could wish, nevertheless, that the director had prefaced his account of the year's work by a short statement of the "statistics of production" in the market-growing industry. For we believe that such a statement would evoke widespread interest among the intelligent public.

Those who know of the origin and purpose of this new research station believe that it is destined to do a great work, and are anxious that its activities may not be curtailed by reason of insufficient

[1] First Annual Report (1915) of the Experimental and Research Station. (Nursery and Market Garden Industries' Development Society, Ltd.).