

THE SOLAR CONSTANT AND THE APPARENT TEMPERATURE OF THE SUN.—In a note published in No. 7, vol. lxi., of the Monthly Notices (p. 611), Dr. Féry discusses the measurement of the solar constant and of the sun's mean temperature. One of the greatest difficulties in these researches is to evaluate the atmospheric absorption, which in published researches has varied from 1.5 to 4; it is generally accepted now as having the value 2.4.

Having designed an instrument for measuring terrestrial high temperatures, MM. Féry and Millochau applied it to the determination of the solar temperature by Stefan's law. More than 750 observations were made at different altitudes, and at the summit of Mont Blanc the zenith transmission was found to be 0.91; with this correction the temperature at the centre of the sun's disc was found to be 5550° absolute, and the mean temperature 5360° C. Before dispatching it to India, this instrument was re-standardised at the National Physical Laboratory, and, on a clear, dry day, gave eight concordant readings, from which the temperature at the centre of the disc was found to be 5153° absolute; on this day the zenith transmission at Teddington was, therefore, 0.74, or the absorption was 26 per cent.

Employing the accepted value of the constant (2.4), the recent researches give 5920° as the mean temperature of the sun; but Dr. Féry thinks this is too high, and, therefore, deduces that the accepted value of the solar constant is too high. The Mont Blanc measures would indicate 1.65 as the value.

THE NATIONAL CONSUMPTION OF WATER.

AN important paper on the increase in the national consumption of water was read by Mr. W. R. B. Wiseman before the Royal Statistical Society on April 27. The paper is of considerable interest, and must have entailed a large amount of time and thought on the part of the author. The historical part, which deals with the early history of water supply in England, treats the question, not only from the general point of view, but gives many interesting details of the early methods adopted and the difficulties met with in many individual towns; in fact, it is not too much to say that the early beginnings of the water supply of all the principal towns in England are reviewed shortly in the paper. It is obvious that, as the object of the paper is to deal with the more modern questions which arise in connection with this subject, the author could not devote very much space to historical details. We can, however, judge that on this subject he has only touched the fringe of the information he has acquired, and it may perhaps not be too much to hope that he may return to this part of his subject at a future date.

The life of Sir Hugh Myddelton and the description of the work carried out by him of bringing the water from the springs of Chadwell and Amwell, in Hertfordshire, by means of the New River, for the supply of London are well known to most of us, and possibly the author of this paper may have material for the making of a story as interesting and romantic in connection with other towns.

The author says he was "tempted" to investigate the estimates of the population in the pre-censal period in order to determine whether the great increases in the population in the nineteenth century were abnormal or otherwise, as upon the answer to the query one must be guided in the provision of water supplies for future populations. As was to be expected, he found such an inquiry not of great value. He has, however, put together some interesting information as regards the growth of many towns, and has dealt with the reasons for the very rapid growth of several of them. From a general review, the conclusion arrived at is that "the nineteenth century was in no wise abnormal, and that a steady increase in the already considerable population may be expected throughout the twentieth century."

The author describes at some length the methods adopted for checking the waste of water in early days, and particularly the system adopted in Liverpool in 1868 of localising the waste by metering the supply in various districts.

Of course, the supply of water per head of population is the important question when dealing with the amount of water required, and the tables given of the supplies in a large number of towns show the variations which exist, and which extend from about sixty gallons as a maximum to below ten gallons as a minimum, leaving out one special case with small population which runs up to 124 gallons per head. The numbers all relate to total supply, which includes domestic, trade, and municipal demands. The statistics given show much greater uniformity of supply in the different towns than would have been anticipated, and it is evident from them that waste of water is carefully looked after in England, and all possible precautions taken to avoid it. If the consumption is compared with what is common in many of the large towns in the United States, where the water supply goes up to 200 gallons and more per head, it will be evident that the precautions taken in England have given very satisfactory results. The opposition to the use of water meters in the United States is probably the reason why leakage and waste continue on a large scale. This opposition is principally due to the view that, on sanitary grounds, it is not well to restrict the supply of water, but, as Mr. F. P. Stearns stated in his presidential address to the American Society of Civil Engineers, "no one has yet demonstrated the sanitary advantages of a leaky faucet or a defective ball-cock."

Table No. 5 is a valuable one. It gives, first, the population of more than 120 cities, towns, or districts in England for two or three years, with intervals, sometimes large and sometimes small, between the years. It then gives the total supply in each of these water areas during the years mentioned, dividing it up under the heads of domestic, trade, and municipal, the daily supply per head of population then following under the same heads.

Considerable space is devoted to the reasons which have caused an increase in the supply of water per head for domestic, trade, and municipal purposes. As regards domestic, it is, of course, well known that the displacement of old methods of sewage disposal by the introduction of the water-carriage system was the first cause of the great increase of the water supply. The increased and increasing use of fixed baths must also largely augment the consumption, as the water used for a bath by one person may vary from thirty to one hundred gallons. The author gives various other reasons for the increase in the domestic supply. As regards municipal supply, attention is directed to the increase in consumption due to the public baths, wash-houses, street conveniences, &c. The author states that he has endeavoured for some time past to collect data which will give some idea of the relative proportion of the water supply needed for particular works or industries, but the results have been too meagre to justify definite conclusions. He, however, deals in a general way with the amount of water used in a large number of industries, among which are breweries, distilleries, paper works, textile industries, and many others, and the information given is of an interesting character. The conclusion is that, on the whole, the rate of increase of water supply is greater in recent times than in those more remote. There probably would have been no doubt about this conclusion in anyone's mind, but, although this may be the case, it does not detract from the value of the information which has been collected in this paper to prove it.

The moral drawn is that, with the increasing amount of water required, there will be an increasing competition for the remaining first-class upland reservoir sites, which will become fewer and fewer as time goes on, and it is therefore desirable that steps should be taken at an early date to create some central authority "which should be charged with the duty of water conservancy in its widest application, and for that purpose should engage in a close and exact study of the water resources of the country." The author then goes more fully into the details which ought to be dealt with by such a body.

This proposal is, of course, not new, although of great importance. It was dealt with by Mr. E. P. Hill in a paper which he read at the Institution of Civil Engineers on November 27, 1906. In the beginning of that paper he said, "the water supply of the country is really a

national matter, and it should be considered as a whole, and a town should not be allowed to appropriate a particular area unless it can be shown that in a general survey of available sources of supply that area can economically, from a water point of view, be allotted to it."

The value of the paper would have been increased if some information had been given as regards what is being done in other countries in connection with systematic investigation of water resources. There is no doubt that such an investigation is of more value and of greater necessity to the United Kingdom, where the population per acre is large, than to some of those countries which are at present rather sparsely inhabited, but which, at the same time, spend money on proposals such as have been suggested. In the United States this work was undertaken as a national one some years ago, a beginning having been made in 1894-5 by a grant of 12,500 dollars. This amount was gradually increased, until the grant in 1905-6 was 200,000 dollars. Since then there has, we believe, been some variation in the amount voted for this purpose.

Considering the large amount of work which the author must have gone through to prepare this paper, it may seem almost ungracious to suggest that he should add anything further to it as regards other countries, but he has shown such a large capacity for putting information together that we hope he may be tempted to even further research in connection with this subject.

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THE WAR AGAINST TUBERCULOSIS.

THE National Association for the Prevention of Consumption and other Forms of Tuberculosis was well advised to open its exhibition or collection of object-lessons in the Borough of Stepney. It may safely be said that the Whitechapel Art Gallery never had any company of more interested sightseers than the thousands who, at this exhibition a few weeks ago, examined and discussed death-rates, ventilation, graduated labour and the apparatus used in performing it in the treatment of consumption, apparatus for the treatment of tuberculous diseases, playgrounds, pathological specimens, back-to-back houses, overcrowding, food-stuffs and the principles of nutrition, methods of disinfection, and the like.

Any interested onlooker would have seen at once that the official conferences and set discussions constituted, after all, but a small fraction of the educational work that was being carried on. Here was an exhibition of which the main object was not to direct the attention of the public to any patent medicine or "all curing" nostrum, but how to regulate their daily life, how to avoid disease, and how to get the best food value out of their weekly wages, be these great or small. Nevertheless, the promoters of this exhibition, realising what an opportunity they had, also gathered together a number of medical and municipal delegates interested in the matter, to discuss the best means of preventing and curing tuberculosis.

Even those dropping in casually found an enthusiastic band of demonstrators, nurses from dispensaries and hospitals, attendants from graduated labour homes, from sanatoria and similar institutions, all hard at work explaining to small groups of interested men and women the meaning of the exhibits of which they were in charge. It was interesting to see the keenness with which both teacher and listener tackled the subject; and that these demonstrators were doing their work well was apparent from the numerous and intelligent questions that were put at the end of the demonstrations. Even to the sharp, snarling Londoner the importance of ventilation, of cleanliness, of light, of suitable feeding, have been small, but a few exhibitions and demonstrations such as those seen and heard in Whitechapel Art Gallery will soon change all that; and the President of the Local Government Board has done nothing better for some time than in giving his countenance and support to what promises to be a really living movement.

What is the object and what are the lessons insisted upon at these conferences? Anyone visiting the exhibition

would have it brought home to him in some way or other that between 1858 and 1907 there had been a fall in the annual death-rate due to tuberculosis from 2700 per 1,000,000 living to 1150 per 1,000,000 living. He would also see that, were the fall to continue at the same rate, tuberculosis would be an extinct disease early in the 1940 decade. Although this is too favourable a state of things to look forward to, as there will always remain a certain substratum of tuberculous patients and foci that it will be almost impossible to reach, tuberculosis should undoubtedly be an almost negligible quantity in our death-rate by that time.

How has this fall been brought about? In the first place, even before Koch was able to prove the presence of the infective agent, the tubercle bacillus, in tuberculous lesions, it was realised by those who were studying the disease most closely that it could be transmitted from one person to another, and that crowded and badly ventilated rooms were, therefore, fruitful centres of infection. This was a very great step forward, the full effect of which, however, was not felt until Koch gave his wonderful demonstration of the presence of the tubercle bacilli. He isolated the infective agent—this tubercle bacillus; its life-history was studied, and its relation to the tissues of the animal body during the course of the development of the disease, demonstrated. In the history of the treatment of any infective disease little progress has been made in fighting against it until the causal agent has been demonstrated. Once this stage has been reached, however, the fight waged against infective disease of all kinds has become more and more effective. In the case of tuberculosis, the attack can now be delivered along many parallels. Every patient is looked upon as a possible centre of infection, and before setting about the cure of the patient those dealing with the case have set themselves the task of attacking the bacillus from every quarter and at every point. It is realised that the first thing to be done is to secure it, or kill it, if possible, immediately it leaves the patient, especially, of course, in the sputum, as it comes from the lungs.

In the case of tuberculosis, isolation, in the ordinary sense of the term, is out of the question, but although the patient cannot be segregated from his fellows—and in many cases it would be both unwise and cruel so to do—he should be carefully trained to isolate himself, so far as the tubercle bacillus is concerned, by taking every precaution to prevent any undisinfected material from getting beyond his immediate vicinity. More is necessary, however, than the mere killing of the bacillus as it leaves the human body; some attempt must be made so to build up the strength of the patient that his tissues may be capable of carrying on war with the bacillus either on fairly level terms or on terms in favour of the patient. This can only be done by ensuring good hygienic conditions—plenty of fresh air, light, good food, work enough with plenty of rest. Given these conditions, and the tubercle bacillus has a bad time of it; remove the conditions, and the bad time falls to the patient. It has been stated above that it is often unnecessary to segregate consumptive patients; it must be remembered, however, that in the late stages of the disease, when the patient is weak and when the various discharges from the body, sputum and other excreta, may contain enormous numbers of the infective bacilli, it may be advisable, and even necessary, in the patient's own interests as well as of those who daily come in contact with him, to keep him in hospital, to make his last days, or even weeks or months, as easy and as pleasant as possible for him. Moreover, under these conditions the destruction of the enormous number of tubercle bacilli coming from the body is a comparatively easy matter.

Those interested in the treatment of tuberculosis have for long been convinced that good feeding and fresh air are factors of prime importance in such treatment. Up to a few years ago, however, the results obtained, though very much better than any obtained under the old methods of treatment, were in certain respects extremely disappointing. The patients were not properly classified for treatment, and many died who apparently ought to have lived. Those who went to Whitechapel to learn would find that the treatment of consumptives under Dr. Paterson at