1922, pp. 387-389. From the repeated trials made, it was definitely proved that the gases so collected are free from water. Thus the theory of the anhydrous nature of the magmatic gases, advanced by Albert Brun, receives fresh experimental confirmation.

on the cyclonic movements caused by convection currents in the hot air over the lava-flow.

In honour of the King and the Premier, the Accademia Gioenia di Catania has given the name Vittorio Emanuele III. to the new craters in the upper part of

FIG. 3.—Explosion-craters, Vittorio Emanuele III.

[Photo: G. Ponte.]

Many observations were made of the temperature of the lava, and it was found that this varied in different parts of the flow owing to superficial cooling in contact with the air. At a temperature of from 670° to 690° the lava was still pliable, and could be easily bent and compressed. Some interesting observations were made

the eruptive region, and has named those near the vent from which the lava issued Crateri Mussolini.

Many foreign vulcanologists came to see the eruption, and among them I had the pleasure of seeing Dr. G. Kemmerling, chief of the Vulcanological Service of the Dutch Indies.

Population and Unemployment.¹

By Sir WILLIAM H. BEVERIDGE, K.C.B.

THE impression that the civilised world is already threatened with over-population is very common to-day. Many, perhaps most, educated people are troubled by fear that the limits of population, probably in Europe and certainly in Great Britain, have been reached, and that a reduction in the rate of increase is an urgent necessity. Most, if they were asked to give reasons for their fear, would refer to one or both of two reasons: they would point to the enormous volume of unemployment in Britain; they would say that economic science, at least at Cambridge, had already pronounced its verdict. I propose to begin by raising some doubts as to the validity of each of these arguments.

The volume of unemployment in Britain is undoubtedly serious, and almost certainly unparalleled

in past history. Those who see, as we now do, more than a million wage-earners whom our industry for years together is unable to absorb in productive employment may be excused if they draw the inference that there are too many wage-earners in the country. The inference, though natural, is unjustified. Unemployment in Britain can in any case prove nothing about the world as a whole. History shows that it does not prove over-population even in Britain.

During the last half of the nineteenth century, the industry of the United Kingdom was finding room for a rapidly increasing number of wage-earners with an admittedly rising standard of production and comfort. Through the whole of that period there was unemployment in the country. The percentage of trade unionists out of work never fell to zero; in no year since 1874 was it less than two; at more than one crisis it reached a height comparable if not equal to that which we have

¹ From the presidential address delivered to Section F (Economic Science and Statistics) of the British Association at Liverpool on September 17.

just experienced. During 1922 this percentage has averaged fifteen; but it averaged over eleven in 1879 and over ten in 1886. These figures are not on an identical basis, and are therefore not absolutely comparable. Taken for one year only, they understate the relatively greater seriousness of our recent experience, since the unemployment percentage was high through a large part of 1921 as well as in 1922, and still continues high. But the difference is one of degree rather than of kind. The peril of inferring over-population from unemployment is conclusively shown.

The experience of 1879 was up to then unparalleled; probably it was as much worse than anything previously recorded as the experience of 1922 appears worse than that of 1879. The experience of 1879, however, the record year of unemployment, heralded, not over-population and the downfall of British industry, but a period of expansion and prosperity which reached, if it did not pass, all previous records. "Real wages," which had risen thirty per cent. in the twenty years to 1880, rose even more rapidly in the next twenty years to 1900. Any one who in 1879, looking at the half or three-quarter million unemployed, had argued that the existing population of the United Kingdom (then about thirty-four millions) was all that the country could support without lowering its standards, would have been lamentably discredited at once. Ten years later he would have found a population nearly three millions more, enjoying a real income per head that was a fifth greater, with the unemployment percentage reduced to two. Ten years later still the population had grown further in size and in prosperity; those trades had grown most rapidly in which there had been and continued to be the largest percentages of unemployment.

The problems of unemployment and of over-population are distinct; they are two problems, not one. Severe unemployment has occurred in the past without over-population, as a function of the organisation and methods of industry, not of its size. On the other hand, it is very doubtful if excessive growth of population has ever shown itself or would naturally show itself by causing unemployment. A more probable effect would be pressure to work more than before in order to obtain the same comforts: a fall of real wages per hour, by increase either of hours or of prices.

The same dependence of unemployment on the organisation and methods of industry, rather than on its size, appears if we look, not backwards in time, but round us in space. It has been pointed out by Prof. Cannan that one of the few groups of economists who from our post-War sufferings can at least obtain the high intellectual satisfaction of saying "I told you so," is that which maintains that changes in the purchasing power of money are the most potent causes of the fluctuations in prosperity known as cycles of trade or booms and depressions. "In the pre-War period booms and depressions swept over the whole western world at once and left their causes obscure. In 1922 we have been treated to a sharp contrast between two groups of countries, one group having boom and full employment, the other depression and unemployment, the difference being quite clearly due to the first group having continued the process of currency inflation, the other group having dropped it." To bring this generalisation down to particular examples, we see

in Central Europe a nation which assuredly should be suffering from over-population if any nation is; Germany, defeated in war, has been compressed within narrower limits, has lost its shipping and foreign investments, its outlets for emigration and trade, and now by high birth-rates is repairing with exceptional speed the human losses of the War. Germany may or may not be suffering from over-population. She certainly has not suffered from unemployment; she has had a boom stimulated by inflation of the currency. We see on the other hand Britain, victorious in war, with expanded territories and the world open to her, pursuing a different, no doubt a better, currency policy, and experiencing unexampled unemployment. To argue uncritically from unemployment to over-population is to ignore the elements of both problems.

In regard to Europe as a whole we find no ground for Malthusian pessimism, no shadow of over-population before the War. Still less do we find them if we widen our view to embrace the world of white men. The fears expressed by Mr. Keynes in his book "Economic Consequences of Peace" seem not merely unnecessary but baseless; his specific statements are inconsistent with facts. Europe on the eve of war was not threatened with a falling standard of life because Nature's response to further increase in population was diminishing. It was not diminishing; it was increasing. Europe on the eve of war was not threatened with hunger by a rising real cost of corn; the real cost of corn was not rising; it was falling.

For Europe and its races the underlying influences in economics were probably still favourable when the War began. But the war damage was great, and we are not in sight of its end. Man for his present troubles has to accuse neither the niggardliness of Nature nor his own instinct of reproduction, but other instincts as primitive and, in excess, as fatal to Utopian dreams. He has to find the remedy elsewhere than in birth control.

Let me add one word of warning before I finish. Such examination as I have been able to make of economic tendencies before the War yields no ground for alarm as to the immediate future of mankind, no justification for Malthusian panic. It has seemed important to emphasise this, so that false diagnosis should not lead to wrong remedies for the world's sickness to-day. But the last thing I wish is to over-emphasise points of disagreement with Mr. Keynes. The limits of disagreement are really narrow. The phrases that I have criticised are not essential to Mr. Keynes's main argument as to the consequences of the War and the peace. Whether Mr. Keynes is right or, as I think, too pessimistic as to economic tendencies before the War, he will, I am sure, be regarded as right in directing attention again to the importance of the problem of population. Nothing that I have said above discredits the fundamental principle of Malthus, reinforced as it can be by the teachings of modern science. The idea that mankind, while reducing indefinitely the risks to human life, can, without disaster, continue to exercise to the full a power of reproduction adapted to the perils of savage or pre-human days, can control death by art and leave

births to Nature, is biologically absurd. The rapid cumulative increase following on any practical application of this idea would within measurable time make civilisation impossible in this or any other planet.

In fact, this idea is no more a fundamental part of human thought than is the doctrine of *laissez faire* in economics, which has been its contemporary, alike in dominance and in decay. Sociology and history show that man has scarcely ever acted on this idea; at nearly all stages of his development he has, directly or indirectly, limited the number of his descendants. Vital statistics show that the European races, after a phase of headlong increase, are returning to restriction. The revolutionary fall of fertility among these races within the past fifty years, while it has some mysterious features, is due in the main to practices as deliberate as infanticide. The questions now facing us are how far the fall will go; whether it will bring about a stationary white population after or long before the white man's world is full; how the varying incidence of restriction among different social classes or creeds will affect the stock; how far the unequal adoption of birth control by different races will leave one race at the mercy of another's growing numbers, or drive it to armaments and perpetual aggression in self-defence.

To answer these questions is beyond my scope. The purpose of my paper is rather to give reasons for suspending judgment until we know more. The authority of economic science cannot be invoked for the intensification of these practices as a measure for to-day. Increased birth control is not required by anything in the condition of Europe before the War, and is irrelevant to our present troubles. But behind these troubles the problem of numbers waits—the last inexorable riddle for mankind. To multiply the people and not increase the joy is the most dismal end that can be set for human striving. If we desire another end than that, we should not burk discussion of the means. However the matter be judged, there is full time for inquiry, before fecundity destroys us, but inquiry and frank discussion there must be.

Two inquiries in particular it seems well to suggest at once. The first is an investigation into the potential agricultural resources of the world. There has been more than one elaborate examination of coal supplies; we have estimates of the total stock of coal down to various depths in Britain and Germany, in America,

China, and elsewhere; we can form some impression of how long at given rates of consumption each of those stocks will last; we know that "exhaustion" is not an issue for this generation or many generations to come. There has been no corresponding study of agricultural resources; there is not material even for a guess at what proportion of the vast regions—in Canada, Siberia, South America, Africa, Australia—now used for no productive purpose, could be made productive; and what proportion of all the "productive" but ill-cultivated land could with varying degrees of trouble be fitted for corn and pasture. Without some estimate on such points, discussion of the problem of world population is mere groping in the dark. The inquiry itself is one that by an adequate combination of experts in geographic and economic science—not by a commission gathering opinions or an office gathering statistical returns—it should not be difficult to make.

The second is an investigation into the physical, psychological, and social effects of that restriction of fertility which has now become a leading feature of the problem. This also is a matter neither for one person—for its scope covers several sciences—nor for a commission; facts rather than opinions or prejudices are required.

If the question be asked, not what inquiries should be made but what action should now be taken, it is difficult to go beyond the trite generalities of reconstruction, of peace and trade abroad, of efficiency and education at home. The more completely we can restore the economic system under which our people grew, the sooner shall we absorb them again in productive labour. Unless we can make the world again a vast co-operative commonwealth of trade, we shall not find it spacious enough or rich enough to demand from Great Britain the special services by which alone it can sustain our teeming population. Even if the world becomes again large enough to hold us, we shall not keep our place in it with the ease of Victorian days; we dare no longer allow, on either side of the wage bargain, methods which waste machinery or brains or labour. Finally, if there be any question of numbers, if there be any risk that our people may grow too many, the last folly that we can afford is to lower their quality and go back in measures of health or education. Recoil from standards once reached is the gesture of a community touched by decay.

Obituary.

MR. FREDERICK CHAMBERS.

THE death is announced of Mr. Frederick Chambers, late Meteorological Reporter for Western India, at the age of seventy-seven years. Mr. Chambers was the younger brother of Charles Chambers, who went out from Kew Observatory in 1864 to take charge of the Colaba Observatory, Bombay. Frederick went out as assistant to his brother. In 1873 his paper, "The Diurnal Variation of the Wind and Barometric Pressure at Bombay," was published in the Phil. Trans. of the Royal Society, and another paper, "Mathematical Expression of Observations of Complex Periodical Phenomena; Planetary Influence on the

Earth's Magnetism," written in collaboration with his brother, appeared in the Phil. Trans. in 1875. About this time Mr. Chambers was appointed Meteorological Reporter for Western India. A quotation from the first annual report which he printed is not without interest. It is explained that meteorological instruments had been sent out from England in 1852, "the duty of making the observations at those places being imposed on the senior medical officers"; the comment is made, "We would hope that from the zeal and energy of medical officers in charge of European hospitals and their love of science, the observations may be made by themselves and their establishments,