SANITATION IN THE TROPICS.[1]

PROF. BOYCE and Messrs. Evans and Clarke, of the Liverpool School of Tropical Medicine, recently returned from a journey to the west coast of Africa, the object of which was to study the present sanitary condition of, and anti-malarial measures practised at, Bathurst, Conakry, and Freetown, to investigate how far the teaching of Ross has there been accepted and acted upon, and if, as a consequence, the health of these communities has improved during the last four years. This report embodies the results of their observations, together with suggestions for the further development of tropical hygiene in the future.

FIG. 1.—Principal Boulevard in Conakry, showing factories and Decauville rails. The main drain is under the footpath on the left.

At Bathurst sanitation is clearly of no low order, the town is well laid out, the streets are drained, and earth closets are the rule in the European quarters; but in the native compounds there are many cess-pits which tend to foul surface-wells, of which there are a number still in use, though there is a good public supply from deep wells. Anti-mosquito measures have been in force since 1902, consisting of the removal of old tins and rubbish, levelling and clearing of roads, examination of wells and water receptacles for larvæ, &c., and the more regular use of the mosquito net by Europeans. These precautions have made people think and be more careful, and the Europeans, it is stated, have been more free from malaria than formerly, but Culex mosquitoes still abound.

Conakry, in French Guinea, is a comparatively new town, well planned and laid out. There are no cess-pits of any kind, the pail system being in use, and a pure water supply is brought from watercourses 41 kilometres distant. In consequence, the private wells have fallen into disuse, but they have not been closed or filled up, and therefore serve as breeding grounds for mosquitoes. Anti-malarial measures do not seem to be carried out, mosquito nets are not made use of to any extent, and malaria is still very rife. The authors remark that (p. 20) "With model water supply under the control of the authorities, no streams, a good porous soil, and perfect sanitation mosquitoes should be got under control, and the freedom of the Europeans and of the natives from malaria guaranteed."

Freetown, in Sierra Leone, is not well laid out, and cess-pits are the rule. Of these there were 2650 in 1897, and their number has since increased, while more than 2000 of the inhabitants have no sanitary accommodation of any kind. The street drainage is still imperfect, and numerous opportunities exist for Anopheles mosquitoes to breed; but this condition of things is undergoing gradual improvement, and mosquito nets are in general use. The authors think that the health of the Europeans has in consequence improved, but evidently no striking result has yet been achieved. On the whole, we are disappointed that more definite results cannot be chronicled as the outcome of the health propaganda so ably preached by the Liverpool School and its energetic staff, but obviously such success as has been attained should prove a stimulus for further effort, and not lead to any relaxation of present measures. The authors formulate a number of suggestions for the improvement of the health of the districts visited, of which the principal are :—(1) the

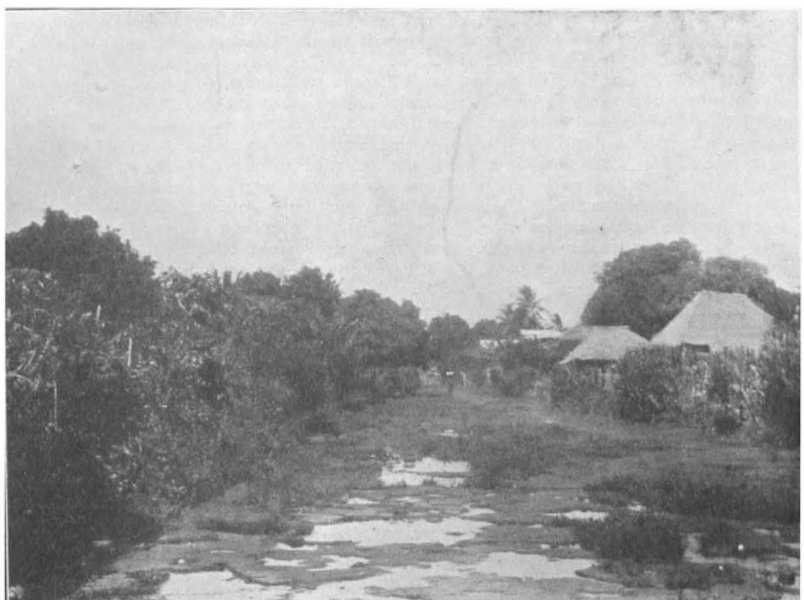

FIG. 2.—A street in Freetown consisting of rock surface, in which there are innumerable pools breeding Anopheles (Rainy season).

[1] "Report on the Sanitation and Anti-malarial Measures in Practice in Bathurst, Conakry, and Freetown." By Prof. Rubert Boyce, M.B., F.R.S., Arthur Evans, M.R.C.S., L.R.C.P., and H. Herbert Clarke, M.A., B.C. (Cantab.), Liverpool School of Tropical Medicine. Memoir xiv. (Liverpool: University Press. London: Williams and Norgate, 1905.)

instruction of newcomers in the part played by mosquitoes in conveying malaria, and in the habitual and proper use of mosquito nets; (2) the segregation of the native population away from the European quarters; (3) the total abolition of cess-pits; (4) the rational and systematic use of anti-malarial measures; (5) the public control of drinking water; and (6) the establishment of laboratories on the spot for the study of health problems. R. T. Hewlett.

IRON AND STEEL INSTITUTE.

The annual meeting of the Iron and Steel Institute was held at the Institution of Civil Engineers on May 11 and 12, and was very largely attended. The report of the council, read by Mr. Bennett H. Brough, the secretary, shows that the institute continues to make satisfactory progress. The membership now amounts to 2000. The proceedings began with the adoption of a resolution of regret at the death of Sir Bernhard Samuelson, Bart., P.C., F.R.S., past president, referred to elsewhere (p. 61).

After the usual routine business, the retiring president, Mr. Andrew Carnegie, inducted into the chair the president-elect, Mr. R. A. Hadfield, whose first duty was to present the Bessemer gold medal to Prof. J. O. Arnold (Sheffield).

Mr. R. A. Hadfield then delivered his presidential address. It dealt chiefly with the history of metallurgy and with those branches of the subject to which his attention had been directed, more especially with the alloys of iron with other elements. He urged the necessity for constant research. In progressive manufacture, the complexity of which increases year by year, there is, in addition to the many ordinary difficulties met with, that of the solution of new problems which constantly present themselves. This can only be done by research, which should form an actual part of industrial operations, and demands almost as much attention as is devoted to the manufacturing side. It is more than ever necessary not to rest satisfied with the knowledge of to-day, or to think that this will satisfy the needs of to-morrow. Rapid and great changes are constantly occurring in metallurgy as in other branches of scientific knowledge. The thanks of the meeting for the address were expressed by Sir E. H. Carbutt and Sir William White, K.C.B.

Mr. S. Surzycki (Czenstochowa) submitted results obtained with the continuous open-hearth steel process as carried out in fixed furnaces in Poland. The process, which has proved eminently successful, is based on the principle of the Talbot process, with the essential difference that it can be carried out in any fixed furnace of not less than 25 tons capacity. The advantages do not consist solely in the continuity of the process, but in the longer life of the furnace, the higher production and yield, the lessened fuel consumption, and the simplicity of the plant.

A very elaborate paper was read by Mr. R. A. Hadfield, the president, describing some experiments relating to the effect produced by liquid-air temperatures on the properties of iron and its alloys. About eleven hundred specimens were tested. The bars, which were prepared with great care, were submitted to various heat treatments, the exact temperatures being recorded, and then forwarded to Sir James Dewar's laboratory at the Royal Institution. The tests were carried out on a small hydraulic testing machine, to which the necessary arrangements could be readily applied for immersing the specimens in liquid air. The results showed that, with certain exceptions, the effect of low temperatures is to increase in a remarkable degree the resistance of iron and iron alloys to tensile stress, and to reduce the ductility from the highest point to practically nil. The changes take place even in the softest wrought iron. The absence or presence of carbon in ordinary carbon steel in which other special elements are not present has little influence. Subjected to Brinell's hardness ball test, a specimen of Swedish charcoal iron at normal temperature had a hardness number of 90, whereas when tested at about −182° C. this increased to no less than 266, or about equal to the hardness of 0·80 per cent. carbon steel at normal temperature. This almost seems incredible when it is remembered that this iron shows by analysis 99·82 per cent. of iron, and normally has only 20 to 22 tons tenacity with 25·30 per cent. elongation. This iron becomes brittle to an extraordinary degree under the influence of the low temperature −182° C., whereas nickel tested at the same low temperature has improved rather than deteriorated, not only in tenacity, which iron also does, but in ductility, in which latter quality iron entirely breaks down. If nickel, therefore, is present in an iron alloy containing but little carbon or comparatively low in that element, it acts as a preventive of brittleness, or is a very considerable modifier of that objectionable quality. This action of nickel is simply marvellous in certain of the alloy specimens, for example, in the case of an alloy of iron, carbon 1·18 per cent., nickel 24·30 per cent., and manganese 6·05 per cent. Here the ductility is extraordinary at not only ordinary but low temperatures, probably the highest known for any iron alloy, and certainly for an alloy having such tenacity as 84 tons per square inch. There is still present in this alloy 68 per cent. of iron, yet the tendency of the latter metal to wander into the paths of brittleness is not only entirely checked at the liquid air temperature—and this brittleness, as shown so clearly in this research, occurs to an extraordinary extent in pure iron cooled to −182° C.—but the elongation or ductility, already so great, is considerably increased, namely, from 60 per cent. to 67½ per cent. There is also an increase of tenacity in both cases, namely, a rise of from 10 per cent. to 38 per cent. Thus the nickel present enables the bar under this high tension and at −182° C. to remain far more ductile than the very best of ductile iron of one-third the tenacity. Although the action of nickel has been specially referred to, it must not be overlooked that in this alloy there is also present 6 per cent. of manganese, which in its ordinary combination with iron, that is, with no nickel present, would confer intense brittleness upon the iron and render it more brittle than if not present. This treble combination of nickel-manganese with iron appears to reverse all the known laws of iron alloys.

Mr. J. H. Darby (Brymbo) and Mr. George Hatton (Round Oak) summarised the recent developments in the Bertrand-Thiel process of steel manufacture. This process, which was first used in Bohemia in 1894, consists in carrying out the preliminary refining in an upper open-hearth furnace, and the steel-making is completed in a secondary open-hearth furnace. The original plan of having furnaces at different levels has not proved so satisfactory as having the furnaces arranged in line with a mixer at one end. Pig iron of almost any ordinary composition may be used. At Brymbo, with a highly phosphoric pig iron, seven 20-ton charges per day have been attained, and at the Hoesch works in Dortmund ten charges per day have been regularly produced.

At the New York meeting of the Iron and Steel Institute, the paper read by Mr. James Gayley on the application of the dry air blast created quite a sensation in the iron industry. Mr. Gayley now gives, in a supplementary paper, a record of operations of the Isabella furnaces at Pittsburg from November, 1904, to March, 1905, showing that the increased iron output and the decreased coke consumption derived from the use of dry air were well maintained.

The rapid development of the gas engine of recent years has given special value to the gas escaping from the blast furnace, previously often described as waste gas. The gas leaving the blast furnace carries with it a varying amount of gritty dust, which has proved a serious obstacle to the successful operation of large gas engines. The various methods of cleaning the gas were described in the paper submitted by Mr. Axel Sahlin, who has designed a slowly revolving apparatus for the purpose.

Dr. O. Boudouard (Paris) submitted a lengthy account of experiments made to determine the fusibility of blast-furnace slags. He gave a chart enabling metallurgists to determine the fusion temperature of a given alumino-calcic silicate. The information given in this lengthy paper is of great value, inasmuch as one of the most important considerations in the satisfactory running of a blast furnace is a knowledge of the degree of fusibility of the slag.

Mr. Sidney A. Houghton contributed a note on the failure of an iron plate through fatigue. The plate was