mind in the course of the arrangements that are being made and will have to be made in the provision for the sick and wounded during the present war. It is quite probable that the accommodation already made will prove insufficient and that large additional space will be needed. In the American Civil War and in the Franco-Prussian War the suitability of wooden buildings was abundantly proved, and with our increased knowledge and confidence in the advantages of simple structures it is to be hoped that no more money will be spent upon structural alterations for hospital use, but that simple erections will be made for which there are many good designs to be seen in the more recently erected sanatoriums for the treatment of consumption, none being better than that recently opened at Little Bromwich, outside Birmingham. Even these, in many respects, may be simplified in accordance with the temporary use to which they will be put.

Open wards dispense with all need for considering methods of heating and ventilation; windows and doors are not required, but it may be desirable in some places to have sliding wooden screens to afford a certain amount of protection in stormy weather. Flooring may be made of asphalt or simply beaten earth covered with a thick layer of pine sawdust, which can be renewed easily with a shovel, and which absorbs all damp to an extraordinary extent. The late Professor George Vivian Poore demonstrated the great value of pine sawdust as an antiseptic absorbent, and its special value for taking up and deodorizing such liquids as urine. He was asked by the South-Western Railway to suggest a simple form of urinal for the use of the men engaged in their works at Basingstoke, and he proposed the provision of a simple trough made by two planks put at an angle, filled with pine sawdust; when he was asked how often the sawdust would have to be renewed, he said, "Practically never." He was in the habit of showing his friends a flannel jelly-bag half full of sawdust, which he and his assistant had used in his room at University College for six months at the time I saw it, as a urinal; the effluent from it in the whole of that time amounted to something less than a pint of a pale fluid which smelt only of turpentine. If these hospitals are put up, as is proposed, in the grounds attached to buildings, or in unoccupied land in their neighbourhood, there ought to be no difficulty about the disposal of faeces, which should be superficially buried in shallow trenches. Soiled dressings should be burnt, and a proper furnace connected with the sterilizing apparatus would be a necessary adjunct to the hospital. The university buildings at Bournebrook, Birmingham, have been transformed at very considerable expense into a hospital of 600 beds, but it is likely that many more will be needed. There is plenty of room there for the erection of such an annexe as I have in mind, and there would be no difficulty in Birmingham in forming a committee to provide the money and equipment and to superintend the provision of all that is needed for such an extension. It is to be hoped that the medical press will support this plan and exert its influence to prevent the unnecessary expenditure of public funds in the costly transformation of originally unsuitable buildings. The campaign in favour of fresh air and sunlight is also that of efficiency and economy; and where, as has been pointed out by high authority, money may in the end be the decisive factor in this great struggle, there can be no justification for wasting it, especially when better results may be obtained by cheaper methods.

MISS FANNY CRESSWELL, PARIS, daughter of the late Dr. John Ayrton Paris, formerly President of the Royal College of Physicians, and author of *Pharmacologia*, celebrated her 100th birthday at her residence at Yarmouth, Isle of Wight, on September 16th.

THE anniversary of Pasteur's death on September 28th is to be commemorated by the publication of a study, entitled *Pasteur and After Pasteur*, by Mr. Stephen Paget. This will form the first volume of a new series of "Medical History Manuals" to be issued by Messrs. Black. It will be followed by *Sydenham and Clinical Medicine*, by Sir William Osler; *The Predecessors of Lister*, by Dr. Alexander Miles; *Galen and Roman Medicine*, by Dr. J. M. Comrie; *Medieval Medicine*, by Dr. James J. Walsh; and *The Artist Anatomists of the Cinquecento*, by Dr. E. C. Streeter.

STERILIZATION OF WATER SUPPLIES FOR TROOPS ON ACTIVE SERVICE.

By PROFESSOR G. SIMS WOODHEAD, M.D.,
LIEUTENANT-COLONEL, R.A.M.C.(T.), SANITARY SERVICE.

SOME years ago, whilst working at the sterilization of the Cambridge water supply, I found that it was not necessary to make a bacteriological examination in order to determine whether the *Bacillus coli* group had been killed by the addition of certain quantities of bleaching powder (chloride of lime) to the water under observation. Working with very dilute solutions of bleaching powder, I found that the amount of "available" chlorine required to be added to the Cambridge water to "sterilize" it was frequently only about 1 part in 7,000,000. In such cases the number of bacteria present was very small and the amount of organic matter very low, and I found, even after the addition of the above small quantity, that if I obtained a blue or a violet-blue reaction with potassium iodide and starch as much as a litre and a half or even two litres of the treated water did not contain a single "living" *Bacillus coli communis*. In some earlier experiments I was able to demonstrate that the typhoid and cholera bacilli were no more resistant to the action of hypochlorous acid than was the *B. coli communis*, and I now realized that water to which bleaching powder had been added, and which at the end of a quarter of an hour gave the above blue reaction, could contain no living members of the *B. coli communis* group, the dysentery bacillus, or any of the pathogenetic organisms mentioned capable of development in bile salt broth or on special media. I suggested, therefore, that this chemical test might be utilized to take the place of a bacteriological examination wherever waters, varying from time to time in their bacterial contents or in the amount of organic matter contained in them, were being treated with bleaching powder as a sterilizing agent; this test taking a few seconds only, against the twenty-four to ninety-six hours required for a bacteriological examination.

Carrying out a further series of experiments, and following the lines laid down, first in this country and then more completely worked out in America, I satisfied myself that if the particulate matter could be removed from a water by means of any of the ordinary filters, it was possible to render even a highly polluted water perfectly safe for drinking purposes by the addition of appropriate amounts of chlorine, and that these appropriate amounts could be determined by means of the iodine and starch test.

Quite recently I have heard from Colonel Horrocks, who has given considerable attention to this question, that instructions have been issued from the War Office that a definite quantity of bleaching powder should be added to any suspicious water after careful filtration through a good rough filter. Moreover, Colonel Horrocks informs me that he has devised a specially large and serviceable filter for the removal of particulate matter from water that is to be treated with this bleaching powder. I believe that by these means he has greatly reduced the risk of typhoid and other infections being conveyed through waterborne bacilli. I realize, of course, the difficulties in the way of getting the test described below carried out in the field; but the importance of keeping the amount of bleaching powder as low as possible (so that there may be no taste of chlorine given to the water)—whilst at the same time resting assured that a sufficient amount of bleaching powder has been added to render the water sterile—is so great that I venture to ask you to publish the following method of testing and sterilizing water for the information of those in charge of the water-cart tanks supplying troops on active service:

ALL WATER EXCEPT THAT FROM PUBLIC TAP WATER
POTABLE SUPPLIES MUST BE REGARDED AS
DANGEROUS AND UNFIT FOR DRINKING.

Filter through the best rough filter available—for example, army service filter, improvised sand filter, etc.

Pollution in water may be detected and the water rendered safe for drinking by the following method:

Test before Treatment in Bulk.

Instruction I.

Rinse a clean service enamelled iron or earthenware reputed pint mug (1, Fig. 1) with the water to be tested,

leaving a few drops in the vessel. Add the 2 grams of bleaching powder—chloride of lime, chloro-hypochlorite of lime—contained in one of the glass

Fig. 1.

Fig. 2.

tubes "A" (white label) and make into a thin paste, rubbing it down with a clean stylographic pen, penholder, pencil, or glass or other similar clean rod available. Then add 500 c.cm., or 18 oz. of water (that is, fill to within $\frac{1}{4}$ in. of the lip of the enamelled mug or $\frac{3}{4}$ in. of the lip of an earthenware mug) and mix thoroughly by pouring into a second mug (Fig. 2), and then back into 1. The quantities indicated below of the resulting solution may be used for testing purposes; the remainder is used for sterilizing the water. This solution should contain 0.66 gram of available chlorine.

Instruction II.

Now fill four service reputed pint mugs to within $\frac{1}{4}$ in. of the top with the water to be tested. Then allow the bleaching powder solution to rise in a pipette graduated to contain 0.15 c.cm. (Fig. 8) to the mark (b); wipe the outside of the pipette and blow the contents into one (Fig. 3) of the four mugs of water to be tested. Add two similar charges of the pipette to a second of these mugs (Fig. 4), three charges to a third (Fig. 5), and four charges

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

to a fourth (Fig. 6), in each case mixing thoroughly (as under Instruction I), and allow to stand for fifteen minutes. Then into a clean mug (Fig. 7) crumble one of the small tablets of potassium iodide contained in tube "C" (red label); also after powdering in the corner of an envelope or between a couple of layers of clean paper, one of the compressed starch tablets "B" (blue label)—other forms of soluble or boiled starch may be used if these tablets are not available—and pour into it the water from 3, and

Fig. 8.—Natural size; capacity to b, 0.15 c.cm.

mix by pouring backwards and forwards from one vessel to the other. Add potassium iodide and starch to 4, 5, and 6, treating in the same way. When a blue colour appears in any of these mixtures it is an indication that the chlorine has not all been used up in that mixture; what remains sets iodine free from the potassium iodide, which, acting on the starch, gives a blue colour—that is, more available chlorine than was necessary to carry oxygen to the organic matter and less resistant organisms has been added, and the water treated in bulk as under Instruction III is rendered "safe." To free the water from the *Bacillus coli communis* and from non-spore-bearing pathogenetic waterborne organisms it is not necessary to add more bleaching powder than is indicated as required by the test.

Sterilization of the Water.

Instruction III.

Should No. 3 give a blue, violet, or brown colour (best seen by daylight) the contents of No. 1 (Fig. 1) may be divided into two equal parts, each of which is sufficient to sterilize 110–120 gallons of water. Distribute this amount, pouring equal quantities into each of the four divisions of the service tank when it is about half filled, and when filled allow to stand for twenty minutes. The water may then be used for drinking without filtration or further treatment.

Should No. 3 give no colour but No. 4 become blue, add the whole of the contents of No. 1 to 110–120 gallons, distributing in the same way and rinsing the mug several times so as to wash into the tank the whole of the bleaching powder.

Should No. 4 give no colour but No. 5 become blue, dissolve a second sterilizing powder "A" (2 grams of bleaching powder), and add half of it along with the contents of No. 1 to the 110–120-gallon tank.

Should No. 5 give no colour but No. 6 become blue, add the whole of the contents of the two tubes "A" to 110–120 gallons. In each case allow the water to stand for twenty minutes before issuing it for drinking. Should No. 6 give no colour the water should be regarded as highly polluted, and as palatability is a matter of some importance, it should be boiled. By the addition of more bleaching powder, however, up to 6 or 8 grams per 110–120 gallons it may be rendered innocuous, though in some cases it may be less palatable.

N.B.—1. The great advantage of this method is that it is not necessary to await the result of a bacteriological examination. The amount of bleaching powder required to render the water safe for drinking purposes may be determined in twenty minutes. Where a new or a variable water has to be used, this is a matter of prime importance.

2. Other advantages are that with the exception of the pipette no special apparatus is required, and that as the same solution is used for both testing and sterilizing, any fall in the available chlorine content of the sterilizing powder is equalized by a similar fall in the test solution, and the need for the addition of more sterilizing powder at once indicated.

3. If for any reason the supply of standard sterilizing tubes should fail, it will be found that three times as much fresh, clean, dry, loose bleaching powder (which should contain 33 per cent. of available chlorine) as can be lifted on a sixpenny piece grasped at the edge between the thumb-nail and the tip of the first finger, and used as a spoon, weighs 2 grams, and corresponds to the amount contained in one of the standard sterilizing tubes.

4. A rough test of the condition of the water to which bleaching powder has been added may be made by taking a cupful of water from the tank fifteen minutes after the addition of the sterilizing powder, dissolving in it one each of the tablets "B" and "C" (starch and KI) and mixing thoroughly.

Should no colour appear, add another charge to the tank, and again apply the rough test.

5. A treated water, to be "safe," should at the end of fifteen minutes, always give a blue "reaction" on the addition of the tablets "B" and "C."

This method may also be used for the testing and sterilization of the water supplies of small communities. I hope shortly, as a result of a series of experiments now nearly completed, to publish further information on several important points concerning the action of bleaching powder on spores, the effect of "killing" the chlorine, etc.

In the meantime, I wish to express my thanks to Messrs. Parke, Davis and Co. for their valuable help in working out the details of a really practical method, and for agreeing to supply the testing outfit containing bleaching powder and tablets of potassium iodide and starch; to Sir John Brunner, Bart.; to Messrs. Burroughs and Wellcome; and to the United Alkali Company—all of whom have assisted me with valuable information. Finally, I must place on record my indebtedness to my assistant, Mr. W. A. Mitchell, who has carried out a number of the experiments for me and kept them going when I was occupied with other work, often of a very different kind, that has had to be done during the last few weeks.

AN American Red Cross steamer, carrying 125 nurses and 30 surgeons, sailed from New York about a week ago. Her first call will be at Falmouth.

SINCE the date of publication of the last Nyasaland Protectorate Sleeping Sickness Diary (December 31st, 1913), 20 more cases of the disease have been diagnosed, 15 in the Dowa District, 4 in the Marimba, and 1 in Zomba. This makes the total number of cases discovered in the Protectorate 192. A native boy, diagnosed on May 19th, 1913, is still alive and apparently well. Clearing of the bush round villages is still being carried on, and a small grant of money has been sanctioned for the purpose.