THE FIELD SERVICE FILTER WATER CART.

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The actual preparation of sterilised water is, as a rule, a simple matter, and most of the numerous methods of sterilisation, whether by heat, or by filtration, or by chemical means, may be trusted to render a polluted water safe for drinking purposes. Careful attention to detail is essential, but the manipulations involved are not generally of a complex kind. Nevertheless, the provision of sterilised water on field service is far from being an easy problem. The great difficulty is to supply the purified water with regularity and in sufficient quantity, amid the bustle and constantly changing conditions which are inseparable from active service; and to make arrangements which will ensure that every soldier in the field can always easily obtain safe water, no matter what his surroundings may be, and so that, however great his thirst, he will not be tempted to drink the first water he comes across. The very difficult nature of the supply part of the problem can perhaps only be fully appreciated by those who have had field service experience. Such difficulties are not confined to our own army, but are the common experience of all armies. For instance, with reference to the French army, Vaillard points out in his paper* on "L'Epuration de l'Eau Potable en Campagne," that although boiling requires no special plant other than the camp kettle, yet there are many difficulties, such as the provision of fuel, the time taken to raise the water to boiling point, and the time taken for it to cool; meanwhile you must control the thirst of the soldier, and in the end offer him water often unpalatable. After fully discussing the question from all points of view, he arrives at the conclusion that for troops on the march boiling and filtration are not practicable measures, and under such conditions he pins his faith to chemical sterilisation by iodine (Vaillard and Georges' red, white and blue "Tabloids"). It has also been recently placed on record from a German source, that great difficulties have been experienced in the attempts made to provide safe water for the German troops engaged in the campaign against the Herrerros in South-west Africa. Several kinds of filters and heat sterilising apparatus have been in use. Some of the filters clogged, others did not sterilise.

* Archives de Medicine et de Pharmacie Militaires, 40, 1902.
A large type of steriliser, mounted on wheels, was on trial, but the apparatus did not always work well and, in a country where draught animals were scarce, transport became a matter of great difficulty, and eventually these sterilisers had to be relegated to stationary camps and hospitals. Small sterilisers were also tried, but with similar results. In the end the soldier was instructed to do his own boiling, and he was advised to avoid water that had not been boiled. Dr. Schian, who gives this information, acknowledges that he himself had often drank unboiled water to appease his thirst, and he lays special stress on the great difficulty of compelling men, parched with thirst, to restrict themselves to the use of boiled water only.

Since the close of the South African War, the question of devising satisfactory means for providing sterilised water for the soldier on field service has received much attention in our own army. Different forms of apparatus have been tried, and every likely method of water sterilisation has received careful consideration, and the teaching of our experience is that the employment of more than one method will probably always be required to meet the variety of conditions obtaining on active service. Boiling and heat exchange apparatus can be effectively used in standing camps. While for use under circumstances where neither boiled nor filtered water are available, each soldier might carry a small box containing a supply of the red, white and blue "Tabloids," for Vaillard's iodine process, which is the most satisfactory of the present known methods of sterilising water by chemical means. The common source of supply, however, will be water sterilised by the field service filter water cart.

It is probably within the knowledge of many officers of the Corps that two demonstrations of the best known methods of sterilising water for field service purposes were given in London, at Millbank Barracks, in February and August, 1905. At these demonstrations the possibility of obtaining a satisfactory solution of the "safe" water supply difficulty, by the use of sterilising filters fitted to the ordinary service water cart, was clearly established. Since then, many improvements have been effected, and the outcome is the cart shown in the accompanying photograph. The trials of the cart have been so satisfactory, that the conversion of a large number of water carts to the "filter pattern" has been sanctioned. It is, therefore, important that the principal points connected with the sterilising fittings of the cart should be widely known, and it is with that object that the following description of the cart, and the instructions for its working, are given.
The cart is the latest pattern, iron, tank water cart, 108 gallons capacity, fitted with two pumps, two clarifying filters, and, for sterilising purposes, eight Brownlow filter candles. There is a small seven-gallon tank at the back of the cart which receives the sterilised water, and fitted to this and to tubes running along each side of the cart are twelve taps at which water bottles are filled. There is a wooden locker in front for carrying spare parts, and a kettle for sterilising the candles is strapped on the top of the locker. Two lengths of hose pipe, each having a rose fitted with wire gauze mesh at one end, and having a screw wing nut attachment at the other end, are carried coiled round hooks on the top of the tank.

*Clarifying Filters*—The main tank of the cart carries water which has been freed from suspended matter by being passed through the clarifying filters. The clarifying filters consist of compressed sponge contained in the two horizontally placed cylinders shown on each side at the back of the cart. Compressed sponge has been found the best material for this purpose; it can easily be cleansed by boiling.
Sterilising Filters.—Water is sterilised as required. The eight Brownlow candles are in two sets of four, placed in separate chambers, which are fitted inside the tank. This has been found the safest position, and the cart has been subjected to very rough usage without damage to the filter candles. Each filter candle is covered with a special filter cloth which is found to lessen clogging. The clarified water in the main tank is pumped through the sterilising filters. Each candle has its own delivery tube, or “swan neck” as it is called, which gives, perhaps, an appearance of complication and fragility, but it is considered better to have eight separate tubes than to have them run together so as to deliver from one, as alteration of the delivery from any one of the candles would give immediate evidence of defect, and show which candle was defective; and for a similar reason the tubes are made to discharge in the open.

A store of sterilised water is not carried, except the water that may be in the seven-gallon tank behind. The reason for this is that the water can be sterilised as fast as it can be distributed. Indeed, as twelve water bottles can be filled at one time, the filling of the water bottles can be carried out much more expeditiously than was previously possible from the ordinary water cart, and the possibility of the sterilised water becoming contaminated during storage almost entirely disappears. The pumping is not laborious. Both tanks can be readily got at for special cleansing.

The output of sterilised water is far beyond anything that can be obtained by any other method, namely, after nine days’ continuous use the yield of sterilised water was found to be 210 gallons per hour. Lastly, it has the advantage of not adding to army transport, as these carts are intended to replace the authorised water carts, two of which are now allotted to each battalion.

To ensure success, these carts will have to be placed in the charge of men who have been specially trained in the use and care of the filtering apparatus.

Some knowledge of the principles of water sterilisation should also be possessed by every soldier, as the success of this, as of any other scheme for providing sterilised water to troops in the field, depends largely on securing the intelligent and willing co-operation of both officers and men. It must be practicable to provide the soldier with sterilised water at all times, and in sufficient quantity, and there must be organised arrangements for its distribution, both on the march and in camp.

The instructions for the working of the Field Service filter water cart are as follows:—
The pumps, which are placed on either side at the back part of the main tank, are quite independent of each other in their action, and can be worked either together or separately.

Each pump serves one set of filters, namely, the clarifying and sterilising filter (4 candles) on its own side.

I.—To Fill the Main Tank.

Fix the lengths of hose to the elbowed unions, which are situated one below each pump. The rose end of the hose should then be dropped into the pond or stream.

Before beginning to pump, turn the cock placed between the horizontal clarifying filter and the vertical sterilising filter, so that the indicator mark points in the direction of the main tank. This shuts off the sterilising filter and opens the way for the passage of water through the clarifying filter into the main tank.

The pump should be worked at about fifteen to twenty strokes per minute. The distance through which the handle of the pump can be moved is limited, and it should be worked easily and without jarring. It is a mistake to attempt to force matters by pumping too quickly. Both pumps can, of course, be worked at the same time.

After filling the tank, remove the lengths of hose, and coil round the hooks on the top of the tank.

II.—To Pump the Clarified Water from the Main Tank through the Sterilising Filter.

Turn the cock (see 4) so that the indicator mark points in the direction of the sterilising filter.

If not already in position, fasten the bent delivery tubes (swan necks), by means of the wing nuts, to the eight ends of the metal tubes which come through and project above the cover of the filter cases containing the sterilising candles. The wing nuts should be screwed up so as to make a tight connection.

The free ends of the swan necks should be brought together in two sets of four, so that each set of four delivers into one of the two circular openings on the top of the small sterilised water tank situated at the back of the cart. The lids for covering these openings should be kept tightly closed except when filtering is going on.

The pumps are worked as for filling the main tank (see 5).

If any tube is observed to be working defectively, the working of the sterilising filter should be stopped, the swan neck
of that particular candle removed and a plug screwed in, so as to throw that candle out of use until time can be obtained for its examination. The filtration can meanwhile be resumed with the remaining candles in use.

(12) There are twelve taps at which sterilised water may be drawn. The large tap underneath the small tank is intended for filling kettles, and through it the tank should occasionally be flushed out.

(13) After filtering is finished, remove the swan necks and store them in the wooden locker in front, placing one of the plugs provided for the purpose in each of the openings of the tubes from the candles.

III.—CLEANSING AND STERILISING THE CART AND FILTERS.

(14) Flush out the large tank once a month, or once a fortnight if very muddy water is in use. The small tank should be flushed out with boiling water once a week. When a cart has been standing unused for a time, both tanks should be carefully cleaned out before the cart is taken into use.

(15) The filter candles should be removed every three days, and, without removing the filter cloth in which they are wrapped, they should be placed in cold water in the flat kettle, and the water raised to the boiling point.

(16) Every sixth day, the filter cloths will be removed for examination of the filter candles. If the inside of the filter cloth is dirty, it may be rinsed in boiling water, but it should never be scrubbed.

(17) If the candles are dirty, scrub the surface well with the brush supplied for the purpose, rinse in clean water, then replace cloths and boil.

(18) Once a week, remove the sponges from the clarifying filter and rinse in boiling water; boil them once a fortnight.