A VERY EFFICIENT TYPE OF SWIMMING BATH.

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Possibly other hygiene officers, like myself, have been asked while serving abroad to advise on the erection of efficient swimming baths. It is hoped the following notes may be of use to them as it is difficult to obtain plans of a modern plant when on foreign service.

A very efficient type of swimming bath, with a capacity of 64,000 gallons, has been recently erected in the Y.M.C.A. at Kowloon (Hong Kong). The bath is fitted up with the most up-to-date filtering, aeration and sterilization plant.

The general outline of the scheme is as follows:—

Fresh water from the drinking water supply of Hong Kong is used. The water passes from the bath in a constant circulation through an opening at the bottom of the bath, near the deep end, then through a coarse screen to a pump where it is pumped into pressure filters of the "Candy type." Before entering the filters, alum is added to the water in order to form a gelatinous precipitate on the surface of the filters. After
passing through the filters the water passes (through the heater in winter) to the aerator, where it is aerated by an air compressor, and finally, before reaching the bath again, it is treated with chlorine and enters the bath at the shallow end.

In addition, owing to the tendency for some of the heavier particles of dirt, etc., to settle out on the bottom of the bath and remain there, a separate suction pump with a nozzle, capable of being moved all over the bottom of the bath, is supplied and used daily.

A certain amount of fresh water is added daily to replace loss by evaporation, etc.

The water is circulated from 5 a.m. to 10 p.m. daily.

Fig. 1 shows the general lay-out of a complete installation.

This swimming bath is run on "the constant filtration" method, which is a considerable improvement on the former practice of filling swimming baths two or three times a week. Among obvious advantages are: (1) Economy in water; (2) the water is at all times under direct control; it is filtered, aerated and, after chlorination, returned to the bath, clean,
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sparkling and bacteriologically pure; the water in the bath completes the cycle every six to twelve hours; (3) economy in coal consumption for heating, as owing to the fact that the same water is used only a few degrees of heat are lost.

Modern dressing rooms are supplied, separate for the sexes. Each individual is required to wash with soap and water under a hot shower spray in a cubicle before being allowed into the bath.

Various notices are displayed requesting bathers to observe the rules of hygiene.

The bath has a special type of spitting trough, with separate drains, fixed all round the edges.

An average analysis of the bath water weekly is:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids</td>
<td>5.4 parts per 100,000</td>
</tr>
<tr>
<td>Free ammonia</td>
<td>0.0011</td>
</tr>
<tr>
<td>Free chlorine</td>
<td>0.002</td>
</tr>
<tr>
<td>pH</td>
<td>Value 7.5</td>
</tr>
</tbody>
</table>

The photograph (fig. 2) shows the swimming bath. The bath and floors are covered with white tiles, also the spectators' gallery; there is overhead lighting; the diving boards, water chutes and water polo goals are movable fittings, so that the bath can be used for racing purposes. The diving boards can be tilted up flat against the walls.

The water is drawn from the deep end of the bath by a centrifugal pump, which can be driven by any available source of power. The most convenient is a direct couple with an electric motor, but where electric current is not available a steam or oil engine can be used instead.

Fig. 3 shows the alumina apparatus, which is self-explanatory.

The floating arm contains a vulcanite regulator on the top for setting the rate of flow. The orifice of the regulator is always at the same level beneath the surface of the solution and consequently the discharge remains constant, irrespective of the depth of solution in the tank.

The tanks are made of wood, lined with lead to resist corrosive action. Where necessary, when dealing with waters which have not much temporary hardness, soda can be added from a similar apparatus, except that the tanks are made of galvanized iron instead of wood.

To remove large particles, such as fluff from bathing costumes, etc., the strainer can be cleaned by lifting the cover and removing the perforated strainer. The cover is secured by a single lever quick-acting shutting device for this purpose.

The filter may be either a pressure or gravity type, and in choosing between them the main considerations are the capacity of the plant and the level of the site available. For large baths gravity filters are cheaper to instal. Pressure filters have the great advantage that they can be placed at any level, whereas gravity filters must be placed so that the water can flow by gravity either from the bath into the filters or else from the filters...
back to the bath, i.e., the filters must be either entirely below or entirely above the level of the bath.

The filter consists of a bed of specially graded sand and gravel supported on a false floor, in which are fitted the Candy patent nozzles. The water admitted at the top, filters downwards through the sand and out through a pipe at the bottom.

After twenty-four to forty-eight hours working, sufficient dirt will have accumulated in the filter to necessitate cleaning. The cleaning is effected by an upward wash of water accompanied by a violent agitation or scouring of the sand. This scouring is obtained by either of the following methods:

(a) The air scour, in which compressed air at five to ten pounds per square inch pressure is blown into the bottom of the filter.
(b) The hydraulic scour, in which jets of water are discharged from an
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Arm placed just above the surface of the filter bed and rotated by hand mechanism when the filter is being cleaned.

The nozzles in the false floor serve to collect the filtered water evenly and also to distribute evenly the upward washwater and the air. In the air scour type the nozzles have stems projecting below the false floor. A small hole is provided at the top of the stem just sufficient to pass the correct quantity of air. The air when blown in rises to the underside of the false floor and passes up through the small holes into the filter, the main mouth of the stem being automatically sealed with water. The upward washwater passes up through the main mouth of the stem.

The even distribution of the air and water for cleaning is most essential as otherwise the filter will become patchy and its effective area will be reduced. With the Candy system the whole of the bed is cleaned and no dirty patches are left anywhere.

The quantity of washwater required is about one per cent of the water treated, and either the bath water or town water, or both, can be used. In

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*Fig. 4.—Section of Candy Air-scoured Pressure Filter.*
large plants it is better to use the bath water for cleaning the filter and to add fresh town water as make-up water in the bath.

A section of an air scour pressure filter is shown in fig. 4.

The water after passing through the filter is perfectly clear and bright, but there still remain two or three further operations to complete the treatment. The water passes into an open aerating tank and a continuous stream of air is blown up through it by a small air compressor. This air compressor is driven either by its own motor or by a belt from a pulley on the pump shaft. The object of the aerator is to release any gases dissolved in the water and to restore its natural sparkle. For this purpose an open aerator is of much greater benefit than an enclosed one. In the latter type there are no means by which the dissolved gases can escape. If economy is essential the aerator and compressor may be omitted without sacrificing the main purpose of the plant.

The only remaining part of the treatment is to supply the water with the necessary heat to make up for heat losses. It is often erroneously supposed that the installation of a continuous filtration plant appreciably increases the normal heat loss. A moment's consideration will show that the loss of heat that occurs during the short period in which the water is circulating through the filtration plant cannot be at a much greater rate than when the same water is standing in the open bath. The length of time for one portion of water to pass right through the system is a matter of minutes only, whereas for a further six to twenty-four hours that water is in the bath. There is, however, a slow but steady loss of heat in all cases where the bath is maintained at a higher temperature than the surrounding atmosphere. This loss of heat will be only a very few degrees per day and will be exactly the same as when the bath was filled with clean water by the old method.

In existing baths, where there is already an arrangement for heating the water by blowing steam into it, there is no need to instal any additional heating apparatus. In new baths a steam calorifier can be installed as an integral part of the plant.

It is every day becoming more possible to supply electrically the small amount of heat required. Where the Municipal Corporation own both the baths and the electrical power station, arrangements can often be made that are advantageous to both concerns. The saving of labour at the bath is considerable as no steam boiler has to be attended to. The electric heating elements are placed either in the bottom of the filter or in the aerating tank or in a separate vessel provided for the purpose. From the point of view of the power station the load is an ideal one as it can be arranged to be on continuously during the day and night and turned off during the few hours of the peak load. Under these conditions, the electric current can often be economically supplied at 3d. per unit or even less.

Before again reaching the bath the water is treated with a small dose of chlorine, which, by absolutely destroying the bacteria, prevents risk of
infectious diseases being spread by an infected bather. The chlorine can be used either in the form of chlorine gas or chloride of lime (bleaching powder), and the usual dose is \( \frac{1}{2} \) to 1 part of free chlorine per 1,000,000 parts of water (5 to 10 pounds free chlorine per 1,000,000 gallons of water).

The bleaching powder apparatus is similar to the alumina apparatus, except that the dissolving tank is replaced by a mixing churn; and for a continuous twenty-four-hour run the solution tank is supplied in duplicate, so that the solution can be settling in one tank while it is being discharged from the other.

The plant installed in the Y.M.C.A. cost about 15,000 Hong Kong dollars—this does not include the swimming bath—roughly about £1,000 to £1,500.

The bath has only been opened a few months and 45,000 individuals up to date have used it. It is well patronized by men of the Services.

I am indebted to J. H. Hunt, Esq., Secretary of the Y.M.C.A., for his kindness in demonstrating the details to me, to the Candy Filter Co. Ltd., Hanwell, who supplied the plant, for the diagrams and photograph, and to Colonel C. D. Myles, O.B.E., A.D.M.S., China Command, for permission to send this article for publication.