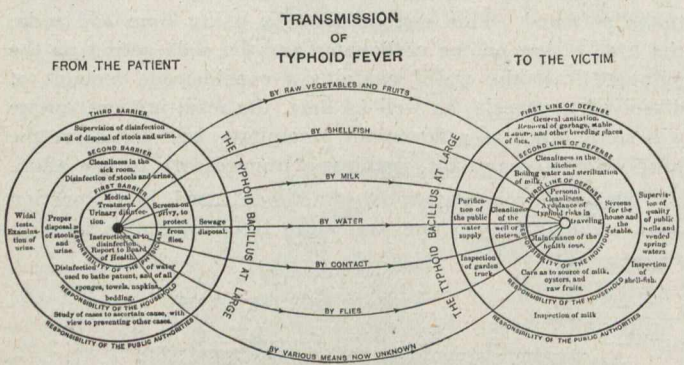
Mechanical Filtration

Mechanical filters, as they are now built, consist of comparatively small, water-tight concrete basins containing a layer of sand, coarser than is used for sand filters, underlaid with a thin bed of gravel in which is imbedded a gridiron system of pipes known as the strainer system. The water to be filtered passes downward through the sand into the strainer system to the outlet pipes. The rate of filtration is many times larger than that of sand filters, often being as high as 125 million gallons per acre per day, this high rate being made possible by the large size of the flakes resulting from the preliminary chemical coagulation of the water. With this high rate it is evident that such a filter must clog rapidly. Instead of having to be cleaned at long intervals it is necessary to clean the filter almost daily and even two or three times a day. To do this by scraping would be impossible. Arrangements are therefore provided for washing the sand in place without removing it from the bed. This is done by reversing the flow of water so that it passes upward through the filter, dislodging the accumulated dirt from the sand and carrying it off through gutters into the sewer. In the early types of these filters mechanical devices were used for stirring the sand while it was being washed, and this gave rise to the name "mechanical filter." These mechanical devices have been generally abandoned, compressed air being substituted. In some cases not even compressed air is used, dependence



being placed upon a greater velocity of the wash water. During the process of washing the upward rate of filter is several times greater than it is during the ordinary time of filtration when the filter is in service. The quantity of water used for washing is from 2 to 4 per cent.

Mechanical filters are generally built with many units, as the filter beds have to be frequently put out of service on account of cleaning. This multiplication of units makes a complicated plan, and the necessity of providing devices for accurately applying the chemical to the water in a precise quantity still further complicates this process. Greater care is therefore required in the operation of these filters and close attention has to be paid to the rates of filtration, the loss of head, etc. Yet, although complicated, there is nothing especially difficult in filters of this type, and many plants have been in successful use for a long time.

Choice of Method of Filtration.

Where filtration is contemplated there is frequently a discussion as to the relative merits of sand filtration and mechanical filtration. The question is sometimes a difficult one, but generally speaking, sand filters are to be preferred where they can be used, namely, with waters that, though polluted, are comparatively clear and colorless, as they are simpler to operate and suffer less by possible neglect. If the color and turbidity are considerable, or if questions of water softening are involved, mechanical filters may be advisable. Sand filters usually cost more to install but less to operate. Mechanical filters can be often put in cheaper, as the structures are smaller, but the annual charges for chemicals and for labor are larger. Local conditions as to site, etc., always figure very largely in a choice between the two methods and the matter is one best left to the expert in such matters.

Aeration.

Many years ago aeration was looked upon as a very important part of water purification, especially in the natural processes of water purification. Then for a time, after bacteriology had shown that aeration would not kill bacteria to any extent, it fell into the background. Recently a new impetus has been given to this process, not only in connection with water purification but with sewage purification. In purifying sewage by the method of sprinkling filters it has been found that aeration is necessary and various devices have been made for sprinkling the sewage upon the beds or spraying it into the air from nozzles. It has been found also that aeration is of decided benefit in the purification of waters that contain odor-producing organisms such as diatoms and various kinds of algæ. Aeration accomplishes two purposes. The exposure of water to air in thin films causes it to take up oxygen from the air, if it be deficient in oxygen, and causes it to liberate dissolved carbonic acid and various odoriferous gases, if such are present. The process is one not only of oxidization but of decarbonation and deodorization. A notable example of the use of thorough aeration in the purification of the old Ludlow supply is at Springfield, Mass., which during hot weather was highly charged with **Anabaena,** one of the most troublesome of the bluegreen algæ. By the use of preliminary aeration and intermittent filtration through sand and subsequent aeration of the effluent, was found possible not only to remove the algæ themselves but to get rid almost entirely of the resulting odors. This plan has been so successful that it was adopted in a much more extensive form in the design of some recent filters for Brisbane, Australia. The process of aeration, therefore, bids fair to be a most important one in many future water purification plants.

Disinfection.

Many attempts have been made by chemists to provide a means for suitably disinfecting a water supply, that is, of poisoning or destroying by chemical means the bacteria in the water. Copper sulphate has been found effective in destroying growths in water, even when used in very minute quantities, such as a few pounds of blue vitriol in a million gallons of water, but it has not proved successful in destroying bacteria without using very large quantities of the chemical.

Ozone has been suggested and is used abroad, to a slight extent, for this purpose. It is reasonably effective but thus far has proved unreliable and very expensive, much more expensive, in fact, than the purification of water by the ordinary methods of filtration. It does not remove the suspended matter in water nor does it decolorize to any great extent.

Recently the use of chloride of lime has been advocated in many cities for disinfecting public water supplied. When put into water nascent oxygen is liberated and this reaction has a destructive effect on bacteria. Comparatively small quantities are needed, say 25 pounds per million gallons, sometimes even as low as 10 or 15 pounds. It often enables a sand filter to be operated at higher rates and a mechanical filter to be run with smaller quantities of coagulant. It has even been used in some cases without filtration, but this should be regarded only as an emergency measure.