In the first instance the system failed because the land was of stiff clay and entirely unsuitable for purposes of either surface or sub-irrigation.

In both cases the system failed because it did not meet local conditions.

The fact that a septic tank in some other locality discharging probably into a large volume of water where it may only have been necessary to remove grosser solids, had no application in this case. Again the fact that septic discharges may have been discharged with a certain amount of efficiency into friable sandy of gravel land and lost by evaporation, absorption and oxidation, did not apply in this case. The history of the sewage disposal of this House of refuge was one of finding out by experiment what the local conditions were, instead of first examining the local conditions and designing a system to suit them.

The local conditions as summed up by the author may be stated as follows:—

(a) A House of Refuge providing accommodation for about 100 people, producing on the average about 3,000 gallons of sewage per day of 14 hours.

(b) Ample fall from the base of the building to the stream receiving the final effluent.

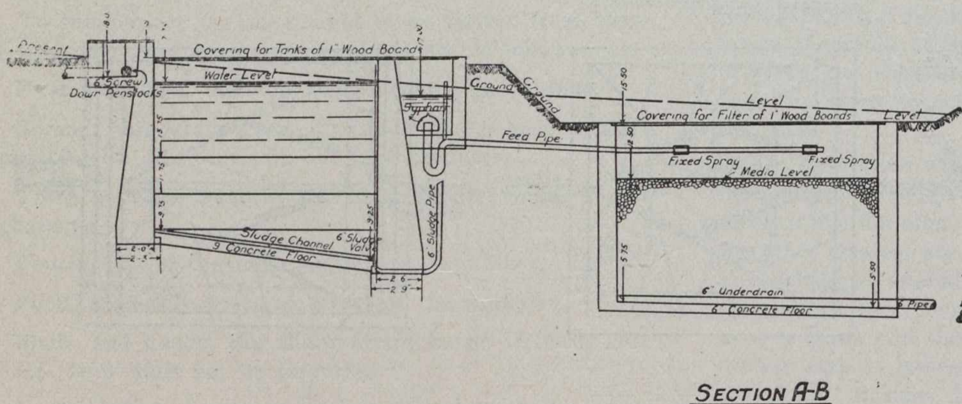

Fig. 2.

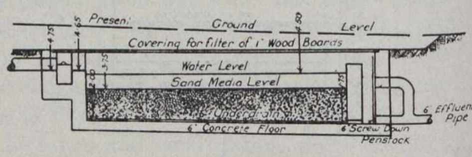

Fig. 5.

(c) A small field presenting about 15 feet of fall located about 60 yards south of the "House" and the property of the "Counties."

(d) A character of subsoil in the neighborhood entirely unsuitable for sewage irrigation.

(e) A stream capable of receiving the volume of sewage discharge, if it was rendered (1st) non-putrescible, and (2nd) non-pathogenic.

The particular field south of the "House" on which the present disposal system existed was selected for the new works. Owing to the non-absorbent character of the land and its proximity to the main road, it was considered that the works most suitable were of the type which has been called "Biological," providing artificial filtration and ignoring the subsoil for this purpose.

Three distinct processes were considered necessary in order to produce an effluent which could with safety be discharged into the stream, these were as follows:—

1st. Sedimentation of solids by natural precipitation.

2nd. Oxidation of the sedimented liquid by means of percolating filters.

3rd. Removal of bacteria by means of sand filters.

With reference to sedimentation and oxidation Fig. 1 shows plan of sedimentation tanks in duplicate, together with a percolating filter fitted with 4 unit fixed sprays. The sewage first enters a small chamber at A, where, by means of hand penstocks, it can be diverted into either sedimentation tank. The tanks are provided with scum boards to keep back floating matter, while the principle of immediate separation of the precipitated solids from the flowing sewage is adopted by provision of a wire reinforced glass apron covering the sludge storage area. The sedimented liquid is passed into a syphonic discharge dosing chamber, and then by means of 6-inch cast iron pipes to four fixed sprays, where it is distributed over the surface of a percolating filter consisting of coarse gravel from 1 inch to 1½-inch cubes in size. The percolating filter is never in a state of saturation but every drop of the liquid sewer is exposed to atmosphere during its downward course. The filter is well underdrained as shown. The oxidized liquid is then passed on to the final sand filter. Fig. 2 shows a section through the sedimentation tank and filters, while Fig. 3 shows a cross section of the sedimentation tank, location of the sludge apron, scum boards, and slopes for movement of the sedimented sludge to the storage area. At the apex of the sludge apron and under it, air pipes are fixed to take care of the gases produced by the decay of the stored sludge. The arrangement is intended to produce a sludge which is thoroughly septized and innocuous from a nuisance point of view.

Figs. 4 and 5 show respectively a plan and section of the sand filter treating the oxidized effluent from the percolating filters. These filters are in duplicate, so that either can be used independently to allow of cleaning and removal of sand. One foot three inches head of liquid is provided over the surface of the sand in order to overcome the friction of the sand particles, while a value and base outlet is used for emptying the filters at any time.

The system is, generally, based upon the following capacities and dimensions:—

Sedimentation tanks in duplicate 12 ft. 0 in. by 4 ft 0 in. by 9 ft. 3 in. at sludge outlet end, with a capacity of 4,500 gallons, or at 3,000 gallons per day of 14 hours equal to 21 hours' flow. At certain hours of the day the flow per hour will exceed the above ratio considerably. The average velocity flow through the tanks is approximately .3 feet per minute. The sludge storage area has a capacity of 8 cubic yards, and approximately a storage capacity of about from three to four months of 85 per cent. water and sludge residue, based upon the sewage sludge of purely domestic sewage. It is anticipated that the sludge will require removal after from 3 to 4 months' septic action to sludge drying beds. These are provided at a level to which the sludge can be drawn by gravitation from the base of the tanks.

The percolating filter is 14 ft. .0 in. by 14 ft. .0 in. by 7 ft. .0 in. deep, equal in capacity to 50 cubic yards. At 3,000 gallons per day the rate of filtration will, therefore, be 60 gallons per cubic yard. This is a much less rate than is generally provided for on account of the use of pebbles in lieu of clinker or broken stone. It is anticipated that this filter will take some time to arrive at maturity, the usual period for pebble filters being from 1 to 2 months.