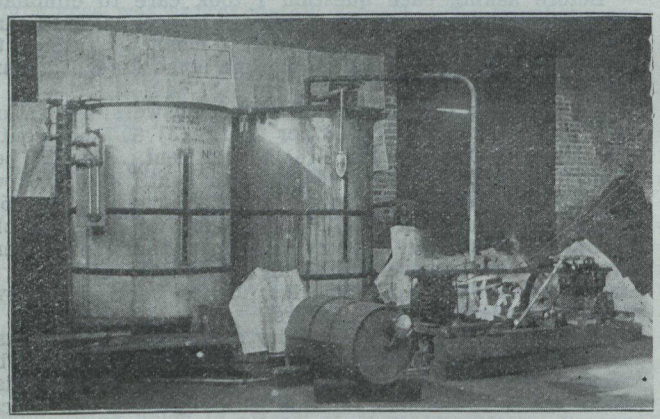
Purifying Sewage by Blowing Air

BY R. O. WYNNE-ROBERTS,

The photograph given below illustrates a small experimental plant recently installed at Regina to see what could be done by blowing air through sewage. The aeration of sewage is by no means a new development, for Messrs. Dibden and Dupre conducted experiments on the aeration of London sewage prior to 1884, and since then many have tried to purify sewage by blowing air, but the results obtained were unsatisfactory. The process was not the same in these experiments; in some instances air was applied to sewage in tanks, others to sewage as it filtered through gravel and sand. Some tried aeration on precipitated sewage, that is after the bulk of the sludge has been eliminated, but no appreciable change was noticed. Later on, the Massachusetts State Board of Health made some experiments at Lawrence, on the cultivated algae, which imparts oxygen to the waters in which it grows. More recently, Fowler and Mumford inoculated sewage containing some iron salts, with a certain organism, and by aeration obtained a well clarified effluent.

Following on this, Messrs. Ardern and Lockett, of Manchester, were able to aerate sewage and obtain excellent results. It was with the object of trying Ardern and Lockett's method of sewage treatment that the writer had two 600 gallon tanks installed at Regina. These tanks are ordinary rain water tanks, with narrow vertical glass windows inserted to observe the process. One tank, that on the right, was connected to a small centrifugal pump, so that the sewage was withdrawn at the bottom and returned over the top. In its return, however, the sewage was made to pass through a constructed throat, similar to an injector, causing the velocity of flow to be greatly increased, and air to be thereby drawn in. The mixture



Experimental Plant at Regina for Testing Sewage

of sewage and air passed down a vertical pipe in the centre of the tank, and discharged against a conical deflection plate which threw the current outwards to the perimeter. Owing to the surplus energy applied to the sewage in this case, the temperature rose gradually from 58 deg. Fahr. to 87 deg. Fahr., and the result that the brochannical changes were probably intensified. The first charge of sewage was that got from the Disposal Works, which is located about three miles from the centre of the city. After two days blowing some concentrated pail sewage was put in and this was repeated several times, so that the contents of the tanks were highly concentrated, and evil smells might be expected, but were entirely absent. The sewage in No. 2 tank was kept in a state of vigorous commotion and circulation, and its character were different to that in No. 1 tank.

In the case of the other tank—No. 1—the air was compressed by means of an old Ford automobile engine. The air was discharged into the tank in a diffused condition through perforated pipes wrapped with canvass sleeves. There was an old gasolene barrel inserted on the pipe line to act as a receiver and to remove the pulsations caused by the compressor. In this case it was a system of straight blowing in of air under slightly greater pressure than that due to the depth of sewage. The distribution pipes were placed on one side of the diameter, and the air in raising to the surface, caused a very perceptible current, and by this means no doubt the air was held in contact with the sewage for a longer period than if the air was distributed over the entire tank floor. Pail sewage was also placed in No. 1 tank.

As Ardern and Lockett found that about fifteen cubic feet of free air was necessary per square foot of tank area per hour, the experiments were conducted on this basis as far as was possible. The air was measured by means of a 3-8 inch circular orifice in their brass plates. In No. 2 there was a negative pressure due to suction, and the height in inches that wate was drawn up a glass tube gave the information, by which the quantity of air drawn in, was computed. In No. 1 the pressure was positive, and the brass plate was inserted in the air pipe; a water gauge indicated the different pressures on the inlet and outlet sides, and the differential pressure afforded the data for computing the quantity of air that was supplied. An electric motor was belted to the centifrugal pump and air compressor, and the entire plant was simple in arrangement, easily taken apart, entirely open to inspection and was cheap to operate, as it was located in the boiler room of the Power House in the City, and operated by the men there employed.

There are points in this method of treating sewage that require careful attention, especially in certain parts of Canada.

The temperature of the sewage must be maintained at about 60 deg. to 70 deg. Fahr. If it falls below 50 deg. Fahr for a prolonged period, the results are inferior, while if the temperature exceeds 85 deg. Fahr. it has a marked effect on the results. Some waters in Canada normally have a low temperature, and in winter time the temperature of sewage at the Disposal Works is not much above freezing point. In such cases the air will require to be heated, which can be easily done.

The quantity of air required to aerate sewage for effectual oxidation must be steadily maintained, and thorough diffusion produces much better results than jets. There are porous plates on the market to diffuse the air as it discharges into the sewage, and doubtless it will be possible to use various materials for this purpose. There is a careful and consistent effort now being made to reduce the quantity of air required. In fact, certain investigators are obtaining excellent results with less than one half the quantity of air already mentioned. An increased depth of the tank will keep the air in contact with the sewage for a proportionately longer period than shallow ones, and the aim of experimenters is to devize a method by which the oxygen of the air is thoroughly absorbed in its passage through commingling with the sewage.

Messrs. Ardern and Lockett aerated one portion of sewage until it was thoroughly nitrified, they then decanted the superiratant water and added more sewage. The process was repeated until the quantity of activated sludge accumulated amounted to about 25 per cent. of the capacity of the vessel. They found that it took about 6 weeks to purify the first portion, and after decanting the superiratant water and adding fresh sewage, it took much less time to purify the second charge, and so on until the time required was reduced from 6 weeks to 6 hours. Indeed, at Salford, England, excellent results are daily obtained by blowing air into sewage for 1½ hours.

This process is applicable for diluted sewage, and for concentrated sewage. The writer is informed that the results obtained with Chicago packing house sewage, which is probably the most difficult in America, leads the investigators to be optimistic. It is being applied to refractive sewage containing large quantity of trade waste and the engineer in charge expects to reduce the cost of treatment down to about one-half that when using lime and chemicals, and obtain superior effluent.

The sludge in the process is brown in color, gelatinous in consistency, separates from water easily and becomes granular when dry. It contains a high percentage of fertilising constituents and will probably be in great demand for gardens, etc.

The writer saw at the Illinois University several pots of wheat grown under identically the same conditions, but fertilized with different manures. That fertilized with

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