used. It requires to be cut in the fall or early spring when no leaves are on. The cost of cutting, bundling, hauling about half a mile and placing the brushwood in the filter was $1.20 per cubic yard, a figure much below that for which any ordinary medium could be obtained. The results have been so satisfactory that brushwood as a medium is being used generally at the North Toronto plants, when any filter needs refilling. The open nature

Putting Brushwood Into Press.

of the brush allows good aeration, and it is very efficient when working at a high rate of flow. The rotary distributor also seems well adapted for this type of filter. It gives a good distribution, does not require a great deal of attention and requires only about a foot of head for its operation.

For small installations, particularly where operating charges are of great importance, it may be a long time before the activated sludge process with the introduction of power that it entails, can compare favorably in cost of construction and maintenance with a plant consisting of sedimentation tanks and brushwood filters. Furthermore, an examination of the two processes will show that they are not so different in principle as at first sight they appear to be.

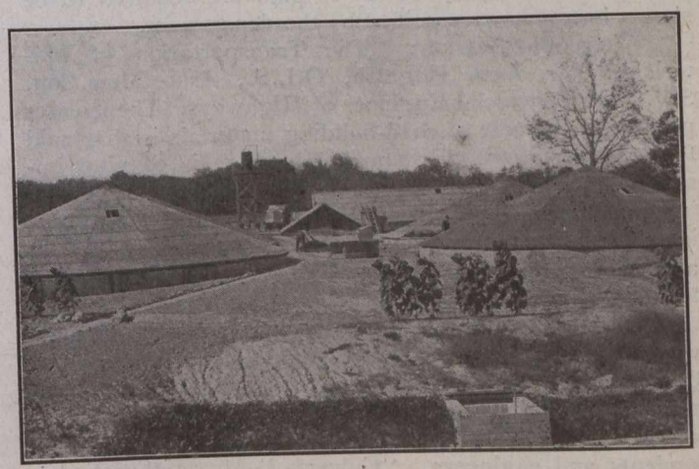
The activated sludge process by the mechanical aeration of sewage induces the growth of organisms on particles of sludge and by a mixing process brings these sludge particles into contact with all parts of the sewage, so accomplishing the process of oxidation and nitrification. The percolating filter accomplishes the same purpose by the reverse process, the organisms being stationary on the medium of the filter and the sewage brought into contact by trickling over the gelatinous substance in which they are contained.

Most recent methods of sewage disposal show that the three main conditions necessary for the effective purification of sewage are: Sufficient aeration, a suitable medium for the growth of nitrifying organisms, which must be brought into intimate contact with all parts of the sewage, and the maintenance of the sewage at a moderate temperature. In the activated sludge process the introduction of the necessary power and machinery for air compressing adds very much to the operating costs, and any process which would automatically maintain the required conditions would naturally recommend itself, provided that the results were satisfactory. The above experiment has shown that the brushwood filter maintains fairly well the conditions set out above, without the introduction of power. Constructed with a good system of underdrains and with a space between the walls of the filter and the brushwood mattresses, the air has very free circulation throughout. The brushwood does not get compacted or lose its spring but keeps quite open, and given proper ventilation, with the falling of a large volume of sewage through the filter, the air contained is constantly being changed.

Brushwood also shows itself to be particularly suitable as a medium for inducing the slimy growth characteristic of sewage filters. The thick coating of this slime over every particle of the brush is in marked contrast to anything that can be seen on a medium such as stone or slag. Regarding temperature, it should be noted that the sewage at the experimental plant does not fall below 40° Fahr. in the winter, and rises to a maximum of 58° Fahr. in the summer; and, as the tanks and filters are all covered, the effluent leaves the plant at about the same temperature as the sewage enters. The temperature of the air at 4 feet above the surface of the filter is noted every day and only occasionally in the coldest weather does it fall as low as 36° Fahr. The temperature of the filter medium can be taken as that of the sewage itself; that it, usually ranging between 40° and 50° Fahr., a favorable working temperature which has probably an important bearing on the efficiency of the filter.

To engineers constructing filters of this type, it is recommended that they be made at least 7 feet deep if possible, and made up to this depth again when the bed has been in work for 12 or 18 months, in which time it will have shrunk down considerably. Nothing has been added to the one described since it was started, not because it is inadvisable, but because it would break the continuity of the experiment. A deeper filter would give the sewage a longer time in contact with the medium and should give better nitrification. A 7-foot deep filter could probably be worked efficiently up to 8 or 9 million gallons per acre per day.

The writer is of the opinion that a brushwood filter would satisfactorily treat raw sewage after passing through a coarse screen and detritus tank, without a preliminary treatment in sedimentation tanks at something approaching the rate of working obtained in the above plant, provided that the effluent were passed through a suitable humus tank, and we hope to be able to continue the experiment along these lines. Such a filter



Filters at North Toronto Sewage Disposal Plant.

might be constructed on a coarse grating over a two-story tank having a deep sludge digestion chamber, free air space being allowed all round, under and above the filter, the sewage falling through the filter directly into the tank. After sewage has been aerated, the suspended solids quickly settle out, and a retention period of one-