being clarified much more rapidly in the summer months than in the winter months. This can doubtless be overcome by using warm air when the temperature of the sewage is below normal.

In another series of experiments, samples of humus sludge contained in 80-oz. bottles were aerated for ten days, when the sludge had become thoroughly "activated." At the end of this time a sample of Wakefield raw sewage was aerated in contact with the "activated sludge," samples being taken every hour over a period of six hours. These results are shown in the following table:—

Experiments Carried Out in 80-Oz. Bottles.

Results Expressed in Parts per 100,000.

	4 Hours' Oxygen Absorption	Free and Saline Ammonia (as N.)	Albuminoid Ammonia (N.)	Nitrites and Nitrates (N.)
Crude sewage	8.44	4.429	1.371	.257
After 1 hour's aeration	1.73	2.071	.543	.557
" 2 hours' "	1.34	1.786	.400	.772
" 3 " "	1.18	1.600	.371	.800
" 4 " "	1.10	1.428	.314	.858
" 5 " "	1.02	1.214	.257	.858
" 6 " "	0.86	1.071	.200	1.000

NOTE.—The air being admitted by glass tubing, the results were not so satisfactory as those obtained where the air was diffused.

Following the results of the experiments in the barrel it was next decided to test the process on a much larger scale and a tank 30′ 0″ by 12′ 0″ by 6′ 6″, has been installed giving a capacity of about 11,000 gallons, exclusive of the "activated sludge." At the bottom of the tank ten sets of diffusers are fixed, four in each set, all connected to the main air delivery pipe. The air is forced through by means of an air compressor, consuming 90 cubic feet of air per minute, at a pressure of 5 lbs. per square inch.

A quantity of humus sludge, about 25 per cent. of the total tank capacity, was placed in this tank which was afterwards filled up with a weak night sewage. After aerating for a few days the results obtained were not satisfactory. Samples were taken at different depths, when it was ascertained that the sample from the bottom contained a great deal more sludge than the sample at the top of the tank.

Since the main object to be aimed at is the intimate contact of air and sewage in the presence of "activated sludge"—air to be in solution as much as possible—the arrangement in the tank is obviously wrong. The area of the tank is 360 square feet and the area of the diffusers is 40 square feet, therefore the surface of the bottom of the tank through which the air is admitted is only about 11 per cent. of the total floor area. The small bulk of sewage immediately above the diffusers is in rapid movement upwards, whilst 89 per cent., or the remainder of the tank, depends upon its supply of air and activated sludge by the falling backwards of the particles and by cross-currents. It was found that the "activated sludge" which should during blowing operations, have been in complete suspension and agitation, had deposited in banks on the spaces between the sets of diffusers. To obviate this difficulty the space between the diffusers was banked up in concrete in ridges about 18″ high and by this means every particle of sludge was kept in motion and any solids falling on the ridges were carried by the water above on to the diffusers and forced up again by the air. This method proved satisfactory, the sludge becoming "activated" very rapidly. At the surface immediately over the diffusers there is, however, violent agitation, which does not occur between the diffusers, and the formation of large air bubbles would seem to indicate that this method of applying the air is not uniform and that it will be necessary if the air is to be introduced at the bottom that the floor of the tank should be completely covered with diffusers, and if constructed of the present type on a large scale would be extremely costly. On the other hand the cross ridge and pocket formation would be most difficult to empty and cleanse. Whilst the aeration was proceeding it was apparent that the porosity of the tiles was very uneven and the tiles unsuited for the purpose, and that the ideal false floor which must be economical in cost and easily cleaned has yet to be evolved.

Since it appears that such a floor is imperative to the process an observation shaft 12 ins. square has been constructed for the purpose of experimenting with various materials and tiles. The shaft is so designed that it will be possible to observe the diffusion of the air and by means of taps placed in the side to take samples at depths varying from 1 ft. to 8½ ft.

The aerating tank is worked on the "fill and draw" principle, taking about ½ hour to fill, 2 hours blowing, 2 hours settlement, ½ hour to empty, making a five hours cycle.

In this tank the air is used for both oxidizing and agitating the sewage simultaneously, but it might prove of considerable advantage if the circulation of the sludge could be obtained by mechanical apparatus, using the air for oxidation only, thereby effecting a considerable saving in air consumption.

Whether the "fill and draw" method will eventually prove to be the simplest to work and give the best results, or whether a properly designed continuous flow treatment will be the more effectual remains for further investigation. If the engineering difficulties in the way of carrying out the process can be overcome it should be possible to purify sewage in tanks having a capacity of five or six hours' flow of sewage. At the present time tanks are constructed larger than this merely for the settlement or precipitation of the suspended matter from the sewage, but in the new process the suspended matter in the sewage is so altered in character that it settles very readily.

The "activated sludge" is quite inoffensive, dark brown in color, flocculent in character and separates rapidly and completely despite its low specific gravity, is inodorous and readily drained.

The chemical analyses of an average sample of the "activated sludge" and precipitation sludge are compared in the following table:—

Analysis of an Average Sample of Dried

	Precipitation sludge Percentage	Activated sludge Percentage
Organic matter	56.14	43.99
Mineral matter	43.86	56.01
Nitrogen, free and saline	—	.052
Total nitrogen (Kjeldahl)	1.30	4.59
Iron (Fe_2O_3)	4.34	9.67
Phosphate (P_2O_5)	0.95	2.74

The moisture in the precipitation sludge is 91.1 per cent. and in the "activated sludge" 96.73 per cent.

None of the forms of sludge generally produced are of much value as manure, but attention should be drawn to the abnormally high percentage of nitrogen in "activated sludge" as compared with ordinary unoxidized sludge.

Since the sludge in a dry state contains 4.59 per cent. of nitrogen it should become a saleable product of high