foot under a 2-inch water pressure, one which would pass from 10 to 12 cubic feet of air per minute created less friction, maintained more uniform diffusion, and was less liable to stoppage.

The sedimentation tank was built 28 ft. 4 ins. in diameter to a depth of 3 feet below water level, and 4 feet in diameter at a depth of 11 ft. 6 ins. below water level. The bottom being built of a slope about 1 to 1. The 4-foot diameter section extended to 34 feet below water level. A 12-inch diameter pipe extended from a few feet above the surface of the water to 9 inches above the bottom of the tank. An air pipe was built inside this 12-inch pipe through which the air is delivered to raise the sludge, accumulating in the bottom of the tank, through the 12-inch pipe to the top and deliver it either to the raw sewage or to the aerating sludge tanks.

The operation of this tank soon proved several facts: That a slope of 1 to 1 was not sufficient to keep the sludge moving towards the central chamber; that it would remain on this slope and become septic reducing the dissolved oxygen in the effluent; that the velocity through the tank was too great and double the detention period was necessary; that there was a distinct relation between the density of the sludge raised from the bottom of the tank and the velocity by which it flowed. That is, a high velocity would raise a wetter sludge than a low velocity of flow. Thus the 12-inch sludge riser pipe should be reduced to 6 inches; and moreover, the sludge should be taken downward, rather than upward, from the apex of the sludge chamber.

The best we could do with the plant as originally designed, was to put through about 750,000 gallons of coarse screened sewage per day and produce a clear stable effluent, reducing the bacteria about 95%, suspended matter 97%, and oxygen consumed about 80%.

Recognizing that the greatest defect was in the sedimentation tank, we improvised No. 11 tank, which had been designed as a sludge aerating and storage tank, into a sedimentation tank. This tank was 30 feet in diameter with an effective depth of about 9 feet. It was divided by a spiral wall into a continuous compartment about 6 feet wide and about 90 feet long.

Reference to Mr. Copeland's report will explain in detail the changes made in turning this tank into a sedimentation tank and need not be repeated here, but the facts observed during the period this tank was operated as a sedimentation tank were, that we obtained a satisfactory effluent at the rate of 750,000 gallons per day with an effective head equal to nearly one-fourth of the head in the main sedimentation tank and with about one-half of the cubical contents; that we satisfactorily treated 1,500,000 gallons of raw sewage through the aerating tanks and were in a fair way to increase this rate when our big pump went out of service.

In other words, the greatest defect of the plant was in the sedimentation end and not in the aerating end, and that the main problem which now confronts us is to design a sedimentation tank which will produce an uniform horizontal velocity of 3 feet per minute or a vertical velocity of 8 inches per minute and insure the complete removal continuously of precipitated sludge as rapidly as formed.

During the shutdown of the plant we decided, after thoroughly examining the condition of the filtros plates, to remove them, substitute new ones over the entire plant and start anew. The General Filtration Company magnanimously consented to co-operate with us and furnish us without cost all the plates we needed and to furnish the best it could produce.

The Connersville Blower Company revised the bearings of the two blowers it had furnished so that all oil would be eliminated from the inside of the blower casing, and we set up an air washer furnished by the Spray Engineering Company to wash and dry the air before it reached the blower. This new installation has just been completed and we hope within the next few months to obtain much more satisfactory results from our plant than heretofore.

Sludge Disposal.—To record all the details of the experiments we have made during the year in investigating the sludge disposal problem, would fill many pages. Everything which held any promise of success has been tried so far as time and labor have been available, to the end that we have determined primarily that activated sludge can be successfully dewatered and reduced to a fertilizer base at an expense less than its value, and that there is ample available market for all we can produce.

Early in the year H. R. Worthington furnished, at its own expense, a Berrigan Press, 6 ft. x 9 ft. in size. Mr. Berrigan, the designer, and Mr. Towle, the engineer for Worthington, carried on a continuous line of experiments with this press for several months, after which we operated it ourselves until the plant shut down.

Starting with the production of less than 100 pounds of pressed cake per pressing, the press was developed to a point where it produced about 1,800 pounds per pressing, containing 75% moisture.

The operation of the press was reversed so that the filter bags could be filled and emptied much more rapidly, and various types of bags were tried out. Investigations were made of the porosity of the bags under the existing conditions, their tendency to shrink, and the necessity for cleaning and repair. Careful estimates were made, so far as information was available, of the cost of pressing, including the cost and upkeep of the filter bags.

The approximate cost, based upon treating 100 million gallons per day, excluding overhead charges on building, is as follows:—

Overhead charges—10% of cost	$1.21
Labor—8 hours—3 shifts	1.36
Cleaning and upkeep of bags	.64
Power	.09
Contingencies	.16
Total cost, per dry ton	$3.46

From our investigations one-half a ton of dry sludge is produced from one million gallons of sewage treated, the approximate cost of pressing sludge would be $1.73 per million gallons of sewage.

From the information available at the present time, the approximate cost of drying and grinding the sludge, exclusive of overhead charges for building, are as follows:—

Overhead charges—15% of cost	$0.39
Labor—8 hours—3 shifts	.73
Fuel—one cent per 82,000 B.t.u.	1.10
Power—one cent per kw. hr.	.52
Grinding	.25
Contingencies	.18
Total cost of drying, per dry ton.	$3.17

On the basis of one million gallons producing one-half ton of dry sludge, the approximate cost of drying will be $1.59 per million gallons of sewage treated, or $3.32 per million gallons of sewage treated for reducing the sludge produced to a fertilizer basis.