judgment of the Falk Company of Pittsburgh, who distilled a sample of considerable size. This is about one-half the current price of good, saponifiable grease, containing less than 4% of unsaponifiable matter. Evidently the value which has been assigned to the recovered grease in previous statements regarding the economy of the Miles process should be correspondingly reduced.

Massachusetts State Experiments

The New Haven authors have referred to the report on the Miles process made by Messrs. Goodnough and Clark of the Massachusetts State Department of Health to a commission appointed by the legislature, and presented by that commission to the legislature early in 1918, and have stated that "these Massachusetts experiments (by X. H. Goodnough and Harry W. Clark) were made on a small scale in bottles, and an eighteen-hour sedimentation period was used, which seems somewhat unfair to the acid process which accomplishes the same results in four hours. The disinfection of the effluent, and the freedom of the process from nuisances, is, of course, ignored in such a comparison." As this report is made by a Massachusetts commission, and because its conclusions are contrary to the New Haven results, we believe it warrants discussion.

The experiments of Goodnough and Clark were made with three 2-gal. samples made up of aliquot hourly portions collected one day each week for several weeks. The sampling was apparently fair, but on account of the infrequency of the samples could not have been as truly representative as the portions of sewage used during the tests made by the Massachusetts Institute of Technology, amounting to a hundred thousand gallons of sewage. The small samples of sewage were acidulated with sulphur dioxide gas, settled, and the sludge collected and analyzed. While it is true that the sewage was treated with acid, enough departures were made from the Miles process so that it can hardly be called a test of that process.

The results compared with the Technology experiments show that 61% as much acid was used and 75% as much sludge; and 79% as much grease was recovered. These lower results may have been due either to a weaker sewage, or to insufficient acidification. But the most radical departure from the Miles process was in the use of an eighteen-hour period of subsidence in place of the four-hour period used in the Miles process. Using the longer period of subsidence, the state authorities came to the conclusion that there was not enough difference (25%) between the amounts of sludge obtained to pay for the acid used. In this conclusion no attention was paid to one of the cardinal points of the Miles process, namely that acid is used to accelerate precipitation; therefore it was hardly fair to compare it with an eighteen-hour period of subsidence, particularly so because no engineer would ever consider the use of so long a period of plain subsidence for the treatment of sewage.* The plan would be prohibited by the initial costs of the work, the local nuisances produced, and the small amount of purification effected by the treatment. Conditions at Moon Island—Where sewage is stored about four hours, on an average—which are bad enough, only approach those which would exist were sewage stored eighteen hours before discharge, and it is abhorrent to contemplate what the conditions would be if the sludge from these tanks could not be discharged with the sewage, but had to be otherwise disposed of. These were the conditions which in a great measure prevented the success of the plant at Cassel, Germany.

Absence of Local Nuisance

Apparently the report of the Massachusetts commission attaches little importance to the sterilizing effect of the sulphur dioxide and the absence of local nuisance, although that point was brought out in the report of the experiments conducted by the Massachusetts Institute of Technology. Furthermore, Winslow and Mohlman state that "it is particularly important from the point of view of the practical sewage-works operator to note that both effluent and sludge were so affected by the acid present as to be stable for considerable periods, so that with a plant of this type no local nuisances need be anticipated. During the whole period of our experience, there were only one or two occasions on which slight signs of septic action were noticed in the tank, and the sludge was stored in barrels for weeks without the production of offensive odors." They also state that "above all, however, the thing that counts most heavily in favor of the Miles process under the conditions obtaining at New Haven is its freedom from nuisance."

In view of the local nuisance produced by many a bacterial tank and filter, we believe the stability and freedom from nuisance of the Miles process effluent and sludge are worthy of all the consideration which previous experimenters, with the exception of Messrs. Goodnough and Clark, have given it.

The Practicability of the Process for Boston Sewage

It is interesting to apply the New Haven estimates of cost to the results of the experiments with Boston sewage which have been made under our direction. These experiments showed that Boston sewage yielded about 1,500 lbs. of degreased tankage, containing 4.53% of ammonia; also about 400 lbs. of recoverable grease per million gallons. With fertilizer ammonia at $4.00 per unit, the tankage is worth $18.12 per ton, or $13.59 per million gallons of sewage. Using 8.5c. as the price per pound for the recovered grease, which seems fair because this was the estimated value of the New Haven Boulevard sewage which contains about the same percentage of unsaponifiable matter as the Boston sewage), the grease would be worth $34 per million gallons.

Modifying the New Haven costs to correspond with the stronger Boston sewage, we have determined the costs as given in the following table, which also shows the costs of treatment of the Boulevard sewage of New Haven. We have not used the East Street sewage for comparison because it is not representative; it contains an unusual amount of machine oils and wastes from the metal industries.

TABLE 7—COST PER MILLION GALLONS OF TREATING 100,000,000 GALLONS OF CALF PASTURE SEWAGE DAILY, APPLYING THE UNIT COSTS ESTIMATED BY WINSLOW AND MOHLMAN FOR 16,000,000 GALLONS OF NEW HAVEN SEWAGE DAILY

	Calf Pasture Sewage.	Boulevard Sewage.
Tanks and buildings	$ 2.47	$ 2.47
Acid treatment	18.65	10.74
Drying sludge	10.35	2.04
Degreasing sludge	9.12	1.91
Redrying tankage	.10	.17
Superintendence	1.06	2.65
Labor on tanks and screens	1.00	1.00
Total cost per million gals	$42.75	$20.98

In applying the New Haven unit costs, we have made no subtraction on acount of the larger plant or the available tanks at Moon Island. Unit costs for all items except superintendence and labor are those used for Boulevard sewage; the unit costs for the superintendence and labor are those used for East Street sewage.

The estimated net financial result of operation is given in the following table.

In the above we have estimated the price of ammonia at $4 per unit. This is low at present. When ammonia is worth $4.50 a unit, the gross revenue would be $49.29, and the profit $6.54 per million gallons, and at $4.75 per unit, the gross revenue would be $50.14 and the profit $7.39 per million gallons. While the above estimate shows a profit under present conditions, it is probably true that under pre-war conditions the process would not produce a revenue; and in their conclusion, Winslow and Mohlman state that "our experience with New Haven sewage lends no color to

*It is obvious that if sewage be held for a period of days, all of the settleable solids would subside, and there would be little or no difference in favor of acid treatment, assuming, of course, that fermentation would not interfere with plain subsidence, as might be expected.