Hand-cleaning, 1,000 sq. yds. daily equals 6,000 sq. yds. per week at 17.53 cents per	$1.052
Washing with squeegee 1,000 sq. yds. 1½ times per week, equals 1,500 sq. yds.	0.1743
Total for combined cleaning once of 6,000 sq. yds. of street	$1.1795
Equal to a cost per 1,000 sq. yds. cleaned once of..	0.1966

This figure seems very low, and probably could not be duplicated in many other cities where the business streets carry a much heavier travel, but it proves that this system of cleaning need not be unusually expensive.

The cost where the flushing machines were used is reported to have been 31.57 cents per 1,000 sq. yds. cleaned once. Assuming that the streets were flushed one and one-half times per week, as in the case of the squeegee, the cost of the combined cleaning once of 1,000 sq. yds. will be found to be 25.42 cents, which must still be regarded as a very reasonable figure.

It should be noted, however, that in neither case do these figures of cost include the value of the water used for washing. The quantity of water required per 1,000 sq. yds. cleaned once as determined by trials in New York, is about 150 gals. for the squeegee and about 470 gals. for the flushing machines; but the cost of this water would be offset, in a measure at least, by the cost of that which would otherwise be used for supplemental sprinkling where the ordinary sweeping machine is used.

SLUDGE ACCUMULATIONS AT SEWER OUTFALLS.

The subject of the relation of sludge deposits to nuisance was discussed by Mr. Langdon Pearse, assistant engineer, Sanitary District of Chicago, at the recent meeting of the American Public Health Association in Washington, D.C.; the paper, slightly condensed, is given below.

The sludge nuisance in the Back Bay Fens in Boston, as reported by Mr. John R. Freeman to the Charles River Basin Commission in 1903, was so marked and the deposits of sludge so large for a small stream (amounting to one-fourth the entire capacity of the basin) that extensive dredging and the removal of the sewage by means of sewer extensions was recommended. In the case of the Providence River in Rhode Island, dredging has relieved conditions. No exact measurements or details, however, have been given.

In the report of the Sanitary District of Chicago, October, 1911, Mr. George M. Wisner, the chief engineer, has described conditions of the fill in the Main Channel of the Sanitary District and given analyses of the same. The anlytical data show a rather heavy material compared to the sludge found in sewage disposal plants, resembling more nearly a grit-chamber sludge than a true sewage sludge. The effect of the sludge on the water passing above in the canal is detrimental, although quantitatively difficult to express. From the most marked sludge deposits just above the power house, considerable ebullition of gas occurs in the summer, and even in the winter, which helps in maintaining the oxygen content at a very low level. In portions of the canal near the city, studies have been made on the distribution of oxygen in the cross-sections, and a difference has been noted between the content at the top and the bottom, the bottom usually being lower. Some variation has also been found between the two banks before mixing is complete, a distance of four to five miles. Where the oxygen content is low the distribution through the section is practically uniform, complete mixing having taken place.

The presence of large sludge deposits and scum in the arms of the Chicago River, known as the Stock Yards slip or Bubbly Creek, is responsible for a condition of nuisance and degree of odor which might not occur to such extent could the suspended matter be kept moving and even partially oxygenated. Dredging has been carried on at times.

In New York harbor, reference has been made to sludge deposits in the report of the Metropolitan Sewerage Commission, and comment has been made on the indications of oxygen in the lower layers of the water through the presence of a reddish surface on the black sludge. This phenomenon indicates the oxidation of the ferrous sulphide. This has also been observed in experiments in the laboratory of the Sanitary District of Chicago, where several inches of sludge were placed in the bottom of shallow jars, the liquid above containing oxygen.

A few quantitative experiments, made by Mr. H. W. Clark, are given in the report of the Charles River Basin Commission, 1903, in which two grams of mud or sludge were placed in ½-gal. bottles full of fresh water, or salt, and the reduction of oxygen was followed. In five days the oxygen in fresh water was reduced to an average of 61 per cent. saturation from an initial complete saturation, the extremes being a reduction to 81 and 33 per cent. saturation. An experiment was also made, with continuous flow, using 9 in. of mud in a tank 12 ft. deep, the liquid being at first 5 and later 7 per cent. sewage. In general the surface layers contained more oxygen. Comment is also made on the production of odors in tidal waters by bacterial reduction of the sulphur compounds in sea water. In the examination of the conditions in the Fens basin, referred to previously, it was found that hydrogen sulphide was formed which rose through 6 ft. of water. No oxygen was found below a surface layer 6 in. deep.

On the absorption of oxygen by sludge, some comments have been given by Mr. Almon L. Fales, supervising chemist of the Sewer Department in the city of Worcester, Mass. In 1903 he conducted some experiments on the aeration of sludge and liquid in a tank holding 1,500 gals., and found that in the early period of the experiments it was necessary to aerate several times a day, but later once in 12 hours proved sufficient. It was also observed that the dissolved oxygen disappeared much more rapidly in the layer just above the sludge. Occasionally after 12 hours or less had elapsed after aeration the dissolved oxygen would be exhausted in the layer just above the sludge, while the top liquid would still contain as high as 25 per cent. saturation. After the experiments had been continued for three weeks it was found that the liquid just above the sludge lost all dissolved oxygen in 24 hours, while the top liquid showed 125 per cent. saturation. The super-saturation was caused by the propagation of chlorophyl containing micro-organisms which gave the liquid a greenish tint. Similar phenomena can be noticed at times in streams of intermittent flow where the dilution is not sufficient to prevent nuisance.

In shallow, wind-swept waters, sludge deposits may prove a greater source of odor, owing to the constant agitation of the waves. An experiment has shown that any disturbance of sludge under water is undesirable from the standpoint of prospective odors.

Of the remedies at hand, dredging seems to be in general but a temporary expedient, aside from its value in cleaning up offensive conditions. Unless a hydraulic suction dredge be used and large space be available for the ponding of the sludge, it may be difficult to remove all the material which should be classed as sludge. With a dipper dredge probably only the more gritty material would be removed, although conditions may be much improved thereby. The composition of sewage sludge, as found in sedimentation tanks of various types, ranges from a specific gravity of 1.01 to 1.06, and seldom exceeds 1.10, the water content