washer throat has to be filtered, or sent to waste, the practical minimum limit with a normally designed plant is about 50% of the rated output, and the simplest working conditions are found at about 66% of the rated output. The loss of head in the stationary sand (column 5) has very little effect on the operation of the sandwasher. This loss follows the normal law of filtration loss of head, that is to say, there are slow increased losses of head at the beginning of a run which increase as the run proceeds.

TABLE—OBSERVATIONS ON LOSSES OF HEAD IN A TYPICALLY DRIFTING SAND FILTER

1	2	3	4	5	6	7	8
Duration of run in hours	Rate of fitration in millions of Imperial gallons per acre per day, based on plan area	Loss of head in sand-washer in feet	Loss of head in filtering through drifting sand in feet	Loss of head in filtering through stationary sand and under-drains, in feet	Induction head provided by sand-washer in feet	Diff. of head at bottom of drifting sand and in washer in feet. Col, 6 less Col. 4	Remarks
0	150	3.0	3.6	2.3	5.1	1.5	1 gr. per gal. of alum
5	150	2.6	5.2	1.7	6.1	.9	
10	150	2.6	5.1	1.9	6.0	.9	
15	150	2.5	3.8	1.8	4.8	1.0	
20	150	2.5	3.3	2.1	4.3	1.0	
25	150	2.5	3.2	2.4	4.1	.9	
30	150	2.4	4.0	2.4	4.7	.7	
35	150	2.4	4.1	2.5	4.8	.6	
40	150	2.5	3.9	2.8	4.7	.8	
45	150	2.5	4.0	2.8	4.8	.8	
50	150	2.5	3.7	2.6	4.3	.6	
55	150	2.6	3.7	2.7	4.4	.7	
60	150	2.4	3.4	2.7	4.2	.8	
65	150	2.5	3.3	2.7	4.0	.7	
70	150	2.4	3.2	2.7	3.8	.6	
75	150	2.4	3.7	2.9	4.3	.6	No coagulant
80	150	2.3	3.3	2.9	3.9	.6	
85	150	2.3	3.4	3.2	4.1	.7	
90	150	2.5	3.8	3.5	4.6	.8	1 gr. iron sulphate and ½ gr. of lime per gal.
95	150	2.6	3.5	3.7	4.4	.9	
100	150	2.6	4.1	4.0	4.9	.8	
105	150	2.8	4.9	4.2	5.6	.7	
110	150	4.2	5.6	4.6	6.5	.9	
115	150	4.2	5.3	4.5	6.2	.9	
120	150	4.2	5.4	4.8	6.4	1.0	

Two Further Difficulties Overcome

In summing up the experience with the test filter sandwasher, two points appeared to require further consideration. One was that the irrigation water jet at the bottom of the washer would foul with sand occasionally after shutting down the filter, and the other that the sand nozzle, (13½ in. in length), was rather long and absorbed by friction more head than was thought necessary; and in the design for the actual sandwasher bases for the Toronto plant shown in Fig. 3, both of these defects were removed.

Some experience with Toronto sandwashers disclosed a local erosion in the throat at the point marked "X" on the vertical plane of the section and opposite the main water inlet which reduced the efficiency of the ejector, and it was found necessary to line the throat of the Venturi tube. This has been conveniently done with carbonized wrought iron pipe in steps as shown. The smallest diameter tube required renewal about every four months and the intermediate one yearly. The sand nozzles last a full year and the scour at the bottom of the washer has had to be repaired once in three years. These experiences being so different from what might have been anticipated from the experiments with the test filter, it was decided to study the matter in further detail.

A sandwasher base from one of the filters was connected up to an independent source of water supply with the water

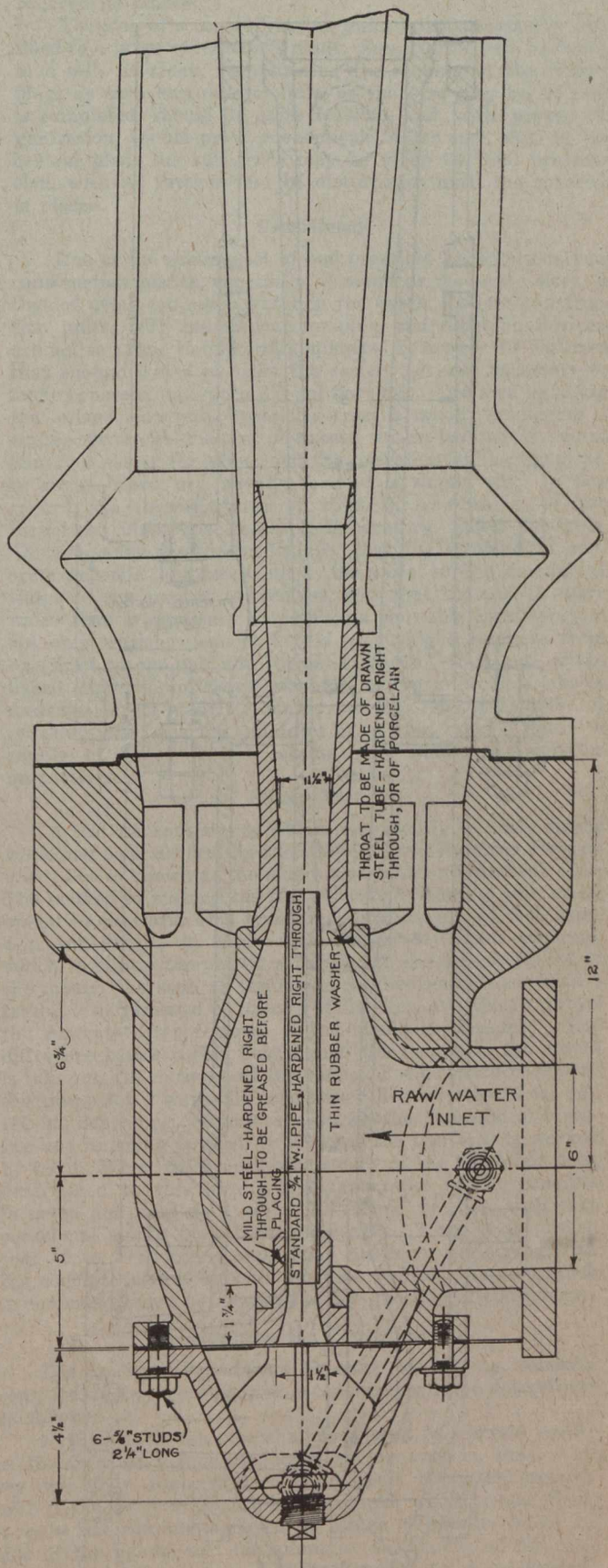

FIG. 4—NEW SANDWASHER BASE, FILTRATION PLANT, TORONTO

jet and sand nozzle exposed, and it was found that the velocity of the water at the jet varied from point to point in a given plane normal to the direction of motion; it being greatest at the point of maximum scour and least at a point