to velocities in the main sewer and grit chamber for the probable flow under conditions immediately following the completion of the present construction and also for the average flow of domestic sewage in 1940.

At the lower end of the grit chamber there is placed a screen so that any large matters in the sewage will be removed. This screen is made of 2-in. by ⅜-in. flat bars spaced 2 ins. apart on centres, making an opening between bars of 1⅝ ins. A 48-in. sluice gate is placed at each end of the grit chamber and a 24-in. by-pass constructed so that at times of removing grit from the sump the sewage will be carried around the chamber. This diverting of the sewage around the chamber will be only at such times as there is no storm water with the sewage. The grit chamber is roofed over at the surface of the ground with a concrete slab reinforced with I-beams and wire mesh. A small brick building for housing the electric motor and other equipment will be erected the coming season. This grit chamber was constructed by the International Construction Company, of Boston, at a total cost to the city of about $8,000.

The plans for the disposal plant have reached completion and bids were opened recently for the construction of settling tanks with separate sludge digestion chamber trickling filters, secondary settling tanks, etc.

Settling Tanks.—Sewage delivered to the works by the 30-in. cast iron siphon is first passed through a 30 x 15-in. recording Venturi meter and is then conducted to the battery of five Imhoff settling tanks. These tanks are built side by side and each is 90 ft. long, 30 ft. wide and has a maximum depth of 26 ft. As regards the inlet and effluent connections, both ends of each tank are identical in design, so that the direction of flow of sewage may be reversed periodically to equalize the sludge deposition on the tank bottom. The inlet to each tank consists of three 12-in. openings below the flow line, controlled by hand-operated sluice gates. The tanks are designed to afford a storage period of three hours, and the sludge-digesting compartment is sufficient for six months' accumulation. Under each gas vent is a sump for the collection of the sludge. Air pumps are to be used in its removal and the deposit will then be conveyed directly to the drying beds, while the settled sewage will leave the tanks over weir plates protected by scum boards, and will flow by gravity to the sprinkling filter.

The sprinkling filter, 2 acres in area, is in the form of a rectangle 410 ft. long and 228 ft. wide. The filtering material will consist of a 10-ft. depth of stone, crushed to a size of from 1 to 2 in. At one end of the bed is a main 36-in. cast-iron header to which 16-in. lateral distributing pipes are connected at intervals of a little less than 13 ft. Each lateral line is controlled by a valve, so that the area of the bed to be dosed with sewage can be varied to suit operating conditions. These lateral lines are reduced from 16 to 12 in. in diameter about half way down the length of the bed. The lateral distributors are supported directly upon the filter stones, in which they are buried to a depth which will bring the top of the pipe about on a level with the surface of the filter beds. This design of the distribution system, therefore, eliminates the use of vertical risers, which are required when the distributors are laid along the floor of the filter beds.

After the joints in the cast-iron pipe distributors have been made with jute packing and lead the pipes are to be tapped with a 2½-in. hole and threaded to receive the distributor nozzles. The specifications lay stress upon the care which must be taken to drill and tap these holes so that the nozzles when inserted shall have their vertical axes exactly plumb. The nozzles will be spaced on 15-ft. centres along the distributor pipes and will throw a circular spray. The type of nozzle to be used has not yet been selected.

Secondary Settling Tanks.—The sprinkling filter effluent will be delivered by a 30-in. concrete conduit into four secondary settling tanks, designed to intercept any solid matter which may be washed out of the sprinkling filters. These secondary tanks are circular in plan, 30 ft. in diameter, 24 ft. deep, with hopper-shaped bottoms. The inlet to each tank is in the form of a cylindrical shell of ¼-in. boiler plate, to which is connected a 15-in. spiral riveted pipe. This inlet cylinder is open at both ends and serves to collect any floating matter which may be carried down to the tank. The effluent will pass over weirs into circular channels around the tops of the tanks and will flow down stepped inclines to an open concrete-lined channel leading to the north branch of the Nashua River. The sludge from these tanks will be removed by a motor-driven centrifugal pump and discharged into the sewage entering the Imhoff tanks, in which it will settle and be further digested with the suspended matters of the sewage. By this procedure it is hoped that the offensive and slowly drying secondary tank sludge can be successfully dried.

Sludge from the Imhoff tanks and from the secondary settling tanks will be dried upon a bed of sand composed of grains having an effective size of at least 0.15 mm. and a uniformity coefficient not exceeding 10. The porous character of the underlying material made it unnecessary to install any system of underdrainage. The bed will be separated into long strips, 15 ft. wide, by concrete posts and planks, and along the centre of each strip will be laid a narrow-gauge railway track to carry cars, into which the dried sludge will be shovelled and carried away.

The works are designed for a capacity of sewage equivalent to 100 gals. per capita per day, which is approximately the amount of water consumed, the tanks providing for an estimated population of 55,000 in 1925. It is expected that the entire plant will be ready for the treatment of sewage early in 1914.

PRINCIPLES OF SHOP DESIGN.*

The laying out of machine shops must depend on the area, the shape of the ground available, and the nature of the product manufactured by a firm. The aim should always be to avoid handling materials and products more than is absolutely essential. To this end certain relations of shops to each other, and to railway sidings or canals, will have to be observed, in addition to the internal designs of the shops, the placing of heavy and light machines therein, and the systems of industrial railways and dispositions of hoisting machinery; so that the main problem includes much detail that varies with the requirements of different classes of manufacture.

With respect to the relative positions of shops as affecting the handling of work, two general cases arise. One is that of concentration in a few buildings, the other their isolation in separate buildings. In a large degree the choice between these depends on the size of a concern. The larger it is, the more desirable does the isolation of shops and of departments in shops become, partly because the necessities of supervision, partly of those of higher specialization. A small firm can carry on its machining and assembling work all under one roof, in charge of one foreman. A very large works must not only separate these departments, but must also create sub-departments in each, for light and for heavy work at least; and very often further sections must be ar-

*Condensed from The Times (London) Engineering Supplement.