

which regulates the rate of filtration from each filter, keeping same constant at any desired rate within certain permissible limits. From the filter rate controllers, pipe connections lead to the clear well, the point of discharge for the filtered water, the high service pumps taking the filtered water from the clear well and pumping same to the standpipe and distribution mains in the city.

### Cleaning the Filters

After a period of operation, the length of which depends both upon the turbidity as well as the rate of filtration, the filters require washing or cleaning, and this is accomplished by what is known as the combined air and waterwash system; that is, the use of both compressed air and filtered water through the same distributing system, utilizing the filter strainer system for this purpose. Both are passed in a reversed direction to the direction of filtration, the air first being applied for a period of about 3 minutes, thoroughly loosening up, agitating and scouring the filter sand, the filtered wash water then being applied for 5 or 6 minutes, this forcing up the dirt and sediment to the top of the sand and thence carrying it off by means of centrally located overflow gutters, whence the dirty water passes off into the main filter drain, discharging into the river below the intake.

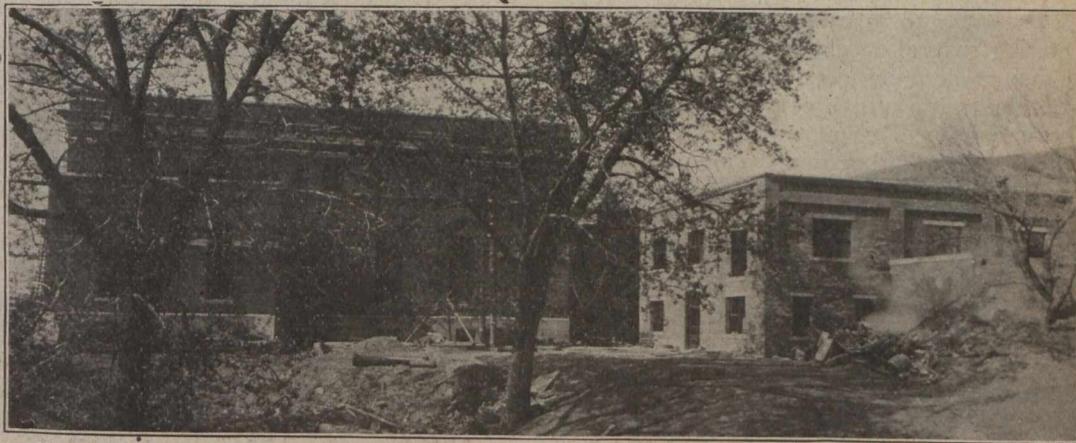
The air for washing the filters is furnished by an electrically operated Root air blower, at a pressure of about four pounds to the square inch, while the filtered water for washing the filters is obtained from a concrete water storage tank located on the hillside at the rear of the filter plant, the water supply for this tank being secured from the high service force main, an automatic control valve being installed on the supply line to the tank for controlling the water level.

All valves on the piping pertaining to the filters are provided with hydraulic cylinders, so that the entire operation of the filters is controlled from operating tables placed on the floor above the pipe gallery, each filter being furnished with a separate table with individual levers and control cocks for each filter valve. The tables are of polished marble with all fittings and trimmings nickel-plated, each table also being provided, in addition to the valve control handles, with indicator dials for each of the filter valves, these indicators showing whether the valves are open or closed, and if open, the degree thereof. Mounted on each operating table are loss-of-head gauges for showing the operation of the filters. These gauges are provided with electric alarms arranged to notify the operator when the filters become so clogged with mud as to require washing. Gauges are also provided for showing the depth of water in the clear well, also for indicating the water level in the sedimentation basins.

As a further safeguard, previous to passing to the high service pumps and thence to the city, all water is sterilized by liquid chlorine, the apparatus for the application of the chlorine being of the Wallace & Tiernan make. This apparatus is so designed that after it has once been set at a predetermined rate, its action is entirely automatic.

For the preparation and application of the coagulant to the raw water previous to filtration, the entire upper floor of the main filter building is utilized for the storage of the alum as well as for the mixing of same into proper solution, about two-thirds of the upper floor being taken up for storage space, while the remainder is utilized for the dissolving boxes, storage tanks for the coagulant solution, the agitating or stirring apparatus for keeping the solution thoroughly mixed, the scales for making up the solution, etc. For the application of the coagulant to the raw water, very accurate measuring devices are used, the liquid being passed through carefully calibrated orifice feed valves, so that the exact amount of alum used can always be definitely known.

The city commissioners all devoted much time and thought to the water problem, made many personal investigations and visits to various types and makes of plant, and only after long study decided upon the present layout, which they are firmly convinced is of both the most efficient and modern type available, there being but one or two in the Dominion, and only a few in the United States which are at all comparable with it. While the cost is comparatively high, in part due to the very complete equipment, the general high cost of building material, labor and machinery has so radically increased



Power House at Left, Filter House on the Right.

in the past few years, affecting all building work, and the water question was so vital, that it was deemed wiser to proceed with the installation of the plant rather than to wait for lower prices which may not come for years.

### Required Elaborate Soil Tests

In view of the city's experience with the faulty foundations of the former power house, much damage having been done to the building through serious settlements and cracking, the commissioners took every possible precaution on the foundations for the filter structure, and required an elaborate series of loading tests on the soil under the filter structures; first, with the object of determining the safe loading capacity of the soil in question; and second, to determine the best type of sub-foundations if same were required. While it was desired if possible, and if it was safe to do so, to avoid the extra cost of this sub-foundation work, the results of the tests of the soil were such as to show the soil to be entirely unsuitable for the loadings of the filter structures, and therefore in order to secure freedom from future settlement and to ensure stability, a comprehensive system of piling and concrete pile caps was provided, amply safe for all future possible loadings.