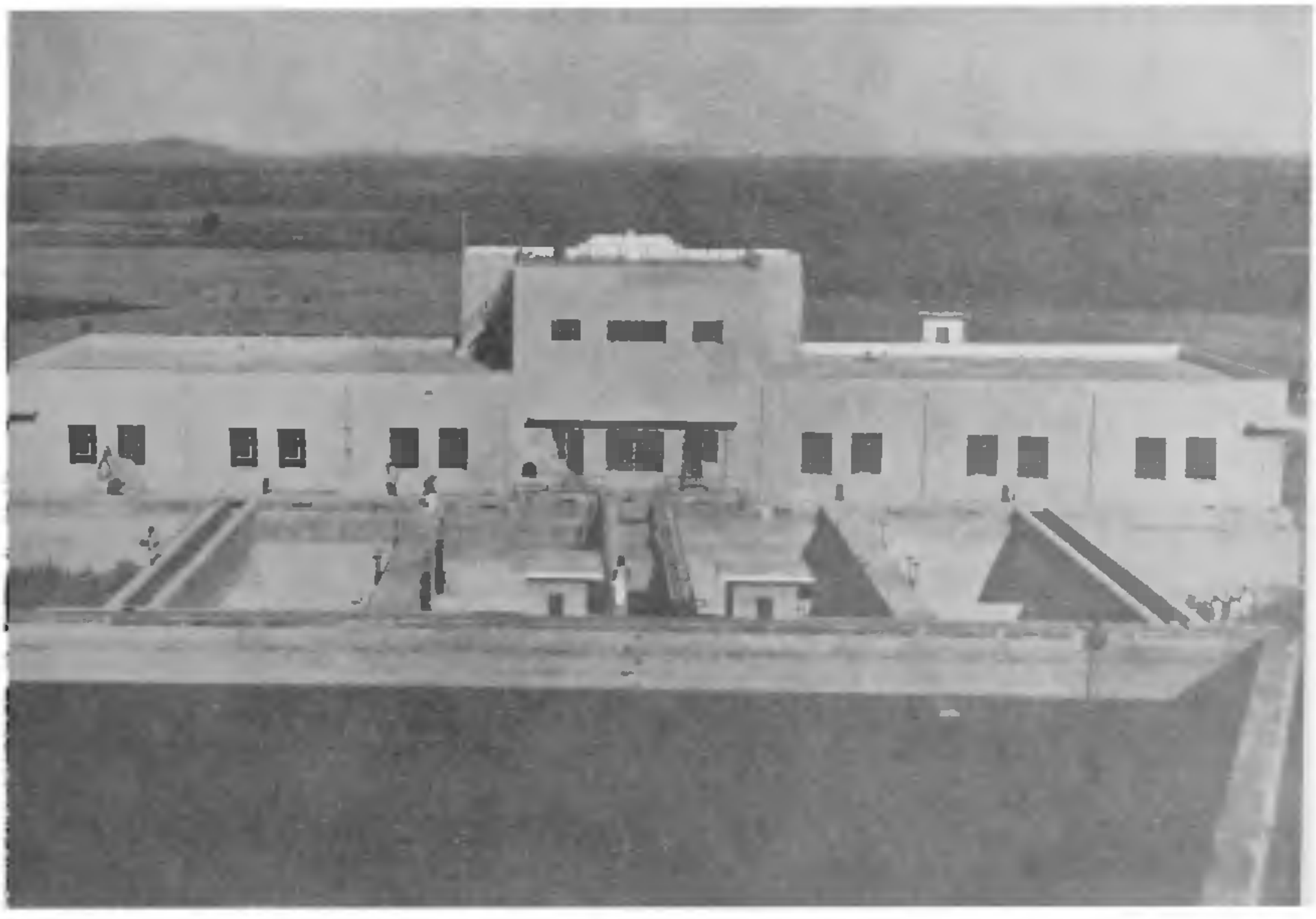
Indore City Filtration Plant

By Rao Bahadur B. L. Modak, M.C.E.
(*Executive Engineer in charge of Indore City Water Supply*)

THE purification plant is a modern Rapid Gravity Filter Plant.

The capacity as constructed is six million gallons per day, but equipment has been provided at present for only four million gallons per day. The ultimate capacity of the plant will be eight million gallons per day.



The plant includes:—

(*a*) Dosage of Coagulants.
(*b*) Mechanical mixing of Coagulants.
(c) Odour Control.
(*d*) Aeration.
(*e*) Aggregating Tanks.
(*f*) Settling Tanks.
(*g*) Sludge Removing Equipment.
(*h*) Filters.
(*i*) Sterilizing Plant—Chloramine Process.
(*j*) Corrosion Control.

Coagulants

Provision has been made for the addition of any or all of the following chemicals:—alumina, sodium aluminate, soda ash and lime. This flexibility will enable any condition of the raw water to be treated efficiently and economically.

Alumina, sodium aluminate and soda ash would be proportioned and added in solution form, while lime would be controlled by a Dry Chemical Feeder.

Mechanical Mixing of Coagulants

The most efficient use is made of the coagulants by proper mixing after addition to the water. This is done by means of two Flash Mixers arranged on the inlet to the Aggregating Tanks.

Odour Control

The removal of unpleasant odours from the water when they occur, will be carried out by the addition of powdered activated carbon which absorbs the odour-producing substances, usually oils from decaying animals and vegetable organisms. The powder

is added before the filters and is removed with the adsorbed oils in the filters.

The action of the carbon is assisted by aeration of the water prior to settlement.

Aeration

At certain seasons the water is known to contain iron, and aeration is provided to deal with this impurity. Besides oxidation of the iron, aeration materially assists in coagulation and odour removal. The aeration is provided in two chambers into which compressed air is blown.

Aggregating Tanks

After the addition of the coagulants and adequate mixing, the water is brought to the aggregating tanks, or primary settling tanks, in which the flocculent particles are conditioned to increase their size and density, making them fall more quickly in the Settling Tanks. This is effected by contact between the sludge already formed in the bottom of the tanks and the incoming water. This contact enables the necessary chemical reactions to go rapidly to completion and the controlled agitation provided by a 'snow balling' action, increases the density and size of the particles.

Settling Tanks

The settling tanks are of the horizontal flow type which are found very efficient in dealing with an adequately 'conditioned' water. They are designed to give a steady and even flow with the minimum of eddying to water passing through them. To this end no baffles are provided but the design of outlet and inlet are such that full use is made of the tanks.

Sludge Removal

Sludge can be removed from both the primary and secondary tanks without interrupting the section of the plant. Both sets of tanks are provided with hopper bottoms which collect the sludge falling from the water in its passage through. These hoppers are designed so that all sludge falls to the bottom of the hopper and is withdrawn by a sludge outlet provided at this point.

This special design eliminates the necessity for putting the tank out of operation for draining down and removal of the sludge by hand.

Filters

The filters are the heart of the plant. All that goes before is conditioning to make the water suitable for filtration.

Each unit is capable of dealing with one million gallons per day. The area of the filter bed is 600 square feet so that the rate of filtration is 1,666 gallons per square foot per day, or 69·4 gallons per square foot per hour. Four units are fully equipped and the masonry work for six has been completed.

All filter controls have been centralized so that the whole operation is carried out from the control platform in front of the filter. These controls are mounted on a table and the opening and closing of the valves, starting and stopping of motors are carried out merely by turning levers or pushing buttons. Also on this table are indicators consisting of dials and signal lights which tell the operator exactly what is happening and record on a chart the rate of flow and the loss of head through the filter.

Power for the operation of the valves is provided from a central hydraulic accumulator with automatic pressure control to the high pressure booster pumps. The valve position indicators are operated by "Teleflex" cables. The signal lights are electrically operated from each control table and there is a master panel in the main office giving a complete indication of the working of the plant to the Supervisor. The starting and stopping of the motors is arranged for push button control from the control table with automatic starters by the motors.

The cleaning of the filter beds is carried out by a new and highly efficient method. Compressed air and water are used, as is usual with other systems but these are arranged for simultaneous application. In addition the patent 'Surface Flush' of the bed after cleaning is incorporated and this enables all dirty water on the bed to be removed from the top of the filter before it is again put into service.

The result of this modern system of filter cleaning is that the filters are kept in an exceptionally clean condition, consistent with efficient filtration, and the consumption of power and wash water is reduced to a minimum.

The flow of water through each unit is controlled by a 'Modern' and a 'Slow Start'. The former controls the rate of flow during normal working while the latter automatically shuts and opens the module before and after cleaning. The opening of the filter after washing has to be done slowly and gradually to ensure that the effluent is

always up to standard. This is not the case if the unit is put into operation immediately after washing at the full rate.

The provision of these modern and automatic units makes for greater efficiency and lower running costs. The case of carrying out the washing operations means that the units are out to operation for a much shorter time and therefore the nett filtering capacity is increased.

The recording instruments provided enable an infallible check to be kept on the performance of the plant by the responsible officer.

Sterilization

After the filtration the water will be clean and bright and free from all suspended matter. Approximately 95% of all bacteria will have been removed but to ensure that there is no possibility of any harmful bacteria passing into the distribution system, a minute dose of chlorine and ammonia is added to the water.

These chemicals will sterilize the water and will also provide the water with a resistance to after-infection so that any pollution finding its way into the distribution system is counteracted.

Corrosion Control

The action of water on steel and cast iron is often the cause of rapid and costly deterioration of the distribution system. Corrosion is controlled by adjustment of the pH of the water and this will be raised when required by the addition of lime after filtration.

Laboratory

A chemical and bacteriological laboratory is provided and tests are carried out as a matter of routine to ensure that proper purification is taking place.

Softening

A feature of the plant is that provision has been made in the design so that when the ultimate capacity of eight million gallons per day is installed, two million gallons of this can be softened by the Lime Soda Ash process. This was done as it was felt that a softened supply would be appreciated by the mills and other industrial concerns in Indore.

General

The plant was designed by the author with the assistance of Candy Filters (India) Ltd., water purification specialists. All equipment was provided by this firm.

India's Forest Pests

THE biological data collected at the Forest Research Institute, Dehra Dun, after years of research and now made available to the public in a recent publication in the *Indian Forest Records* (new series) Entomology, have been found to be of great assistance in organising a fight against the numberless pests which cause enormous losses to India's forest wealth.

The average annual loss due to the sal borer, for instance, in Government forests alone is not less than Rs. 2,50,000, while in epidemics the loss may rise to enormous proportions.

In a small epidemic affecting eight square miles of forest in the United Provinces, 45,000 trees with timber content of nearly a million cubic feet, were killed with a loss of Rs. 2,70,000.

The most serious epidemic on record was one which affected five forest divisions of the Central Provinces, an Indian State and extensive private land. When remedial measures were taken, it was found that, on 150,000 acres of sal forest in two divisions, timber, valued at about Rs. 7,50,000 had been destroyed. In the following year the attack extended to 5,500,000 trees in this area, with a loss of forest capital of nearly Rs. 1,37,50,000. Before the epidemic was checked, the total number of trees attacked over the whole infested area rose to 7,000,000. Four years of control operations and an expenditure of Rs. 1,25,800 were necessary, before the epidemic was definitely overcome.

Particularly injurious to avenue and shade trees planted in towns and along roads, especially willows and poplars, is a pest called *Æolesthes sarta*. It also works damage in fruit orchards. The avenue and garden trees of Quetta were severely attacked by this borer in 1904–06, necessitating the felling of some 5,000 trees. Over 20,000 beetles were collected and destroyed in 1905 and 3,000 in 1906.

Another beetle (*Chlorophorus strobilicola*) which attacks the cones of pines from altitudes of 2,000 feet to 6,500 feet, is the commonest in open sunny stands of chir pine. The damage done is almost negligible in a good seed year, but when cones are few the proportion infested may rise to even as high as 40 per cent.