is now being used throughout the shire, with the following variation, which the writer believes to be unique in Victoria.

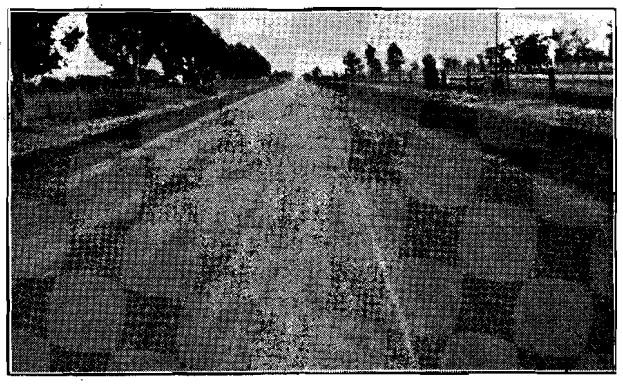

Fig. 3

The 5-in gravel foundation course is put down and allowed to consolidate thoroughly under traffic for a year or more. The wearing course and binder is then laid on the consolidated foundation. This method of construction enables road construction to be pushed forward cheaply, and rapidly, and gives excellent results, the well-consolidated foundation tending to eliminate the formation of potholes.

Fig. 2 shows a road in the course of construction. The gravel used for the foundation course in this road is a curious limestone pebble formation which, when wet, sets almost as hard as lime mortar under traffic. The formation occurs as a ridge on the shores of Lake Bulloak. This material is too soft for a binder, but makes an excellent foundation course.

Fig. 3 shows a main water-bound road which carries comparatively heavy rubber and steel-tyred traffic, but will show no sign of unravelling.

The writer is indebted to Mr. F. W. Rigg, shire engineer, for the foregoing information.

Water Purification at Swan Hill, Vic.

On August 14 Mr. F. Brawn, M.L.C., chairman of the Victorian Provincial Towns Sewerage Authorities' Association, officially opened the Paterson Chloronome, which has been installed at Swan Hill for the purification of the town water supply through the courtesy of the Commonwealth department of health.

The plant was made by the Paterson Engineering Co., of London, for whom Messrs. Fyvie and Stewart, Melbourne, are agents. Mr. H. G. Furphy, of the Commonwealth health department, supervised the erection of the plant, and, at the official opening gave the history of water purification by chlorine. It has been established for many years in American cities, and was adopted at the Western front in the war. Chlorine is not capable of destroying all germs in water, but so purifies the water as to neutralise considerably the effects of pathogenic bacteria and bacilli.

Other officials present at the opening included Mr. F. E. T. Cobb, chief sanitary engineer of the state health commission, Dr. C. P. Rowan, district health officer, and Mr. J. M. Mathew, supervisor of testing of the Victorian state rivers and water supply commission.

Water Purification by Chlorine Gas

The sterilisation of water as chemically performed must satisfy the following requirements: 1. It is essential that the water, after treatment should be palatable, and have no harmful or unpleasant effects upon consumers. 2. It is highly desirable that the treatment should not cause any precipitate, the removal of which would complicate the process, and increase its cost. 3. The sterilising agent must be cheap and simple in application, so that its use for the treatment of large volumes of water may not entail any heavy outlay either for material or labor. 4. The plant necessary for its application must not only admit of sensitive and accurate control over its administration, but must be capable of working regularly for long periods without attention. 5. The initial cost of the installation must be low in relation to the volume of water to be treated.

Chlorine is the sterilising agent which conforms most closely with these requirements, but, prior to its introduction, it had been the practice to use bleaching powder or sodium hypochlorite. Both these methods, however, are open to the objection that the reagent contains only a small proportion by weight of available chlorine, so that large quantities must be used to attain the desired result. In addition, the former substance is unstable, and the proportion of chlorine which can be made available is rapidly reduced in warm and moist climates.

Further, it is essential that the bleaching powder be mixed in paste form before addition to the water. Pure chlorine can, however, be obtained in gaseous form, and is entirely free from the objections given above. It is a reagent in a state approaching absolute purity, and as it contains 100 per cent available chlorine its

whole weight is available for sterilising purposes. It is now produced in large quantities at low cost, and is supplied compressed to a liquid state in steel cylinders. The reaction which occurs is expressed by the equation:

$$2Cl_2 + 2H_2O = 4HCl + O_2$$

Nascent oxygen is liberated, and it is not improbable that the chlorine itself has a direct toxic effect upon the organisms apart from the production of oxygen.

The design of a suitable apparatus to apply chlorine gas with precision, resolves itself largely into producing a mechanism which is unaffected by the virulently corrosive properties of chlorine upon metals in the presence of moisture. The "Chloronome" (the registered name of the Paterson Engineering Co.'s device for regulating, measuring and administering chlorine gas to water supplies), has the unique feature that it interposes between the metallic parts of the apparatus and the absorbing water supply, an isolating column of liquid unaffected either by the gas or the absorbing water, thus ensuring that the chlorine gas in contact with the metallic parts of the apparatus is dry and free from any corrosive tendency.

The Chloronome consists essentially of a means for conducting the gas from the storage bottles to the instruments for the reduction of pressure and regulation, so that the gas is administered at constant low pressure, and for the exact measurement of the gas, its application and distribution throughout the entire body of water to be treated. Two types have been designed, the Pulser type, Fig. 1, dealing with small to medium supplies, and the Manometer type[1] with large supplies.

Fig. 1 shows a typical arrangement of apparatus. The liquid chlorine is contained in a steel cylinder from which it passes into gaseous form on evaporation by the heat abstracted from the atmosphere through the walls of the cylinders. These latter are usually placed on a weighbridge for checking purposes. A coil connector valve is coupled to the valve on the cylinder head.

The chlorine gas is led through a flexible connecting coil of copper tube to the filter, which removes any slight deposit carried by the gas from the exposed coil tubes or cylinder fittings.

Two pressure reducing valves are arranged in series to maintain a constant pressure of gas on the regulating valve. From the regulating valve the gas passes to the meter (to which later reference is made in detail), thence through a central pipe down nearly to the bottom of the glazed absorption tower, which is fitted with a water distributing tray, and packed with pumice. A small trickle of water is uniformly distributed over the pumice, and in its downward flow absorbs the measured gas. The chlorinated water flows from the bottom of the tower through a chlorine resisting rubber pipe or earthenware pipe, and is uniformly distributed through the main body of the water to be disinfected.

The Chloronome pulsing meter consists essentially of a U-shaped tube with a connecting branch between the two limbs. This tube contains sulphuric acid which acts as an inert seal between the dry chlorine gas in the instrument, and the absorbing water supply. The flow of gas into

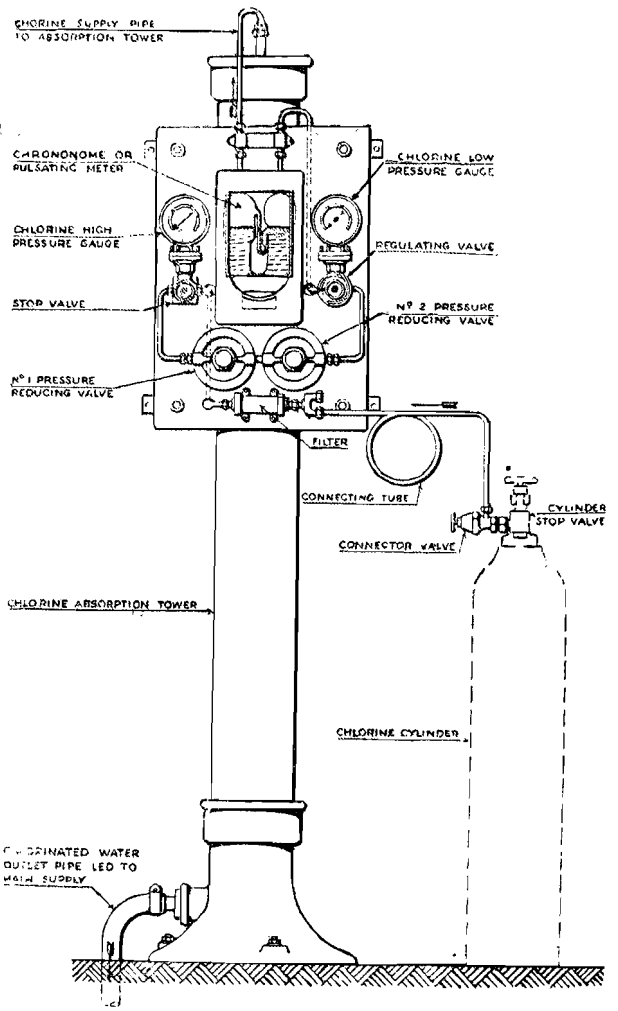

Fig. 1. Paterson "Chloronome"—Pulser Type

the inlet limb depresses the column of sulphuric acid until it unseals the small vent pipe, so permitting the passage of the measured quantity of gas from the inlet to the outlet limb. This establishes equilibrium, and allows the return of the column of sulphuric acid until it again seals the vent pipe, when the cycle of movement is completed, and another downward stroke commences. The rate of pulsation and known volume gives the weight of chlorine added. Prolonged tests have shown that when the regulating valve is once set the meter continues to pulse for months at the same rate.

1. Described in the "Commonwealth Engineer," February 1, 1925, pp. 249 and 250.