fully absorbed, but in the majority of purification plants they pass into streams with the effluent. Unless the dilution of such effluents is very considerable this oxidized organic matter is capable of causing considerable growths of vegetation which may become nuisances either by their abundance or by their later putrefaction. The effluent from the Withington works at Manchester, England, is non-putrefactive, but furnishes food for considerable quantities of carchesium, beautiful organisms with bell-shaped heads on delicate thread-like stems. When living this is unobjectionable, but the rotting of masses of it is capable of producing a distinct nuisance. This organism has also been found at the base of a secondary percolating filter at Davyhulme dealing with the effluent from primary contact beds. This effluent is clear and bright, non-putrescible, and practically saturated with dissolved oxygen. Nitrifaction is well advanced, yet considerable development of carchesium takes place in the outlet channel, with simultaneous diminution of the dissolved oxygen content. Apparently, this particular organism can grow in effluents which would be passed as satisfactory from a chemical point of view.

The production of green growths, consisting, as a rule, of oscillatoria nigra, a green chlorophyllous alga, is generally considered evidence of satisfactory purification; but the influence of sunlight appears to determine to some extent whether this or carchesium shall grow in the effluent.

Where purification is not carried so far, and especially where small proportions of unpurified sewage are mixed with it, other organisms develop whose decomposition may be even more offensive. Below the outfall of the Gorton plant of the Manchester disposal works masses of beggiatoa, or sulphur fungus, were found and measures have recently been taken for its removal by sterilization of the effluent, the greater part of which consists of a tank effluent from chemical precipitation. The rate of development of fungus in this effluent was extraordinary. A wooden shoot nearly 50 yards long was covered with a well-defined growth in two days. This was completely arrested by the addition of chloride of lime at the rate of 3 grams per gallon.

The production of fungoid growths is a very sensitive index of pollution and it is possible to differentiate between varying sources of pollution by the character of growth developed. This was pointed out years ago by Santo Crimp, but it is doubtful whether the subject has received as much attention as it deserves. It is well known that small leakages of unpurified sewage passing direct into the sub-drains of irrigation areas may produce disproportionately large amounts of fungus, the species depending upon circumstances. The growth of fungus in sub-drains may depend also on the character of the land and of the effluent applied to it. If, for example, iron is present in the latter there is a great liability to the development of crenothrix, a filamentous organism which collects large masses of hydrated oxide of iron around it. The effluent from the Birmingham sewage farm has to be screened before passing to the river in order to remove particles of this fungus from it.

There are, of course, countless other flora and fauna which are characteristic of different stages of purification. The scientific biologist would be considerably assisted in the study of these if those in charge of sewage works would keep systematic records of the more characteristic developments occurring under specific conditions, such as composition of sewage, time of year, temperature, etc. Thus, for example, it is probable that dilution of the sewage will affect the question of growth owing to the greater ease of osmosis. The development of fungus in the Withington sewage, previously referred to, is probably due to the exceptional dilution of such sewage.

*Abstract of a paper by Gilbert J. Fowler before the Leeds Sanitary Congress.

These growths may be temporarily arrested, of course, by sterilization, but such a process is costly and open to objection because of its possibly deleterious effect on the normal life of streams. On the other hand, there can be no doubt that many fungoid growths form excellent habitats for larvae, small worms and probably numerous forms of crustacea. The development of gnat larvae is a matter of rather serious moment, which has been carefully watched. In connection with the effluent from the percolating filter at Davyhulme, gnats appear at certain periods of the year in objectionable numbers at the manhole covers of the closed channel through which the effluent passes. These forms of life, however, may constitute excellent food for fish, and at the Berlin sewage fields large ponds have been constructed into which the final effluent flows, and in which carp and other coarse fish attain large sizes.

It is now generally recognized that the provision of some kind of tank to arrest deposits from percolating filters is necessary, and the Royal Commission suggests a similar provision in the case of contact beds. It is worth consideration whether this idea might not be developed, and such tanks extended to form aquariums. Careful management would be necessary in order, by the growth of aquatic plants or otherwise, to maintain an adequate supply of dissolved oxygen. It is probable that considerable diminution in the bacterial content of effluents would result from such storage. The cost might be partly met by the value of the fish produced, and, in any event, the complete cycle from offensive organic matter through mineral matter and back again to organized life would be under control, instead of allowing the effluent to pass directly into the stream with all the possible contingencies which may arise.

EXPERIENCE WITH CONCRETE WATER MAINS AT RAHWAY, N.J.*

By William Bishop.

In every profession, conditions are met which render desirable some method other than the usual standard; so in some places the use of cast-iron pipe is almost prohibited by excessive freight rates, lack of transportation facilities, encrustation or other causes, and frequent requests have been made for information concerning the use of concrete mains.

This information can be of little or no value unless the conditions under which the pipe are used are considered.

In the years 1871 and 1872 about 12.6 miles of concrete mains were laid in Rahway; the largest of these were 12″ in diameter.

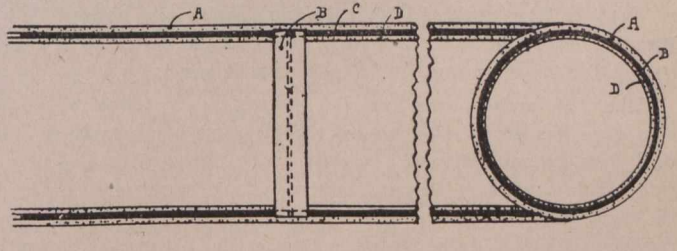

Fig. 1

Each section of pipe is 7′ long and consists of a sheet iron shell riveted lengthwise, and lined, both inside and outside, with a coating of concrete ½″ in thickness.**

The larger sizes of pipe are butt-jointed with a short band at the joint, as shown in Fig. 1. The smaller sizes are made

*Read Before the American Waterworks Association, New Orleans, La.

**The thickness of the shell for 6″ pipe is .036 inch or B. & S. wire gauge No. 19.