

Sewerage and Sewage Disposal.

It is often held by the conservative citizen that the cost of sanitary works is an obstacle to their construction, but when a great work which will enhance the wealth and comfort of a community is under consideration, too much stress should not be laid upon the cost, for "What will a man give for his life? Correct sanitation is life, health and happiness, and correct sanitation the world over means the complete extirpation of cholera, typhoid fever, diarrhoea, dysentery, diphtheria and every other infectious disease, and if all communities were equally interested in advancing the condition of their sanitary arrangements, our bodily complaints would then be limited to those due to our personal habits.

The discharging of raw sewage into streams and rivers, some of which are now or soon will be sources of public water supply to cities and towns, will in due time be prohibited by law in every locality where offence to health or the bodily senses is liable to follow the pollution of water by sewage discharges. Opinions will likely always differ upon the amount of sewage contamination which a stream may suffer without risk to the animal life which may be compelled to draw its water supply from such stream below the sewage outfall, but the opinions of those who are reinforced by long and careful observation, clearly points to the possible danger of discharging any sewage into a stream, the water of which is later drawn for drinking purposes, especially as the disease-producing bacteria which may come into the stream with the sewage are not easily detected, and may propagate and produce dire results before their presence in the water is suspected.

The attempts to recover from dilute sewage its theoretical value as a fertilizer have occupied the attention of sanitarians and chemists for more than forty years and it cannot be said that any very satisfactory success has attended their efforts. Some sewage farms and works abroad, seem to pay something more than the cost of maintenance, but a majority are, and have been, operated at a loss to the municipal corporations which have adopted this means of sewage disposal.

Certain soils work very well for filtration of sewage, especially when the effluent is applied intermittently to respective areas of land, and time is given for the sewage to pass out of the filtering soil, and air to pass in and fill the interstitial spaces. In such instances, if the rate of filtration is properly proportioned to the filtering material in the ground, the oxidation or combustion of the organic matter in the sewage is practically complete, but, of course, such a method of treatment assumes that no value is attached to the solid matter in the sewage for manurial purposes, and that the whole object is to obtain the best sanitary condition of the

effluent. Sewerage filtration can best be had by the use of the modern mechanical filter, with an arrangement of tanks or subsiding and intercepting reservoirs to retain the heavier solid matter, and the filters rotated and rested in service at frequent intervals.

The most approved, and apparently the most successful solution of the question is found in a mode of treatment which combines subsidence and interception of the solid matter in the sewage in reservoirs or tanks, with chemical precipitation: The sludge which accumulates in the tanks to be pumped into the filter presses, and the resulting solid sewage cake disposed of as a fertilizer, or dried and consumed as fuel.

In those instances where sewage is used for irrigation purposes, it is applied directly to the land by a hand hose, through carriers or small channels cut in the earth, or by means of porous, open-jointed drain tile laid from two and one-half to three feet below the surface; the liquid in this case being taken from the soil surrounding the carrier pipes to the roots of the growing vegetation by capillary attraction.

One difficulty in the path of the successful disposal of sewage by irrigation schemes, is the inability of the vegetation to assimilate at all times, all the organic matter which may come to the sewage-irrigated field. During winter, the growth of plant life is practically nothing, and the effect of irrigation then is simply to keep the ground saturated with sewage, and to depend on such filtration as the soil is capable of furnishing to reduce the amount of organic matter in the effluent to safe proportions. It generally happens, however, that when the sewage-irrigated field cannot take the sewage effluent and produce the reactions due to the absorption of the nitrogenous compounds by active plant life, that the raw sewage can be discharged into a neighboring watercourse with the least injury to the stream.

The stream usually being in flood at this season, the dilution of the sewage is great enough to remove the present danger from pollution of the watercourse by sewage, unless the sewage effluent contains disease germs, when no amount of dilution will certainly remove the danger due to these.

When the surface is relied upon as sufficient for the purpose, and broad irrigation is the mode in which the sewage is applied, the surface should present a gentle slope in order that the sewage may travel slowly forwards in a lateral direction and thus admit of the surface being equally wetted throughout, and also admit of the drainage and drying of the surface subsequent to the application of the sewage.

When Intermittent Filtration is the method by which the purification is to be effected, the land is laid out in level beds, and the sewage applied to each bed passes

vertically downward through pervious stratum from which, in a more or less purified condition, it escapes by means of drains or otherwise.

If the soil for intermittent, downward filtration be open or porous, no sub-soil drains will be required, but if the soil is heavy and retentive, as, for instance, clay soils and mixtures of clay and loam, sub-soil drains will become necessary to avoid a supersaturation of the ground, which will of course prevent proper filtration of the sewage, and in warm weather produce a nuisance and a menace to health which sewage disposal works, for a principal object, should aim to avoid.

Educating Pathmasters.

The Atlantic Monthly contains an excellent article on the subject of country roads, by Prof. N. H. Shaler, of Harvard University. The Professor says:

This field of activity is not one which can be advantageously cultivated by ignorant men whatever be their natural capacities, or the measure of the experience which they may have derived from a wise use of their blunders. This art demands a wide and well-founded training. It must rest, indeed, upon a good knowledge of several natural sciences. No amount of general determination to improve our conditions in this economic field will be fruitful unless we provide our communities with men who are well trained for the work which is to be done. Unless provision is at once made to educate roadmasters, the present access of interest in this art will lead inevitably to a vast array of costly mistakes which will be likely to discourage our people, and to lead them to the conviction that their new estate is worse than the old. At present there are probably not fifty engineers in the United States who have been properly trained for the work of constructing highways. There may be several times this number who are more or less satisfactorily expert in constructing city streets; but that particular task, though difficult enough, is, as compared with that which the rural highway engineer has to take up, of a relatively simple nature. Few, if any, of our engineering schools pay any particular attention to this science and art. The question of common ways is treated incidentally, and with no emphasis at all commensurate with its importance. There is practically no effort made to develop specialists in this profession.

The first step towards our new dispensation is to persuade our greater schools to undertake the systematic education of roadmasters, giving to the task the same care which they devote to the preparation of young men for railway or hydraulic engineering.

The next question for the reformer in the matter of road-building concerns the method by which the work of construction, improvement and repair can be insured against the evils of ignorance.