

The Canadian Engineer

A weekly paper for engineers and engineering-contractors

THE DEVELOPMENT OF SEWAGE DISPOSAL PRACTICE

HISTORICAL REVIEW OF THE SCIENTIFIC DISPOSAL OF WASTE
—VARIOUS AGENCIES IN USE—PAPER READ BEFORE THE
ONTARIO MUNICIPAL ASSOCIATION, TORONTO, AUGUST, 29TH

By E. SHERMAN CHASE,

Sewage Experiment Station, New York City.

IT is a fundamental biological law that no living organism can long exist in the midst of its own wastes. This law is as applicable to the municipal organism as to the individual. Methods for the disposal of human wastes are as old as mankind itself, but the problem of sewage disposal which confronts us to-day originated only sixty or seventy years ago. Before this time the disposal of waste was largely an individual duty and not until the adoption of the water-carriage system did it become a civic responsibility. At the beginning of the water-carriage system, the method of disposal was by discharging the contents of the sewers into the nearest watercourse. This same method is too frequently used to this day. As long as the volume of water receiving the sewage was large compared with the amount of sewage no great attention was paid to the desirability or otherwise of this means of disposal. Before the germ theory of disease, and even much later, the discharge of sewage in bodies of water used for water supply has been tolerated and the use of unpurified water from such sources has caused enormous loss of life from typhoid. With rapid growth of population the waters receiving sewage have become not only unsafe for water supply but have become, in many cases, so grossly polluted as to be unfit for boating, bathing or fishing. Many otherwise attractive streams and lakes have become open sewers, offensive both to sight and smell. In other cases, as with certain sea coast towns, extensive shell-fish industries have been threatened by the pollution of harbor water.

In Europe the problem became acute much earlier than in America, on account of the smallness of the streams and the density of population. Local nuisances, due to fouling of the streams, became so pronounced that means had to be taken very soon after the introduction of the water-carriage system to prevent further fouling of the streams receiving sewage. The condition of the Thames at London became so intolerable that a government commission was appointed in 1868 to investigate methods of sewage disposal with the end in view of restoring the river in England to some degree of its former purity. This commission, called the Rivers Pollution Commission, after investigation, reported that the best means of disposal was land irrigation, and for many years this opinion was of powerful effect in shaping sewage pro-

jects in Europe, and in England land irrigation had official sanction almost exclusively until 1908.

In America the problem was first attacked in Massachusetts, and the Massachusetts Board of Health started experiments in 1888 on the purification of water and sewage which are being continued to the present day. In respect to sewage the immediate result of their first experiment was the adoption in Massachusetts of sand or gravel beds for sewage treatment. The most important results, however, were the establishment of the scientific basis upon which sewage purification depends and the stimulation given to other investigations of the sewage question.

The Massachusetts experiments proved that sewage purification is largely a matter of oxidation through bacterial agencies. Bacteria and other micro-organisms in soil, water or artificial devices, if given an abundance of oxygen, oxidize complex, putrescible, organic compounds to simple, non-putrescible, inorganic substances. As long as oxygen is present the organic compounds in sewage give comparatively little offence, but as soon as this oxygen is exhausted the unoxidized organic matters decompose, giving rise to foul, ill-smelling compounds and gases. From this it will be seen that the whole problem in a nutshell is to supply sufficient oxygen to the sewage. In fact, the sewers of a city may be likened to the veins of a human body, the sewage to the impure blood in the veins and the means of purification to the lungs where the impurities are oxidized by the inhaled air.

Sewage Defined and Classified.—Sewage itself has been defined as the water supply of a city after use. It contains the wastes of man and of man's activities. In composition it is mainly water and the proportion of solid matter to water is about 1 to 999. Aside from the solid matter it carries innumerable forms of microscopic life, and often contains bacteria dangerous to health. The solid matter and the harmful bacteria bring about the sewage problem, the solid matter by offensive decomposition and the bacteria by producing disease. The solid matter can be divided into two kinds, organic and inorganic; the organic solids being those subject to purification. For practical purposes, another classification is made of the solids into floating, suspended and dissolved