two new sources of water supply (Loing and Lunain); additions to the present supply to Paris which is about 250 litres (55 gallons) per head per diem, of which about one fourth is almost irreproachable spring water.

The Press, both political and industrial, is still devoting much attention to a gigantic project promoted by M. Duillard for constructing an aqueduct to bring water to Paris from the Lake of Geneva. We fully recognise the desirability of an abundant supply, and admit that the Lake of Geneva would furnish it, but the cost would reach 600 million francs (£24,000,000), many accidents are possible along a course 300 miles long. What would happen if in time of war an enemy cut the line? We do not think that the proposal has been sufficiently considered—it raises many grave problems, and before the Swiss lake fills the Parisian water-bottles, the Municipality had better acquire some of the excellent springs of the central plateau of France, and lead them to the suburbs of Paris by aqueducts less costly and more secure.

SANITARY MATTERS IN THE UNITED STATES.

COL. G. E. WARING, M.INST.C.E.

NOTHING has been done in recent years in this country of such importance and interest to the sanitarian as the very thorough and continued investigations of the Massachusetts State Board of Health, as to the natural processes involved in, and the practical results to be secured by, the intermittent filtration of sewage through various media.

These investigations began in 1887 by the construction of experimental works on a large scale in the outskirts of the considerable city of Lawrence, one hour by rail from Boston. The apparatus was of two classes; one being water-tight tanks sunk in the ground 6 feet deep, and having an area equal to one two-hundredth of an acre,—of these there were six or more; second, a series of iron tanks above ground of the same depth, but only 20 inches in diameter. These tanks were filled with various materials, ranging from fine river silt, peat, and garden soil, to sands of various coarseness, and even to pebble stones as large as the ball of one's thumb. The experiments are made on the ordinary dry weather flow of the city sewers.

The investigation has now been continued for more than six years, and has been controlled at every step by the most careful chemical and bacteriological investigations. The processes and

even the detailed results are too minutely described for even summarization here. They are fully set forth in the published reports of the Board of Health, notably in a special volume on the filtration of sewage and water, published in 1890. The best result in continuous practical filtration was obtained by the use of a rather coarse mortar sand, which produced a purity superior to that of most of the public drinking-water supplies of the State, at the rate of about 100,000 gallons per acre per day, more than 99 per cent. of the free and albuminoid ammonias of the sewage being converted into nitrates, and all but a small fraction of 1 per cent. of the bacteria being destroyed, with an indication that the few existing in the effluent were harmless bacteria that had grown in the effluent drains. The most instructive result was obtained in the use of gravel stones "as large as beans," which had been washed clean of sand before they were put into the tank. The bed was 5 feet deep. The sewage was applied nine times a day, six days in the week, at the rate of 81,400 gallons per acre, per day. After that amount had been applied daily for more than seven months, it was found that 98.6 per cent. of the organic matter, shown by the sum of the ammonias, had been nitrified, and more than 99 per cent. of the bacteria had been destroyed. This was a remarkable result with an effluent averaging 70,000 gallons per acre, per day, for every day in the year. In 1890, the quantity was increased for three months to 126,000 gallons for six days in the week. The purification and destruction of bacteria were substantially the same. The application was such that each pebble was kept covered with a thin film of liquid in continual contact with the air spaces between them. "The liquid starting at the top as sewage, reached the bottom within twenty-four hours, with the organic matter nearly all burned out. The removal of this organic matter is in no sense a mechanical one of holding back material between the stones, for they are as clean as they were a year ago; but it is a chemical change, aided by bacteria, by which the organic substances are burned, forming products of mineral matter which pass off daily in the purified liquid."

These two references are only striking examples of hundreds of the valuable determinations effected. The State of Massachusetts spends about 20,000 dollars per annum on these investigations.

In sewerage, the most notable work now being carried on is the sewerage of the City of New Orleans by an incorporated company, under a franchise giving it the right to collect rates from householders, compelling connections, and constituting the rates a lien on the property. The population of the city

is about 300,000, and its area is 12 feet higher at the river bank than at the swamp in the rear of the inhabited territory. At certain seasons the river runs bank-full. The sewerage is to be carried out according to what is known here as "Waring's System." All rain-water being rigidly excluded, and all sewers to be automatically flushed, and ventilated through the soil-pipes of the houses, no trap being allowed on the main drain. The main sewer lies at the rear of the town, and the sewage is to be pumped from a depth of 27 feet through a force-main delivering into the Mississippi River below low water mark.

On the Atlantic Coast, the City of Brunswick (Georgia), standing on a low, saturated sand formation, bordered by a large tidal river, is now being sewered by the same system, the main sewer delivering into a pumping well five feet below tide, the sewage being driven through a force-main, of which the outlet is at the bottom of the river, 100 feet beyond low water mark and some twenty feet below low water level. The mean rise and fall of the tide is seven feet, and parts of the city are not more than a few inches above extreme high water.

The construction of this work was stimulated, as had been that of Memphis in 1880, by the occurrence of a severe epidemic of yellow fever (in 1893). Serious, and often fatal, malarial fevers prevail every year, fostered no doubt by the saturation of the ground nearly to its surface. The under-drains laid in connection with the sewers have reduced the level of the water of saturation nearly to the level of low tide, so far as the work has been completed, about two-thirds of the district. The whole is to be finished next year, but owing to the tropical climate, work is suspended from June 1st to November 1st.

THE ELEVENTH INTERNATIONAL MEDICAL CONGRESS, ROME, 1894.

BY DAWSON WILLIAMS, M.D. (LOND.)

The Eleventh International Medical Congress, which met at Rome in the last days of March of this year, was the most gigantic assembly of the kind which has ever taken place. To quote the words of a recent writer in the *Nuova Antologia*: "It is a fact beyond all dispute that the Roman Congress has registered the apogee of International Medical Congresses, and without fear of making a false prediction we may anticipate from this period onward a steady decline in their magnitude."*

* Quoted in the *Lancet*, May 26th.