## EIGHT EXAMPLES OF HYPOCHLORITE STERILIZATION OF WATER.*

(Continued from page 674).

The amount of hypochlorite first added to the water was 0.25 grains per gallon, but after complaints were received from the consumers the quantity was reduced to 0.14 grains per gallon and sometimes to less. The addition of from 0.14 to 0.25 grains per gallon of hypochlorite made from April 14 to April 27, 1909, produced a water from which 99.7 of the bacteria had been removed. Owing to complaints the treatment was discontinued from April 28th to May 3rd, with the result that the bacterial content per c.c. of water rose from 15 to 493, the per cent. removal being 77.5. From May 4th to June 9th the water was treated with 0.14 grains per gallon of hypochlorite, and the per cent. removal of bacteria was 96.1. It should be observed, however, that the number of bacteria in the raw river water had risen from 2,193 to 3,986 per c.c., and that the number per c.c. in the treated water was 154. From June 11th to 23rd the water was not treated with hypochlorite, and the result at first sight was very remarkable, seeing that the bacterial count per c.c. in the filtered water rose from 154 to 2,038. This shows very clearly that the water needed further treatment, but it does not by any means show that the previous treatment of 0.14 grains per gallon would have given a good result, for the reason that during this period the bacterial content per c.c. of river rose from 3,986 to 63,443, and it is probable that as the hypochlorite would have been added before filtration that the effect would have been to some extent neutralized by the organic matters in suspension. Also it is clear that a great deal of purification was effected by the coagulants and by the filters, and it is impossible to tell exactly how much of the work was done by the sterilizing agent. However, bearing these facts in mind and judging from the general results, it appears that when the water was treated with hypochlorite even in such small quantities as those used, a considerable improvement was effected. Thus between April 6 and November 8, 1909, the plant was operated during six different periods without hypochlorite and the maximum removal of bacteria was 98.4 per cent. and the minimum 72.6 per cent., the average for the six periods being 87.7 per cent. The bacterial content per c.c. being 276,493, 2,038, 1,265,942 and 96 respectively on the average for the six periods

There were also nine periods during which the water was treated with hydrochlorite varying in amount from 0.035 to 0.25 grains per gallon, with a maximum removal of 99.7 per cent. and a minimum of 95.8 per cent., the average removal for the nine periods being 97.7 per cent. or 10 per cent. higher than in the case of the samples which were not treated with hydrochlorite. The bacterial contents per c.c. on the average for the nine periods were respectively 15, 154, 36, 853, 265, 139, 22, 64, 72.

There are indications that as the solution was applied with greater skill so the results improved. Thus, in November, 1909, with the river water containing 4,337 bacteria per c.c., a removal of 98.3 per cent. was effected with a .10 grain per gallon treatment, while earlier when the river water contained only 3,996 bacteria per c.c., 0.14 grains per gallon only effected a removal of 96.1 per cent. Hence it is clear that comparative results can only be judged when the means of application are up to the same standard of efficiency, and when the preliminary removal of organic matter is the same in both cases.

**Hartford, Connecticut.**—The experiments with hypochlorite of lime at Hartford, Connecticut, have already been mentioned in these pages. The water of the Connecticut River has been treated, and Prof. Newlands has stated that when one part per million or more of available chlorine is used the removal of bacteria from this particular water is always greater than 99.5 per cent., and that the colon bacillus is not found in water so treated. The object of these experiments was to ascertain the possibility of using the river water for the town supply, in the event of the exisiting supply from the surface gathering grounds failing, a thing which was considered very likely to occur.

**New Jersey.**—It will also be remembered that in our issue of September 24th, 1909, the sterilization of the New Jersey water was described. The daily supply being 40,000,000 gallons is sterilized at a cost of 14 cents per 1,000,000 gallons. A ½ per cent. solution of bleaching powder (5 lb. of dry bleaching powder to 1,000 lb. of water) is the sterilizing agent. One part of this solution is then added to 10,000 parts of water, or, in other words, 5 lb. of bleaching powder is added to every 1,000,000 gallons of water. The bleaching powder used has about 35 per cent. of available chlorine, so that the amount of available chlorine used is about 0.2 parts per 1,000,000, or very much less than the amount once considered necessary at most places. Out of 455 tests made during a period of sixty-two days the total number of bacteria averaged 15 per c.c. in the treated water, and only once was B. Coli isolated.

The sterilizing agent is mixed and stored in tanks and discharged through orifices under a constant head, the supply being regulated in proportion to the flow of water in the aqueduct into which the solution is discharged.

**Toronto.**—The treatment of the water drawn from Lake Ontario with hypochlorite of lime was dealt with in these pages in a recent issue. It has been adopted in order to purify the sewage polluted lake water in the face of a typhoid epidemic.

Enough has been said to demonstrate how this new process is coming into use on a very large scale. The methods of application are at present somewhat crude, and the agent commonly used—viz., chloride of lime in the form of bleaching powder—is not without its drawbacks, but these will rapidly receive the attention they deserve, and sterilization by means of hypochlorite will undoubtedly form one of the ordinarily accepted methods of water purification.

## ELEMENTARY ELECTRICAL ENGINEERING.

L. W. Gill, M.Sc.

### CHAPTER IV.

### DIRECT CURRENT APPARATUS AND SYSTEMS.

This series of articles will be continued for some months. They will be of particular interest to the student of electrical work and the civil engineer anxious to secure some knowledge of the simpler electrical problems.

Up to this point it has been assumed that the magnetic flux which passes to and from the armature is caused by a current flowing in coils of wire placed on the poles, but nothing has been stated as to how this current is obtained. If the poles were permanent magnets, there would be no need of these coils and current; and it may be here noted that the magnetic flux in the first generator which was constructed by Faraday was obtained from a horseshoe magnet. Generators with permanent magnets