THE PURIFICATION OF DRINKING WATER BY MEANS OF ELECTRICITY.

The reappearance of that dreaded scourge, cholera, in Europe, and the chance that it may be transmitted to this country, has naturally led our medical authorities to exert themselves to the utmost to render sanitary conditions as perfect as possible. It is generally recognized that cholera is due to a germ which findsits way into the stomach and intestines, being usually conveyed through the medium of the drinking water supplied in cities. It was, indeed, established beyond doubt that the terrible plague of Hamburg last year was due to the pollution of the river Elbe, Hamburg's old source of water supply. While it is true that the water can be sterilized and made safe for drinking by boiling, the fact remains that the process, simple as it is, is applied in but a small minority of cases. This is well recognized among sanitary authorities, with the result that the conclusion has been reached that true relief must be looked for in the purification of the water supplied before it reaches the consumers.

It has been noted that the pollution of drinking water for city purposes is most frequently due to sewage, which is either led directly to the waters serving as a source ef supply or finds its way into such sources by percolation through the earth. In either case, unless measures be taken to destroy the disease germs or other compounds, usually of a nitrogenous nature, the result is inevitably a large increase in zymotic diseases. The purification of sewage has, therefore, attracted the attention of sanitarians for some time past; but up to the present little, if anything, has been done looking toward a satisfactory solution of the problem.

At the same time, the methods adopted for the purification of the water supply have been not less numerous, and several have been tried in actual practice, among them aeration. It is doubtful, however, whether the results thus far obtained justify the expectations with which they were hailed, so that there still remains a wide field open for improvement.

It was a condition of affairs similar to that outlined above which for some time has caused much uneasiness to the inhabitants of New York City, and the local medical authorities, at the head of whom is Dr. Cyrus Edson, have been unceasing in their efforts to devise means for improving the condition of the water supply of New York City. One of its chief sources of pollution was found to be the sewage outlet at the village of Brewsters, a little town situated some twenty miles from New York. At this place the sewage drained into a stretch of marsh situated at an elevation, and so located that the percolation reached one of the streams forming the water supply for New York City. These marshes had in themselves already grown to be a nuisance and a menace to the health of the inhabitants of the town, and hence the local authorities were also greatly interested in any means which would afford them relief. On looking up various methods with this end in view, Dr. Edson decided that the simplest way out of the difficulty was the thorough purification and rendering harmless of the Brewsters sewage; but the difficulty of effecting a thorough purification with the means ordinarily employed for that purpose, involving the use of expensive chemicals containing hypochlorites and chlorides, led him to the adoption of a method proposed by Mr. Albert E. Woolf, of this city.

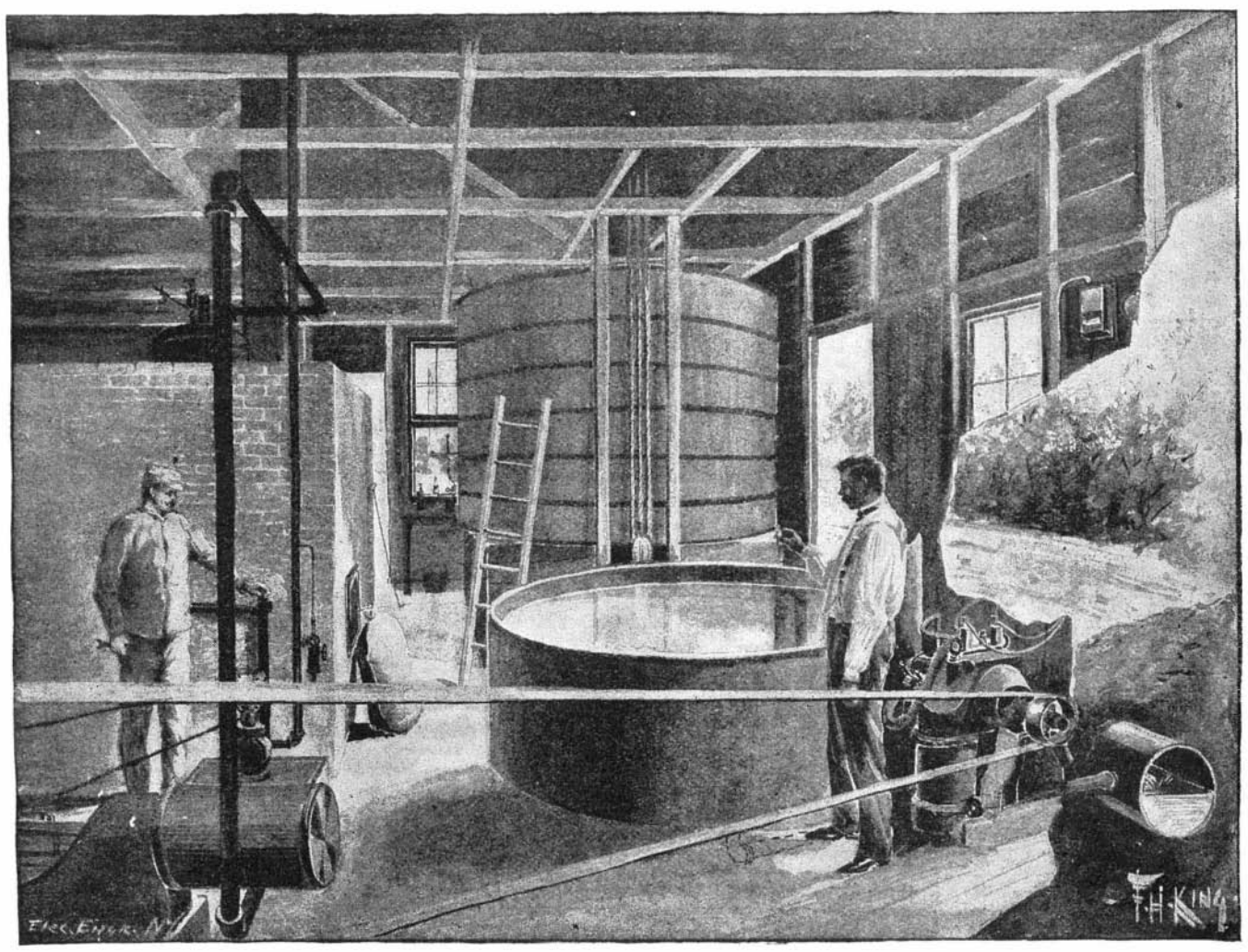
Mr. Woolf, whose work in storage batteries has already been mentioned in these columns, has recently developed a method of obtaining a cheap disinfectant by electrolyzing sea water.

The principal solids held in solution in sea water in the Atlantic Ocean are the following, the figures denoting parts in 100:

Chloride of sodium	2·7558
Bromide of sodium	0·0326
Sulphate of potassium	0·1715
" " lime	0·2046
" " magnesia	0·0614
Chloride of magnesia	0·3260
Total	3·5519

By passing a current through the sea water the chlorides, bromides, etc., are converted into hypochlorites, hypobromides, etc., and other compounds of a more or less complex nature are formed. When a solution of hypochlorite of sodium is brought into contact with organic matter, a decomposition at once takes place. While it is impossible to state just what the reaction would be, it is probably as follows: Part of the chlorine in the hypochlorite replaces a part or the whole of the hydrogen in the organic substance. Another portion unites with the liberated hydrogen, and, as in bleaching, ozone is produced, which, in its turn, acts on the organic matter. In other words, the organic material, be it organized, as in the lower forms of vegetable life (viz., bacteria, etc.), or non-organized, as in the solid or suspended matter of sewage, is decomposed, and if sufficient hypochlorites be present, the organic matter is permanently disinfected.

In the preparation of the Woolf disinfecting material it is, of course, essential to employ electrodes which are not decomposed by the electrolyzing action, and for that purpose Mr. Woolf employs a positive electrode consisting of copper coated with platinum; while as a negative he employs carbon.



THE WOOLF ELECTRICAL APPARATUS FOR THE PURIFICATION OF WATER.

As already remarked, the plant for the production of the new disinfectant has been established at the town of Brewsters, and our engraving shows the interior arrangement. It consists of a steam plant operating a Zucker & Leavitt dynamo, which is capable of furnishing 700 amperes at a potential of 5 volts. The engine has a capacity of 15 horse power. Close beside the dynamo is an electrolyzing tank, which has a capacity of 1,000 gallons and which is fed from a 3,000 gallon storage tank beside it, and elevated above it so that the solution flows to the electrolyzing tank by gravity.

The electrodes which rest on the bottom of the tank are composed of three platinum plates of the nature described above, and four of carbon, the positive and negative plates alternating. The carbon plates present a surface of 12 by 12 inches and are 1 inch thick. The arrangement, as will be seen, is such that the process is a continuous one. The flow of the solution is so timed that the salt water is electrolyzed to a proper degree, and then overflows directly into a pipe leading into the sewer.

This plant of 15 horse power capacity is far in excess of that required to disinfect thoroughly the entire sewage of the town of Brewsters, but was designedly arranged so that it would eventually be able to take care of an increase of population amounting to 30,000.

The effect of the electrolytic disinfectant on the sewage outlet at Brewsters is of a most marked character. The offensive odors arising from the marshes no longer exist, and the sewage shows a marked diminution in the nitrites present. It is also noticed that the green algæ and other organic matter upon the surface of the marshes, and which had usually collected on the retaining walls, has become bleached.

As showing the value of this electrical disinfectant produced by the aid of electrolysis, it is interesting to note some recent reports made by the officers of the Health Department of New York City. Dr. Cyrus Edson, chief of the medical staff of the Board of Health, states that in a series of experiments on anthrax spores and staphylococcus pyogenous aureus, in all cases save the exposure of anthrax for one minute to a 10 per cent solution, the liquid exercises a marked inhibiting effect on the growth of the micro-organisms employed. It has also been shown that the solution is an effective agent for the destruction of cholera spirillum. Experiments made show that no cholera colonies are developed after an exposure of 30 seconds to the disinfecting agent. Tests of the Woolf disinfectant show that it equals in strength a 1 per cent solution of chloride of lime. In the latter there are 175 grains of available chlorine to the gallon, while in the Woolf disinfectant 186 grains were found to be available.

In the matter of cost, however, the great value of the Woolf disinfectant will be apparent when it is considered that a 1 per cent solution of chloride of lime costs about 1·4 cents per gallon with lime at 6 cents per pound. The estimated cost of the electrolyzed sea water, however, is only 10 cents per 1,000 gallons. Reckoning on this basis, therefore, Dr. Edson shows that its price per gallon may be 0·01 cent; in other words, 140 gallons of electrolyzed sea water will cost only as much as 1 gallon of a 1 per cent solution of chloride of lime. Comparing the cost with that of bi-chloride of mercury, the disproportion is in the ratio of 100 to 1 in favor of the Woolf disinfectant; while a 5 per cent solution of carbolic acid costs from two to three hundred times as much. Besides this, the two latter are extremely dangerous when handled by inexperienced persons. From this standpoint, electrolyzed sea water is harmless; indeed, we have seen the inventor drink it as one would spring water, without any apparent ill effects. The experiments made thus far have been so successful that Dr. Edson has recommended that steps be taken to locate a disinfecting plant in New York City, and no doubt the plan will soon be carried out.—*The Electrical Engineer.*

The New Regulation Bullet.

The Frankford arsenal is now making ammunition for the new "United States magazine rifle," caliber 30, with a 220-grain bullet, the weight of the bullet used at present being 500 grains. The rifle is a modified Krag-Jorgensen rifle, with which the troops of Denmark are armed.

Experiments made at the Frankford arsenal demonstrate that a nickel-steel covered, unlubricated cartridge of the new type is better than the old copper case with lubricated bullet. The velocity of the new 220-grain bullet of 30-caliber is 2,000 feet per second, while the velocity of a 45-caliber, 500 grain bullet is only 1,300 feet. The penetration is remarkable. A small caliber bullet of the new type fired at oak timbers placed lengthwise, penetrates 30 inches at 30 yards range, while the present bullet will only penetrate 4 to 5 inches at the same range. The accuracy of fire with the new bullet is very remarkable. The new bullet is called a humanitarian bullet, for the reason that there is every chance of the bullet passing directly through a bone without shattering it. It is possible that our army may now have the best bullet, as our navy has the best armor plate in the world.