ELECTROLYTIC CORROSION OF THE BOTTOM OF OIL TANKS AND OF OTHER STRUCTURES.*

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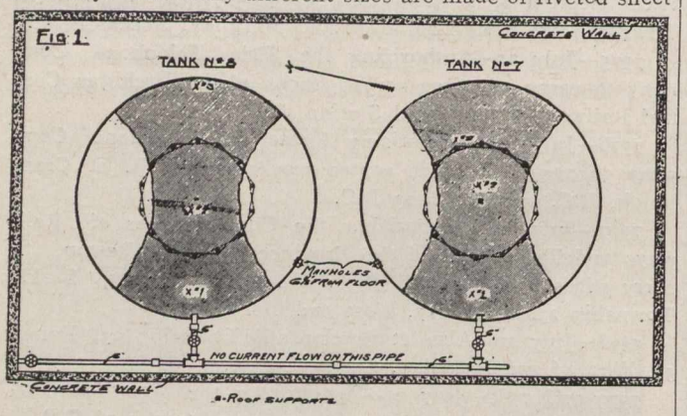
The subject of the corrosion of iron in its broad sense being of wide and growing interest at the present time, any data furnished of special or important features of corrosion discovered in the practical operation of various industries will doubtless be of some value, not only to those engaged in laboratory studies of the question searching for cause and remedy, but those directly concerned who are seeking to avoid the depreciation of costly structures.

In accepting the invitation to prepare a paper for this meeting, the writer has felt a sense of duty as a member of the society to bring before it at this time for discussion, a case of most pronounced corrosion which has recently come under his notice, and which, it seems plain, comes squarely under the head of electro-chemistry.

The case to which we refer is the destructive effects found upon the bottom of oil tanks. Three such tanks have been examined and the the principal subject of this paper. Two of these are located in the gas works of an eastern city and one in the Standard Oil Works of another city.

First, a word in regard to the construction of oil tanks. This being fairly well known, a brief description only is necessary. The many different sizes are made of riveted sheet



steel plates, usually 11 feet by 5 feet and from ¼-inch to ⅜-inch in thickness for the sides and bottoms, and somewhat thinner for the roofs. The roofs are supported in some cases by upright wooden joists from floor to roof, the joists suitably braced. In other cases a steel frame is placed under the roof supported from the sides, similar in appearance to an umbrella frame.

The conditions found in the three tanks examined will now be considered. First, the two tanks at the gas works. These will be considered together, as all the conditions were practically the same in each case, even to the extent of the damage found.

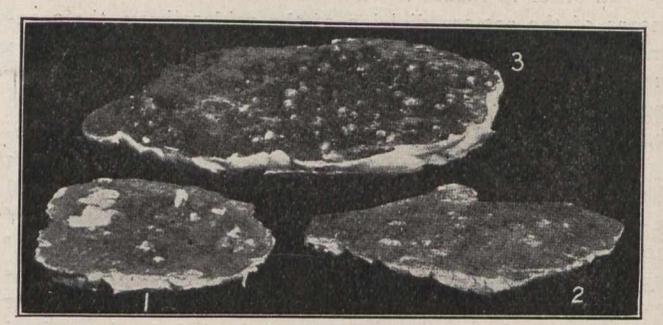
Fig. 1 shows the top view in section of both tanks. These were found numbered 7 and 8 (the same numbers used in the drawing), and will be herein so referred to. These tanks are 35 feet in diameter and 16 feet high, slightly higher at the peak of the roofs. The roofs are supported in this case by perpendicular wooden joists from the floor, as shown by the circle of square dots in the drawing. An intake pipe is located about 6 inches from the bottom of each tank, which is also used as an outlet. These intakes connect to the out side pipe line shown in the drawing.

These tanks which are located on the end of a dock are enclosed within a concrete wall, with concrete foundations; this presumably to prevent oil flowing into the harbor in case of leaks or fire. Both of these tanks were discovered to be leaking. The oil was run off and sediment of a consistency soap of soap removed. The numerous pittings and holes in the bottoms suggested to the men at first, electrolysis due to railway currents, as it was known such currents were flowing through the works. When the writer was called to examine, the first discovery made was the pittings originated at the interior of both tanks, the larger part of such pittings on the inside floor, and tapering downward, many of them terminating in holes through the iron. These holes ranged in size from ¼-inch in diameter to more than 1-inch in several cases.

Plaster casts were taken in a few places on the floors of both tanks, so these effects could be later considered. These casts are herewith submitted for your inspection. Plaster casts, it is well known, are the reverse of holes and pittings. Photographs of these casts have been made and appear in the paper. The shaded portions of Fig. 1 show the location where these pittings and holes were found most numerous. It will be noted they were immediately in line of the intake pipes and spreading out at the opposite sides. The numbers on the casts correspond with the numbers in the drawing, indicating where they were taken. Each of the casts will be briefly explained.

The first three are from Tank No. 7, Fig. 2.

Cast So. 1.—A pitting with a projection near the centre, representing a hole through the metal ¼-inch in diameter. This is the only projection on the casts representing holes



which remained intact; the other broke off when the casts were removed. At the left of this pitting are two white spots which represent holes, where the plaster broke off.

Cast No. 2.—A pitting at the far side nearly through the iron. This was taken about the centre of the tank.

Cast No. 3.—A cluster of pittings representing a fair average of those discovered at the opposite side of the tank. from the intake.

Plaster Casts from Tank No. 8. Cast No. 1.—A group near the intake, which represents a fair average at this point, excepting some holes not far away.

Cast No. 2.—Shows a ridge representing a furrow or channel in the iron bottom 4 inches long, 2½ inches wide, and 6-32-inch at the deepest point, or within 2-32-inch of being through the iron. In the immediate vicinity of this cast were found several holes.

Cast No. 3.—The top broken off, representing a pitting with a hole at the centre. This hole was 1-inch long and ½-inch wide, measuring from the longest and widest parts.

These two tanks have been in service seven years. As they were much needed for storing oil, temporary repairs have been made by filling the pittings and holes with litharge and red lead, but it is probable that new bottoms will soon be placed in them.

Samples of the water obtained from the bottom of two of the gas company's tanks have been analyzed by Dr. Stillman, of Stevens Institute of Technology, Hoboken, N.J., who reports as follows:—

Thos. B. Stillman, M.S., Ph.D., Chemical Engineer,
Hoboken, N.J., October 29th, 1908.

Adolphus A. Knudson, Electrical Engineer,
New York City.

Dear Sir;—The sample of water from bottom of oil tank marked No. 11 contains 1.6 per cent. mineral residue—mostly salts of soda. The sample of water from bottom of oil tank marked No. 7 contains 1.3 per cent. mineral residue—mostly salts of soda.

Both solutions react alkaline.

Respectfully yours,
(Signed) Thos. B. Stillman.

*Read at Fourteenth General Meeting of American Electro-Chemical Society