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OUTFALL SEWER AND SEWAGE FARM AT SALT LAKE CITY, UTAH

(With full-page engraving.)

Among the most important of the new public works of Salt Lake City are the gravity intercepting sewer and the sewage farm, which were undertaken to prevent the pollution of the Jordan River, and were referred to in the "Notes of a Transcontinental Trip" in our issue of Oct. 15, 1896. The sewer was described and illustrated in our issue of Jan. 4, 1894, but in Fig. 1 we show a part of the deep trench. The sides and bottom of the sewer are of concrete, the material being rammed outside of a form supported by collapsible centers. The two side pieces of each center are hinged to the bottom piece and are folded inward when the top brace is removed. This brace has been removed from the front center shown in the cut. The arch of the sewer is built of native Utah (yellow) brick, and as this is poor and porous, the outside of the arch was well plastered with cement mortar. The sewer is 36,151 ft. long, with diameters as follows:

38-in.	200 lin. ft.
42-in.	5,133 " "
48-in.	12,868 " "
64-in.	17,950 " "
Total	36,151 lin. ft.

The sewer was planned to extend to the intersection of Ninth South and Fourth East Sts., but the City Council ordered the work stopped at the intersection of Fifth South and State Sts., on account of lack of funds. About 200 ft. of the 38-in. section was constructed with a gate placed at the lower end, where it connects with the 42-in. section, and this is used as a flush tank. There are 20 miles of laterals connected with the gravity sewer, and the number of house connections is 912.

The volume of sewage entering the gravity sewer is 2,500,000 gallons in 24 hours, and the volume of ground water entering is 1,500,000 gallons in the same time, making a total of 4,000,000 gallons per 24 hours.

Where the sewer passes under North Temple St. there is a drop manhole connecting with the North Temple St. aqueduct, which is shown in Fig. 2. The aqueduct has a concrete lining at this point, and is fitted with an iron gate hinged to the sides of the channel and raised by chains wound on a transverse bar operated by gearing. The channel is 10 ft. wide on top. The gate is shown raised to its normal position to allow all the water to flow down the aqueduct. When it is desired to flush the sewer or to carry off storm water, the valve

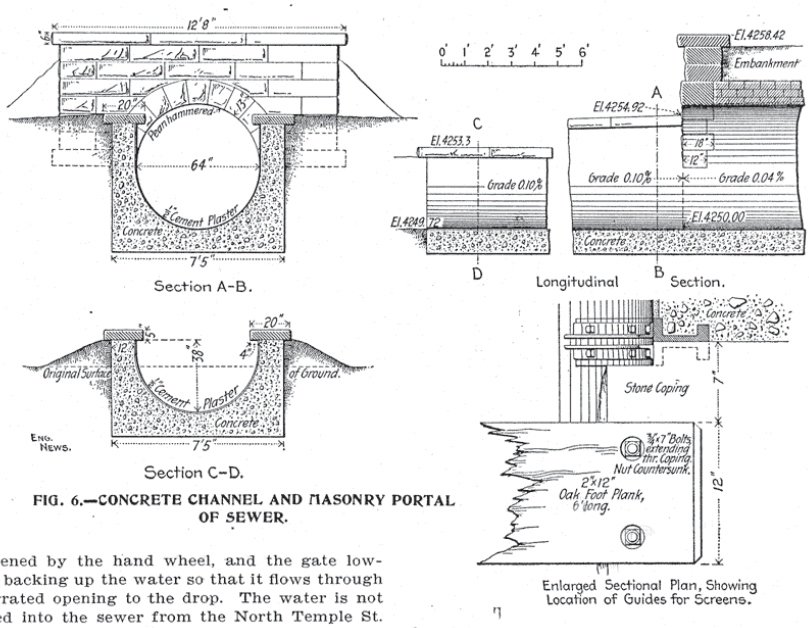

FIG. 6.—CONCRETE CHANNEL AND MASONRY PORTAL OF SEWER.

is opened by the hand wheel, and the gate lowered, backing up the water so that it flows through the grated opening to the drop. The water is not turned into the sewer from the North Temple St. aqueduct except for flushing, and during high water, then the amount turned in is about 15,000,000 gallons in 24 hours.

At the mouth of the sewer tunnel there is an open concrete channel leading to the sewage farm. This is shown in Figs. 3, 4 and 6. In Fig. 3 the tunnel curves away to the right, along the valley, near the foothills. Fig. 4 is looking from the tunnel portal to the sewage farm, the channel connecting with the ditch where the white line of the coping ceases. Fig. 5 shows the construction of the channel and sewer portal.

Sewage Farm.—When this plan of disposal was first decided upon it was thought that farmers would be willing to take the sewage for irrigation, since all land here for cultivation must be irrigated. The farmers, however, were afraid of it, mainly from ignorance, thinking that it would damage the crops, clog the ground and be otherwise injurious. Proposals for the right to use the sewage were advertised for, but the only bid received was one by which the bidder asked to be paid for taking the sewage. This condition of affairs was discussed in our issue of Nov. 7, 1895. The call for proposals estimated the sewage discharge at about 1,500,000 gallons in 24 hours, with perhaps an equal amount of ground water. The volume of water turned in at the North Temple St. aqueduct connection, above mentioned, would vary with the season, and during high water in the river the combined volume of the aqueduct water, ground water and sewage may equal the full capacity of the sewer at the point of connection, while at other seasons there may be but little if any water turned in here. There is a large area of unimproved land near and below the outlet of the sewer that is without water for irrigating purposes, which could be reclaimed by turning the sewage upon it in a proper manner. The city had purchased 75 acres of this unimproved land at the sewer outlet and offered the use of this free to the contractor. When it was found that no satisfactory arrangement could be made for handling the sewage by contract, it was decided to undertake cultivation by sewage irrigation on the city's land, as a means of educating the people to the advantages of the use of sewage for irrigation, and it is confidently expected that the results will be so satisfactory as to destroy the prejudice against the use of sewage and lead the farmers to take it for their land, and it is considered that the conditions here are specially favorable to its use since all land for cultivation must needs be irrigated. The original farm comprised 75 acres, but additional land has been acquired, and there are now 200 acres, of which 90 acres have been plowed. The land extends to the Jordan River, and the main ditch is carried to the river, so that when the sewer is running full with water from the aqueduct, the flow can be sent directly along the ditch to the river, without being turned upon the land at all. A plan of the farm is shown in Fig. 5, and it will be noted that at one point the property is practically separated, since it meets only at a corner. Here it has been necessary to obtain right of way for the sewer across the corner of the adjoining property.

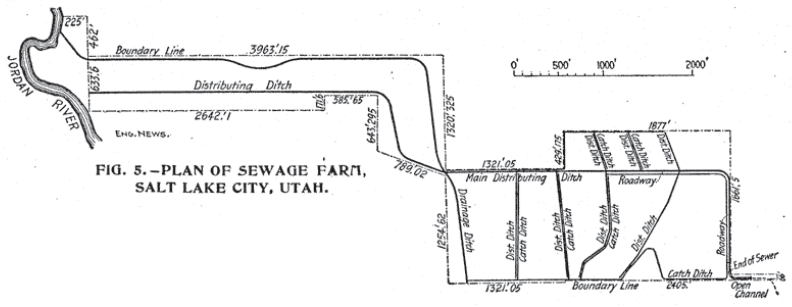

FIG. 5.—PLAN OF SEWAGE FARM, SALT LAKE CITY, UTAH.

The gravity intercepting sewer tunnel ends at the sewage farm in a portal of Park City yellow sandstone, from which an open cement-lined conduit leads to the main ditch, as shown in Figs. 3 and 4, already referred to. The details of this portal and conduit, or channel, are shown in Fig. 6. Parallel with the main ditch is the secondary or distributing ditch from which the sewage flows through furrows plowed at right angles to the ditch. In Fig. 7 the main ditch (with one of the gates opening to the secondary ditch) is just beyond the fence, while the two men in the foreground are standing on opposite sides of the secondary ditch. Culverts of Utah sewer pipe connect the main and secondary ditches, and are closed by gates in the side of the main ditch. The construction of these culverts and gates is shown in Fig. 8. At these culverts the main ditch is lined with concrete, and faced with cement plaster, a groove being formed in the face of the concrete to receive the flat iron gate, the gate being guided by studs embedded in the concrete. A yoke is embedded in the top of the concrete slope,

and carries studs or catches to hold the gate in any desired position. Vertical iron rods are built into the concrete floor of the ditch at the opening, to hold movable stop planks, and brick paving is laid for a short distance adjacent to the concrete lining.

The sewage farm has been in constant use since the sewage was turned into the gravity sewer, on July 11, 1896. It then being so late in the season no crops were planted, except about five acres of corn for fodder. It is the intention to improve the farm by erecting buildings, planting shade trees along the roadways and planting an orchard on the land which is too high for surface irrigation (about 6 acres). Next season the plowed land will be utilized for raising crops.

The land is prepared for the sewage by throwing it into ridges, about 3 ft. apart, with a 14-in. lister (a double mold-board plow that throws the dirt both ways) which forms a furrow about 12 ins. deep between the ridges. About 4 ins. in depth of sewage is turned into the furrows from the head ditch and allowed to run until the land is thoroughly soaked, when it is changed to another set of furrows. By the time the sewage reaches the catch ditch at the lower side of the land, it is clear. It then runs into the drain ditch and thence to the Jordan River. The land is watered every day for three or four days, then the watering is discontinued and as soon as the ground is dry the lister is run through the ridges, splitting them, filling up the old furrows and forming new ones. The main distributing ditch has a bottom width of 3 ft.; it is 3 ft. in depth and has slopes of 1 to 1. The grade is from 0.1 to 0.16%. The small distributaries are 2 ft. wide and have grades of from 0.1 to 0.2%.

The works have been planned and carried out by Mr. F. A. Doremus, M. Am. Soc. C. E. (until recently President of the Board of Public Works), and Mr. F. C. Kelsey, City Engineer, and we are indebted to the latter for photographs and information made use of in the preparation of this article.

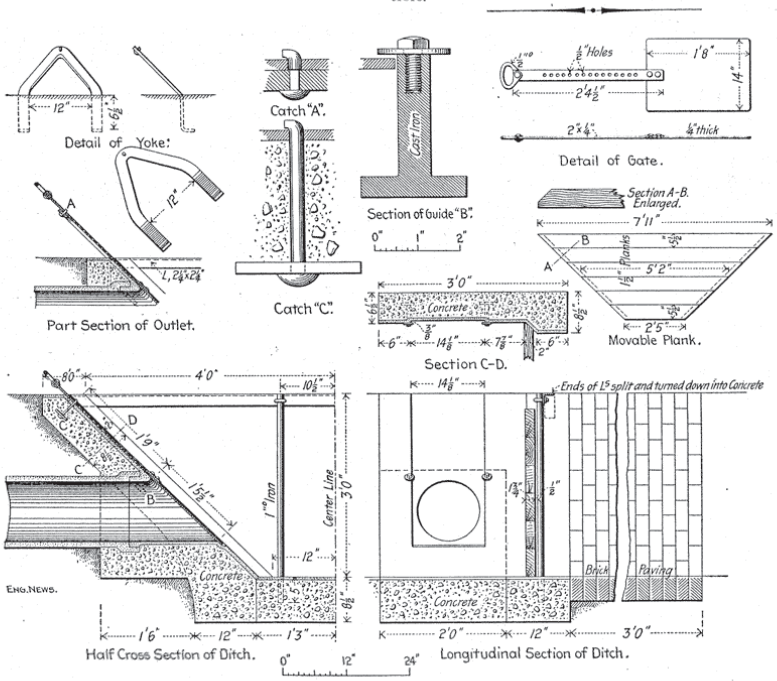

FIG. 8.—DETAILS OF CULVERTS BETWEEN THE DITCHES ON SEWAGE FARM.