

whereas the double ladder permits the greatest number of movements either from one platform to another or of the main line trains, to be made without interference. A layout of this nature can only be economically used where an interlocking plant is in operation.

In main line work refinements have to be made in the switches to make them easy riding, such as the use of longer switch points, and spring frogs. The latter are made with

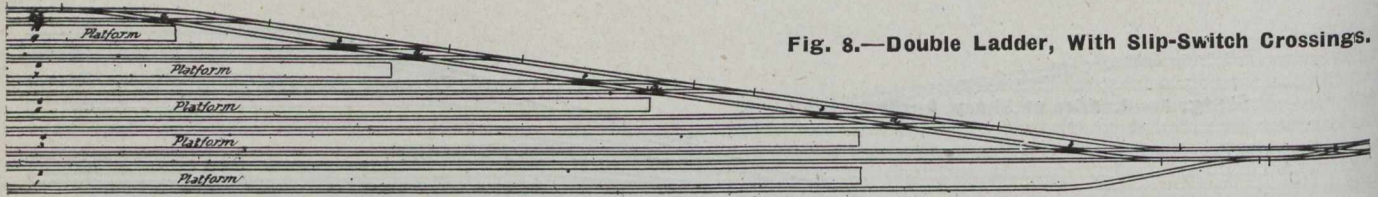


Fig. 8.—Double Ladder, With Slip-Switch Crossings.

one arm pivoted in such a way that ordinarily the main line rail is continuous, but when the turnout is being used the wheel flanges of the cars push this arm to one side, against the pressure of a strong spring.

On the railways in Great Britain even greater refinements are carried out with switches, to meet such conditions

as are often obtained at junctions between stations where trains will frequently pass from the main line to the branch at as high a speed as 60 miles an hour. To meet these requirements the switch points are made very much longer and the whole switch is constructed on the principle of a spiral curve.

Great strides have been made in this subject during the past years, but even now it is quite possible to see yards

with a jumble of switches at their extremities which might have been made into orderly ladders, and with "stub" switches which should be on the scrap heap; but these will all no doubt be replaced in the course of a few years with the neat and efficient layouts that are now in general use in modern track construction.

SEWER CONSTRUCTION.

The laying of sewer pipe by contractors in treacherous ground of the quick sand type usually means pecuniary loss for the contractor if he was unaware, at the time of making his bids, of the soil of the above type he would encounter. A description of the troubles and difficulties of this kind unexpectedly run into is given in a paper presented before the Iowa Engineering Society, by C. P. Chase, and reads as follows:—

A contract was let in October, 1910, to Mr. C. R. Nichols, embracing $5\frac{1}{2}$ miles of 8-in. to 15-in. pipe sewers, with manholes and flush-tanks, and a reinforced concrete septic tank with dosing chambers and sand filters.

It was expected to begin work at once, but the contractor was busy and let it go over winter. Conditions early in 1911 were ideal; but the contractor failed to begin, though constantly urged. At last, in July, 1911, work was begun on the disposal plant by a sub-contractor and the grading done and excavation made for the tank. Here the contractor, tied up by other affairs, abandoned the work.

The council gave notice to the bonding company to take up the work, and very shortly it came forward and agreed to complete the job. The contract was placed in the hands of the Lytle Construction Company, of Sioux City, which immediately began operations. The first trenching machines steamed up on Aug. 20, 1911, and conditions seemed to be favorable for completion that season.

In the deepest cut of some 21 ft. the machine cut to grade with no bracing and ditch dry as a bone. A large number of laterals on the east side were built, with cuts from 7 to 20 ft., with an occasional brace, the machines making in some instances as high as 650 ft. in one day on a 6 to 8-ft. trench. The laterals were nearly in before cold weather, but in the meantime, on the other branch of the main sewer, something had happened. As will be remembered, 1910 and 1911 to the fall of the latter year were very dry; this was especially true around West Liberty. A rain of several days came about Oct. 1, and the dry ground in 48 hours was filled with water, there to remain.

Quicksand.—In a recent English lawsuit a lawyer described a certain quicksand that had resulted disastrously to his client as "an oily, slithery, nasty mess, where men would

speedily sink to their death if not rescued." There you have West Liberty. Molasses, soft glue, or crude tar come nearest. By various sewer men it was designated as quicksand, floating clay, sea mud, boiling sand, and worse. I would designate it as a silt deposit of some ancient lake bed. It varied from a fine, silty sand to a molasses-like mud, in which men frequently sank to their hips and were pulled out with ropes, and it would go anywhere that water would.

The first encounter with this was fought out in the usual way, with hand-driven sheeting afterward removed. One block about 300 ft. long, put in in this way, was clear and in good shape when finished; later the sides settled and the whole line was heaved out of line and grade and nearly every pipe crushed. The various ordinary expedients of sewer building were tried without much success.

First a small section was taken out by hand, driving the sheeting down as the excavation proceeded; when to grade short ship lap was driven about 2 ft. below grade and left 2 ft. above. Straw, cinders, stone, brickbats and other material simply floated away, the great trouble being that after the pipe was laid the bottom of the trench would raise up from pressure of the sides and break open the joints or even crush the pipe.

It was seen that although expensive, more strenuous methods must be adopted, and that perfectly tight sheeting must be used, of sufficient strength to hold the side pressure and that it must be secured and left in. It was also found to be impossible to depend on hand driving. An Amott hammer and a proper outfit were secured. To prepare for sheeting, the ditch was opened with a trenching machine as deep as the banks would stand, which was from 6 to 9 ft., much better success attending machine digging than hand digging. Then 2 x 12-in. tight sheeting was driven about 3 ft. below the grade of the flow line of the pipe, thoroughly cross-braced and spiked. It was allowed to remain in the trench. Any attempt to remove the sheeting was attended with almost immediate disaster.

Two methods of placing and driving the sheeting were employed. In both cases the excavation was carried down 6 to 9 ft. with a trenching machine, temporary braces being set to hold the clay banks until the stringers could be placed.