pass through the frog, as the latter will simplify the problem, and the radius of the rail is determined simultaneously by measuring the middle ordinates for one or more chords.

Having the angle of intersection, as described above, the radius of the curved track, and the angle of the frog to be used, and having selected a radius for the connecting curve, the essentials of the location are the distance between the point of intersection and the point of the frog, the central

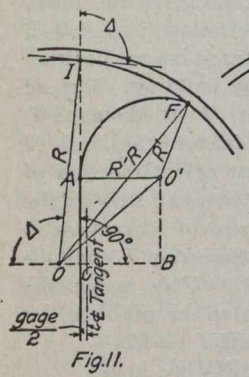

Fig.11.

[Case 3. Curves in Same Direction. Δ greater than 90°.]

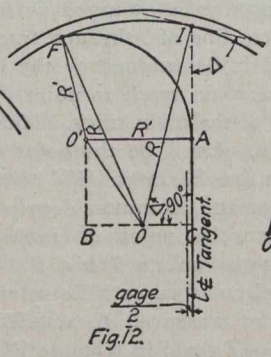

Fig.12.

[Case 4a. Curves in Same Direction. Δ less than 90°. R¹ greater than R cos Δ.]

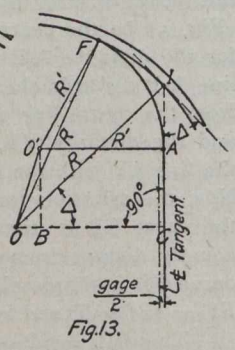

Fig.13.

[Case 4b. Curves in Same Direction. Δ less than 90°. R¹ less than R cos Δ.]

angle of the connecting curve and the distance between the point of intersection and the B. C. of connecting curve.

The following solutions offer ready and accurate methods of obtaining the above-named points:

In Figs. 8, 9, 10, 11, 12 and 13 let CA represent a line offset one-half the gauge from the centre line of tangent, which is to be connected with the gauge line of the rail of the curved track by means of a frog having an angle of F and a curve whose radius is R. O and O¹ are the centres, I the point of intersection where the angle Δ has been measured, and the other notations are as shown in the diagrams. The rail opposite the frog and the switch rails are not shown as they have no bearing on the problem. Required to determine the angle I O F. Then measure on the curve:

Arc F I = R × angle I O F in minutes × a constant (= 0.00029089).

Or chord F I = 2R × sin ½ I O F.

The distance OO¹ is determined by solving the triangle OFO¹ of which the angle F and its including sides R and R¹ are known. This also determines the angles FO¹O and FOO¹.

In cases 1 and 3, Figs. 8 and 11, O B = B C + O C = R¹ + R cos Δ

In cases 2a and 4a, Figs. 9 and 12, O B = B C — O C = R¹ — R cos Δ

In cases 2b and 4b, Figs. 10 and 13, O B = O C — B C = R cos Δ — R¹.

It should then be noted that when O B is computed to be greater than O O¹, impossible conditions have been imposed; the radius of the connecting curve has been taken too large.

Having determined the angle O¹ O B from the right triangle O B O¹, in which O B and O O¹ are known, the angle I O F is found as follows:

In cases 1 and 2a, I O F = Δ — (F O O¹ + O¹ O B).
In cases 3 and 4a, I O F = 180° — (Δ + F O O¹ + O¹ O B).
In case 4b, I O F = O¹ O B — (F O O¹ + Δ).
In case 2b, I O F = Δ — (180° — O¹ O B + F O O¹).
In cases 1 and 2a, A O¹ F = O¹ O B — F O¹ O.
In cases 3 and 4a A O¹ F = F O¹ O — O¹ O B.
In case 4b, A O¹ F = F O¹ O — (180° — O¹ O B).
In case 2b, A O¹ F = 180° — (O¹ O B + F O¹ O).

To determine the distance AI:

In cases 1 and 2, A I = A C — I C = O¹ B — I C, = O¹ O sin O¹ O B — R sin Δ.

In cases 3 and 4 A I = I C — A C = R sin Δ — O¹ O sin O¹ O B.

The engineer should be careful to add or subtract one-half the gauge to the centre line radii, as the case may require. The point A which is the B. C. of the connecting curve, and the point F, which is the theoretical point of frog P. T. of the connecting curve can now be readily fixed in the field and the entire connection staked out.

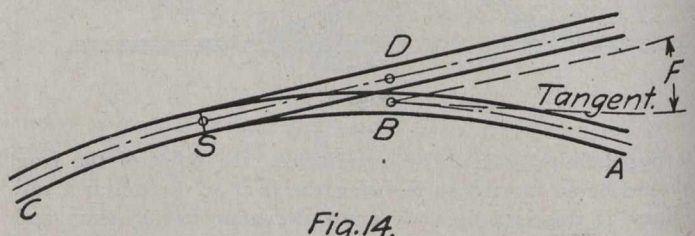

Fig.14.

While the writer realizes that it is better practice to place the frog end of the connecting curve at the heel of the frog, to impose that condition in the above problem would complicate it beyond measure. In inserting 10 or 15-ft. frogs in a curved track, the trackmen cannot help slightly changing the original alinement of the track at that point, and energy spent in making a closer solution than that outlined above will surely be wasted.

Method of Obtaining Straight Leads.—Theoretically, a turnout leading off the outside of a curve, the degree of which is equal to that for the turnout from straight track will have a straight lead. Practically, however, the lead will not be straight, but curved to a greater or less extent. This is due to the fact that switch rails and frogs are straight and

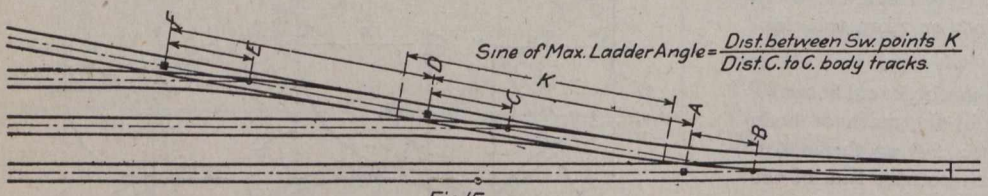

Fig.15.

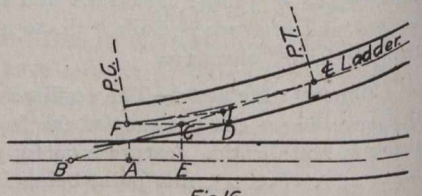

Fig.16.

not curved as is generally assumed. When it is possible to do so, it is desirable from both the operating and maintenance standpoints to obtain absolutely straight leads. To obtain straight leads in turnouts leading off the outside of a curve where the main curve is also being staked at the same time, the following method will prove effective. (See Fig. 14).

After staking out the main curve ABC to B, the point decided upon for the location of the frog, set up the instrument at D, this point being in the centre of the turnout track opposite the point of frog. The frog angle is now turned off from a line through D parallel to the tangent to the curve at B, and the point S is located a distance equal to the length of the switch lead from point D. The instrument is now set up at S, and the main curve is continued from the line DS, or switch lead, after which the alinement of the turnout beyond the frog can be proceeded with.