June 17, 1941. T. R. HARTRAMPF 2,245,915

SPIRAL TEMPLATE

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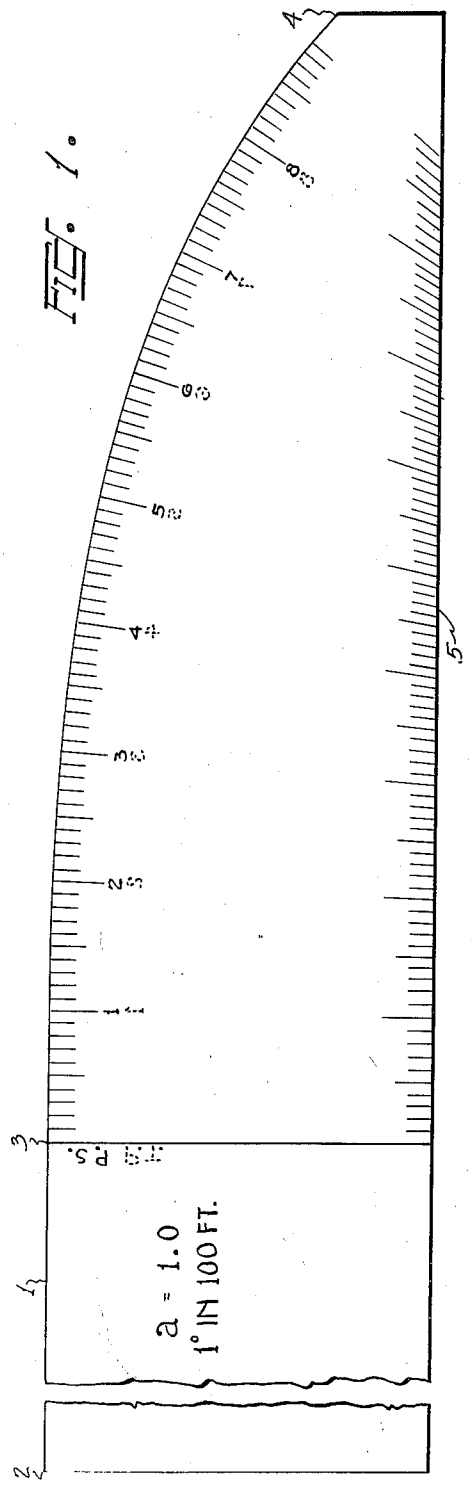


FIG. 1.

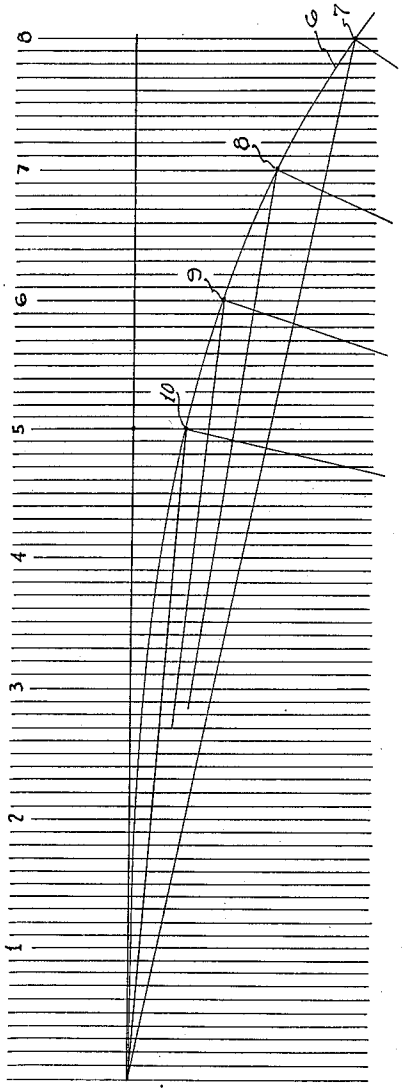


FIG. 2.

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FIG. 3.

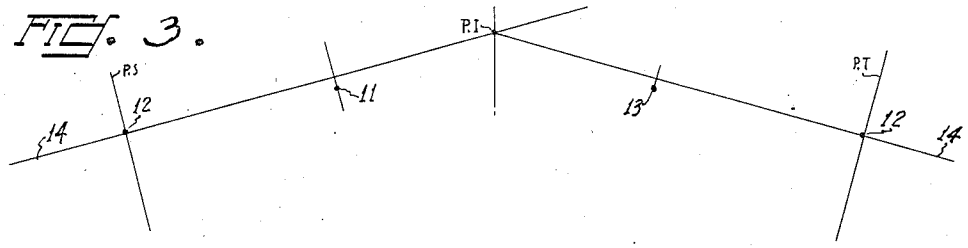


FIG. 4.

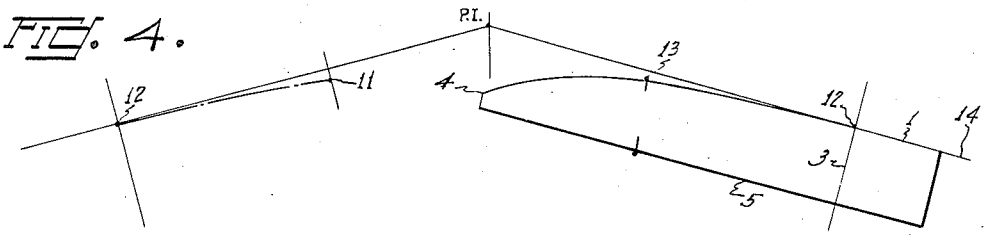


FIG. 5.

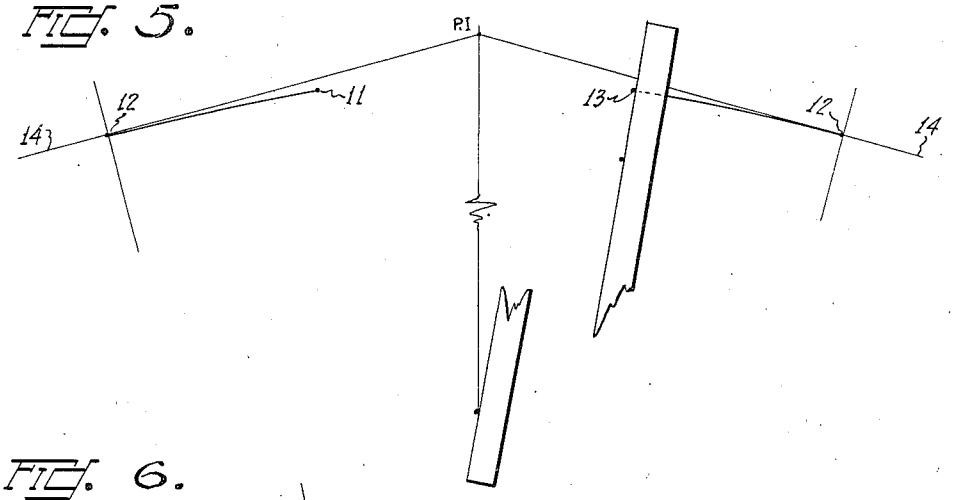
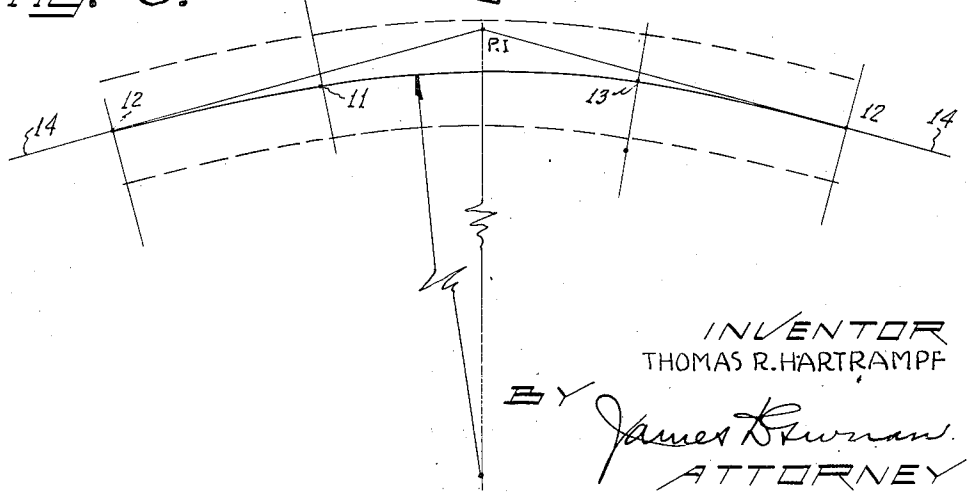


FIG. 6.



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2,245,915

SPIRAL TEMPLATE

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Application July 8, 1939, Serial No. 233,413

6 Claims. (Cl. 33—1)

This invention relates to instruments for plotting curves, and more particularly for plotting irregular curves for which formulas are used.

These curves are referred especially to those in desirable use in the construction of highways and are based more or less exactly upon changing radial values to produce curves of loxodromic characteristics, or curves embodying a constant kinetic factor as referred to contrifugal forces developed in speeding vehicles. These curves further are particularly designed for use in the orthographic representation of practical highways as plotted to represent horizontal projections.

In the drawings:

Figure 1 represents a view of the face of the instrument as conveniently made of Celluloid.

Figure 2 is a diagram illustrative of a manner of plotting curves as referred to coordinate axes.

Figures 3, 4, 5 and 6 represent the progressive development of a highway curve as referred to two intersecting courses of a traverse.

Referring now more particularly to the drawings:

This invention consists essentially of a flat, transparent body having an edge 1 consisting of a rectilinear segment extending from the corner 2 to a line 3, and a curved portion tangentially related thereto extending to the corner 4. From the line 3, the curved portion extending to the corner 4 is conveniently graduated in uniform linear divisions with marks disposed perpendicularly to the curve and projected radially to the opposite edge 5 to demarcate the direction of the center of curvature at any point in the curve.

In accordance with surveyors' practice, curves are specified in accordance with the value of central angles subtended by uniform linear segments of the curve; the usual unit being 100 feet.

In the construction of modern highways, the circular curve is desirably employed only in a middle portion of the whole curve and is desirably of that radius, which represents the practical safe value in centrifugal characteristics dictated by experience.

To connect the tangent to this circular curve, spirals are employed to provide either a constant radial increment, or some approximation to a uniform force in lateral acceleration of traversing vehicles. It is immaterial, however, of what order the spiral may be. This invention contemplates templates identified by convenient markings to denote the controlling constant that may be required. This marking is represented at the lower portion of Figure 1 where the notation indicates that the radius of the spiral of this particular instrument is diminished by a constant decrement amounting to one degree of curvature in each one hundred feet of linear measure, on a scale of one hundred feet to the inch.

Obviously, curves of any practical order having characteristic constants of successive radial values may be constructed for analogous use.

The nature of the instrument can best be understood by an illustration of its use.

In Figure 2, the curve 6, developed by plotting the points 7, 8, 9 and 10 with reference to coordinate axes, is now ordinarily drawn with an irregular curve fitted by experimentation to the plotted points. These points, of course, are first plotted from computed values, all of which requires much time and effort and involves considerable liability of error.

With the instrument embodying this invention, it is proposed to obviate the necessity for these computations and the arduous task of plotting points and drawing curves therethrough.

Assuming that two intersecting courses have been plotted, as represented in Figure 3, and it is next required to locate the intersection 11 of the initial spiral extending from the point 12 and the circular curve extending between the points 11 and 13, the instrument is placed upon the paper with the straight portion of the edge 1 in alignment with the tangent 14 and the line 3 in coincidence with the point 12. A spiral having the characteristic radial decrement, as shown in Figure 1, may be drawn to any length as measured upon the graduations along the curved edge of the instrument. Obviously, it will be unnecessary to compute, or plot tangent offsets to define the curve, or locate the point 11. Before the instrument is moved, the direction of the center of the last portion of the curve is indicated by a suitable mark placed in coincidence with the opposite edge 5 of the instrument, whereat the determining graduation of the curve is produced in alignment with the radius of curvature.

The other end of the curve is produced in a similar manner by inverting the instrument and orienting the same upon the other tangent, in accordance with the practice above described.

Figure 4 shows the instrument in place for scribing the other side of the curve.

Now, if the two symmetrical radii thus oriented upon the paper be produced to the point of intersection, the center of the middle circular portion of the curve will have been established from

which the arc may be struck to connect the two symmetrically disposed spirals.

In this manner, the center line of the highway, as illustrated in Figure 6, is plotted. It now becomes necessary to plot the lateral limits of the highway right-of-way, roadway boundaries, or the like. These lines are disposed interiorly and exteriorly of the center line and are parallel therewith and, therefore, of different radii.

In the plotting of the center line as above described, it is good practice in exacting work to lay off as many radii of the spirals as may be found practicable. These radii are produced, so as to traverse the whole of the probable width of the highway as represented in the drawing. When the width of the right-of-way has been established along the spirals, the parallel spirals to the center line are found by placing the instrument over the said produced radii so as to bring into coincidence with the graduations on the instrument as many thereof as possible. The spirals are drawn in successive segments through as many of these radii at a time as may thus be brought into coincidence.

It will be necessary in the plotting of the external spiral, to move the instrument ahead as these successive segments are drawn and to move the instrument backwardly as the successive segments of the interior spiral are drawn.

By this method, the portion of the curve to be used and its precise orientation are determined with reference to the said radial markings and the radially disposed graduations on the instrument.

Because of the great facility with which these operations may be carried out, great economies of time and effort are effected and drawings produced with a higher degree of precision than was possible by other methods.

It will be obvious that instruments may be provided to incorporate the experience of highway builders in the various districts, characterized by radial increments suited to the special topography of the country.

While I have shown a particular form of embodiment of my invention I am aware that many minor changes therein will readily suggest themselves to others skilled in the art without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to protect by Letters Patent is:

1. An instrument for plotting points in a curve comprising, a flat body formed with an edge consisting of a rectilinear segment and a curved segment in tangential relationship with the former, said edge being graduated in linear divisions denoting curvatures in terms of central angles, wherein the said divisions are disposed upon the said body perpendicularly to the said edge and are produced to an opposite edge, and another edge in spaced relationship to said first edge to which said graduations are produced in radial alignment.

2. An instrument for plotting points in a curve comprising, a flat body formed with an edge consisting of a straight segment and a curved segment in tangential relationship with the former, said edge being graduated in linear divisions denoting curvatures in terms of central angles with markings disposed perpendicularly to the said edge produced to an opposite edge, wherein the said divisions represent radial values of magnitudes denoted by characteristic constants.

3. An instrument for plotting points in a curve comprising, a flat transparent body formed with an edge consisting of a straight segment and a curved segment in tangential relationship with the former, said edge being graduated in linear divisions denoting curvatures in terms of central angles with markings disposed perpendicularly to the said edge, wherein the said divisions represent radial values of magnitudes denoted by characteristic constants, and the same are produced to an opposite edge of said body in radial alignment.

4. An instrument for plotting points in a curve comprising, a flat transparent body formed with an edge consisting of a straight segment and a curved segment in tangential relationship with the former, said edge being graduated in linear divisions denoting curvatures in terms of central angles with markings disposed perpendicularly to the said edge symmetrically on both sides of said transparent body, wherein the said divisions represent radial values of magnitudes denoted by characteristic constants, and the same are produced to an opposite edge of said body in radial alignment.

5. An instrument for plotting points in a curve comprising, a flat transparent body formed with an edge consisting of a straight segment and a spirally curved segment in tangential relationship with the former, said edge being graduated in linear divisions denoting curvatures in terms of central angles with markings disposed perpendicularly to said edge, wherein the said divisions represent radial values of magnitudes denoted by characteristic constants.

6. An instrument for plotting curves to a tangent comprising, a transparent body formed with straight and spirally curved segments in tangential relationship, linear graduations along said edge, and radial lines extending from said graduations across the body of the instrument.

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