(Model.)

C. F. JESPERSEN.

Surveying Instrument.

No. 231,325. Patented Aug. 17, 1880.

Fig. 1.

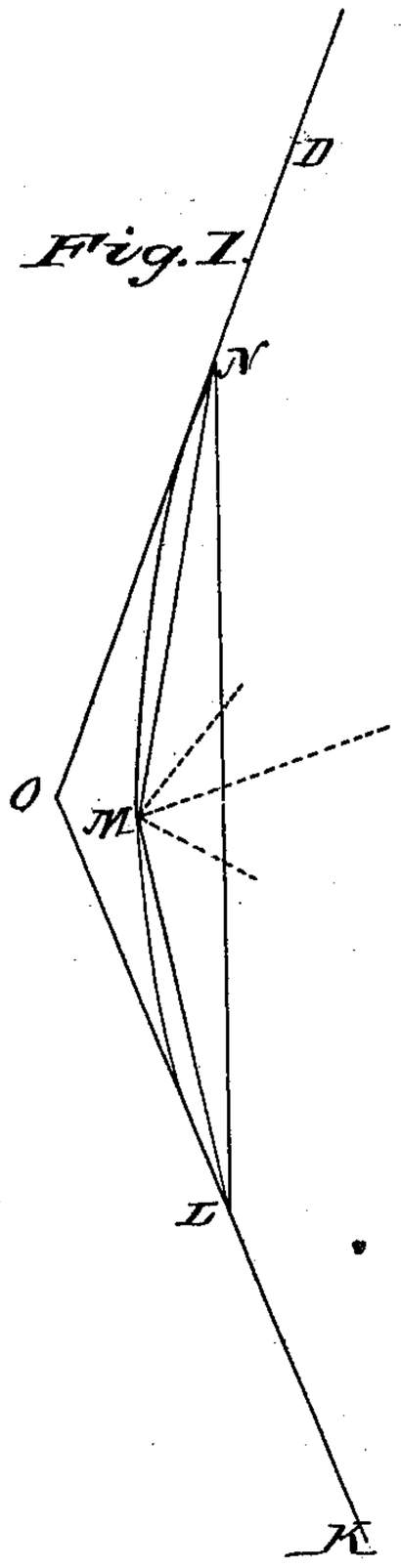


Fig. 2.

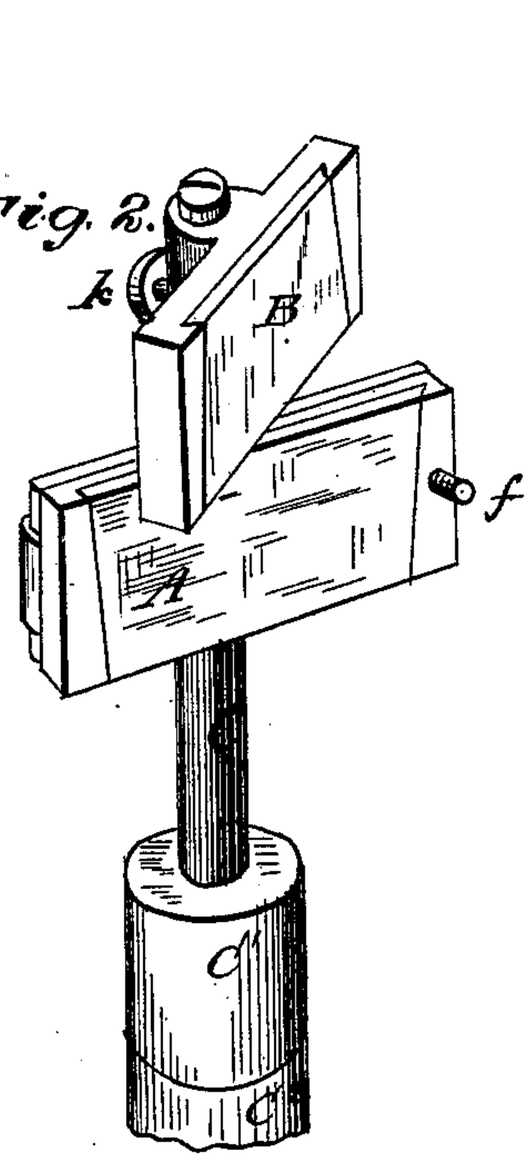


Fig. 3.

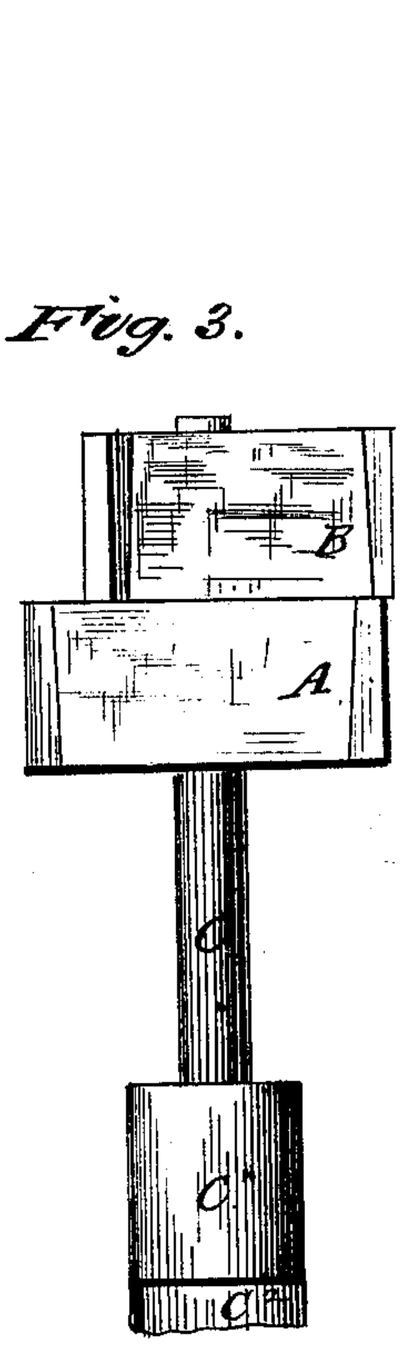
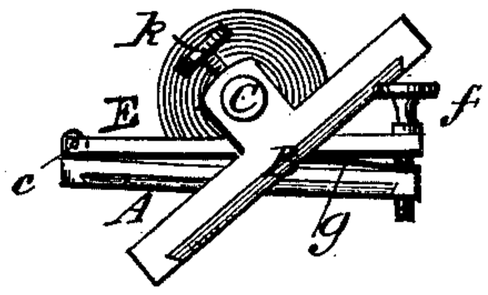


Fig. 4.



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UNITED STATES PATENT OFFICE.

CARSTEN F. JESPERSEN, OF COPENHAGEN, DENMARK.

SURVEYING-INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 231,325, dated August 17, 1880.

Application filed May 8, 1880. (Model.)

To all whom it may concern:

Be it known that I, CARSTEN FRÜS JESPERSEN, of the city of Copenhagen, in the Kingdom of Denmark, have invented a certain new and useful Improvement in Instruments for Laying Out Circle Curves or Arches in the Field in Civil Engineering; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to the art of civil engineering, and has for its object to facilitate the marking out of curve-lines of any desired radius in the field—in the construction of railroads, for example; and it consists in the construction of a very simple, inexpensive, and convenient instrument adapted for this purpose, substantially as hereinafter more fully set forth.

In the annexed drawings, Figure 1 is a diagram representing the method of using the instrument which I call a "curve-mirror," and of which Fig. 2 is a perspective view; Fig. 3, a side elevation, and Fig. 4 a top plan.

Similar letters of reference indicate corresponding parts in all the figures.

My invention is founded upon the axiom that in a circle of any given radius all angles constructed upon a chord in the circle with their point or apex resting in the periphery at any desired point therein, and having the chord for their base, are of equal size. To illustrate: All angles the sides of which intersect the circle at the points L N, (see Fig. 1 of the drawings,) where the chord intersects or cuts the periphery of the circle, and the points of which are in the periphery, as at M, (referring to the obtuse angle L M N,) will be angles of equal degrees; and, again, the angles formed at each end of the chord L N by tangents K O or O D to the circle-arch and its chord L N are not only of equal size, but of exactly the same size or degrees as the angles constructed upon said chord. In other words, K L N=L M N=L N D.

It follows that if two mirrors which are adjustable in relation to each other are placed one perpendicularly above the other at any given point in the circle-arc—for example, at the point marked M—and are then adjusted in such a manner that one of the mirrors shall reflect a stake or any other mark placed at the point L, where the chord L N intersects the periphery, while the other mirror is so adjusted upon its vertical axis or pivot that a stake placed at the opposite end N of the chord is reflected therein perpendicularly below (or above, as the case may be) the reflected figure in the first mirror, then the vertical planes represented by the two mirrors will be at an angle to each other which is exactly one-half of the angles L M N or K L N or L N D, and that without regard to at what point in the arc the mirrors so adjusted respective of each other are placed. It is obvious, therefore, that after the proper adjustment of the mirrors in respect of the points (stakes) K L N or L N D is effected the arc of the circle can readily be marked in the field by staking out any desired number of points, as indicated by the reflections in the mirrors.

The apparatus itself is represented in Figs. 2, 3, and 4 on the accompanying drawings, and is composed, it will be seen, of two small mirrors, A B, of rectangular shape, which are mounted one vertically above the other upon a post, C, having a thimble, C′, at its lower end, by means of which it may be attached to the top of a stake, C^2, of any suitable height.

The lowermost mirror, A, is hinged, at *c*, upon a plate, E, upon which it may be adjusted by means of a set-screw, *f*, and spring *g*, as shown in Fig. 4, the back plate, E, being fixed rigidly upon post C. The upper mirror, B, on the contrary, is pivoted upon the post or standard C, upon which it may be fixed in any given position by the set-screw *k*. This arrangement admits of the mirrors being placed at any desired angle to each other, the stake C^2 being driven into the ground—at M, for example—so that the stationary mirror A will reflect the stake driven at L, after which the upper mirror, B, is turned until it reflects the stake driven at N. The mirrors are then further adjusted by turning the upper mirror until the reflected pictures of stakes L and N fall in the same vertical line, to facilitate which adjustment and cause it to be made with micrometrical nicety and exactness the plane of the

lower mirror may be adjusted by means of the set-screw *f*.

This instrument or apparatus is used as follows: Two points are selected arbitrarily in the line of the arc or curve to be marked out. The mirrors A B are then adjusted at the proper angle and the movable mirror B fastened upon post C by its set-screw, after which the stake or standard C^2 is driven into the ground at one of these points, M, and a stake is driven at the other point, L. Stake C^2 is now turned until one of its mirrors, A, reflects the stake at L, when another stake is carried, at an equal distance from stake C^2, to a point where the other mirror, B, will reflect it, at which point N it is driven into the ground. Thus we have the angle L M N clearly marked out, and by now substituting a plain stake for C^2 at M and shifting C^2, with its mirrors to the point N, adjusting it so that the mirror A will reflect the stake at M, another stake is planted equidistant from C^2 at N, at the point farther down the arc, where it is reflected in mirror B, and so on, the mirror-stake being shifted from point to point, making a series of successive staked points, through which the curve is run.

It is obvious that the relative arrangement of the mirrors may be reversed, if desired, the upper mirror being made stationary and the lower pivoted, without deviating from the spirit of my invention, or that both the mirrors may be pivoted upon post C and provided with set-screws *k* for securing them in their adjusted positions. Hence I do not limit myself to the precise construction herein shown and described; but

I claim as my invention and desire to secure by Letters Patent of the United States—

1. An apparatus or implement for the marking out or staking off curve-lines in the field, composed, essentially, of two plane mirrors, A B, mounted one above the other upon a vertical staff or post, C, and adjustable upon said post in respect of each other, substantially as and for the purpose herein shown and set forth.

2. The apparatus or implement for marking out or staking curve-lines in the field, composed of a stake, C^2, having at its upper end a post or standard, C, upon which is mounted rigidly the rectangular plate E, provided with a hinged adjustable mirror, A, set-screw *f*, and spring *g*, and also the pivoted mirror B, provided with the set-screw *k*, substantially as and for the purpose herein shown and specified.

In testimony whereof I have signed my name to the foregoing specification in the presence of two subscribing witnesses.

CARSTEN FRÜS JESPERSEN.

Witnesses:

FREDERIK WOLFF,

CHARLES ERLANDSEN.