(No Model.) 2 Sheets—Sheet 1.

# I. J. PALMER.

## COMPASSES FOR LAYING OUT STAIR CURVES.

No. 461,367. Patented Oct. 13, 1891.

Fig. 1.

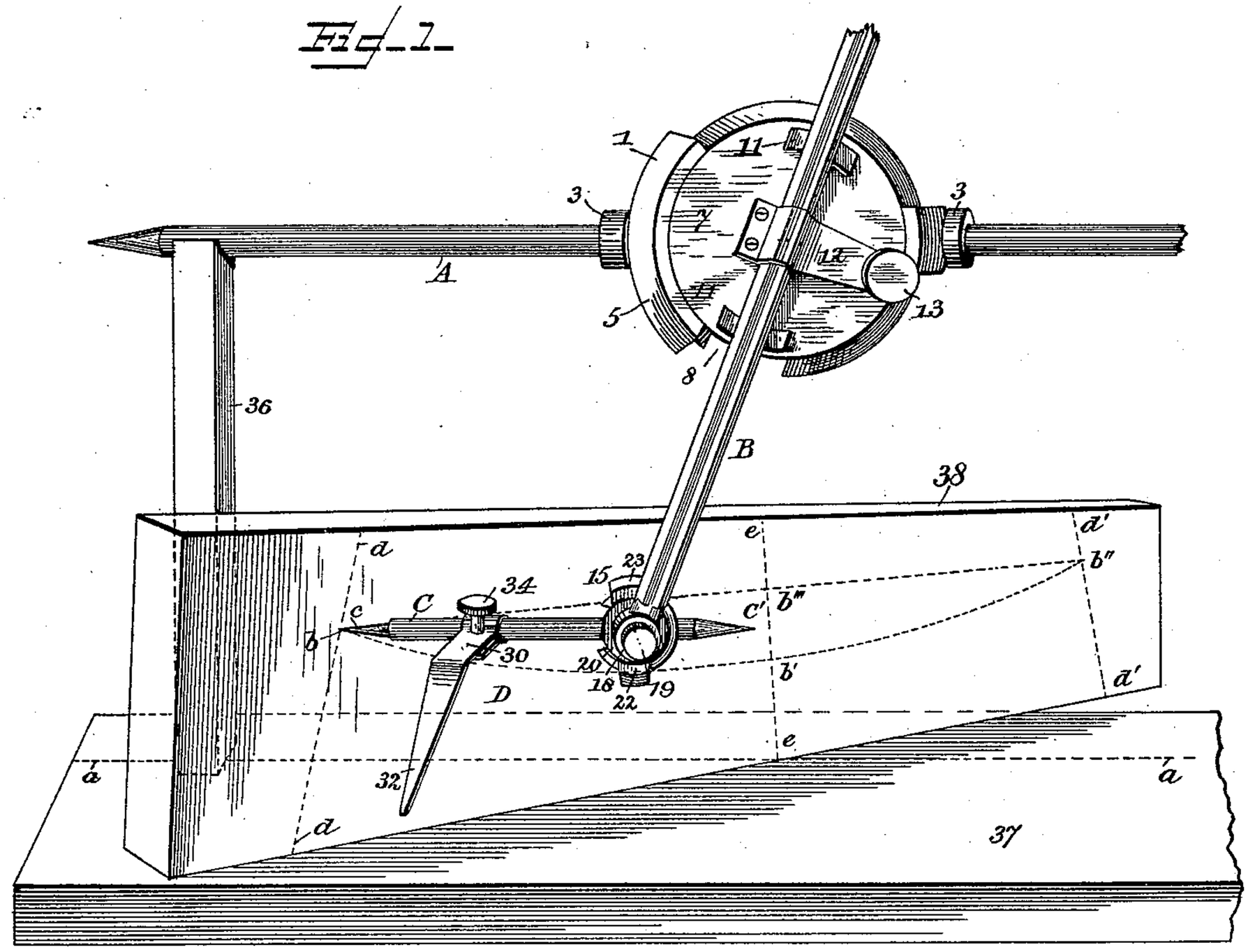
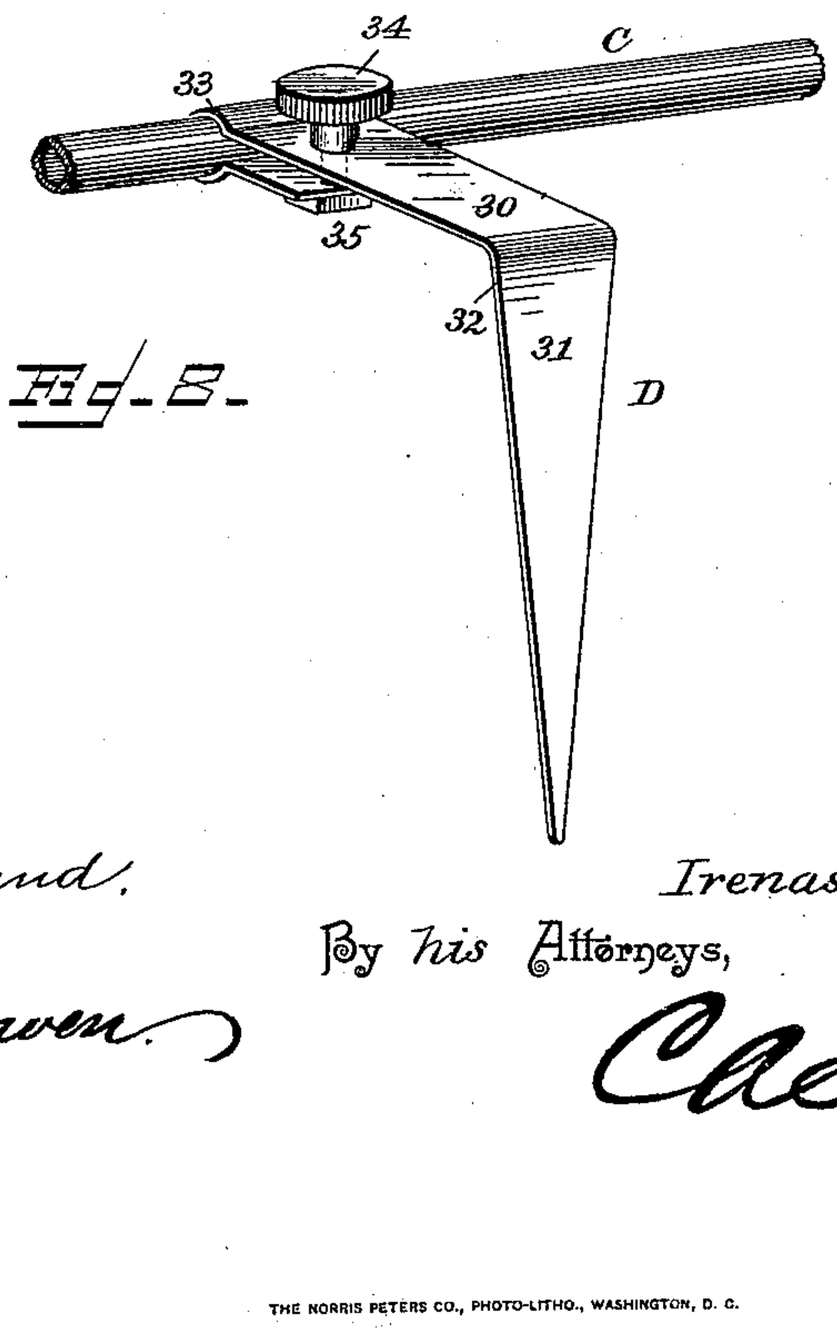



Fig. 2.




Witnesses
Chas. H. Durand.
Percy C. Bowen.

Inventor
Irenas J. Palmer
By his Attorneys,
C. A. Snow & Co.

(No Model.) 2 Sheets—Sheet 2.

# I. J. PALMER.

## COMPASSES FOR LAYING OUT STAIR CURVES.

No. 461,367. Patented Oct. 13, 1891.

Fig. 2.

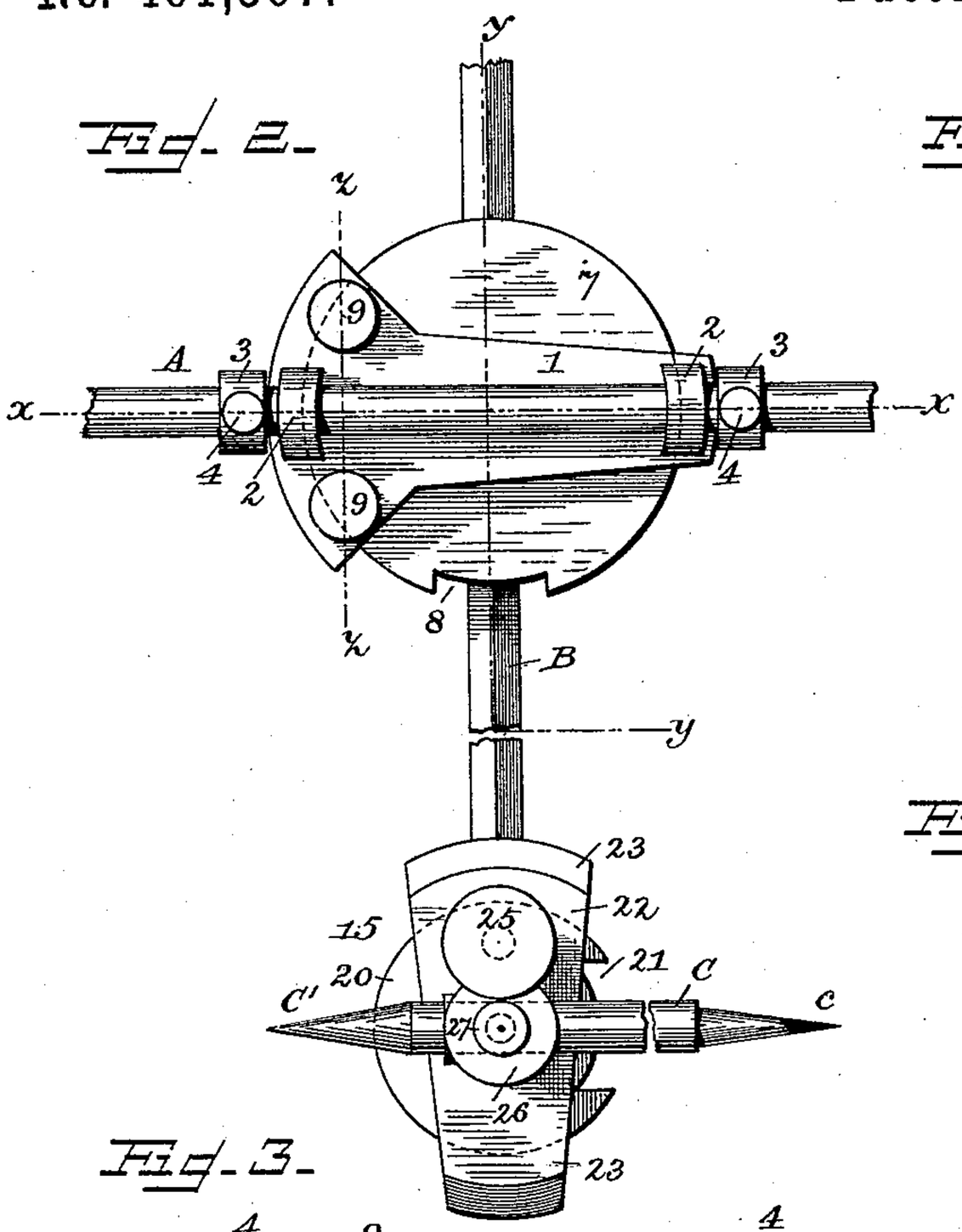



Fig. 4.

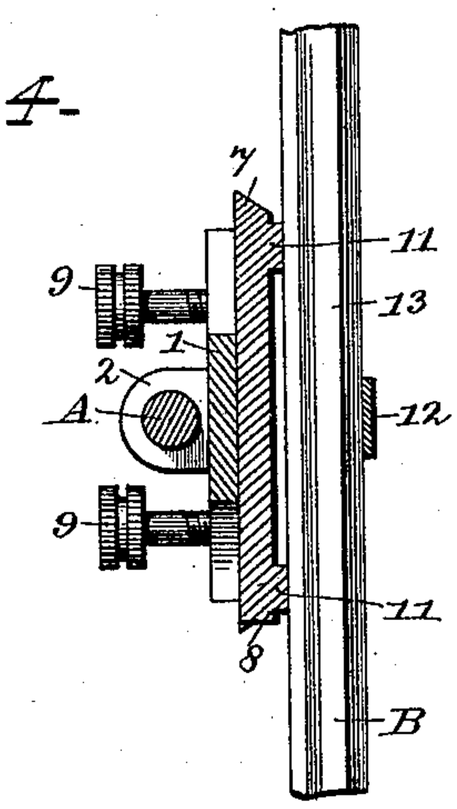



Fig. 5.

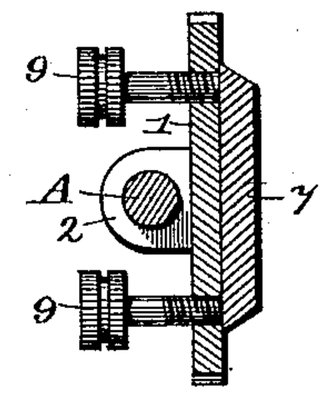



Fig. 3.

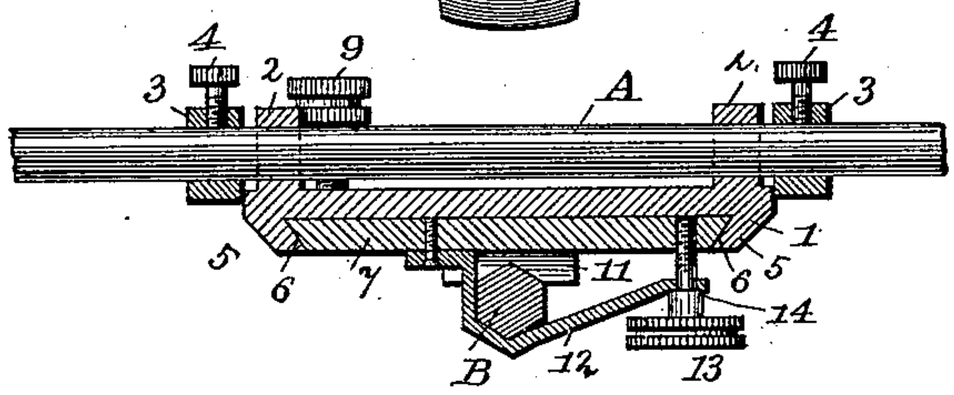



Fig. 6.

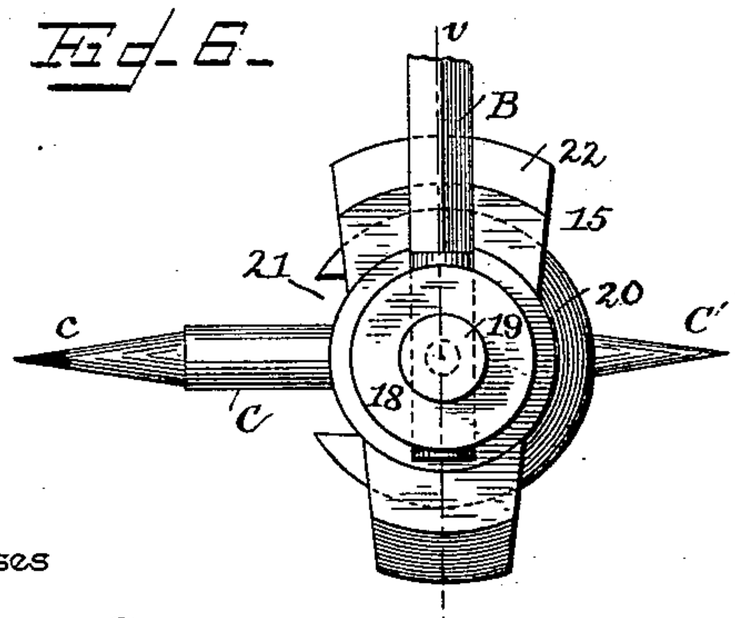
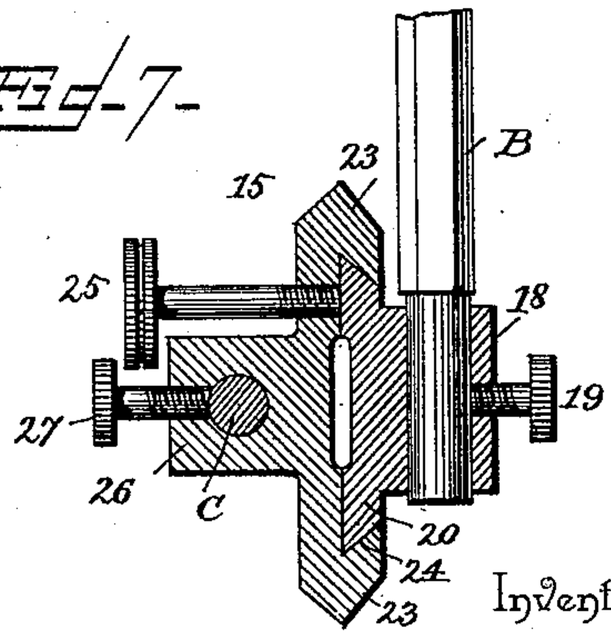



Fig. 7.




Witnesses

Chas. H. Durand.

Percy C. Bowen

Inventor

Irenas J. Palmer

By his Attorneys,

C. A. Snow & Co.

# UNITED STATES PATENT OFFICE.

IRENAS J. PALMER, OF OLEAN, NEW YORK, ASSIGNOR OF ONE-HALF TO LEBIUS A. WRIGHT AND GEORGE A. ROSS, OF SAME PLACE.

## COMPASSES FOR LAYING OUT STAIR-CURVES.

SPECIFICATION forming part of Letters Patent No. 461,367, dated October 13, 1891.

Application filed April 9, 1891. Serial No. 388,271. (No model.)

*To all whom it may concern:*

Be it known that I, IRENAS J. PALMER, a citizen of the United States, residing at Olean, in the county of Cattaraugus and State of New York, have invented a new and useful Divider, of which the following is a specification.

My invention relates to compasses or dividers, and has for its object to construct an instrument of this class that will do all that the ordinary dividers will, and in addition will readily and accurately describe any of the conic sections or any section of a paraboloid, and will give with precision on the lines in which the surface of a cone, a cylinder, or a paraboloid intersect any surface whatever, however rough or uneven it may be, will lay out the block that is to be worked into any stair-rail crook or into any segment of a winding-stair rail, will give upon the upper and under sides of the block the lines for the concave and convex sides and the middle of the rail, will give the vertical distance which the segment will reach in the finished rail, and will give the lines on the block in which the ends of the segment are to be cut, that they may fit the adjoining segments. The underlying principle of my invention is that the distance between the point of either leg and the pin or center that hinges the two legs together can be changed at will, and that this change can take place while the dividers are describing a curve, thereby determining the curve described.

I attain the above objects and such others as fairly fall within the scope of the invention by means of the mechanism illustrated in the accompanying drawings, the peculiar construction, combination, and arrangement of which will be hereinafter fully described, and the specific points of novelty particularly pointed out in the claims.

Referring to the drawings, Figure 1 is a perspective view of my invention, showing the operation of the device as applied to laying out winding-stair rails. Fig. 2 is an elevation of the opposite side of the invention. Fig. 3 is a sectional view on the line *x x* of Fig. 2. Fig. 4 is a similar view on the line *y y* of Fig. 2. Fig. 5 is a similar view on the line *z z* of Fig. 2. Fig. 6 is an elevation of one of the hinge-joints. Fig. 7 is a sectional view on the line *v v* of Fig. 6. Fig. 8 is a perspective view of an attachment used in laying out winding-stair rails.

Similar letters and numerals of reference designate corresponding parts in the several views, referring to which, A and B designate the two legs proper of a pair of dividers. Upon the leg A is mounted a Y-shaped plate 1, having its ends curved to coincide with an arc of a circle struck from the center of the plate and having lugs 2 2 upon one side near the ends thereof, through which the leg A passes. The said leg A is cylindrical in shape, and the openings through the lugs 2 2 correspond therewith, so that the plate 1 can slide longitudinally upon and also be revolved about the leg A. Collars 3, having set-screws 4, are placed upon the leg A on each side of the plate 1 and may be adjusted and clamped to prevent the said leg from sliding through the lugs 2 2, but still allow the lugs and plate to turn upon the leg A.

Upon the opposite side of the plate 1 from the lugs 2 2 are formed raised flanges 5 5, corresponding with the curvature of the ends thereof and inclined inwardly, as at 6, thus forming a dovetail recess between the two flanges. A circular plate 7, having its edges beveled to correspond with the inner edges of the flanges 5 5 and a recess 8 long enough for the flange on the narrow end of the plate 1 to pass through cut in its edge, is introduced in the dovetail recess between the two flanges by placing one edge in position under the long flange on the wide end of the plate 1 and passing the recess 8 over the short flange at the opposite end of the plate, then turning the plate 7 so that its bevel edge will pass under and engage the flange at both ends of the plate 1. Thus the plate 7 can make one complete revolution in the dovetail recess upon the plate 1 and have only one point at which it can be removed therefrom. The recess 8 may be so placed in the edge of the plate 7 that the two plates can only be separated when the legs A and B are pointing in exactly opposite directions, and as this position is seldom, if ever, used in practice the danger of the plates coming apart when the instrument is in use is reduced to a minimum.

The plate 7 turns freely upon the plate 1; but it is held where desired by the binding-screws 9 9, which pass through threaded openings in the plate 1 and bind against the plate 7.

The leg B is straight and of any uniform angular shape, or, if cylindrical, it requires a longitudinal ridge or groove to prevent it from turning on its bearings.

Near opposite edges of the plate 7 are the raised parts 11 11, which are shaped to engage an angle or groove on the leg B to prevent its turning, but not to prevent its sliding lengthwise. One end of a clamp 12 is fastened to the plate 7, and the clamp is bent over the leg B and is pressed down upon the leg by a thumb-screw 13, which passes through the end of the said clamp and into a threaded opening in the plate 7, a shoulder 14 upon the thumb-screw 13 bearing upon the top of the clamp 12. By tightening the thumb-screw 13 the leg B is held where desired. The shape of the leg B is shown as hexagon, but one end of it is for a short distance made cylindrical to fit a hinge-joint 15, by which a rod C is attached.

The rod C is preferably a cylindrical tube, one end of which may hold a steel point C′ and the other end a pencil-point *c*. The rod C is hinged to the leg B in a manner similar to the way the legs A and B are hinged together. A cylindrical block 18 is perforated at right angles to its axis to fit upon the cylindrical end of the leg B, where it is held at any desired adjustment by a set-screw 19. At one end of the cylindrical block 18 is an annular flange 20, the edge of which is beveled and has a recess 21, thus corresponding with the plate 7. A plate 22, which is wider at one end than at the other, has flanges 23 upon one side at the ends thereof, which conform to the arc struck from the center of the plate and are inclined inwardly, as at 24. Thus the plate 22 corresponds with the plate 1. The parts are put together by hooking the flange at the wide end of the plate 22 over the bevel edge of the flange 20 upon the block 18 and passing the flange at the narrow end of the plate 22 through the recess 21 in the said flange 20. A binding-screw 25, which passes through a threaded opening in the plate 22 binds upon the flange 20 to hold the two pieces in any desired position. A stud 26 projects from the center of the plate 22 on the side opposite to the flanges 23 and is perforated at right angles to its axis and also to the longitudinal center of the plate to receive the rod C, which latter passes through the perforation in the stud and is held at any desired adjustment by a set-screw 27.

In Fig. 8 is shown an attachment D, which is to be used in laying out winding-stair rails, and consists of a thin piece of metal 30, pointed at one end and bent at right angles, as at 31, having a straight edge 32 from the point to the bend and turned over at its wide end, as at 33, to fit the rod C, to which it may be clamped by means of a thumb-screw 34, having a nut 35 upon its threaded end.

The operation of my invention is as follows: When the dividers are to be used as ordinary dividers, the collars 3 are placed at each end of plate 1 to prevent its sliding along the leg A, and all other parts of the device are made rigid. They are then simply a pair of ordinary dividers. In the case of the conic sections or the sections of a paraboloid the axis of the leg A is the axis of the cone or paraboloid, and leg A is placed in a fixed position. The clamp 12 is slackened sufficiently to permit the leg B to slide lengthwise. The point *c* of the rod C will therefore keep in the surface of a cone as the leg B slides endwise and revolves about the leg A, and will thus trace upon the surface to be marked any desired conic section or will give the lines in which the surface of the cone intersects any surface whatever. If the point *c* of the rod C travels in a line which does not intersect the axis of the leg A, then it keeps in the surface of a paraboloid with results similar to those of the cone. If the clamp 12 be tightened and the collars removed, so that the plate 1 may slide along the leg A, the point *c* will keep in the surface of a cylinder, with results similar to those of the cone.

The dividers enable persons not experienced in any of the existing methods to successfully lay out winding-stair rails. The following is the process: The leg A, Fig. 1, is supported horizontally, resting in notches in the posts 36, which project upwardly from a work bench or platform 37, and is held at such a distance above it as will suit the radius of the plan over which the rail is to be built. The line *a′ a′* describes the lower edge of a plane perpendicular to the platform 37 and passes through the axis of the leg A, which coincides therewith. The block 38, which is to be laid out for a segment of winding rail, is placed upon the platform 37 and so secured that it will not move while being laid out. The face of the block makes the same angle with the line *a a* that the segment into which it is to be worked will make with a vertical line when placed in the finished rail. The plate 1 is free to slide along or revolve about the leg A, but all other parts of the dividers are made rigid after the point *c* has been adjusted to the radius of the cylinder that fits, say, the concave side of the rail. The plate 1 is now slid along and revolved about the leg A; drawing the point *c* along the face of the block, thereby describing one line for the concave side of the segment. The dividers are now lifted out and changed ends and replaced in the posts without disturbing any of the adjustments, when a similar operation will describe on the other side of the block a corresponding line for the concave side of the segment. By a similar operation the lines for the convex side of the segment and the middle of the segment are found. Let *b*, *b′*, and *b″* be the line for the

middle of the segment on the face of the block and *d d* the line in which one end of the segment is to be cut off. Let *d' d'* be the line in which the other end is to be cut off and *b b''* the point in which the middle line intersects the lines in which the ends of the segment are to be cut off. The distance which the plate 1 slides along the leg A while the point *c* is moved from *b* to *b''* is the vertical distance which the segment will reach in the finished rail. The line *e e* on the face of the block is perpendicular to the axis of the leg A. A plane containing this line and perpendicular to the face of the block is the plane in which the ends of the segments are usually cut if the block was to be cut at this place. We will now place the point *c* upon the block at the point *b'* and adjust the attachment D (shown in Fig. 8) until the edge 32 coincides with the said plane and tighten the thumb-screw 34 to hold the attachment D secure. Now as a line and a point not in the line determine a plane, the edge 32 and the point *c* determine the plane in which the block should be cut if cut on the line *e e*. The adjustment being true for this place is true for any other point on the segment if the point *c* rests upon the middle line of the segment. Hence to get lines in which the ends of the segment should be cut, that they may fit the adjoining segments, it is only necessary to adjust the attachment D to the proper place on the line *e e*, then place the point *c* upon the middle line in the point where the block is to be cut off and trace upon the block, the plane touching the edge 32 and passing through the point *c*. If the block to be worked into a segment of winding rail has rough surfaces—such as those on unhewn stone, a limb, or a root—the method described will lay out the lines for the concave and convex sides of the segment and for the middle of the segment. The adjustment of the attachment D can be gotten from a true block, which may temporarily take the place of the block being laid out, and a straight line from *b* to *b''* should make the same angle with the line *a a* that the face of the block 38 does. It has been said that this angle should be the same that the segment in the finished rail makes with a vertical line. The winding-stair rail is of double curvature, and it is not easy to determine what angle a line of double curvature makes with a straight line. There is no difficulty, however, in determining with these dividers what angle a straight line from *b* to *b''* should make with the line *a a*. In the plan over which the finished rail is to be placed let a chord be drawn connecting two points in the curve horizontally projected by the middle line of the rail and let the quantity of rail which covers the said curve between the said points reach a known vertical distance. Let this distance be, say, twenty inches, and let the maximum distance between said chord and said curve be, say, three inches. Now on block 38 draw the chord *b b'''*, connecting *b b''*. The chord *b b'''* is parallel to platform 37, and its maximum distance from the curve *b b' b''* is *b'* to *b'''*, which equals three inches. Hence the block 38 must be adjusted till plate 1 slides twenty inches along the leg A, while *c* goes from *b* to *b''*. The point *c* is nearest the platform 37 at *b'*. When *c* is at *b* or *b''*, it is three inches farther from the platform 37 than when at *b'*. Hence the adjustment of the block 38 can be determined by measuring the distance between point *c* and platform 37 and the distance which the plate 1 slides on the leg A.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a pair of dividers, the combination of the two legs with two plates pivoted together and bearings upon the sides of the plates in which the legs are mounted and through which they are free to slide, substantially as described, for the purpose specified.

2. In a pair of dividers, the combination of the two legs with two plates pivoted together, bearings upon the sides of the plates in which the legs are mounted and through which they are free to slide, and means for locking the plates together and also for locking the legs to the plates, substantially as described, and for the purpose specified.

3. In a pair of dividers, the combination of a plate 1, flanges upon the ends of the said plate, a plate 7, engaging the flanges of the plate 1 and free to rotate thereupon, means for locking the two plates together, bearings upon the sides of the plates, legs A and B, mounted in and free to slide through the said bearings, and means for locking the legs in the bearings, substantially as described, for the purpose specified.

4. In a pair of dividers, the combination of a leg A, a plate 1, bearings 2 upon the said plate in which the said leg A is mounted and free to slide and rotate, collars 3, mounted loosely upon the leg, means for locking the collars upon the leg to prevent the leg from sliding through the bearings, and a plate 7, pivoted upon the plate 1, to which the leg B is secured, substantially as described.

5. In a pair of dividers, the combination of a leg A, a plate 1, bearings 2 upon the said plate in which the said leg A is mounted and free to slide and rotate, collars 3, mounted loosely upon the leg, means for locking the collars upon the leg to prevent the leg from sliding through the bearings, flanges upon the ends of the plate 1, a circular plate 7, having its edges beveled to engage the flanges of the plate 1 to hold the two plates together and allow them to turn upon each other, a leg B, secured to the plate 7, and means for locking the two plates together, when desired, substantially as described.

6. In a pair of dividers, the combination of a leg B, one end of which is cylindrical, a perforated block upon the cylindrical end of the

leg B, an annular flange upon the said block, a plate 22, having flanges at each end to engage the flange of the block and hold the two parts together, a perforated lug 26 upon the said plate, a rod C, extending through the said lug, said rod having points at its ends, and means for locking the two parts together and also for locking the leg B and the rod C to their respective parts, substantially as described.

7. In a pair of dividers, the combination of a leg B, one end of which is cylindrical, a perforated block upon the cylindrical end of the leg B, a plate pivoted to the said block, a perforated lug upon the said plate, a rod C, having points at its ends extending through the said lug, and means for locking the plate and block together and also for locking the leg B and rod C to their respective parts, substantially as described.

8. In a pair of dividers, the combination of a leg B, one end of which is cylindrical, a perforated block upon the cylindrical end of the leg B, a plate pivoted to the said block, a perforated lug upon the said plate, a rod C, having points at its ends extending through the said lug, means for locking the plate and block together and also for locking the leg B and rod C to their respective parts, an attachment consisting of a strip having a straight edge, and means for clamping the said strip to the rod C in the proper position, substantially as described, for the purpose set forth.

9. In a pair of dividers, the combination of a leg B, a perforated block 18, mounted upon one end of the said leg and adjustably secured thereto, a plate 22, pivoted upon the block 18, a rod C, having points at its ends adjustably secured to the said plate, a plate 7, bearings upon the said plate through which the leg B is arranged to slide, a clamp upon the said plate 7 to hold the leg B at any desired adjustment, a plate 1, pivoted to the plate 7, a leg A, adjustably secured to the plate 1, and means for locking the several parts rigidly together, substantially as described, for the purpose specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in presence of two witnesses.

IRENAS J. PALMER.

Witnesses:

WILLIAM V. SMITH,

GEORGE A. ROSS.