No. 639,488. Patented Dec. 19, 1899.

W. ZIETHEN.

COMPASS FOR DRAWING CONIC SECTIONS.

(Application filed June 10, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.

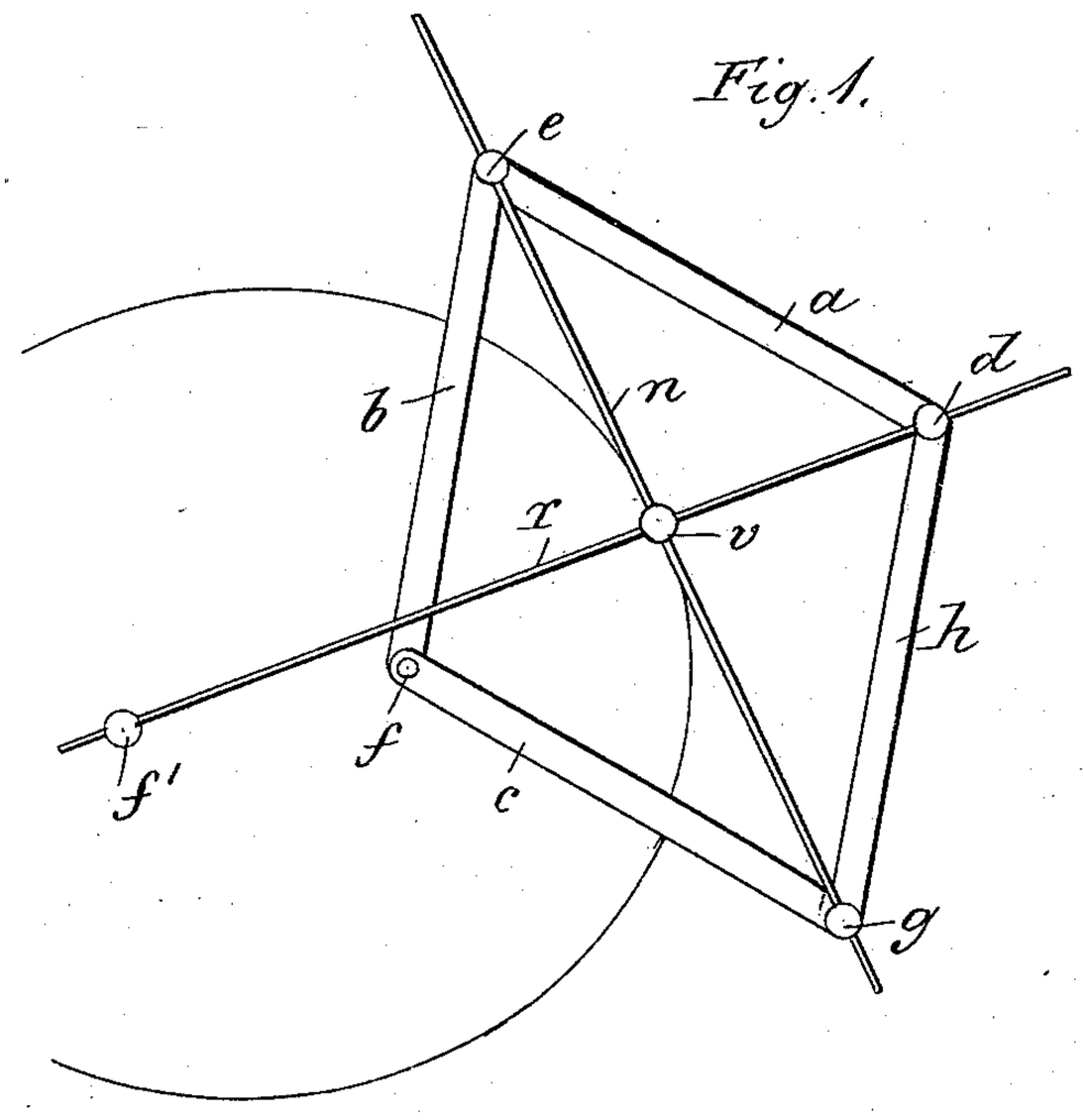

Fig. 2.

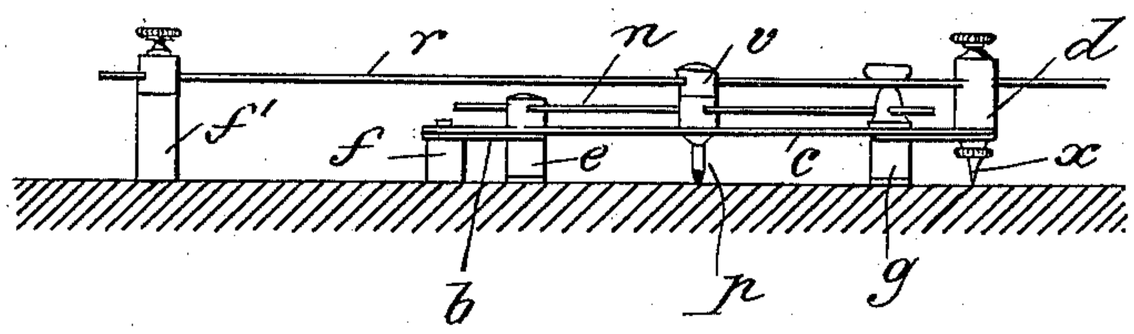

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Fig: 3.

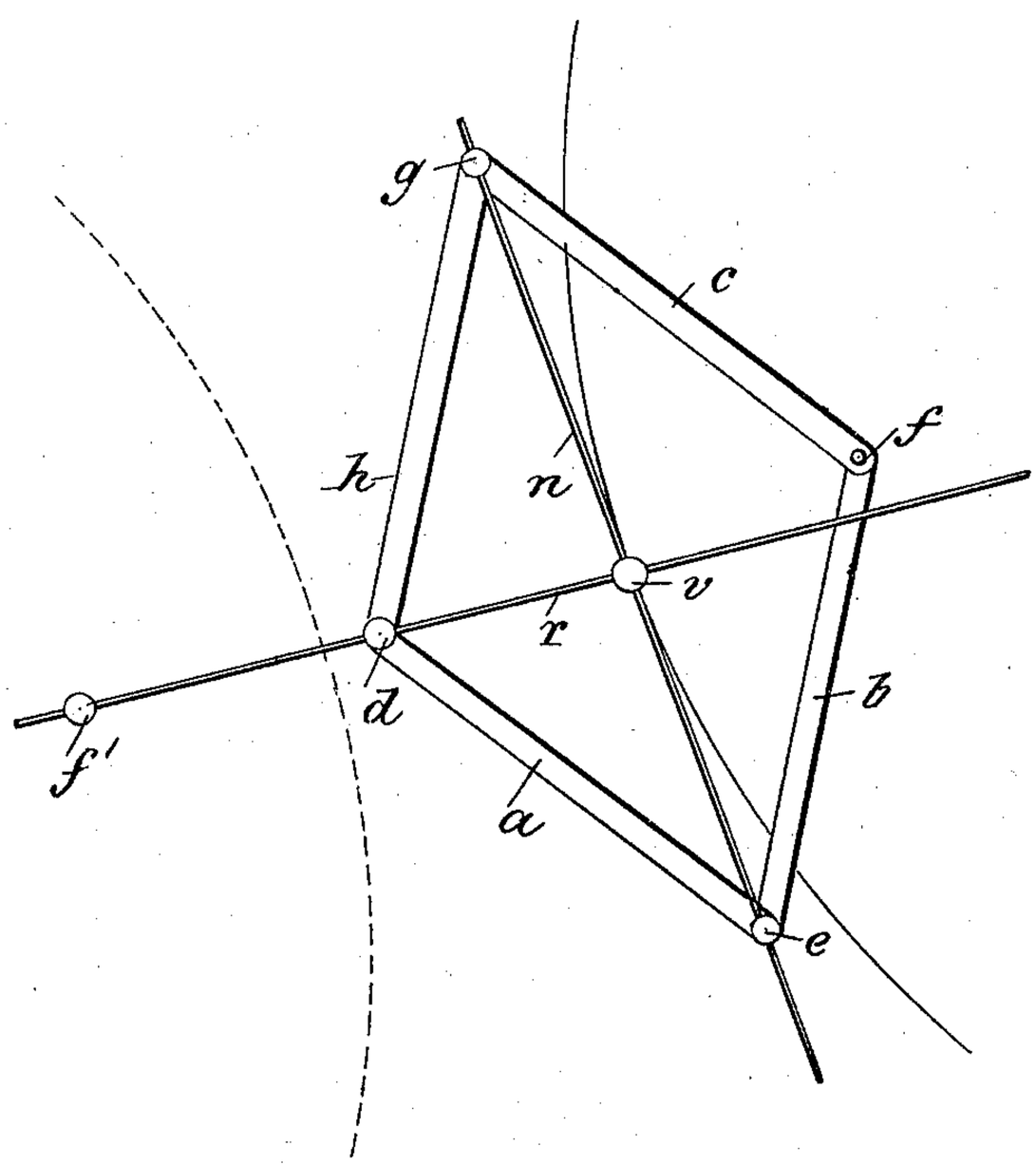
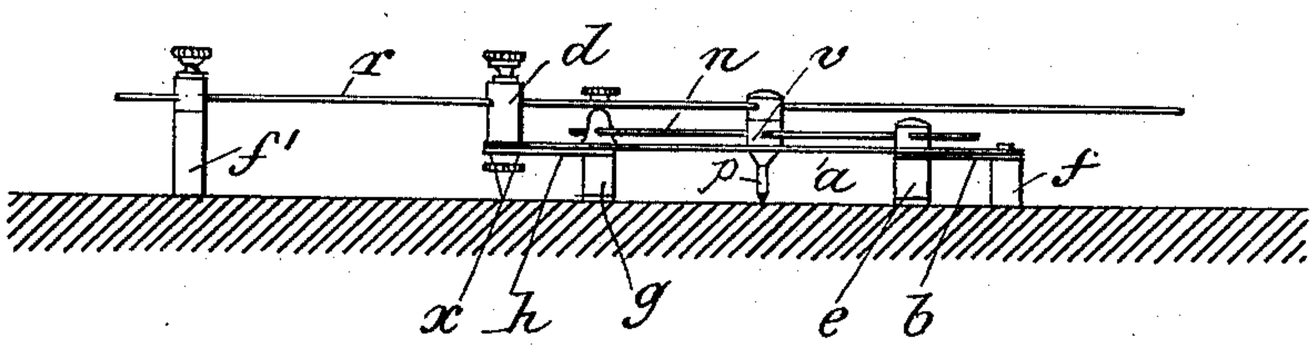


Fig: 4.



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(No Model.) 4 Sheets—Sheet 3.

Fig. 5.

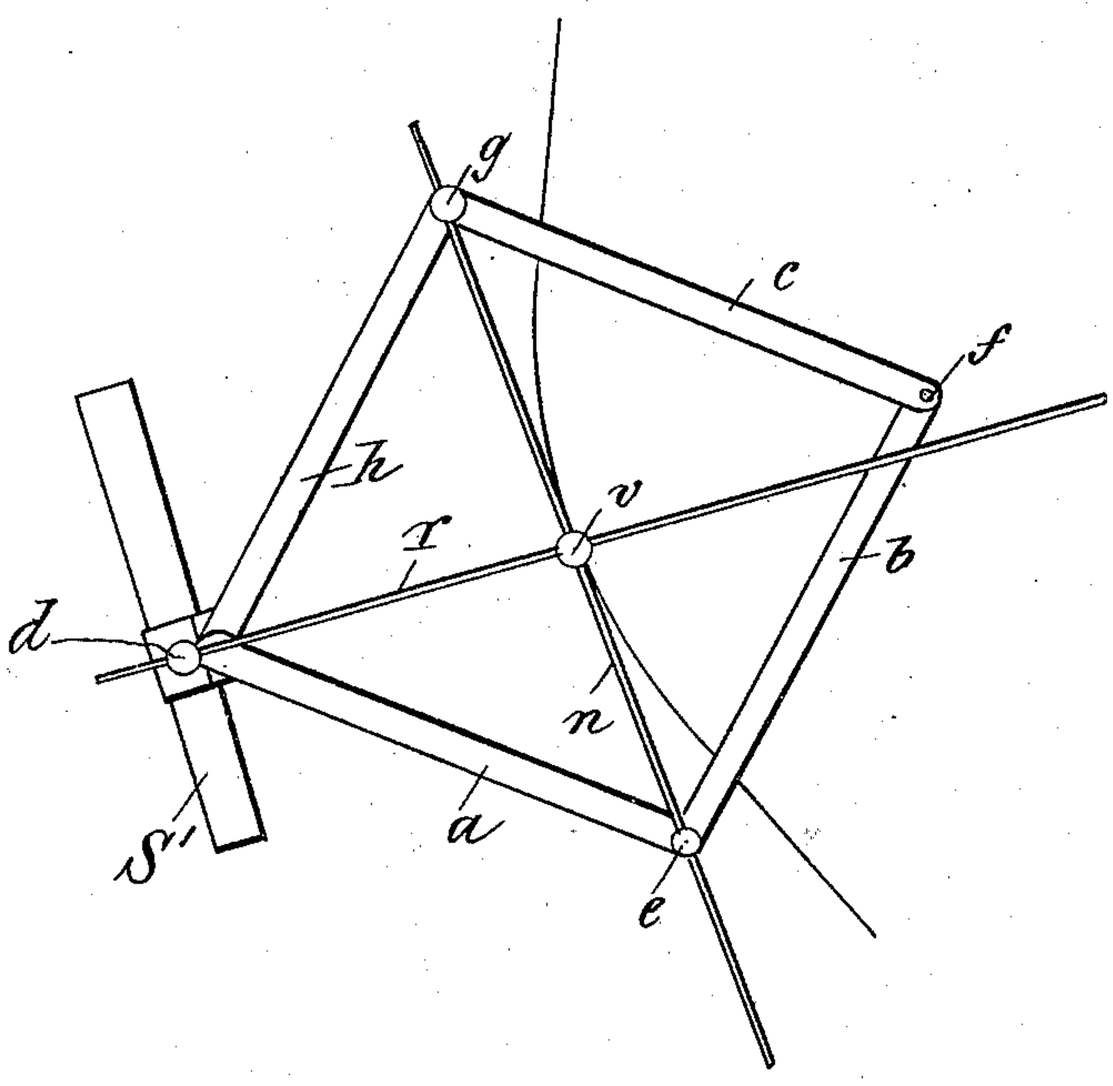
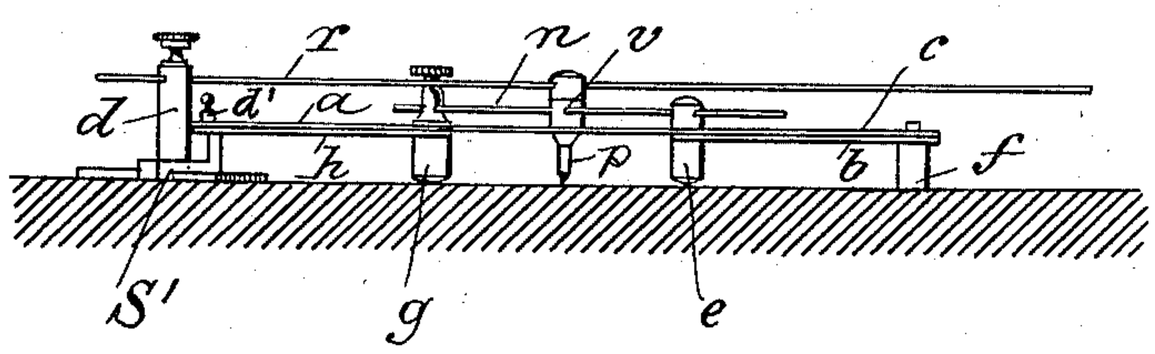


Fig. 6



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(No Model.) 4 Sheets—Sheet 4.

Fig. 7.

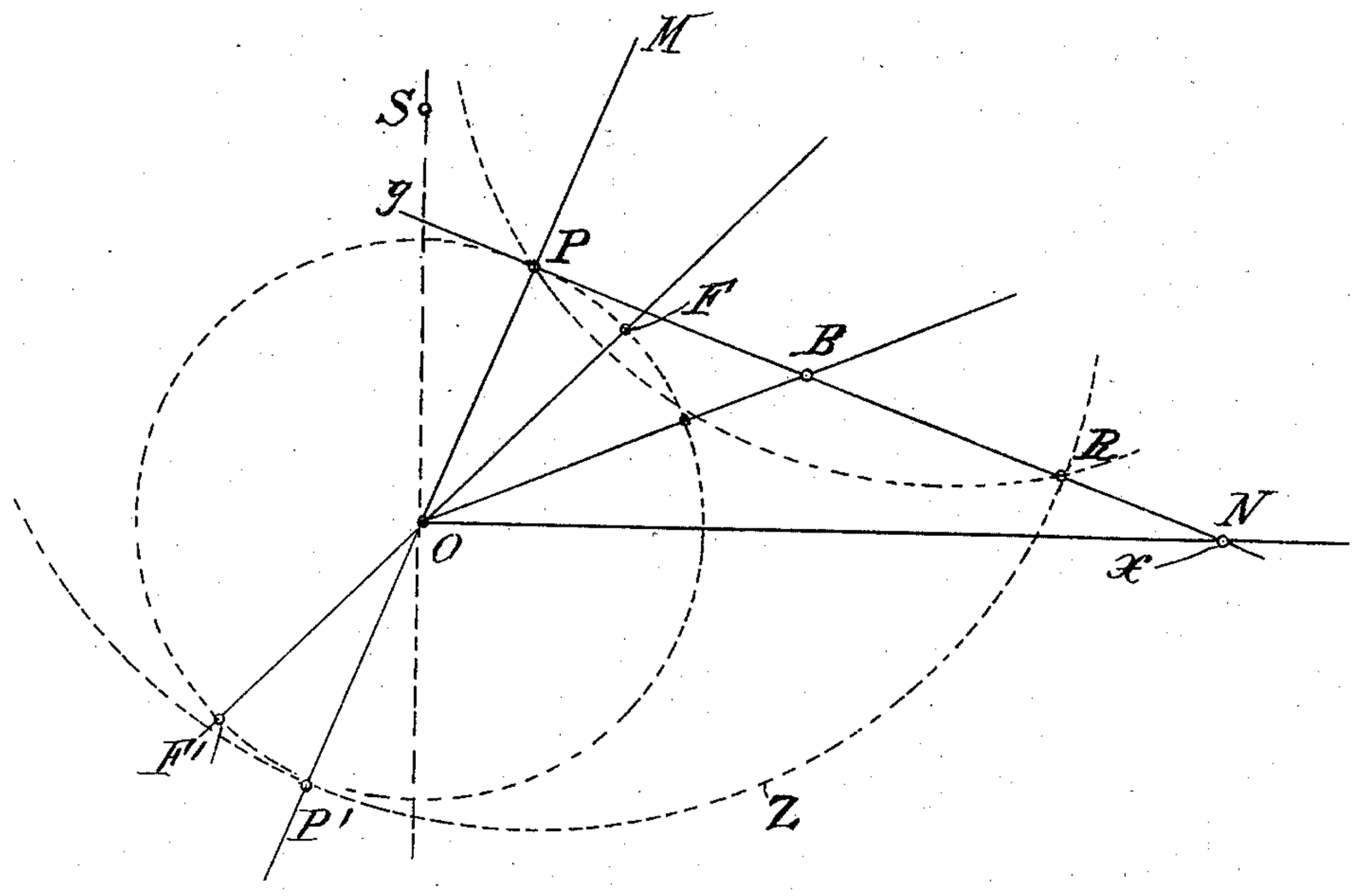
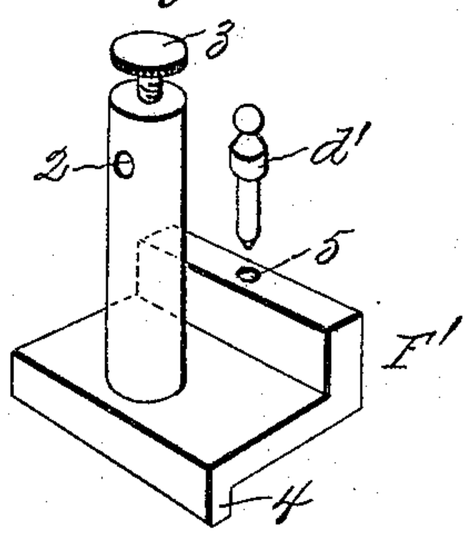


Fig. 8.



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UNITED STATES PATENT OFFICE.

WILHELM ZIETHEN, OF BERLIN, GERMANY.

COMPASS FOR DRAWING CONIC SECTIONS.

SPECIFICATION forming part of Letters Patent No. 639,488, dated December 19, 1899.

Application filed June 10, 1899. Serial No. 720,076. (No model.)

To all whom it may concern:

Be it known that I, WILHELM ZIETHEN, a subject of the King of Prussia, German Emperor, residing at the city of Berlin, Germany, have invented a new and useful Improvement in Compasses for Drawing Conic Section-Lines and for Trisecting Angles, of which the following is a specification.

My invention relates to compasses for drawing conic section-lines and for trisecting angles; and the object of my invention is to provide such a combination of parts that by one and the same instrument there can be drawn at will either an ellipse, a hyperbola, or a parabola, and the trisection of angles can be performed.

My invention substantially consists of a system of links pivotally connected to each other to form a movable rhomb, and the said rhomb is provided with a diagonal rod passing loosely through a pair of opposite pivots of the same and is pivotally connected with one of the two other pivots by a guide-rod, a drawing-pen being secured at the crossing-point of the two rods, movable on either of the same.

I have represented my invention in the accompanying drawings, of which—

Figures 1 and 2 are a plan and a side view, respectively, of the instrument when used for drawing an elliptic line; Figs. 3 and 4, similar views when drawing a hyperbola, and Figs. 5 and 6 corresponding views when drawing a parabola. Fig. 7 is a diagram of my invention, showing the same applied to the trisection of angles; and Fig. 8 is a perspective view of the leg F′ for guidance along a ruler when the instrument is used for drawing a parabola.

Similar parts are indicated by similar numerals and letters throughout the several views.

Referring to Figs. 1 and 2, a system of links *a b c h* are pivotally connected to each other at *d e f g*, so as to form a movable rhomb. A rod *n* passes through pivots *e* and *g* and a stud *v* is movably mounted on rod *n*. Another rod *r* is provided, passing loosely through stud *v* and passing likewise through pivot-stud *d* and a center stud *f′*. Rod *n* is firmly connected to stud *g* by a clamping-screw and passes loosely through stud *e*, while rod *r* is firmly connected by clamping-screws to both of the studs *d* and *f′*. Studs *f* and *f′* are provided with points, as appearing from Fig. 2, in order to be fixed in the drawing-plan and to adjust the instrument for its work, a pin projection *x* of stud *d* serving at the same time as a movable support of the rhomb, opposite to stud *f*. A drawing pen or pencil *p* is secured to stud *v* in contact with the drawing-surface.

In the position of parts represented in Fig. 1 the instrument is adjusted to draw with the pencil an ellipse, the focuses of which are indicated by the fixed points *f* and *f′*, the constant sum of the radii vectors being represented by the fixed distance from point *f′* to point *d*, firmly connected to each other by the clamped rod *r*. If now rod *r* is given a rotary movement around point *f′*, pencil *p* will draw a curved line, and as in any position of the pencil the distance between points *f′* and *p* constantly equals that between points *p* and *d*, *f g d e* being a rhomb, and point *p* placed on its diagonal line, the curved line drawn by the pencil is characterized by that for each of its points the distance sum from two fixed points is a constant quantity—that is to say, the said curved line is an ellipse.

In the position of parts represented in Figs. 3 and 4—that is to say, point *d* being placed between the fixed points *f* and *f′*—the instrument is adjusted to draw a hyperbola, the focuses again being indicated by *f* and *f′* and the constant difference of the radii vectors again represented by the fixed distance *f′ d*. For the distance, *p d* always equaling that *p f*, for the above-mentioned reason, the curved line drawn by the pencil *p* at the rotary movement of rod *r* will be characterized by that for each of its points, the distance difference from two fixed points is a constant quantity—that is to say, the said curved line is a hyperbola, with the focuses at *f* and *f′*.

Figs. 5 and 6 show my invention adjusted to draw a parabola with the focus at *f* and the directrix represented by a rule S′. In this case the pivot-legs *f′* and *d* shown in the preceding figures are removed and the leg shown in Fig. 8 is substituted, which consists of a post having a perforation 2, into which one end of the rod *r* is secured by means of the thumb-screw 3. The foot of this post has a flange 4, which guides it along the ruler S′, and is provided with a perforation S, into

which the pivot d' is placed, which latter substitutes the pivot d, while the rod f is rigidly held by the thumb-screw 3, so as to constantly keep rod r in a perpendicular direction with respect to the rule. If now pivot-stud d is shifted along rule S', pencil p will draw a curved line characterized by that for each of its points the distance from a fixed point f equals that from a straight line S', as $d\ p$ constantly equals $f\ p$, for the reason repeatedly mentioned—that is to say, the said curved line is a parabola.

Fig. 7 is a diagram explaining the use of my invention for trisecting angles. Supposing angle M O N is to be divided into three equal parts, I prolong side M O of the angle beyond O and I draw a circle of any radius O P, with the center at O intersecting the prolonged angle side at P'. Through O, I draw a straight line, forming an angle of forty-five degrees with line O N and intersecting the said circle at F and F', and I finally draw a circle Z with the center at P and with the radius P P'. The instrument is then adjusted, as shown in Fig. 3, points f and f' being fixed at F and F', respectively, and pencil p adjusted so as to register with point P by releasing the clamping-screw of stud d. After that the said screw is clamped again, the instrument thus being adjusted to draw with the pencil an equilateral hyperbola passing through P. The instrument is then actuated to draw the said hyperbola until intersecting the above-mentioned circle Z at R. I then draw a straight line passing through R and P, and I finally bisect the distance P R at B. If now connecting point B with O by a straight line, angle B O N will form the third part of the entire angle M O N to be trisected, and by finally bisecting angle M O B in the well-known manner the trisection of angle M O N will be performed. To prove this, it may be observed that by drawing a line O S perpendicularly, directed with respect to line O N and prolonging line P R to intersect line O N at X and line O S at Y, the line portions R X and P Y are of the same length, (as a well-known characteristic of the equilateral hyperbola,) and therefore R Y equals P X, and as angle S O N is of ninety degrees there will likewise be B X = B O, and therefore angle P B O the double of angle B O N. As now P P' equals P R, (both being radii of one and the same circle,) there will likewise be P O = P B, O being the middle of P P' and B the middle of P R. Therefore angle P O B equals angle P B O—that is to say, angle P O B is likewise the double of angle B O N, or angle B O N the third part of the entire angle M O N to be divided.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. An instrument for drawing conic sections, comprising four connected links, a rod adjustably connecting two opposite pivots, means for fixing a third pivot, a guide-rod adapted to pass through the fourth pivot, means for fixing one end of said guide-rod, and a pen-carrier adapted to slide on both of said rods, substantially as set forth.

2. An instrument for drawing conic sections, comprising a rhomb composed of links, and a rod adjustably connecting two opposite pivots, a needle-point for fixing the third pivot, a leg for rigidly holding a guide-rod, and means for connecting the fourth pivot to said leg, and a pen or pencil carrier adapted to slide on both of said rods, substantially as set forth.

3. An instrument for drawing conic sections, comprising a variable rhomb, a rod adjustably connecting two pivots at opposite angles thereof, means for fixing a third pivot, a guide-rod passing through the fourth pivot thereof, means for fixing one end of said guide-rod, and a swiveled pen or pencil carrier adapted to slide on both of said rods, substantially as set forth.

4. An instrument for drawing conic sections, comprising a variable rhomb, a rod adapted to be fixed at one pivot and slide through an opposite pivot, means for fixing a third pivot thereof, a guide-rod adjustably connected to the fourth pivot, a support for fixing and rotatively mounting at will one end of said rod, and a swiveled pen or pencil carrier adapted to slide on both of said rods, substantially as described.

5. An instrument for drawing conic sections and trisecting angles, consisting of a system of links pivotally connected to each other to form a variable rhomb, a rod passing through a pair of opposite pivot-studs of the rhomb, a pencil-stud or drawing-pen movably mounted on said rod, and a guide-rod passing through the pencil-stud and through one of the other pair of pivot-studs, substantially as set forth.

6. An instrument for drawing conic sections, comprising a variable rhomb, a rod rotatably fastened at one pivot and adapted to slide in the opposite one, means for rotatably fixing a third, and a guide-rod adapted to pass through the head of the fourth pivot, a support adapted to rigidly and at will rotatably fix one end of said rod, means for connecting said support to the fourth pivot, and a swiveled sliding pen or pencil carrier adapted to slide on both of said rods, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

WILHELM ZIETHEN.

Witnesses:
WALDEMAR HAUPT,
HENRY HASPER.