

No. 637,476.

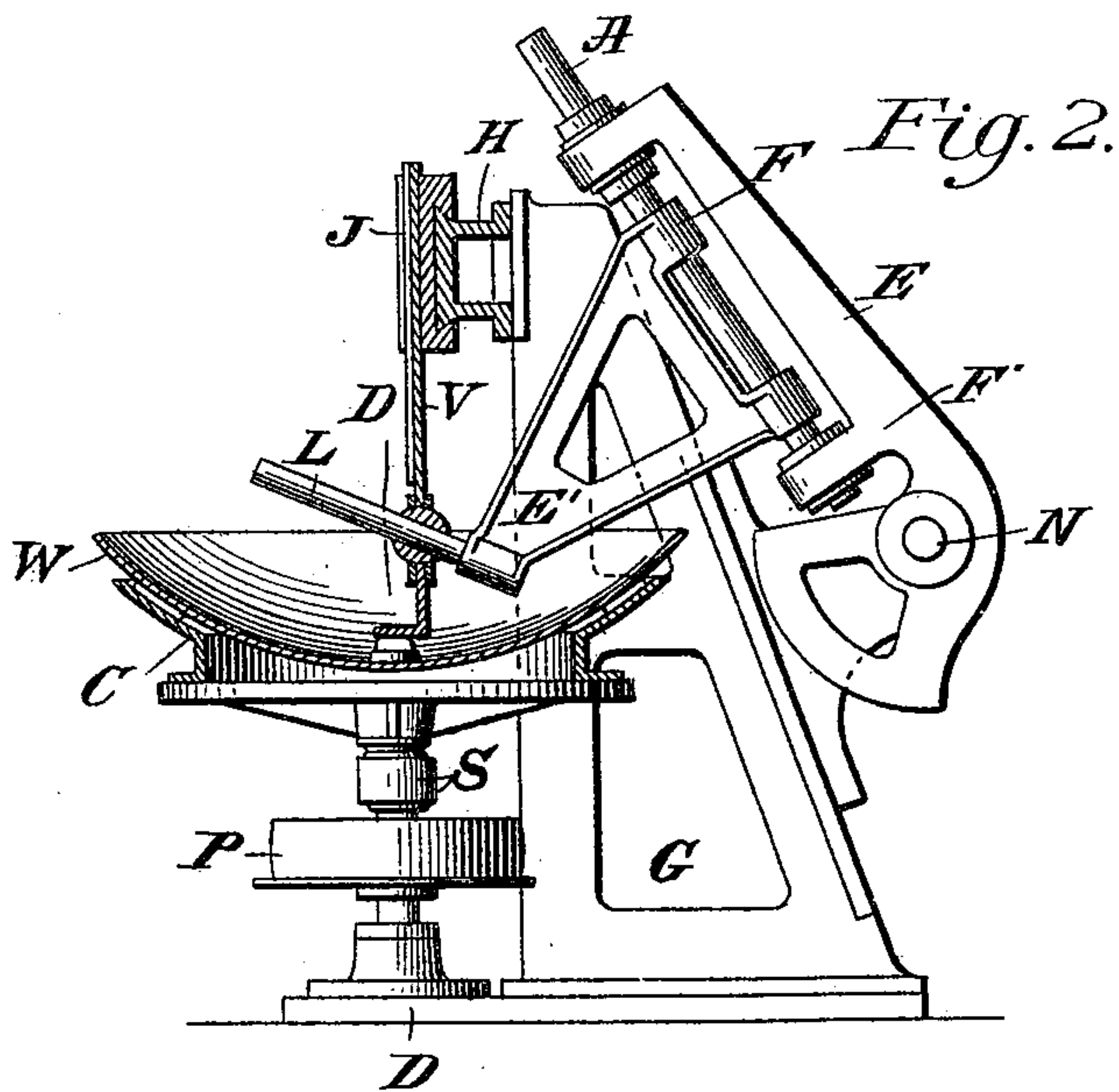
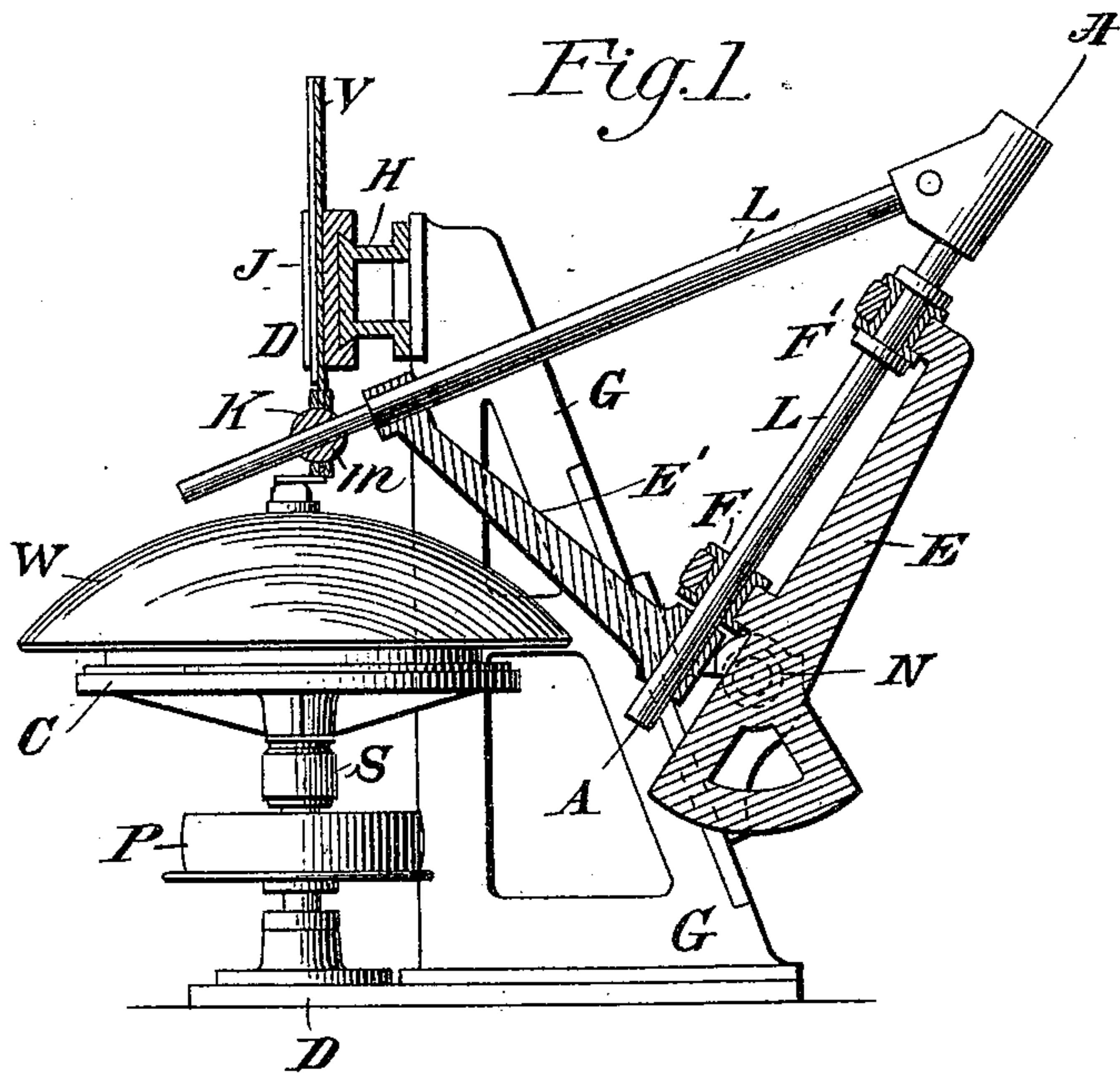
Patented Nov. 21, 1899.

F. NERZ.

GRINDING MACHINE FOR SURFACES OF REVOLUTION OF CONIC SECTIONS.

(Application filed Dec. 29, 1897.)

(No Model.)



Witnesses:  
*W. Murphy*  
*M. J. Keating*

Inventor:  
*Fidelis Nerz*  
By his atty  
*Charles J. Kuntz*



# UNITED STATES PATENT OFFICE.

FIDELIS NERZ, OF NUREMBERG, GERMANY.

GRINDING-MACHINE FOR SURFACES OF REVOLUTION OF CONIC SECTIONS.

SPECIFICATION forming part of Letters Patent No. 637,476, dated November 21, 1899.

Application filed December 29, 1897. Serial No. 664,310. (No model.)

*To all whom it may concern:*

Be it known that I, FIDELIS NERZ, a subject of the King of Bavaria, residing at Nuremberg, in the Kingdom of Bavaria, German Empire, have invented a new and useful Grinding-Machine for Surfaces of Revolution of Conic Sections, (for which I have obtained patents in Germany, No. 44,786, bearing date July 21, 1888, and No. 47,606, bearing date March 23, 1888; in England, No. 7,836, bearing date May 29, 1888, and No. 2,863, bearing date February 18, 1889; in Italy, No. 362, Vol. 46, bearing date July 26, 1888, and No. 309, Vol. 48, bearing date February 14, 1889; in Austria, No. 41,726, bearing date February 2, 1889, and No. 6,978, bearing date August 27, 1889, and in Hungary, No. 64,043, bearing date February 2, 1889, and No. 40,195, bearing date August 27, 1889,) of which the following is a specification.

For many optical purposes there are wanted reflectors or lenses of ellipsoidal, hyperboloidal, or parabolic reflectors, and it is but for the difficulty to produce them accurately that they are not in general use as a common optical means. They are, however, used for some special purposes—as, for instance, for search-lights, for large projectors, and so on:

The object of the present invention is to improve the machinery required for grinding and polishing such surfaces by limiting the path of the grinding-tool to the geometrical curve, (ellipsis, hyperbola, and parabola,) and it is an essential feature of the invention that the operation of the machine may easily be changed so as to produce an ellipsis instead of a parabola or hyperbola, and vice versa.

Figure 1 is a part sectional and part side elevational view of a machine adapted to grind exterior surfaces of the character indicated; and Fig. 2 is a similar view of a modified form of the machine adapted to grind interior surfaces of the character indicated.

The method of operation of the machine consists in guiding the cutting, grinding, or other tool, first, by an arm at an angle to and movable about an axis, which arm would by turning around the axis describe the surface of an imaginary cone, and, secondly, by a compound slide-rest whose guides are at right angles to one another and coincident or parallel with the plane of the imaginary conic

section whose outline the tool is required to follow, the connection of the tool with these two guiding mechanisms being made through the agency of a ball-and-socket joint. The work to be effected is revolved upon an axis which is coincident or in line with the axis of the imaginary conic section—that is to say, at an angle to the axis of the cone depending on the surface to be produced. To enable this angle to be varied, the axis of the above-mentioned guide-arm is carried by a frame movable on a pivot which is perpendicular to the said axis, so that it may be adjusted at various angles relative to the axis of rotation of the work. The tool being constrained by the compound slide-rest to move in the plane of a conic section and being also constrained to move with the guide-arm in its partial rotation about its axis will be so guided as to move around the side of the cone and in the plane of a conical section, and will hence describe either, first, a circle; second, a parabola; third, a hyperbola, and, fourth, an ellipse. These motions of the tool, in conjunction with the rotary motion of the work, will result in the production, respectively, of spherical, paraboloidal, hyperboloidal, or ellipsoidal surfaces.

Referring now to the drawings in detail and first to Fig. 1, G is the frame of the machine, to which is journaled a vertically-arranged shaft S, carrying a frame or support C for sustaining the work W and a pulley P for rotating the same. To one side of the frame F is pivoted at N a movable frame E, to which in turn is journaled at two points F' F' a rod L', with its axis A A having an angular relation to a second rod L, secured at one end, as shown, the other end of said rod L passing through an arm E'. This rod L is rotatable, so that if it were rotated about the axis A A it would describe a cone which passes through the ball K and is adapted to slide therethrough. The ball K moves in a corresponding shell or universal joint m and is in connection with the tool-holder V, sustained by a compound slide J H, secured to the upper end of the frame G, and is constrained to move in one place, being vertically guided by the guide J and horizontally guided by the ball K; but as the tool-holder V is coincident with the ball whose motion is constrained to both the conical and



the plane motion it (the tool-holder) will move in a curve which is the section of the cone and the plane that is a conic section. Consequently if the shell to be acted upon is rotated  
 5 upon its own axis the tool will describe an ellipsis, parabola, or hyperbola, as required. In this manner the final result will be a surface of revolution of conic section.

It will be easily conceived that the position  
 10 of plane and cone will determine what kind of curve will be produced. For the parabola you will have the condition that plane must be parallel to one side of the cone. As a skilled mechanic will be able to arrange the  
 15 details of the machine without further information, all these details are omitted in the drawings as unnecessary.

The example will illustrate how the machine may be varied without altering its principle,  
 20 so instead of the cone as properly understood in geometry a more general meaning is here to be taken.

In Fig. 2 I have illustrated the arrangement of parts for adapting the invention to the  
 25 grinding of the surfaces in the exterior of the work W, the arrangement of the parts being obvious in view of the description of Fig. 1.

I do not claim generally a machine whose grinding-tool is guided on parabola, ellipsis,  
 30 or hyperbola, as I am aware that such machines already existed before my invention.

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

35 1. In a machine for producing grinding and polishing surfaces of revolution of conic sections, the combination with a tool and tool-holder of two guides limiting the liberty of  
 40 movement of the tool to a simultaneous movement on two cones, substantially as described.

2. In a machine for producing, grinding, and polishing surfaces of revolution of conic sections, the combination with a tool and tool-holder of two guides, one of them being a link  
 45 rotatable on an axis, limiting the liberty of movement of the tool to a simultaneous movement on two cones, substantially as shown and described.

3. In a machine for producing, grinding, and polishing surfaces of revolution of conic sections, the combination with a tool and tool-holder of two guides, one being a guide-rod,  
 50 which is movable about an axis, the other a compound slide, substantially as shown and described. 55

4. In a machine for producing, grinding, and polishing surfaces of revolution of conic sections, the combination with a tool-holder of two guides, one being a link rotatable on an  
 60 axis and the other a compound slide-rest, whose two directions are at right angles to each other and with a ball-and-socket joint connecting the link with the compound slide-rest, substantially as shown and described.

5. In a machine for producing, grinding, and  
 65 polishing surfaces of revolution of conic sections, the combination with a tool-holder of two guides, one being a rod oscillating about an axis, the other a parallel-motion frame  
 70 composed of radius-links, transverse member and guide-pins and with a universal joint, substantially as shown and described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

FIDELIS NERZ.

Witnesses:

ALOIS GOBANZ,  
 OSCAR BOCK.