

(No Model.)

2 Sheets—Sheet 1.

C. A. BENEDICT.

# LATHE FOR TURNING ARTICLES HAVING LONGITUDINALLY CURVED SURFACES.

No. 388,110.

Patented Aug. 21, 1888.

*Fig. 1.*

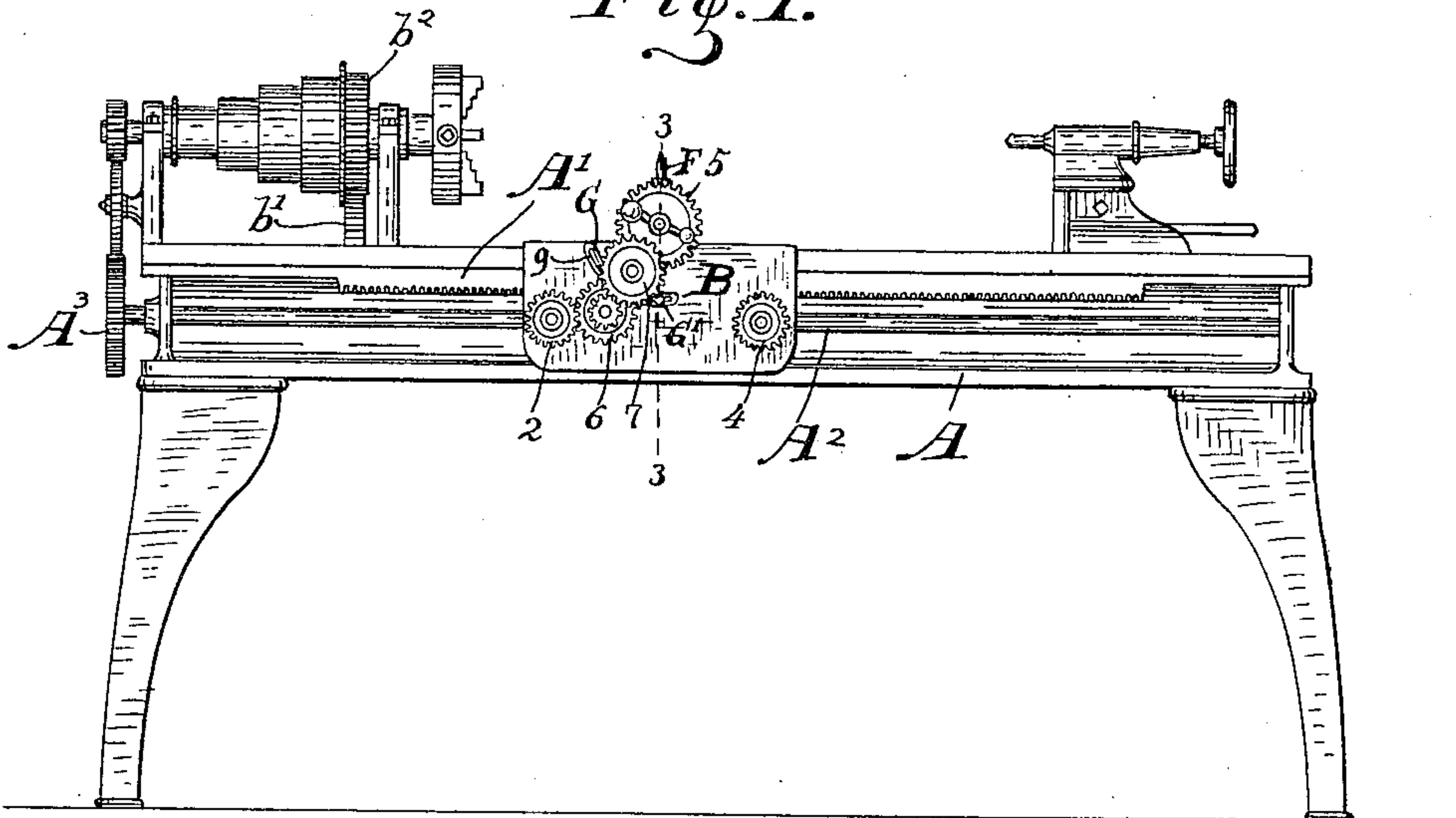
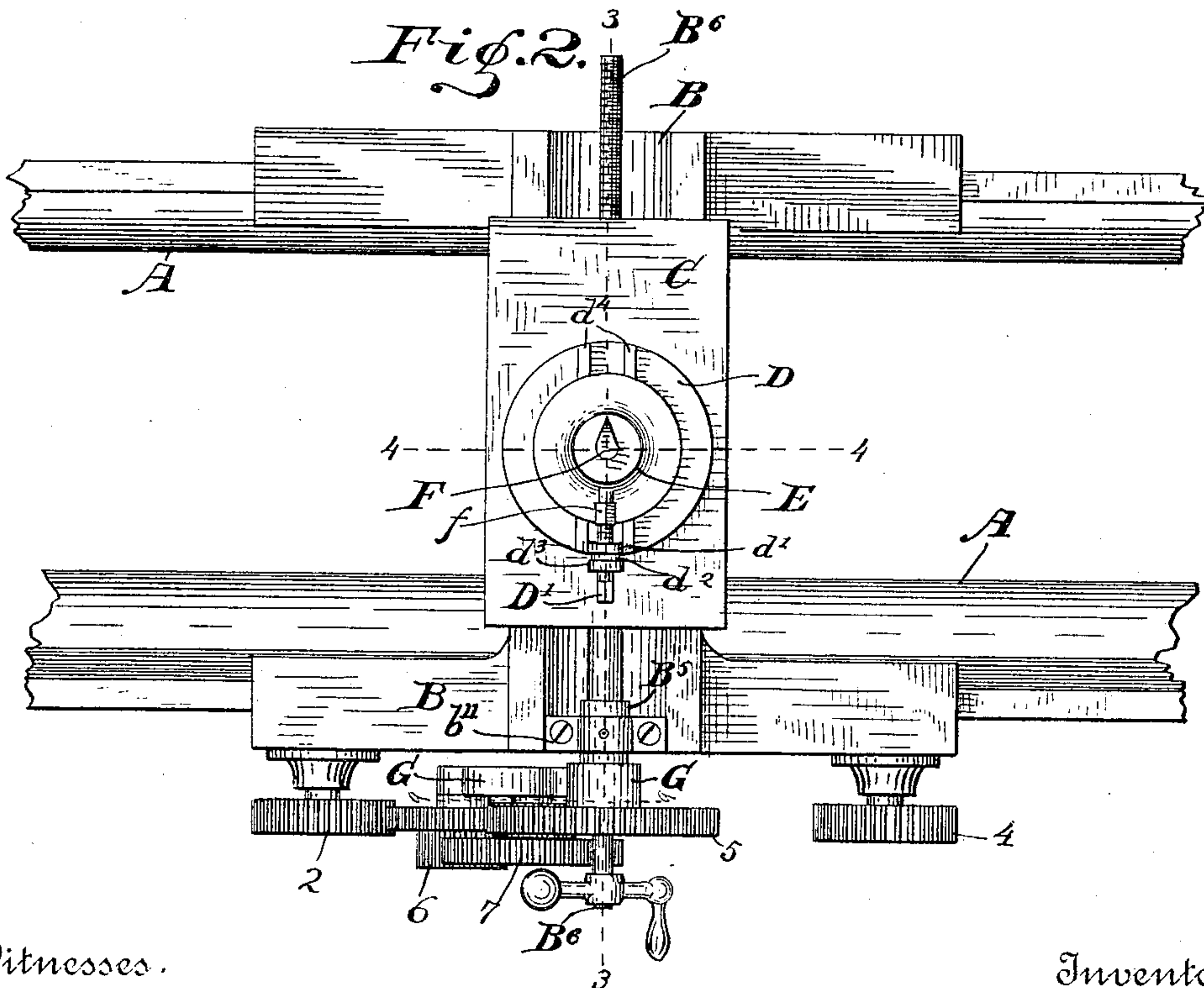


Fig. 2. 



Witnesses.

Cha<sup>s</sup> Leonard.  
Charles L. Thurker.

Inventor,

Charles A. Benedict,  
Per C. A. W. Braefer,  
Attorneys.

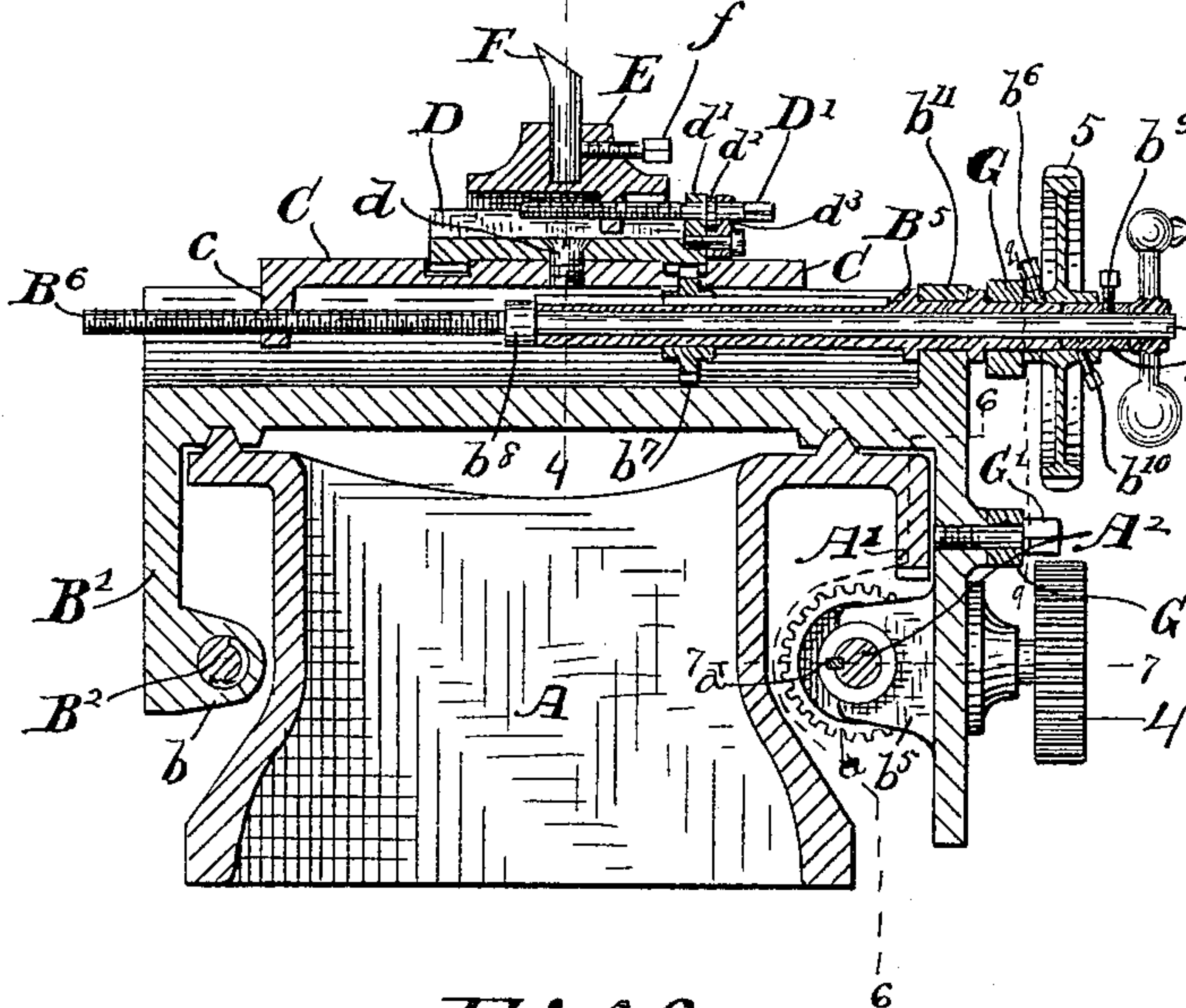
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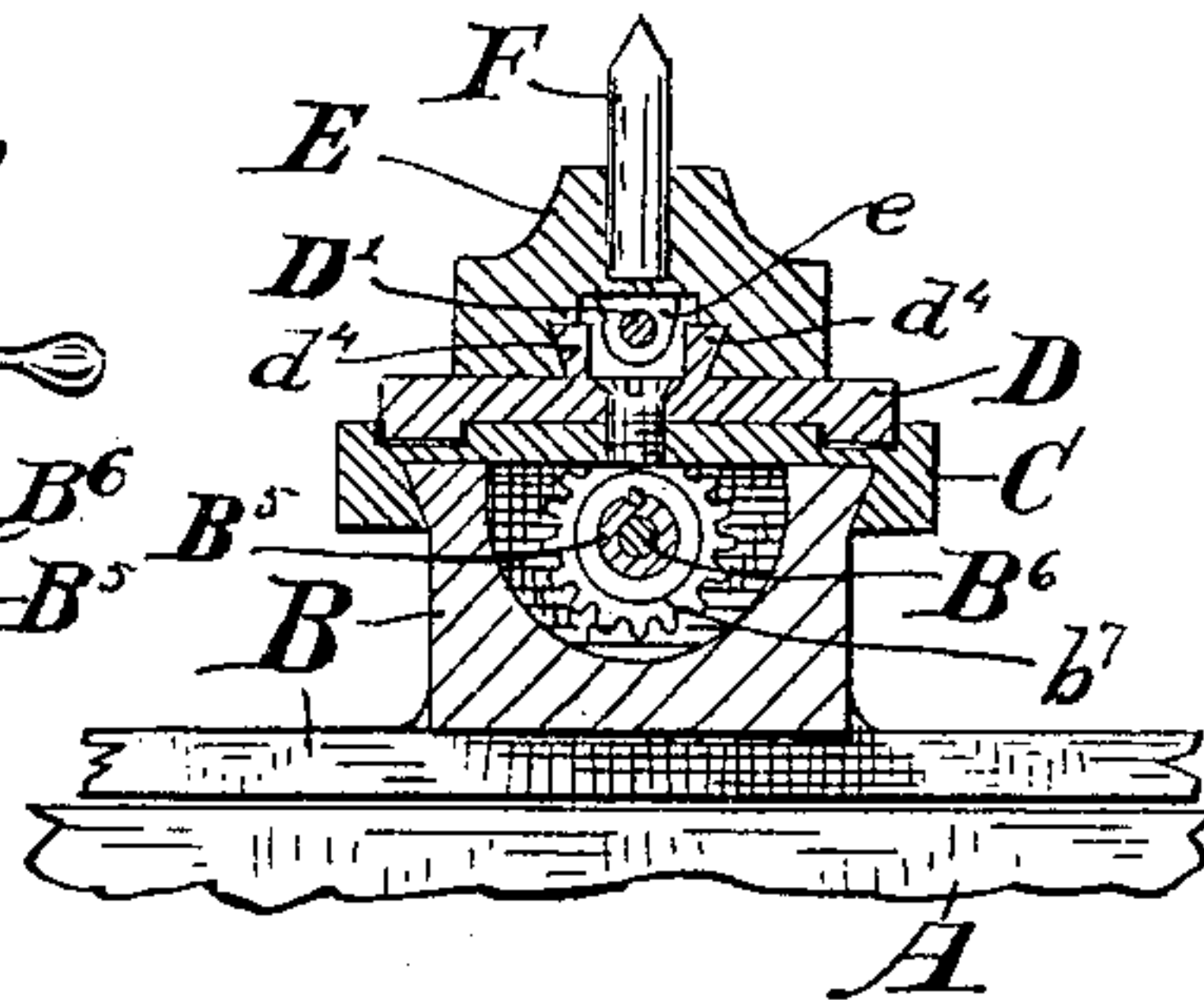
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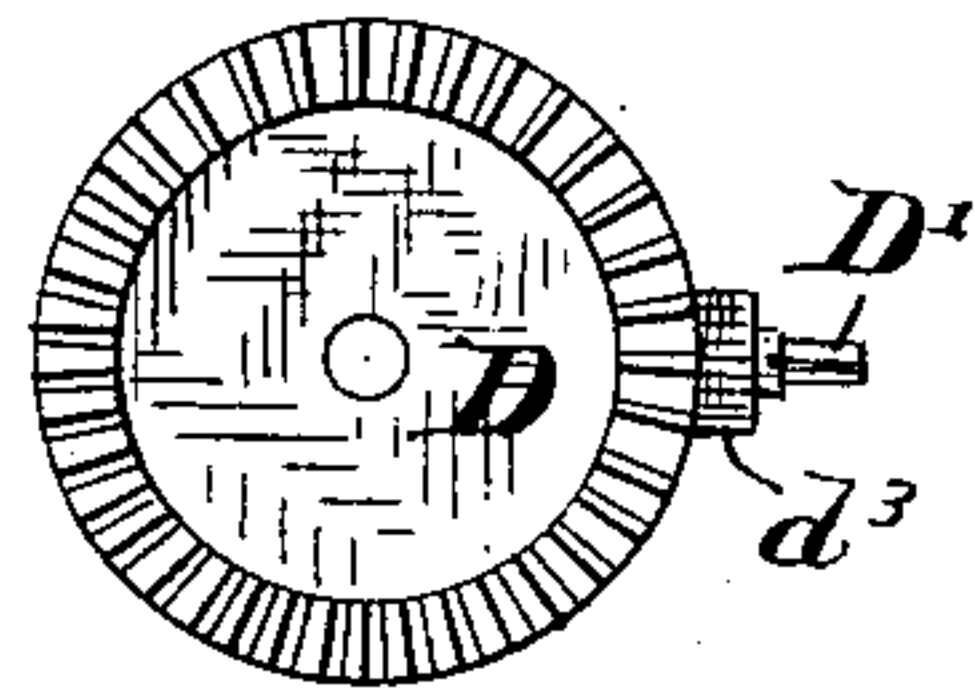
*Fig. 3.*



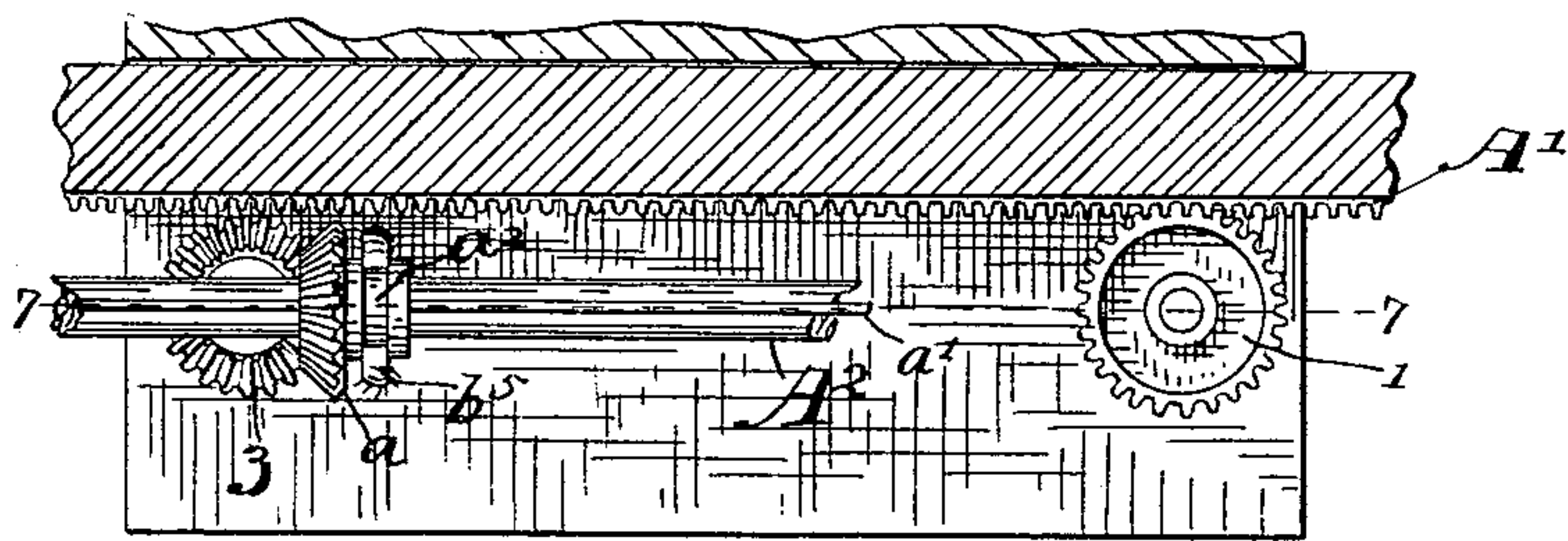
*Fig. 4.*



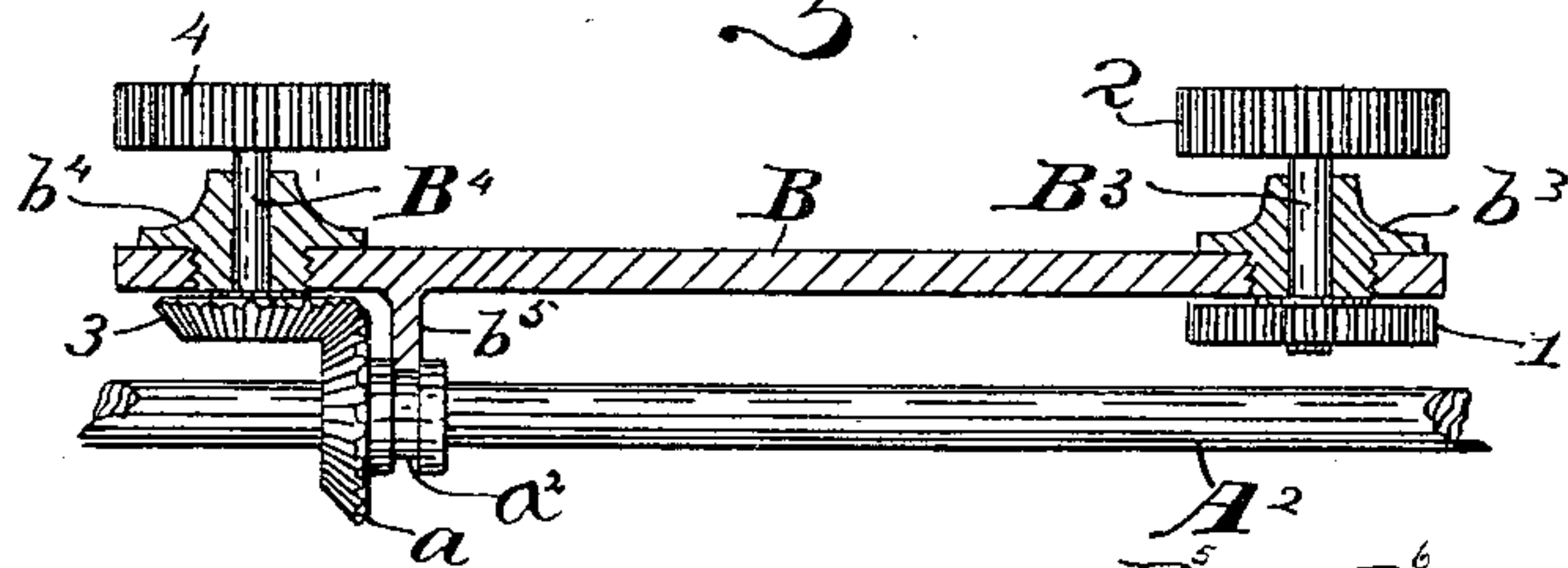
*Fig. 5.*



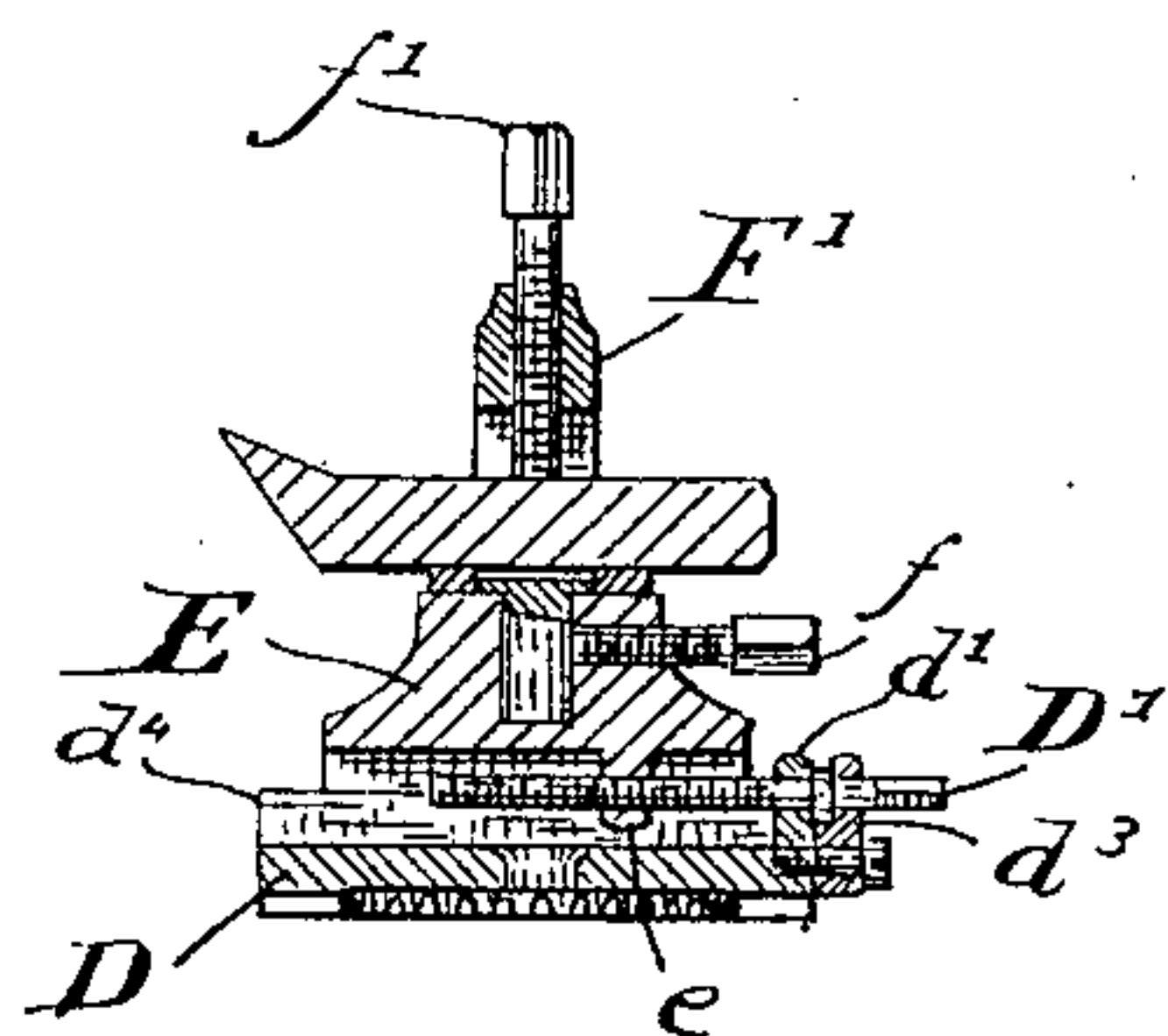
*Fig. 6.*



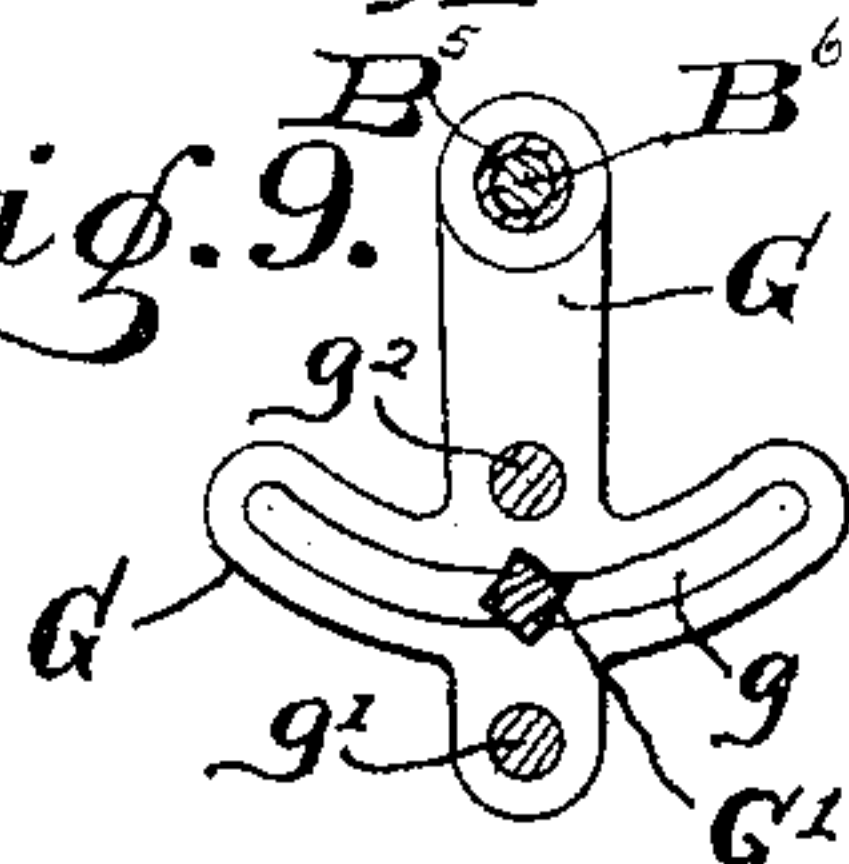
*Fig. 7.*



*Fig. 8.*



*Fig. 9.*



Witnesses,

Charles Leonard,  
Charles R. Thurber.

Inventor,

Charles A. Benedict,  
Per C. A. M. Bradford,  
Attorneys,



# UNITED STATES PATENT OFFICE.

CHARLES A. BENEDICT, OF INDIANAPOLIS, INDIANA.

LATHE FOR TURNING ARTICLES HAVING LONGITUDINALLY-CURVED SURFACES.

SPECIFICATION forming part of Letters Patent No. 388,110, dated August 21, 1888.

Application filed January 10, 1888. Serial No. 260,290. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES A. BENEDICT, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Lathes, of which the following is a specification.

My said invention consists in various improvements in the construction and arrangement of the mechanism for holding and operating the tool and carriage supporting it of turning-lathes, whereby the lathe is adapted for use in turning spheres, ellipses, cones, concave, curved, and other like surfaces automatically, as will be hereinafter more particularly described.

Referring to the accompanying drawings, which are made a part hereof, and on which similar letters of reference indicate similar parts, Figure 1 is a side elevation of a lathe embodying my said invention; Fig. 2, a top or plan view of the portion of the same to which my invention particularly relates; Fig. 3, a cross-section looking toward the right from the dotted line 3 3 in Figs. 1 and 2; Fig. 4, a cross-section through the upper portion of the tool-supporting mechanism on the dotted line 4 4 in Fig. 3; Fig. 5, an under side plan of the part which carries the tool-holder; Fig. 6, a detail longitudinal section looking toward the right from the dotted line 6 6 in Fig. 3; Fig. 7, a horizontal section looking downwardly from the dotted line 7 7 in Fig. 6; Fig. 8, a view showing a horizontal bit mounted in position for use, instead of the vertical bit shown in the other figures; and Fig. 9, a detail view looking to the left from the dotted line 9 9 in Figs. 2 and 3.

In said drawings, the portions marked A represent the bed of the lathe; B, the carriage on which is mounted the mechanism for supporting and operating the tool; C, a plate mounted to slide on top of said carriage; D, a circular plate pivoted to said plate C, carrying the tool-holder; E, said tool-holder; F, the tool, and G a swinging frame carrying a portion of the gearing.

The bed A may be of any construction desired, as it does not form any part of my invention, and need not, therefore, be particularly described, except incidentally in the description of the other parts.

The carriage B is mounted and arranged to slide longitudinally on the bed A in any suitable manner. On its rear side a downwardly-projecting part, B', is provided, on the end of which is formed a nut, *b*, through which a screw-threaded rod, B<sup>2</sup>, passes, which is driven by means of a chain of gearing, *b'* b<sup>2</sup>, engaging with a cog-wheel on its end, said chain of gearing being driven by the power which drives the lathe, as will be readily understood, thus operating said carriage back and forth on the bed in the well-known manner. The front side of said carriage is extended down over the front of the bed, affording a suitable support for the gearing mounted thereon, as will be presently described. At one corner of said downwardly-projecting portion is mounted a short shaft, B<sup>3</sup>, in a suitable bearing, *b*<sup>4</sup>, provided for the purpose. On its inner end it carries the cog-wheel 1, which meshes with a longitudinal rack-bar, A', provided on the edge of the bed, as shown, and on its outer end is mounted the cog-wheel 2, for purposes which will be presently described. At the opposite corner of said portion of the carriage, in a similar bearing, *b*<sup>4</sup>, is mounted a similar shaft, B<sup>4</sup>, carrying a miter gear-wheel, 3, on its inner end and the cog-wheel 4 on its outer end. Said miter gear-wheel 3 is arranged to mesh with a miter gear-wheel, *a*, mounted on the shaft A<sup>2</sup>, which shaft is journaled in suitable bearings in each end of the bed, and is driven by a chain of gearing connecting the cog-wheel A<sup>3</sup> on its end with the mandrel carrying the chuck. (See Fig. 1.) Said miter gear-wheel *a* is mounted to slide on said shaft A<sup>2</sup> by means of a spline, *a'*, and is provided with an extended hub in which is formed a circumferential groove, *a*<sup>2</sup>. A bifurcated part, *b*<sup>5</sup>, formed on the downwardly-projecting portion of the carriage just in front of the miter gear-wheel 3, is arranged to engage with said circumferential groove, one fork engaging on each side thereof, thus holding said wheel in connection with the miter gear-wheel 3 regardless of the movements of the carriage, said fork operating to slide said wheel *a* on the shaft A<sup>2</sup> as the carriage moves back and forth and maintain it in the same relative position to the wheel 3 at all times. On the front edge of the carriage B at its top a bearing, *b*<sup>11</sup>, is provided, in which is journaled a hollow shaft,



B<sup>5</sup>, which is held from sliding therein by means of collars mounted on said shaft on each side of said bearing, as shown. Near its outer end it is provided with a cog-wheel, 5, secured from turning on said shaft by a set-screw, b<sup>6</sup>, mounted in the inner end of its hub. Said shaft is divided at the center of the wheel, the outer portion being secured to a solid rod, B<sup>6</sup>, by a set-screw, b<sup>9</sup>, and another set-screw, b<sup>10</sup>, is provided in the outer end of the hub of said wheel, by which it may be secured to this part of said hollow shaft when it is desired, for the purposes which will be hereinafter more particularly described. Near its inner end a cog-wheel, b<sup>7</sup>, is mounted on said shaft by means of a spline, which permits it to slide longitudinally thereon. The solid rod or shaft B<sup>6</sup> extends through the entire length of said hollow shaft, at the inner end of which it is provided with a collar, b<sup>8</sup>, from which point to its outer end it is made screw-threaded, as shown. On its opposite end it is provided with a balanced crank, by which it may be operated.

The part C is mounted on the top of the carriage to slide longitudinally thereof or transversely of the bed, and on the rear edge is provided with a downwardly-projecting lug, c, having a screw-threaded perforation, with which the screw-threaded portion of the rod B<sup>6</sup> engages, thus affording a means for operating said sliding part back and forth, as will be readily understood.

The plate D is circular in form and pivoted at its center on top of the part C by means of a bolt, d, seated in a suitable bearing in said plate and screwed into said part C, as shown. The under side of said plate is provided with cogs around its edge, (see especially Fig. 5,) with which the cog-wheel b<sup>7</sup> on the hollow shaft B<sup>5</sup> engages, said cog-wheel being arranged to extend up through a suitable slot in the part C in a position to form the engagement, which slot also serves to slide said wheel on its shaft as the part C travels back and forth. On the front edge of this part is formed an ear, d', in which a set-screw, D', is journaled. A collar, d<sup>2</sup>, in front of said ear d' prevents said screw from sliding inwardly, and a removable ear, d<sup>3</sup>, secured on the outside, prevents it from sliding outwardly.

The tool-holder E is mounted on the top of said plate, being provided with a dovetail-shaped recess in its under side, which engages with correspondingly-formed tongues, d<sup>4</sup>, on the top of the plate D. A downwardly-projecting ear, e, is formed on the under side of said tool-holder, provided with a screw-threaded perforation, with which the set-screw D' is arranged to engage, as shown.

The tool F is any suitable tool secured in a vertical seat in the top of said tool-holder by means of a set-screw, f. In Fig. 8 I show the tool secured in a horizontal instead of a vertical position, it being then mounted in a supplemental tool-holder, F', which is secured

in the same manner as the tool itself in the tool-holder E, and provided with a transverse slot in which the tool is mounted in a horizontal position and secured by means of a vertical set-screw, f'. In turning spheres and circles it will be found necessary to use the bit in the vertical position, as the horizontal bit is not adapted for this kind of work, and I regard the arrangement by which the bit can be used in a vertical position as an important part of my invention.

The swinging frame G is mounted to swing on the end of the hollow shaft B<sup>5</sup>, between the wheel 4 and the bearing. It is provided with a curved transverse slot, g, through which a bolt, G', passes and enters a screw-threaded perforation in the downwardly-projecting end of the carriage B, thus affording a means for securing said swinging frame in any position desired. Said swinging frame carries suitable stud-shafts, g' g<sup>2</sup>, on which gear-wheels 6 and 7, connecting the gear-wheel 5 with the gear-wheel 2, are mounted.

The operation of my said invention is as follows: The parts being in the position shown in the drawings and being put in operation, the carriage B is driven longitudinally on the bed by means of the screw B<sup>2</sup> operating in a screw-threaded bearing, b, on the rear side of said carriage. As the carriage travels, the gear-wheel 1, engaging with the rack-bar A' on the bed, drives the shaft B<sup>3</sup> and the gear-wheel 2 on its outer end, which meshes with the gear-wheel 6, which in turn, by means of a smaller pinion formed on its front side, meshes with the gear-wheel 7, which, by means of a similarly-formed pinion on its rear side, engages with the gear-wheel 5 and drives the hollow shaft, which, through the gear-wheel b<sup>7</sup> and the cogs on the under side of the circular plate D, operates to revolve said plate and feed the tool toward the work in a path corresponding to the radius of a circle. It will be understood, of course, that the arrangement of the gear-wheels, by which motion is communicated to said shaft, can be varied to secure the speed required. For instance, the gear-wheel 6 may be removed and a gear-wheel of any other size mounted on its shaft in its place, and by means of the swinging frame adjusted to engage with the wheel 2, and thus communicate the speed desired to the shaft. When it is desired to operate upon the work with the carriage in a stationary position, the screw-threaded shaft B<sup>2</sup> is thrown out of gear with its driving mechanism, and the shaft A<sup>3</sup> is connected by suitable gearing to the power and thus put in motion, which, through the miter gear-wheels a and 3, operates the shaft B<sup>4</sup> and the wheel 4 on its outer end. The swinging frame is then adjusted so that the wheel 6 will engage with the wheel 4 and be secured in this position. When it is desired that the plate D shall not revolve and the tool be fed to the work in a straight line, the set-screw b<sup>6</sup>, which holds the wheel 5 to the hol-



low shaft on the inner side of its hub, is loosened, and the screw  $b^{10}$  in the outer end of its hub is tightened against the outer portion of said shaft, which permits, as will be readily understood, said hollow shaft to stand still, (it being possible to secure it rigidly by tightening the bearing  $b^{11}$  thereon, if desired,) but continues to drive the solid rod  $B^6$ , which is mounted therein, and thus maintain the motion of the tool toward the work. When it is desired to turn a sphere, the tool-support E is drawn back by means of the set-screw D' until the tool is behind the center of said plate D, (the tool being used in the vertical position in this character of work,) and thus, as said plate revolves, said tool is fed into the work in such a manner as to form a sphere when the carriage B is standing still or an ellipse when it is moving, the degree of ellipse formed being regulated by the speed of the carriage. In the same manner, to form a concave surface, the tool-support is moved in front of the center, and then, when the carriage B is stationary, a true circle of the size desired, which can be regulated by the degree at which the tool is placed in front of the center, can be turned, or if a hollow surface is desired the carriage B is put in motion, and by regulating the speed the exact degree of curvature desired can be readily secured. When it is desired to turn a cone, the hollow shaft can be disconnected from the gearing by which it is driven, and the tool will then be gradually fed forward to form the desired "pitch," which can be regulated, as before described, by regulating the speed of the parts. By arranging these gear-wheels so as to obtain the speed required the curves and other surfaces formed will be of an exact and true curvature or slant, it being possible to turn a perfect sphere, or an ellipse or curve of any length or degree desired.

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

1. The combination, in a lathe, with the carriage, of a hollow shaft mounted in a suitable bearing at one side, provided with a gear-wheel on its outer end by which motion is communicated to said shaft and another gear-wheel on its inner end, a sliding part mounted on said carriage, provided with a slot through which said gear-wheel on the inner end of said hollow shaft projects, a circular plate pivoted on the top of said sliding part and formed with cogs around its edge engaging with said gear-wheel, and the tool-holder mounted on said circular plate, substantially as set forth.

2. In a turning-lathe, the combination, with the carriage thereof, of a hollow shaft mounted in a suitable bearing thereon, a sliding part, C, mounted on the top of said carriage, the screw-threaded rod  $B^6$ , mounted in said hollow shaft and engaging with a screw-threaded perforation at one side of said sliding part, the gear-wheel  $b^7$ , mounted to slide on said hollow shaft

and extending up through a slot in said part C, the circular plate D, pivoted on the top of said part C, provided with cogs engaging with said gear-wheel  $b^7$ , and the tool-holder carrying the tool mounted on said circular plate, substantially as set forth.

3. In a lathe, the combination of the carriage carrying a hollow shaft at its top and a chain of gearing on its side engaging with said hollow shaft for driving the same, a solid shaft mounted within said hollow shaft formed with a screw-threaded end, the sliding part C, mounted on top of said carriage and provided with an ear,  $c$ , having screw-threaded perforation arranged to engage with said screw-threaded end of the shaft  $B^6$ , the gear wheel  $b^7$ , mounted to slide on said hollow shaft  $B^5$ , the circular plate D, pivoted to said part C and provided with cogs engaging with said gear-wheel  $b^7$ , and the tool-holder mounted on said circular plate D, substantially as set forth.

4. The combination, in a turning-lathe, with the carriage and mechanism for supporting the tool, of a circular plate pivoted on the top of said carriage, the gearing for operating said plate, the tool-holder mounted to slide on the top of said plate, means, substantially as described, for adjusting it in front of or behind the center of said plate, and the tool mounted in said tool-holder, substantially as described, and for the purposes specified.

5. The combination, in a lathe, with the carriage thereof and mechanism for supporting and operating the tool, of a tool-holder adjustably mounted on a pivoted part on said carriage and provided with a vertical socket, and the tool mounted in said socket of said tool-holder in a vertical position, substantially as described, and for the purposes specified.

6. The combination, in a turning-lathe, of the carriage, the means for driving the same, a shaft extending through a portion formed in the front side of said carriage and provided with a gear-wheel on each end, the inner one of which engages with a rack-bar on the bed of said lathe, the hollow shaft  $B^5$ , journaled at the top of said carriage and having a gear-wheel mounted on its outer end, and a chain of gearing connecting said two gear-wheels, the circular plate D, pivoted on the top of said carriage and provided with cogs around its edge, and the gear-wheel  $b^7$ , mounted on said shaft and engaging with said circular plate, substantially as set forth.

7. The combination, in a turning-lathe, of the shaft  $A^2$ , means for driving the same, the miter gear-wheel  $a$ , mounted to slide thereon, the carriage arranged to slide on the bed of said lathe, carrying a short shaft,  $B^4$ , in a bearing mounted in its front side, the gear-wheel 3, mounted on said short shaft and engaging with a wheel,  $a$ , the device  $b^5$ , engaging with said wheel  $a$  to hold it into connection with the wheel 3, the wheel 4, mounted on the outer end of said shaft  $B^4$ , the shaft  $B^5$ , mounted in

the top of said carriage carrying the wheel 5,  
the swinging frame G, carrying a chain of  
gearing arranged to connect said wheel 5 with  
said wheel 4 when it is desired, and the mech-  
5 anism for supporting and operating the tool  
mounted on the top of said carriage and con-  
nected to said shaft B<sup>5</sup>, substantially as set  
forth.

In witness whereof I have hereunto set my  
hand and seal, at Indianapolis, Indiana, this 10  
6th day of January, A. D. 1888.

CHARLES A. BENEDICT. [L. S.]

Witnesses:

E. W. BRADFORD,

CHARLES L. THURBER.