No. 884,125. PATENTED APR. 7, 1908.

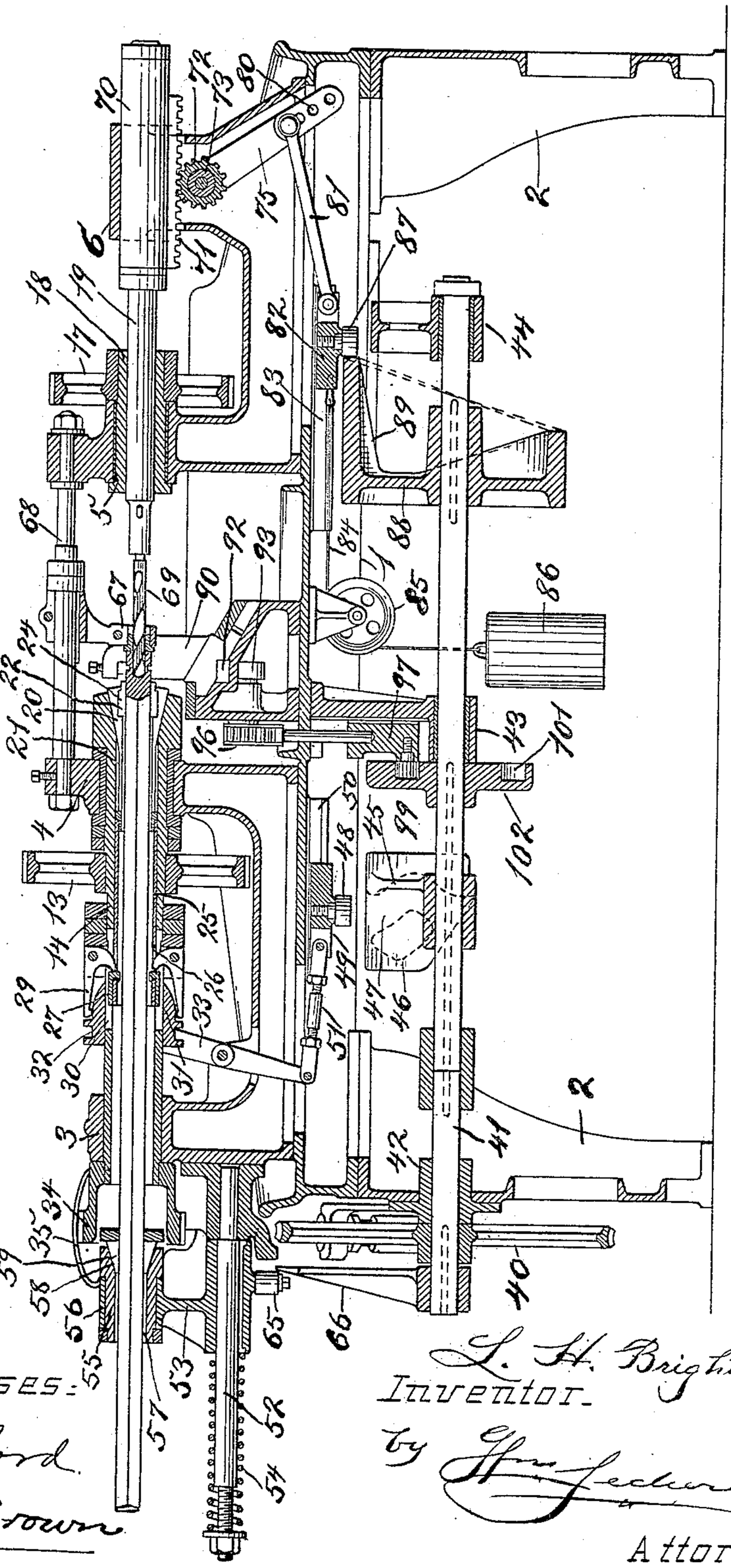
L. H. BRIGHTMAN.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 1.

Fig. 1.



Witnesses:-

A. L. Lord.

P. C. Brown

L. H. Brightman,
Inventor.

by Glenn Jeckon

Attorney.

No. 884,125. PATENTED APR. 7, 1908.

L. H. BRIGHTMAN.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 2.

Fig. II

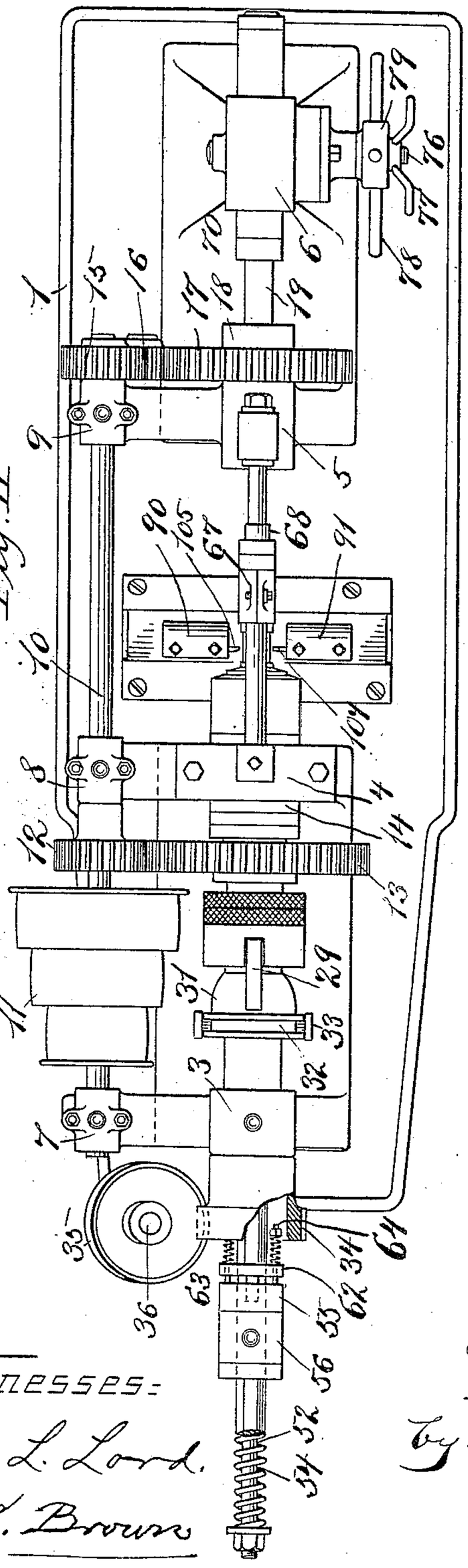


Fig. XIII.

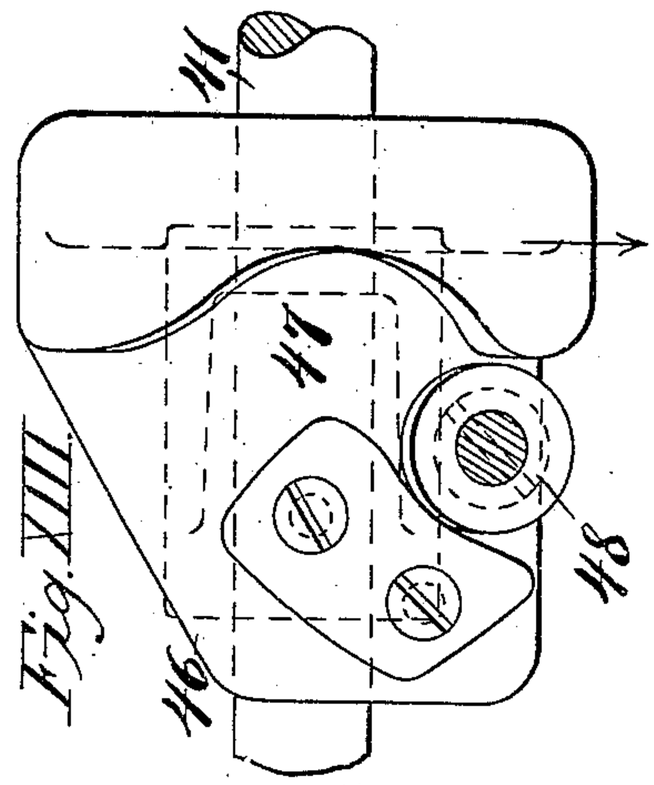


Fig. XII.

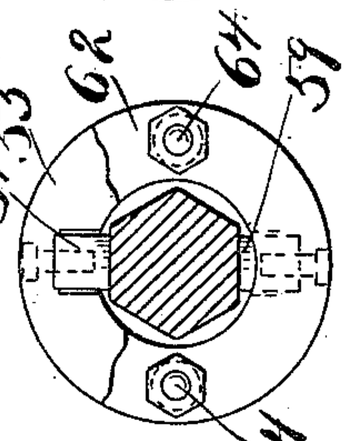
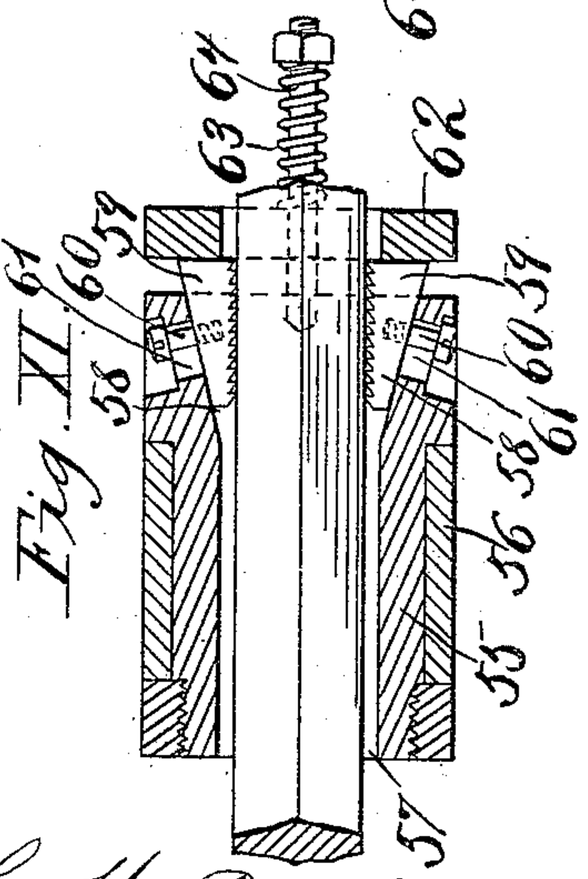


Fig. XI.



Witnesses:

A. L. Lord.

O. C. Brown

L. H. Brightman,
Inventor,

by John Jecker
Attorney.

L. H. BRIGHTMAN.

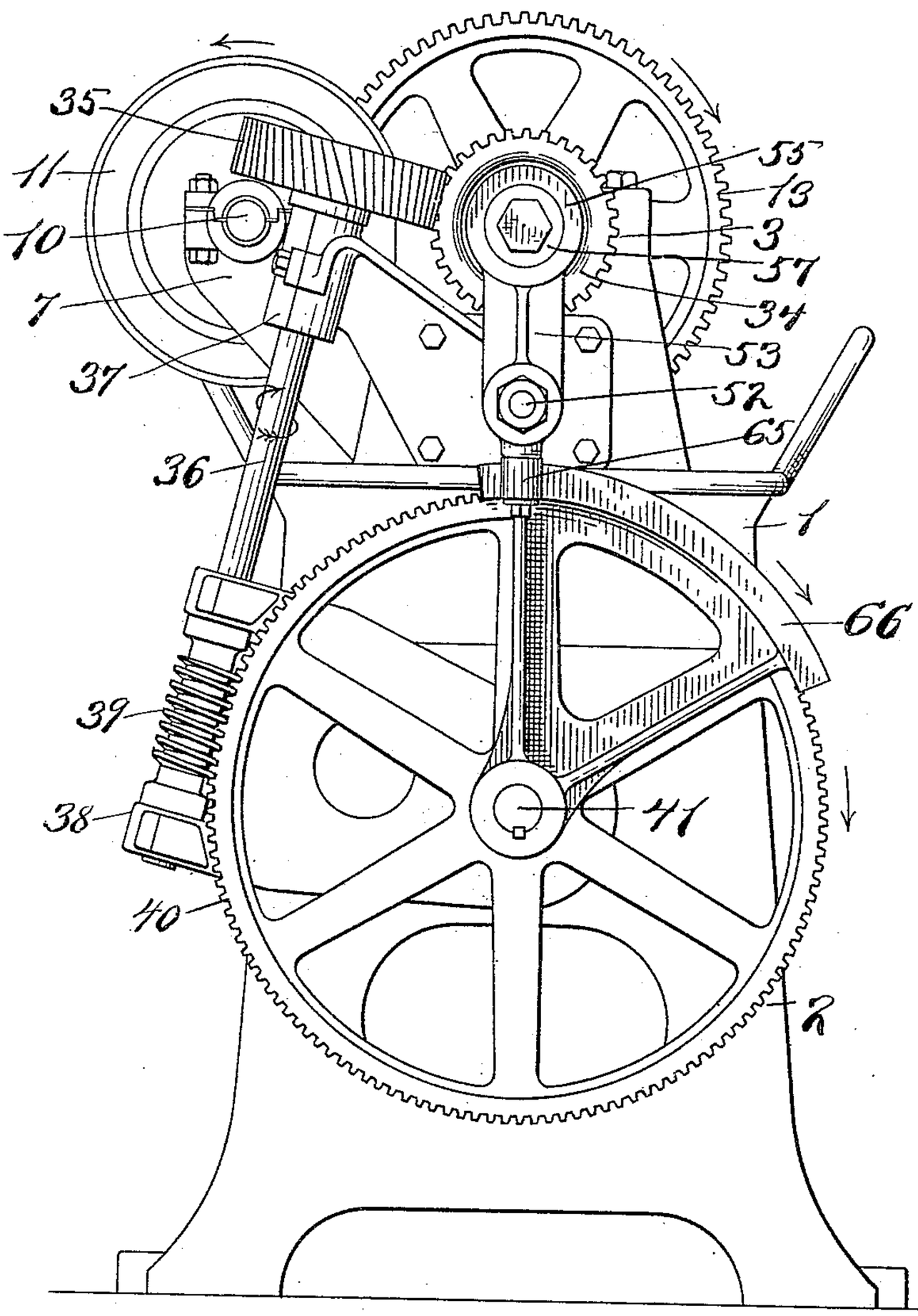
PATENTED APR. 7, 1908.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 3.

Fig. III



Witnesses:

A. L. Lord.

P. C. Brown

L. H. Brightman,
Inventor,

by Jno. Jecker

Attorney.

No. 884,120. PATENTED APR. 7, 1908.

L. H. BRIGHTMAN.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 4.

Fig. IV.

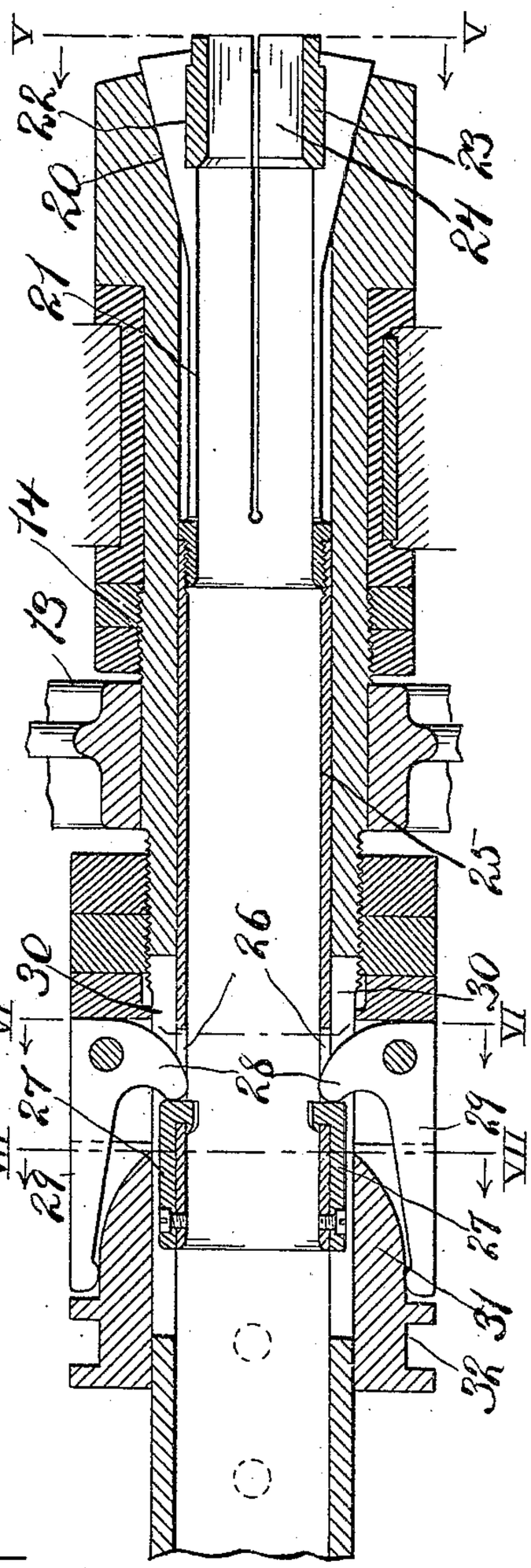


Fig. V.

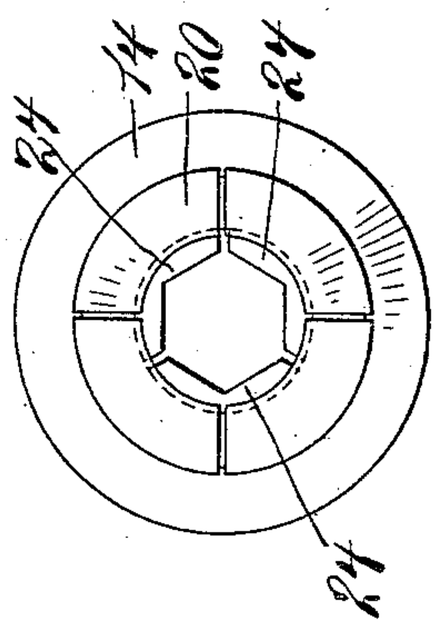


Fig. VI.

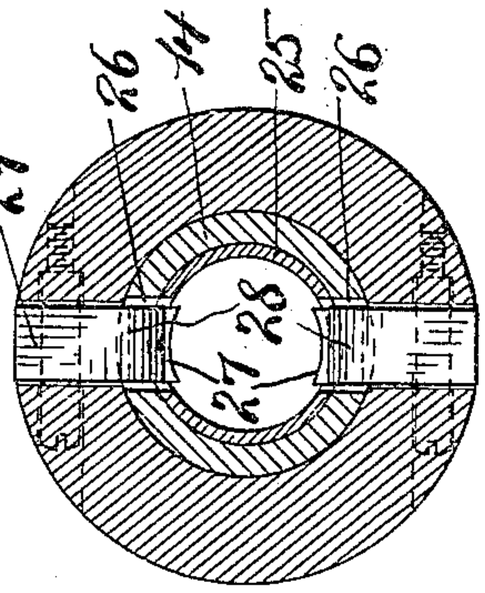
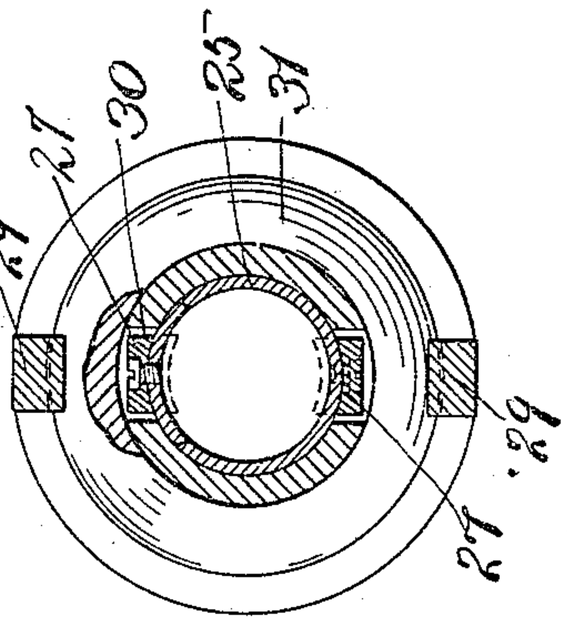


Fig. VII.



Witnesses:

A. L. Lord.

P. C. Brown

L. H. Brightman,
Inventor,
by Geo. Fecher
Attorney.

No. 884,125. PATENTED APR. 7, 1908.

L. H. BRIGHTMAN.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 5.

Fig. V.

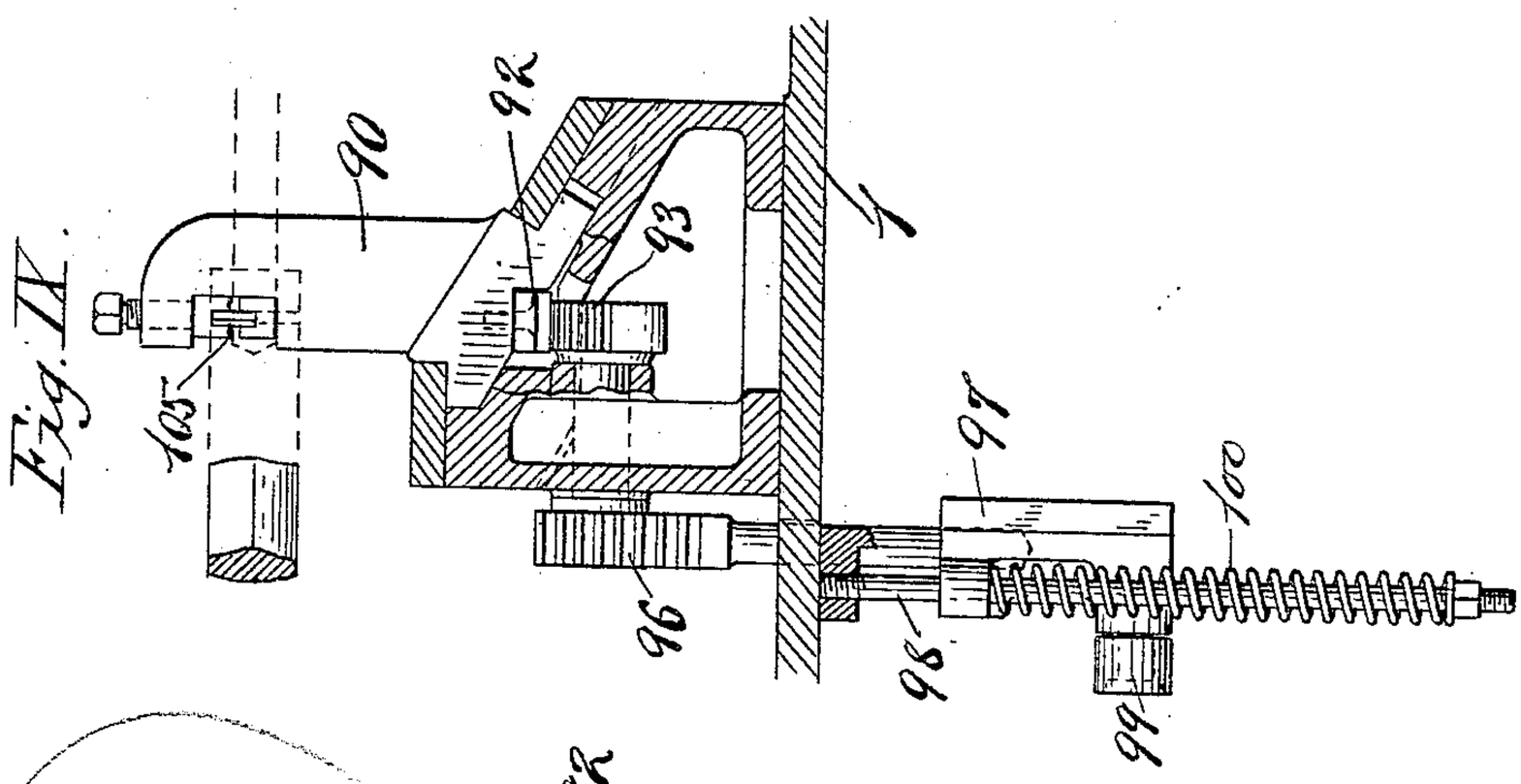
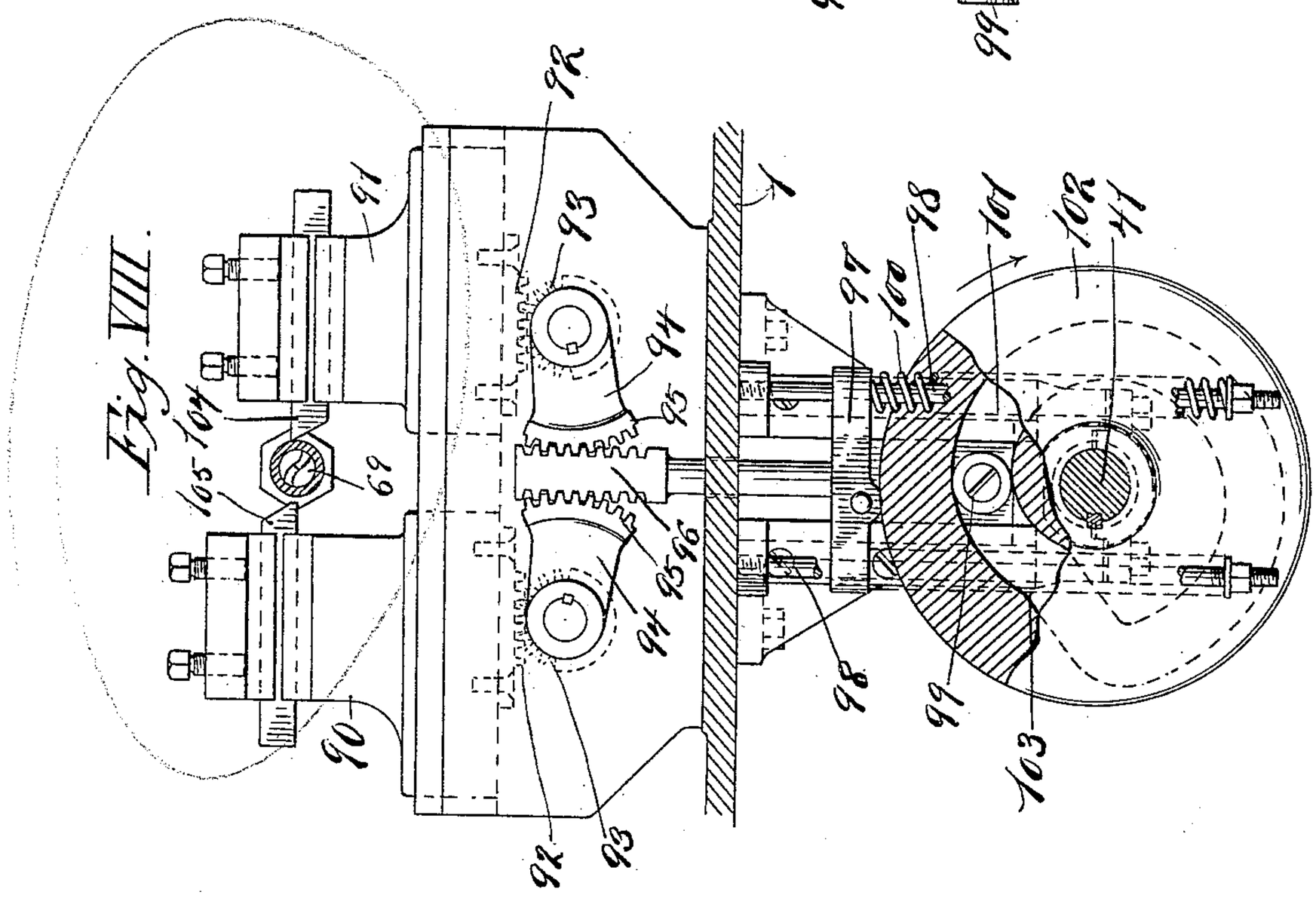


Fig. VIII.



Witnesses:

A. L. Lord.

P. C. Brown

L. H. Brightman,

Inventor,

by Jno. Secor

Attorney.

No. 884,125. PATENTED APR. 7, 1908.

L. H. BRIGHTMAN.

AUTOMATIC TURNING AND BORING MACHINE.

APPLICATION FILED NOV. 27, 1905.

6 SHEETS—SHEET 6.

Fig. X.

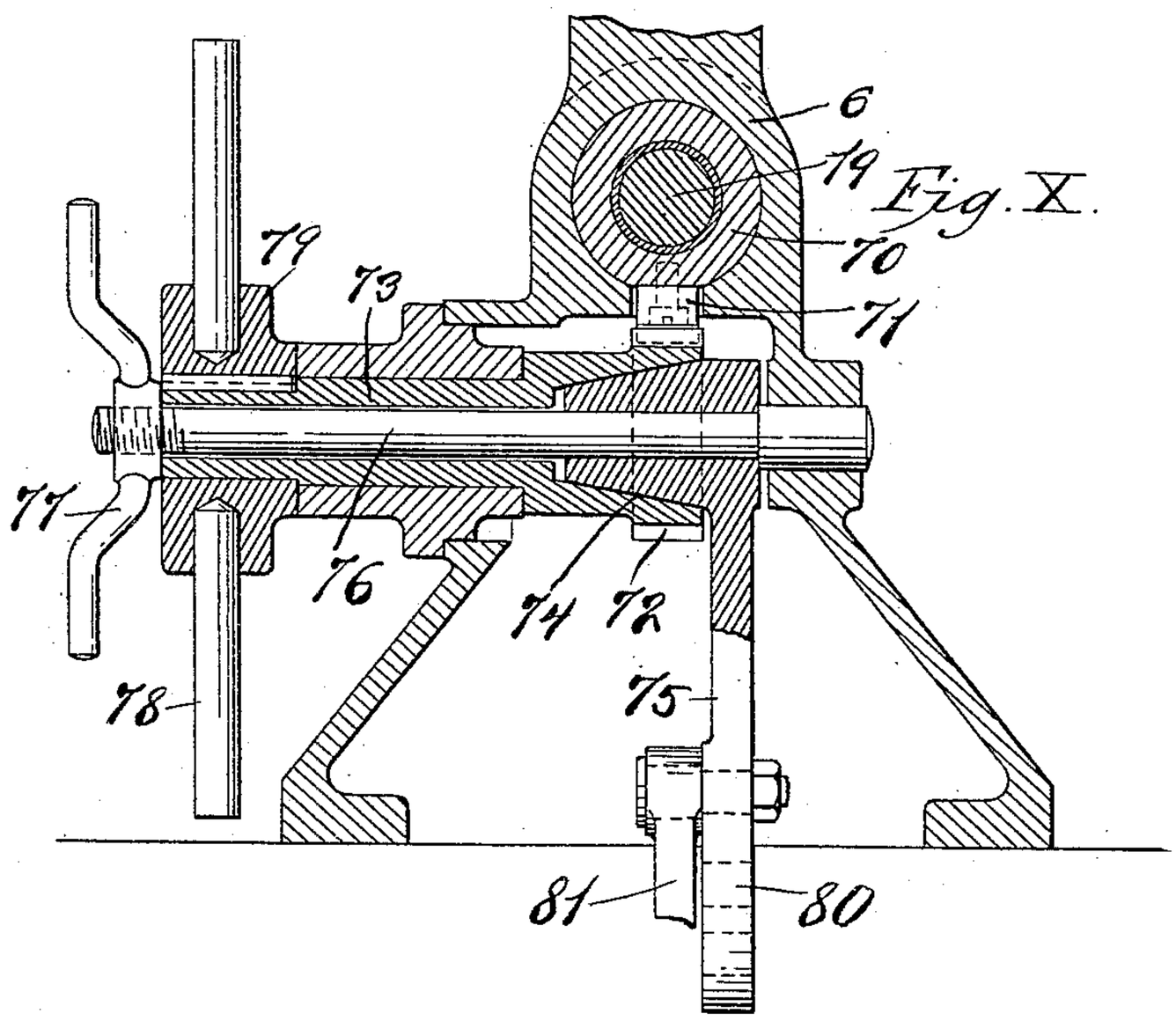
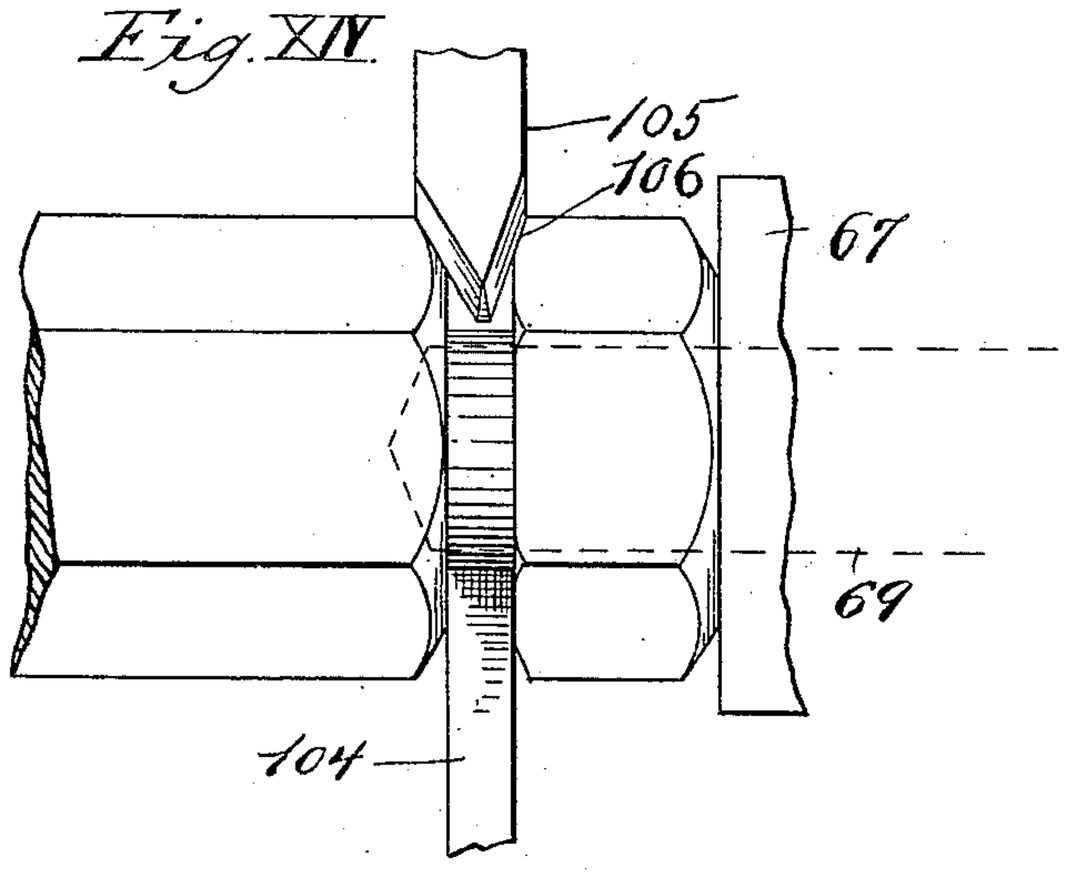


Fig. XIV.



Witnesses:
A. L. Lord.
P. C. Brown

L. H. Brightman,
Inventor,
by Hyer & Fecher
Attorney.

UNITED STATES PATENT OFFICE.

LATHAM H. BRIGHTMAN, OF SHELBY, OHIO.

AUTOMATIC TURNING AND BORING MACHINE.

No. 884,125. Specification of Letters Patent. Patented April 7, 1908.

Application filed November 27, 1905. Serial No. 289,210.

To all whom it may concern:

Be it known that I, LATHAM H. BRIGHTMAN, a citizen of the United States, resident of Shelby, county of Richland, and State of Ohio, have invented certain new and useful Improvements in Automatic Turning and Boring Machines, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The annexed drawings and the following description set forth in detail, one mechanical form embodying the invention; such detail construction being but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings, Figure I represents a longitudinal vertical section of my improved automatic turning and boring machine as adapted for making cold steel nuts, Fig. II, a top plan view of the machine; Fig. III, a view of a feed-end of the machine; Fig. IV, an axial section of the hollow mandrel and chuck which holds the stock; Figs. V, VI, and VII, transverse sections on lines V—V, VI—VI and VII—VII in Fig. IV; Fig. VIII, a transverse sectional detail view, looking towards the discharge-end, and illustrating the tool-stocks and the means for operating them; Fig. IX, a sectional detail view of the mechanism and at a right angle to the former view; Fig. X, a transverse section through the drill-spindle and its feeding mechanism; Fig. XI, an axial section of the stock-feeding clutch; Fig. XII, an end-view of the same; Fig. XIII, a face-view of the cam which actuates the stock-holding chuck in the mandrel, and Fig. XIV, a detail view on an enlarged scale of the stock, a completed nut, and the tools severing the latter and facing the next nut.

While the machine is illustrated and described as adapted to turn and bore nuts from polygonal bars of steel, it is evident that the machine may be adapted to make any metallic articles from a bar, longitudinally boring the same and cutting them off from the bar in suitable lengths.

The machine has a bed, 1, mounted on suitable legs, 2, and formed with four longitudinal and axially-alined bearings, 3, 4, 5, and 6. Three bearings, 7, 8 and 9, are provided parallel with and transversely-alined with the three bearings, 3, 4, and 5, and a drive-shaft, 10, carrying a cone-pulley, 11, to which the driving power is applied, is journaled in said bearings 7, 8 and 9. The drive-shaft has a pinion, 12, which meshes with a cog-wheel, 13, upon a tubular mandrel, 14, journaled in the bearings 3 and 4. A pinion, 15, upon the drive-shaft meshes with an idle pinion, 16, which meshes with a cog-wheel, 17, upon a bearing-sleeve, 18, journaled in the bearing 5 and secured upon a drill-spindle, 19.

The tubular mandrel has the end of its bore flared to have the conical end, 20, of a longitudinally-split sleeve, 21, fit into it. The end of this split sleeve has an annular recess, 22, into which an annular rib, 23, of a collet formed from a plurality of sections, 24, fits. The interior bore of this collet corresponds in shape to the cross-sectional shape of the bar of stock treated in the machine, being illustrated as hexagonal in the drawings, as the machine there illustrated is designed for the manufacture of hexagonal nut-blanks. The split sleeve has its inner end secured to a sleeve, 25, having longitudinal slots, 26, near its end, which slots have wear-plates, 27, secured at their ends to be engaged by the curved and inwardly-projecting arms, 28, of two hook-shaped levers, 29, pivoted at their angles in longitudinal slots, 30, in the tubular mandrel. The outer arms of said levers are engaged by a cone, 31, to be spread outward by the same, which cone slides upon the mandrel and has a circumferential groove, 32, engaged by the arms of a forked lever, 33, fulcrumed in the machine bed. When the cone is forced in between the outer arms of the hooked levers, the inner curved arms of said levers draw the inner and split sleeve inward, so that the conical end of the latter is compressed to close the collet upon the stock so as to firmly clamp the latter. A spiral gear, 34, is secured upon the feed-end of the mandrel and meshes with a spiral gear, 35, at right angles to it and secured upon the upper end of a shaft, 36, journaled in bearings, 37 and 38, at the feed-end of the machine-frame and having a worm, 39, at its lower end, which engages a large worm-wheel, 40, upon a cam-shaft, 41, journaled in bearings, 42, 43 and 44, in the machine-frame and beneath the bed and parallel with the mandrel and drill-spindle. An arm, 45, is secured upon this shaft and carries a drum-segment, 46, at its outer end, upon the outer face of which is formed a portion of a cam-

groove, 47, curved to make a substantially right-angled configuration. A roller, 48, projects downward from a slide, 49, to be engaged by this cam-groove, and the slide is supported to slide longitudinally in ways, 50, upon the under side of the machine-bed. A link, 51, adjustable as to length, is pivoted to this slide and to the lower arm of the forked lever, so that said lever and the chuck-mechanism in the mandrel will be operated to open and close said mechanism by the engagement of the roller by the segmental cam-groove.

A rod, 52, projects from the feed-end of the machine-frame and has the lower and longitudinally-bored end of the slide, 53, fitted to slide upon it. A spring, 54, is coiled around the rod and bears against the slide to force it towards the frame. The upper end of the slide has a bushing, 55, journaled in a longitudinal bearing, 56, and this bushing has a bore, 57, formed with two outwardly-flaring grooves, 58, in which two wedge-shaped dogs, 59, slide. Said dogs have headed screws, 60, in their oblique outer sides, which screws slide in guide-slots, 61, in the bushing and thus prevent the dogs from falling out when the stock is removed. A ring, 62, bears against the wide ends of the dogs, having springs, 63, upon bolts, 64, forcing said ring against the dogs and the dogs into the grooves. The inner clamping faces of the dogs may be serrated or otherwise roughened to insure a firm bite upon the stock in feeding it forward. A roller, 65, projects downward from the slide and is engaged for about one-sixth of each revolution of the cam-shaft by a wedge-shaped cam-segment 66, upon said shaft, whereby the feed-slide is forced back for a distance about equal to the thickness of a nut-blank to secure a new hold upon the stock, released by the roller slipping off from the thick end of the cam-wedge and forced forward by the spring feeding the stock forward. A stop or gage 67, which serves as a jig or drill-guide, is adjustably secured to project downward from a rod, 68, secured between the brackets of the bearings 4 and 5, so as to stop the stock after it has been fed the proper distance forward through the mandrel, and has a closed cylindrical bearing for the boring-tool.

A twist-drill, 69, or other suitable metal-boring tool, is guided in the stop 67 to longitudinally bore the revolving stock, and is secured in the spindle 19, and the end of said spindle is journaled in a sleeve, 70, having a cogged rack, 71, and longitudinally sliding in the bearing 6. Said rack is engaged by a pinion, 72, secured upon a hollow shaft, 73, transversely journaled in the bearing 6. The inner end of the bore of this shaft is flaring to receive a conical head, 74, of an arm, 75, having a bolt, 76, secured in the head and having one end journaled in the wall of the bearing and the other end extending beyond the end of the hollow shaft and screw-threaded. A winged nut, 77, fits upon this end of the bolt to draw and lock the conical head of the arm in the flaring bore of the pinion-shaft. Radial arms, 78, project from a hub, 79, upon the pinion-shaft, so as to admit of said shaft being rocked by hand and the drill or boring-tool to be longitudinally moved by hand. The arm, 75, has a series of holes 80, at its outer end, and a link, 81, is pivoted to a slide, 82, moving in longitudinal guide-ways, 83, on the under side of the machine-bed. A cord or chain, 84, is fastened to this slide and is carried around a guide-pulley, 85, and has a weight, 86, at its end, which draws the slide and the lower end of the arm inward to withdraw the boring-tool from the work. A roller, 87, projects from the under side of the slide, and a cam, 88, upon the cam-shaft has its cam-edge bearing against said roller. This cam-edge has a gradual rise and an abrupt shoulder, 89, so that the roller and slide is gradually moved to force the boring-tool into the stock until the roller reaches the shoulder, when the weight will draw the slide inward and thus withdraw the tool. Beneath and about in a transverse line between the stop and the chuck of the mandrel are two alined transverse guide-ways upon the machine-bed. Two tool-stocks, 90 and 91, slide in said guide-ways, one at each side of the line of the work, and said stocks have cogged racks, 92, upon their flanged feet within the ways, which racks are engaged by pinions, 93. The shafts of said pinions carry sector-arms, 94, which have cogged segments, 95, engaging a double-cogged rack, 96, vertically sliding in the machine-bed. The shank of the rack has a cross-head, 97, sliding upon vertical guide-rods, 98, and carrying a roller, 99. Springs, 100, upon the rods, force the cross-head upward. The roller upon the cross-head engages a groove, 101, in the face of a cam-disk, 102, and said groove is spiral, starting from the periphery and curving inward to near the cam-shaft upon which the disk is secured, with an abrupt portion, 103, connecting the outer and inner end of the groove. The tool stocks have cutting-tools, 104 and 105, respectively secured in them, one of which 104, extends further inward than the other, so as to begin cutting the stock before the other and to extend further into the same than the other. The cam-groove, roller, racks and pinions gradually feed the cutters into the stock until the finished nut-blank is severed, when the abrupt portion of the cam-groove will cause the stocks to be again moved outward. The cutter 105 has a beveled side which in cutting into the stock forms the bevel or chamfer of the nut, while the severing-cutter 104 has parallel sides to form the flat faces of the nut.

The former cutter 105 has preferably a small bevel, 106, at the other side which cuts the points of the nut on the side facing the surface against which it bears, so as to prevent said points from scratching the surface.

In practice, the collet in the chuck-end of the mandrel is inserted and has its interior passage of the size and shape of the stock to be fed through the machine. A stop or gage having the bore of a diameter to fit the boring-tool, is adjusted to a distance from the line of the cutting-tools corresponding to the thickness of the nut to be made. The boring-tool is inserted through the stop and into the socket of the spindle, and the throw of the feed-sleeve in which the spindle is journaled is adjusted by means of the holes in the end of the arm connected to the cam-slide and by adjustment of the conical head of said arm in the bore of the rock-shaft. Suitable cutting-tools are secured in the tool-stocks and are of suitable shape and adjustment so as to cause one tool to form the beveled face-portion of the nut while the other tool cuts through the stock until it reaches the axial bore in the same and thus severs the finished nut. When all parts are adjusted as to shape and size of the stock and finished product, the steel-bar which forms the stock from which the nut-blanks are formed, is pushed through the feed-slide and mandrel until it reaches the stop. This bar has the transverse sectional form of the finished nut-blank, and may be rolled or drawn or both rolled and drawn into the required shape. In the drawings, the stock-bar is hexagonal in cross-section so as to make hexagonal nuts, but any regular or irregular cross-sectional shape of bar may be handled in the machine, according to the shape of the finished article. When the bar is in place, the machine is started up and the mandrel is rotated in one direction while the boring-tool revolves in the opposite direction and the two cutting-tools are gradually fed towards and into the rotating bar cutting a circumferential groove into the same. The boring-tool is fed into the stock by means of the cam, cam-slide, rock-arm, rock-shaft, pinion and rack upon the feed-sleeve. As the stock and boring tool are rotated in opposite directions the boring speed will be equal to the joint speed of the two elements, whereby the axial bore through the stock and to a slight distance beyond the depth of one nut-blank will be finished before the cutting-tools have severed the nut-blank from the stock. The cam which actuates the feed of the boring-tool has its cam-surface so shaped as to allow the weight to withdraw the boring-tool at a time when the bore into the stock exceeds the depth or thickness of the nut-blank to a slight degree. After the boring-tool has been withdrawn, the cutting-tools finish the severance of the nut-blank from the stock. As soon as the finished nut-blank is severed from the stock and drops down into a suitable receptacle, the cam which controls the clamping and release of the chuck-device in the mandrel will engage the roller upon the cam-slide with its cam-groove, and draw the cone towards the feed end of the machine to release the chuck and again push the cone to spread the hooked cam-levers to again close the chuck. While the cam thus has opened and closed the chuck-mandrel, the wedge-shaped cam upon the cam-shaft and at the feed-end of the machine has engaged the roller upon the feed-slide and pushed the latter back and again released it so as to cause it to engage the stock and feed the latter through the mandrel towards the stop. It will thus be seen that the feed of the stock takes place while the chuck in the mandrel is open, and that the chuck will be closed to firmly clamp the stock as soon as the same is fed forward and before the boring-tool and cutting-tools begin to act upon the stock. By reason of the rotation of the boring-tool at the same time as the stock is rotated and in the opposite direction, the axial boring of the nut-blanks will be quickly finished, so that the shaping and severing of the nut-blanks by the cutting-tools may be done as fast as such tools can cut into the stock. In the ordinary automatic lathe, the stock is usually rotated and the boring-tool held rigid. This prevents boring in the metal from being done at any reasonable speed, as the drill or boring-tool is liable to be twisted and broken if rapidity of revolution is attempted; but when the boring-tool is rotated, this twisting tendency is avoided. As the end of the stock bears immediately against the stop and drill-guide, the drill is completely centered and will enter the stock without danger of buckling, being guided at its end entering the stock by the drill-guide.

This machine is particularly adapted for making nuts from steel by cold process, such as steel nuts used in engine building and wherever a well-finished and strong nut is required. The machine may, however, be used for making any object from a bar of metal which requires a perforation through it and the finishing, only, of the two faces, where the object is severed from the stock-bar. Heretofore, cold steel-nuts have usually been made by punching the nuts from a flat bar of steel and punching the hole through the nut. This method of making such nuts has been very expensive, as such punching is very hard on the dies employed and very quickly destroys the same, and the nuts produced by such punching-process are rarely true, and require finishing of their sides and faces in milling-machines and lathes, and truing of their holes by reaming. All of such subsequent finishings increase the cost of the nut. When employing

my machine, a bar of steel, either drawn from a round bar into the cross-sectional form of the nut-blank, or first rolled and then drawn into the required shape, is employed. This insures perfection of cross-sectional shape and finish of the sides of the nut-blank. As the bar is centered and supported in axial alinement with the boring-tool, the bore or hole in the nut-blank will be absolutely square with the faces of the same, and, as the cutting-tools finish the faces of the nut-blank as they sever the nut-blank from the stock, such faces will be finished when the nut-blank drops from the stock and is discharged from the machine. By reason of this procedure of manufacture, the blank needs no subsequent finish, save in exceptional cases where extraordinary finish is required, and this practical finishing of the blank, with the exception of tapping, in one operation and at a comparatively rapid speed, makes the process of producing such nut-blanks much less expensive than the process of first punching and thereupon further finishing the nut-blanks. The holes in the punched nut-blanks have the fibers of the metal dragged down the sides of the hole, so that when the hole is tapped these screwthreads intersect this distorted fiber and are liable to be very weak on account of this distortion. In the nut-blanks produced in my machine, the sides of the hole are without distortion of fiber, and the screwthreads will be as perfect as the character of the steel and the sharpness of the tap will permit.

Other modes of applying the principle of my invention may be employed for the mode herein explained. Change may therefore be made as regards the mechanism thus disclosed, provided the principles of construction set forth respectively in the following claims are employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In an automatic turning and boring machine, the combination of a revolving mandrel having means for clamping a bar within it, an axially-alined boring-tool having means for revolving it in the opposite direction to the mandrel, and a jig at the end of the forward feed of the stock-bar and formed with a cylindrical bearing for the boring-tool, whereby the end of such tool is directly guided into the end of the stock-bar.

2. In an automatic turning and boring machine, the combination of a revolving mandrel having means for clamping a bar within it, an axially-alined boring-tool having means for revolving it in the opposite direction to the mandrel and having means for feeding it towards and from the mandrel, and a jig at the end of the forward feed of the stock-bar and formed with a cylindrical bearing for the boring-tool, whereby the end of such tool is directly guided into the end of the stock-bar.

3. In an automatic turning and boring machine, the combination of a revolving mandrel having means for clamping a bar within it, means for intermittently feeding such stock-bar forward, an axially-alined boring-tool having means for revolving it in the opposite direction to the mandrel, means for feeding such boring-tool towards and from the mandrel, and a jig at the end of the forward feed of the stock-bar and formed with a cylindrical bearing for the boring-tool, whereby the end of such tool is directly guided into the end of the stock-bar.

4. In an automatic turning and boring machine, the combination of a bearing, a bearing-sleeve sliding in said bearing and having a cogged rack, a boring-tool spindle journaled in said sleeve, a hollow shaft transversely journaled to the bearing sleeve and having a pinion upon its inner end engaging the rack and having that end of its bore flaring, an arm having means for rocking it and formed with a conical head fitting in the flaring bore of the rock shaft, and a bolt having one end journaled and passing through the conical head and the hollow shaft and provided with a clamp-nut at its end to bear against the end of the hollow shaft.

5. In an automatic turning and boring machine, the combination of a revolving mandrel having means for clamping a bar within it, means for intermittently feeding the stock longitudinally through such mandrel, an axially alined boring-tool having means for revolving it in the opposite direction to the mandrel, a jig at the end of the forward feed of the stock-bar and formed with a cylindrical bearing for the boring-tool whereby the end of such tool is directly guided into the end of the stock-bar, opposed cutting-tools arranged laterally to the mandrel and boring-tool to shape and sever a portion of the bar held in the mandrel, means for moving such tools towards and from the stock-bar, and means for feeding the boring-tool axially into the stock-bar to a depth greater than the thickness of the piece severed and for retracting the same before the cutting-tool has severed the portion of the bar operated upon.

In testimony that I claim the foregoing to be my invention I have hereunto set my hand this 6th day of April A. D. 1905.

LATHAM H. BRIGHTMAN.

Witnesses:
WM. SECHER,
E. D. GRUMNEY.