E. B. SELLEW.

BORING, TURNING, AND FACING MACHINE.

APPLICATION FILED JULY 30, 1906.

913,312.

Patented Feb. 23, 1909.

4 SHEETS—SHEET 1.

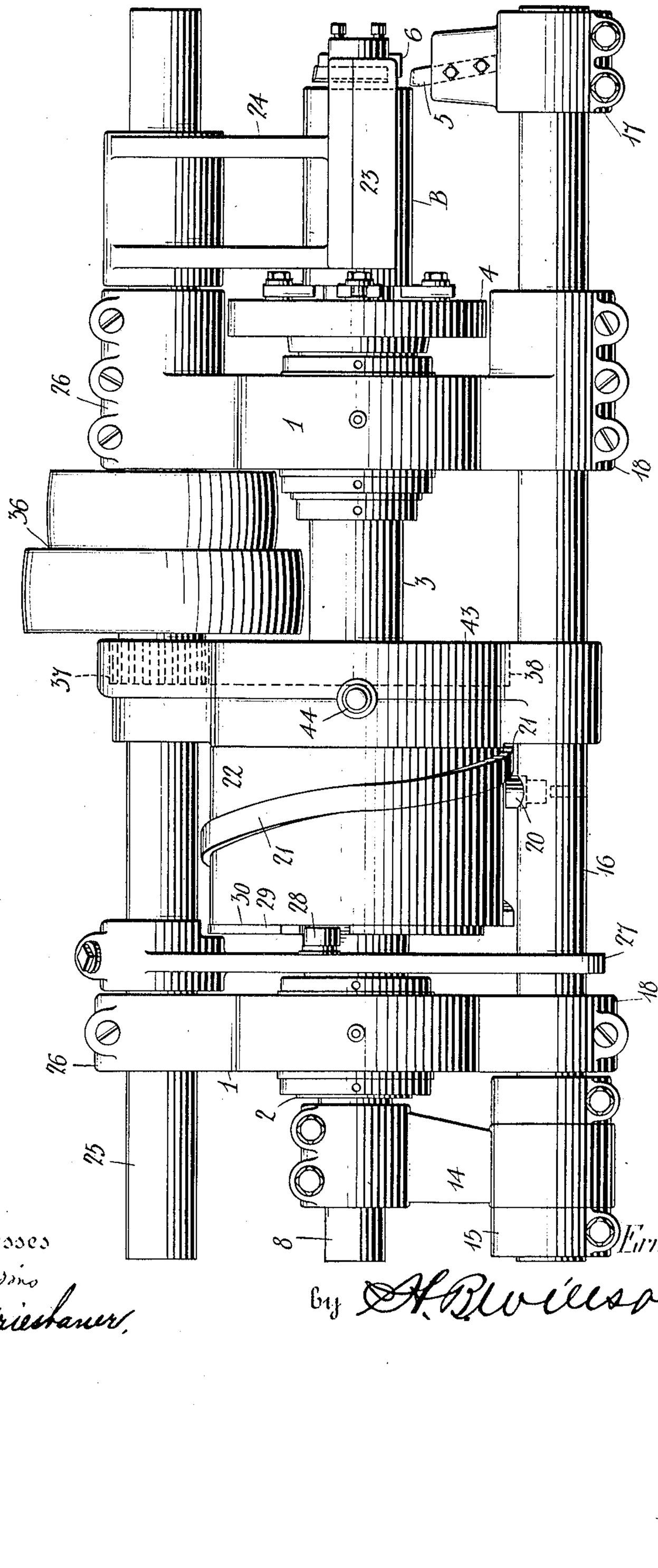

Fig. 1.

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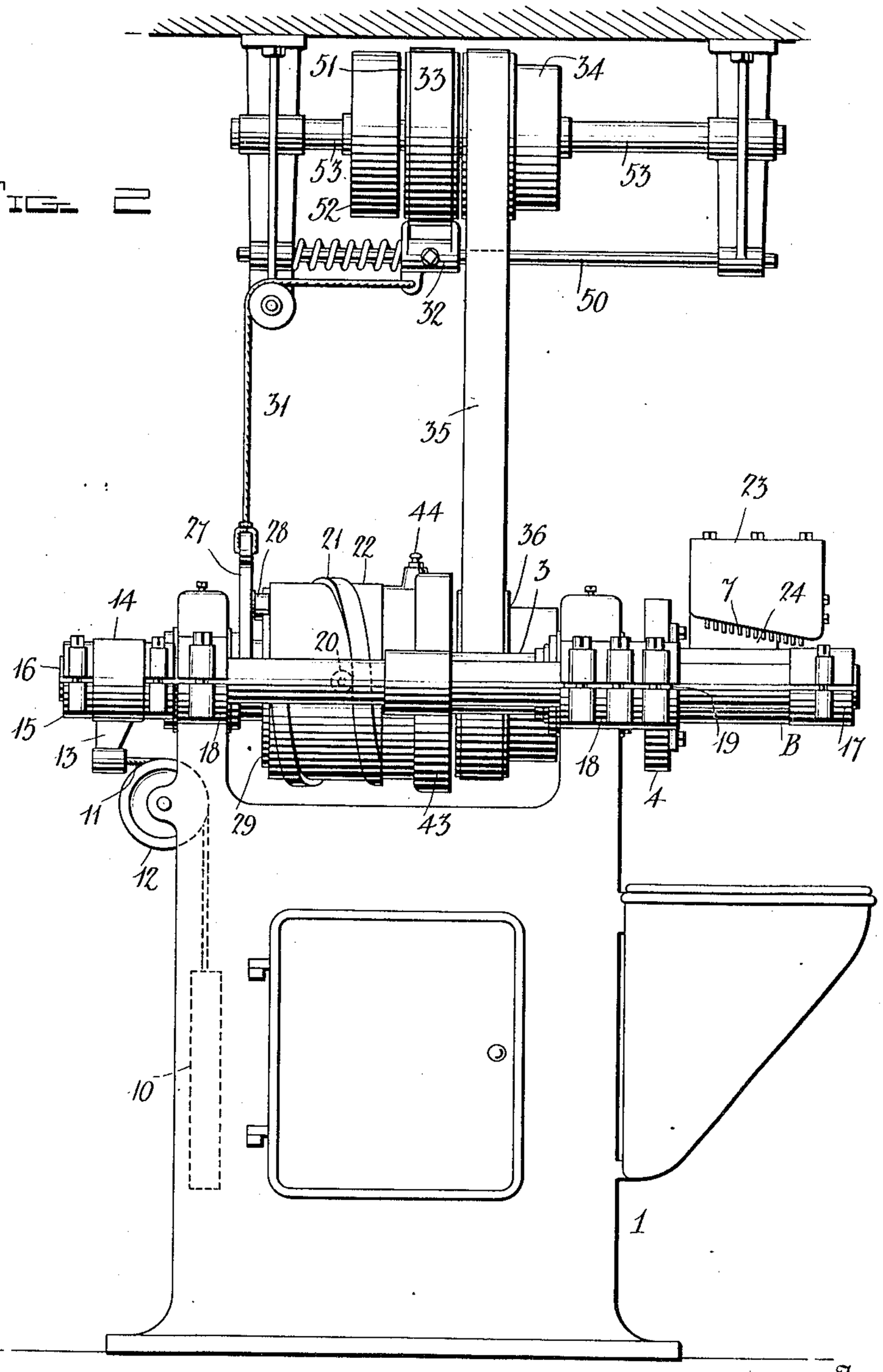
4 SHEETS—SHEET 2.

FIG. 2



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4 SHEETS—SHEET 3.

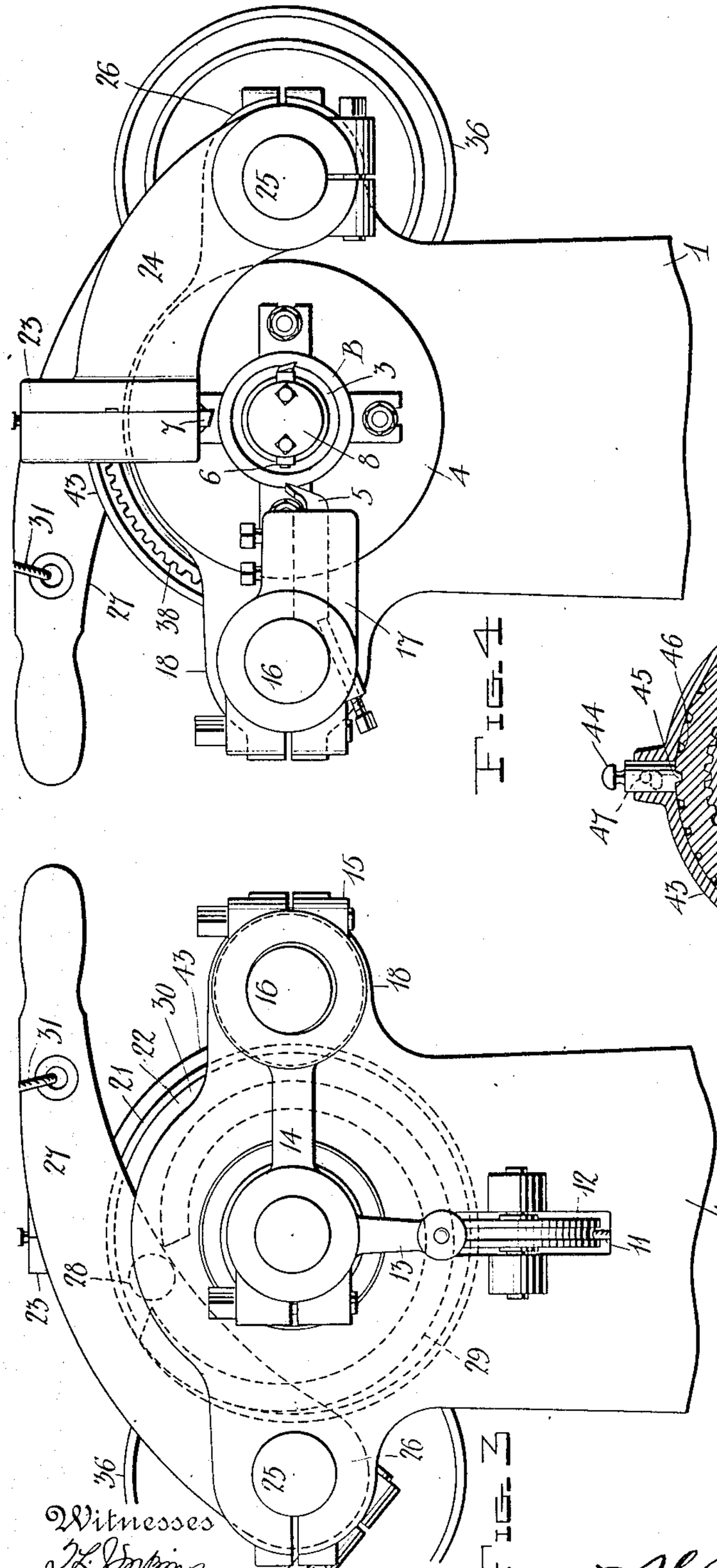

FIG. 4.

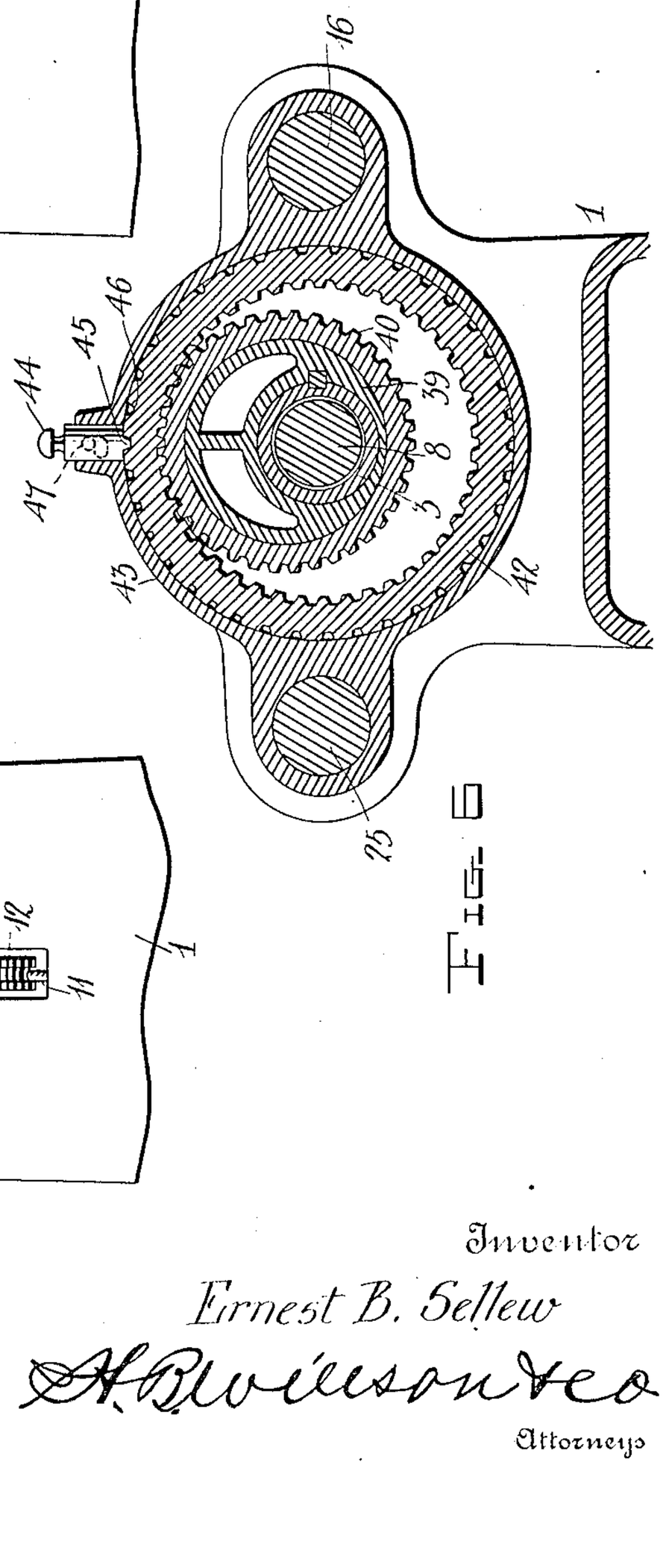

FIG. 6.

FIG. 5.

Witnesses

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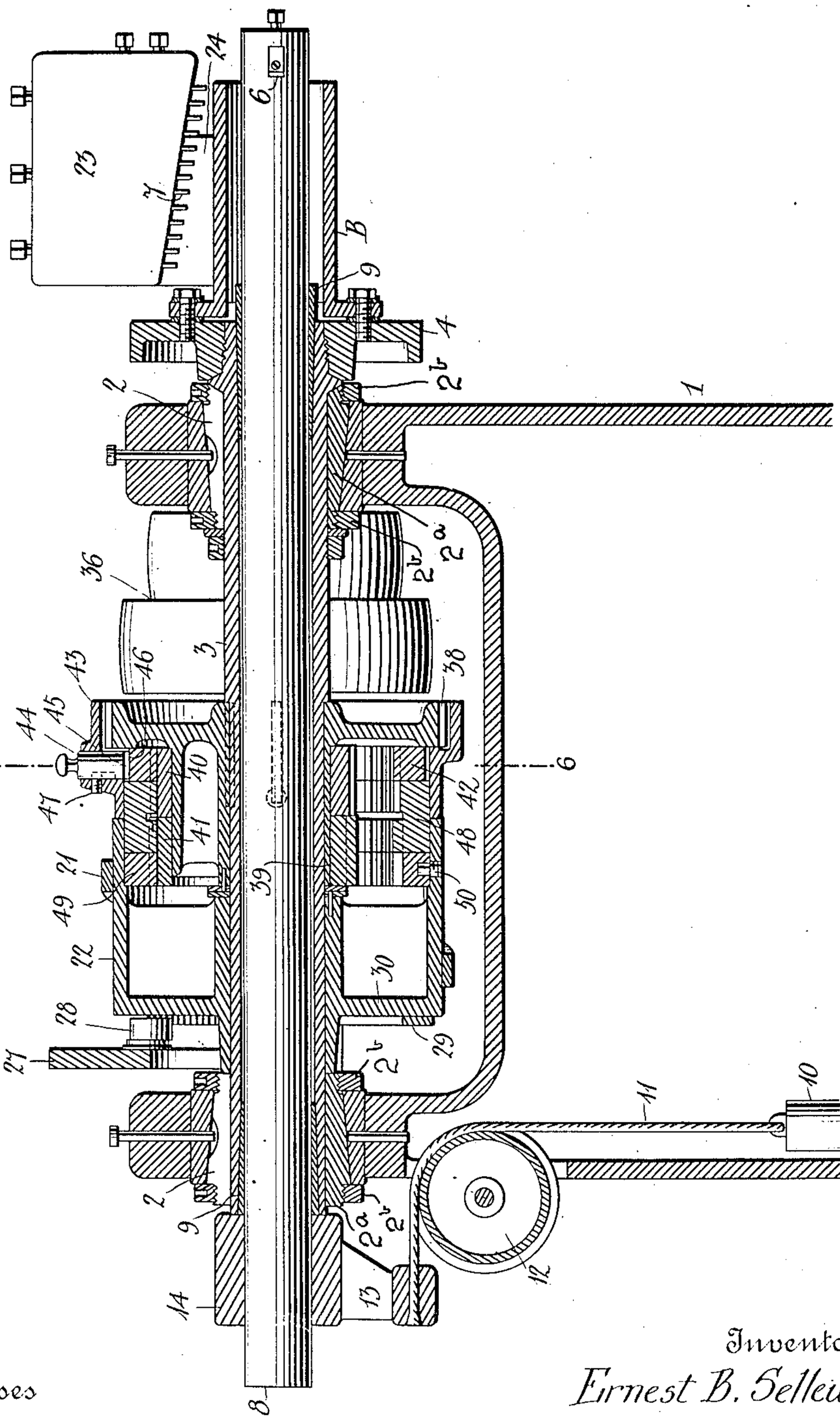
4 SHEETS—SHEET 4.

FIG. 5



Witnesses

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UNITED STATES PATENT OFFICE.

ERNEST BURCHARD SELLEW, OF PAWTUCKET, RHODE ISLAND.

BORING, TURNING, AND FACING MACHINE.

No. 913,312. Specification of Letters Patent. Patented Feb. 23, 1909.

Application filed July 30, 1906. Serial No. 328,423.

To all whom it may concern:

Be it known that I, ERNEST B. SELLEW, a citizen of the United States, residing at Pawtucket, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Boring, Turning, and Facing Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in metal working machines, and more particularly to one for automatically dressing or finishing metal work-blanks.

One object of the invention is to provide a machine for automatically and continuously turning, boring and facing, grooving, cutting off or otherwise acting upon a piece of metal to produce a finished article or articles from a rough blank, the present embodiment of the invention being adapted for automatically making eccentrically-bored piston rings.

Another object of the invention is to provide a machine of this character with an internal eccentric differential gear feed mechanism for reducing the speed between the driving and driven parts of the machine.

A further object of the invention is to improve and simplify the construction of machines of this character and thereby render the same more efficient.

With the above and other objects in view, the invention consists of certain novel features of construction, combination and arrangement of parts hereinafter described and claimed.

In the accompanying drawings,—Figure 1 is a top plan view of the improved machine; Fig. 2 is a side elevation of the same; Figs. 3 and 4 are detail end elevations; Fig. 5 is a vertical longitudinal section through the upper portion of the machine, and Fig. 6 is a detail vertical transverse section taken on the plane indicated by the line 6—6 in Fig. 5.

The present embodiment of the invention comprises a supporting frame 1 preferably in the form of a hollow rectangular cast metal stand having at the ends of its top, upright portions in which are mounted suitable bearings 2 for a work-rotating tubular spindle or shaft 3. As shown, each of the bearings 2 consists of a split, tapered bushing-sleeve 2^a retained in bearing blocks by nuts 2^b upon its threaded ends. The end thrust of the spindle 3 is prevented by an annular shoulder formed upon the forward end of the same and a stop collar or nut screwed upon said spindle and locked thereon by a set screw, said annular shoulder and stop collar or nut engaging the opposite ends of the bushing of the bearing 2 at the front end of the machine. Any suitable means may be provided upon the forward end of the spindle 3 for supporting or holding a piece of work or a work-blank, but, as shown in the drawings, a face plate 4 is screwed thereon and has connected to it by bolts, a cylindrical work-blank B, the said bolts passing through apertures in a flange on one end of the blank. Instead of the face plate 4, I may substitute therefor a chuck or the like of any suitable construction for holding a piece of work of any description.

The machine shown in the drawings is adapted to automatically form from the blank B, a plurality of eccentrically bored piston rings, and this is accomplished by the simultaneous operation upon the blank of a longitudinally movable exterior cutting or turning tool 5 and a longitudinally movable internal cutting or boring tool 6, and also by the subsequent operation upon the blank of a transversely movable multiple cutting off or facing tool 7.

The boring tool or cutter 6 is adjustably secured by means of set screws in a transverse opening or recess adjacent to the forward end of a boring rod 8, which projects through the tubular or hollow spindle 3 and is mounted to slide in bearing sleeves 9 provided adjacent to the ends of said spindle, said bearing sleeves in the present embodiment of the invention being eccentrically bored so that the sliding bar 8 is held slightly eccentric with respect to the spindle, and the tool or cutter 6 will bore the cylindrical blank B eccentrically. The boring rod 8 is moved forwardly by the descent of a weight 10 hung within the frame 1 by a cable 11 which is passed over a grooved guide pulley 12 in a slot in the rear end of the frame 1, and is connected to an arm 13 secured upon the projecting rear end of the rod 8. The latter is prevented from rotating with the spindle 3 and is moved inwardly or rearwardly by means of a transverse horizontal arm or link 14, which has one of its ends clamped to the rod 8 and formed with the depending arm 13. The opposite end of the arm or link 14 has a loose engagement with a bearing block 15, which is clamped upon the rear end of a longitudinally slidable bar 16, which latter

carries at its front end a clamp or chuck 17 for the turning tool 5. This slidable turning bar 16 is mounted in suitable bearings in arms 18 projecting from the frame 1. The bar 16 is prevented from rotating in its bearings by a key 19 and it is moved outwardly by the boring bar 8 owing to its connection therewith through the arm or link 14. Both of the bars 8 and 16 are moved inwardly to cause their cutters to simultaneously operate upon the work blank B, by the engagement of a roller 20 mounted upon the bar 16 and coacting with a cam rib 21 formed upon a drum 22 which is rotated as hereinafter described.

The transversely movable cutting tool 7 may be either of the single or multiple type, for facing, grooving, cutting off or otherwise acting upon the blank B or any other piece of work rotated by the spindle 3. As shown, this cutting tool 7 comprises a plurality of cutter blades adjustably clamped by means of set screws in a head 23 formed upon a transversely disposed rocking arm 24. These cutter blades are so arranged as to successively operate upon the blank B, the outermost one having its cutting point nearest to the work and the innermost one farthest from the work, the remaining or intermediate cutters having their points in the plane of a line connecting the points of the two end blades, to successively act upon the blank B after it has been turned concentric with the spindle 3 by the cutter 5 and bored eccentric with said spindle by the cutter 6. The transversely swinging arm 24 is clamped upon the forward end of a rock shaft or bar 25 mounted in bearings provided in arms 26 projecting from the main frame 1. The rock shaft 25 is actuated by a transverse lever 27, which has one of its ends clamped thereon and its other end formed with a handle, said lever being actuated by the engagement of a roller 28 which it carries with a cam rib 29 formed upon the end or head 30 of the drum 22.

The free end of the lever 27 is connected by a cable 31 to a spring-actuated shipper 32, secured upon a rod 50, mounted to slide in hangers, in which is also mounted a counter-shaft 53. The latter carries a loose pulley 51 and a tight pulley 52 for a driving belt 33, which extends over a pulley upon the main drive shaft (not shown). The belt 33 is shifted by the shipper 32, the latter being actuated by a spring upon a rod 50 to hold the belt 33 normally upon the loose pulley 51. On the counter-shaft 53 are also fixed pulleys 34, one of which is connected by a belt 35 to one of two pulleys or wheels 36, connected together, and mounted to rotate upon the rock-shaft 25. Formed upon or connected to the hub of this double pulley 36 is a toothed pinion 37 meshing with a toothed gear 38 keyed upon the work rotating spindle 3, the latter being thus driven. Between this main driving gear 38 and the driven cam drum 22, I provide an internal eccentric differential drive gearing for reducing the speed between said parts, so that the drum 22 will rotate but once in about six hundred revolutions of the gear 38, and hence of the work-rotating spindle 3. This gearing comprises an eccentric hub 39 formed upon the gear 38 and adapted to serve as a journal bearing for two double ring gears 40, 41, the latter having their outer surfaces or peripheries formed with teeth, as clearly shown in Fig. 6 of the drawings. By mounting these gear rings 40, 41, in this manner, it will be seen that they may rotate upon the eccentric bearing 39 and at the same time will be revolved in an orbital path, owing to the eccentricity of said bearing 39 and its rotation with the gear 38. The teeth on one-half or side of the gear-ring 40 mesh with the teeth of a normally stationary gear ring 42, which is mounted in a stationary casing 43 supported from the two bars or shafts 16, 26 as shown or in any other suitable manner and serving as a covering and guard for the gears 37, 38. As shown, the internal gear ring 42 is detachably locked or secured to and in the stationary casing 43, by a key or plug 44, which has its reduced inner end 45 projecting into one of a series of notches or recesses 46 formed in said ring 42, as clearly shown in Fig. 6. This key 44 slides in a tubular boss upon the casing 43 and may be supported, by means of a pin and slot connection 47, in an elevated position, so that its end or projection 45 will not engage one of the recesses 46. A knob upon its projecting upper end permits said key to be readily turned and raised or lowered. It is normally in its lowered or locked position to hold the gear ring 42 stationary and is disengaged from the same only when it is desired to drive the work revolving spindle 3 without imparting motion to the cutting tools. The engagement of the teeth of the gear ring 42 with the teeth of the ring 40, as the gear 38 revolves, will cause said ring 40 to rotate upon its axis or drum 39. The rotation of the gear 40 is imparted to the gear ring 41 by a double internal gear ring 48, which rotates partly in the rear end of the casing 43 and partly in the front end of the drum 22. It will be seen that the two sections of internal gear teeth formed in the ring 48 mesh with the teeth upon the adjacent halves of the rings 40, 41. The rotation of the ring 41 is imparted to an internal gear ring 49 which is fixed in the drum 22, as shown at 50, so that the two rotate together. The reduction in speed from six hundred revolutions of the driving gear or element 38 to one of the driven drum or element 22 is effected by forming the gear rings 42, 40, 48, 41 and 49 with varying numbers of teeth; for instance, I may form the stationary gear 42 with seventy-three teeth, the gear 40 with fifty-eight teeth, the

front half section of the gear 48 with seventy-two teeth, the opposite half section of said gear 48 with sixty-three teeth, the gear 41 with fifty-one teeth and the gear 49 with sixty-four teeth. When the gears are so constructed, the desired reduction in speed will be effected, but it will be understood that the number of the teeth and the number and arrangement of the gears may be varied as desired.

The operation of the invention is as follows:—Assuming the parts to be in their normal positions shown in the drawings and the work blank B secured to the rotating spindle 3, the hand lever 27 is depressed and its roller 28 engaged with the cam 29. The downward movement of the lever 28 draws upon the cord or cable 31, which latter shifts the belt shipper 32 against the tension of its actuating spring and thereby throws the belt 35 from the loose to the tight pulley upon the shaft 33. The rotation of the countershaft will be imparted by the belt to one of the pulleys 36 and the motion of the latter will be imparted to the main gear 38. This gear rotates the work revolving spindle and the internal eccentric differential reducing drive gearing above described. As the drum 22 is slowly rotated, its cams 21 and 29 will actuate the rollers 20 and 28, so that the turning bar 16, and hence the boring bar 8, will be moved slowly inwardly to cause the cutters 5, 6 to act upon the exterior and interior faces of the blank B, and the lever 27 will slowly rock the shaft 26 to move the multiple cutter tool 7 transversely against the blank B, the cams 21, 29 being so shaped as to time the parts to cause the cutter tool 7 to operate upon the blank after the tools 5, 6 have acted thereon. It will thus be seen that the blank B will be simultaneously turned concentric with the spindle 3 and bored eccentric with the same, and then cut into finished rings which drop into a suitable wire basket provided in a receptacle at the front end of the frame 1. When the cam drum 22 completes one revolution, the roller 28 of the lever 27 passes through the slot or opening between the ends of the cam 29 and is elevated by the action of the spring of the shipper 32, which latter will then shift the belt from the tight to the loose pulley to stop the operation of the machine. The upward movement of the lever 27 causes the cutter 7 to be elevated, and the descent of the weight 10 will move the bars 8, 16 outwardly to their normal position, so that the operator may remove the remaining portion of the blank B and replace it by a new one.

While the present invention is in the form of a machine for automatically making eccentrically bored piston rings, it will be understood that it may be adapted for making various other articles, and for dressing or finishing metal blanks of various kinds. It will also be understood that various changes in the form, proportion and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of the invention, as defined by the appended claims.

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

1. In a machine of the class described, the combination of a tubular work-revolving spindle, a longitudinally movable interior tool-carrying rod in said tubular spindle, a longitudinally movable exterior tool-carrying rod, connected to and movable with the interior tool-carrying rod, means to move said rods to retracted position, a rock shaft having a rocking element and a transversely movable work-cutting tool holder, a drum revoluble on the tubular spindle and having a cam to operate the said rocking element and a cam to operate said tool-carrying rod, and means to rotate the said drum and the said tubular spindle.

2. In a machine of the class described, the combination with a work-revolving element, of a rock shaft having a rocking element and a transversely movable work-cutting tool holder, a drum revoluble on the work-revolving element and having a cam to move the rocking element inwardly and yieldable means tending to hold the rocking element in raised position and in disengaged relation with the cam of said drum.

3. In a machine of the class described, the combination with a work-revolving element, of a rock shaft having a rocking element and a transversely movable work-cutting tool holder, a drum revoluble on the work-revolving element and having a cam to move the rocking element inwardly, a driving mechanism including a belt for said drum and work-revolving element and yieldable means tending to hold said belt in inoperative position and the rocking element in raised position and in disengaged relation with the cam of said drum.

4. In a machine of the class described, the combination with a work-revolving element, of a rock shaft having a rocking element and a transversely movable work-cutting tool holder, a drum revoluble on the work-revolving element, said drum having a cam to operate said rocking element, gears on the rock shaft and work-revolving element to rotate the latter, a countershaft, connections between the countershaft and said gear on the rock shaft to drive said gear, fast and loose pulleys on the countershaft, a driving belt for said pulleys, a shifting element on said belt, a connection between the shifting element and the rocking element of the rock shaft, and yieldable means to normally hold said shifting element in throw-off position, and to cause the same to disengage the

rocking element of the rock shaft from the cam of said drum.

5. In a machine of the class described, a work rotating means, a longitudinally movable exterior cutter for turning the work on said work rotating means, a longitudinally movable eccentrically mounted interior cutter for boring said work, means to prevent rotation of said cutter either on its own axis or eccentrically about the axis of said work rotating means, a transversely movable cutter for cutting the work transversely, and means for automatically operating said cutters and said work rotating means.

6. In a machine of the character described, the combination of a work rotating spindle, a drum revoluble thereon, a bar, operated by said drum, slidable in said spindle and carrying an internal cutter, a sliding bar carrying an external cutter and connected to the first-mentioned bar, a transversely-movable cutter, means actuated by the drum to operate the last-mentioned cutter, and means to rotate the spindle and the drum.

7. In a machine of the character described, a hollow work rotating spindle, a bar slidable in said spindle and carrying an internal cutter, a sliding bar carrying an external cutter and connected to the first-mentioned bar, a transversely swinging cutter, a driving element for rotating said spindle, a driven element, a cam upon said driven element for moving said bars longitudinally in one direction, a lever for operating said transversely swinging cutter, and a second cam upon said driven element for actuating said lever.

8. In a machine of the character described, a work rotating spindle, a transversely swinging cutter, a driving element for rotating said spindle, a driven element, a lever for actuating said transversely swinging cutter, a cam upon said driven element for actuating said lever and means controlled by said lever for controlling said driving element.

9. In a machine of the class described, a hollow work rotating spindle, eccentric bearings in said spindle, a longitudinally slidable bar in said spindle and carrying an internal cutter, a drum having means to operate said bar, means to rotate said spindle and said drum, and means to prevent rotation of said bar either on its own axis or eccentrically about the axis of said work rotating spindle.

10. In a machine of the class described, the combination of a tubular work-rotating spindle, a longitudinally-movable tool carrier therein, a drum revoluble on said spindle and having cams, an external longitudinally-movable tool carrier connected to the first-mentioned tool carrier and having an actuating device coacting with one of the drum cams, a rock-shaft having a rock arm actuated by the other drum cam and further provided with a transversely-movable cutting-off cutter, a driving pulley mounted on the said rock-shaft, and gears operated by said pulley to rotate said spindle and said drum.

11. The combination with a rotatable work support, of a tool support movable relatively to the work support longitudinally of the axis thereof, a tool carried by the tool support for operating upon the work, a second tool support movable transversely of the axis of the work support, and a plurality of cutting-off tools carried by said second support and having their cutting edges arranged in a line inclined to the axis of the work support.

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

ERNEST BURCHARD SELLEW.

Witnesses:
FRED NEWELL ROBERTS,
WILLIAM M. GILKER.