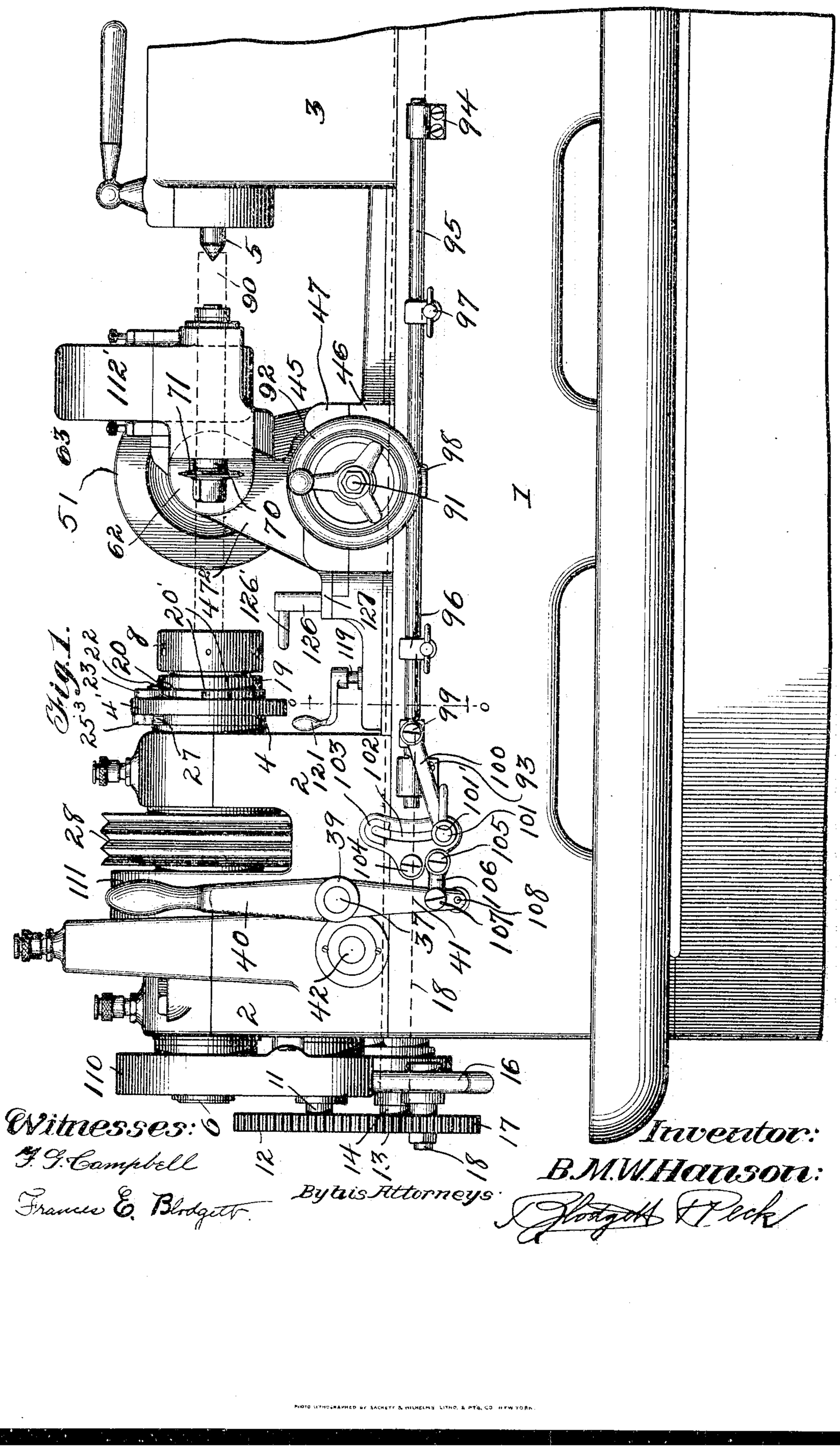
No. 782,236. PATENTED FEB. 14, 1905.

B. M. W. HANSON.

MACHINE FOR MILLING SPIRALS.

APPLICATION FILED JULY 12, 1902.

7 SHEETS—SHEET 1.



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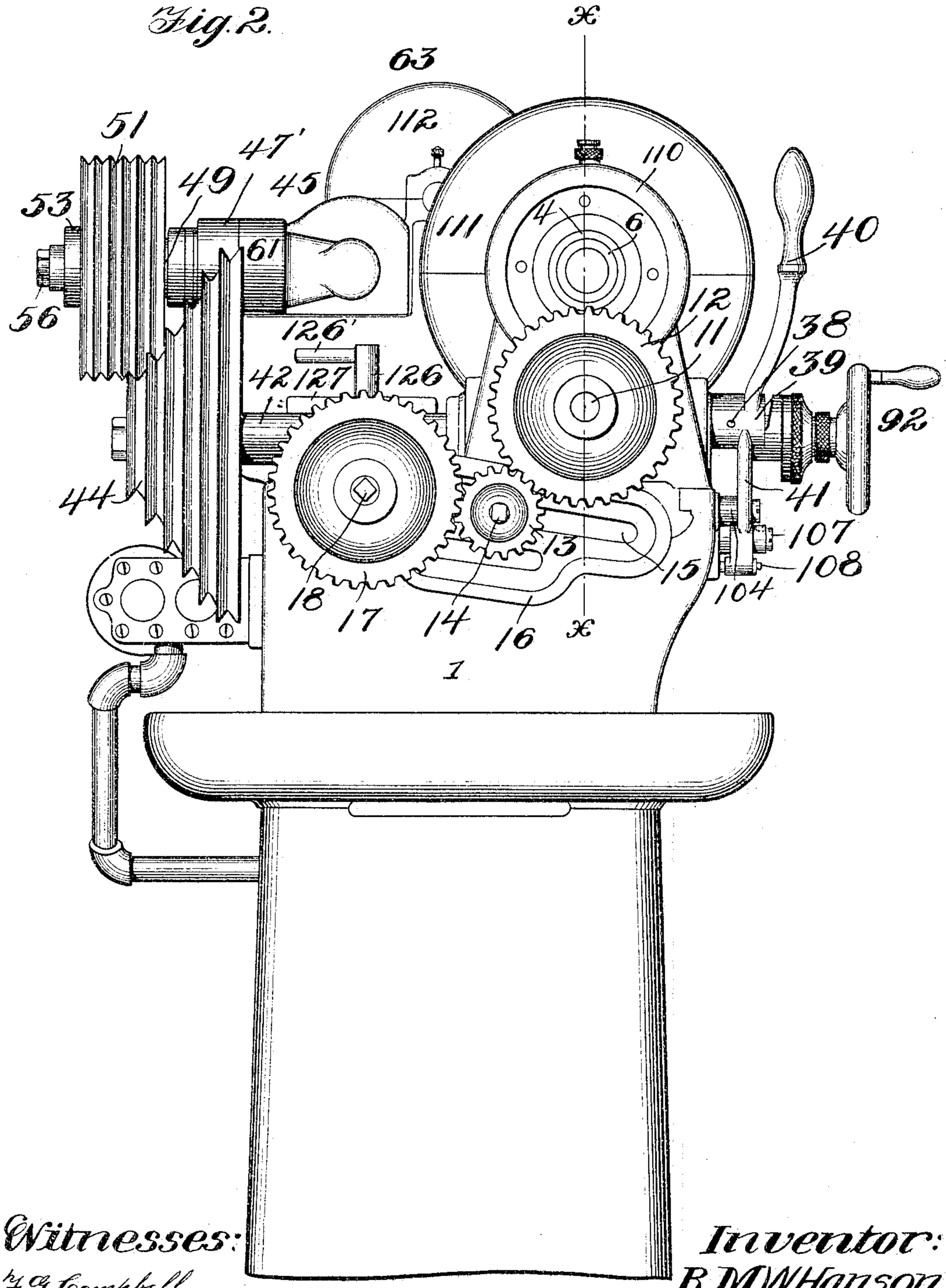
7 SHEETS—SHEET 2.

Fig. 2.



Witnesses:

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Frances E. Blodgett.

Inventor:

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By his Attorneys:

Blodgett & Peck

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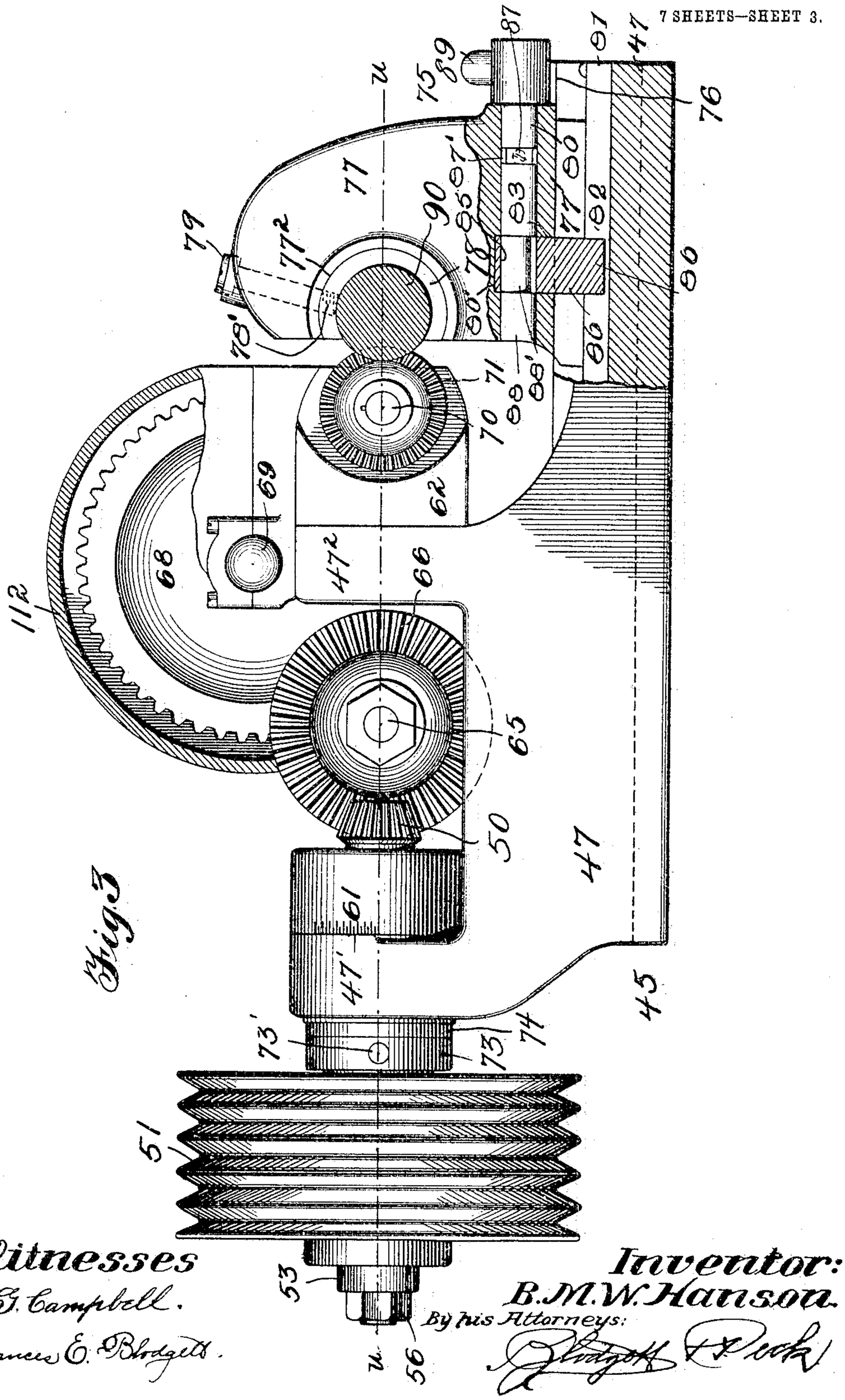

Fig. 3.

Witnesses
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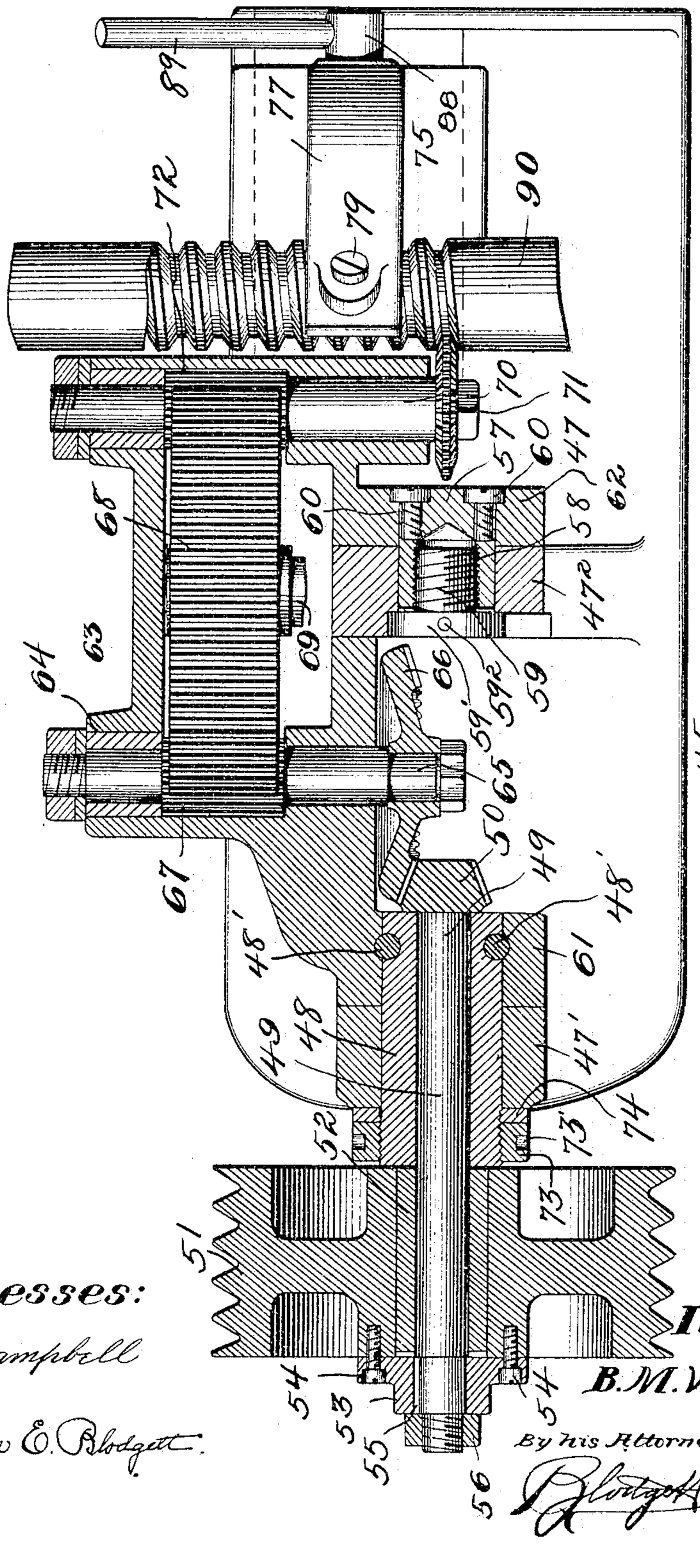

Fig. 4.

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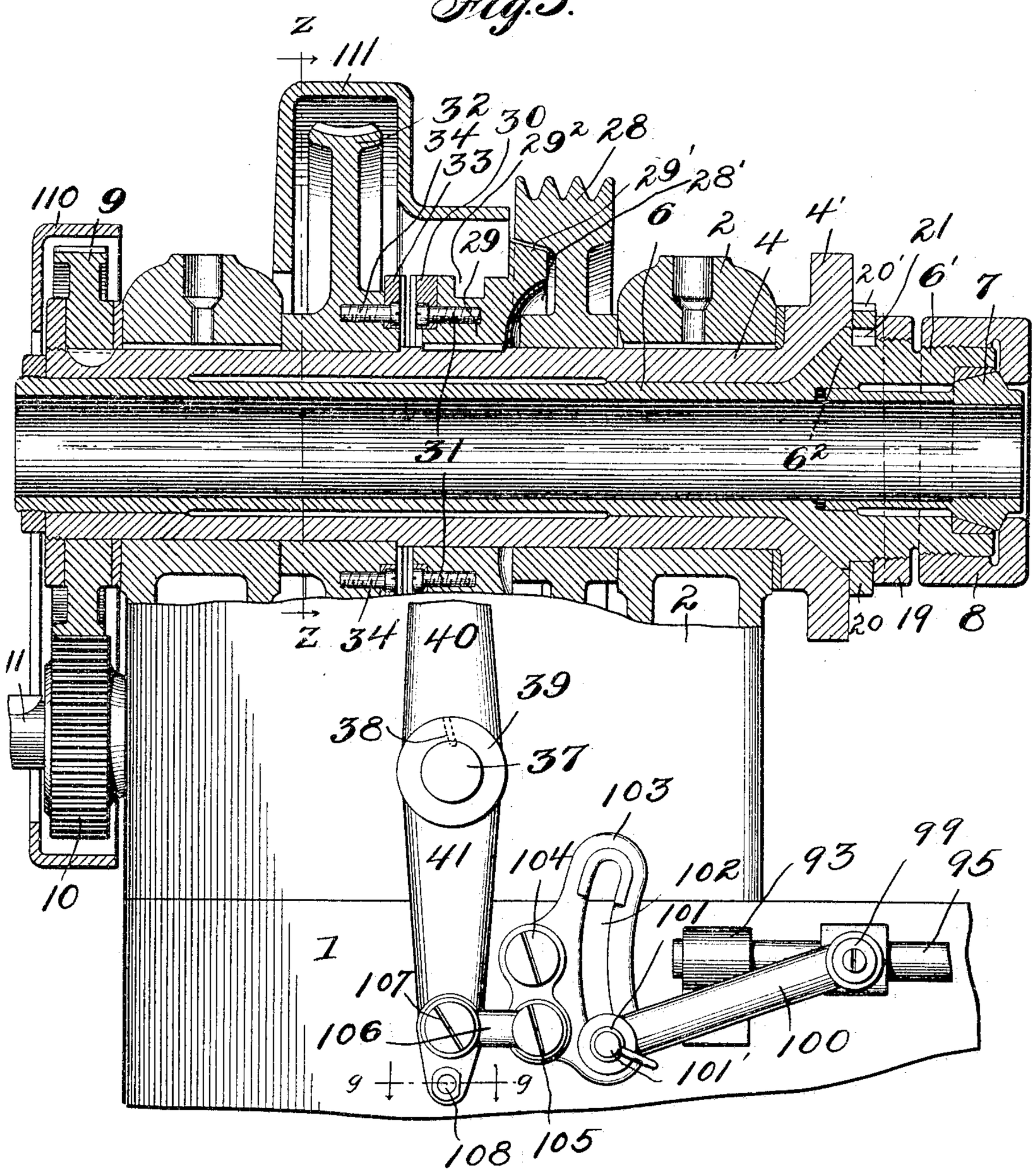
7 SHEETS—SHEET 5.

Fig. 5.



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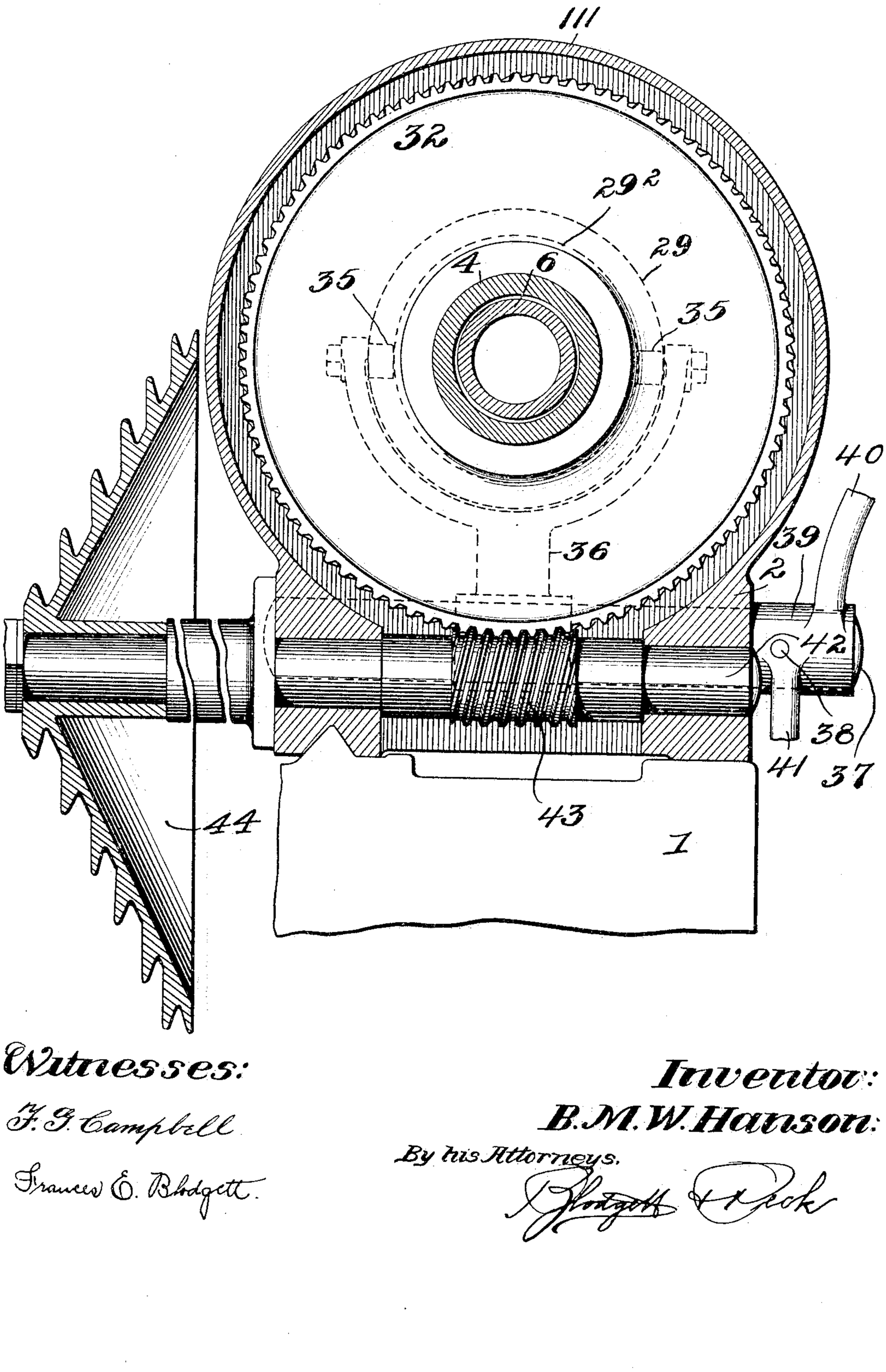
7 SHEETS—SHEET 6.

Fig. 6.



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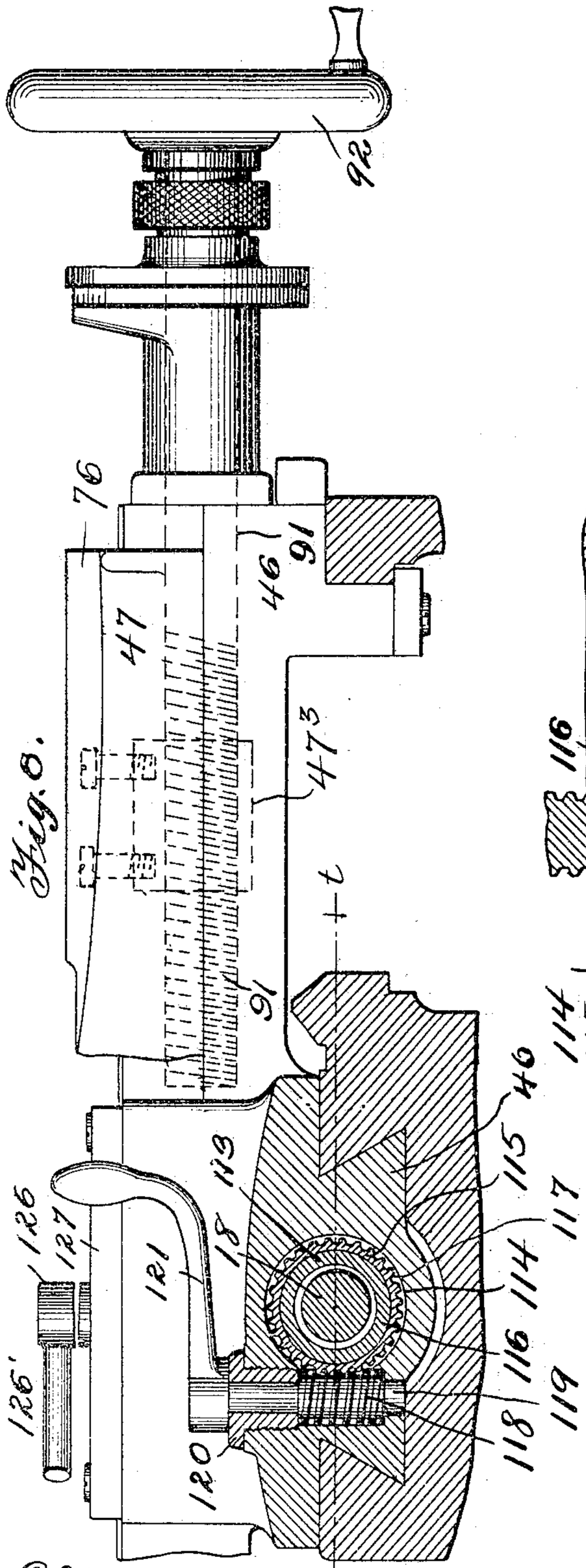

Fig. 6.

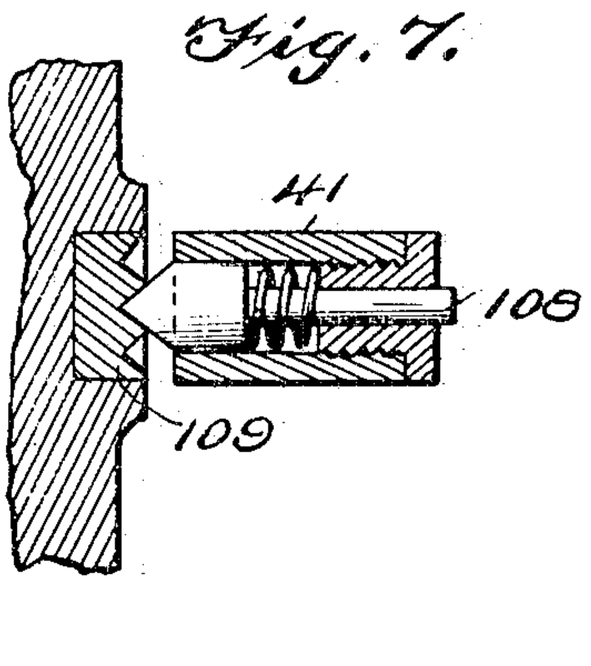

Fig. 7.

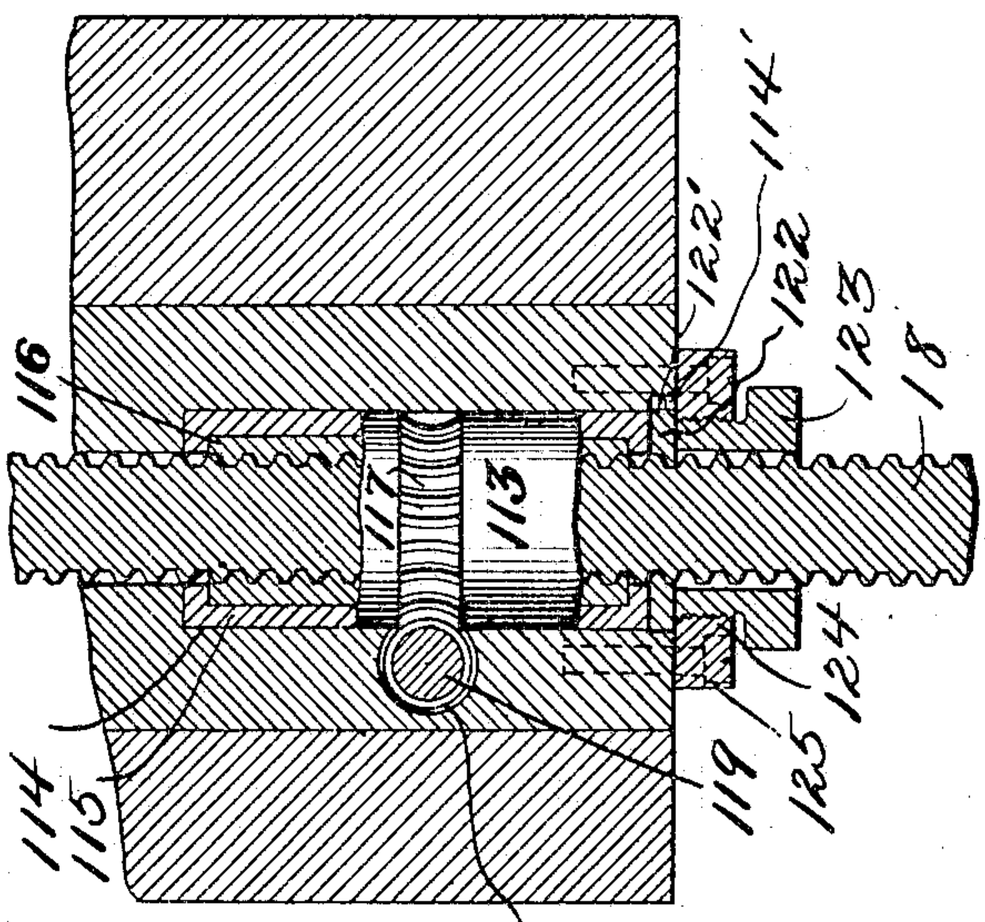

Fig. 9.

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Inventor:

B. M. W. Hanson:

Blodgett & Peck

No. 782,236. Patented February 14, 1905.

UNITED STATES PATENT OFFICE.

BENGT M. W. HANSON, OF HARTFORD, CONNECTICUT, ASSIGNOR TO PRATT & WHITNEY COMPANY, OF HARTFORD, CONNECTICUT, A CORPORATION OF NEW JERSEY.

MACHINE FOR MILLING SPIRALS.

SPECIFICATION forming part of Letters Patent No. 782,236, dated February 14, 1905.

Application filed July 12, 1902. Serial No. 115,337.

To all whom it may concern:

Be it known that I, BENGT M. W. HANSON, a subject of the King of Sweden and Norway, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Machines for Milling Spirals, of which the following is a specification.

My invention relates to machines for milling either right or left spirals, worms, or screw-threads in metal; and it has for its object the provision of improved mechanism for accomplishing this result.

A further object of the invention is the provision of improved mechanism for controlling the movement of the slide carrying the milling-cutter.

Further objects of the invention will be set forth in the following description.

In the accompanying drawings, Figure 1 is a side elevation of a worm or thread milling machine embodying my improvements with the steady or follow rest omitted. Fig. 2 is an end view of the machine looking from the left in Fig. 1. Fig. 3 is a side elevation, partially in section, of the cutter-slide, showing part of the mechanism for rotating the cutter. Fig. 4 is a horizontal section on line *u u* of Fig. 3. Fig. 5 is a longitudinal vertical section of the work-carrying spindle, taken on line *x x* of Fig. 2, with part of the clutch-shifting means in elevation. Fig. 6 is a transverse vertical section on line *z z* of Fig. 5 looking toward the right. Fig. 7 is a sectional view of the lever-arm, taken on line *y y* of Fig. 5, a part of the bed being in section to show the toothed plate with which the spring-actuated plunger engages. Fig. 8 is a section on line *v v* of Fig. 1, and Fig. 9 is a horizontal section on line *t t* of Fig. 8.

Like characters designate similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates the frame or bed of the machine, which may be of any approved construction. Rising from this bed are heads 2 and 3, respectively, in the former of which is journaled a hollow spindle 4, and in the latter is mounted the usual adjustable center 5. Fitted within the hollow spindle 4 is a chuck-spindle 6, having a head 6′, carrying a split or other form of chuck 7, and a screw-cap 8 for compressing said chuck upon the work passing therethrough, said work being supported at its end opposite the chuck upon the center 5 of the head 3. These heads 2 and 3 are supported upon shears or ways of the bed in the usual manner, the head 3 being adjustable to bring the center 5 to the proper position.

The hollow spindle 4 is provided at its inner end with a flanged head 4′, having a flaring recess for receiving a conical enlargement 6^2 of the hollow chuck-spindle 6, and at its outer extremity said spindle 4 carries a gear-wheel 9 in engagement with a gear 10, secured to a shaft 11, to the outer end of which is keyed a gear 12, the latter being in mesh with a "change-gear" pinion 13, mounted upon a stud 14, adjustable in a slot 15 of a pivoted carrier 16, said pinion driving a gear 17, secured to the lead-screw shaft 18, whereby said shaft 18 may be driven from the spindle, and the desired speed thereof may be obtained by employing a gear 13 of the selected size.

Clamped against a shoulder of the head 6′ of rotary spindle 6 by a nut 19, engaging an exterior thread of said head, is an index-ring 20, bearing at one side against the flange 4′ of spindle 4 and provided with a series of notches 20′, said ring being connected to said head, to rotate therewith, by a spline 21. Pivoted at 22 to the flange 4′ is an index-pawl 23, having a tooth adapted to enter any of the notches 20′ of the index-ring 20, said pawl being actuated by devices illustrated and described in my divisional application filed November 19, 1903, Serial No. 180,319, to which reference may be had.

Loosely mounted upon the live-spindle 4, adjacent to one of the bearings of the head 2, in which said spindle is journaled, is a pulley 28, shown as having a series of peripheral grooves for the reception of belting (not shown) by which said pulley may be driven, and the side of this pulley is grooved at 28′

for a purpose hereinafter stated. Splined or otherwise connected to rotate with and slide upon the spindle 4 is a clutch 29, having a tapered flange 29′, constituting a friction-clutch element, adapted when the clutch is thrown to the right to engage the complemental clutch element 28′ of pulley 28. At the side opposite the friction-clutch element 29′ the clutch 29 is provided with a toothed plate 30, shown secured to a grooved or rabbeted portion on the end of the clutch by screws 31, although the teeth might be made integral with said clutch, if desired. Loosely mounted on the spindle 4, adjacent to one of its bearings in the head 2, is a worm-gear 32 of considerable amplitude, and to the side of this gear opposite the clutch-face 30 a toothed plate 33 is secured by screws 34, as illustrated in Fig. 5.

The clutch 29 is grooved at 29^2 for the reception of shoes 35 on the yoke-shaped end of a lever-arm 36, said lever-arm projecting from a rock-shaft 37, extending transversely of the head 2 and journaled in bearings thereof, as shown in Fig. 6. Sleeved upon this rock-shaft 37 and secured thereto by a pin 38 is a hub 39, from which projects a hand-lever 40 and a depending lever-arm 41, said arm 41 being connected to mechanism controlled by the cutter slide or carriage for shifting the clutch to a neutral position, as will be hereinafter described. Located transversely of and journaled in bearings in the head 2 is a shaft 42, carrying a worm 43, the teeth of which engage those of the worm-wheel 32, above described, and secured to the end of said shaft 42 is a conical belt-pulley 44, having a series of belt-receiving grooves of different diameters, so that the desired speed may be imparted to the worm-shaft to drive the spindle 4 in the manner required for the kind of worm-thread or spiral to be made.

Designated in a general way by the numeral 45 is a slide or carriage which is mounted for reciprocatory movement upon the shears of the machine-bed. This slide or carriage consists of a bed-plate 46, grooved to fit upon the shears aforesaid, and fitted upon transverse ways of this bed-plate is a cutter-slide 47, provided with extensions 47′ 47^2 for a purpose hereinafter described. Journaled in a bearing of the extension 47′ is a sleeve or hollow trunnion 48, and mounted for rotary movement in this sleeve is a shaft 49, carrying a bevel-gear 50 at its inner end and a pulley 51 at its outer extremity. This pulley is shown as having a grooved periphery for the reception of multiple belts actuated from a counter-shaft, (not shown,) and it is sleeved upon a hub 52, through which the shaft 49 passes. A plate 53 is secured to the pulley by screws 54, and this plate has a hub which is splined to the shaft 49, as at 55 in Fig. 4, and the pulley is located between the end of the sleeve 48 and a nut 56, secured to a threaded end of the shaft, as illustrated in Figs. 3 and 4.

Within a bearing of the extension 47^2 is located a partially-hollow hub or trunnion 57, internally threaded at 58 for the reception of a screw 59, having a wide head 59′ bearing against a shoulder of said extension 47^2, this head being provided with holes 59^2, in which a tool may be inserted for adjusting the screw. In its solid end the hub 57 is threaded for the reception of screws 60, the heads of which fit in recesses in the arm of a cutter-frame hereinafter described, said screws serving to secure the hub to said arm and to prevent its turning in the perforation therein. Sleeved and capable of rotary adjustment upon the parts 48 and 57 are arms 61 62, respectively, of a cutter-frame 63, said frame being provided with a bearing 64 for the reception of a shaft 65, to the end of which a bevel-gear 66, intermeshing with the bevel-pinion 50, is secured. Upon this shaft 65 is a spur-pinion 67, the teeth of which are in engagement with a larger spur-wheel 68, carried by a shaft 69, journaled in bearings of the adjustable frame.

Designated by the numeral 70 is a shaft or spindle to which the milling-cutter 71 is secured, and this shaft is also journaled in a bearing of the adjustable frame, and it carries a pinion 72 in engagement with the large gear 68, as illustrated in Fig. 4. It is desirable at times to vary the position of the cutter with relation to the work, so that grooves of different inclination may be formed when required, and the object of the construction just described is to enable this result to be effected in a quick and convenient manner. Threaded upon the sleeve 48 is a nut 73, provided with openings 73′ in its periphery, in which a tool may be inserted for turning said nut, and between this nut and the end of the extension 47′ is a washer 74.

When it is desired to vary the angular relation of the cutter to the work, the nut 73 and screw 59 are loosened, thereby permitting the frame to be rocked, the sleeve 48 and hub 57, attached to said frame by keys 48′ and screws 60, respectively, rotating in their seats or bearings, and after the desired adjustment has been obtained the nut 73 is turned against the washer 74 to cause the bearing 61 of said frame to be brought tightly against the extension 47′, and the screw 59 is also turned to cause the extension 62 to be brought into close contact with the bearing 47^2.

To prevent the work from springing while the milling-cutter 71 is in operation, an improved follow or steady rest is employed, which is designated in a general way by 75 and is adjustable upon a way 76 of the bed-plate 46 toward and from the cutter-spindle. This follow or steady rest comprises a standard 77, having its base longitudinally grooved to fit upon the guideway 76, and on its inner side said standard is provided with a parti-cylindrical open-sided groove or recess 77^2 for the reception of the work or of inter-

changeable bushings 78 open at one side and fitting over said work, each interchangeable bushing being secured in place by a screw 79 passing through the overhanging curved end of the standard and its threaded end entering an internally-threaded socket 78′ in the bushing, as shown in Fig. 3. This standard 77 is provided with a longitudinal bearing 80, enlarged at 80′ for a purpose hereinafter stated, and the slide 47 is formed with a longitudinal slot 81 and another slot 82, communicating with said slot 81. For securing the column or standard 77 in the desired position with relation to the work a binder 83, having a rectangular perforated head 83′, fitted in recess 80′ of said standard 75, is employed. This binder is perforated at 85 and is provided with a flanged base 86, separated from its perforated portion by a shank 86′, said base and shank fitting in the slots 81 82 of the slide 47, as illustrated in Fig. 3. Secured against longitudinal movement in a bearing of the standard by a screw 87, entering a groove 87′ in its periphery, is a rod or shaft 88, having an eccentric or cam portion 88′, and attached to the end of this rod is a handle 89. As will be seen by Fig 3, the eccentric portion of this rod passes through the opening in the head of the binder 83, and it is evident that when the rod is turned by its operating-handle said eccentric will raise and lower the binder to thereby either release or bind the standard 77 in the place to which it has been adjusted. Other means may be substituted for accomplishing this result without departure from the invention.

To provide for adjustment of the cutter-slide 47 transversely of its base 46 to force the cutter up to and withdraw it from the work, said slide 47 is provided with a nut 47^3 for the reception of a screw 91, carrying a hand-wheel 92, and it will be obvious that by turning this screw the slide 47 may be adjusted transversely back and forth upon its support in the usual manner.

In bearings or brackets 93 and 94, respectively secured to the side of the bed 1, is mounted a shifting rod 95, and upon this rod are placed adjustable stops 96 97, respectively adapted to coöperate with a lug 98, depending from the tool-carriage, as illustrated in Fig. 1. These stops may be of any approved kind and constitute, by themselves considered, no feature of my present invention. Articulated to the shifting rod 95 at 99 is a link 100, having a wrist-pin 101 fitted in a curved slot 102 of a rocker 103, pivoted at 104 to the main frame, as shown more clearly in Fig. 5, said pin being rigidly secured in either end of the slot by a lever-screw 101′. Secured to this rocker 103 by a screw 105 is a short link 106, connected by a screw 107 to the arm 41 of sleeve 39. At its lower end the arm 41 carries a spring-pressed plunger 108, Fig. 7, adapted to engage a notched block 109, set in the frame, and thus to hold the lever in place when swung to its neutral and active positions. This construction constitutes a "link-motion," and it has for its object the shifting of the clutch 29 to a neutral postion at both limits of the stroke of the tool-carriage when cutting either right or left spirals in a manner that will be hereinafter more fully explained. For protecting the gears 9 and 10 a head or cap 110 is employed, and a similar cap 111 is used for covering the worm-gear 32 and the clutch 29. So, too, the gearing for driving the cutter-spindle may be protected by a cap or head 112, as illustrated in Fig. 3. These protecting caps or covers are in common use and constitute no part of the invention.

It is frequently desirable to adjust the reciprocatory slide 46 by hand in order that the milling or other cutter carried thereby may quickly be brought to the desired position, and to enable this result to be accomplished independent of the usual action of the lead-screw the instrumentalities now to be described are provided.

Designated generally by 113 is a feed-nut which is fitted in a recess 114 of the slide 46 and is composed in the illustration given of a barrel 115, open at its ends for the reception of the feed-screw 18. This barrel is provided with an interior lining or nut proper, 116, composed of Babbitt or equivalent metal, which is cast around the screw 18, and on its exterior surface with a circumferential worm-wheel 117, the teeth of which are in mesh with a worm 118, carried by a shaft 119, journaled at its lower end in the slide and at its upper end in a sleeve or bushing 120, threaded into the slide, said shaft being provided with an operating-handle 121, as illustrated in Fig. 8. For securing the barrel 115 in the recess 114 of the slide a washer 122 is slipped over the lead-screw and inserted in the recess 114, said washer having a lateral projection 122′, which enters a notch 114′ in the slide adjacent to the end of the recess and prevents the washer from turning. This washer is forced snugly against the end of the feed-nut by a hollow externally-threaded screw 123, through which the lead-screw passes, said screw engaging a nut 124, secured to the end of the slide by screws or other fastenings 125, as shown in Fig. 9.

From the construction just described it will be seen that the feed-nut is locked against rotation with the lead-screw by the engagement of the teeth of its worm-wheel 117 with those of the worm 118, thereby enabling the screw when rotated in the manner described to advance the carriage automatically, and that when for any reason it is desired to adjust the cutter-slide by hand this can readily and quickly be accomplished by simply grasping the lever 121 and rotating the nut.

For rigidly binding the transverse cutter-

slide 47 in place when desired a binder-screw 126 is tapped into said slide, the under surface of the head of said screw bearing against the guideway-cap 127 and the screw being manipulated by a handle 126′, as shown in Figs. 1 and 8.

The operation of my improved machine is as follows: The stock 90, upon which it is desired to cut a worm, thread, or spiral gear, is inserted in chuck 7 of hollow spindle 6, is passed through the bushing 78 of steady-rest 77, and is supported on the tail center 5, and said chuck is then compressed upon the stock by screwing the internally-threaded cap 8 upon said spindle 6. Lever 40 is then actuated to shift clutch 29 into contact with pulley 28, whereby through the connections described slide 46 is shifted by the lead-screw 18 to the right to bring the cutter into proper position to begin its operation, and as the cutter-slide reaches this position the lug 98 comes into contact with the adjustable stop 97 and shifts the rod 95 to the right, thereby through the link-motion described or a suitable substitute therefor actuating the arm 41, sleeve 39, shaft 37, and lever-arm 36 and throwing the clutch to a neutral position, thus stopping the machine, as illustrated in Fig. 5. The slide 47 is now adjusted to bring the milling-cutter 70 into position for operation, and hand-lever 40 is then grasped and shifted to the left, thereby causing through the described connections the clutch to be thrown in the same direction and its teeth 30 to engage the complemental teeth 33 of the worm-wheel 32, this worm-wheel being continuously driven in a direction opposite to that of pulley 28 while the machine is in operation by belting upon the pulley 44, as above stated. This sets the spindle 4 and chuck-spindle 6 mounted therein in operation and through the gearing 9, 10, 12, 13, and 17 described turns the lead-screw 18, and the movement of the cutter-slide of course immediately commences, the speed of such slide being governed by the change-gear 13, having the number of teeth desired and actuated by the gear 9 of the live-spindle. This motion of the slide is, of course, a slow one to enable the milling-cutter (rotated by the shaft 49 and gears 50 66, shaft 65 and gears 67, 68, and 72 and shaft 71) to act in a proper manner during the cutting operation, and the cutter continues to operate until the slide 45 reaches a position where the lug 98 comes into contact with the adjustable stop 96 on rod 95, thereby through the link-motion described again shifting the clutch to a neutral position and stopping the machine. To enable right or left spirals to be cut by the same machine, the clutch must be shifted to accord with the motion of the cutter-slide, and this is provided for by the link-motion above described, the wrist-pin 101 being manipulated in the slot 102 to either side of the pivotal point 104 of lever 103 and then rigidly secured in position by the lever-nut 101′. In the illustrations the machine is shown set for making right-hand threads or spirals, the pin 101 is in the lower end of slot 102, and the clutch will be shifted to its neutral position when the lug 98 comes into contact with stop 96 at the limit of the stroke of the cutter-slide toward the left, and when thus shifted the lever 40 is grasped and the clutch is thrown into engagement with the reversing-pulley 28, which through the mechanism described will cause the lead-screw quickly to return the cutter-slide to the right to bring the cutter to a position for a new operation. To form left-hand spirals, an additional idler-gear is placed in the train between the spindle 4 and lead-screw 18, and the frame 63, in which the cutter-spindle 71 is journaled, is then adjusted to the proper angle and firmly secured in position. To throw the clutch-shifting mechanism into action when cutting left-hand threads, (the lead-screw being reversed, as described,) the wrist-pin 101 is shifted to the opposite end of the link 103 and is then secured by the lever-screw 101′, and the lug 98 will then engage the stops 96 and 97, as before described, and will through the intermediate elements set forth shift the clutch 29 to a neutral position at the limit of each stroke of the cutter-slide.

By the improved machine spirals—such as worms, threads, or teeth of various pitches, proportions, and numbers—may be readily formed and the stock may be accurately indexed to enable these results to be accomplished.

Changes may be made in the details of various parts of the improved machine without departure from the invention. For instance, other systems of gearing may be employed for driving the feed-screw, and the live-spindle may be rotated by other means. So, too, the invention is not limited to the precise mechanism for rotating the cutter nor to the means by which said cutter may be swung or adjusted to enable it to assume a different angular position with relation to the work. Substitutes may also be employed for the link-motion, the invention not being limited in this respect, and a different kind of clutch may also be employed without departure from the invention.

Claims are not made to the steady-rest described, for it constitutes the subject-matter of my application, filed November 18, 1902, Serial No. 131,807; to the screw-feed mechanism set forth, for it is covered by my application, filed November 29, 1902, Serial No. 133,179, nor to the adjustable cutter-frame and the cutter-driving mechanism, for said frame and mechanism are covered in my application, filed November 29, 1902, Serial No. 133,180.

No claim is herein made to the details of the indexing mechanism shown and described,

for said mechanism constitutes the subject-matter of my divisional case, filed November 9, 1903, Serial No. 180,319.

Having thus described my invention, what I claim is—

1. The combination, with a chuck-spindle, of an element loose on said spindle, and having a clutch-surface; means for rotating said element in one direction; a reversely-driven element also loose on the spindle, a clutch in sliding connection with the spindle between said elements; lever mechanism for shifting said clutch; a rocker; a connection between said rocker and an element of the lever mechanism; a device adjustable along the rocker to each side the fulcrum thereof; means for securing said device to the rocker; a carriage; and means controlled by the carriage for actuating the rocker.

2. The combination, with a spindle, of a pulley loose on said spindle, and having a friction clutch-surface; means for rotating said pulley in one direction; a gear loose on the spindle, and having a toothed clutch-surface; means for rotating said gear in a direction opposite to that of the pulley; a clutch in sliding connection with the spindle, and having a friction clutch-surface and a toothed clutch-surface; lever mechanism for shifting said clutch; a rocker having a slot; a device connecting said rocker with an element of the lever mechanism; a wrist-pin shiftable in the slot of the rocker to each side of the fulcrum thereof; means for securing the wrist-pin in position; a tool-carriage having a lug; a shiftable rod; stops adjustable on said rod, and with which the lug on the tool-carriage engages at the end of its stroke; and means for connecting said rod with the wrist-pin of the rocker.

3. The combination, with a spindle, of means for driving said spindle in opposite directions; a clutch constituting a part of said means; clutch-shifting means; a rocker connected to an element of said clutch-shifting means; a reciprocatory carriage; a shiftable rod having stops actuated by said carriage; means for connecting said rod with the rocker; and a device for permitting the adjustment and attachment of said means to each side of the axis of the rocker.

4. The combination, with a spindle, and with means for driving said spindle in opposite directions, of a clutch; a lever for shifting the clutch; an arm projecting from the lever; a rocker; a device for connecting the rocker and arm; a link shiftable to each side of the axis of the rocker; means for connecting said link to the rocker; a carriage; and means operated by the carriage and connected to the link for actuating the rocker.

5. The combination, with a chuck-spindle, of means for driving said spindle in opposite directions; a clutch-actuating device; a slotted rocker connected to said device; a wrist-pin adjustable in the slot of the rocker to each side of the axis of said rocker, a link articulated to the wrist-pin; a shiftable rod; stops adjustable on said rod; and a tool-carriage carrying a lug for engaging the stops of the rod.

6. The combination, with means for rotating stock, of a clutch constituting a part of said means; a lever for shifting the clutch; a rocker connected to the lever; a device connected to the rocker, and shiftable to each side of the axis thereof; a shiftable rod connected to said rocker; stops carried by said shiftable rod; and a tool-carriage having an abutment which engages the stops.

7. The combination, with a live-spindle, of means for securing stock to said spindle; a pair of loosely-mounted driven elements upon said spindle; a clutch in sliding connection with the spindle, and adapted to engage either of said driven elements; a lever-arm for shifting the clutch; a pivoted shiftable device; means for connecting said device with the lever-arm; a link; a pin carried by the link and adapted to be secured to said pivoted shiftable device on each side of the fulcrum thereof; a tool-carriage; means controlled by the live-spindle for actuating said tool-carriage; and means controlled by said tool-carriage for actuating the pivoted shiftable device and thereby the clutch.

8. The combination, with a spindle, of a clutch in sliding connection with said spindle; a worm-wheel loose on the spindle at one side of said clutch; a belt-pulley loose on the spindle at the other side of the clutch, and adapted to be driven in a reverse direction to that of the worm-wheel; a worm in engagement with the worm-wheel; a tool-carriage; a lead-screw; gearing controlled by the live-spindle for actuating said lead-screw; a shiftable rod; adjustable stops on said rod; a device on the tool-carriage adapted to each limit of the stroke of said carriage to engage one of the stops and shift the rod; a rocker; a link adjustable to each side of the axis of the rocker, and connected to the rod; and devices for connecting the rocker with the clutch.

9. In a machine of the class specified, the combination, with a tubular spindle, of a pair of loosely-mounted, reversely-driven elements on said spindle; means for securing stock to said spindle; means for supporting the other end of said stock; a clutch in sliding connection with the spindle between said driven elements; a lever-arm for actuating the clutch; a rock-shaft to which said lever-arm is secured; a sleeve connected to said rock-shaft; an arm depending from said sleeve; a link articulated to said depending arm at one end; a slotted shiftable device to which the other end of said link is connected; a pin adjustable in the slot of said shiftable device to each side of its support; means for securing said pin in position after adjustment; a link connected to the pin at one end; a shiftable rod to

which the other end of said link is articulated; adjustable stops upon said rod; a tool-carriage having a lug adapted to engage said stops and shift the rod at the limit of each stroke of said tool-carriage; and means controlled by the tubular spindle for reciprocating the tool-carriage.

10. The combination, with a rotary spindle, of reversely-operable driven elements loose on said spindle; a clutch splined to the spindle between said driven elements and adapted to engage, and to be thrown to a neutral position between, them; a lever-arm connected to the clutch; a rock-shaft to which said lever-arm is secured; a sleeve attached to the rock-shaft; a handle projecting from the sleeve; an arm depending from said sleeve; a spring-controlled plunger fitted in a bore of the depending arm; a notched stop-plate with which said plunger engages; a tool-carriage; mechanism controlled by the rotary spindle for reciprocating said tool-carriage; and means controlled by said carriage and serving to actuate the lever mechanism for shifting the clutch.

In testimony whereof I affix my signature in presence of two witnesses.

BENGT M. W. HANSON.

Witnesses:
FRANK HARRINGTON,
FRANK G. CAMPBELL.