No. 869,862.

PATENTED OCT. 29, 1907.

D. BACON.

# DOUBLE ARBOR LATHE.

APPLICATION FILED DEC. 14, 1904.

5 SHEETS—SHEET 1.

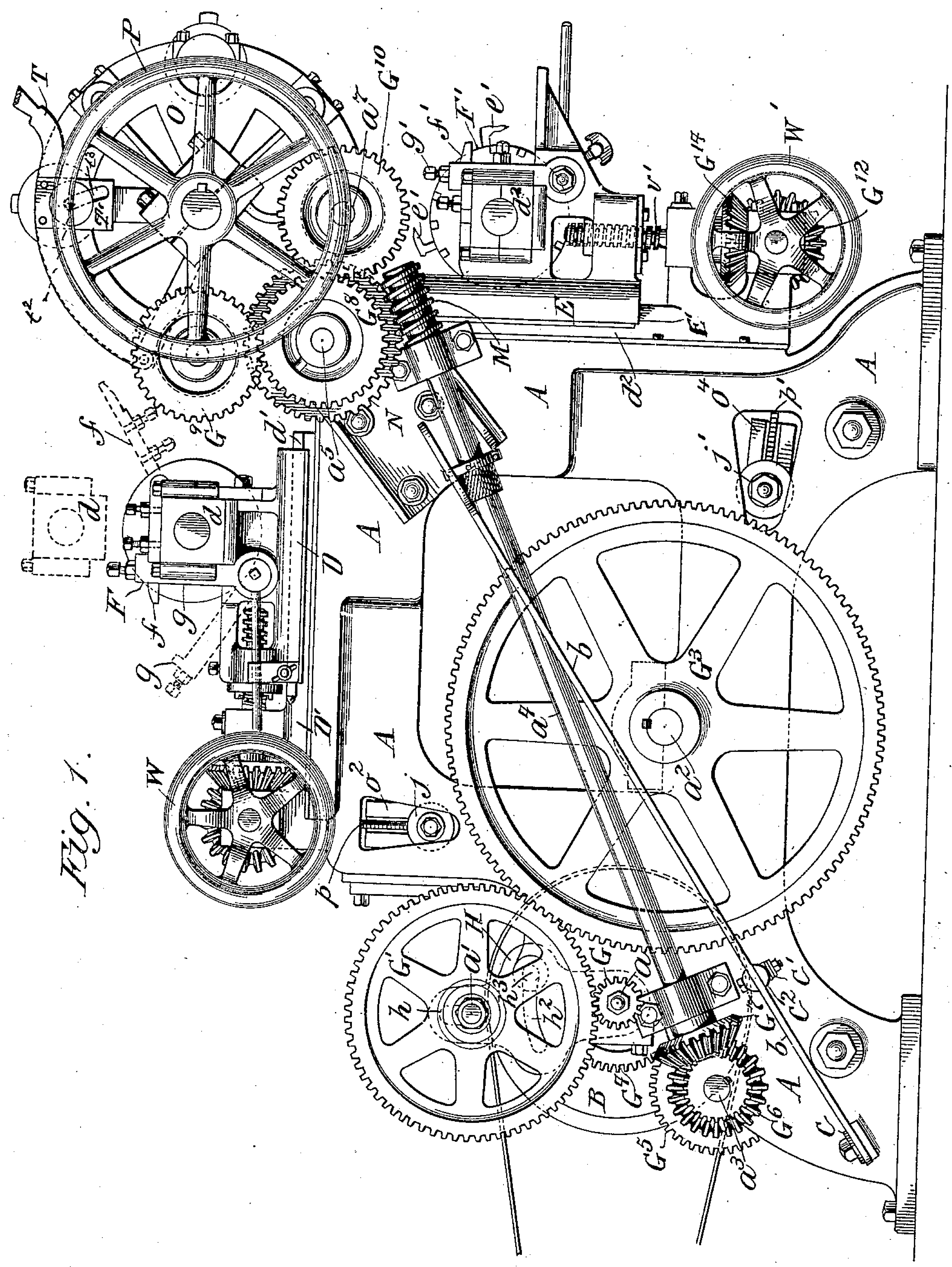

Fig. 1.

Witnesses
Edward Rowland
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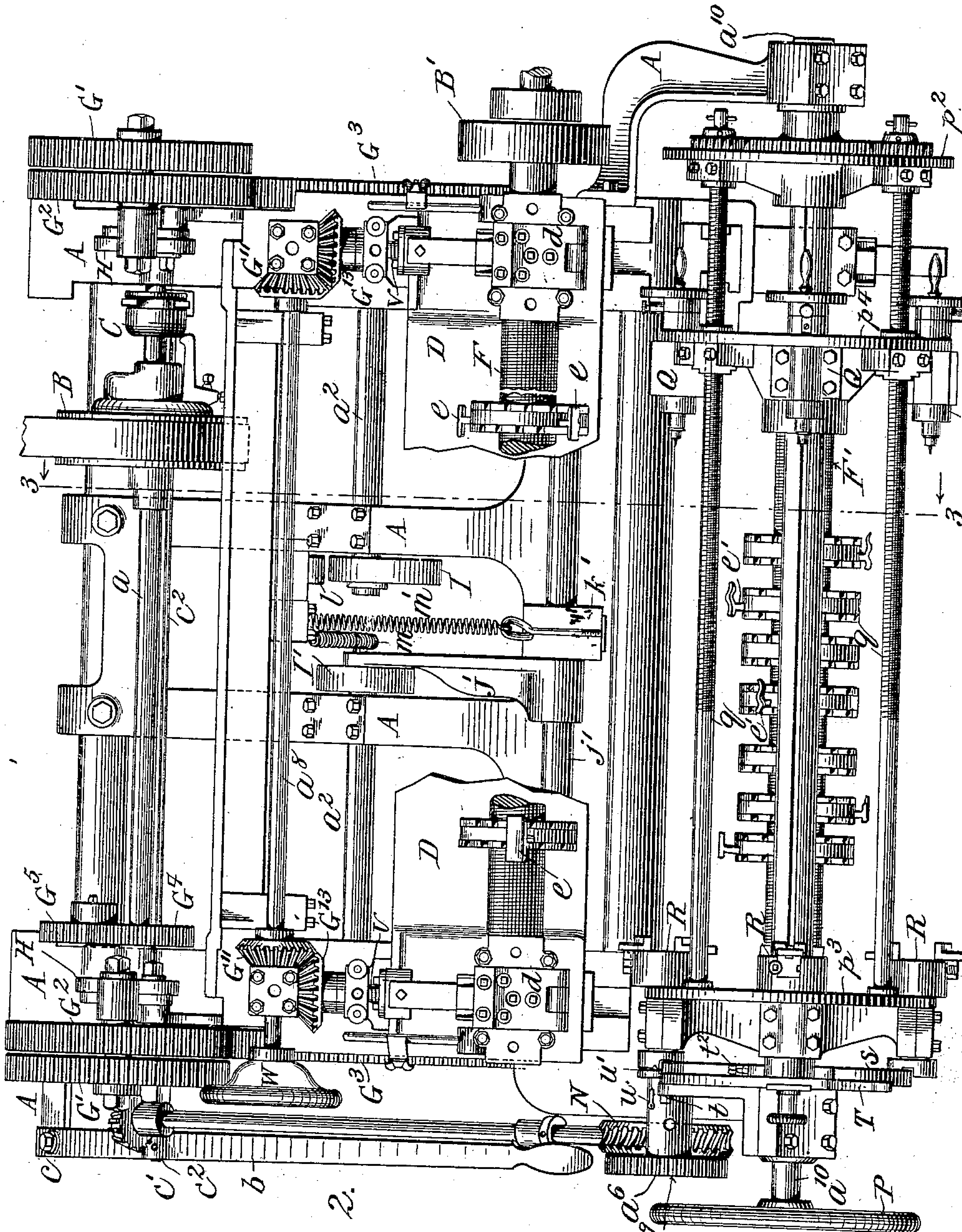

Fig. 2.

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Fig. 6.

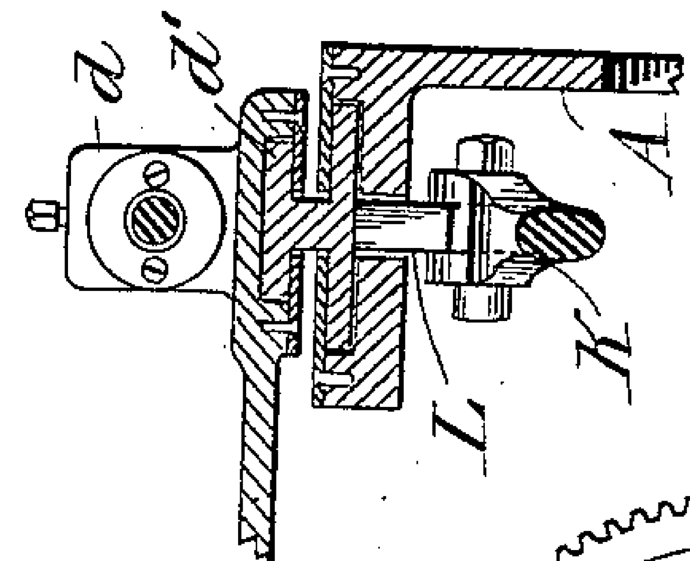
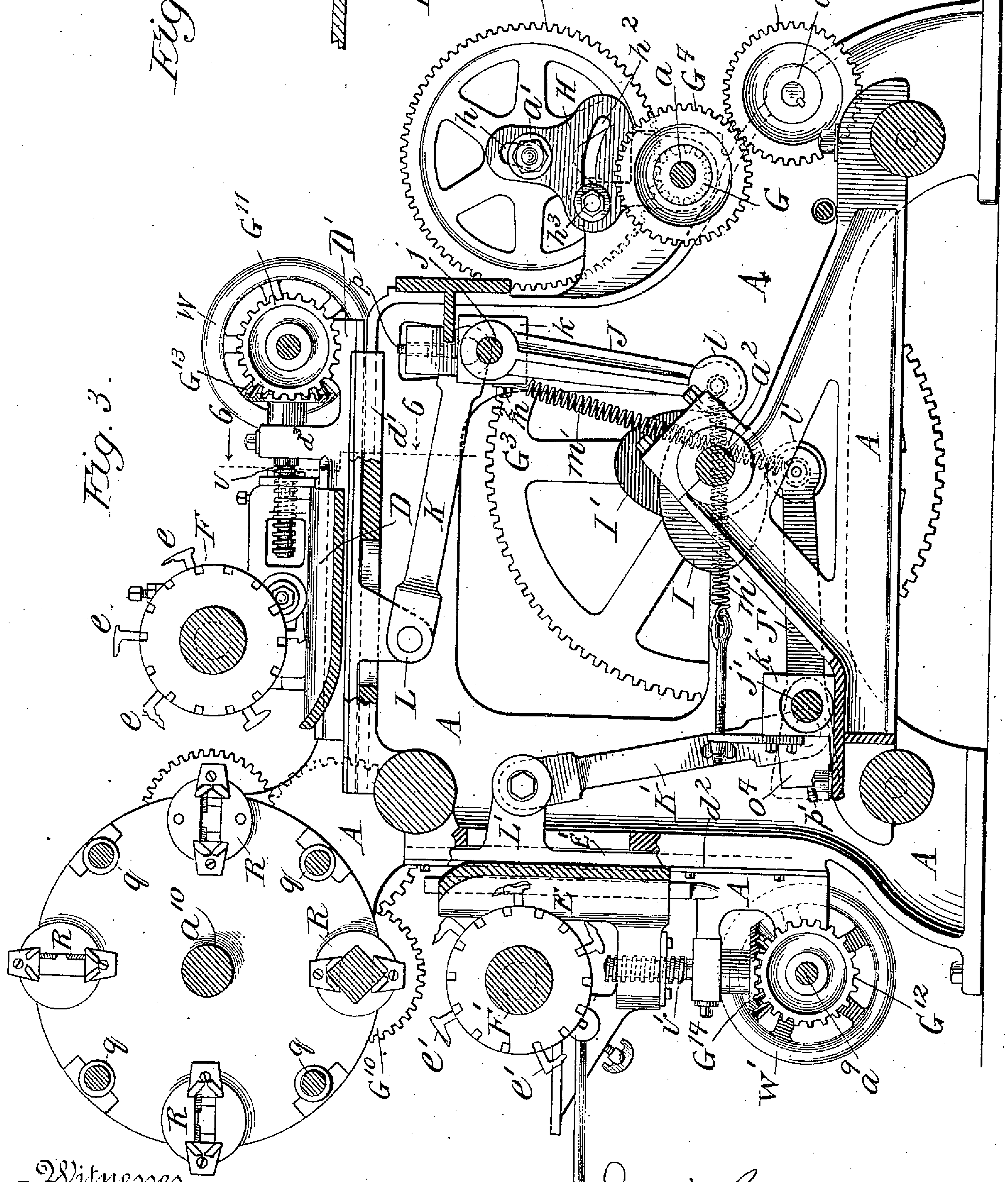


Fig. 3.



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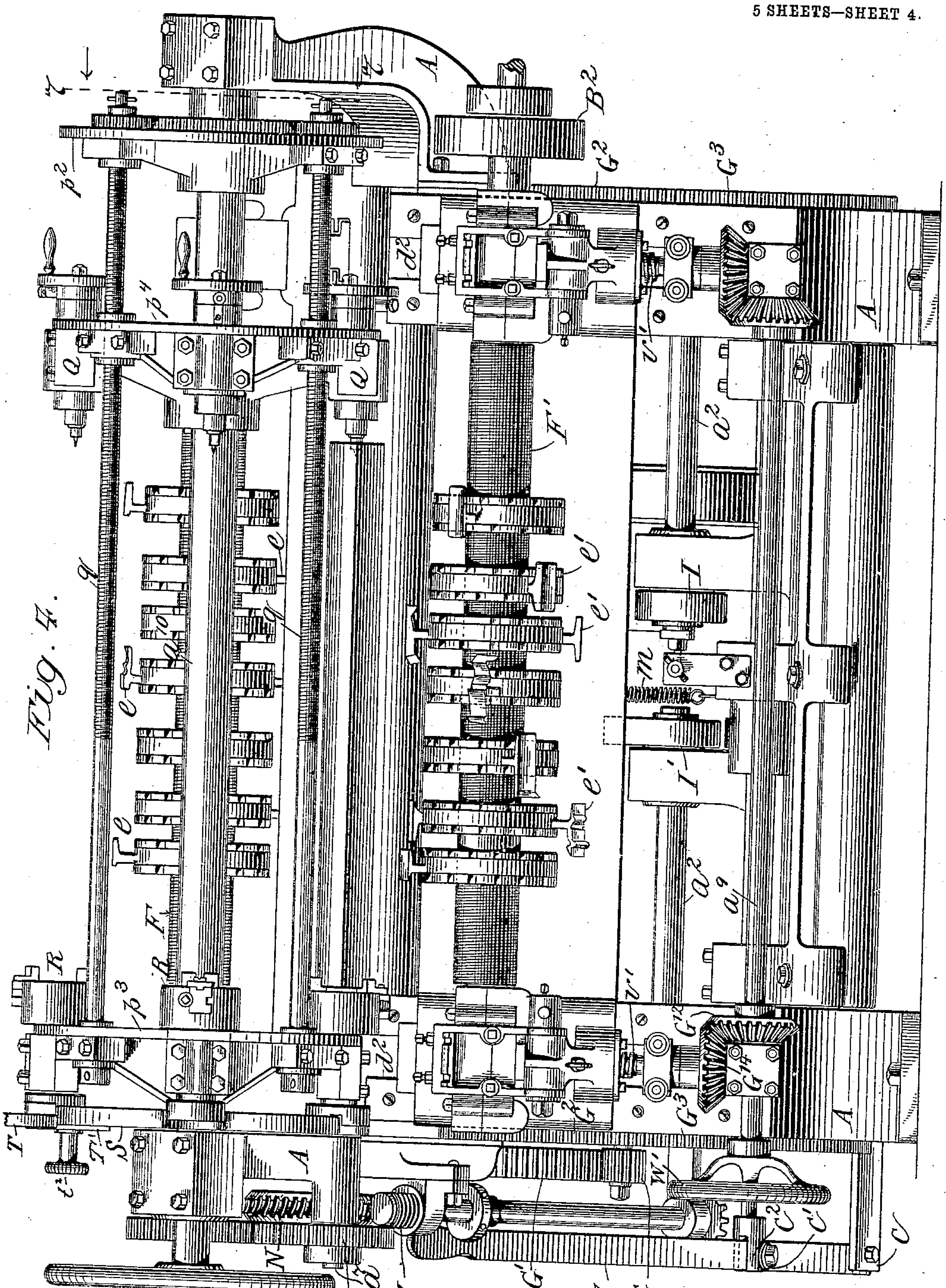

Fig. 4.

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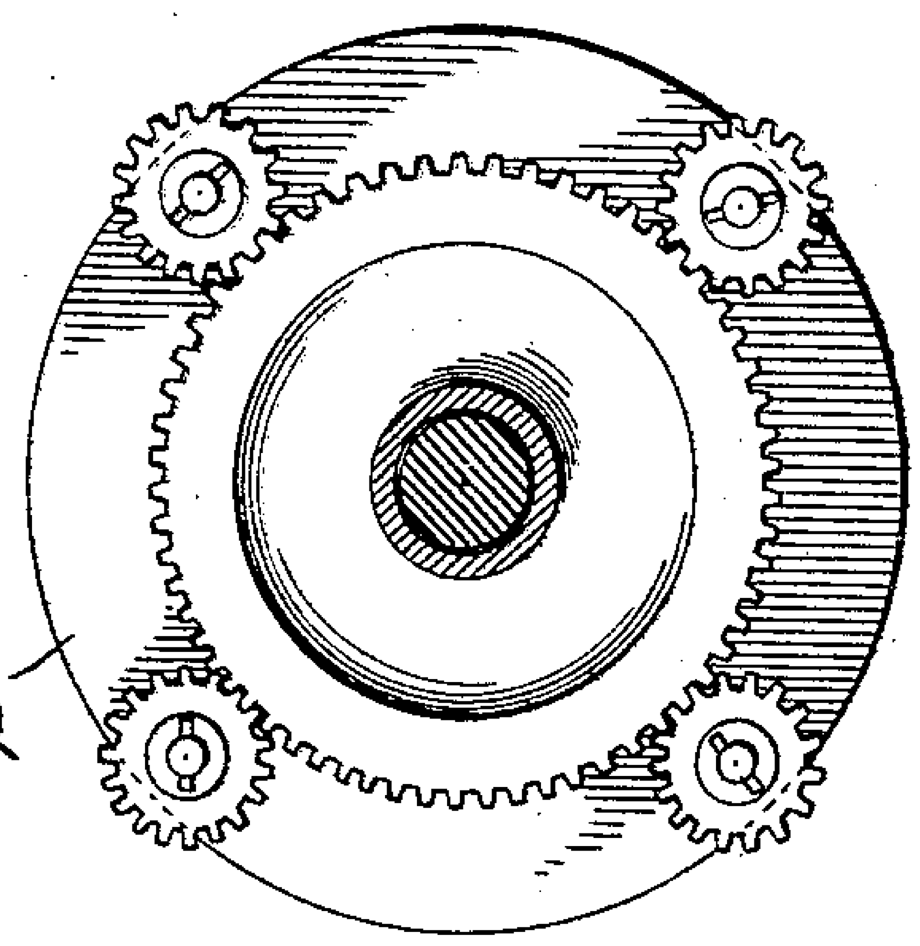
5 SHEETS—SHEET 5.

Fig. 7.



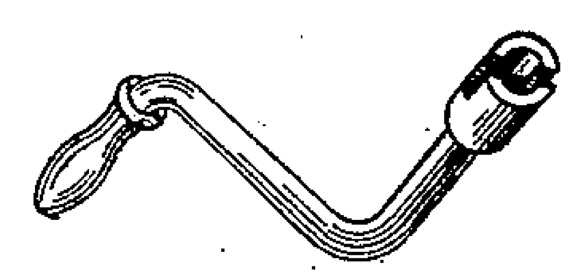



Fig. 9.

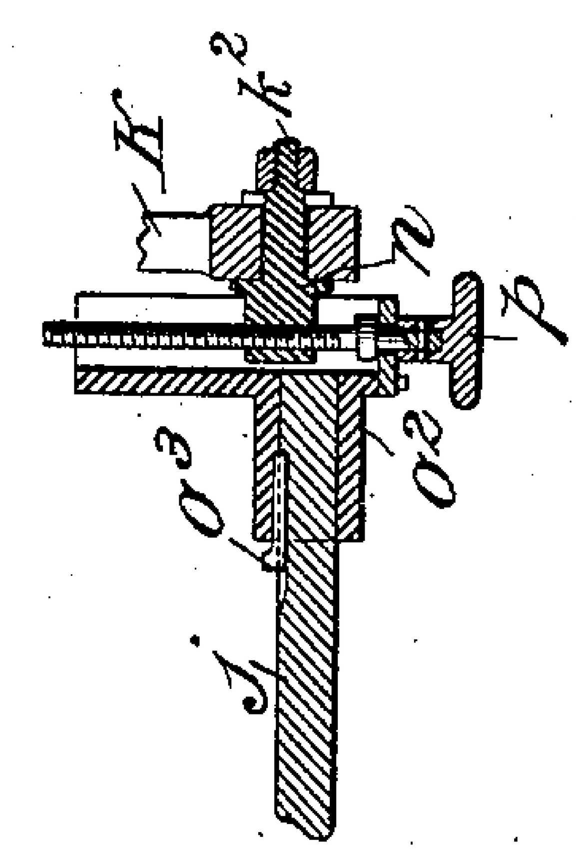
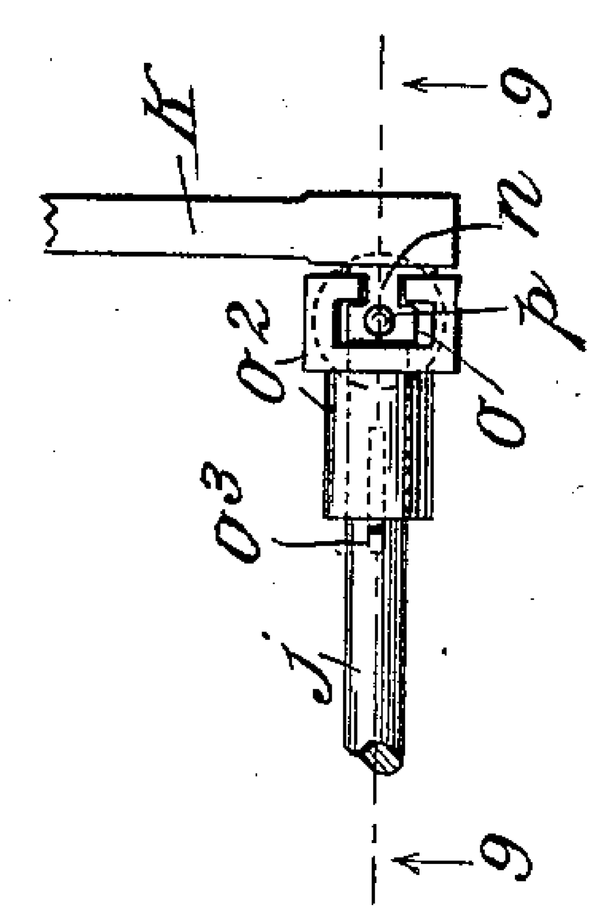



Fig. 8.



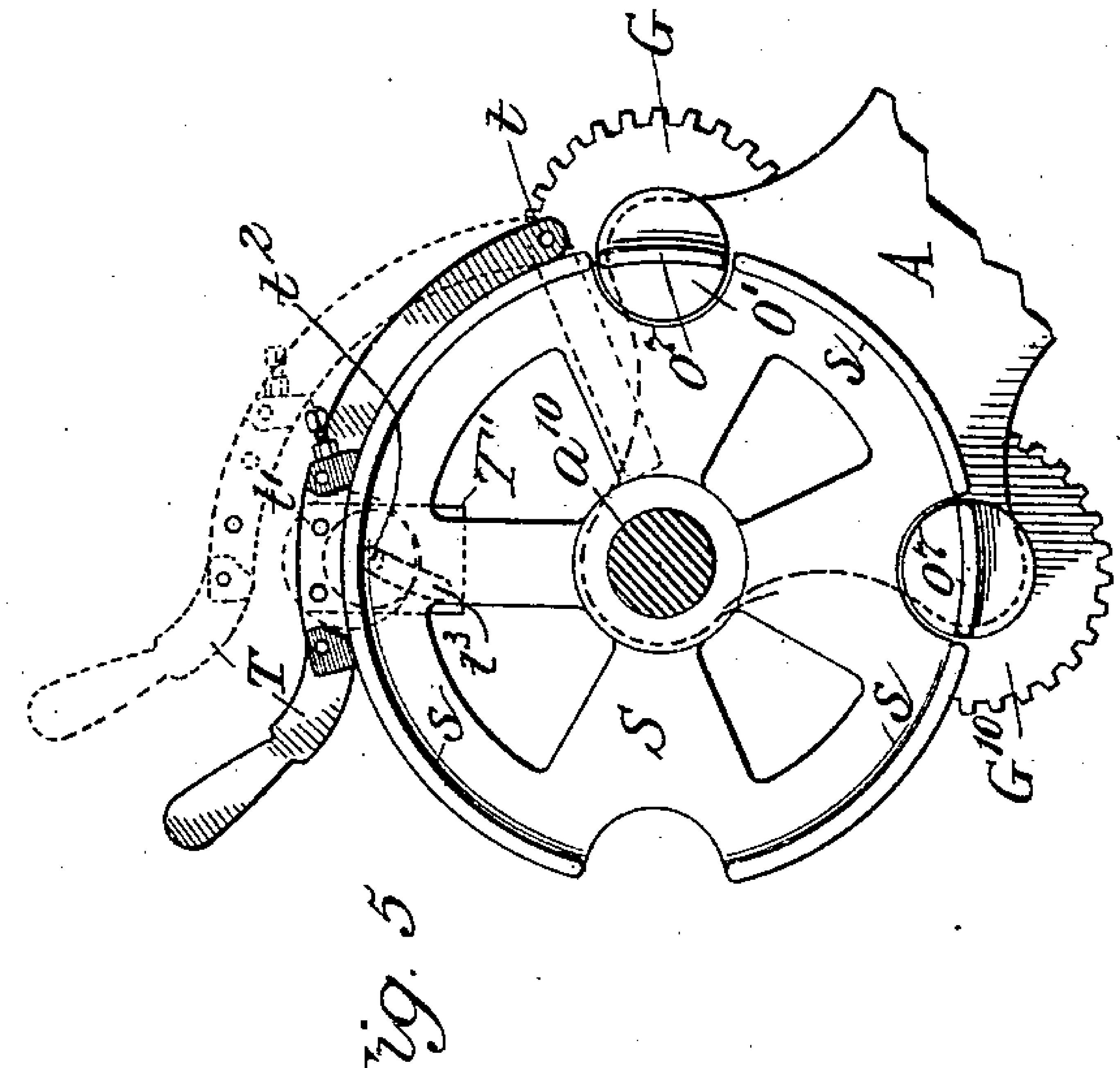
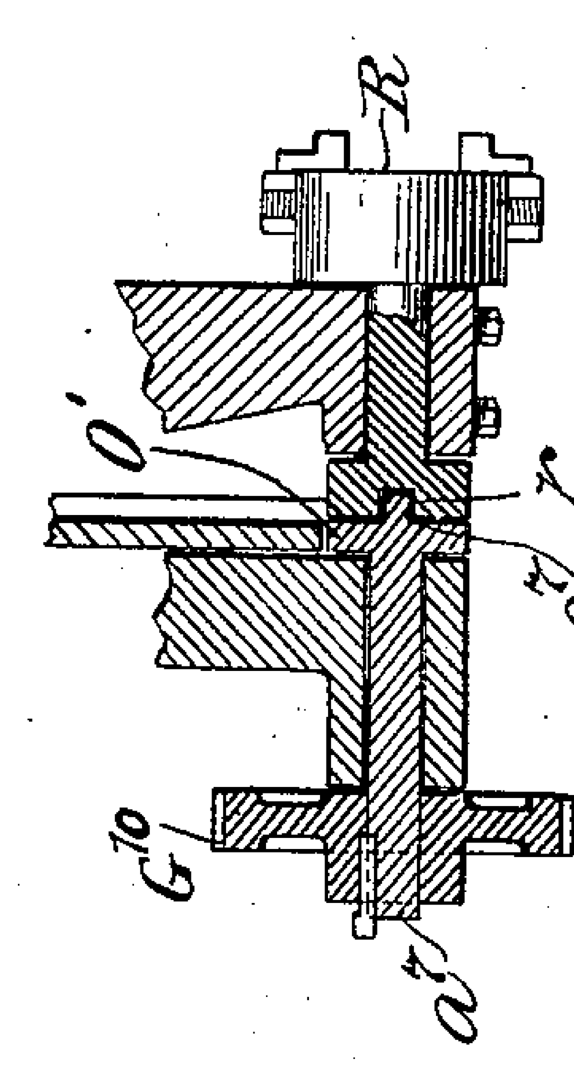




Fig. 5

Fig. 10.




Witnesses
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By his Attorney
W. P. Preble Jr

THE NORRIS PETERS CO., WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

DANIEL BACON, OF NEW YORK, N. Y., ASSIGNOR, BY MESNE ASSIGNMENTS, TO WILLIAM BENEDICT BULL, OF CHICAGO, ILLINOIS.

## DOUBLE-ARBOR LATHE.

No. 869,862. Specification of Letters Patent. Patented Oct. 29, 1907.

Application filed December 14, 1904. Serial No. 236,802.

*To all whom it may concern:*

Be it known that I, DANIEL BACON, a citizen of the United States, and a resident of Brooklyn borough, New York city, and State of New York, have invented certain new and useful Improvements in Double-Arbor Lathes, of which the following is a specification.

My invention relates to that class of turning lathes in which two cutter arbors may be operated simultaneously, either upon two blocks or pieces of wood, metal or other material which are to be shaped independently of each other or consecutively upon the same blocks or pieces, one cutter arbor producing part of the desired configuration and the other cutter arbor the rest, such as shown in Patent #682,185, issued September 10th, 1901 to C. H. Fitler, for Machine for cutting or shaping wood or other material. Such lathes are commonly known as double arbor lathes and they are equipped, preferably, with a reel, having a sufficient number of chucks to allow the simultaneous turning of two pieces of material, the removal of the pieces already turned and the insertion of fresh stock.

The object of my invention is principally to increase the efficiency of such double arbor lathes by so locating and feeding the cutter arbors as to diminish the vibration of the rotary cutter; avoid clogging by saw-dust; and to have all the operations visible at all times and easily controlled, whereby better finished work can be accomplished.

A further object is to provide a locking device for the chuck carrying reel whereby all danger of injury to the material operated upon is avoided. Such danger exists where there is any possibility of the reel shifting its position when any of the material carried by any of the chucks is within reach of the cutters.

Another object of my invention is to provide a simple means whereby the operator may stop the machine at the exact point necessary to permit the turning of the chuck-carrying-reel so as to bring the new stock within the field of the cutters and remove the finished work, whereby the time required for this shifting of material is greatly diminished.

One application of my invention is shown in the accompanying drawing in which:

Figure 1 is an end elevation. Fig. 2 is a top plan partly cut away to show driving mechanism underneath. Fig. 3 is a vertical section on line 3—3—of Fig. 2 looking in the direction of the arrows. Fig. 4 is a front elevation. Fig. 5 is a detail of the locking device, for the chuck carrying reel. Fig. 6 is a sectional detail on line 6—6 of Fig. 3. Fig. 7 is an end view of the reel on line 7—7 of Fig. 4. Figs. 8, and 9 are detailed views of the end of the arm which reciprocates the cutter carriage. Fig. 10 is a sectional detail showing the connection of the head stock on the reel with its driving gear.

Same letters indicate similar parts in the different drawings.

A. is the framework of the lathe on which the movable parts are mounted. It is to be understood that the revolution of the cutter arbors is brought about independently of the operation of the lathe itself and that the chuck-carrying-reel is normally stationary, the chucks which hold the material upon which the work is performed being the only ones in motion. The turning of the chuck-carrying-reel itself when required is done by hand.

All the operations of the machine except the revolution of the cutter arbors and the loading, unloading, and turning of the chuck-carrying reel, are brought about by the pulley B, on main shaft $a$, driven by belting from a source of power not shown. The main shaft $a$ is journaled in suitable bearings in the frame-work A and is provided with a clutch C by means of which the pulley B is brought into or out of action to clutch or release the shaft $a$. The clutch C is operated from the forward end of the machine by the handle $b$, (see Fig. 1) which is pivoted at $c$ to the frame-work A and connected by the pin $c'$ to the yoke-bar $c^2$, which extends rearwardly under the shaft $a$, as shown in Fig. 2, to the clutch C.

From the main shaft $a$, motion is communicated to two reciprocating bed plates D′, E′ (see Fig. 1) through a duplicate system of multiple gearing, about to be described. The bed-plate D′ reciprocates horizontally and the bed-plate E′ reciprocates vertically, and therefore one can approach the side of the chuck-carrying reel while the other may come up from below to the bottom of the chuck-carrying reel. Each of these reciprocating bed-plates, D′, E′, carries a revolving cutter arbor which, as before stated, is revolved independently from a source of power not shown. As my improved double arbor lathe is intended more particularly for what is known as polygonal work, in distinction from ordinary round work, it is important to impart a variable speed of reciprocation to the two bed-plates, corresponding to the number of sides to be given to the material to be turned on the lathe at the time.

It is, of course, well known that the number of sides given to the work in polygonal turning where the material revolves continuously, will depend upon the ratio of revolutions of the cutting tool to the reciprocations of the machinery employed in cutting. This may be done in two ways, by imparting the proportionate reciprocation to the tool carriage and leaving the work carriage stationary, or imparting the reciprocation to the work carriage and letting the cutter arbor revolve in a fixed position. In my improved double arbor lathe I have preferred to reciprocate the cutter arbor and let the work-carrying chuck remain stationary.

Although the two bed plates D′, E′, are practically alike in themselves and in the devices carried by or connected with them or their operation, so that a description of one should answer for both, I will describe them separately in view of the possibility of confusion arising from the fact that in one case the devices work horizontally and in the other vertically.

The bed-plate D′, then slides on a track $d'$ mounted on the frame-work A and carries the cutter arbor F, mounted in the journal boxes $d$, $d$, supported in standards adjustably mounted upon the bed plate D′, and only two cutters $e$, $e$, are shown for sake of clearness. The number of cutters employed at any one time will, of course, vary with the length of the object to be cut and will be arranged successively along the arbor in positions to conform to the outline desired for the finished work.

The cutter arbor F, derives its rotation by means of the pulley B′ from a source of power not shown and is adapted to lift out bodily or be set in the journal boxes $d$, $d$, so that a fresh arbor with new knives properly arranged can be substituted while the old knives are being sharpened or re-arranged. To permit this the journal boxes $d$, $d$, have a hinged lid $f$ which is held down by the lever catch $g$ (see Fig. 1) the upper end of which fits over the edge of the lid. By throwing back the lever catch the lid is free to rise to permit the removal of the cutter arbor as shown in dotted lines in Fig. 1. The cutter arbor F′, derives its rotation by means of the pulley $B^2$, and has boxes $d^2$ $d^2$, with lids $f'$ $f'$ and catches $g'$ $g'$, as just described for cutter arbor F.

The point to which the cutters $e$, $e$, are allowed to approach the material to be cut and consequently the depth of cut made by the revolving cutters are determined and controlled by the operator by means of hand-wheels as will be hereafter explained, which communicate a forward and back feed of the standards carrying the journal boxes and cutter arbor on the surface of the reciprocating bed-plate in the usual manner, but the to and fro motion of the bed-plate itself is automatically brought about by the mechanism of the lathe itself as follows:—The main-shaft $a$ carries at each end a small pinion G which meshes with the toothed gear G′ mounted on an adjustable shaft $a'$ (see Fig. 3) mounted in the slot $h$ of the swinging arm-bearing H, loosely mounted on the main-shaft $a$ and adjustably connected with the frame-work A to permit lateral adjustment by means of the slot $H^2$ and pin $H^3$ which pin is set in the frame-work. While I have not thought it necessary to show the pinion G and this adjustable bearing in duplicate because they are the same at both ends of the lathe, it will be understood that the object of this duplicate transmission of power from the main-shaft $a$ is to secure steadiness and freedom from avoidable jar on the part of the reciprocating bed-plates D′, E′.

The gear G′ is constant but coupled with it on the same shaft is the interchangeable gear $G^2$, which meshes with the cam driving gear $G^3$ on the cam shaft $a^2$, journaled in the frame-work A and which is made interchangeable in order to permit changes in the reciprocations of the bed-plate.

The gear $G^1$ is shown in the drawing as of the same size as $G^2$, but when it is desired to change the number of reciprocations of the bed-plate D′ and E′ relatively to the revolutions of the chuck carrying reel, the interchangeable gear $G^2$ is removed and another gear substituted of a different size and therefore bearing a different ratio to the number of teeth of the gear $G^3$. The shaft $a^2$ is made in duplicate, that is, there are two shafts $a^2$, alined with each other and running from the two ends of the machine toward each other, but not meeting. One of these alined shafts communicates motion to the bed-plate D′ and the other to the bed-plate E′. So that thus far the description of the mechanism operated from the main-shaft applies to both bed-plates.

I, I′, are cams which control the reciprocation of the bed-plate E′ and D′ respectively being mounted respectively on the inner ends of the alined shafts $a^2$ $a^2$ near the center of the machine.

The rocking-arm J which reciprocates the bed-plate D′ is operated by the cam I, (see Fig. 3) and is mounted on the rock-shaft $j$ which turns in the journal box $k$ secured to the frame-work A. The rocking arm carries at its outer end a roller $l$ which is held constantly against the periphery of the cam I by a spring $m'$ which is fastened to a fixed support.

On a crank extension of the rock shaft $j$ is adjustably mounted a link K as more particularly shown in Figs. 8 and 9. The outer end of the link K is pivoted to a lug L projecting from the bottom of the bed plate D′ and by the forward and back stroke communicated by the link the cutters $e$, $e$, are brought into and out of position to act upon the material in the wood-carrying chuck.

The adjustability of the stroke is secured as follows: Instead of being mounted directly on the rock-shaft $j$ the link K is mounted on a spud $k^2$ projecting from a bearing block $n$ through a slot $o$ in a hollow bearing-box $o^2$ keyed to the rock-shaft $j$ by the key $o^3$ as shown best in Fig. 9. Through the bearing block $n$ is threaded the adjusting screw $p$ which passes through the end of the box $o^2$. By turning this adjusting screw the bearing block $n$ may be raised or lowered in the hollow bearing box and thus the spud $k^2$ which serves as the pivot on which the link K hangs may be shifted to various positions relatively to the axis of the rock-shaft $j$. The amount of throw given to the link and therefore the amount of the stroke communicated to the bed-plate will obviously depend upon the distance which the spud $k^2$ is from the axis of the rock shaft $j$. When the adjusting screw $p$ is so set that the spud $k^2$ corresponds with the axis of the rock shaft the parts are at a dead center and no reciprocation would be imparted to the bed-plate and therefore the cutter $e'$ if in contact with the wood would simply produce ordinary round work, thereby acting only as a stationary cutter pressing against a revolving object.

When the adjusting screw $p$ is so turned that the spud $k^2$ is farthest out of line with the axis of the rock-shaft $j$ the bed-plate E will have its maximum slide and the effect of the cutter upon the work will be to produce a concave outline. When the adjusting screw is turned to bring the spud toward the axis of the rock shaft the concavity diminishes until it becomes neutral at which point the effect upon the work is to produce flat or straight sides. By turning the screw beyond the neutral point the cut produced begins to become convex and this convexity increases as the block continues to approach the center of the axis of the rock-shaft until it merges into a circle or round work when the center of the axis is reached as before stated.

It does not seem to me necessary to repeat this description as applied to the vertically reciprocating bed-plate E′, as it will be readily understood that the action in the two cases is substantially the same. The mechanism employed is the cam I′, rocking-arm J′, rock-shaft $j'$, journal box $k'$, roller $l'$, spring $m'$, link K′, lug L′, cutter arbor F′, cutters $e'$, $e'$, boxes $d'$, $d'$, lids $f'$, $f'$, lever-catches $g'$, $g'$, spud $k^2$, bearing-block $n$, slot $o$, bearing-box $o^2$, key $o^3$, adjusting screw $p$, respectively similar to those above-described for bed plate D′.

As before stated, the distance to which the cutters are allowed to penetrate towards the center of the wood or other material worked upon, is controlled by the operative by hand. For bed-plate D′ he uses hand-wheel W, (see Fig. 2) which is mounted on the shaft $a^8$, journaled in boxes on the bed-plate D′, and carrying a gear $G^{11}$, (beveled) at each end of the shaft. These beveled gear $G^{11}$, $G^{11}$, engage beveled gear $G^{13}$, $G^{13}$, which are mounted upon feed screws $v$, $v$, journaled in boxes mounted in standards $d^3$ on the bed-plate D′. The inner ends of these feed-screws $v$, $v$, are threaded into the boxes $d$—$d$ which support the cutter arbor F and the turning of said screws feed said boxes either towards or away from the work as the operator may desire.

For controlling the cutters on bed-plate E′, the operative uses hand-wheel W′, (see Figs. 1 and 3) which is mounted on the shaft $a^9$, journaled in boxes on the bed-plate E′, and carrying at each end of the shaft a beveled gear $G^{12}$. The beveled gear $G^{12}$, $G^{12}$, engage beveled gear $G^{14}$, $G^{14}$, which are mounted upon feed screws $v'$, $v'$, journaled in boxes on the bed-plate E′ and with their inner ends threaded into the boxes $d^2$, $d^2$, which support the cutter arbor F′ with its cutters $e'$, $e'$, and by turning the hand wheel in either direction the said boxes are fed towards or away from the work as desired.

As before stated, in polygonal turning the number of sides to be given to the work can be pre-determined by establishing a fixed ratio between the number of reciprocations of the cutter arbor to the speed of revolution of the material to be turned. The cutter arbor revolves very rapidly but the wood or other material to be turned revolves with comparative slowness. Taking the rotation of the wood as one, an oval contour will result by having the cutter arbor move forward and back twice for every revolution of the wood. A triangle will result if the cutter arbor moves forward and back three times for each revolution of the wood. A square, for four times; a pentagon for five times and so forth. This pre-determination is brought about in my improved lathe by interchanging the gears $G^2$ $G^3$ so that the number of reciprocations imparted to the cutter bed plate through the cam is the desired multiple of the revolutions of the wood brought about by the mechanism about to be described. This interchanging of gears would be readily understood; the larger the number of teeth of the wheel $G^2$ compared with that of $G^3$ the higher will be the speed of the cam shafts $a^2$ as compared with that of the main shaft $a$ from which the wood derives a fixed speed.

Having now described the cutting devices and the mechanism by which their action is brought about and controlled I will now describe the mechanism which carries and controls the material upon which the work is to be performed by said cutting devices.

The main shaft $a$ carries near the forward end a gear $G^4$ which meshes with the gear $G^5$ keyed on a parallel shaft $a^3$, journaled in the frame-work A. This shaft $a^3$ carries at its forward end a beveled gear $G^6$ which engages a beveled gear $G^7$ at the lower end of the inclined worm-shaft $a^4$ which is journaled in bearings on the frame-work A and carries at its upper end a worm M which engages the worm-wheel N on a shaft $a^5$ journaled in the frame-work A. By means of this mechanism power is brought up from the main-shaft $a$ which is set comparatively low in the lathe to a convenient height of distribution to the two chucks of the chuck carrying reel, which it is necessary to turn to revolve the wood or other material to be worked upon. The shaft $a^5$ also carries a toothed gear $G^8$, which meshes with two gears $G^9$ and $G^{10}$ which are mounted respectively on short shafts $a^6$ and $a^7$ which are journaled in the upper part of the frame-work A, opposite the end of the chuck carrying reel O. Each of these shafts carries on its inner end a tongued disk O′, see Fig. 5 the tongue $o^7$ serving to engage the chucks in turn. The two chucks thus engaged are caused to revolve by the gear wheels while the other two chucks are idle.

The reel O is mounted on a shaft $a^{10}$, which is journaled in the frame-work A and, while ordinarily stationary, is turned when desired by the hand wheel P. This reel O consists of two fixed disks $p^2$, $p^3$, and a movable disk $p^4$. These disks are bolted together by the screw-bolts $q$, $q$, by means of which also the movable disk $p^4$, is fed along in one direction or the other according to the length of the material to be held in the chuck, said movable disk thus serving as a tail-plate for all of the chucks. This reel preferably carries four chucks, consisting of the tail pieces Q, Q, which are mounted, revolubly, in the movable disk $p^4$, and of the head-stocks R, R, which are revolubly mounted in the disk $p^3$, through which they project forward enough to present a curved channel or groove $r$, see Fig. 10 on the forward side of the reel and facing the gears $G^9$ and $G^{10}$ above-mentioned. This groove $r$ is concentric with the periphery of the reel disk and is intended to receive the curved tongue $o^7$ (see Fig. 10) on the inner end of the shaft $a^6$ and $a^7$. When this groove and tongue are interlocked the revolution of the shafts is communicated to the chucks with the grooves of which engagement has been made while the other chucks remain idle.

To insure the proper interlocking of these devices I provide, in front of the reel, see Fig. 5 a circular guide-plate S, the inner side of which is provided with projecting curved flanges $s$ $s$ which extend peripherally around the plate except at the points corresponding to the inner, lower and outer chucks. The chucks are therefore prevented from turning on their axis while passing from one position to another and the upper chuck is always prevented from turning by the guide flange. I also provide a locking device for the reel to hold it against any lateral slipping when the chucks are revolving. This consists of a hinged arm T, pivoted to the guide plate at $t$, and provided with a curved opening $t'$, which, as shown in Fig. 5, fits over the upper chuck disk and effectually prevents any turning of the reel. A set-screw $t^2$, is provided passing through a curved slot $t^3$ in plate T′ secured to the arm T, and engaging a threaded opening in the guide plate S, which may be used to bind the locking arm T, whether raised above the plate to permit the turning of the reel as shown in Fig. 3, or lowered upon the chuck to prevent the turning as shown in Figs. 1 and 5. To enable the operative to see just when to stop the machine, which must be when the chucks are in engagement with the tongue, I provide see Fig. 2 an indicating device which consists of a pointer $u$ on the tongue disk at the inner end of the shaft $a^6$, and a line $u'$, upon the periphery of the grooved chuck disk which pointer and line can only come into alinement when the two chucks are in proper position to be engaged by the tongues.

It will be noted that the chuck carrying reel is mounted in bearings at the upper corner of the frame A with its shaft $a^{10}$ in the horizontal plane of travel of the shaft of cutter F, and in the vertical plane of travel of the shaft of cutter F′, and that the apertures of guide plate S are so spaced apart and the locking lever T so positioned, that the cutting thrust on the work from both cutters is exerted in line with the reel shaft, thus reducing to a minimum the tendency of the parts to jar and rack when the cutters are brought to their work. At the same time the forward chuck is presented in convenient position for the attendant to remove the finished work and insert a blank in the chuck, while the fourth chuck is in convenient position for engagement by the lever T which holds the reel stationary when the cutters are in operation. Also, the bed-plates D′ and E′ which carry the adjustable slides D and E carrying the cutters, being mounted to reciprocate in or on ways directly on the horizontal and vertical faces of the machine frame gives steadiness to their movement, and lends to the avoidance of hurtful vibrations to the reel, chucks, and cutters.

I claim

1. In a double arbor lathe, the combination of bed plates reciprocating in ways on the horizontal and vertical faces of the machine frame, cutters adjustably supported on said bed-plates, a chuck-carrying reel mounted in bearings of the frame with its shaft in the horizontal and vertical planes of travel of the cutters, a plurality of chucks carried by the reel, and a lock to hold the reel from movement when the appropriate chuck is in the plane of travel of a cutter.

2. In a double arbor lathe, the combination of bed-plates reciprocating in ways on the horizontal and vertical faces of the frame, cutters adjustably supported on said bed-plates, a chuck-carrying reel mounted in bearings of the frame, its shaft being in the horizontal and vertical planes of travel of the cutters, chucks carried by the reel, a fixed guide plate having guide openings at points in said plane of travel of the cutters, and a locking lever to engage an idle chuck and hold the reel rigid during the operation of the cutters.

3. In a double arbor lathe, the combination with cutters adapted for horizontal and vertical reciprocation in planes at right angles to each other, a chuck-carrying reel mounted in bearings in the frame with its shaft in the horizontal, and vertical plane of travel of the cutters, four chucks symmetrically spaced apart carried by the reel, a guide plate secured to the frame and provided with two guide openings in the horizontal and one guide opening in the vertical plane of travel of the cutters, and a locking lever having a notch positioned to engage the idle chuck of the reel when the other chucks of the reel are opposite the openings of the guide plate.

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