(No Model.) 8 Sheets—Sheet 1.

J. H. REED.

MACHINE FOR TURNING LASTS, &c.

No. 580,531. Patented Apr. 13, 1897.

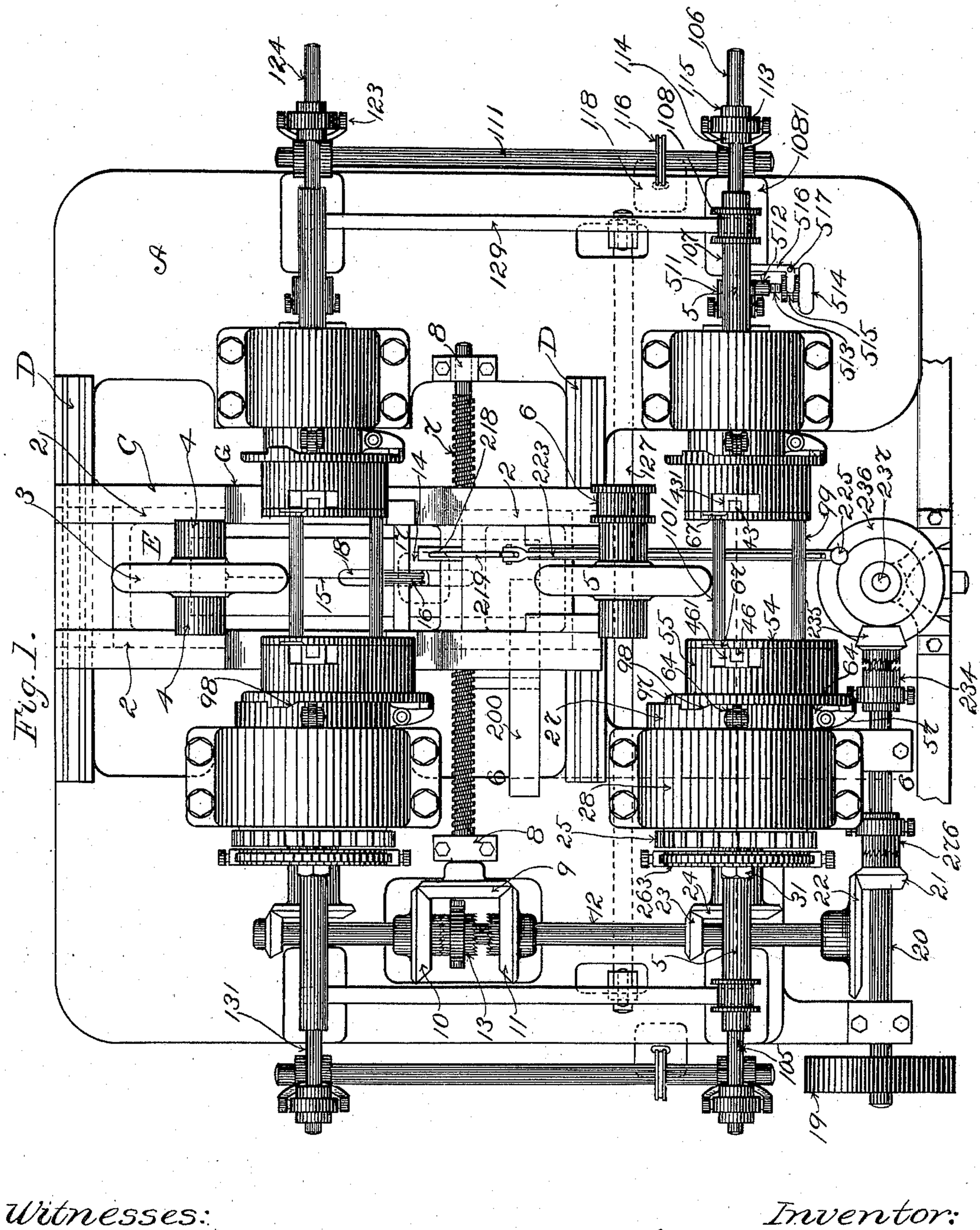

Fig. 1.

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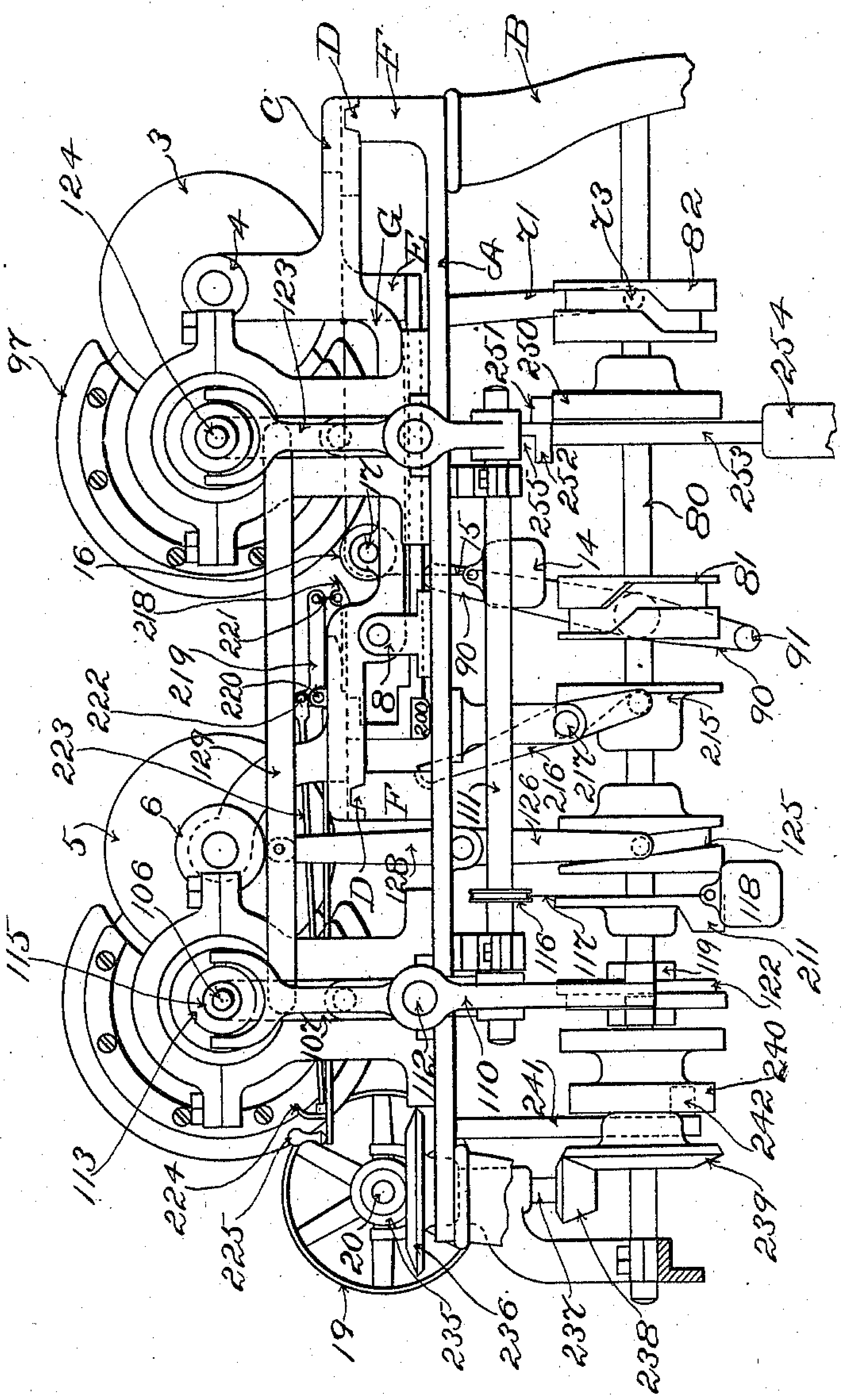

Fig. 2.

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Fig. 3.

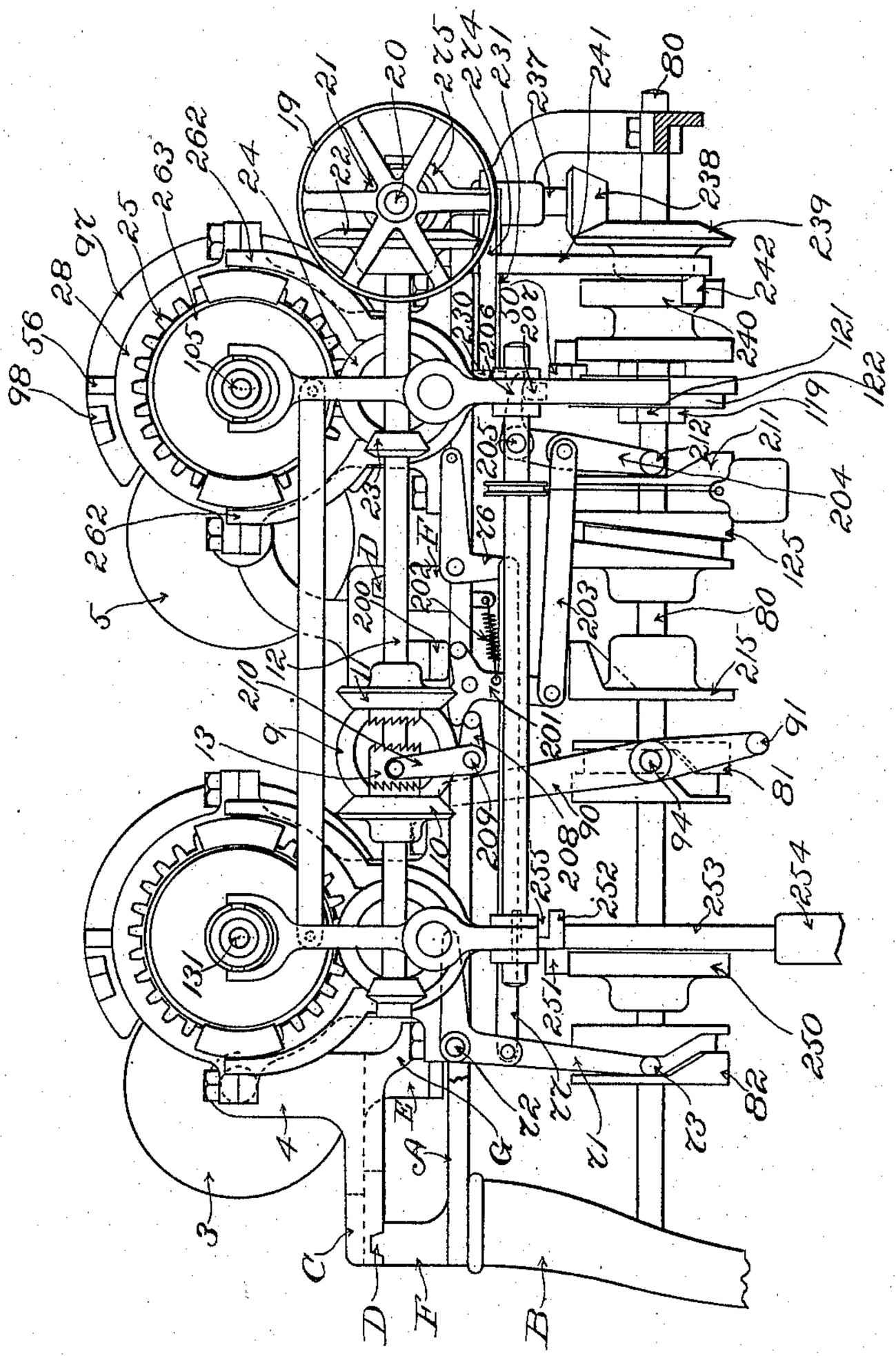

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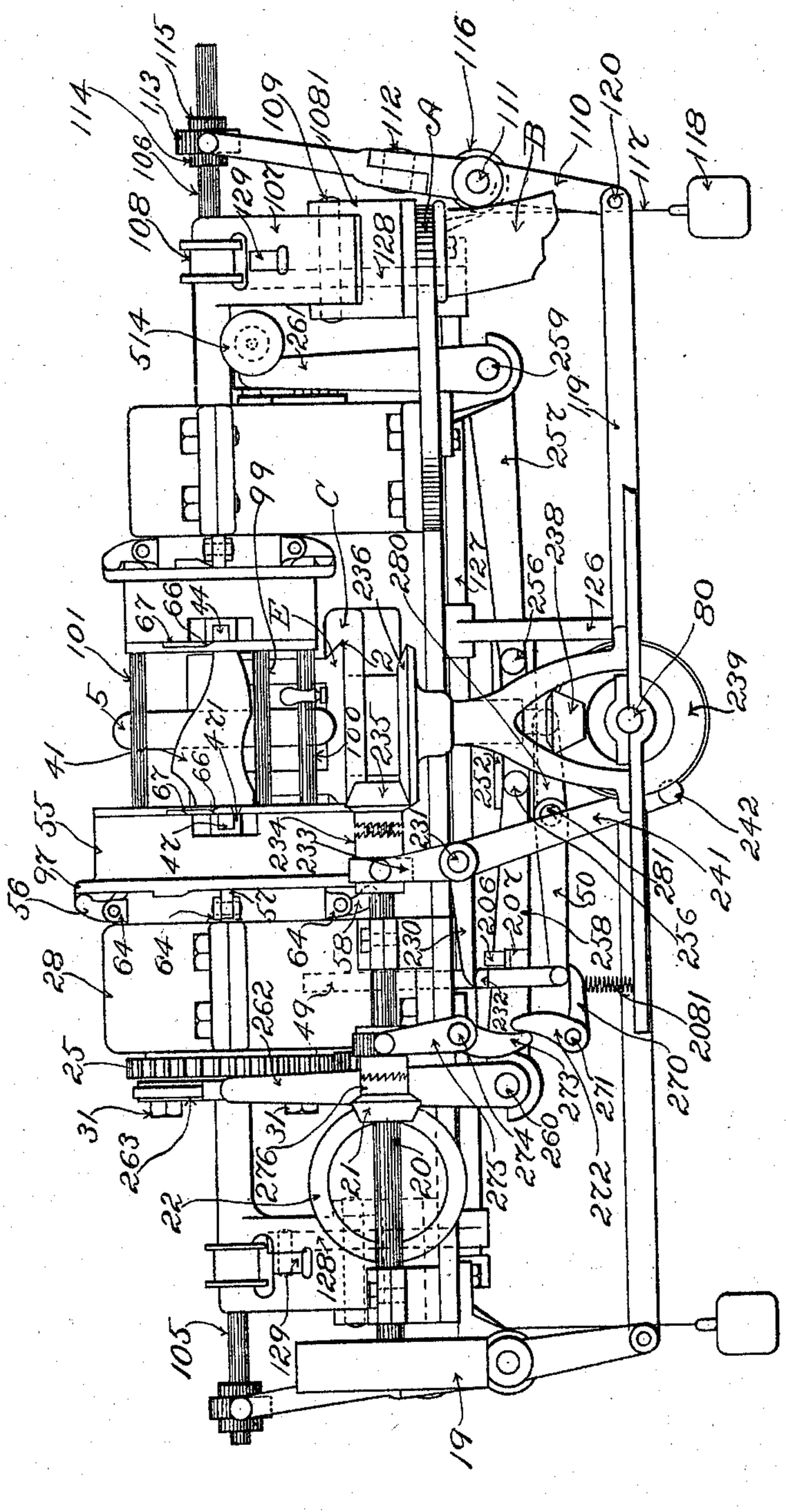
Fig. 4.



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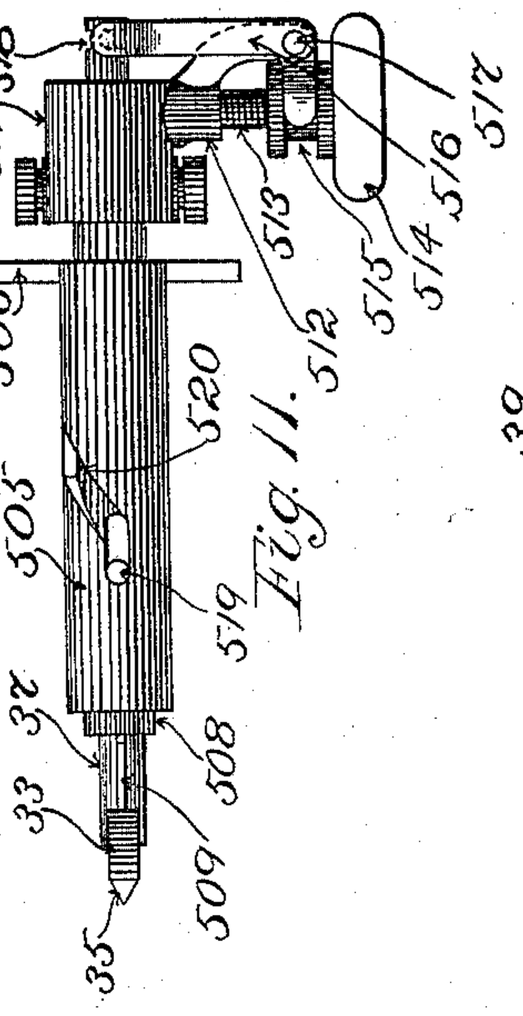

Fig. 11.

Fig. 5.

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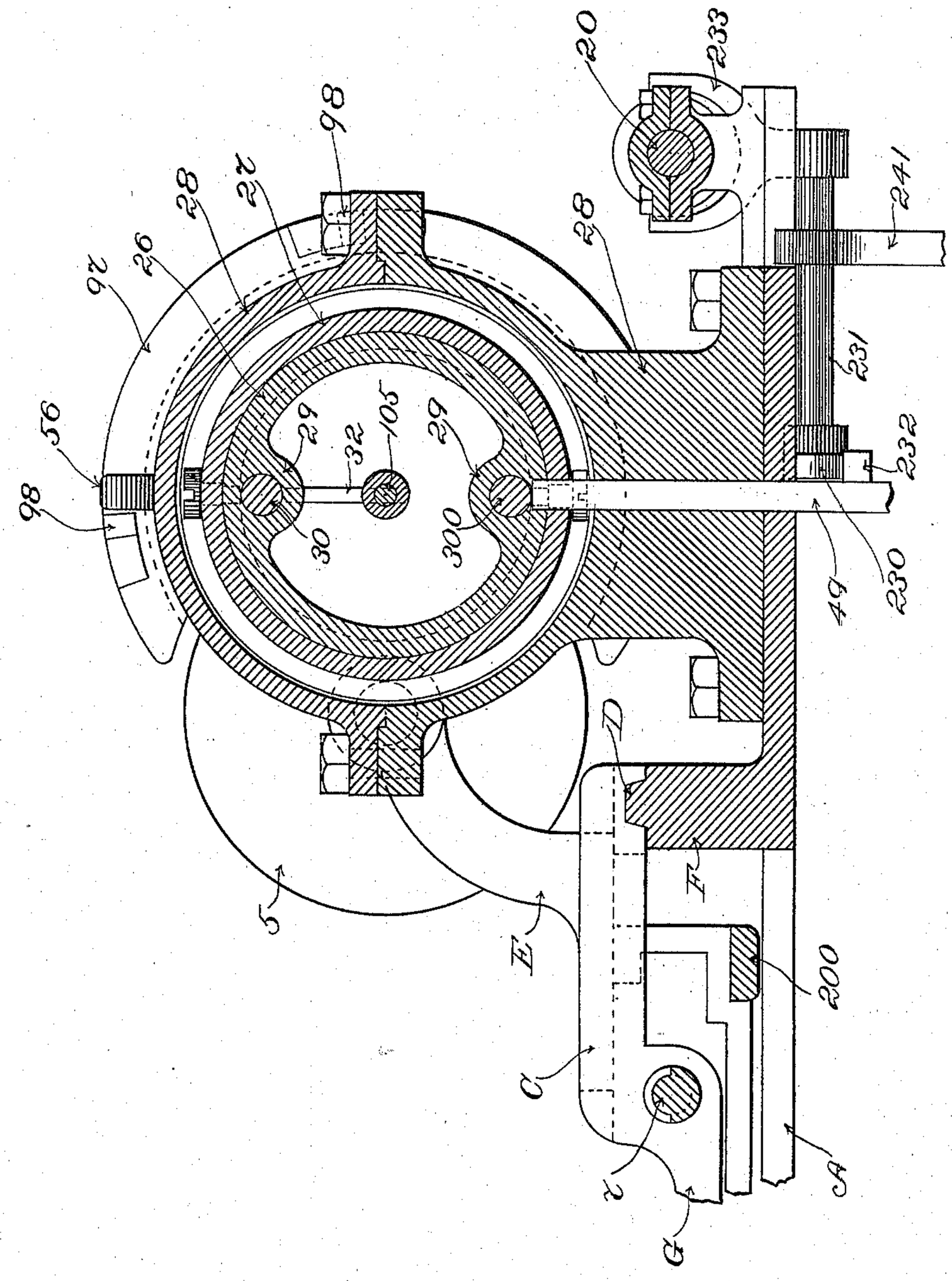
Fig. 6.



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MACHINE FOR TURNING LASTS, &c.

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Fig. 8

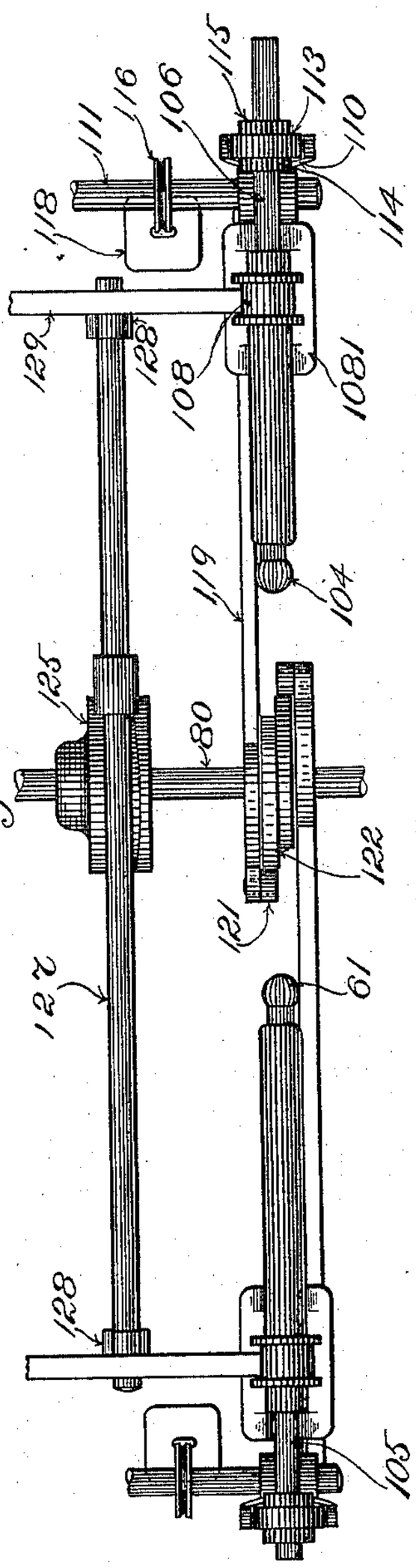
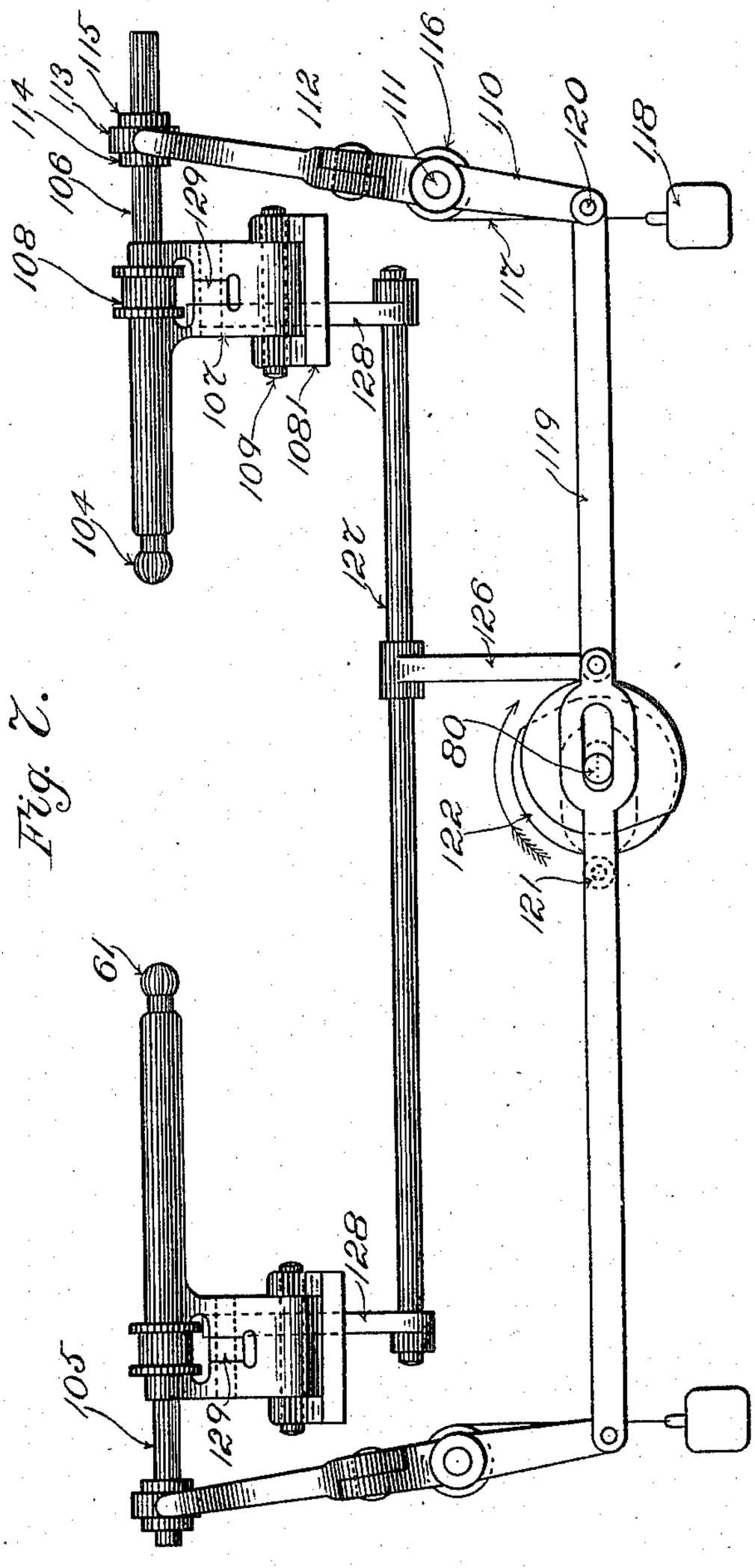


Fig. 7.



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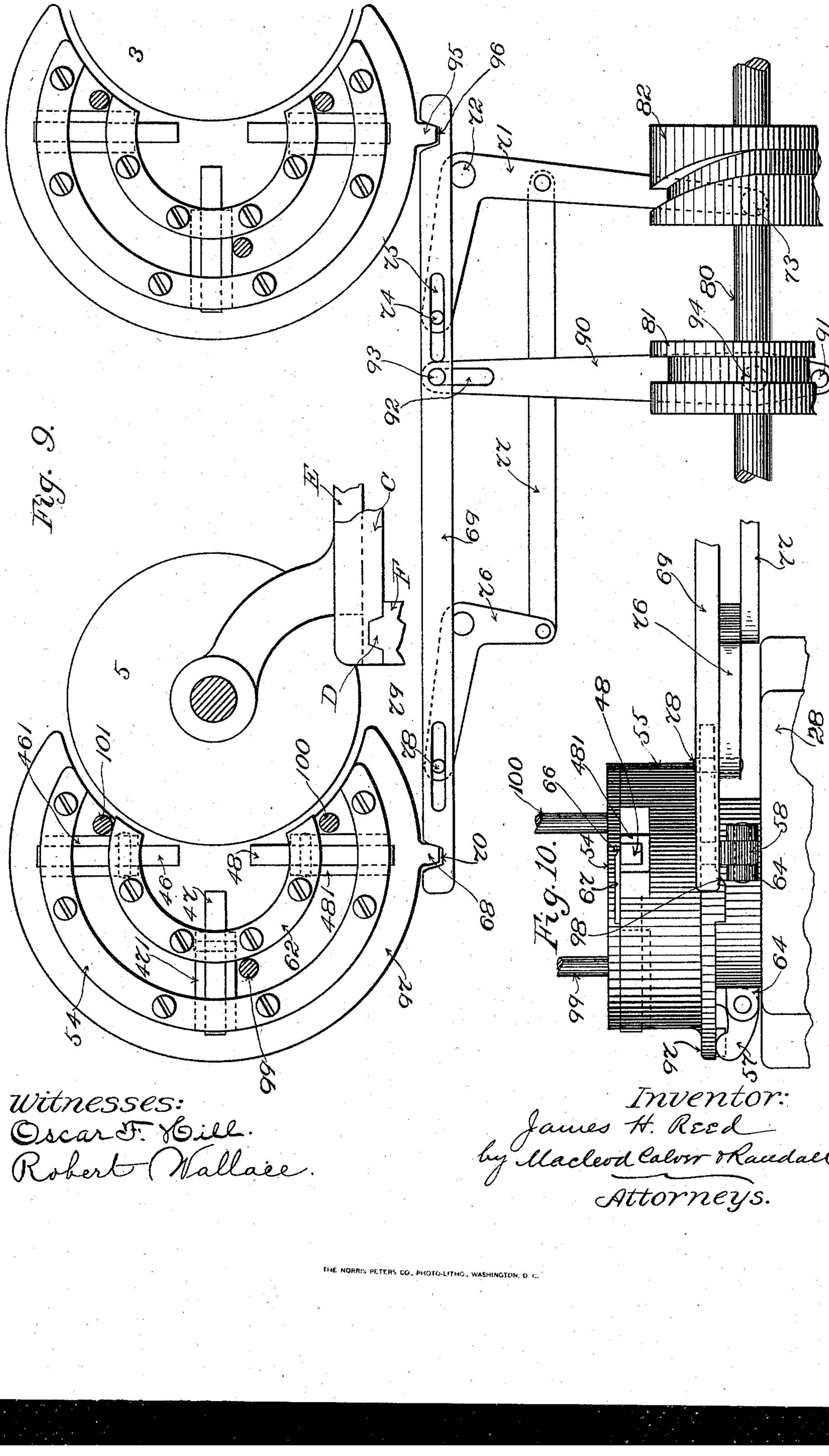

Fig. 9.

Fig. 10.

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UNITED STATES PATENT OFFICE.

JAMES H. REED, OF LYNN, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO WILLIAM H. BAKER, OF SAME PLACE.

MACHINE FOR TURNING LASTS, &c.

SPECIFICATION forming part of Letters Patent No. 580,531, dated April 13, 1897.

Application filed July 24, 1896. Serial No. 600,356. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. REED, a citizen of the United States, residing at Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Machines for Turning Lasts, &c., of which the following is a specification, reference being had therein to the accompanying drawings.

My invention has for its object to provide an improved machine for turning or forming articles of wood which have an irregular shape—such, for example, as lasts for boots or shoes—which shall operate automatically and continuously without the intervention of hand labor to form or shape the last or other articles from a blank to the exact shape required.

My invention is fully set forth in the following description, and the novel features thereof are pointed out and clearly defined in the claims at the end of the specification.

In the accompanying drawings, Figure 1 is a plan view from above of a machine embodying my invention. Fig. 2 is an end elevation of the machine shown in Fig. 1, viewed from the right of said figure. Fig. 3 is a similar view from the left of said Fig. 1. Fig. 4 is a front elevation of the same. Fig. 5 is a section on line 5 5 of Fig. 1, showing the last in position, as also the last-holding mechanism and cutters. Fig. 6 is a section on line 6 6 of Fig. 1. Figs. 7 and 8 are details showing in side elevation and plan, respectively, the finishing-cutters and their operating mechanism. Fig. 9 is a detail, on a larger scale, of the supplementary holding mechanism and its operating means. Fig. 10 is a plan view from below of a supplementary holding device and its operating mechanism shown at the left of Fig. 9. Fig. 11 is a plan view of the cylindrical support shown in Fig. 5.

In the manufacture of wooden articles of irregular shape, as, for example, lasts for boots or shoes, the mechanism now in use, so far as known to me, while adapted to turn or form the last from the blank or block of wood from a point near the toe to a point near the heel, is not adapted to finish the last. By the present methods, after the machine has formed the last along the sides and top and sole to a point near the heel and top thereof, the unfinished last thus produced is taken out of the machine and the heel and toe portions thereof finished by hand. Since it is very essential that the heel and toe portions of the last be accurately formed, so as to coincide in all respects with the model, the operation of finishing the last by hand is comparatively slow and expensive and requires skilled labor. By the machine hereinafter described, which embodies my present invention, I am enabled not only to finish the sides and top and sole of the last, but also to finish the heel and toe thereof, forming them on exactly the lines of the model, the entire operation from the placing of the block of wood in the machine to the production of a finished last being automatic and continuous and not requiring throughout any portion thereof the employment of hand labor or the direction or supervision of a skilled operator.

Having reference to the drawings, A is a table, provided with suitable legs B, by means of which it is supported. On the table A is mounted a sliding carriage C, which is adapted to slide on ways D, supported by the table A and located at each end of the said carriage C. The carriage C carries a sliding plate E, which is adapted to slide in ways 2 on the carriage C. By this arrangement the carriage C is permitted to have a lateral movement and the sliding plate E on the carriage C a transverse movement. The sliding plate E carries toward one end thereof a follower 3, which is mounted in suitable bearings 4 on said plate E. The follower 3 is of the wheel or disk shape shown, the periphery of the said disk being rounded or curved in cross-section. The follower 3 is in contact with the form or pattern which is to be duplicated out of the block of wood upon which the cutter hereinafter described operates. If it be a last for boots or shoes which is being formed, the pattern-last will be in contact with the follower 3, the said pattern being held rigidly in the holding mechanism hereinafter described which is adjacent the said follower 3. It will be apparent that the lateral movement of the carriage C and transverse movement of the sliding plate E will permit the follower 3 to be brought into con-

tact with all portions of the revolving pattern from a point very near the toe to a point very near the heel thereof. At the other end of the sliding plate E, I provide a cutter 5, also mounted on said table in a manner similar to that in which the follower 3 is mounted. The cutter 5 is preferably of the same disk or wheel shape as the follower, and is provided at its periphery with a series of knives or cutters, so that as the cutter 5 is rotated in the same relative position with reference to the long axis of the block from which the last is to be formed that the follower 3 occupies with reference to the long axis of the pattern-last the block will be cut or turned to the same shape as the pattern, the said follower 3 and said cutter 5 being given the same movement relatively to the pattern and block of wood, respectively.

For the purpose of rotating the cutter 5 the shaft of the said cutter is provided with a belt-pulley 6, through which power is independently applied to rotate the said cutter 5. For the purpose of moving the carriage C laterally with reference to the table A, I provide a screw 7, which is mounted in bearings 8 on the table A, and which passes through a threaded hole on the under side of the carriage C. At one end of the said screw-shaft 7 is secured a beveled gear 9, which is in mesh with the beveled gears 10 and 11, which are mounted on the shaft 12. The beveled gears 10 and 11 are alternately clutched to the shaft 12 and are alternately free on the said shaft 12—that is, when one of said gears is engaged by the clutch and caused to revolve with the said shaft 12 the other of said gears revolves loosely on said shaft. In this way the screw-shaft 7 may be caused to rotate in either direction and the carriage C be caused to travel in either direction on the table A. The clutch 13 may be thrown into or out of contact with either of the gears 10 and 11, and thus the direction of rotation of the shaft 7 changed. The mechanism for operating the clutch 13 will be hereinafter described.

For the purpose of holding the follower 3, which it will be understood is an idler, in contact with the pattern I employ a weight 14, which is suspended on a cord 15, (see Fig. 2,) which passes over a pulley 16, mounted on a shaft 17, journaled in bearings on the carriage C. The cord thence passes rearwardly to a point on the slide E beneath the said idler 3. Directly beneath the pulley 16 a slot 18 is formed in the slide E, so that the said slide E may move transversely relatively to the table A without interfering with the cord 15. By this means the idler 3 is held against the pattern, and the cutter 5 is brought to proper position relatively to the blank. As will be seen from an examination of Fig. 2, the ends of the carriage C are located above the table A, the ways D, upon which said carriage C slides, being formed on the upper edges of upwardly-projecting portions F, formed integrally with or resting upon the table A at each end of the said carriage C. The central portion of the carriage C is depressed or curved downwardly, as shown at G, Fig. 2, the object of thus forming the carriage C being to permit it to pass under the revolving heads (hereinafter referred to) which carry the pattern. It will also be noted that what I have termed the "sliding" plate E is in the same manner curved downwardly, freeing the central portion thereof. The weight 14, above described, operates to pull the sliding plate E forward, and thus to hold the follower 3 in contact with the pattern at all times, and it also serves, as above stated, to hold the cutter 5 in proper position with reference to the blank or block of wood to produce a last which will be a duplicate of the pattern. The pattern and block from which said last is to be formed are both rotated on their long axes, and I will now describe the mechanism by means of which a rotary movement is communicated to the heads which carry the pattern and block, respectively, and will then describe the construction and operation of the said heads.

The driving-pulley by means of which the machine is driven is shown at 19, Fig. 1. Said pulley is fast on a shaft 20, mounted in suitable supports secured to the table A. A beveled pinion 21 on said shaft 20 is in mesh with a beveled gear 22, which is mounted on the shaft 12. A beveled pinion 23 on said shaft 12 is in mesh with the beveled gear 24, mounted on a stud secured to the housing 28. The said stud also carries a gear which is in mesh with a gear 25, formed at one end of the cylinder 26. (See Fig. 5.) The cylinder 26, during some portions of the operation of the machine, revolves inside the sleeve 27, which at such times forms a bearing for said cylinder 26, and during other portions of the operation of the machine the said cylinder 26 and sleeve 27 revolve together in the housing 28, which is mounted on the table A. The cylinder or head 26 revolves inside the sleeve 27, the latter being stationary during the time the cutter 5 is operating to shape the sides and top and sole of the last—that is, all portions of the last between the heel and toe thereof.

The cylinder or head 26 is thickened at two portions of the circumference thereof, as shown at 29, Figs. 5 and 6. At each of these thickened portions a hole is formed from end to end of said cylinder. One of said holes forms a bearing for the shaft or rod 30 and the other a bearing for the rod 300. The said rod 30 is adapted to slide endwise and is provided in its inner end with an arm 32, which projects downwardly and is curved at its lower end, as shown in Fig. 5. Said lower end is provided with preferably two or more sharpened projections or teeth 34, which engage the end of the blank 41 and hold the same centrally with reference to the cylinder 26. In this way the long axis of the blank is coincident with the axis of rotation of the cylin-

der, the two revolving together while the sides, top, and sole of the last are being formed. The opposite end of the blank is engaged by a conical projection 35 at the inwardly-curved end of an arm 33, which is formed on the rod 37. When the supplementary holding devices, consisting of the radial arms 46, 47, and 48 at one end of the blank and 43, 44, and 45 at the other end thereof, are brought into contact with the blank the rod and arm 32 are withdrawn, the rod 30 moved endwise in its bearing, and the teeth 34 are moved out of engagement with the blank. When this endwise movement of the rod 30 occurs, the rod is at the same time partially rotated by means of a pin 301, which is set in the said rod and which engages a curved slot or recess 302 in the bearing. By this means the arm 32 is moved rearwardly as the rod 30 is moved endwise, and the end of the blank with which the teeth 34 were in engagement is uncovered, so that the cutter 61 may be brought into contact therewith to finish the said end. At the same time that the endwise movement of the rod 30 occurs the rod 300 is also moved endwise, the ends of both said rods being passed through holes in the ring 263 and being provided with nuts 31 outside said ring. The rod 300 is slotted, as shown at 500, and in said slot is placed a pivoted dog 501. Beneath the free end of said dog the cylinder 26 is slotted and the sleeve 27 is provided with a recess 502. As the said rod 300 is moved endwise away from the blank 41 gravity will cause the free end of the dog 501 to drop downwardly through the slot in the cylinder 26 and into the recess 502 in the sleeve 27, thus locking the said cylinder and sleeve together. As the face of the slot in the cylinder 26 is beveled, the endwise movement of the rod 300 in the opposite direction will operate to withdraw the dog 501 from the recess 502, and the cylinder 26 will then be unlocked and may move independently of the sleeve 27. The endwise movement of the rods 30 and 300 is obtained by means of a forked lever which engages the ring 263 and which is operated from a cam-shaft underneath the table of the machine. The said forked lever and its connections will be hereinafter described. The rod 37 and arm 33, which engage the opposite end of the blank 41, are similar in construction and operation to the rod 30 and arm 32. The said rod 37 is mounted in a cylindrical support 505, having a downwardly-projecting secured portion 506, by means of which it is secured by bolts 507 to the housing 40.

Intermediate the cylindrical support 505 and the rod 37 is placed a sleeve 508, the said rod 37 being secured to the said sleeve 508 by means of a spline 509. The sleeve 508 is provided at its outer end with an annular projection or flange 510, which fits within a cylindrical housing 511. The said housing 511 is provided at one side with a boss 512, which is threaded to receive a screw 513, to which is secured the hand-wheel 514, having a boss with an annular groove 515. (See Fig. 11.) A bell-crank 516, which is pivoted at 517 to a suitable support from the housing 511, is in engagement at one end with the annular groove 515, the said end being forked to engage said annular groove at opposite sides, the other end of the bell-crank engaging an annular groove 518 in the end of the rod 37. By these means, as the hand-wheel 514 is turned, the rod 37 may be moved endwise, as will be clear. The rod 37 is provided with a pin 519, which projects through a slot formed lengthwise of the sleeve 508 and engages a curved slot 520 in the cylindrical support 505. When the hand-wheel 514 is turned to withdraw the rod 37, the said rod first moves outwardly endwise until the pin 519 has traversed the slot in the sleeve 508 and the straight portion of the slot 520 in the cylindrical support 505. The pin 519 then follows the slot 520, causing a partial rotation of the rod 37, so that the arm 33 is first moved out of engagement with the end of the blank 41 and is then swung rearwardly to uncover the end of said blank and permit the free operation of the cutter 104. The said cutter 104 may then be moved into contact with the said end of the said blank to finish the same.

When the sides, top, and sole of the last have been formed and it remains to finish the heel and toe portions thereof in order to complete the last, the arms 43, 44, and 45 at the toe of the last and the corresponding arms 46, 47, and 48 at the heel of the last, all of which have been withdrawn during the previously-described operation of the cutter 5, are thrown into contact with the surface of the partially-formed last and are held rigidly in contact therewith in the manner presently to be described. In this way the blank or partially-formed last is rigidly held by the said radial arms before the arms 32 and 33 are withdrawn. It will then revolve in precisely the same position as while the said arms 32 and 33 were in engagement with it.

Immediately before the arms 46, 47, and 48 are brought into contact with the heel of the blank or last which is being formed, the locking-bolt 49 is moved upwardly into the position shown in Fig. 5, in which position it serves to lock the cylinder 26 and sleeve 27 firmly together. It is necessary that the said cylinder 26 and sleeve 27 be locked together and both prevented from revolving while the radial arms 46, 47, and 48 are being brought to a bearing on the blank. As soon as the said radial arms are brought firmly into contact with the blank the locking bolt 49 is withdrawn from the cylinder 26 and sleeve 27. The rods 30 and 300 are then moved endwise, withdrawing the teeth 34 from the blank 41—that is, the said rods are moved toward the left in Fig. 5. As this movement is being accomplished the arm 32, carrying the teeth 34, is moved rearwardly by means of the pin 301 and slot 302, as previously described, uncovering the heel end

of the said blank, so that it may be operated upon by the finishing-cutter 61.

At the inner end of the sleeve 27 is secured a ring or cylinder 55, which encircles the said inner end of said sleeve 27. In the cylinder 55 are formed three radial slots or recesses in which boxes or housings 461, 471, and 481 are placed. In these housings are placed the radial arms 46, 47, and 48, respectively, which are held in place by rings 54 and 62. (Shown more clearly at Fig. 9.) The ring 54 is secured to the cylinder 55, and the ring 62 is secured to the inwardly-projecting flange 63, which is integral with the sleeve 27. The supplementary radial holding-arms 46, 47, and 48, which, together with the arms 43, 44, and 45, serve to hold the blank in position while the heel and toe portions thereof are being finished, are each operated by a bell-crank lever, (shown, respectively, at 56, 57, and 58.) These levers are pivoted to projections or lugs 64 on the sleeve 27, and their inwardly-projecting portions engage the housings of the radial holders or arms 46, 47, and 48, respectively. The arms of said levers which engage the said housings are forced downwardly by springs, (shown at 59,) said springs operating to move the said housings and the arms carried thereby inwardly into contact with the blank or partially-completed last 41. The said radial arms 46, 47, and 48 are each pivoted in its housing, as shown at 65, Fig. 5. This arrangement of pivot permits the inner or contact end of the arm to be swung slightly toward the central portion of the last—that is, permits the inner ends of the arms 46, 47, and 48 to be moved toward the right in Fig. 5. This slight movement toward the central portion of the last causes the said arms to grip the last more securely, since they are forced onto a thicker portion thereof. For the purpose of thus swinging the said radial arms on their pivot 65 I form a recess 67 on the inner edge of the ring 54, (see Fig. 10,) said recess being beveled at one end, as shown at 66. By moving the cylinder 55 slightly the upper ends of the radial arms are forced against the beveled portion 66, causing the said upper portion of the arms to be moved backwardly away from the last and the lower portions thereof to be moved onto the last, as previously described. The ring 54, upon which the bevel 66 is formed, is secured, as previously stated, to the ring or cylinder 55, and the slight movement of the said ring or cylinder, which operates to force the inner ends of the radial holding-arms onto the last, as just described, is effected by means of the mechanism shown in detail in Fig. 9, and is as follows:

At one point on the periphery of the cylinder 55 a tooth or projection 68 is formed, which engages with a horizontal bar or rod 69, a recess 70 being formed near the end of said rod to engage the tooth 68. Since the cylinder 55 revolves with the sleeve 27 and cylinder 26 during one portion of the operation of the machine, the tooth 68 must at this time be out of engagement with the recess 70. It is therefore necessary to provide mechanism to raise and lower the horizontal bar 69 vertically into and out of engagement with the said tooth 68, and it is also necessary to provide mechanism by means of which, when the said bar 69 is in engagement with the said tooth 68, the bar 69 is moved endwise in order to move the cylinder 55 relatively to the sleeve 27, and thus cause the bevel 66 to move onto the radial arms, to tilt the arms, so as to cause their inner ends to ride onto the last and thus grip it more securely. This movement of the bar 69 is obtained from the cam-shaft 80 by means of cams 81 and 82, which are on the said shaft. The vertical movement of the bar 69 is obtained from the cam 82. A bell-crank lever 71 is pivoted at 72 to a suitable projection upon the frame. The lower end of the lever 71 is provided with a cam-roll 73, which engages the cam 82. The upper end of said lever 71 is provided with a pin 74, which engages a slot 75, formed lengthwise of the said bar 69. (Shown in Fig. 9.) As the cam 82 revolves, swinging the lower end of the bell-crank 71, the upper end thereof will be caused to rise and fall, and that end of the bar 69 with which the upper end of said bell-crank 71 engages will also be caused to rise and fall. In order that both ends of the said bar 69 may rise and fall, the bell-crank device is duplicated at the other end of said bar, a bell-crank 76 being employed, the lower end of which is connected with the downwardly-extending portion of the bell-crank 71 by means of a connecting-rod 77. The upper end of the bell-crank 76 is provided with a pin 78, which engages a slot 79, formed lengthwise of the bar 69. It will be clear that by this arrangement the bar 69 may be lowered out of contact with the tooth 68, while the part 55, with which the said tooth is integral, is revolving, and may, when the said part 55 is stationary, be raised so as to cause the notch 70 in said bar to engage the said tooth. For the purpose of causing the said bar 69 to move endwise I provide a lever 90, which is provided at its lower end at 91 to a suitable support, and its upper end is provided with a lengthwise slot 92, which engages a pin 93 on the said bar 69. The lever 90 is provided with a cam-roll 94, which engages the cam 81. The slot 92 at the upper end of the said lever 90 is provided to permit of the vertical movement of the bar 69. In the preceding description of this part of the mechanism I have referred to the tooth 68 and the notch or recess 70, which is shown at the left in Fig. 9. A corresponding tooth 95 and notch or recess 96 are shown at the other end of the bar 69 and have the same operation as the tooth 68 and notch or recess 70 previously described. The said tooth 95 is, however, on the head of that portion of the machine which carries the pattern.

It will be understood that the devices which

hold and carry the pattern are duplicates of and are operated by the same means and simultaneously with the mechanism for carrying and holding the blank from which the last is formed. This will be clear by noting the position of the cutter 5 and follower 3 on Fig. 9. When the radial arms 43, 44, and 45 are freed from the last by the reverse endwise movement of the bar 69, by which the cylinder 55 is moved slightly in the opposite direction from that which it was moved to clamp the said radial arms firmly on the last, the annular projecting portion 97 is also moved, since it is a part of the cylinder 55. This annular projecting portion 97 is provided with beveled faces 98, one for each of the bell-cranks 56, 57, and 58, and as the said cylinder 55 and projection 97 are moved in the reverse direction, freeing the radial arms 46, 47, and 48, the beveled portion 98 engages the upwardly-projecting portion of the bell-crank and forces this upwardly-projecting portion rearwardly or to the left in Fig. 5, causing the arms of said bell-cranks which engage the housings 461, 471, and 481 to be moved outwardly, moving the said housings outwardly, freeing the said radial arms from the contact with the blank and permitting the latter to fall out of the machine. The radial arms and the mechanism for operating them are provided at each end of the blank and also at each end of the pattern and are substantial duplicates of each other—that is to say, there are four sets of such operating-arms, one for each end of the pattern and the other for each end of the blank. The movement of the sleeve 27 is communicated to the sleeve 39 by means of the rods 99, 100, and 101, which extend across in front of the cutter 5 and serve to secure the said sleeves 27 and 39 rigidly together. The cutters which finish the toe and heel of the last, together with the means by which they are operated, are shown more clearly in Figs. 7 and 8. The said cutters 61 and 104 are what are known as "bur-cutters." They are each mounted on a shaft 105 and 106, respectively. These shafts are given two movements, an endwise movement and a movement rearwardly, considered with reference to the front of the machine. The said shafts and the mechanism for actuating them are duplicates, and I will describe one of said shafts and its operating mechanism.

The shaft 106 is mounted in a support 107, which is cut away to accommodate the band-pulley 108, which is splined on said shaft 106 and by means of which power is applied to rotate the said shaft and its cutter from an independent driving-pulley. The support 107 is pivoted in a pillar-block 108′, the pivot being shown at 109. This pivoted arrangement of the support 107 permits the cutter 104 to be moved rearwardly, as previously stated. The movement of the said cutter 104 toward and from the work—that is, the lengthwise movement of the shaft 106—is obtained by means of an arm 110, which is fast on the rock-shaft 111. The upper end of the lever-arm 110 is pivoted at 112 to the lower portion thereof, so as to permit the rearward movement of the shaft 106. The upper end of the lever 110 is forked and is pivoted to a collar 113, loosely mounted on said cutter-shaft 106 and held in place by means of the collars 114 and 115, fast on said shaft.

The shaft 111 is provided with a sheave 116, upon which is wound a cord 117, having suspended from the lower end thereof a weight 118. The said weight tends to turn the shaft 111 to the left, as viewed in Fig. 7, and thus to force the shaft 106 inwardly and to move the lower end of the lever 110 outwardly. A connecting-rod 119 is pivoted at 120 to the lower end of the lever 110, and the opposite end of said connection 119 is provided with a cam-roll 121, which engages the face of the cam 122. The connection 119 is enlarged and slotted, as shown in Fig. 7, the cam-shaft 80 passing through said slot. The weight 118, as will be clear, tends to hold the cam-roll 121 in contact with the cam 122. The inward movement, therefore, of the shaft 106 and cutter 104 is obtained from the weight 118 and the movement in the opposite direction from the cam 122. The cutter 104 therefore has a yielding movement. The shaft 111 extends rearwardly (see Fig. 1) to a lever 123, which corresponds with the lever 110 already described, but which engages the shaft 124, upon which the dummy or follower corresponding with the cutter 104 is carried, so that the movement of the said dummy or follower which is in contact with the toe of the pattern is communicated to the cutter 104. For the purpose of moving the cutter-shaft 106 and the corresponding follower-shaft 124 rearwardly, a cam 125 (see Fig. 8) is provided. The said cam is mounted on the cam-shaft 80 and coöperates with a cam-roll on the arm 126, which is fast to the rocker-shaft 127. The said shaft 127 is mounted in suitable supports on the frame of the machine. (Not shown in Figs. 7 and 8.) At each end of the shaft 127 is secured an arm 128, which extends upwardly and is pivoted to a connecting-rod 129. The connecting-rod 129 at the right, Figs. 7 and 8, is pivotally secured at one end to the pivoted support 107 and at the other end to a corresponding pivoted support for the follower-shaft 124. (See Fig. 1.) As the cam 125 revolves the arm 126 will be moved forwardly, rocking the shaft 127 and moving the arm 128 and connecting-rod 129 rearwardly. The rearward movement of the connecting-rod 129 moves the pivoted supports for the shafts 106 and 124 rearwardly, thus communicating a rearward movement to the said shafts and to the cutter and follower respectively carried thereby. At the opposite end of the rock-shaft 127 similar mechanism is provided for giving the same rearward movement to the shaft 105 of the cutter 61 and the shaft 131 of the corresponding follower.

On the under side of the sliding plate E, I

secure a bar or rail 200. When the cutter 5 has passed along to the heel end of the blank by the transverse movement of the said sliding plate on the table A, as heretofore described, the end of the bar 200 will have passed off the forwardly-extending arm of the pivoted T-shaped lever 201. (See Fig. 3.) A spring 202 will then act to throw the said arm of the lever 201, which has been thus freed, and the downwardly-extending end of said lever will be moved forwardly or to the right, Fig. 3, carrying with it the connecting-rod 203, to which the said lower end is pivoted. The forward end of said connecting-rod is pivoted to a lever 204, which is in turn rigidly secured at its upper end to a shaft 205. This shaft 205 is rocked in its bearings by the means just described, and an arm 206, which is rigidly secured on said shaft 205, is raised.

The arm 206 bears on a projection 207 on the bolt 49. When the said arm 206 is raised, the bolt is free to be moved upwardly by the means of a spring 2081. (See Fig. 4.) The said bolt 49, as heretofore described, operates, according to its position, to secure the cylinder 26 and sleeve 27 together and hold them rigidly or to secure the sleeve 27 and hold it rigidly while the cylinder 26 is free to revolve, or, again, the said bolt may be withdrawn from the said sleeve 27 and cylinder 26, permitting them both to revolve. When the spring 202 forces upwardly the forward-projecting arm of the T-shaped lever 201, the rearwardly-projecting arm is moved downwardly. Said rearwardly-projecting arm is in engagement with a forwardly-projecting arm 208, fast on a rocker-shaft 209. An upwardly-projecting lever 210 is also fast on said shaft 209, and its upper end is in engagement with a sliding clutch device 13 on the shaft 12. The movement thus effected serves to shift the clutch device 13 to a position midway between the beveled gears 10 and 11, and said gears being both loosely mounted on said shaft 12 the movement of the screw 7, and consequently of the carriage C, ceases. On the cam-shaft 80 is secured a cam 211, which as it revolves engages a cam-roll 212 on the lower end of the lever 204 and operates to throw the lower end of said lever farther forward, thus carrying the connection 203 farther toward the front of the machine or to the right of Fig. 3 and moving the rearwardly-projecting arm of the lever 201 downward still farther than it was moved by the action of the spring 202. This farther-downward movement of the said arm of the lever 201 forces the clutch device 13 into contact with the bevel-gear 11, thus reversing the movement of the screw 7 and causing the said screw to move the carriage C in a reverse direction back into the position which it occupies when the cutter 5 begins to operate on a new blank. This reverse movement of the cutter-carriage C is heretofore accomplished while the heel and toe of the last are being finished.

Before this reverse movement of the carriage C is commenced the sliding plate E, carrying the cutter 5, is moved rearwardly and held locked in its rearward position, so as to prevent the cutter 5 during the reverse movement of the carriage from coming in contact with the work. This rearward movement of the sliding plate E is accomplished by means of a cam 215 on the cam-shaft 80. (See Fig. 2.) The said cam operates a lever 216, which is pivoted at 217 to a hanger on the table A. The upper end of the said lever 216 is moved rearwardly at the proper point in the revolution of the said cam-shaft 80 and engages the rail or bar 200, which is fast on the under side of the said sliding plate E and operates to force the said sliding plate E rearwardly. When the said plate has moved rearwardly to the proper point, a spring-hook 218, the shank of which is secured to the said sliding plate E, snaps over a cross-bar of the carriage C and serves to hold the sliding plate E in its rearward position.

When the machine is ready to begin work on a new blank, the operator raises the snap-hook 218, thus permitting the sliding plate E to be moved forward by the weight 14, previously described. (See Fig. 2.) For the purpose of raising the said snap-hook 218 a bell-crank lever 219 is pivoted at 220 on the said sliding plate E. The rear end of said bell-crank 219 is connected, by means of a link 221, to the said hook 218. The opposite end of the bell-crank is pivotally connected at 222 to a rod 223, which extends forward to the front of the machine (see Figs. 1 and 2) into a position where it may be readily grasped by the operator. The forward end of said rod 223 is provided with a notch or projection 224, by means of which it may be seized, and which is located behind the handle 225 and in such proximity thereto that the operator may readily seize the said handles 224 and 225 and move the rod 223 forward, raising the rearwardly-projecting end of the bell-crank 219 and freeing the said snap-hook from engagement with the cross-bar of the carriage C.

When the bolt 49 is moved upwardly by its spring, as heretofore described, the lever 230, (see Fig. 4,) which is fast on the shaft 231, and the free end of which rests on a projection 232 on the bolt 49, is moved upwardly, rocking the said shaft 231 and throwing the upward end of the lever 233, which is in engagement with a clutch device 234, to the right, Fig. 4. The said lever 233 is forked in the usual manner at its upper end and is fast to the said shaft 231. This movement of the clutch device 234 throws the said device into engagement with a beveled pinion 235 (see Fig. 1) on the shaft 20, causing the said pinion to revolve with the said shaft. The pinion 235 is in mesh with a beveled gear 236, which is fast on the vertical shaft 237, on the lower end of which is a beveled pinion 238, which is in mesh with a beveled gear 239 (see Fig. 3) on the cam-shaft 80. By these means the

cam-shaft is caused to rotate, the rotation thereof being confined to that period of the operation of the machine which follows the completion of its work by the cutter 5. To insure the clutch device 234 being held in contact with the beveled pinion 235 and also insure the operation of the cam-shaft, I provide a downwardly-extending lever 241, which is fast on the shaft 231. The lower end of the lever 241 (see Fig. 4) carries a cam-roller 242, which is in engagement with the cam 240 throughout almost the entire revolution of the cam-shaft 80—that is to say, the lever 241 is moved by the upward movement of the arm 230 when the clutch device 234 is brought into contact with the beveled pinion 235—and as soon as the cam-shaft 80 is started the cam 240 is moved into engagement with the cam-roll 242 on the said lever-arm 241, and the clutch 234 is thus locked in the position which it occupies when in engagement with the pinion 235. In this way the continued operation of the cam-shaft 80 is insured.

As previously stated, the chucks which hold the blank 41 while the cutter 5 is operating thereon are moved endwise away from the blank after the cutter 5 has finished its work of shaping the sides and top and sole thereof. This endwise movement of the said cutters is effected at the proper time in the operation of the machine by means of the following-described devices: On the cam-shaft 80 I provide a cam 250, which engages a cam-roll 251 on the grooved horizontal bar 252. (See Figs. 3 and 4.) The said bar 252 is provided with a slotted guide-bar 253. The said bar 253 is slotted lengthwise thereof to accommodate the cam-shaft 80, which passes through said slot. The lower end of said bar is placed in a vertical socket in the upright 254 and is free to move vertically in the said socket. The guide-bar 253 and socket 254 serve to keep the horizontal bar from lateral displacement and cause it to move vertically in the same plane. The bar 252 is slotted, as shown at 255, and receives in said slot pins or studs 256, which are secured on the inner ends of the levers 257 and 258, the said pins 256 being free to slide horizontally in the said slot 255 as the bar 252 is moved vertically. The slotted bar 252 not only provides for this play of the pins 256, but also permits the levers 257 and 258 to be moved toward or from each other, thus permitting an adjustment of the machine to lasts of different sizes. The levers 257 and 258 are pivoted at 259 and 260, respectively, and are rigidly connected with the upwardly-extending forked levers 261 and 262. The levers 257 and 261 and 258 and 262 are therefore in effect bell-crank levers.

When the bolt 49 is moved upwardly, the lower end thereof is raised from the arm 270, which is fast on a shaft 271. On the shaft 271 is secured another arm 272, the upper end of which engages a downwardly-projecting arm 273, fast on the shaft 274. On the shaft 274 is secured an upwardly-projecting forked lever 275, which engages a clutch device 276 on the shaft 20. The lever-arm 270, above referred to, when freed by the upward movement of the bar 49, is forced upwardly by means of a spring 2081. This causes the arm 272 to move to the left, Fig. 4, moving the arm 273, with which the said arm 272 is in engagement in the same direction, swinging the forked lever 275 to the right, Fig. 4, and freeing the clutch device 276 from engagement with the pinion 21. Said pinion is then loose on the shaft 20 and ceases to drive the shaft 12, which remains stationary until the said clutch device 276 is again forced into engagement with the pinion 21. This latter occurs when the cam-shaft 80 begins to move, causing the cam to force the free end of the lever 280 upwardly, (see Fig. 4,) rocking the shaft 281, to which said lever is secured, and causing the lever 50, which is also secured to said shaft 281, to move downwardly, thus forcing downwardly the arm 270 against the operation of its spring and reversing the movement heretofore described of the levers 272, 273, and 275 and forcing the clutch device 276 again into engagement with the pinion 21, causing the shaft 12 to operate and the carriage C to be returned to the position which it occupies when the cutter 5 commences to operate on the blank.

The operation of the machine is as follows: The pattern having been placed in front of the follower 3 between the rear heads which serve to hold it in position and to give it the necessary movement, the operator places a blank of wood of proper size in position between the forward heads and in front of the cutter 5. This blank is placed in position by hand, the operator holding one end of it against the teeth 34 of the arm 32 and moving the arm 37, which engages the opposite end of the blank, inwardly by means of the hand-wheel 514. (Shown more clearly in Fig. 11.) The handles 224 and 225, Fig. 2, are then seized to free the snap-hook 218, permitting the weight 14 to move the slide-plate E forward, bringing the cutter 5 into contact with the blank. The forward movement of the sliding plate E, which carries the cutters, carries forward the bar 200, which rides onto the forwardly-projecting arm of the T-shaped lever 201, (see Fig. 3,) depressing the said arm and throwing the downwardly-projecting portion of the said lever 201 rearwardly, moving the connection 203 rearwardly, swinging the lever 204, and moving the arm 206 downwardly, thus pulling down the bolt 49 and freeing its upper end from the cylinder 26. This permits the cylinder 26 to revolve in the sleeve 27. The same movement of the bar 200 permits the clutch-operating lever 210 to move toward the left, Fig. 3, causing the clutch device to engage the beveled gear 10, thus starting the screw-shaft 7. The screw-shaft 7 continues in operation and causes the carriage C and cutter 5, mounted thereon, to

move across the table A, the said cutter 5 during this movement operating to form the blank to shape from end to end thereof. When the carriage C has reached the end of its movement, the bar 200 will have moved off the T-shaped lever 201, permitting the lever 201 to move in a reverse direction, unshipping the clutch device 13 and stopping the screw-shaft 7. The operation of the lever 201 in said reverse direction likewise frees bolt 49, permitting it to be moved upwardly to lock the cylinder 26 to the sleeve 27. The upward movement of the bolt 49 operates to throw the clutch device 234 into engagement with the beveled pinion 235, which drives the vertical shaft 237 and starts the cam-shaft 80. The cams on the cam-shaft 80 then operate to move the sliding plate E, carrying the cutter 5 rearwardly, in which position it is held by the snap-hook 218. The clutch device 13 is brought into engagement with the beveled gear 11, causing a reversal of movement of the screw-shaft 7 and a reverse movement of the carriage C to return the cutter 5 to the position which it occupies when it begins to form the blank. The radial arms, which serve as supplementary holding means to hold the blank while the heel and toe are being finished, are then brought into contact with the blank and gripped thereon. The arms 36 and 32, which hold the blank while it is being operated upon by the cutter 5, are then withdrawn and moved out of the line of the heel and toe cutters 61 and 104. The locking-bolt 49 is then moved downwardly to its lowest position to permit the cylinder 26 and sleeve 27 to revolve together and to cause the sleeve 39 to revolve with them, and the heel and toe cutters are moved toward and into contact with the heel and toe of the blank. After these cutters have moved inward to the extreme of their inward movement they are moved rearwardly, so that the entire unfinished end portions of the blank at the heel and toe may be formed to shape. The heel and toe cutters are then withdrawn and the holding arms 32 and 36 are again brought into position to receive a new blank, the corresponding arms which engage the pattern again coming into contact with and operating to hold the pattern and to prevent it from falling out of the machine. The supplementary radial holders 43, 44, 45, 46, 47, and 48 are then freed and withdrawn and the finished last is permitted to drop out of the machine.

What I claim is—

1. The combination with the centers by which to hold the blank, and a cutter by which to shape the blank, of supplementary holding devices to engage with the blank and by which to maintain it in its original working position after the centers aforesaid have been disengaged, and supplemental cutters to operate upon the portions of the blank where it was in engagement with the centers aforesaid, substantially as described.

2. The combination with centers by which to hold the blank, a cutter by which to shape the blank, and pattern devices whereby to determine the shape produced by the action of the said cutter upon the said blank, of supplemental holding devices to engage the blank and by which to hold it in its original working position after the disengagement of the said centers therefrom, supplemental cutters to operate upon the portions of the blank which at first were engaged by the said centers, and pattern devices whereby to determine the shaping of said portions of the blank by the said supplemental cutters, substantially as described.

3. In a machine for turning articles of irregular shape, the combination with a carrier which has a lengthwise and a lateral movement, of a cutter carried therein, centers which hold the blank during a part of its formation, mechanism for rotating the blank, means for holding said cutter in contact with the blank by a yielding pressure guided by the pattern, so that the said cutter shapes a part of the blank to correspond with the pattern, supplemental holding devices which engage the blank and hold it in its original working position, and means for disengaging the centers after the said cutter has completed its part of the work of shaping the blank, and supplemental cutters, which have a lengthwise and a lateral movement and are held in contact with the blank by a yielding pressure guided by the pattern and which operates upon the unfinished portions of the blank to complete the formation thereof, substantially as described.

4. In a machine for turning articles of irregular shape, the combination of a reciprocatingly-sliding carriage, a plate which slides reciprocatingly on said carriage at right angles with the line of reciprocation of said carriage, holding devices for the blank and means for rotating the blank, a cutter mounted on said sliding plate and means for holding the said cutter against the blank by a yielding pressure during the traverse of the cutter and sliding plate in one direction to partially form the blank, means for disengaging the said cutter and causing the carrier to return to its first position, and supplemental cutters which engage with the blank and complete the formation after the first cutter is disengaged, substantially as described.

5. In a machine for turning articles, the combination of a reciprocatingly-sliding carriage, a carrier which slides on said carriage at right angles with the line of reciprocation of said carriage, a rotary cutter mounted on said carrier and moving therewith, centering devices to hold the blank, mechanism for rotating the blank, means for keeping the said cutter in operative connection with the blank during its traverse in one direction to shape the blank, means for stopping the rotation of the blank and the travel of the carriage after the said cutter has completed its

traverse, supplemental holding devices which then engage the blank to hold it in its original working position, means which disengage the centering devices from the blank and mechanism which causes the carriage to traverse in its reverse direction, mechanism which causes the blank to again rotate after it is engaged by the supplemental holding devices, and supplemental cutters which operate upon the unfinished portions of the blank during said return movement of the carriage, substantially as described.

6. In a machine for turning articles, the combination of a sliding carriage, a carrier which slides on said carriage at right angles with the line of reciprocation of said carriage, a cutter mounted on said carrier, a driving-shaft, a shaft on which said sliding carriage moves, a beveled gear on said carriage-shaft and two beveled gears on said driving-shaft with which the carriage-shaft gear engages, a clutch on said driving-shaft which may be thrown into engagement with either of the gears on said shaft or out of engagement with both, mechanism which throws the clutch into engagement with the carriage-shaft gear to cause it to rotate and move the carriage in one direction, and throws it temporarily out of engagement with both gears at the end of the traverse of the carriage and then throws it into engagement with the other gear thereby causing the carriage-shaft to rotate in a reverse direction, and also causing the carriage to slide in its reverse direction, substantially as set forth.

7. In a machine for turning articles, a rotatable cylinder, a centering device to hold the blank consisting of a shaft mounted in bearings in the side of the cylinder and having a bent arm which engages the blank, mechanism for rotating the cylinder and blank, a cutter which shapes the blank when so held, a sleeve loosely surrounding said cylinder and held stationary during the operation of said cutter, a locking device which, when the said cutter has completed its work on the blank, locks the said cylinder and sleeve together, a fixed portion with a detent which engages the sleeve to prevent rotation of the sleeve and cylinder, supplemental holding devices which are brought into engagement with the blank when said cutter has completed its work, mechanism which then withdraws and turns aside said centering devices, mechanism which then releases from the sleeve the detent attached to the fixed portion, the sleeve and cylinder remaining locked together, mechanism which then rotates the sleeve and cylinder and blank together, and supplemental cutters which operate upon the unfinished portions of the blank, substantially as described.

8. A rotatable cylinder, a shaft having bearings in the side thereof, and having a bent arm adapted to engage an object and cause it to rotate on the axis of rotation of said cylinder, said shaft being capable of a partially rotary and reciprocating movement in its bearings whereby the centering-arm may be withdrawn and turned out of the center, a sleeve surrounding said center, means for locking the cylinder and sleeve together and of unlocking them so that they may be rotated together or the cylinder be rotated alone, a fixed portion with a detent which may be made to engage with the sleeve and prevent rotation of both sleeve and cylinder when the two latter are locked together, and radial arms pivoted in said sleeve which grip said object to hold it when the centering-arm is withdrawn, substantially as described.

9. In a machine for turning articles, a rotatable cylinder, centering devices to hold the blank at each end of its axis of rotation, consisting of shafts mounted in bearings at one side of the center and having bent arms which engage the blank and center it, mechanism for rotating the cylinder and blank, a cutter which shapes the blank when so held, sleeves loosely surrounding the cylinders which hold the centering devices, said sleeves being rigidly connected with each other, means for locking the sleeves and cylinder together and unlocking them so that they may be rotated together or the cylinder alone be rotated, a fixed portion with a detent which may be made to prevent rotation of the sleeves and cylinders when locked together, radial arms pivoted in said sleeves which grip the blank when the first cutter has completed its work, and means for withdrawing the centering devices when the radial supplemental holding devices grip the blank, the rotation then being resumed, and supplemental cutters which operate upon the unfinished portions of the blank, substantially as set forth.

10. In a machine for turning articles of irregular shape, the combination of a reciprocatingly-sliding carriage, a plate which slides reciprocatingly on said carriage at right angles with the line of reciprocation of said carriage, a pattern device to determine the shape of the article to be formed, a follower mounted on said sliding plate in the rear of said pattern and adapted to be held in contact with said pattern by a yielding pressure, centers to hold the pattern while one portion of the cutting mechanism is in operation, and supplemental holding devices to hold the pattern in its original working position after the centers aforesaid have been disengaged and while the finishing-cutters are in operation, a cutter to shape the blank and adapted to be held in yielding contact therewith by a pressure corresponding with the pressure of the pattern, centers to hold the blank while the main cutter is in operation and supplemental holding devices to hold the blank in its original working position after the cutters aforesaid have been disengaged and while the finishing-cutters are in operation, mechanism which rotates the pattern and the blank on their axes, mechanism which moves the sliding carriage parallel with the axis of rotation of the blank,

mechanism which keeps the follower in contact with the pattern and keeps the main cutter in contact with the blank by a yielding pressure throughout the operating travel of the carriage mechanism which at the end of the operating travel of the carriage stops the rotation of the pattern and blank and retracts the sliding plate and thereby removes the follower from contact with the pattern and removes the main cutter from contact with the blank, mechanism which then withdraws the centers and causes the supplemental holding devices to engage the pattern and the blank, mechanism which then moves the carriage back to its first position, mechanism which after the engagement of the supplemental holding devices again rotates the pattern and the blank and supplemental cutters at the ends of the blank which operate upon the portions of the blank which were unoperated upon by the main cutter, substantially as described.

11. In a machine for turning articles of irregular shape, the combination of a reciprocatingly-sliding carriage, a plate which slides reciprocatingly on said carriage at right angles with the line of reciprocation of said carriage, a pattern device to determine the shape of the article to be formed, a follower mounted on said sliding plate in the rear of said pattern and adapted to be held in contact with said pattern by a yielding pressure, centers to hold the pattern while one portion of the cutting mechanism is in operation, and supplemental holding devices to hold the pattern in its original working position after the centers aforesaid have been disengaged and while the finishing-cutters are in operation, a cutter to shape the blank and adapted to be held in yielding contact therewith by a pressure corresponding with the pressure of the pattern, centers to hold the blank while the main cutter is in operation and supplemental holding devies to hold the blank in its original working position after the cutters aforesaid have been disengaged and while the finishing-cutters are in operation, mechanism which rotates the pattern and the blank on their axes, mechanism which moves the sliding carriage parallel with the axis of rotation of the blank, mechanism which keeps the follower in contact with the pattern and keeps the main cutter in contact with the blank by a yielding pressure throughout the operating travel of the carriage, mechanism which at the end of the operating travel of the carriage stops the rotation of the pattern and blank and retracts the sliding plate and thereby removes the follower from contact with the pattern and removes the main cutter from contact with the blank, mechanism which then withdraws the centers and causes the supplemental holding devices to engage the pattern and the blank, mechanism which then moves the carriage back to its first position, mechanism which after the engagement of the supplemental holding devices again rotates the pattern and the blank, and supplemental cutters at the ends of the blank which operate upon the portions of the blank which were unoperated upon by the main cutter, said supplemental cutters having a lateral movement, and having a lengthwise movement by a yielding pressure on the blank guided by the pattern so that the lateral movement will follow the inequalities of the pattern, connecting mechanism which causes the supplemental cutters to properly form the unfinished ends of the blank, mechanism which when the supplemental cutters have completed their traverse of the blank withdraws them from contact with the blank, brings the blank centers into position for a new blank, and brings the pattern centers into a holding position for the pattern, and releases the supplemental holding devices from the blank, substantially as described.

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

JAMES H. REED.

Witnesses:
WM. A. MACLEOD,
ROBT. WALLACE.