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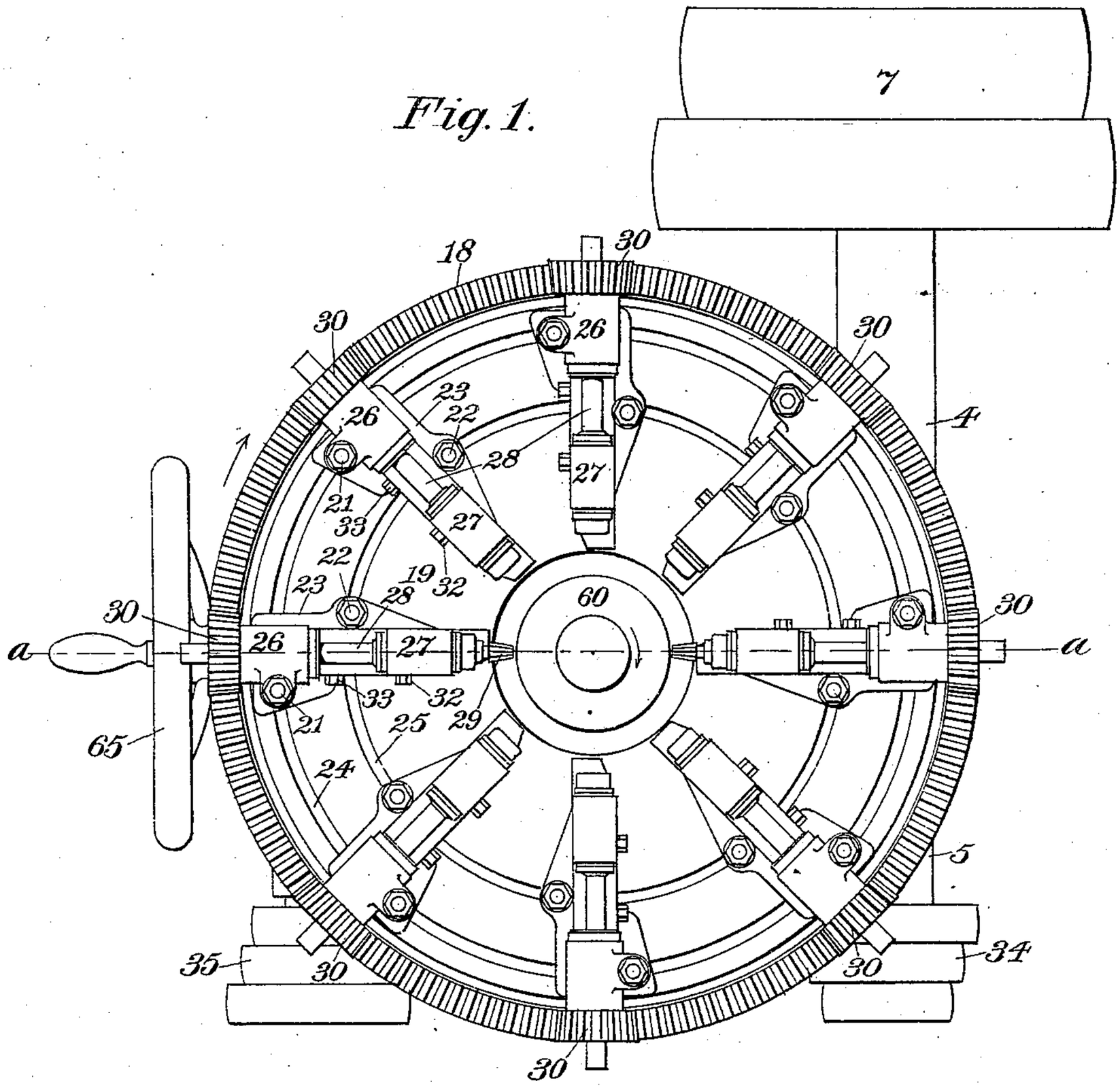
A. WHITNEY & J. JOHNSTON.

MILLING MACHINE.

No. 533,978. Patented Feb. 12, 1895.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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Fig. 2.

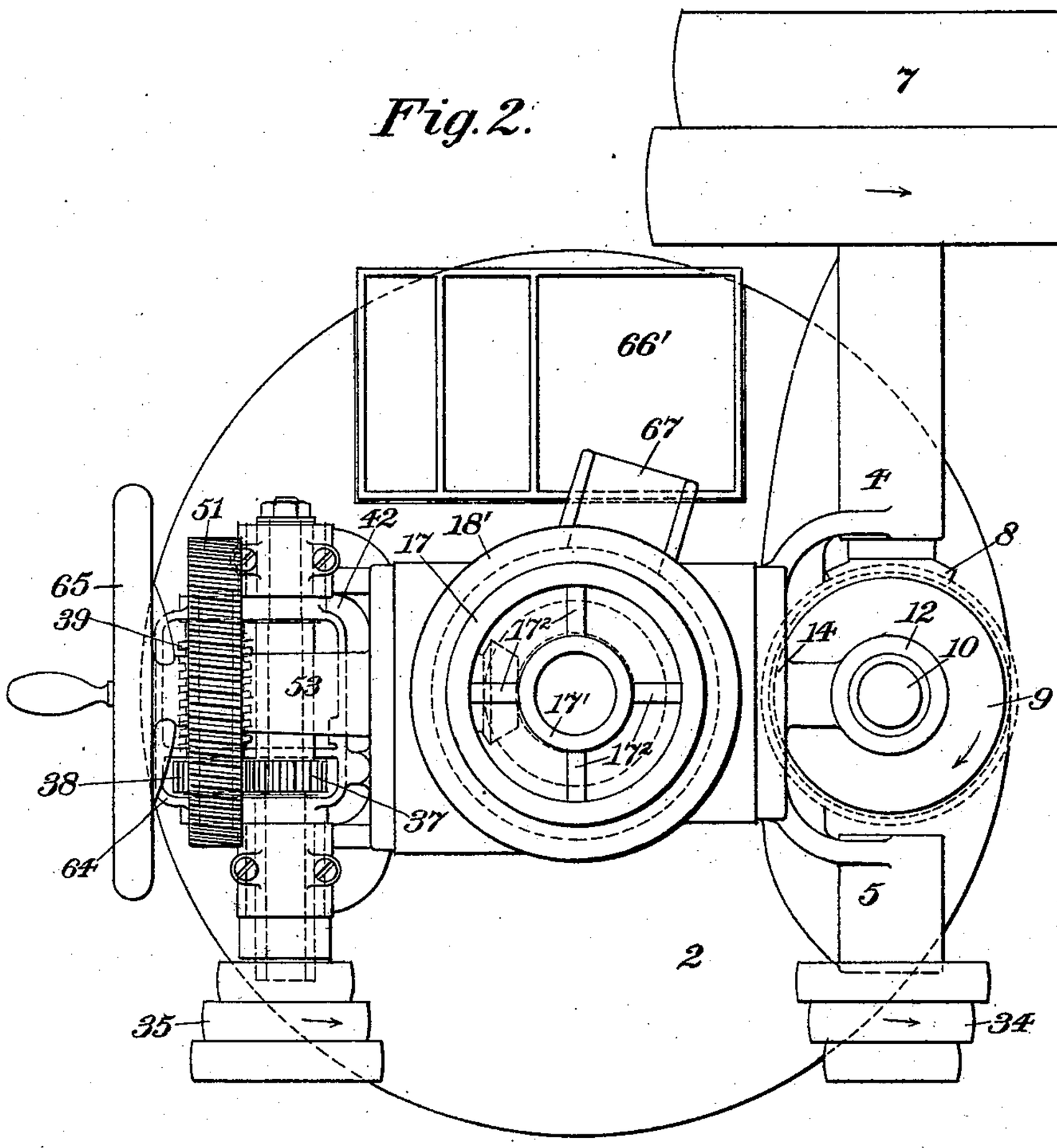

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Fig. 3.

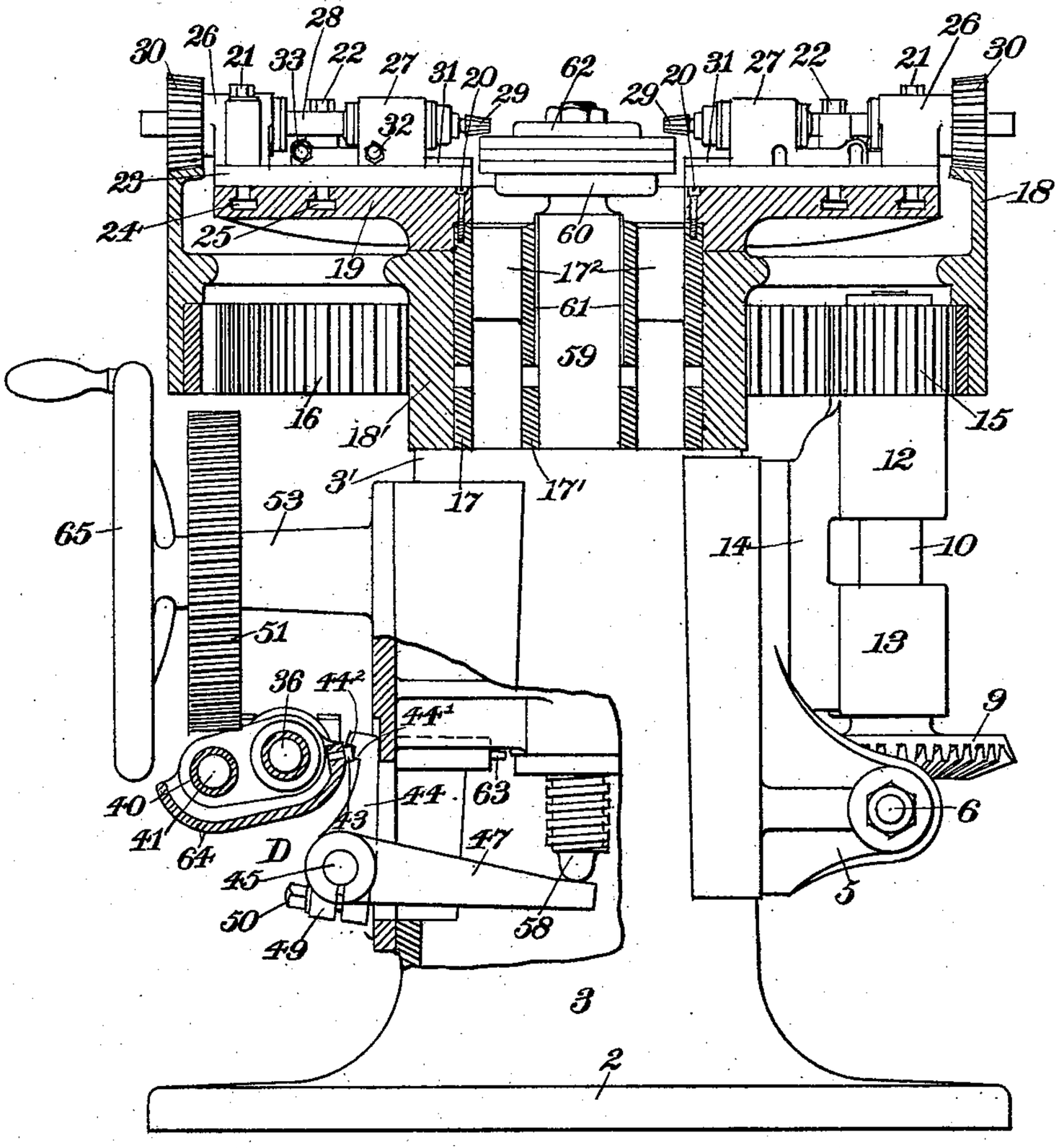

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Fig. 4.

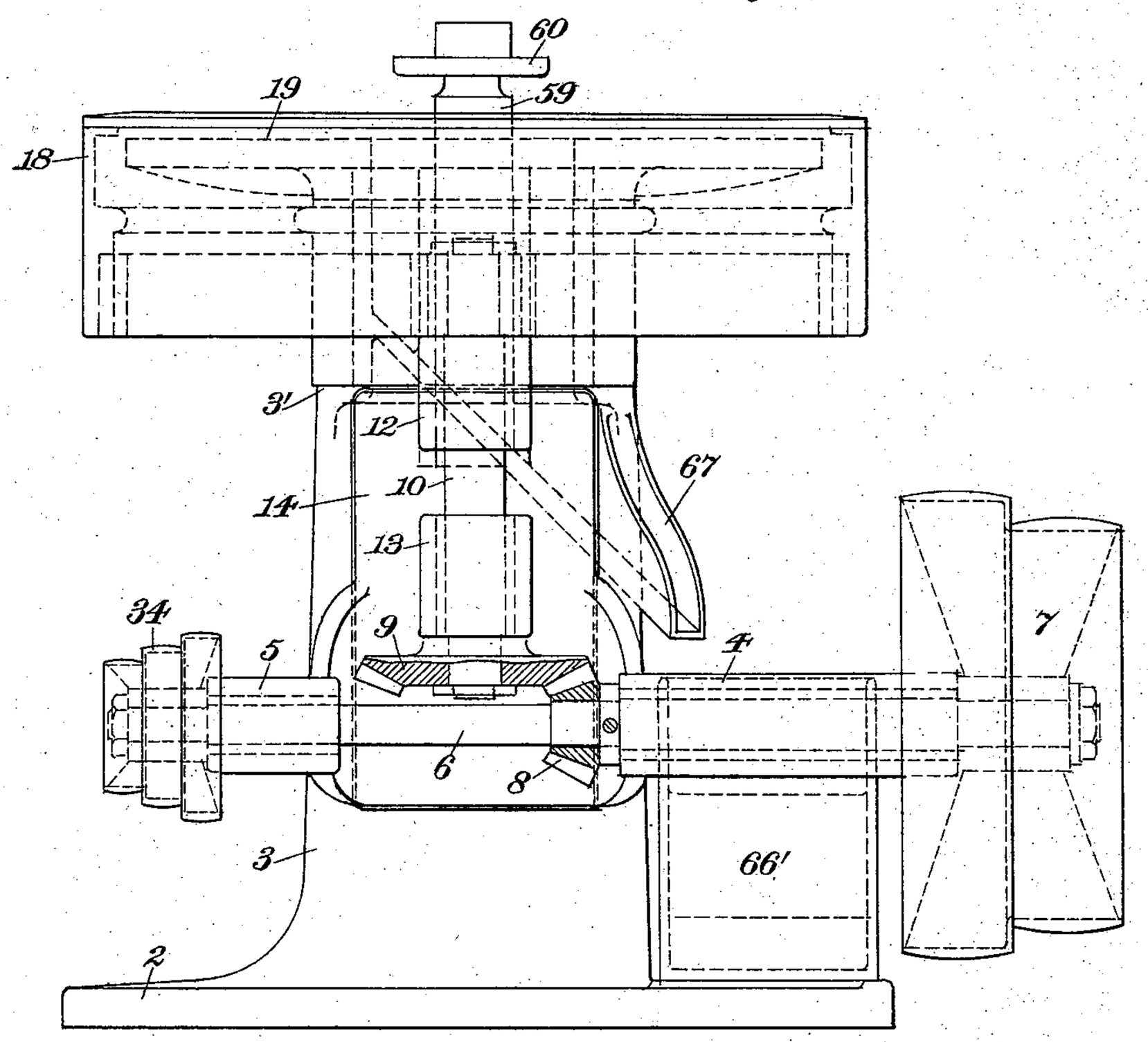

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Fig. 6.

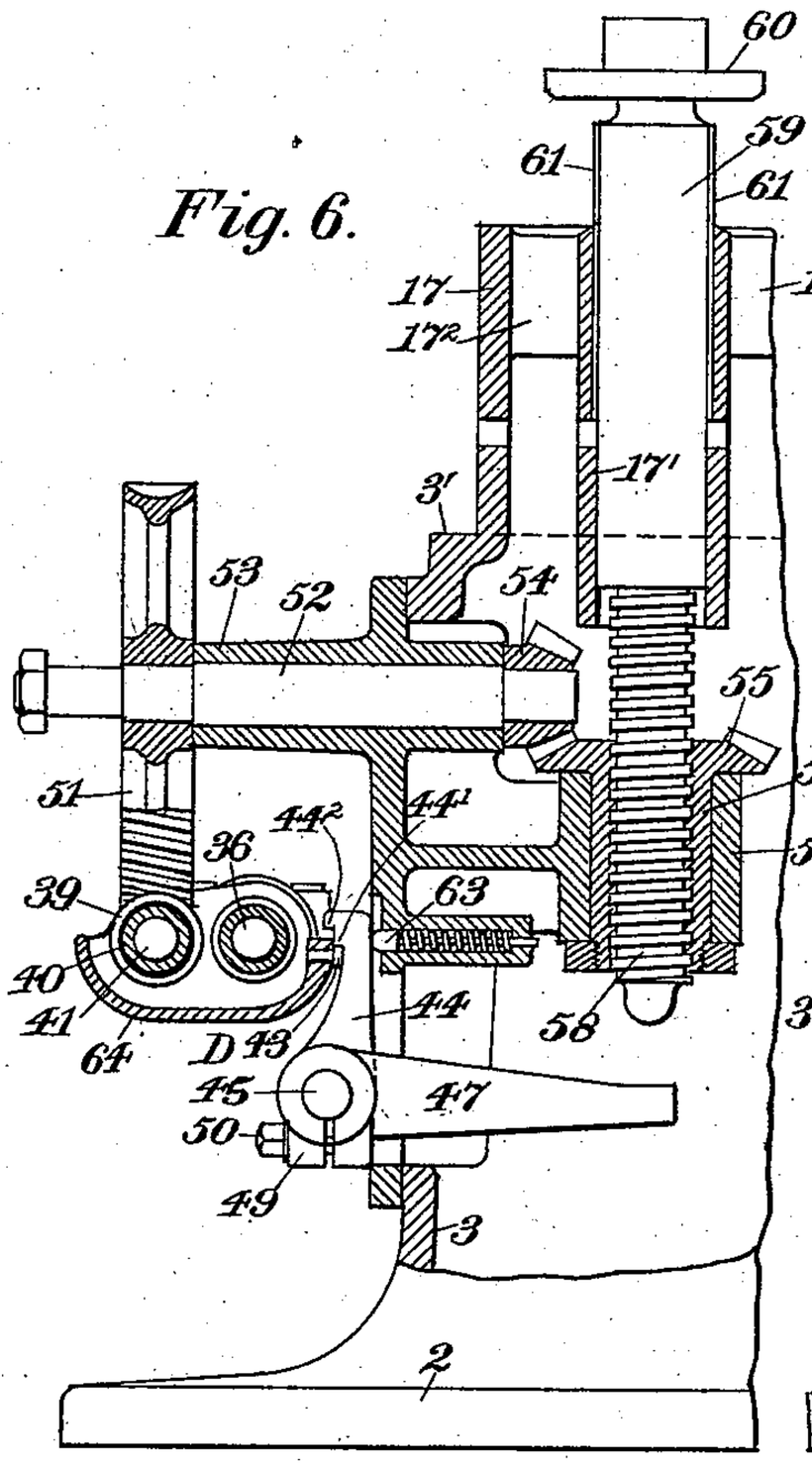
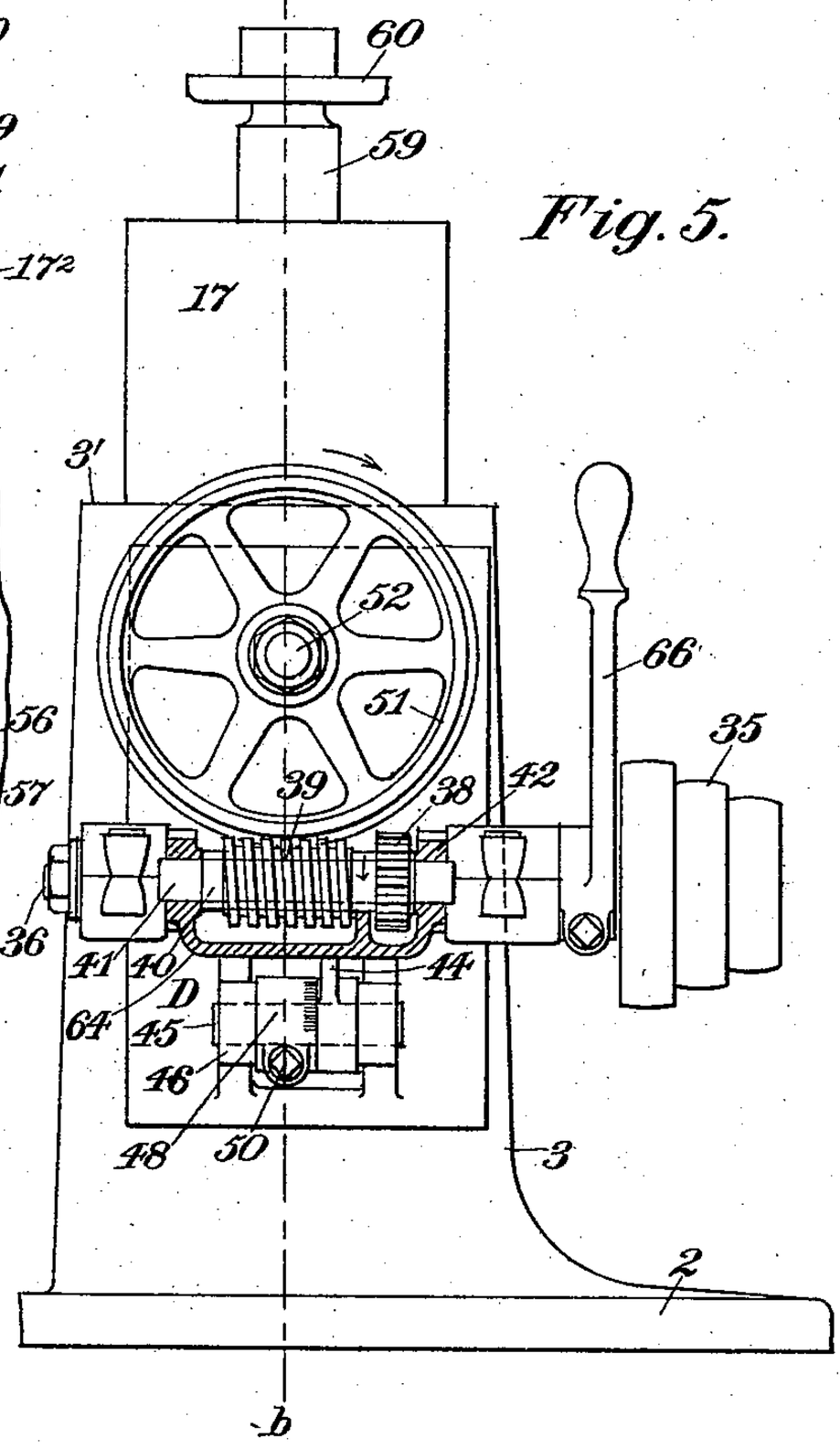


Fig. 5.



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UNITED STATES PATENT OFFICE.

AMOS WHITNEY AND JOHN JOHNSTON, OF HARTFORD, CONNECTICUT.

MILLING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 533,978, dated February 12, 1895.

Application filed July 12, 1894. Serial No. 517,298. (No model.)

To all whom it may concern:

Be it known that we, AMOS WHITNEY, a citizen of the United States, and JOHN JOHNSTON, a subject of the Queen of Great Britain, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Milling-Machines, of which the following is a specification.

This invention relates to milling-machines and especially multiple-milling-machines for simultaneously cutting a series of teeth upon or recesses in the peripheries of wheels; the object of the invention being to provide a machine of this character especially adapted for finishing sprocket-wheels for bicycles, and in which the holder for the blanks reciprocates within a circuit of rotary cutters adjustably-mounted with respect thereto, and receiving their rotary movement from a common driving mechanism, actuated from the main driving-shaft, which is also operatively connected to reciprocate the blank-holder.

In the drawings accompanying and forming part of this specification, Figure 1 is a plan view of a milling-machine constructed in accordance with our invention. Fig. 2 is a similar view with the upper parts of the cutter-operating and holding means removed. Fig. 3 is a sectional side elevation of the same taken in line *a*—*a*, Fig. 1. Fig. 4 is a rear elevation of the same, partially in section. Fig. 5 is a front view of a portion of the machine partly in section, showing the feed-operating devices for the blank-holder. Fig. 6 is a central vertical section of the same taken in line *b*—*b*, Fig. 5.

Similar characters designate like parts in all of the figures.

According to our present invention we mount upon the bed-plate 2, supporting the main frame or standard 3, the hangers or brackets 4 and 5, carrying the journals for the main driving-shaft 6. This shaft is actuated from the main driving-cones 7, and carries a bevel pinion 8, meshing with a bevel-gear 9, which is secured upon the end of the shaft 10, journaled in the upper and lower bearings 12 and 13 in the hanger or bracket 14, at the rear of the machine. A pinion or spur-wheel 15, is secured to the upper end of this shaft and meshes with the teeth of a large internal-gear 16, which rotates around the central column or fixed shaft 17, secured upon the standard 3. The gear 16 is either formed integral with or is rigidly secured to, a broad crown-wheel 18, which is mounted directly upon and rotates around the column or axis 17. As the crown-wheel is here the driving wheel for the rotary cutters, and the internal gear-wheel the driven wheel of the train, the crown-wheel is mounted upon the column 17, while the internal-gear practically forms part of the crown-wheel. This crown-wheel is therefore provided with a hub 18′, having a large bearing surface upon the periphery of the main column or shaft. A head-plate or table 19, is rigidly secured upon the top of the shaft 17 by means of bolts 20, passing through the table and into the upper edges of the fixed shaft, which, as shown, is hollow. The crown-wheel is supported upon the hollow shaft between said table and the shoulder 3′.

Mounted upon the annular table 19, and adjustable thereon by means of the two series of T-bolts 21 and 22, carried in the annular T-slots or concentric guide-ways 24 and 25, is a series or circuit of brackets 23, having bearings 26 and 27, carrying spindles 28, the inner ends of which spindles are provided with seats or heads adapted to hold the milling-cutters 29. Upon the outer ends of these spindles are firmly secured the beveled pinions 30, meshing with and actuated by the teeth of the crown-wheel 18.

It will be seen that any number of cutters may be disposed upon the carrier-table, equidistant from each other, and in position for revolution in the same horizontal plane, by clamping the supporting brackets at the proper points, and that all of said cutters will be rotated in the same direction, that is, to the right. The brackets and fastening devices thus constitute means for supporting and circumferentially adjusting the spindles, and for engaging the guide-ways 24 and 25 to maintain the spindles against radial misalignment.

The bearing 27 is longitudinally adjustable upon the way 31, and when set in position is secured to said way by means of the set-screws 32 and 33, the pinions 30 of course, being adjustable upon the spindles also in a

longitudinal direction. We thus not only adjust the cutters for milling any desired number of teeth upon the blanks, but also for milling blanks of any size, within the limits of the machine, while maintaining the spindles and cutters in axial alignment with the axis of the blank-holder.

Upon the opposite end of the shaft 6 from that carrying the main cone 7, is a smaller feed-cone 34, adapted to drive, in the well known manner, the opposite cone 35, secured to the end of the axle 36. This axle carries a small spur-wheel 37, meshing with the pinion 38, formed integral with the worm 39, upon the sleeve 40 which is rotatable about the spindle 41 secured within the ends of the bracket 42, forming the frame of a drop-feed device, designated in a general way by D. This drop-feed device as a whole rocks upon shaft 36, and at its rear carries a stud or bolt 43, adapted to be engaged by the latch 44, firmly secured to a rock-shaft 45, secured within the arms of a bracket 46, projecting from the lower front portion of the frame. A lever 47, is firmly secured to the rock-shaft 45, and is adjustable thereon for vertical play by means of a divided collar 49 and adjusting-screw 50. When in operative position the stud 43 of the drop-feed device is engaged by the lower stop $44'$ of the latch 44. The worm 39 is also then in engagement with the teeth of the worm-wheel 51, mounted upon the shaft 52, journaled within the bearings 53, extending from the main frame. Upon the inner end of this shaft is secured a bevel pinion 54, actuating a bevel-gear 55, having an interiorly-threaded elongated hub 56, carried in the central bearing 57, formed integral with the frame. Within the sleeve a feed-screw 58, carrying upon its upper end a plunger 59 supporting a blank-holder 60, reciprocates by the rotation of the sleeve 55. The plunger 59 is longitudinally slotted near its upper end and secured by means of splines 61 against rotation; but is adapted to reciprocate within the central, axially-disposed sleeve or cylinder $17'$, forming part of the column 17 and secured thereto by means of radial arms or ribs 17^2. A cap 62 is adapted to secure the blanks, (see Fig. 3,) upon the holder 60. This cap may be of any usual construction, comprising preferably a holding-plate, adjustably secured in position by means of a nut and bolt.

It will be seen that, when power is transmitted from the main-driving shaft, the crown wheel 18 will be rotated in the direction of the arrow, and thereby the spindle-pinions 30, actuating the milling-cutters. At the same time the shaft 36, will also be rotated through the medium of its step-cone, thereby actuating the spur-wheel 37, and the pinion 38, which in turn causes the rotation of the worm-wheel 51 in the direction of the arrow, through the worm 39. The rotation of the worm-wheel is transmitted through the shaft 52, to the bevel-pinion 54, and the bevel-wheel 55, which, by the rotation of its hub 56, causes the descent of the plunger and feed-screw. As the plunger is fed gradually down, the blanks are fed transversely through the plane of revolution of the cutters and subjected to the simultaneous action of all of said cutters, the mills cutting their way upward through the edges of the blank or blanks upon the carrier or holder 60, until they emerge from the upper side of the topmost blank, when the point of the screw 58, strikes the tripping-lever 47, which has been suitably adjusted in accordance with the number of blanks upon the holder, and releases the latch 44 from engagement with the stud 43, thereby throwing the drop-feed device out of engagement with the worm-wheel 51, and stopping the descent of the feed-screw and plunger. When the latch is released, the stud 43 engages with the upper stop 44^2, of the latch; as the spring-pressed bolt 63, working in an aperture or recess in the frame of the machine, and held in place by a stop, prevents any further movement of the rock-frame 64, than is necessary to release the worm from engagement with the worm-wheel. As soon as the feed-screw and carrier have been returned to their original positions, which operation is effected by means of a hand-wheel 65, reversing the direction of rotation of the cap 62, and the gear-train for effecting the reciprocation of the blank-holder, a new supply of blanks is secured in position. The stud 43 is brought into engagement with the lower stop of the latch by means of the hand-lever 66, controlling the return of the drop-feed device, thus throwing the worm into engagement with the worm-wheel, and restoring the operative position of the plunger-feeding-devices.

The waste-oil from the mills, and the turnings cut from the blanks, are carried to a box or tank $66'$, by means of a chute 67. This chute is preferably formed integral as shown with the column 17, and so arranged that its upper part will span the entire space between the central sleeve or guide-way $17'$ and the outer wall or shell of the fixed shaft.

By mounting the actuating crown-wheel upon the wide bearing formed by the upper portion of the central fixed shaft or axis 17, and between the shoulder $3'$ thereof and the under bearing-face of the table or head-plate 19, a very smooth, even movement of the said actuating wheel is obtained and perfect working of the milling-cutters controlled by the spindle pinions driven by said wheel is assured.

The long sleeve or guide-way $17'$, cast integral with the fixed shaft 17, provides a very perfect means for accurately centering the blanks to be milled, and for holding them in an absolutely rigid position while being operated upon by the cutters.

All of the usual kinds of sprocket wheel blanks can be readily milled by means of our improved machine, by the proper radial ad-

justment of the movable bearings 27 upon their guides or ways 31, the spindles being firmly secured in position by means of the set-screws 32 and 33, for holding said adjustable bearing, after the spindle-pinion has been correspondingly set. Moreover, any desired number of teeth within the capacity of the machine may be cut upon the blank or blanks being operated upon, by throwing certain of the cutters out of operation and properly disposing about the table, those which are to be used, and then locking them in position by means of the T-bolts working in the T-slots or channels in the face of the table.

It will be apparent from the foregoing that our improved machine is not limited in its functions to the milling of sprocket-wheels, but that, by employing the proper sizes and shapes of cutters, it may be adapted for any use in connection with the milling of the edges of circular blanks.

Having thus described our invention, we claim—

1. In a milling-machine, the combination with a table or bed-plate having concentric guide-ways in its face, of a circuit of cutter-operating spindles, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles against radial misalignment, a driving-shaft, and means substantially as described for actuating said spindles from said shaft, as set forth.

2. In a milling-machine, the combination with a table or bed-plate having concentric guide-ways in its face, of a circuit of radially-adjustable cutter-operating spindles, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles against radial misalignment, a driving-shaft, and means substantially as described for actuating said spindles from said shaft, as set forth.

3. In a milling-machine, the combination with an annular table or bed-plate having concentric guide-ways in its face, of a blank-holder centrally disposed for reciprocation through said table, a circuit of cutter-operating spindles adapted for revolution in the same horizontal plane, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles in axial alignment with the axis of said blank-holder, and means for actuating the blank-holder and thereby carrying the blank transversely through the plane of revolution of the cutters and subjecting said blank to the simultaneous action of all of said cutters, substantially as described.

4. In a milling-machine, the combination with an annular table or bed-plate having concentric guide-ways in its face, of a blank-holder centrally disposed for reciprocation through said table, a circuit of radially-adjustable cutter-operating spindles adapted for revolution in the same horizontal plane, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles in axial alignment with the axis of said blank-holder, and means for actuating the blank-holder and thereby carrying the blank transversely through the plane of revolution of the cutters and subjecting said blank to the simultaneous action of all of said cutters, substantially as described.

5. In a milling-machine, the combination with the main driving-shaft, of a crown-wheel actuated therefrom, a circuit of pinions driven by said crown-wheel, cutter-operating spindles controlled by said pinions and in position and adapted for revolution in the same horizontal plane, a reciprocatory blank-holder centered within said crown-wheel, and means controlled from the main shaft for actuating said blank-holder and thereby carrying the blank transversely through the plane of revolution of the cutters and subjecting said blank to the simultaneous action of all of said cutters, substantially as described.

6. In a milling-machine, the combination with a table or bed-plate having concentric guide-ways in its face, of a main driving-shaft, a crown-wheel actuated therefrom, a blank-holder centrally disposed for reciprocation through the table, a circuit of pinions driven by the crown-wheel and concentric with said guide-ways, a circuit of radially-adjustable cutter-operating spindles actuated by said pinions and adapted for revolution in the same horizontal plane, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles in axial alignment with the axis of said blank-holder, and means for actuating the blank-holder and thereby carrying the blank transversely through the plane of revolution of the cutters and subjecting said blank to the simultaneous action of all of said cutters, substantially as described.

7. In a milling-machine, the combination with a table or bed-plate having concentric guide-ways in its face, of a main driving-shaft, a crown-wheel actuated therefrom, a blank-holder centrally disposed for reciprocation through the table, a circuit of pinions driven by the crown-wheel and concentric with said guide-ways, a circuit of radially-adjustable cutter-operating spindles actuated by said pinions and adapted for revolution in the same horizontal plane, means for supporting and circumferentially adjusting said spindles and in position and adapted to engage said guide-ways and maintain said spindles in axial alignment with the axis of said blank-holder, means for actuating the blank-holder a predetermined distance in one direction and thereby carrying the blank transversely through the plane of revolution of the cutters and subjecting said blank to the simultaneous action of all of said cutters, and

means for automatically stopping said blank-holder-actuating means after a predetermined period of movement of the blank-holder, substantially as described.

8. In a milling-machine, the combination with the main driving-shaft, of a circuit of cutter-operating spindles controlled from said shaft, a reciprocatory blank-holder centered within said circuit of spindles, a gear-train for actuating said blank-holder and also controlled from the main shaft, and a drop-feed device adapted to disconnect said gear-train after a predetermined period of movement of the blank-holder, substantially as described.

9. In a milling-machine, the combination with the main driving shaft of a central vertical guide-way, a reciprocatory screw-threaded plunger traveling in said guide-way, a blank-holder mounted upon said plunger, a bevel-wheel having an internally-threaded hub engaging the screw of the plunger, a bevel pinion actuating said bevel wheel, a worm-wheel controlling said bevel-gear, a worm meshing with said worm-wheel means controlled from the main driving-shaft for actuating said worm, and a drop-feed device controlled by the plunger and adapted to disconnect said worm from the worm-wheel after a predetermined period of movement of the plunger, substantially as described.

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