(Model.) 3 Sheets—Sheet 1.

J. T. WILKIN.

MACHINE FOR PLANING CYCLOIDAL SURFACES.

No. 497,997. Patented May 23, 1893.

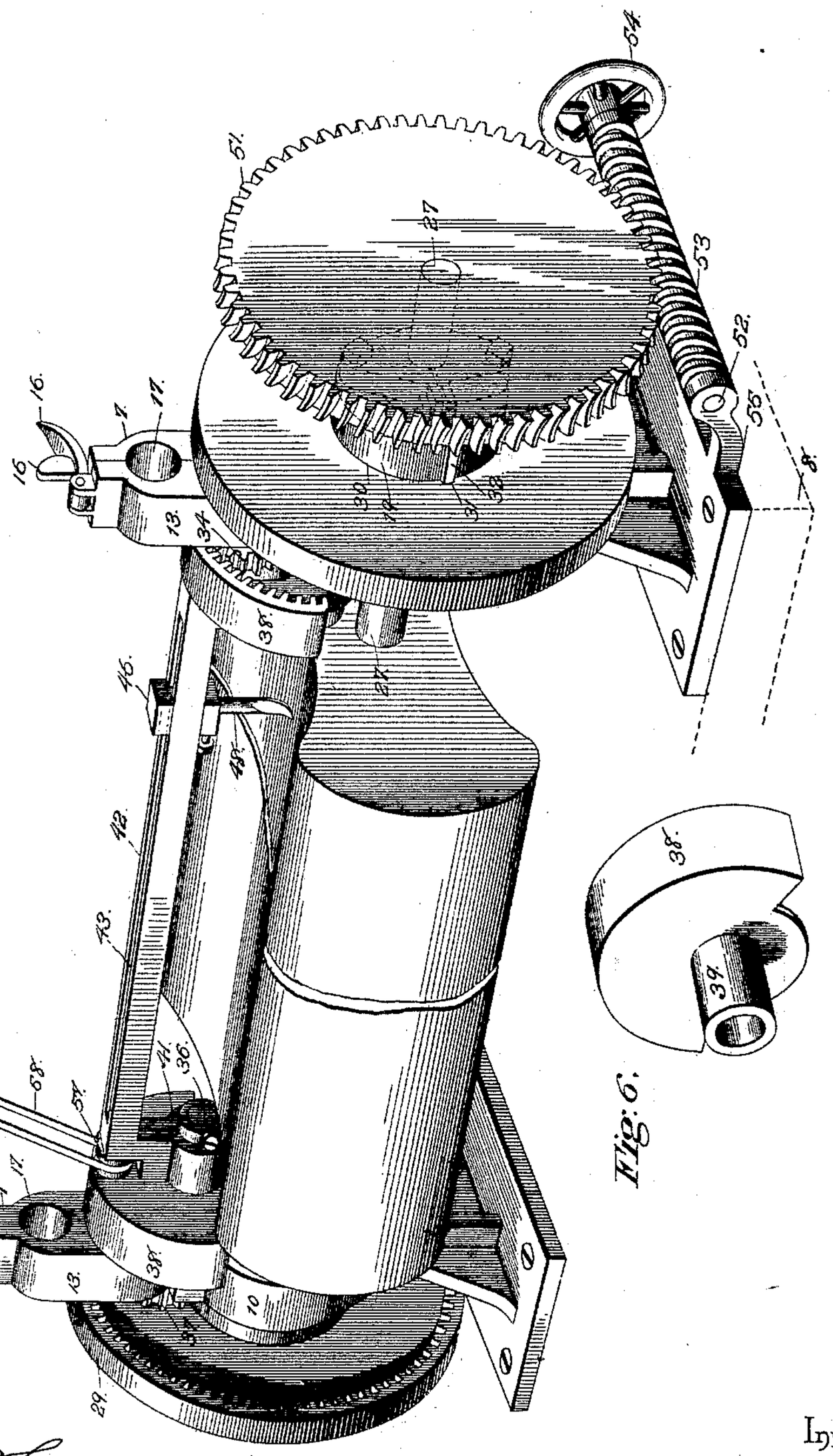

Fig. 1.

Fig. 6.

Witnesses

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(Model.) 3 Sheets—Sheet 2.

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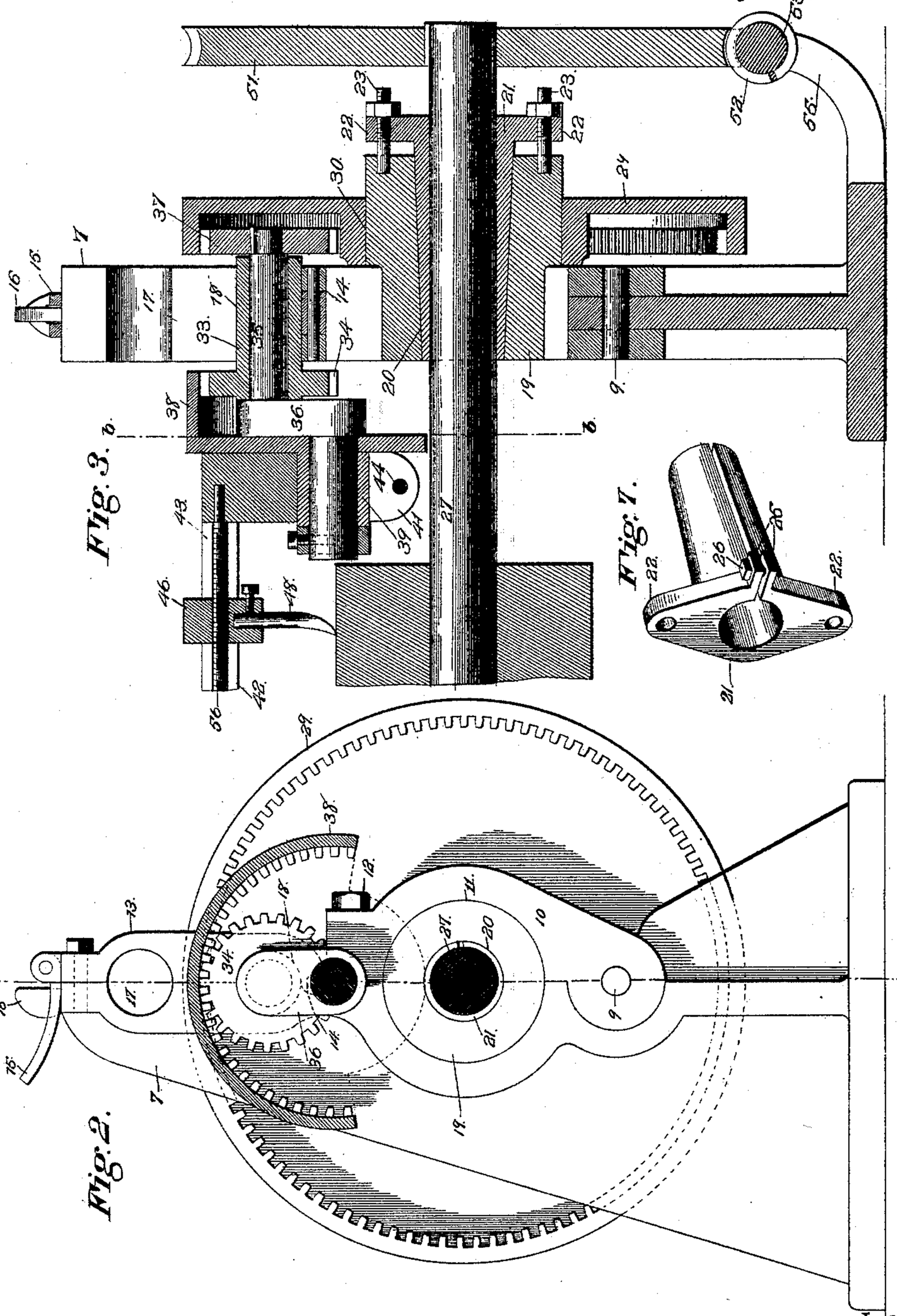

Fig. 3.

Fig. 1.

Fig. 2.

Witnesses

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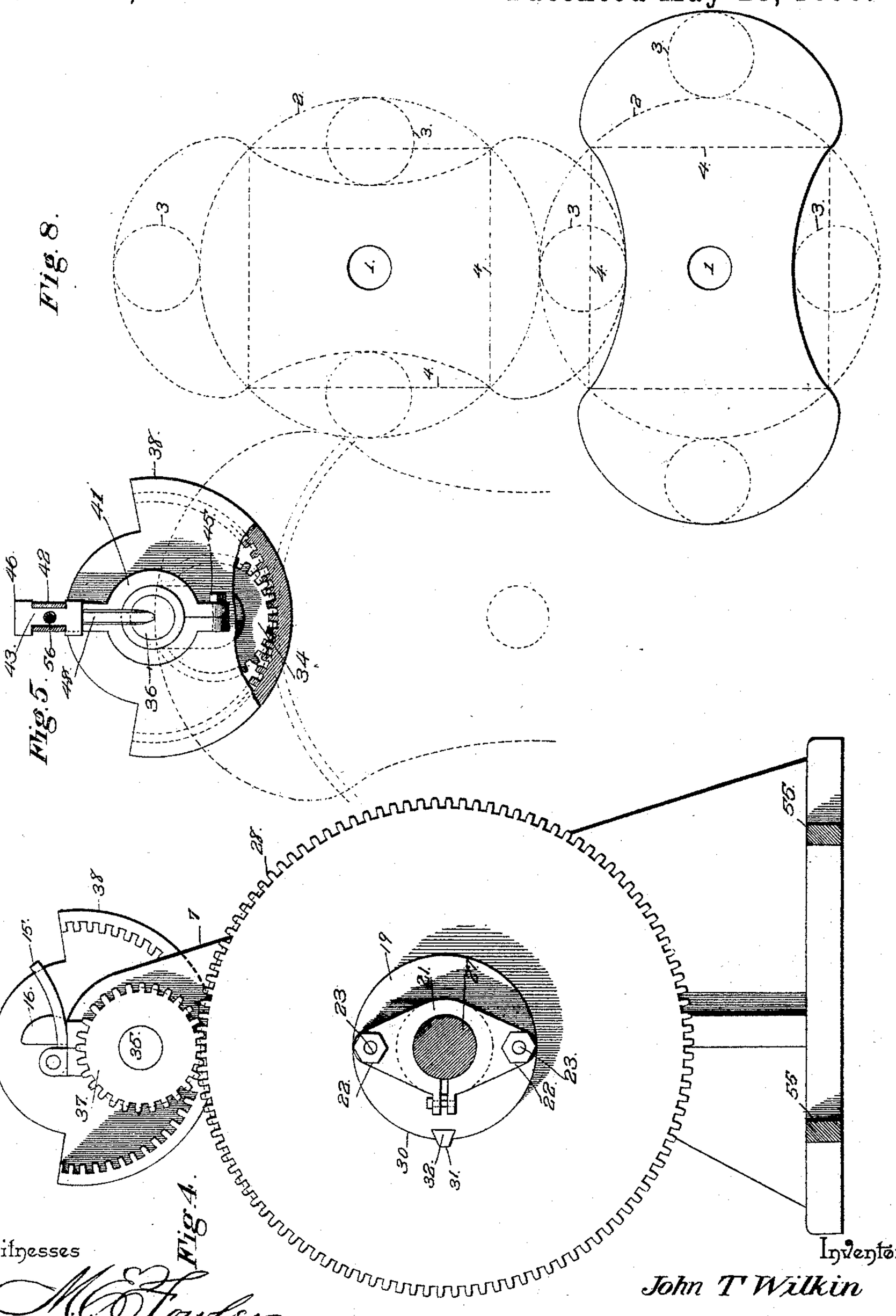

Fig. 8.

Fig. 5.

Fig. 4.

Witnesses

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UNITED STATES PATENT OFFICE.

JOHN T. WILKIN, OF CONNERSVILLE, INDIANA.

MACHINE FOR PLANING CYCLOIDAL SURFACES.

SPECIFICATION forming part of Letters Patent No. 497,997, dated May 23, 1893.

Application filed May 19, 1892. Serial No. 433,609. (Model.)

To all whom it may concern:

Be it known that I, JOHN T. WILKIN, a citizen of the United States, residing at Connersville, in the county of Fayette and State of Indiana, have invented a new and useful Machine for Planing Cycloidal Surfaces, of which the following is a specification.

My invention relates to a machine for cutting cycloidal revolvers for rotary blowers, pumps, &c., and that particular class of revolver employing two or more lobes. As is well known to those familiar with this art, and having practical experience, the two-lobe revolver employing what might be termed hypocycloidal and epicycloidal lines possesses many advantages, especially in the construction of blowers, in that the revolvers may be constructed and adapted so as to always revolve in contact. The difficulty heretofore in the employment of these revolvers, though their virtue was well known, was the cost of their manufacture, and hence they have been practically abandoned in the manufacture of pumps, blowers, and the like.

The object of my invention is, primarily, to produce a machine that will accurately and with facility cut or plane these cycloidal revolvers.

Various other objects of the invention will appear in the following description, and the novel features thereof will be particularly pointed out in the claims.

Referring to the drawings: Figure 1 is a perspective view of a machine embodying my invention. Fig. 2 is an inner side elevation of one of the standards, the revolver shaft, segmental gear and crank-pin appearing in side elevation. Fig. 3 is a vertical transverse section of one end of the machine. Fig. 4 is an end elevation of the machine, the feed mechanism being broken away. Fig. 5 is a side elevation of the segmental gear, the same being partly broken away. Fig. 6 is a detail in perspective of the segmental gear. Fig. 7 is a detail in perspective of the bearing sleeve. Fig. 8 is a diametrical view illustrating the principle of the cycloidal revolver.

Like numerals of reference indicate like parts in all the figures of the drawings.

In order that I may fully explain the character and formation of the article to be produced by my machine, I make the following statement: Referring to Fig. 8, wherein I have shown two cycloidal revolvers in operative contact, 1 designates the center of motion of said revolvers, and 2 is the pitch-circle. Equal chords 4, 4, are drawn within the pitch-circle, forming an exact square. This having been done, it is now simply necessary to revolve a circle 3, which is one-fourth the diameter of the pitch-circle over the pitch-line of the pitch-circle between the opposite angles formed by the chords, beginning and ending exactly at said angles, and the lines scribed by the scribing point of the circle 3 will form the opposite epicycloidal lobes. Now, by arranging the same sized circle at the inner edge of the pitch-circle, and revolving from angle to angle of the opposite chords, the line scribed by the scribing point of the circle will constitute the hypocycloidal faces. In the same manner and upon the same principle, revolvers having a greater number of lobes may be formed; for instance, a three-lobed revolver would be formed by first scribing the pitch-circle, next forming a hexagon by means of six chords drawn upon the circle, and scribing lines between the angles of the chords by means of a circle of one-sixth the diameter of the pitch circle, all as will be obvious.

In constructing the machine, any suitable framework may be employed, but I prefer to employ the one herein shown, which comprises a pair of opposite vertical standards 7, mounted upon a bed-plate 8, and securely bolted thereto. As these two standards are simply duplicates, as is also the mechanism they support, a description of one will therefore suffice for both. The standard is divided transversely on a vertical line from its upper end to a point near its lower end, and to the lower end of the division there is hinged at 9, a clamping-section 10, the upper end of which extends above the center of the standard. The standard and clamping-section are provided at their meeting edges with half-bearings, arranged opposite to each other and combining to produce a circular opening 11, which may be opened or closed by a lowering or raising of the section 10 of the standard. This section 10 may be locked against the standard by any suitable device, but in this instance I have merely shown a bolt 12 for the purpose, that passes through the upper end

of the section 10, and into a threaded opening formed in the standard.

An upper section 13 is located above the section 10, against the cut-away face of the standard, and this section is also preferably hinged at its lower end, at 14, to the standard, and is provided at its upper or free end with a hinged lever 15, having an opening designed to be engaged over and interlock with a cam lug 16, formed on the upper end of the standard. Other means may be devised for accomplishing this purpose, but I prefer some simple means that may be quickly operated in order to expedite the shifting of certain mechanism to be hereinafter described. The upper section and the face of the standard, at their meeting edges, are provided with upper and lower circular bearing-openings 17 and 18, respectively, of similar diameters.

Located in the circular opening or bearing 11 is a bearing-sleeve 19, and the same projects from the inner face of its standard to a point beyond the outer face thereof. The bearing-sleeve is provided with an internal tapered bore 20, and in said bore there is located a longitudinally split and externally-tapered bushing 21, having a plain internal bore of a uniform diameter throughout its length. This bushing is provided at its outer end at diametrically opposite sides with perforated lugs 22, through which extend the outer ends of a pair of threaded drawing bolts or rods 23, projecting rigidly from the outer end of the sleeve. The outer extremities of these bolts or rods have nuts applied thereto, and by running the nuts down upon the bolts or rods it will be obvious that the externally-tapered bushing will be drawn inward into the tapered bore of the sleeve, and hence the edges of said bushing drawn together. These meeting edges are provided with opposite perforated lugs 25, and a clamping or securing bolt 26 passes through the same.

27 designates a transversely-disposed shaft, the opposite ends of which pass through and are clamped by the aforesaid bushings of the two standards, and by the clamping of the bushings the shaft becomes centered therein. This shaft constitutes the shaft of the revolver when the same is completed, and upon the shaft the revolver, as hereinafter described, is mounted. Upon the outer extremities of the shaft worm-gears 51 are secured, and the same, at their lower sides, engage with and are operated by the worm 52, formed upon a horizontal power-shaft 53, one being provided for each of the gears. This shaft terminates at one end in a hand-wheel 54, and is journaled in a pair of short vertical bearing standards 55, that project from the base of the standard. Other means may be provided for feeding the shaft, but I prefer the one herein shown, in that it is positive and gradual, two very essential points to be provided for.

28 designates a spur-gear wheel, whose pitch-diameter equals the pitch-circle of the revolver, and 29 designates an internal gear of similar pitch-diameter. These two gears are intended to be substituted one for the other, and each is therefore provided with a circular opening 30, adapted to slide snugly yet removably upon the outer end of the bearing-sleeve 19. Each gear is provided with a key-seat 31, which corresponds with and receives a spline 32, with which the exterior of the bearing-sleeve is provided. For a purpose hereinafter apparent, the pairs of gears 28 and 29 are made interchangeable, as before stated.

A tubular stationary stud 33 is adapted to fit and be located removably in either one of the openings 17 or 18, and the said stud projects beyond the inner face of the standard where its extremity is encircled by a series of spur-teeth forming a pinion 34, which being integral or fixed upon the stud is stationary. Mounted for movement in the stud is a short transverse shaft 35, and the same extends beyond the opposite ends of the stud, as shown. The inner end of this shaft is provided with a crank-arm 36, which is of a length to the center of its crank-pin agreeing with the pitch-radius of the pinion 34. The outer end of the shaft is provided with a small pinion 37, which is of a pitch-diameter agreeing with the pinion 34, said gear 37 being keyed upon and moving with the shaft. As seen, the pinions 34 and 37 are of the same pitch-diameters, and they are exactly one-fourth of the pitch-diameters of the two spur and internal gears 28 and 29.

38 designates an internally-toothed segmental gear, and the same is provided with an elongated hub 39 which fits loosely and is adapted to work upon the crank-pin of the crank-arm. The pitch-diameter of this segmental gear is exactly one-half of the pitch-diameter of the gears 28 and 29, and twice the diameter, therefore, of the pinions 34 and 37. The hub of this segmental gear is embraced by a sleeve 41, and the two sleeves at opposite sides of the machine are connected by a transversely-disposed tool-supporting bar 42, which is provided for nearly throughout its length with a longitudinal slot 43. The sleeves are split and clamped upon the hubs at a proper point by means of clamping-screws 44 passing through perforations formed in the extremities of the sleeves and provided with nuts 45. The opposite ends of the slotted bar are provided with bearing-openings, and in the same is journaled the transverse shaft 56, which is provided with a fine thread whereby the shaft may feed or cause the tool-carrying block 46 to travel from end to end thereof. This shaft is provided at one end with a small pulley 57, and the same is operated through the medium of a belt 58, which may be run by any suitable motor or mechanism.

The block 46, which carries the tool 48, is provided upon its opposite sides with grooves

in which fit the opposite edges of the slot of the bar. Various devices will suggest themselves for giving the tool and its carriage a back-and-forth travel, and this is only one of the many ways I have in mind.

When the machine is operating upon that part of the epicycloidal lobes of a revolver, as shown in Figs. 4 and 5, the cranks extend upward, as do the sleeves, and the segmental gears extend downward and engage with the lower portions or teeth of the pinions 34. In this instance also the shafts 35 and studs 32, and such parts as are carried thereby, are supported in the upper bearing-opening 17, and the spur-gear wheel 28 is employed to give motion through the medium of the pinions 37 to the parts. In operating upon the hypocycloidal curves of the revolver, or those portions between the lobes, the shafts and studs are removed from the upper bearings of the standards and placed in the lower bearings, as shown in Figs. 1, 2, and 3. The segmental gears now engage the upper portions of the fixed pinions 34, the cranks depend and the sleeves having been loosened are swung to a vertical position and there secured. The spur-gears 28 are removed, and the internal gears are substituted. In either instance, however, the operation of cutting is practically the same. The shaft 27 is very gradually revolved in order to feed the revolver to the tool, and at the same time the tool is reciprocated or travels back and forth, while the segmental gear causes the tool to always remain exactly at a right angle to the surface upon which it is operating. From this it will be seen that the sleeves upon the crank are caused to revolve, their movements being through one-half the angle traveled by the crank-arm carrying the point of the tool in a path which generates on the revolving revolver the epicycloidal or hypocycloidal lines, so that as the tool is fed across the work, the planing is accomplished. The point of the tool is always in the line of the centers of the two opposite crank-pins.

From the foregoing description, in connection with the accompanying drawings, it will be seen that I have provided a simple mechanism capable of producing with facility the advantageous form of revolvers, whose virtues, though heretofore recognized, have been lost by reason of the extreme difficulty accompanying their manufacture.

Having described the invention, what I claim is—

1. In a machine of the class described, the combination with the opposite side frames provided with bearings, a blank-carrying shaft mounted for rotation therein, and means for revolving the shaft, of a superimposed tool-carrying device, means for reciprocating the device between the side frames, and means for transversely feeding the device upon cycloidal lines to the blank, substantially as specified.

2. In a machine of the class described, the combination with the opposite side frames having bearings, a transverse revolver-carrying shaft mounted therein, tool-carrying devices located above the shaft, means for reciprocating the devices for rotating the shaft and for moving the tool-carrying devices upon hypocycloidal and epicycloidal lines to the blank, substantially as specified.

3. In a machine of the class described, the combination with the opposite side frames, and the blank-supporting shaft, a superimposed tool-carrying device, means for reciprocating said device between the frames, and for feeding the same in cycloidal lines to the blank, substantially as specified.

4. In a machine of the class described, the combination with the opposite side frames having bearings, a transverse blank carrying shaft mounted in opposite bearings therein, means for revolving the shaft, of a crank-shaft for each of the standards, standards rising from the crank-shafts, a tool-carrying bar connecting the standards, and means for revolving the crank-shafts, substantially as specified.

5. In a machine of the class described, the combination with the opposite side frames, the blank-carrying shaft mounted in bearings therein, and pairs of upper and lower bearings in the frames, of hollow studs removably mounted in either the upper or lower pairs of bearings, crank-shafts located in the hollow studs, which latter are fixed, a pinion fixed upon the inner end of each of the hollow studs and upon the outer end of each of the crank-shafts, internally-toothed segmental gears mounted on the crank-pins of the crank-shafts and adapted to engage with the fixed pinions of the studs and having a pitch-diameter twice as great as the pinions, said crank-arms corresponding in length with the pitch-radius of the pinions, standards loosely connected with the crank-pins, means for adjusting the same upon the pins, a transverse bar connecting the standards, a tool mounted for reciprocation upon the bar, means for reciprocating the tool, and means for revolving the crank-shafts and their pinions, substantially as specified.

6. In a machine of the class described, the combination with the opposite side frames, the blank-carrying shaft, means for operating the same, the opposite crank-shafts, the studs for receiving the same removably mounted in bearings formed in the side frames, inner fixed pinions mounted on the inner ends of the studs, and means for revolving the crank-shafts, of opposite segmental gears internally-toothed and adapted to engage the teeth of the fixed pinions, the opposite series adjustably mounted on the crank-shafts, the slotted bar connecting the sleeves, the feed shaft journaled in opposite ends of the slot and provided with a pulley, the tool-carrying block grooved to receive the opposite edges of the

slot and centrally threaded to receive the rod, a belt for driving said pulley, substantially as specified.

7. In a machine of the class described, the combination with the opposite standards having the upper pairs of bearings, removable sections closing the same, means for locking the sections, the tubular studs clamped within the bearings and adapted to be inserted in either pair, the opposite crank-shafts loosely mounted in the studs, the fixed gears at the inner ends of the studs, the gears at the outer ends of the shafts, the internally-toothed segmental gears upon the crank-pins, the sleeves extending from the pins, the connecting bar for the sleeves, a tool-carriage, and means for reciprocating the same, of gear-wheels mounted on the shafts, means for rotating the wheels, the said wheels being adapted to engage and operate the outer pinions of the crank-shafts, and means for rotating the gear-wheels and for removably locking them on the shafts, substantially as specified.

8. In a machine of the class described, the combination with the opposite standard longitudinally and vertically divided, and the upper and lower sections removably connected thereto, the sections and standards being provided at their meeting edges with pairs of upper and a pair of lower bearings, a sleeve mounted in each of the lower bearings and provided with a tapered bore, split bushings externally tapered and internally bored inserted in the sleeves, means for securing the sleeves in position, and a shaft carrying blank removably mounted in the sleeves, gear-wheels, and means for locking the same upon the outer ends of the sleeves, of means for operating the shafts, opposite hollow studs removably mounted in the upper bearings and terminating at their inner ends in pinions whose pitch-diameter is one-fourth of that of the two gear-wheels, the opposite crank-shafts journaled in the studs, the pinions upon the outer ends of the crank-shafts, the cranks of said shaft equaling in length the pitch-radius of the pinions, the segmental gears having a pitch-diameter double that of the pinions and provided with inwardly-disposed hubs, the sleeves mounted adjustably upon the hubs, and the tool-carrying bar supported by the sleeves, substantially as specified.

9. In a machine of the class described, the combination with the opposite standards having upper and lower pairs, and a lower pair of openings, of the opposite sleeves provided with internal conical bearings, and with a fin, the opposite longitudinally split boxes mounted therein and externally made conical to fit the same, perforations formed in lugs at the outer ends of the bushings and at the meeting edges thereof, threaded rods passing through the former perforations and extending from the outer ends of the sleeves, nuts on the outer ends of the rods, transverse bolts passing through the lugs at the meeting edges of the bushings, the removable gears having central openings provided with grooves to receive the splines, the opposite transverse crank-shafts, the pinions on the outer ends of the same engaged by the gears, the hollow studs for the reception of the shafts and provided at their inner ends with toothed gears fixed thereon, the internally toothed segmental gears mounted on the crank-pins, and means for supporting the tool-carrying device upon the pins, substantially as specified.

10. In a machine of the class described, the combination with opposite supports, means for supporting a blank between the same, of a tool-carrying device, means for reciprocating the same longitudinally of the blank and transversely feeding it upon cycloidal lines, substantially as specified.

11. In a machine of the class described, the combination with means for supporting a blank, of a tool-carrying device located adjacent thereto, and means for moving the tool upon cycloidal lines over the face of the blank, substantially as specified.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JOHN T. WILKIN.

Witnesses:
JNO. H. SIGGERS,
E. G. SIGGERS.