No. 867,077. PATENTED SEPT. 24, 1907.

W. PORTEOUS.

REAMING AND TAPPING MACHINE.

APPLICATION FILED SEPT. 11, 1905.

6 SHEETS—SHEET 1.

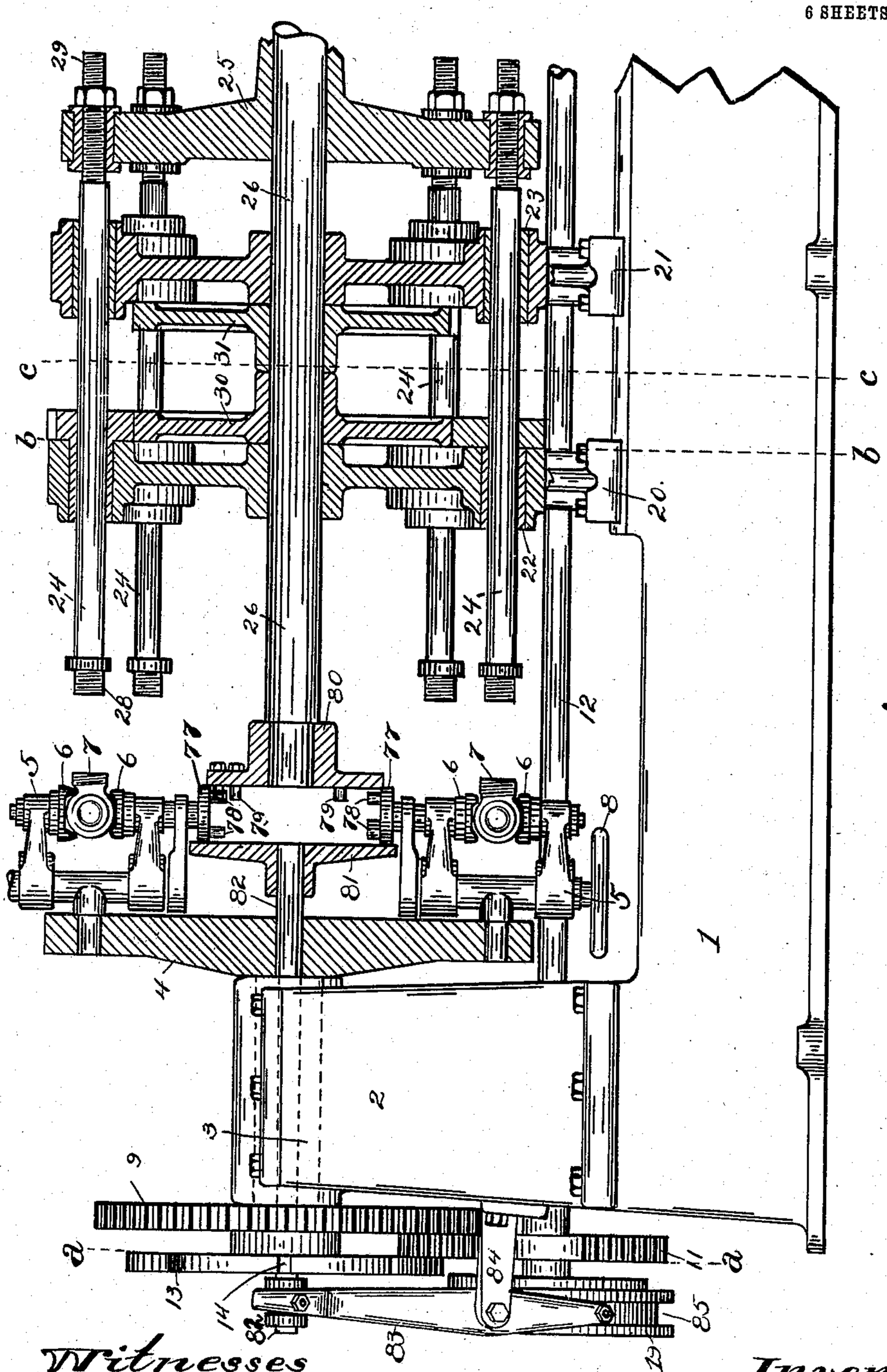

Fig. 1.

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6 SHEETS—SHEET 2.

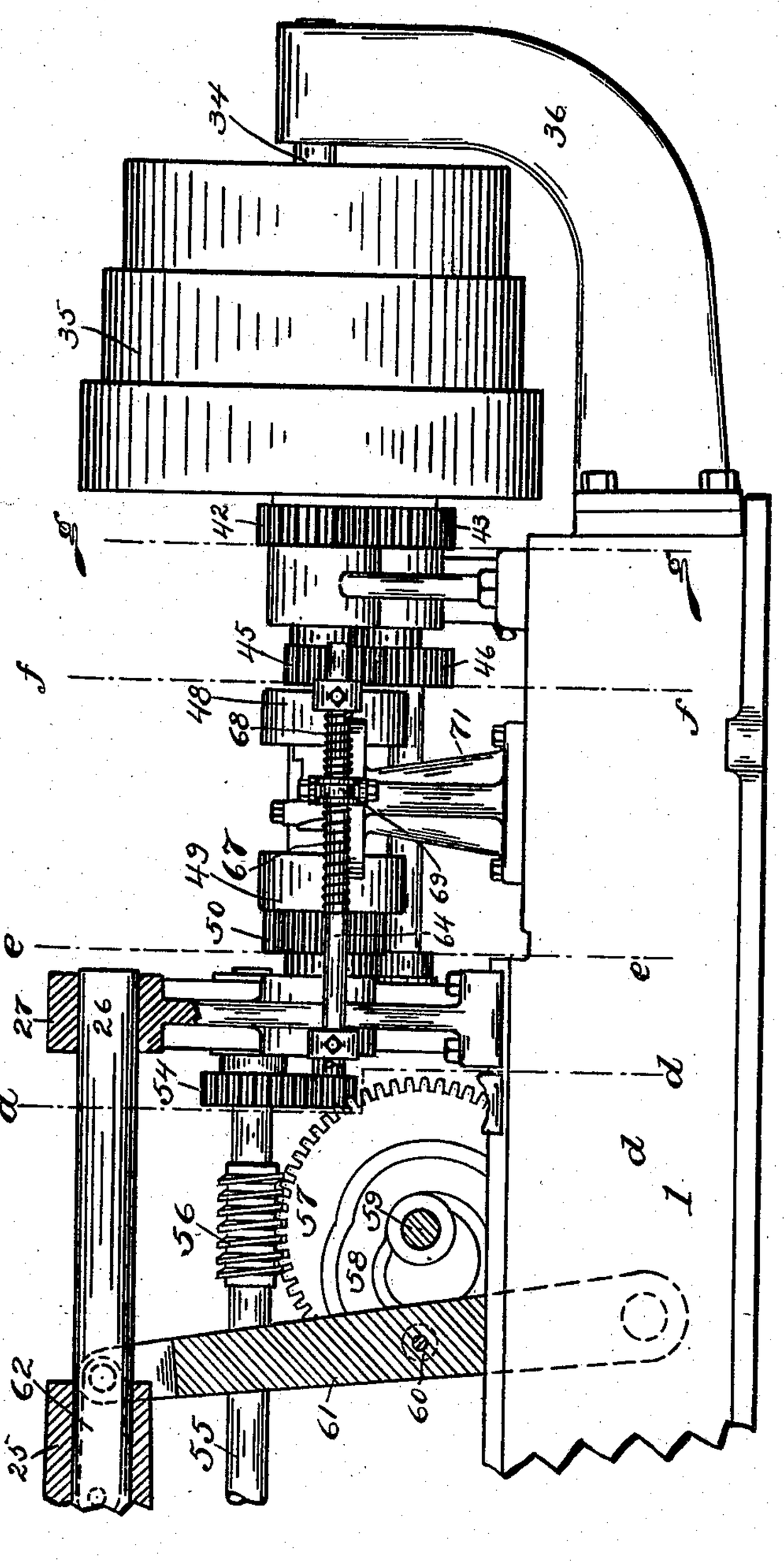

Fig. 2.

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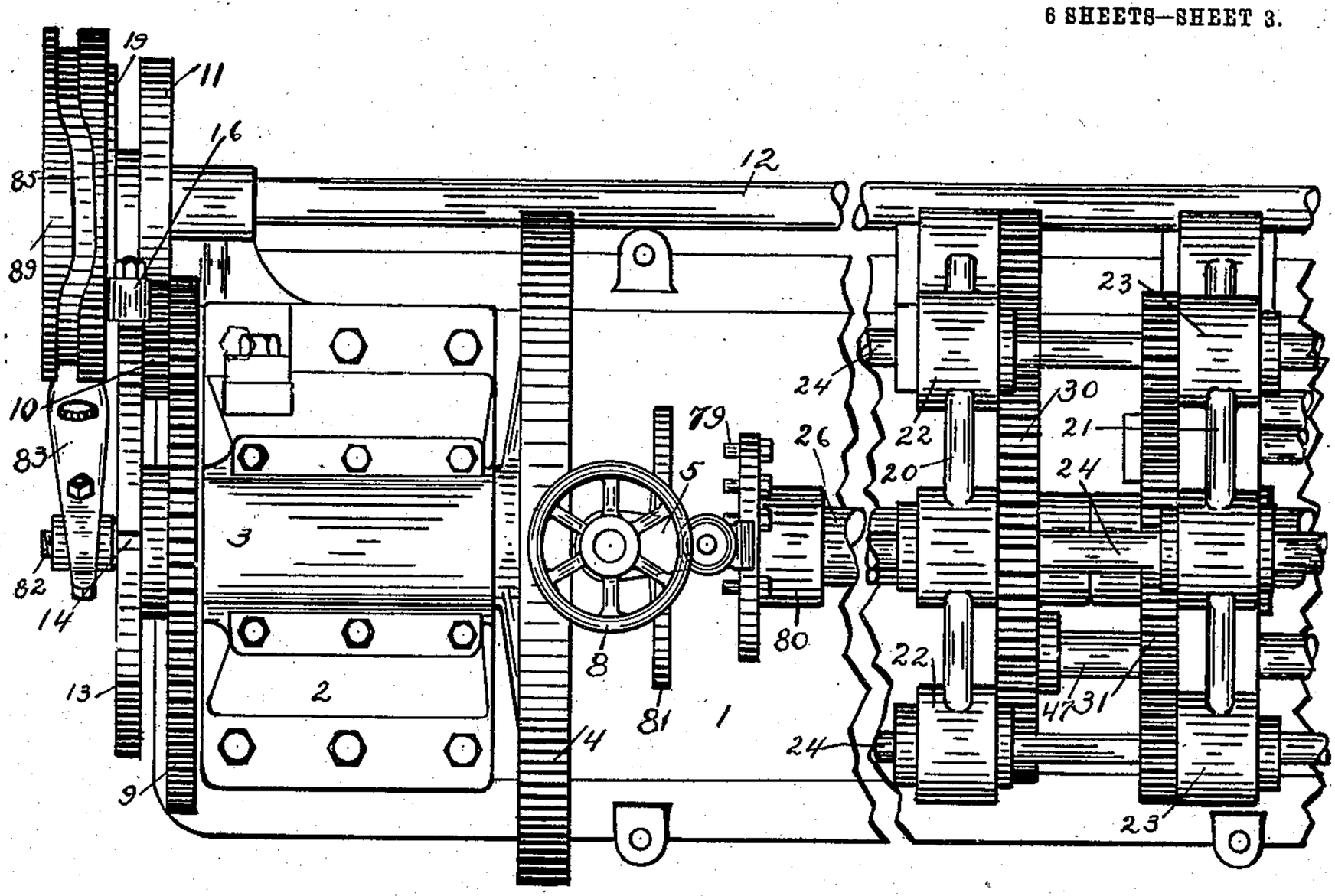

Fig. 3.

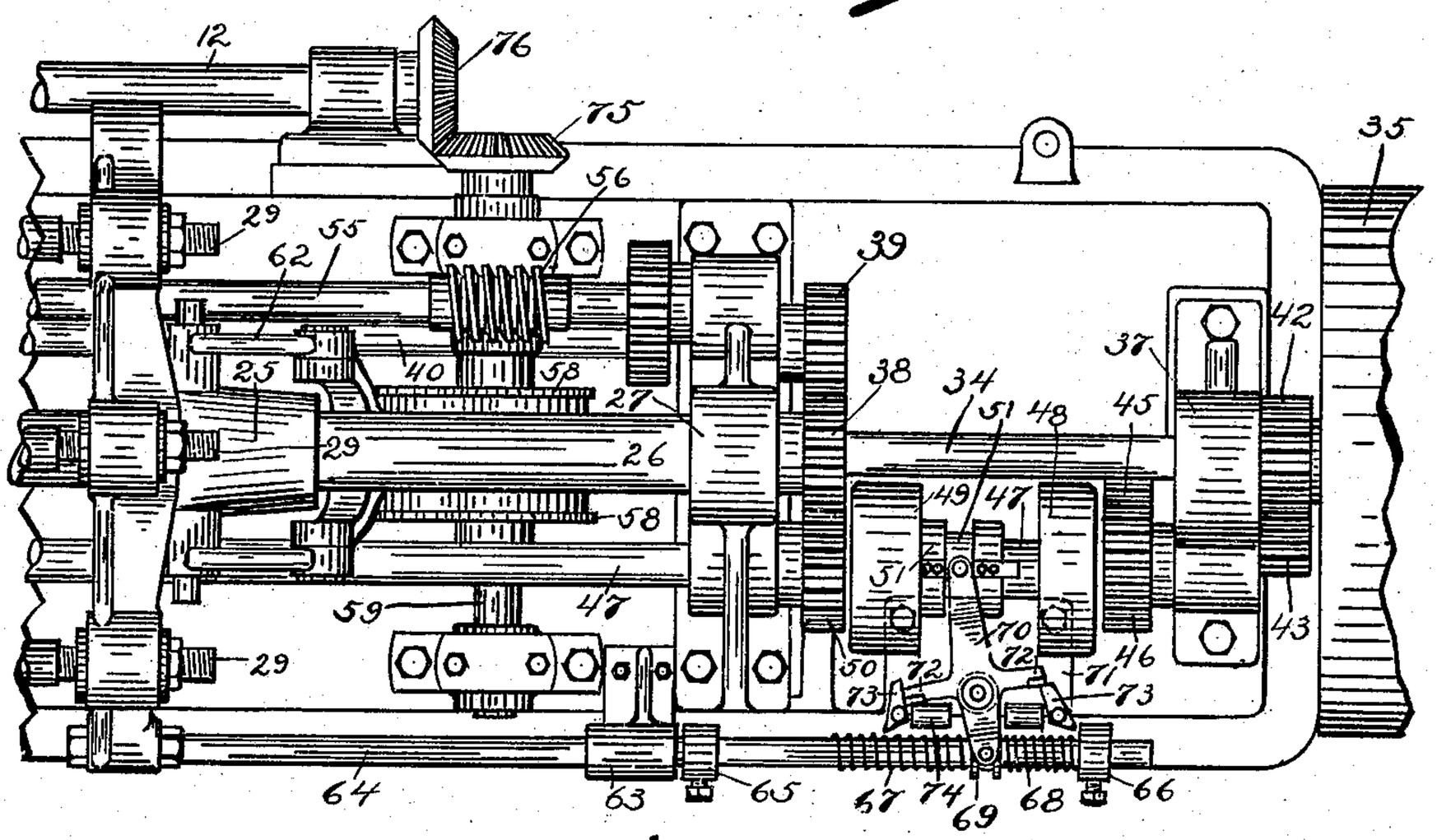

Fig. 4.

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6 SHEETS—SHEET 4.

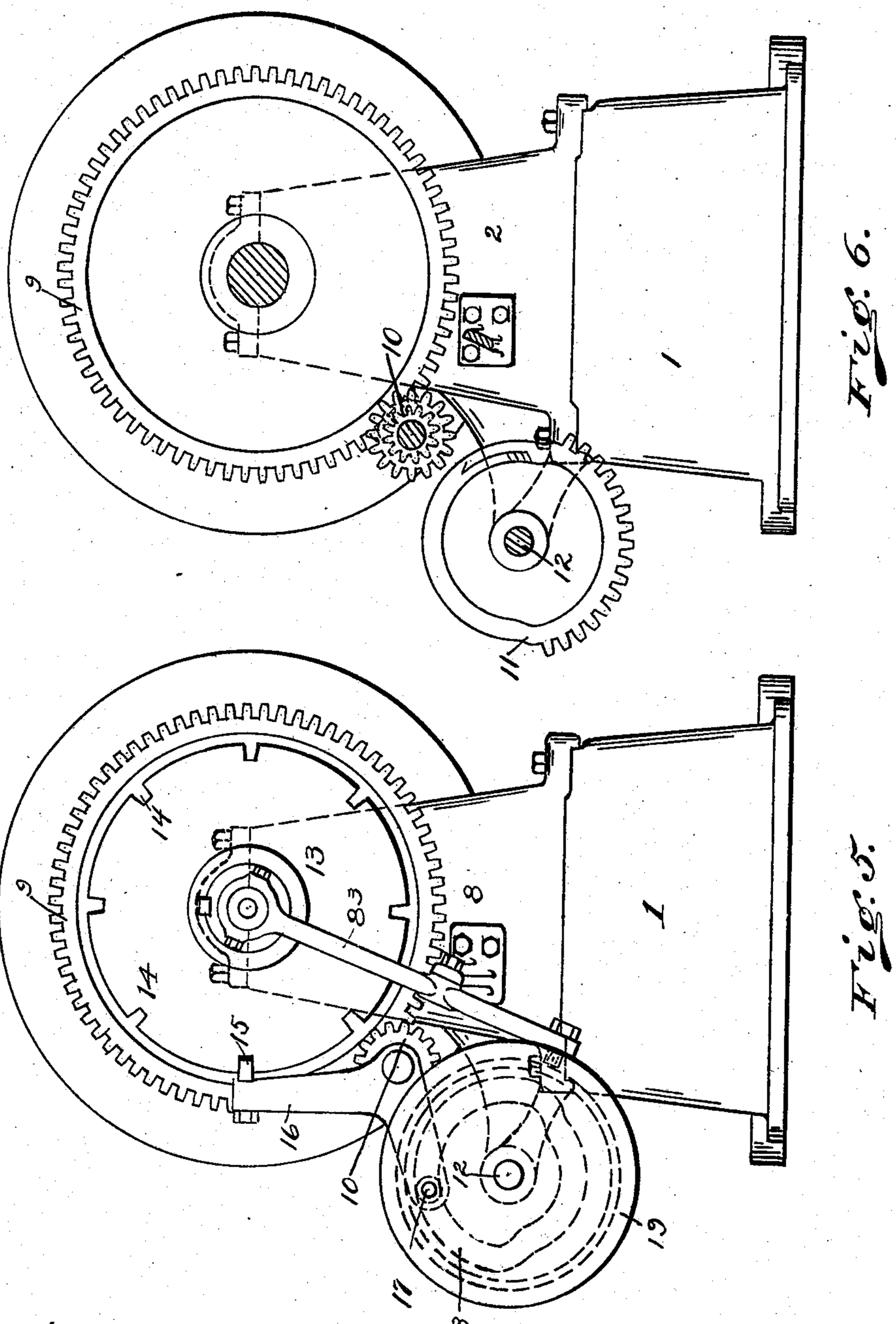

Fig. 6.

Fig. 5.

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6 SHEETS—SHEET 5.

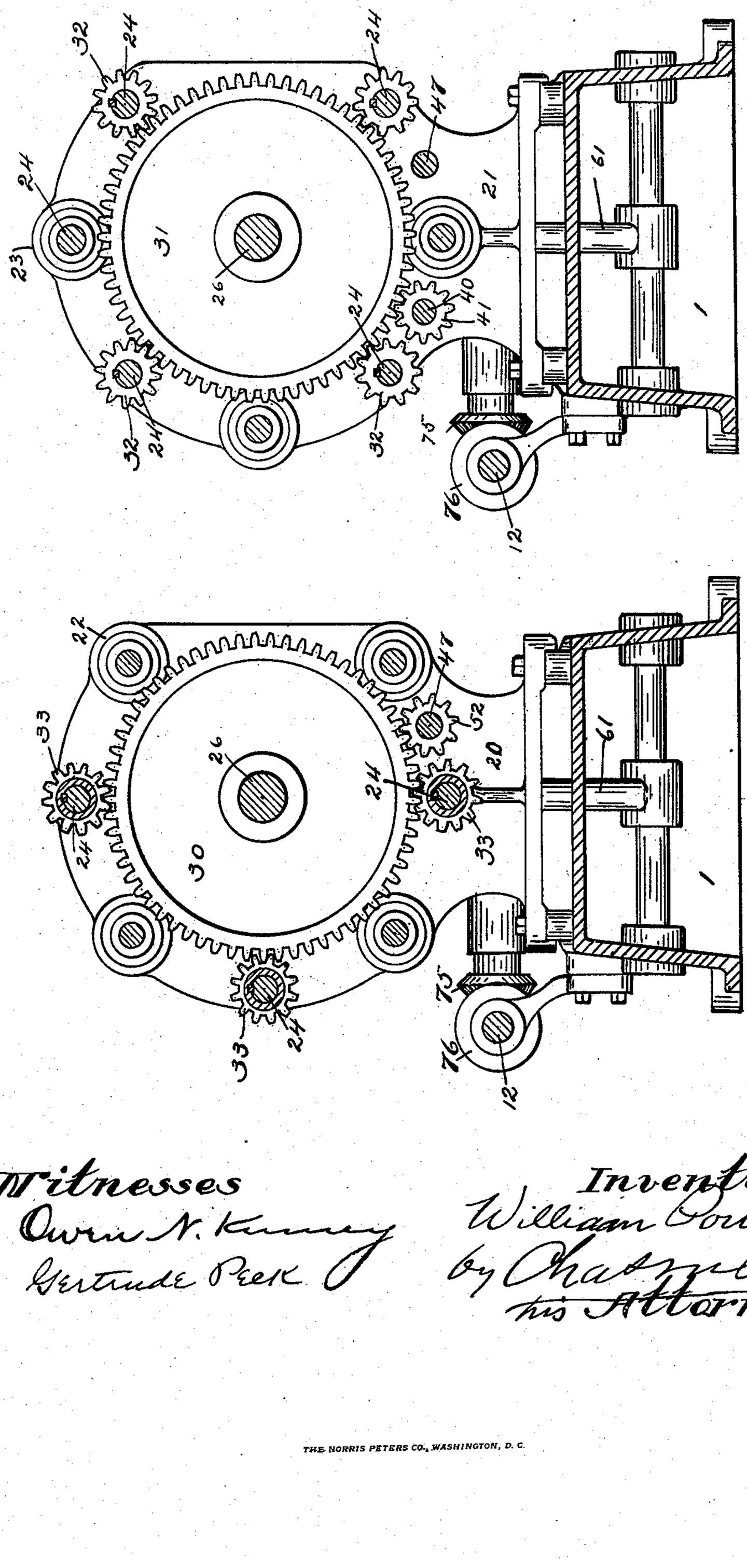

Fig. 8.

Fig. 7.

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APPLICATION FILED SEPT. 11, 1905.

6 SHEETS—SHEET 6.

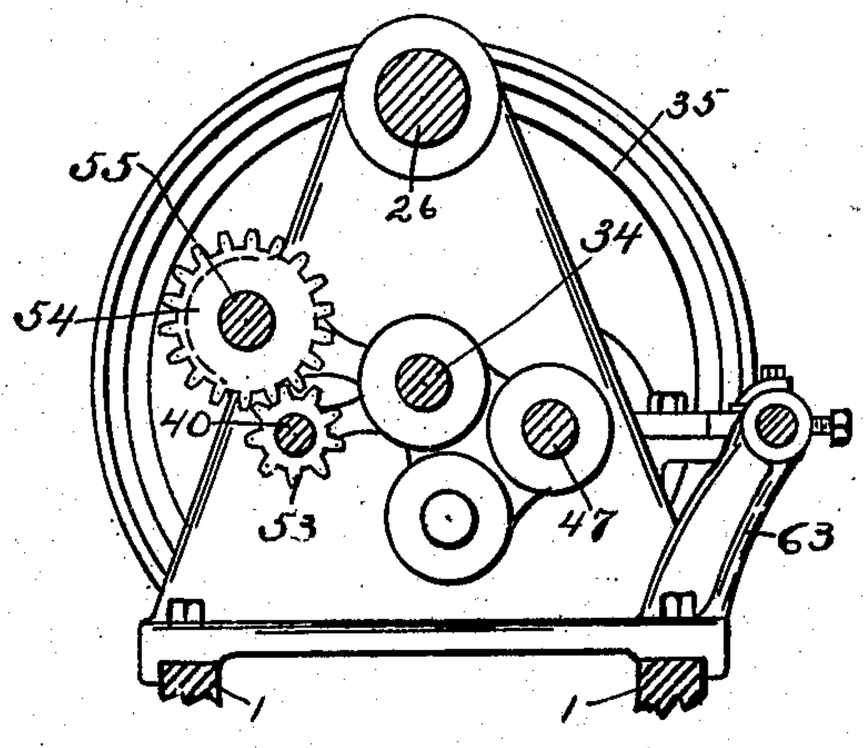

Fig. 9.

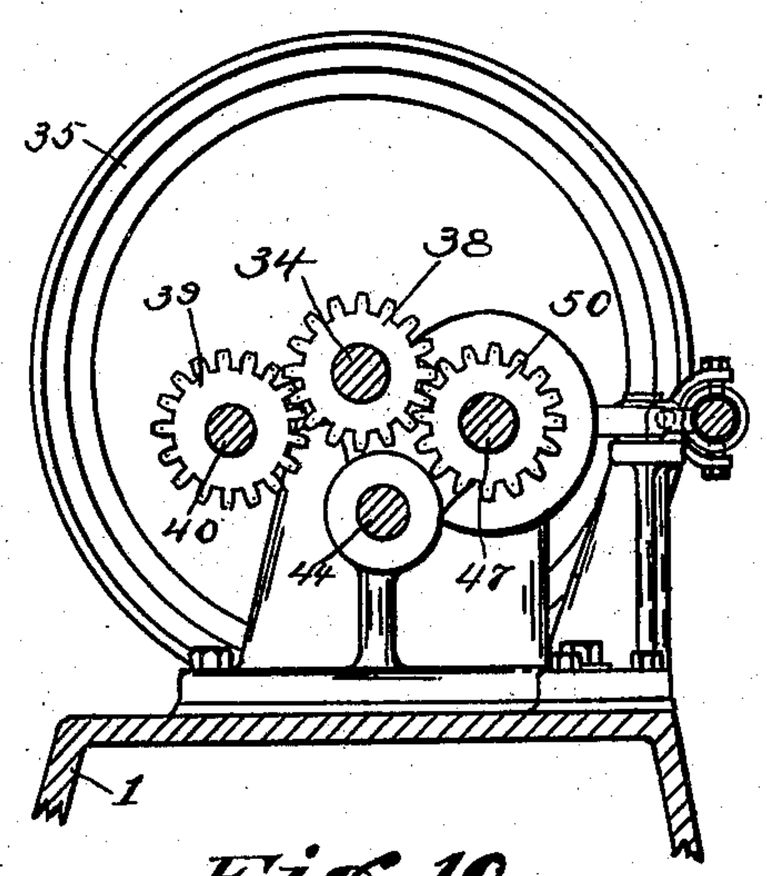

Fig. 10.

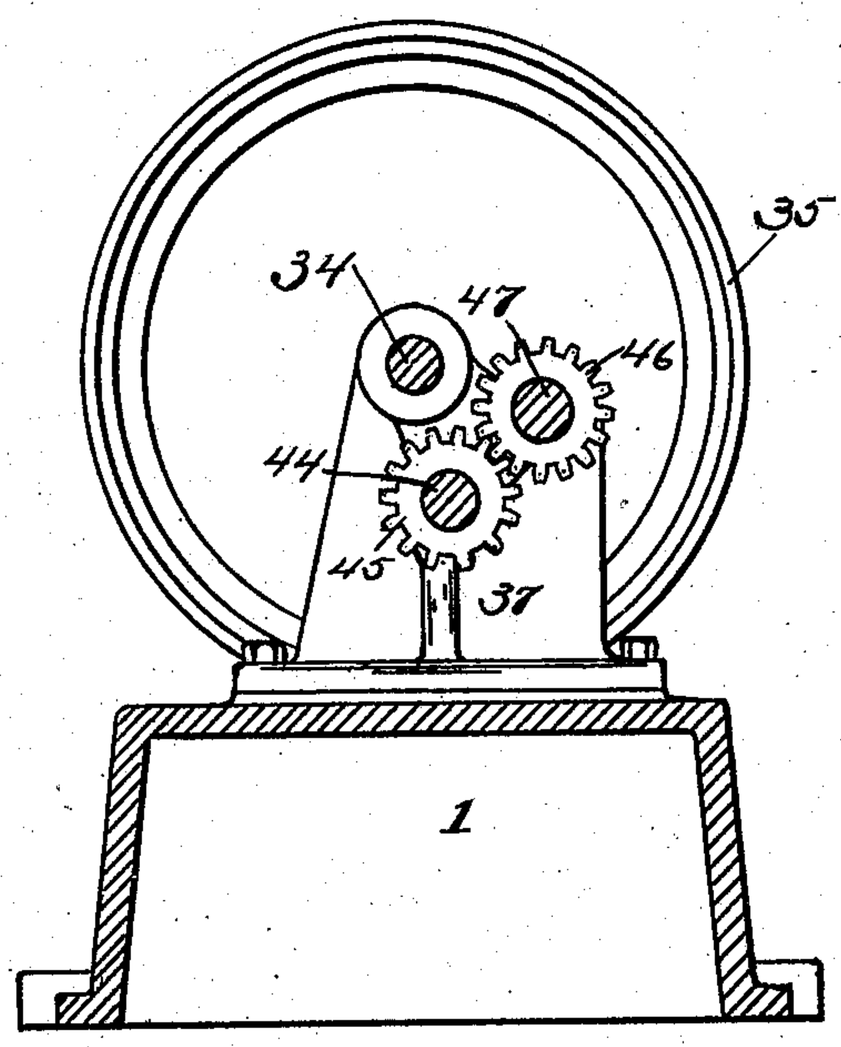

Fig. 11.

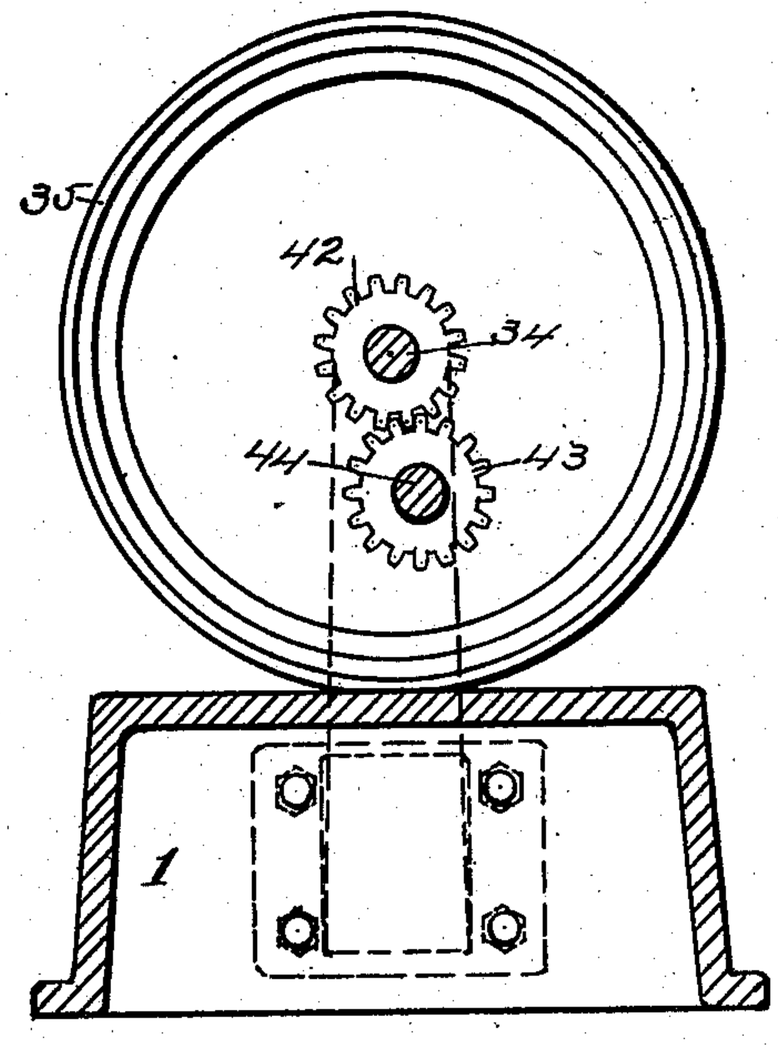

Fig. 12

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

UNITED STATES PATENT OFFICE.

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REAMING AND TAPPING MACHINE.

No. 867,077. Specification of Letters Patent. Patented Sept. 24, 1907.

Application filed September 11, 1905. Serial No. 278,017.

To all whom it may concern:

Be it known that I, WILLIAM PORTEOUS, a citizen of the United States, residing at College Hill, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Reaming and Tapping Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

My invention relates to machines for reaming and tapping valves, cocks and other brass or iron fittings and it has for its object the improved construction of such machines, whereby the output of the machine is greatly increased and the power necessary to drive the same materially reduced and the machine rendered as nearly automatic in its action and as easy to handle as possible.

The novelty of my invention will be hereinafter more fully described and specifically pointed out in the claims.

In the accompanying drawings:—Figure 1, Sheet 1 is a partial front elevation partly in section of a machine embodying my invention. Fig. 2, Sheet 2 is a similar view of the balance of the machine, at the right of Fig. 1. Fig. 3, Sheet 3 is a plan view partly broken away of the left end of Fig. 1. Fig. 4, Sheet 3 is a similar view of Fig. 2. Fig. 5, Sheet 4 is an end elevation of Fig. 1 looking to the right. Fig. 6, Sheet 4 is a sectional end elevation on the dotted line *a*—*a* of Fig. 1 looking to the right. Fig. 7, Sheet 5 is a sectional end elevation on the dotted line *b*—*b* of Fig. 1 looking to the right. Fig. 8, Sheet 5 is a section on the dotted line *c*—*c* of Fig. 1 looking to the right. Fig. 9, Sheet 6 is a section on the dotted line *d*—*d* of Fig. 2 looking to the right. Fig. 10, Sheet 6 is a section on the dotted line *e*—*e* of Fig. 2 looking to the right. Fig. 11, Sheet 6 is a section on the dotted line *f*—*f* of Fig. 2 looking to the right. Fig. 12, Sheet 6 is a section on the dotted line *g*—*g* of Fig. 2 looking to the right.

The same numerals of reference are used to indicate identical parts in all of the figures.

The machine consists essentially of a series of horizontally reciprocating and rotating tool carrying spindles and an intermittently revolving work carrying table provided with intermittently revolving work-carrying chucks together with mechanims for synchronously actuating the various parts of the machine.

Mounted upon any suitable bed 1 and at the left end thereof when viewed from the front, is a head stock 2 which has journaled therethrough a hollow spindle 3, shown in dotted lines, and this spindle carries the work carrying table or face plate 4, upon which is mounted a series of work carrying chucks 5 provided with jaws 6 for clamping and holding the valve bodies or other fittings 7 to be operated upon. The jaws 6 are adapted to be clamped or released by means of a hand wheel 8 revolving a right and left screw within the chuck 5 after the manner described in my chuck Patent No. 487,292 dated December 6, 1892 to which reference is made, which eliminates the necessity of a detailed description of the construction of this part of the mechanism. A gear 9, suitably mounted upon the spindle 3 serves to intermittently revolve the same when its driving cone gear 10 (Fig. 6) is engaged by the segmental gear 11 which is constantly driven by a shaft 12, suitably journaled to the bed 1 and driven by the main driving mechanism, to be presently described. Adjacent to the gear 9 and likewise carried by spindle 3 is a notched locking disk 13 (Figs. 1, 3 and 5) which is provided with notches 14, one for each stationary position of the face plate 4, and these notches 14 are adapted to be engaged by a detent 15 (Fig. 5) carried on a bell crank 16, fulcrumed on the stud which carries the cone gear 10. The other end of this bell crank 16 carries a roller 17, dotted lines Fig. 5, which travels in a cam groove 18 in a disk 19 mounted upon the shaft 12 and adjacent to the segmental gear 11. The operation of this part of the machine is as follows: (Figs. 5 and 6). Assuming the shaft 12 to be constantly driven and carrying with it segmental gear 11 and cam disk 19 and that the parts are in the position shown in Figs. 5 and 6, no action will take place until the segmental gear 11 is revolved in the direction of the arrow (Fig. 6) until its teeth engage the teeth of the cone gear 10 (Fig. 6) at which time the contracted portion of the cam groove 18, by its engagement with the roller 17, disengages the detent 15 from the notch 14 of the plate 13, whereupon the face plate 4 will be revolved a distance equal to the amount of revolution imparted thereto by the duration of the engagement of the segmental gear 11 with the cone gear 10 and this distance will be equal to the distance between any two of the notches 14 in the plate 13, whereupon the segmental gear will pass out of mesh with the cone gear 10 and the expanding portion of the cam groove 18 will cause the detent 15 to engage the next notch 14 in the plate 13 thereby locking the same and the face plate 4 from further revolution as will be readily understood.

Suitably mounted upon the bed plate 1 are a pair of carrying members 20 and 21 (Figs. 1, 3, 7 and 8) which are provided with bearings 22 and 23, within which are journaled a series of horizontal tool carrying spindles 24, which are adapted to slide, through said bearings, toward and from the face plate 4, and which are operated by a cross head 25 which is slidably mounted upon a central spindle 26. The spindle 26 is rigidly mounted in the carrying members 20 and 21 and is also rigidly connected to the member 27 (Fig. 2). The spindles 24 are provided, on the free end with any suitable mechanism for holding a tool or a tool carrying chuck, such as a thread and collar at 28, and these spindles are adjustable toward and from the work by means of

the screw adjustment 29 where they pass through the cross head 25, so that the tools carried by the spindles 24 may be caused to enter the work 7 as far as necessary, and the spindles are free to rotate in their bearing in the cross head 25 and free to slide forward and back in their bearings 22 and 23 in the supporting members 20 and 21.

Suitably journaled upon the shaft 26 and between the carrying members 20 and 21 are a pair of gears 30 and 31 (Figs. 1, 7 and 8), the gear 31 being constantly driven in one direction, and the gear 30 being capable of being driven in either direction, in a manner to be presently described. By referring to Figs. 7 and 8, it will be seen that there are seven of the spindles 24 mounted in the carrying members 20 and 21, and in Fig. 8 it will be noticed that upon four of the spindles 24, pinions 32 are feathered and mesh with gear 31 and these spindles 24 are constantly driven in one direction and carry reamers or cutters, the intermediate spindles carrying screw threading taps, and by reference to Fig. 7, pinions 33 similar to pinions 32 will be seen, and these pinions, like the pinions 32 are feathered on their spindles 24. From the above it will be seen that when the large gears 30 and 31 are revolved in the same direction, all of the spindles 24 will likewise be revolved in the same direction and that when the direction of revolution of the gear 30 is reversed, the direction of revolution of the spindles 24, driven thereby, will be also reversed.

I will now describe the mechanism for driving and reversing the gears 30 and 31 as well as the mechanism for causing the spindles 24 to approach and retract from the work carried on the face plate 4 reference being had to Figs. 1, 2, 3, 4, 9, 10, 11 and 12, wherein 34 represents the main driving shaft, which is driven by any suitable mechanism such as a cone pulley 35 (Fig. 2). An outboard bearing 36 carries the rear end of the shaft 34, the shaft being also journaled in the standard 37 and in the member 27, (Figs. 2, 4, 9 and 11). A gear 38 (Figs. 4 and 10) is mounted on the shaft 34 and drives gear 39 mounted on a shaft 40, which extends forward and carries a pinion 41 (Fig. 8) which meshes with and drives the gear 31 and this constitutes the driving mechanism for the cutters. A gear 42 (Fig. 12) mounted on the shaft 34 meshes with and drives a gear 43 mounted below the same, which is carried upon and drives a stub shaft 44 journaled through the member 37 (Fig. 11) and this stub shaft 44 carries a gear 45 meshing with and driving a gear 46 loosely mounted upon a shaft 47. This gear 46 carries one member 48 of a clutch mechanism, the other member 49 (Fig. 4) being carried by a gear 50 (Figs. 4 and 10) which meshes with the gear 38 carried on the shaft 34, and it will be seen that the two members 48 and 49 revolve in opposite directions, the gear trains described above and shown in Figs. 11 and 12 constituting idler mechanism inserted between the gear 42 and the gear 46. Feathered upon the shaft 47 and between the clutch members 48 and 49 is a clutch body 51 which is adapted to engage either of the members 48 or 49 to drive the shaft 47 in one direction or the other according to which member is engaged by the clutch body 51, and this shaft 47 carries on its end a pinion 52 (Fig. 7) which meshes with and drives the gear 30, either in the same or in the opposite direction as compared with the gear 31.

At 53 (Fig. 9) is shown a pinion mounted on the shaft 40 and driving a gear 54 mounted on a shaft 55 (Figs. 2, 4 and 9) which is suitably journaled in the members 27 and 21, and this shaft 55 carries a worm 56 which meshes with and drives a worm wheel 57 (Fig. 2) which is provided with a cam groove 58 and is carried on a transverse shaft 59, suitably journaled on the bed 1. A roller 60, dotted lines Fig. 2, carried on a yoke bar 61 engages this cam groove 58 in such manner that when the worm wheel 57 is revolved, the yoke bar 61 will be moved toward and from the transverse shaft 59, the lower end of the yoke bar being pivoted to the bed 1 in any suitable manner. The upper forked end of the bar 61 is connected by short links 62, dotted lines Fig. 2 and solid lines Fig. 4, to the hub of the cross head 25 and this connection serves, when the worm wheel 57 is revolved, to reciprocate the cross head 25 and with it all of the spindles 24, which will cause the cutters and taps carried thereby to approach or retract from the work carried by the face plate 4 as will be readily understood.

Carried by the cross head 25 and sliding through a bracket 63 (Figs. 4 and 9) is a rod 64 which carries adjustable collars 65 and 66 (Fig. 4) which serve as abutments for coiled springs 67 and 68, loosely mounted on the rod 64 and these springs are alternately compressed aganist a piece 69 carried by the bell crank shifting arm 70, which is fulcrumed on a bracket 71 secured to the bed plate 1, and this shifter 70 engages a groove in the clutch body 51. Projections 72 extend outwardly from this shifter 70 and are adapted to be engaged by pivoted dogs 73, which, when so engaged hold the clutch 51 in engagement with either of the members 48 or 49 as will be readily understood. The dogs 73 are provided with extensions which lie in the path of travel of the collars 65 and 66 and are adapted to be tripped thereby out of engagement with the extensions 72. Any suitable housed springs 74 may be employed to snap the dogs 73 into engagement with the extensions 72, when the shifter 70 is rocked from one position to the other.

A bevel gear 75 carried by the shaft 59 and located outside of the bearings on the main frame, meshes with and drives a similar gear 76 secured to the end of the shaft 12 (Figs. 4, 7 and 8) and this gearing forms the driving connection between the main driving mechanism and the mechanism for intermittently revolving the face plate 4 which has been hereinbefore described.

The work carrying jaws 6, before described, are rotatably mounted in the chucks 5 and the inner ends of these jaws are provided with square plates 77, which carry pins 78 that lie or extend outward therefrom in such manner as to be struck by pins 79 carried by a face plate 80 mounted upon the free end of the shaft 26 in such manner that when the work carrying face plate is intermittently revolved, the pins 78 coming against the pins 79 will cause the work 7 carried by the jaws 6 to be intermittently revolved to present a new surface to the spindles for their operation thereupon. A locking plate 81 (Fig. 1) carried by a shaft 82 and operated by a rocker arm 83, fulcrumed by a bracket 84 to the head stock 2 is adapted to bear against the square plates 77 and hold the same against rotary movement during the time of operation by the spindles 24 upon the work 7, and this rocker arm 83 is operated by a cam groove 85 cut in the edge of the cam disk 19 (Figs. 1, 3 and 5).

The operation of the machine is as follows:—The operator, standing by the face plate 4 inserts a fitting in the chuck nearest him, there being a spindle 24 omitted (Figs. 7 and 8) for the purpose of giving access to the chucks, and starts the machine, which starting causes the revolution of the shaft 12, which by revolving the disk 19 draws the locking plate 81 away from the plates 77, causes the disengagement of the detent 15 and the engagement of the segmental gear 11 with its cone gear 10 and imparts a partial revolution to the face plate 4, which carries the piece of work, just inserted, around to a position to be operated upon by the first spindle 24, at which time the segmental gear passes out of engagement with the cone gear 10, the detent 15 engages the next notch 14 and the rocker arm 83, through the medium of cam groove 85, forces the plate 81 against the plates 77 to lock the same from turning, at which time the cam roller 60 shown in Fig. 2, having traveled the distance of the concentric part of the cam groove 58 is operated upon by the cam groove 58, thereby rocking the lever 61, and, through the medium of the links 62, imparts a horizontal motion to all of the spindles 24, which at this time are driven in the same direction or clock-wise, thereby causing the first cutter to approach and operate upon the fitting inserted and when this operation is completed, which will be determined by the cam groove 58, the lever 61 will be drawn back, drawing with it the spindles 24. Just before the end of the approaching stroke of the spindles 24, the spring 68 (Fig. 4) carried by the shifter rod 64 will be compressed against the piece 69 by the collar 66 and tend to shift the clutch 51 to cause the reversing of the spindles 24 which carry the taps, but this spring pressure will be ineffective until the collar 66 trips the dog 73 out of engagement with the extension 72, Fig. 4 showing the position of the parts immediately prior to this tripping, whereupon the spring pressure becomes effective and shifts the clutch 51 out of engagement with the member 49, this being the forward driving member, and into engagement with the rearward driving member 48, where it is locked and held by the dog 73 until the cross head about completes its rearward stroke whereupon the shifting mechanism is again operated to cause the reengagement of the clutch 51 with the forward driving member 49. During the backward stroke of the spindles 24, the face plate operating mechanism again comes into play to partially rotate the face plate 4 as has been before described, and upon the approach of the spindles toward the work, the first piece inserted will have been moved to the second spindle where the aperture last operated upon will be tapped by the first tap and during this operation the third fitting will be introduced into the third chuck. At the next partial revolution of the face plate 4, the first fitting in addition to being carried to the next cutting spindle, will be partially rotated to present a new surface to this spindle for its operation thereupon, during which operation, the second fitting will be brought under the operation of the first tap and the third fitting will be brought under the operation of the first cutter, at which time the fourth fitting will be inserted in the fourth chuck, and these operations and partial revolutions of the fittings will continue until the first fitting has been finished and has made one complete revolution with the face plate 4, at which time it is removed from the chuck by the operator and another fitting inserted in its place.

The timing of the various operations with relation to each other is such that during the approach and retraction of the cutters and taps toward and from the work carried on the face plate, the latter remains stationary and locked and that during the time of partial rotation of the face plate 4, the cutters and taps have no forward and back movement and the setting of the reversing mechanism for the taps is such that the same are reversed coincident with the reversal of the stroke of the spindles 24, and it follows, from this arrangement, that all the operator has to do, after starting the machine is to extract one fitting and insert another during the interval when the face plate 4 is held stationary and the machine may be so regulated, as to speed, as to give the operator just sufficient time for the removal of a finished piece and the insertion of a rough one.

Having thus fully described my invention, I claim:—

In a machine of the character described, provided with tool carrying spindles and a reciprocating carrier therefor, the combination with a shaft 47 for rotating the spindles, of clutch members 48 and 49 on said shaft, an intermediate shiftable clutch 51, a clutch lever 70 engaging a circumferential groove in the clutch and provided with double bell-crank arms 72, pivoted spring dogs 73 adapted to engage the arms 72 alternately, the shaft 64 having longitudinal movement controlled by the tool-carrying spindle carrier, coiled springs 67, 68 for connecting the said shaft to an extension of the bell-crank lever 70 and whereby said bell-crank lever is alternately shifted, substantially as described.

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