

No. 712,855.

H. J. SCHMICK.

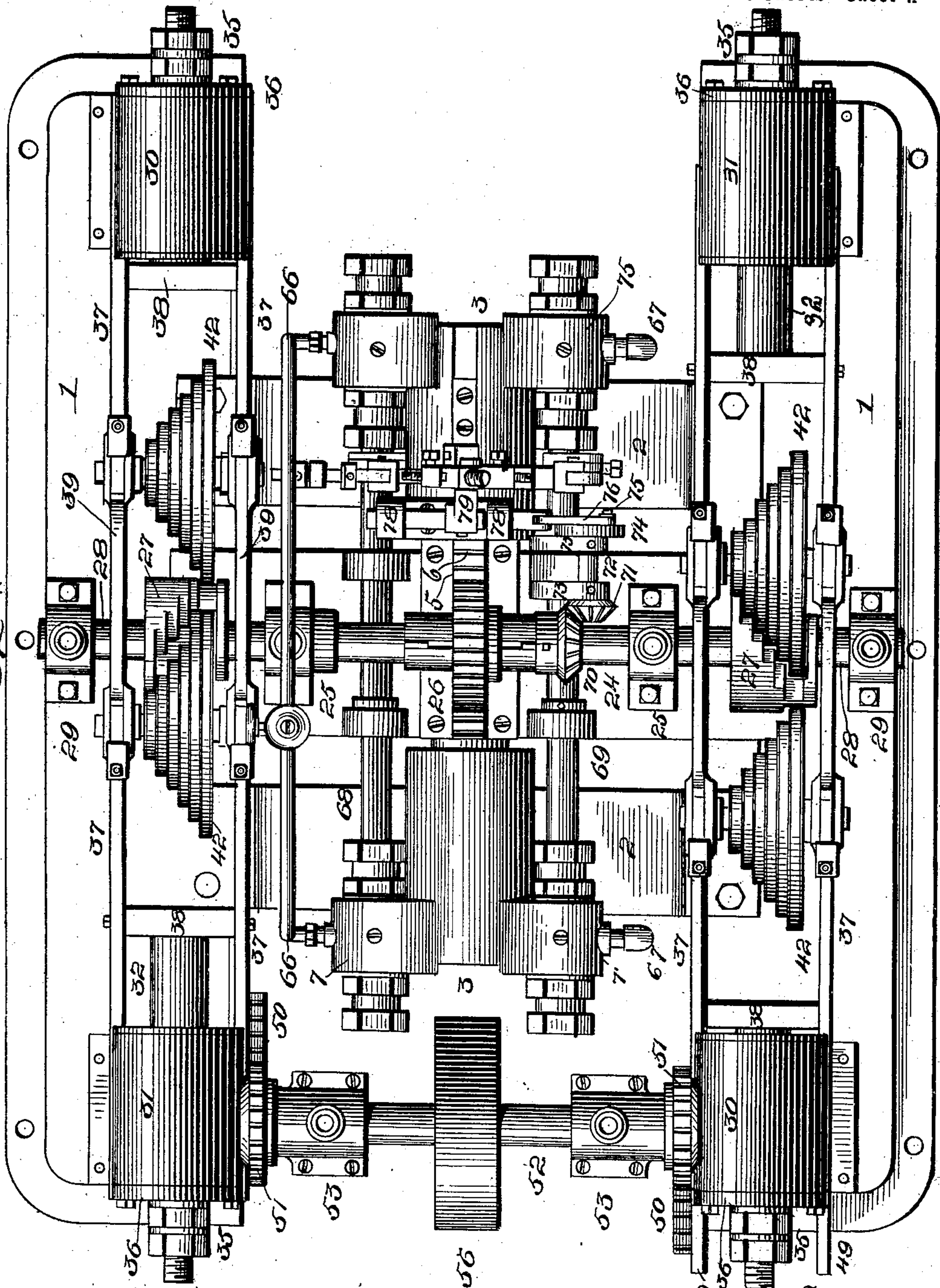
Patented Nov. 4, 1902.

MOTOR.

(Application filed Dec. 8, 1901.)

(No Model.)

6 Sheets—Sheet 1.



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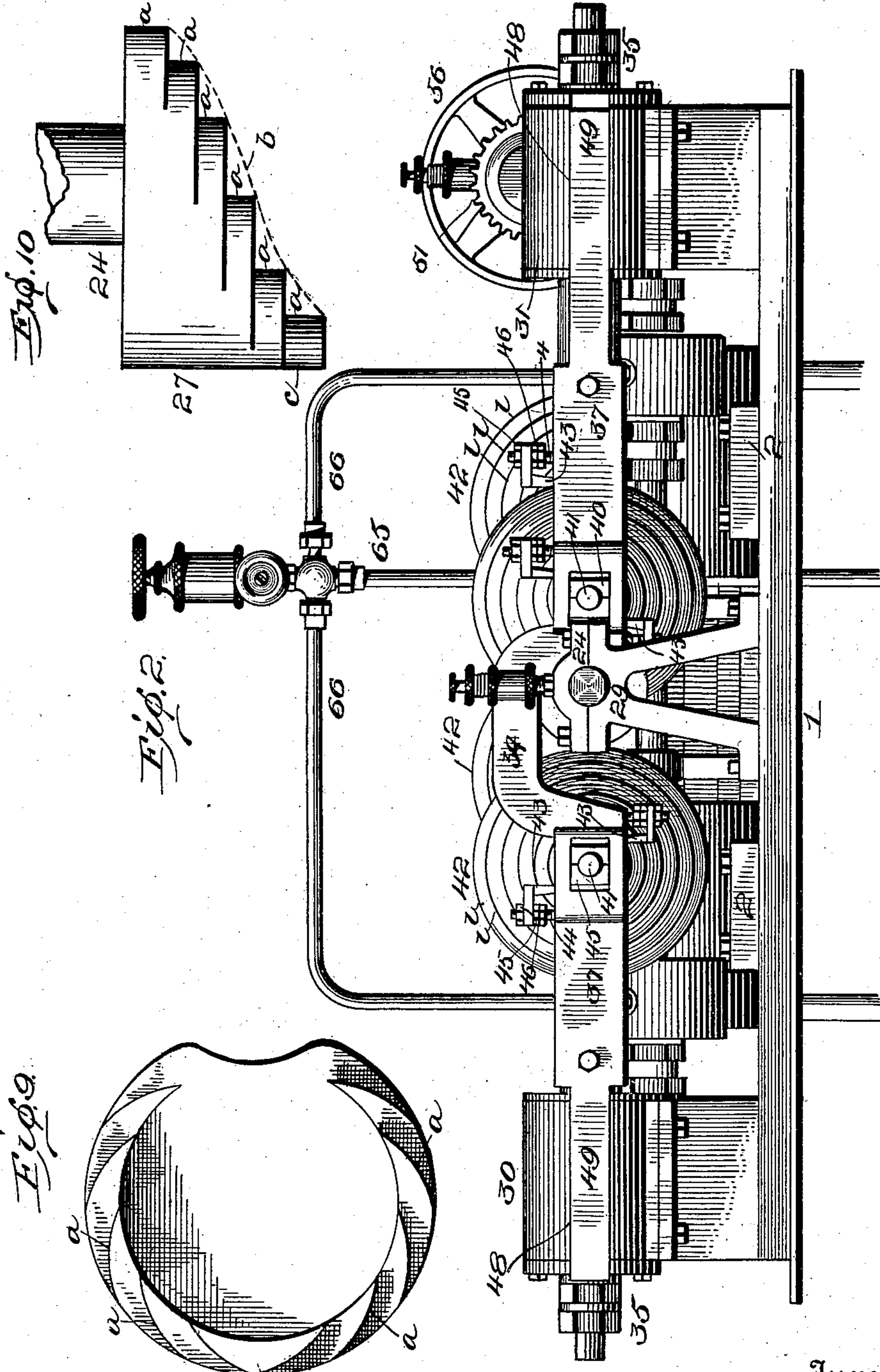
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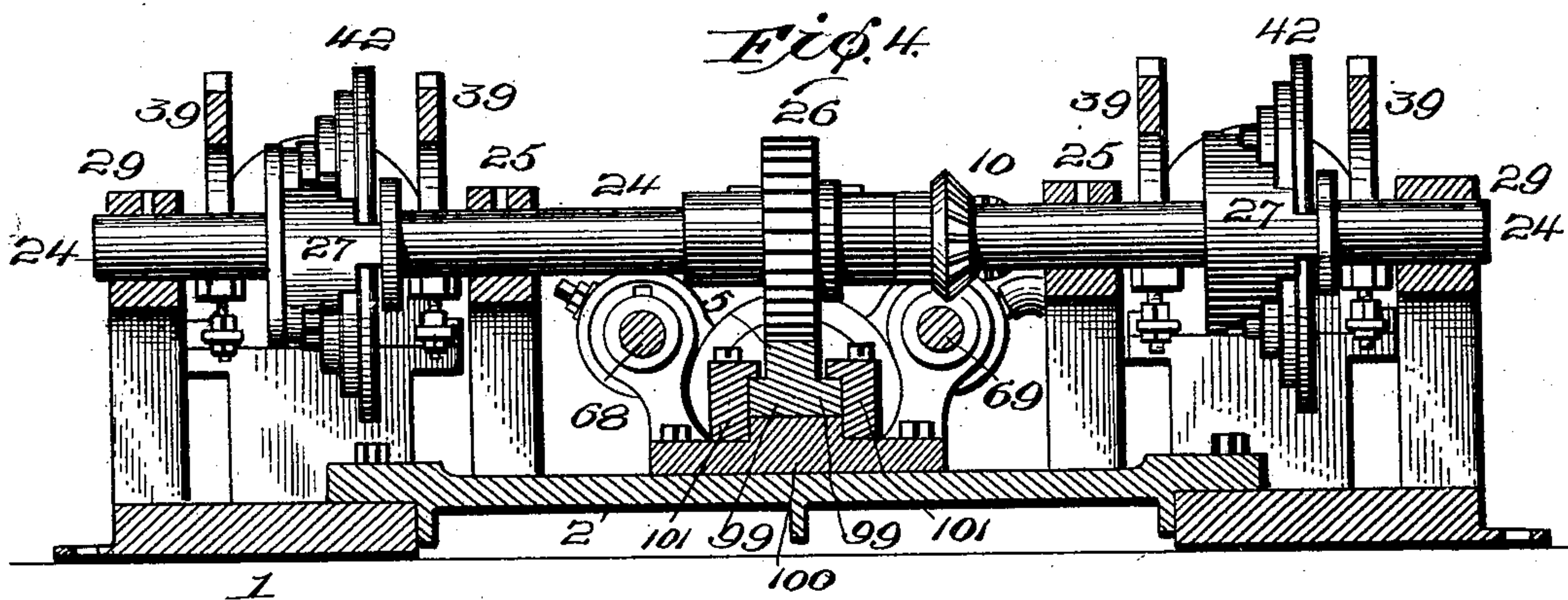
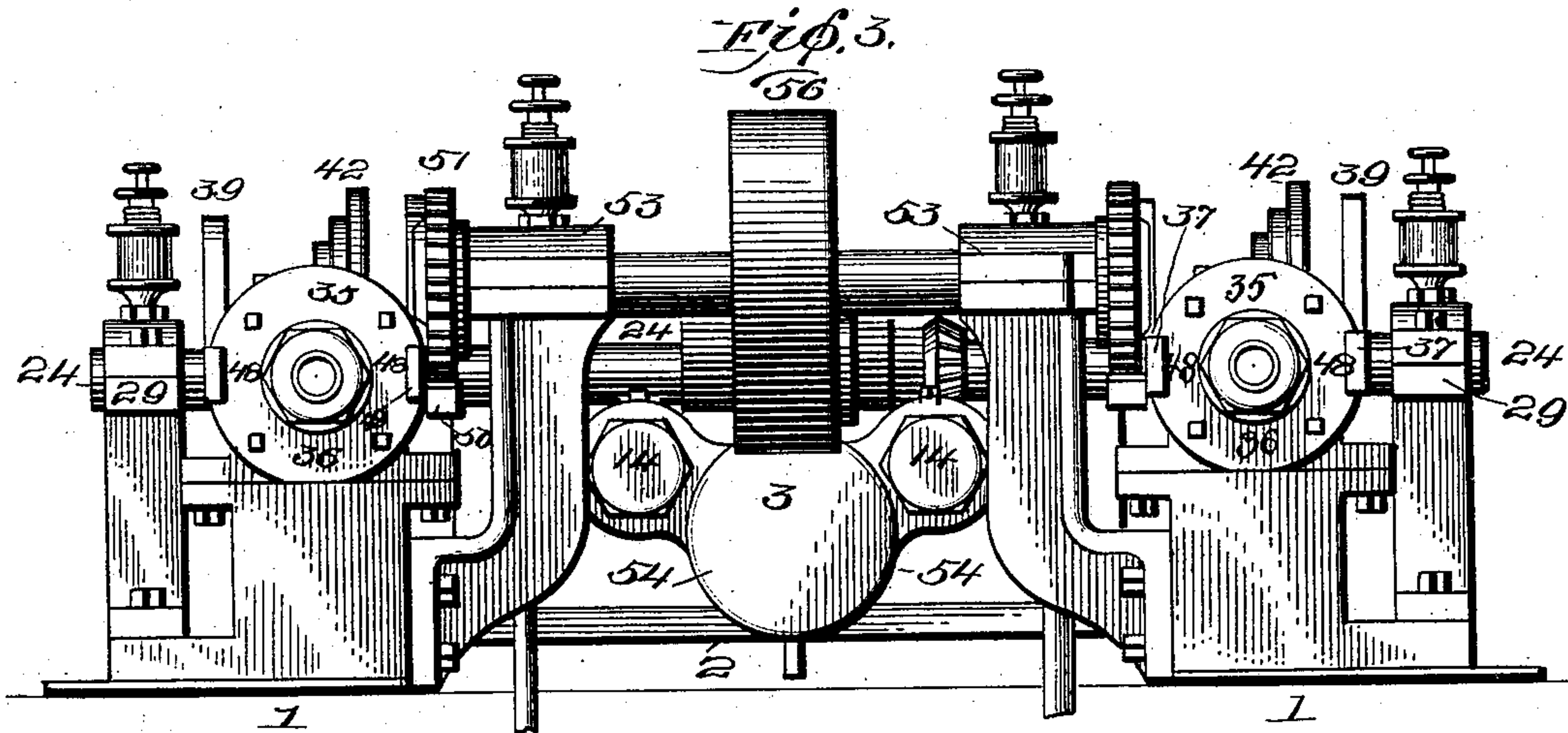
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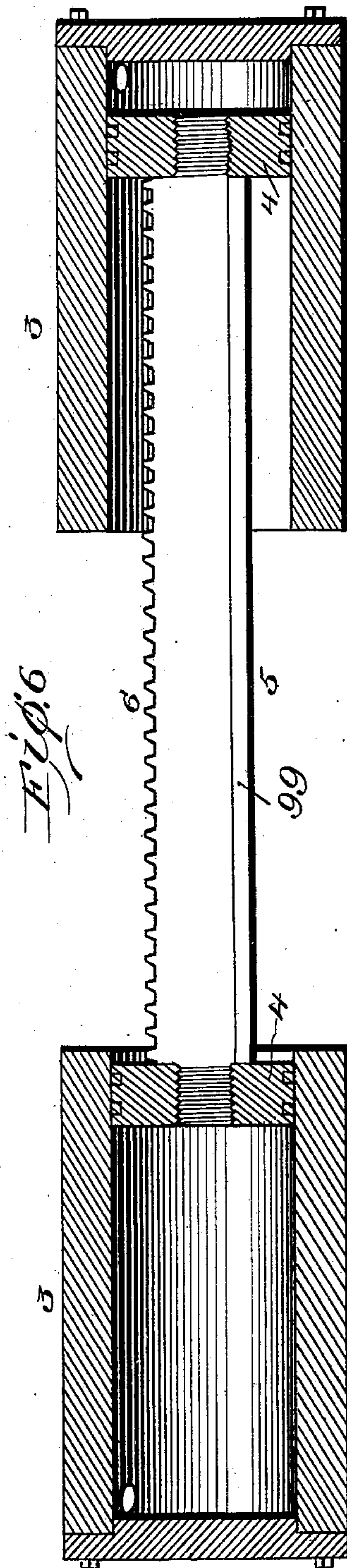
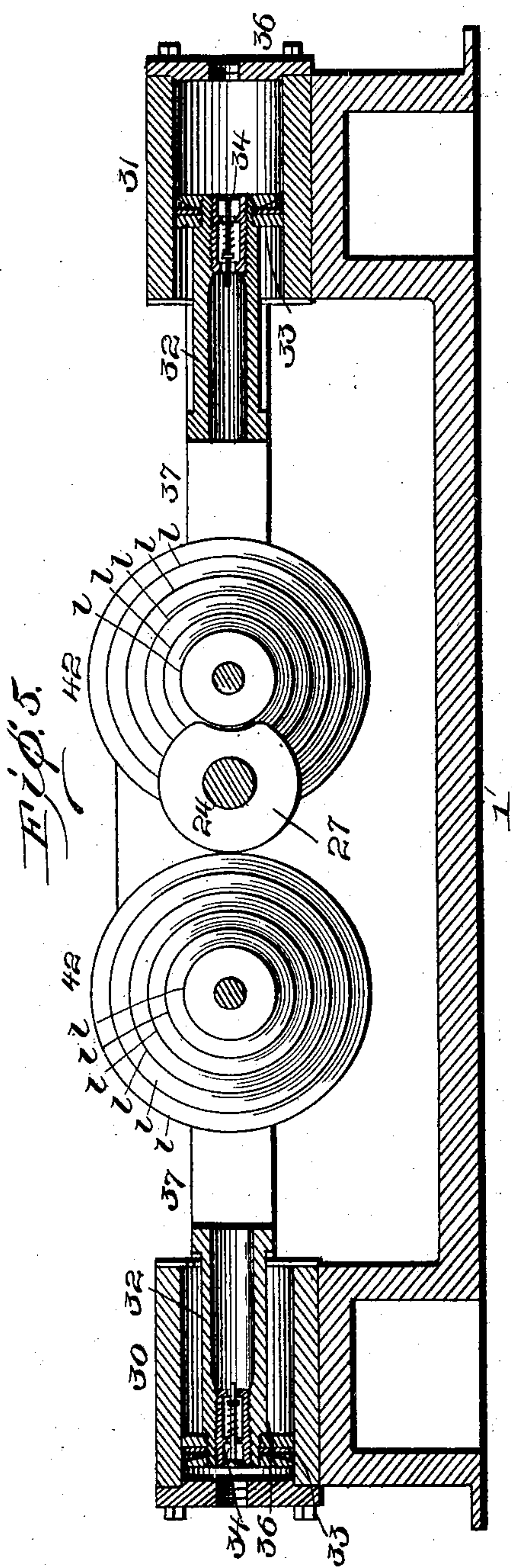
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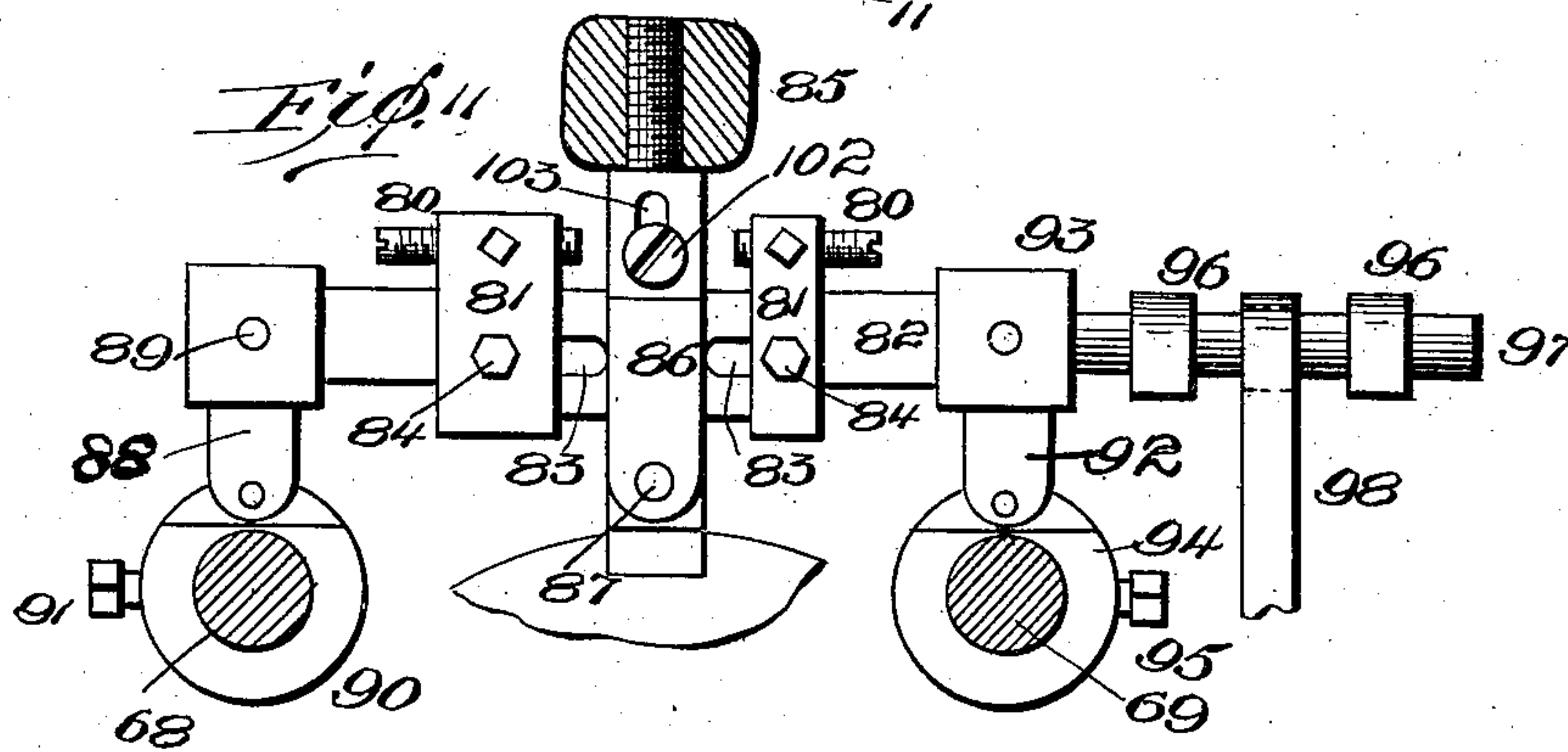
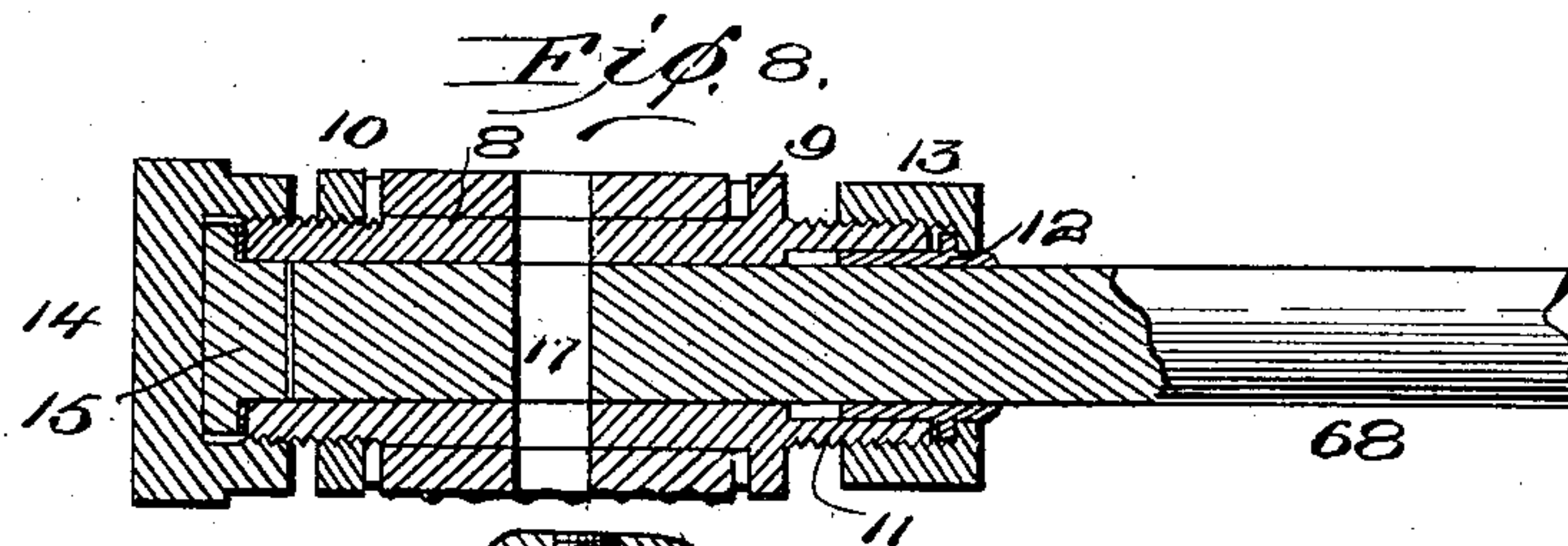
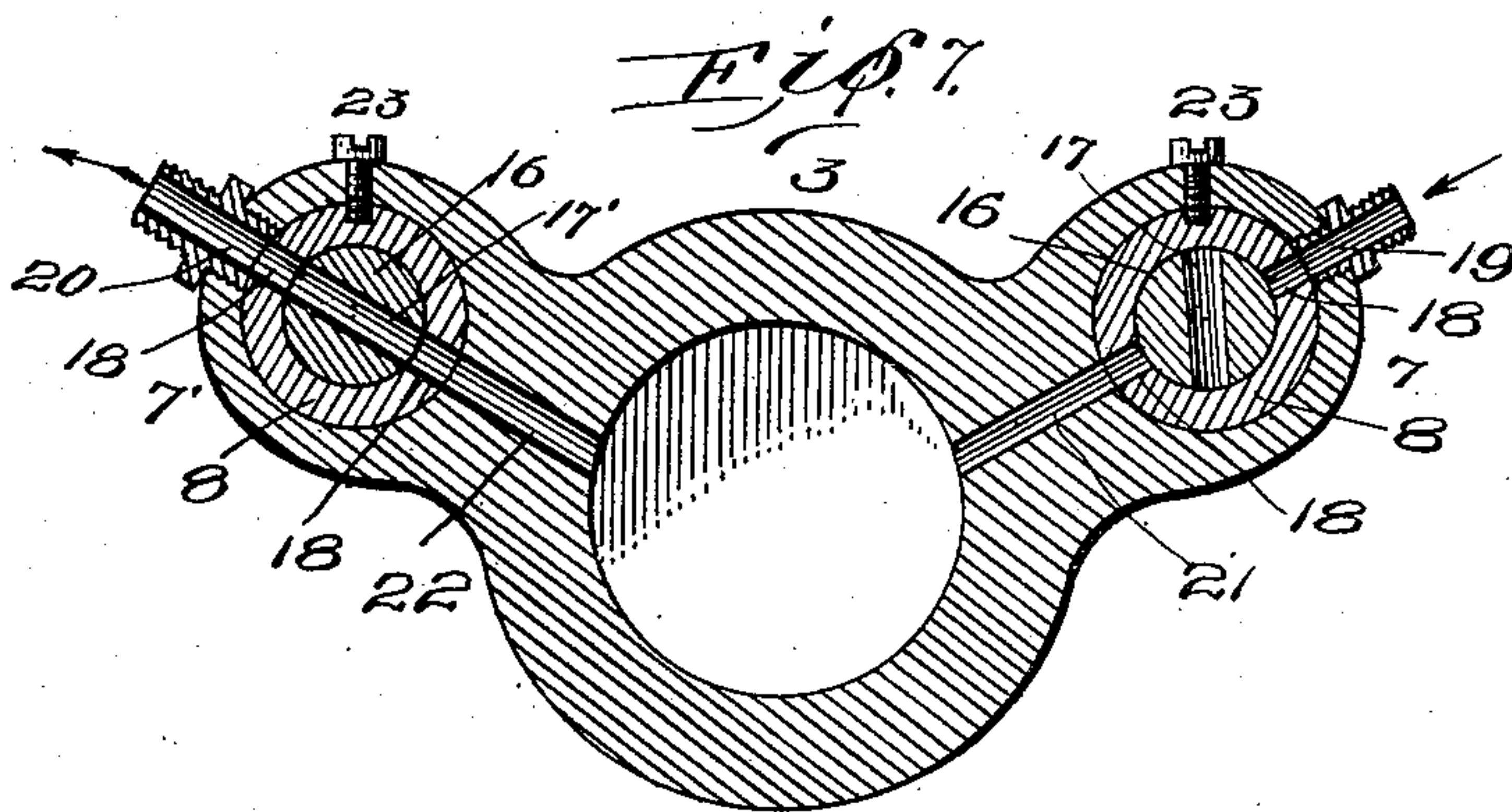
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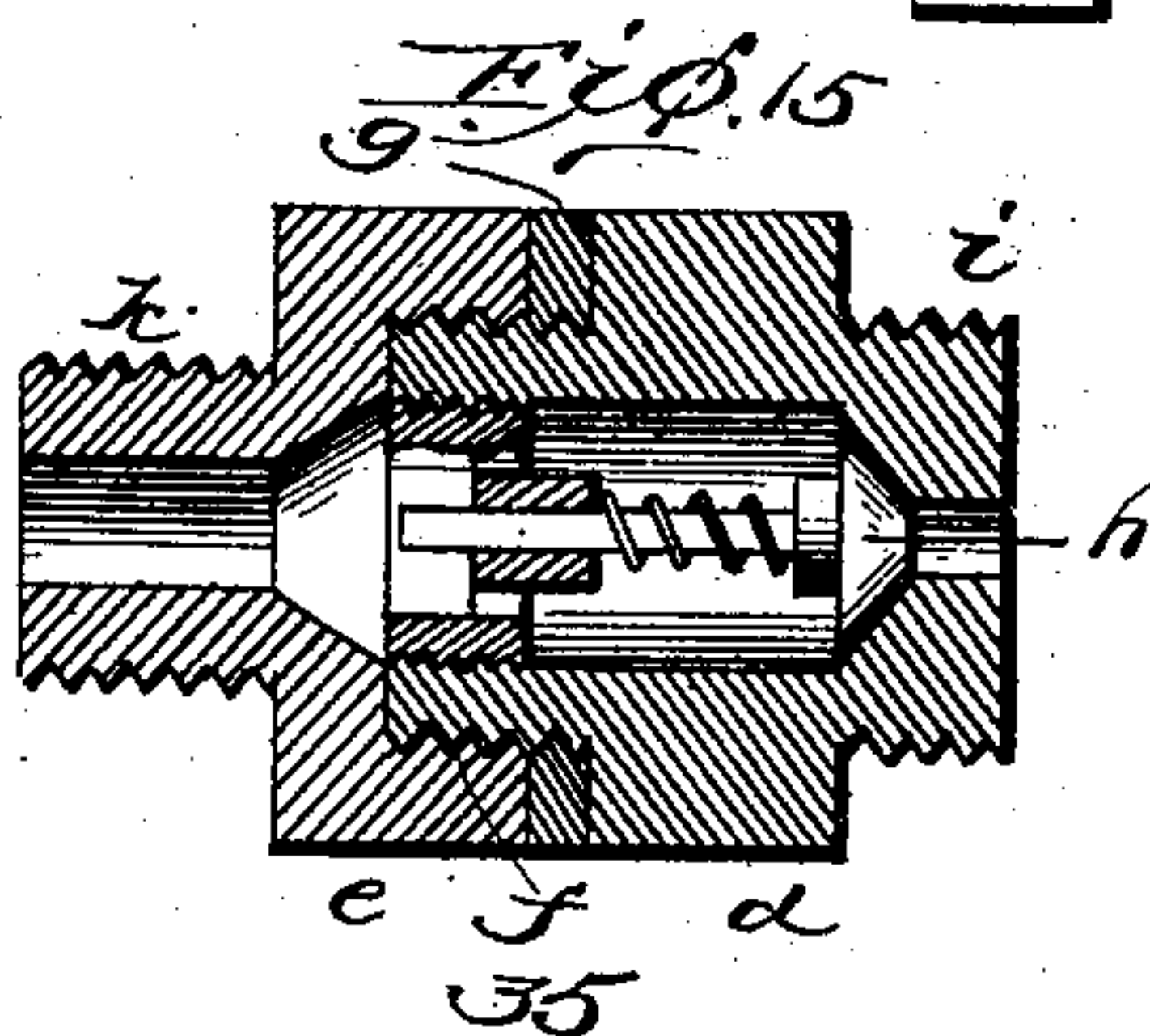
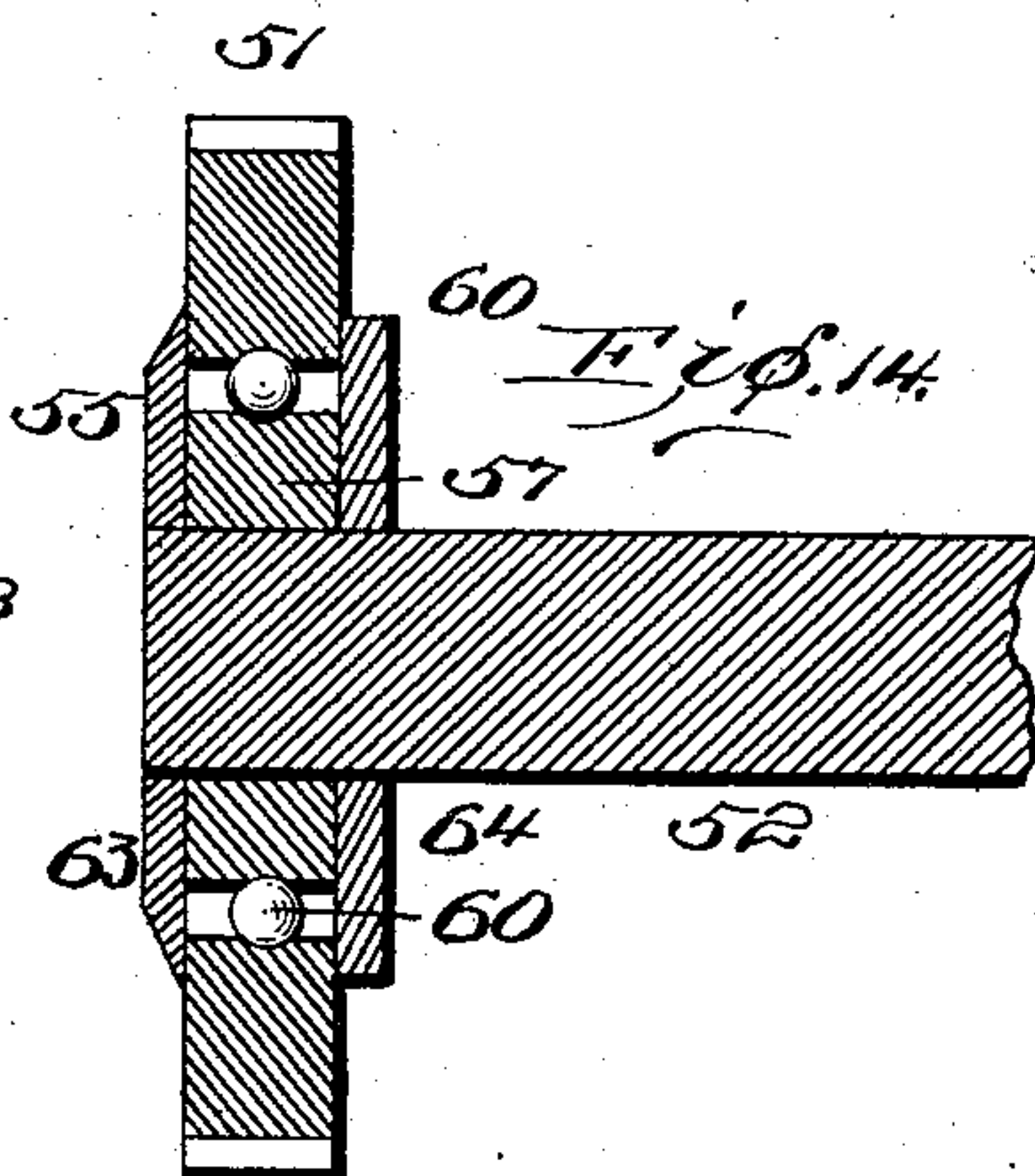
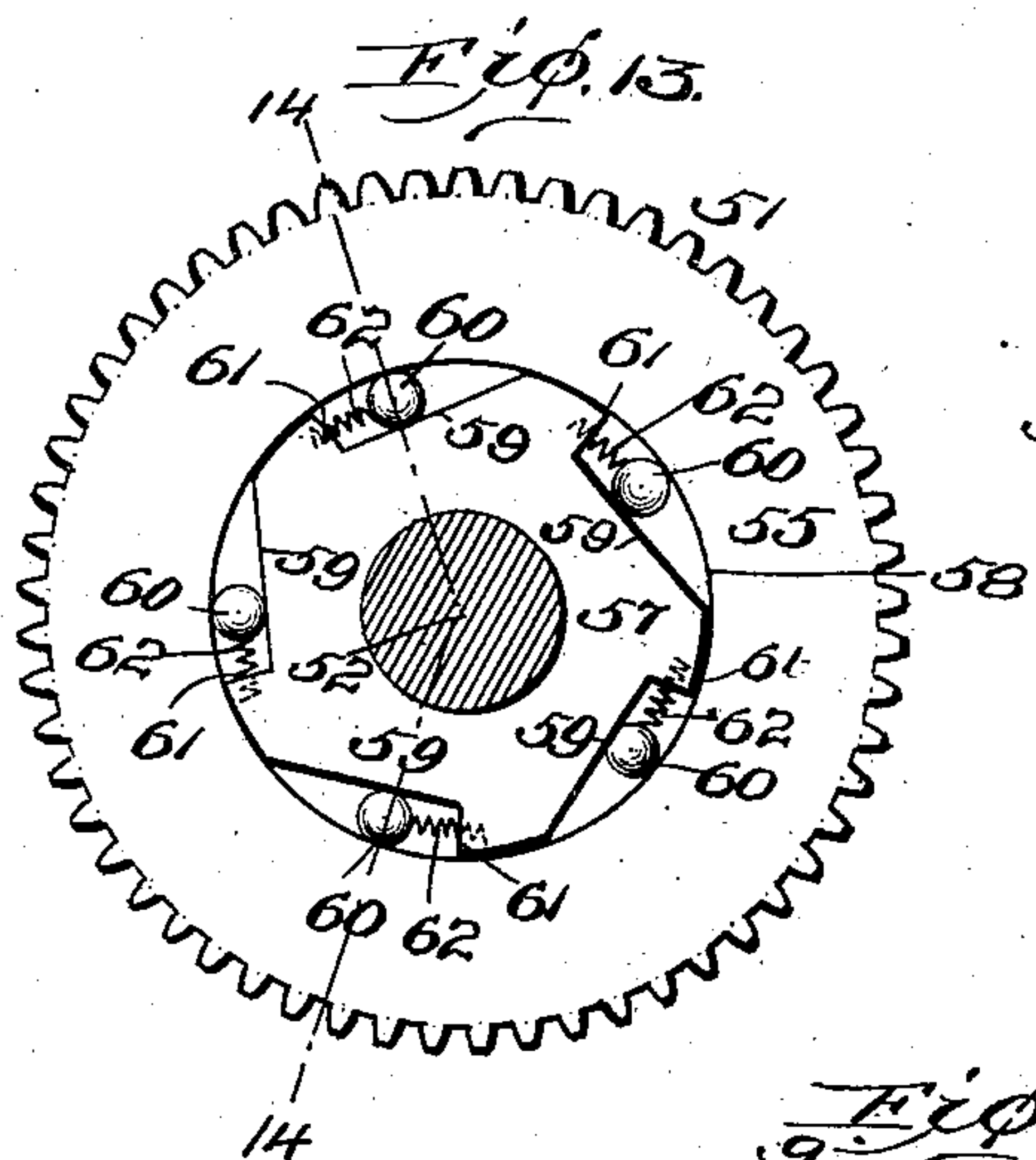
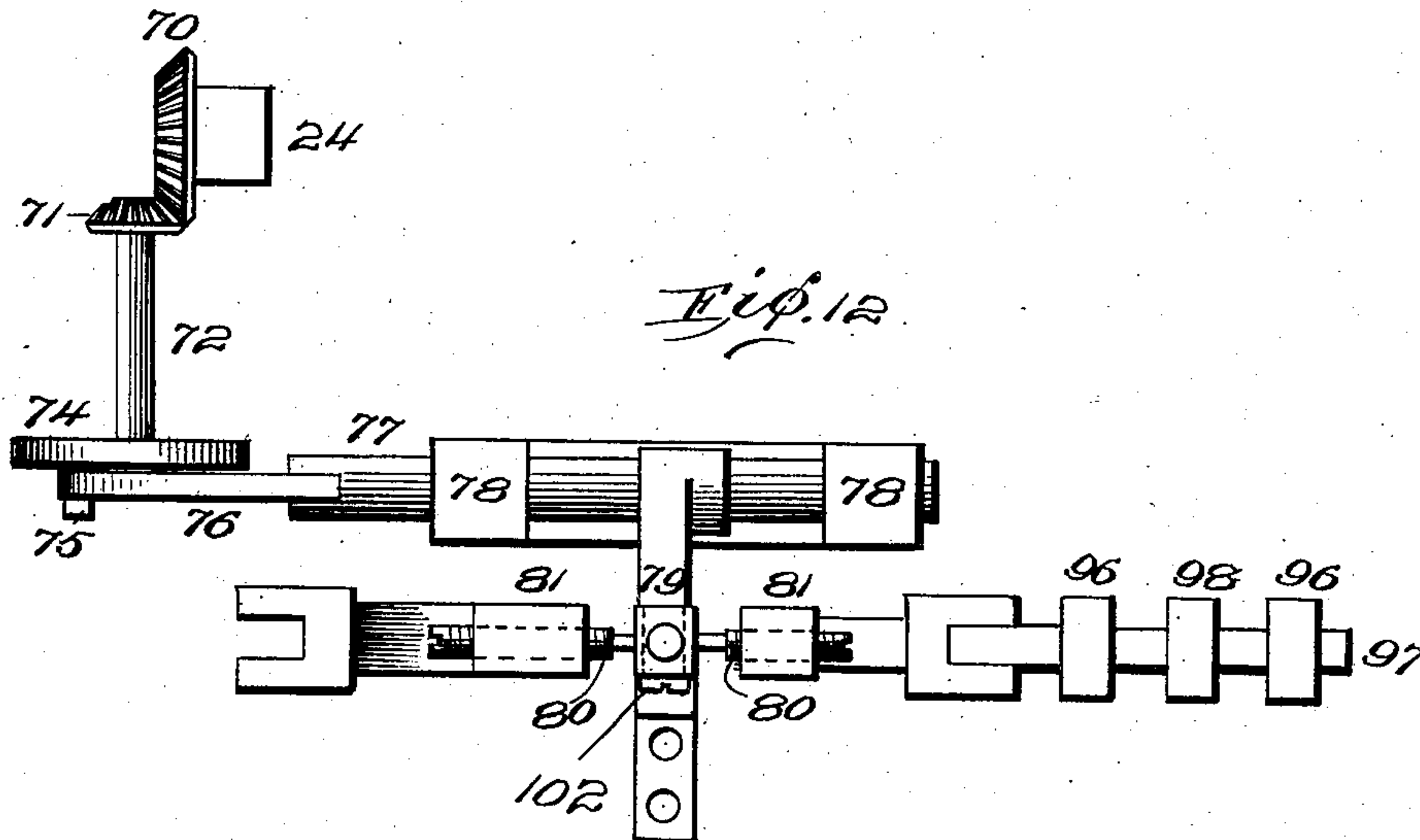
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UNITED STATES PATENT OFFICE.

HENRY J. SCHMICK, OF HAMBURG, PENNSYLVANIA.

MOTOR.

SPECIFICATION forming part of Letters Patent No. 712,855, dated November 4, 1902.

Application filed December 6, 1901. Serial No. 84,901. (No model.)

To all whom it may concern:

Be it known that I, HENRY J. SCHMICK, a citizen of the United States, residing at Hamburg, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as it appertains to make and use the same.

My invention relates to steam or other engines, has especial reference to that class of engines used for pumping or compression purposes, but is not limited or confined to such use, has for its object the economical transmission of power from the engine or the actuating to the actuated medium with the maximum amount of leverage confined within a limited space or body and the minimum amount of frictional contact-surface between the actuating and the actuated, and consists in certain improvements in construction, which will be fully disclosed in the following specification and claims.

In the accompanying drawings, which form part of this specification, Figure 1 represents a top plan view of my improvement; Fig. 2, a side elevation of the same; Fig. 3, an end elevation; Fig. 4, a vertical transverse section on line 4 4, Fig. 1; Fig. 5, a vertical longitudinal section on line 5 5; Fig. 6, a like view on line 6 6; Fig. 7, a vertical transverse section on line 7 7 through one of the steam-cylinders and its valve-chests, on an enlarged scale; Fig. 8, a vertical longitudinal section through one of the valve-chests and its valve; Fig. 9, an end view of one of the cams, the connection with the shaft being removed; Fig. 10, a side elevation of the same; Fig. 11, a side elevation of the valve-operating mechanism; Fig. 12, a top plan view of the valve-operating mechanism, showing its connection with the power-shaft; Fig. 13, a vertical transverse section on one end of the driven shaft, showing the clutch mechanism and the gear-wheel; Fig. 14, a section of the same on lines 14 14, Fig. 13; and Fig. 15, a vertical longitudinal section of the eduction-valve of the air-compression cylinder.

Reference being had to the drawings and the characters thereon, 1 1 indicate the sides of the engine-frame, connected by transverse

bars 2 2 3 3, the engine-cylinders supported on said bars and which in the present instance are single direct-acting engines, with their open ends adjacent to each other, as shown in Figs. 1 and 6, and whose pistons 4 4 are connected by rod or rack bars 5, on the upper edge of which are the teeth 6, forming the rack.

7 7' are the valve-chests, each provided with a cylinder 8, having an annular flange or collar 9 at one end and a nut 10 at the opposite end, by which the cylinders are secured in the valve-chest, as shown in Figs. 7 and 8, a stuffing-box 11, a gland 12, and a follower or nut 13, a head 14, and a separate supplemental head 15, held in the outer end of the cylinder 8 by the head 14, and a cylindrical valve 16, provided with a transverse port 17, which registers with a like port 18 in the cylinder and one side of said port 18 registers with the steam-supply port 19 in the chest 7 and with the exhaust-port 20 in chest 7', and the opposite side of said port 18 registers with the steam-port 21 in chest 7 and with exhaust-port 22 in chest 7', the cylinder 8 in each chest being held against rotation by set-screws 23.

The semirotary power-shaft 24 is supported in bearings 25 25 and 29 29 is provided with a master gear-wheel 26, which engages the rack-bar 5, and with a "radio-helical cam" 27 27 on each side of the gear-wheel intermediate said wheel and the ends 28 28 of the shaft, which rest in the bearings 29. The cam is fully described and shown in its details in Letters Patent of the United States granted to me on the 28th day of May, 1901, and numbered 675,020, and shown in my patent for a design for radio-helical cams bearing date of June 11, 1901, and numbered 34,659, and will therefore require only a general description in this connection. The cam 27 is a cylindrical body having dwells *a*, of which there may be any preferred number, extending longitudinally of the shaft and in an approximately helical path, as indicated by line *b* in Fig. 10. The cam imparts motion in a direction at a right angle to the axis of the cam to a member whose throw equals for every half-revolution of the cam the diameter of the cylinder minus the thickness of the neck *c*. As applied in this instance,

this motion is communicated to the pistons of oppositely-arranged pumps on each side of the engine and which may be used for pumping any fluid; but in this instance I have elected for the purpose of illustration air-pumps. The stroke of each piston during each half-revolution of the cam by which the piston is actuated is in excess of the radius of the cam in each half-revolution thereof.

The cams 27 are set on the shaft 24 directly opposite each other, as shown in Figs. 1 and 4, and as a consequence the pistons of the pumps diagonally opposite each other operate synchronously, one pair of pistons making an outstroke while the opposite pair are making an instroke, as shown in Fig. 1. The pump-cylinders 30 and 31, arranged in pairs, as described, are provided with hollow piston-rods 32, to which pistons 33 are attached, and each piston is provided with an ingress-valve 34, and each cylinder is provided with an egress-valve 35, the preferred construction of which latter valve is shown in Fig. 15 and in which the body of the valve is made in two parts *d* and *e*, connected by a screw-threaded extension *f* with a washer *g*, interposed between the sections, and the section *d* is provided with a valve *h* and a neck *i*, by which the body of the valve is connected or attached to the head 36 of the pump-cylinders, and the section *e* is provided with a neck *k* for connecting a pipe thereto by a suitable coupling for conveying air to a suitable tank or storage-reservoir. (Not shown.)

The piston-rods 32 are each connected to a frame composed of bars 37 37 by cross-heads 38, and each bar is provided with a yoke 39, which spans the semirotary power-shaft 24, and in said bars adjacent to each end of the yoke are journal-boxes 40 to support the shafts 41 of revoluble bearings 42 on each side of each cam, as shown in Figs. 1, 2, and 5. These bearings have faces *l* corresponding with the number of dwells *a* on the cam 27 and are revolubly mounted in the journal-boxes 40, whereby the contact-surface with the dwells of the cam is constantly changing and the friction between the contact-surfaces reduced to the minimum. The journal-boxes 40 are adjustable longitudinally of the bars 37 by means of tapered keys 43, adjusted by a bolt 44 and nuts 45 and 46 to set the bearings 42 in proper contact with the cams 27 and to take up wear on the boxes.

In the sides of the cylinders 30 and 31 are guideways 48 to receive the reduced ends 49 of the bars 37 and support the frame as it is reciprocated by the cam, and to the inner bar of each frame is attached a rack 50, which is engaged by a pinion 51 on each end of the driven shaft 52, supported in bearings 53 on brackets 54, and is provided with a clutch 55 in each pinion 51 for converting the reciprocatory motion of the frame into rotary motion of the shaft 52, which is transmitted to any line of shafting or machine from pulley 56 on shaft 52 by a suitable belt.

The clutch 55 consists of a head 57 of a diameter equal to the bore 58 in the pinion 51, secured to the shaft 52, and is provided with a plurality of pockets having faces 59, between which and the wall of the bore 58 balls 60, secured to the shoulders 61 by springs 62, engage as the pinion 51 revolves during the outstroke of the bar and are disengaged while the pinion rotates in the opposite direction, and on each side of the clutch is a plate 63 64, also secured to the shaft 52 to prevent displacement of the clutch.

The motor-fluid-supply valves 16 in the valve-chests 7 are supplied from the pipe 65 and its branches 66 66, and the exhaust is conducted through pipes 67 67. The supply-valves are connected by a rod 68 and the exhaust-valves by a rod 69 and are operated from the power-shaft 24 by a miter gear-wheel 70 on said shaft engaging a like wheel 71 on a shaft 72, supported in bearings 73 73, and having a crank-disk 74 secured thereon, to whose wrist-pin 75 a pitman 76 is connected and engages a shaft 77, supported in bearings 78 78, and is provided with an arm 79, which is connected to arm 86 by a screw 102, which works in a slot 103 in arm 86 and in its reciprocation engages adjustable tappets 80 80, supported in arms 81 81, adjustably secured to a bar 82, having slots 83 83, by bolts 84 84, engaging said arms and the slots in said bar. On the bar 86 is secured a counterweight 85, and said bar 86 is pivoted at 87 to the frame of the engine to vibrate as the rod 82 is reciprocated through the medium of arm 79 and arm 86, and at one end of bar 82 a link 88 is pivotally connected thereto at 89 and also connected to a collar 90, secured to valve-rod 68 by a set-screw 91, and at the opposite end of said bar 82 a link 92 is pivotally connected thereto at 93 and also connected to a collar 94, secured to valve-rod 69 by a set-screw 95, whereby the supply and the exhaust of both cylinders are operated simultaneously. The reciprocation of bar 82 is also arrested by collars 96 96 on an extension 97 of the bar, which extension is supported by a post 98, extending up from the engine-frame.

The rack-bar 5 is provided with lateral extensions 99, (see Fig. 4,) which form a cross-head resting on a support 100, secured to the transverse bar 2 of the frame, and is held in position by side jaws 101, forming a cross-head guideway in which the cross-head reciprocates.

It is obvious that a double-acting cylinder-engine may be substituted for the engine shown without departing from the spirit of my invention by changing the connections between the engine and the actuated parts to suit the change in the engine substituted.

Having thus fully described my invention, what I claim is—

1. The combination of a motor, a power driving-shaft provided with a cam, means for connecting the motor to said shaft, a reciprocatory frame, a driven shaft, means for con-

necting said frame and driven shaft, and means for converting the reciprocatory motion of the frame into rotary motion of the shaft.

5 2. The combination of a motor, a power or driving shaft provided with oppositely-arranged cams, means for connecting the motor to said shaft, a pair of reciprocatory frames provided with revoluble bearings engaging
10 said cams, a driven shaft, means for connecting said frame and driven shaft, and means for converting the reciprocatory motion of the frames into rotary motion of the shaft.

3. The combination of a motor, a power or
15 driving shaft provided with oppositely-arranged radio-helical cams, means for connecting the motor to said shaft, a pair of reciprocatory frames having yokes, revoluble bearings supported in boxes in said frames, means
20 for adjusting said boxes, a driven shaft, means for connecting said frames and driven shaft, and means for converting the reciprocatory motion of the frame into rotary motion of the shaft.

25 4. The combination of a motor, a semirotary power or driving shaft provided with oppositely-arranged cams, means for connecting the motor to said shaft, a pair of reciprocatory frames operated by said cams, pistons
30 connected to each frame on opposite sides of the driving-shaft, and cylinders at each end of each frame.

5. The combination of a motor, a semirotary power or driving shaft provided with oppositely-arranged cams, means for connecting
35 the motor to said shaft, a pair of reciprocatory frames operated by said cams, cylinders at each end of and supporting said frames, and pistons for said cylinders connected to
40 the frames.

6. The combination of a motor having oppositely-arranged, direct-acting, and connected pistons, a power or driving shaft, means
45 for connecting the motor and said shaft and for converting the reciprocatory motion of the motor into rotary motion of the shaft, a pair of oppositely-arranged radio-helical cams on said shaft, reciprocatory frames operated by said cams, a pair of oppositely-arranged
50 revoluble bearings supported in each frame, cylinders having pistons connected to said

frames and in pairs diagonally opposite each other.

7. The combination of a motor having oppositely-arranged direct-acting pistons, a
55 rack-bar connecting the pistons, a power or driving shaft having a gear-wheel engaging the rack-bar and provided with a cam near each end thereof, a pair of reciprocatory
60 frames operated by said cams, a pump-cylinder at each end of each frame, and a piston for each cylinder connected to said frames.

8. The combination of a motor, a semirotary power or driving shaft provided with a cam,
65 means for connecting the motor to said shaft, a reciprocatory frame provided with revoluble bearings adjustable in the frame, a pumping-cylinder at each end of the frame, and a piston for each cylinder connected to the
70 frame.

9. The combination of a motor, a power or driving shaft provided with a radio-helical cam, means for connecting the motor to said
75 shaft, a reciprocatory frame, revoluble bearings adjustable in said frame, a pumping-cylinder at each end of and supporting the frame, and a piston for each cylinder connected to said frame.

10. The combination of a pair of oppositely-arranged cylinders having their pistons con-
80 nected and their supply and exhaust valves connected separately, a semirotary power-shaft driven by said cylinders, and a valve-operating mechanism connected to the supply, and to the exhaust-valve of each cylinder
85 and means for communicating power from said shaft to said valve-operating mechanism.

11. The combination of a motor, a power or driving shaft provided with a cam, means for
90 connecting the motor to the shaft, a reciprocatory frame provided with a rack, a driven shaft provided with a gear-wheel engaging said rack, a clutch mechanism on the shaft, a cylinder at each end of the frame, and pistons for said cylinders connected to said
95 frame.

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

HENRY J. SCHMICK.

Witnesses:

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JOHN H. SNELL.