

G. H. EBEL.
REVERSING GEAR FOR ENGINES.

(Application filed Aug. 15, 1901.)

(No Model.)

2 Sheets—Sheet 1.

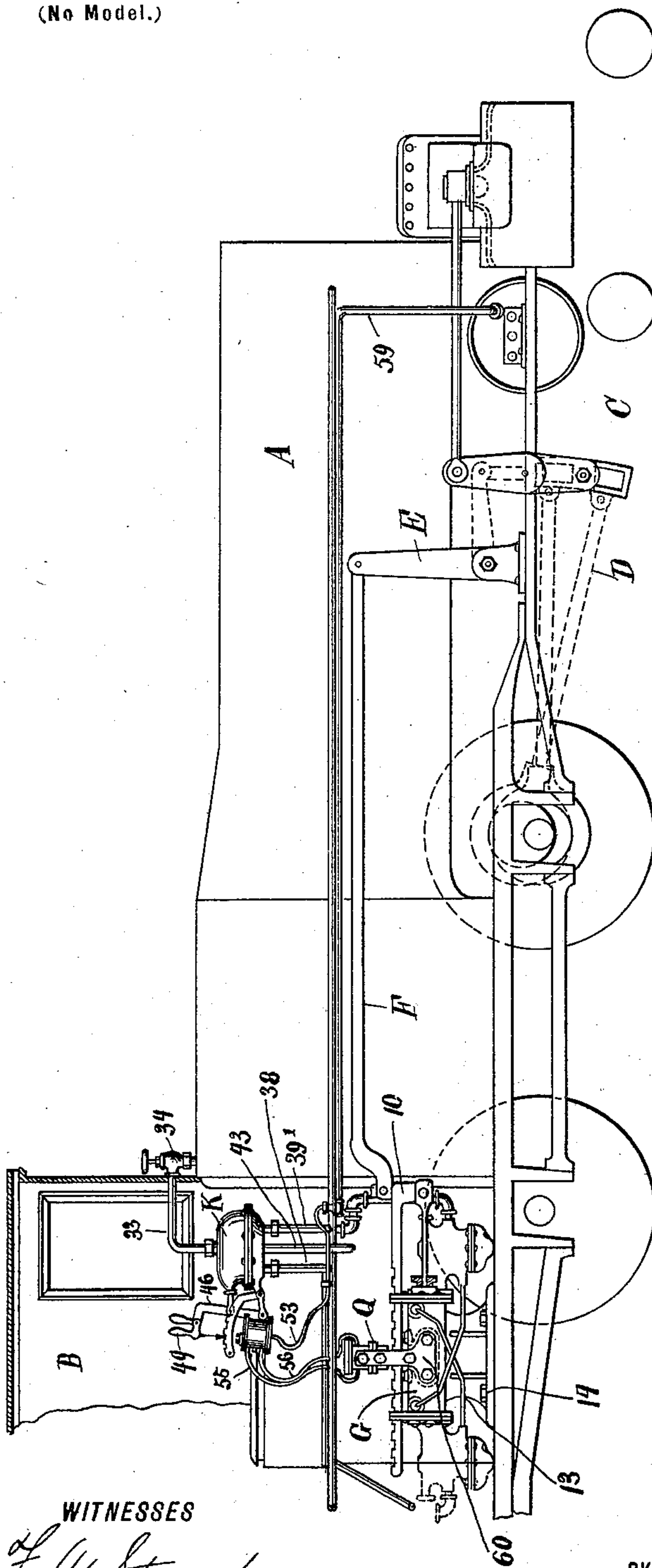


FIG. 1

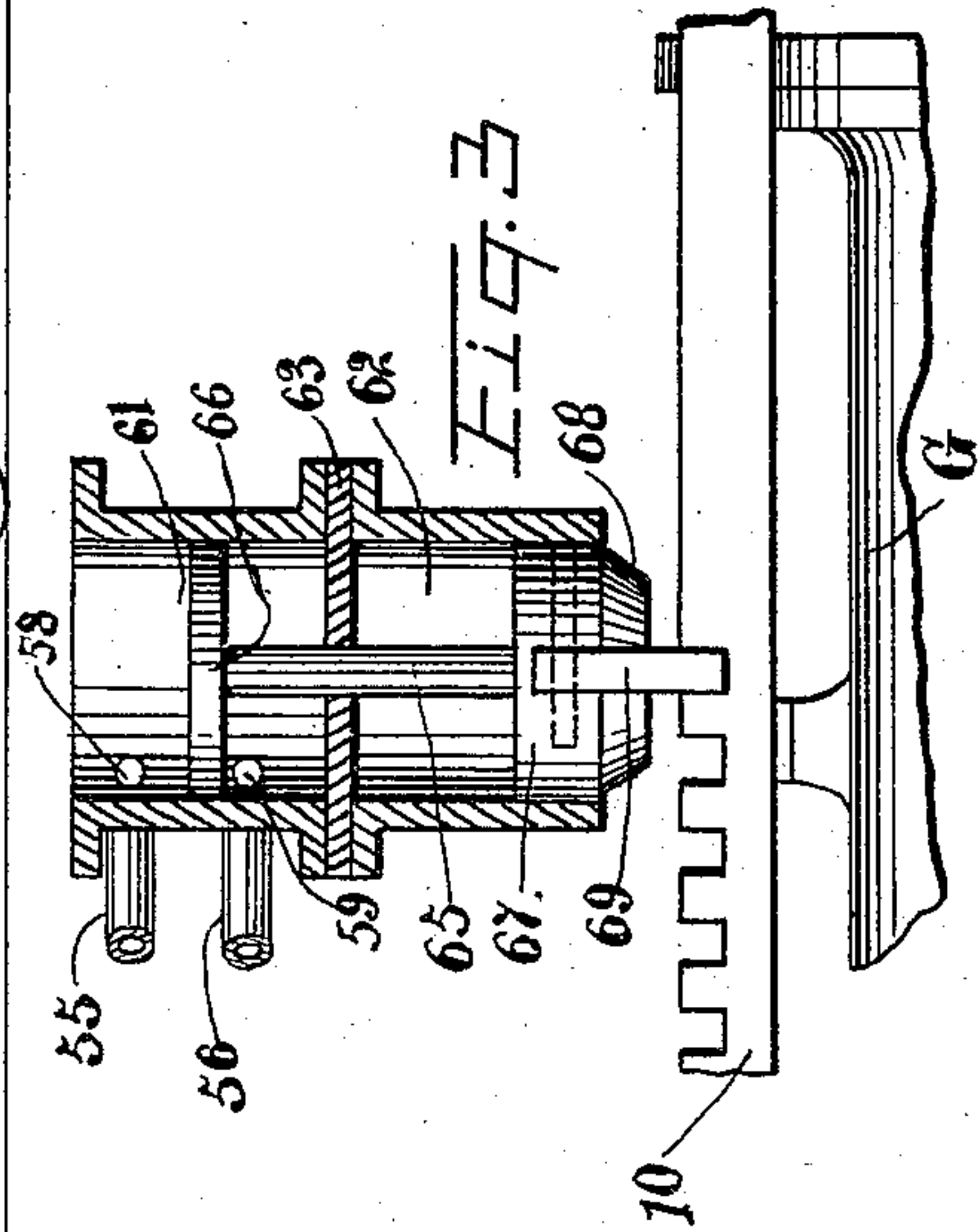


FIG. 2

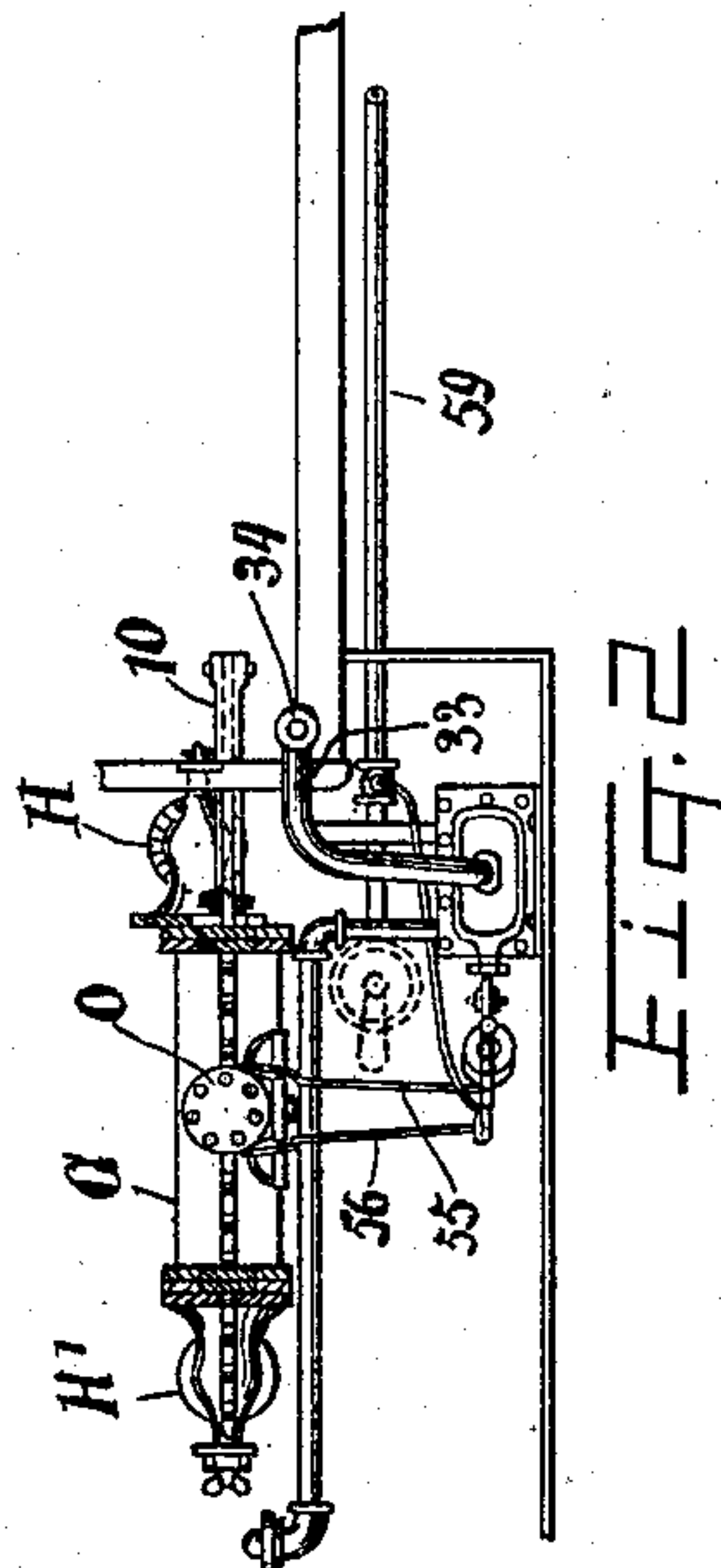


FIG. 3

WITNESSES

F. W. Stewart
L. R. Bayes

BY *George H. Ebel* INVENTOR

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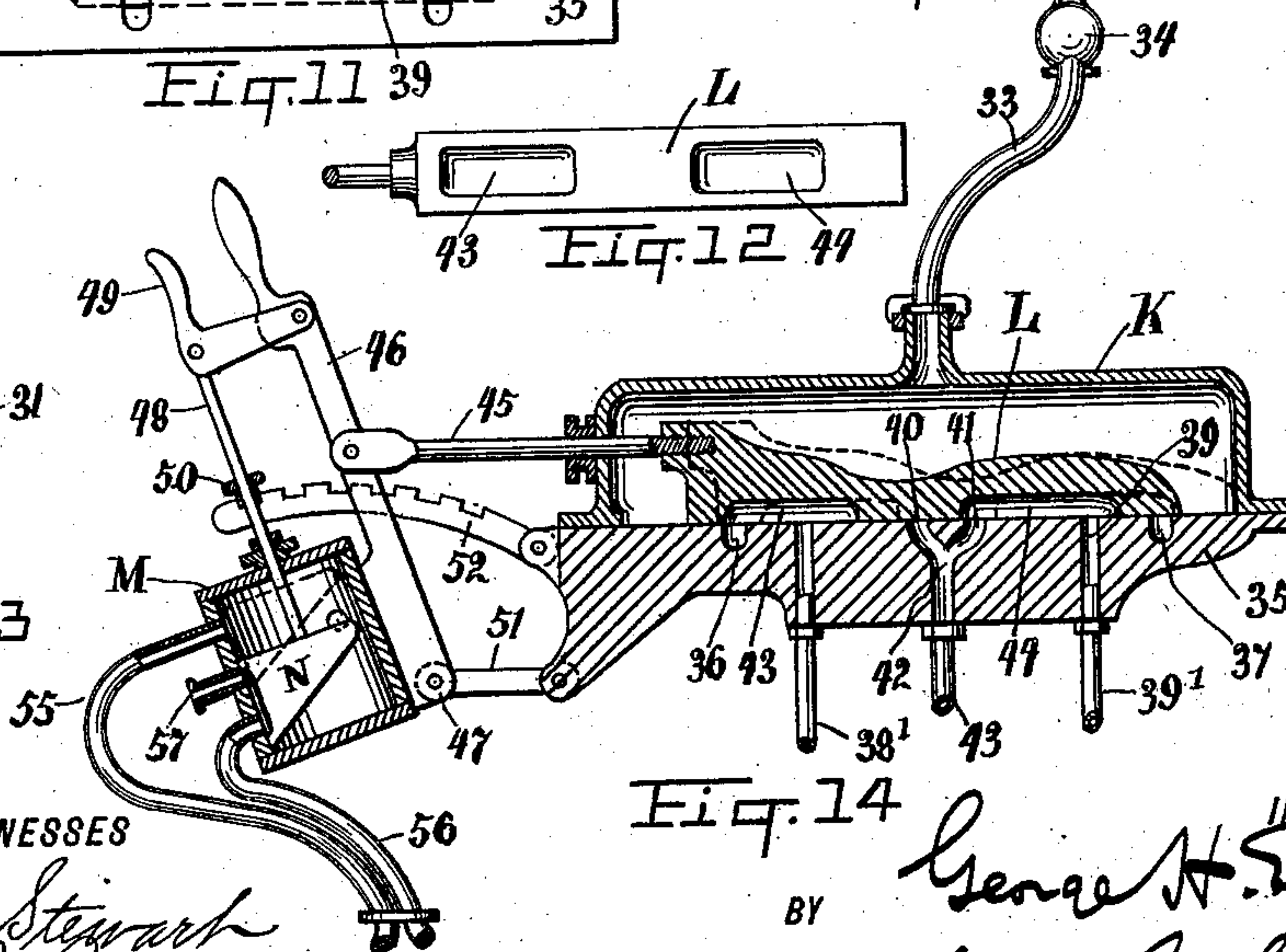
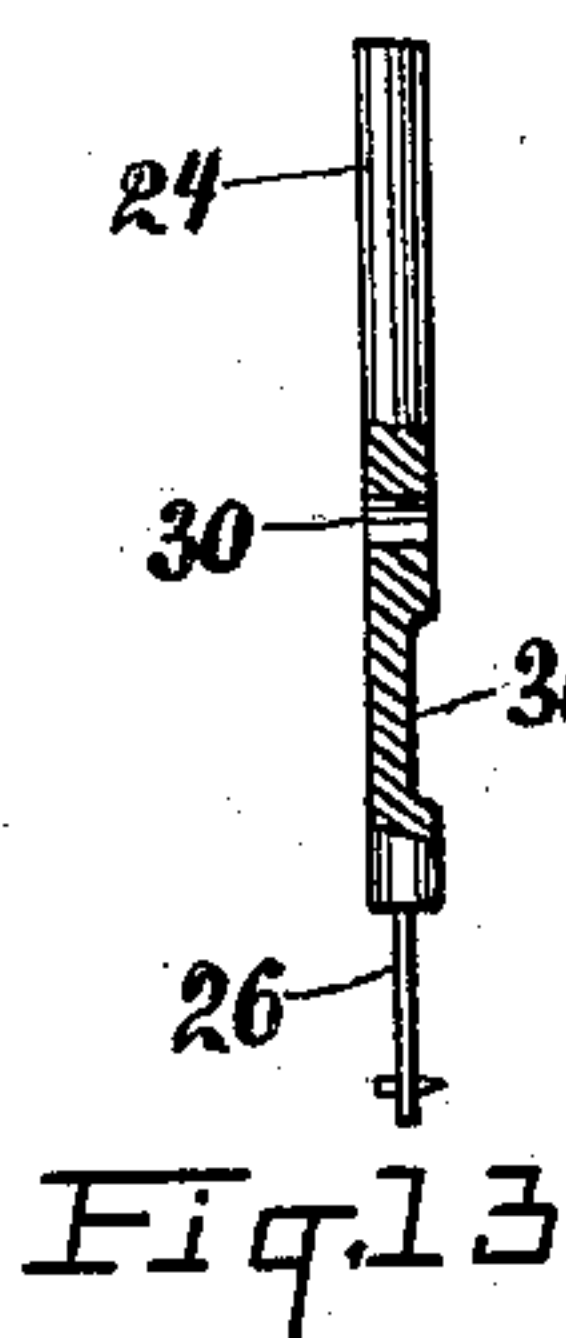
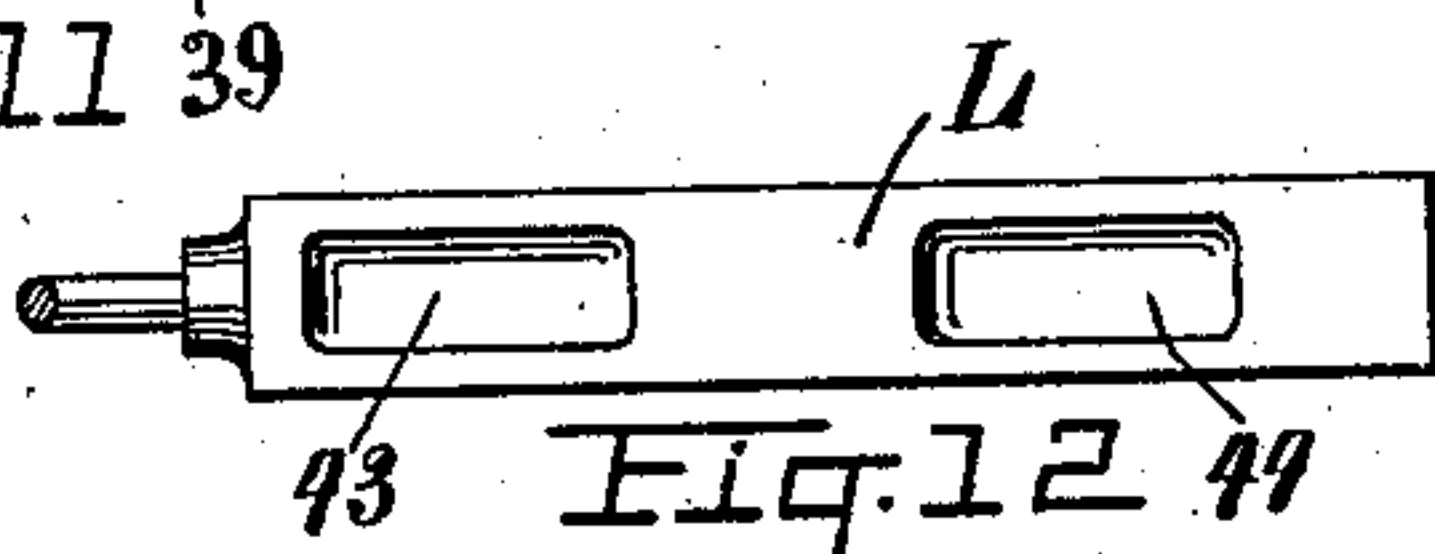
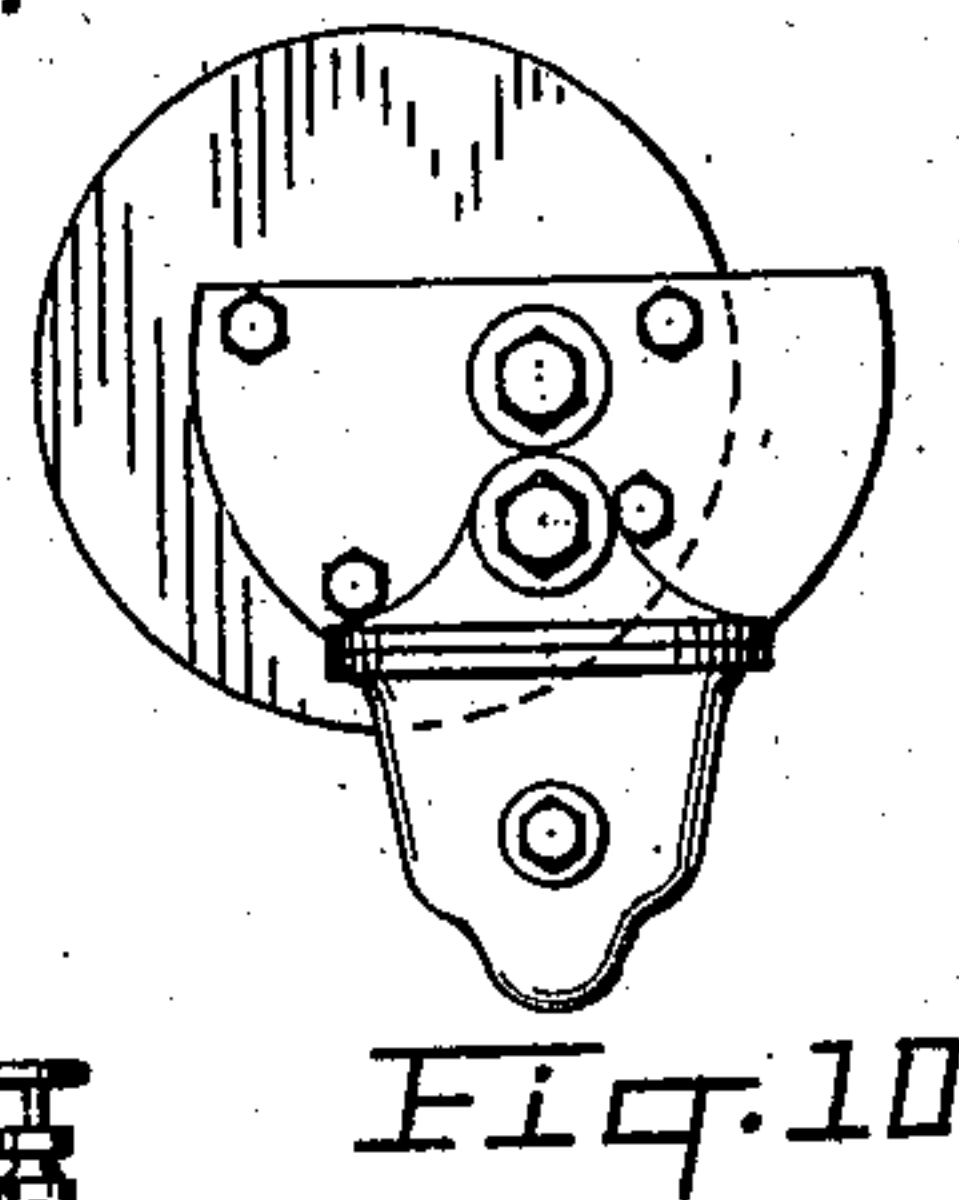
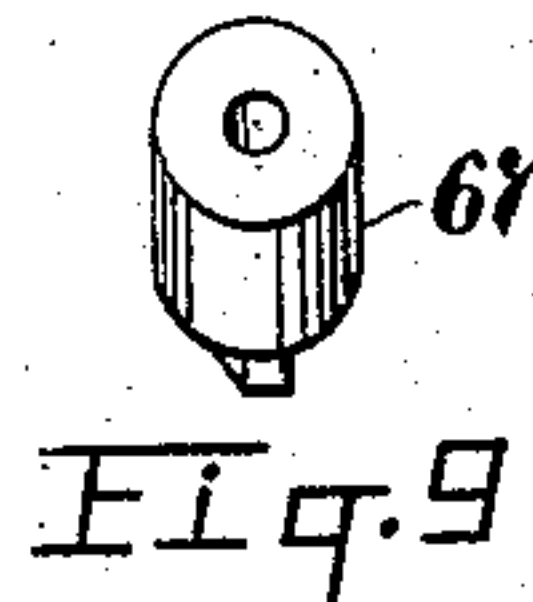
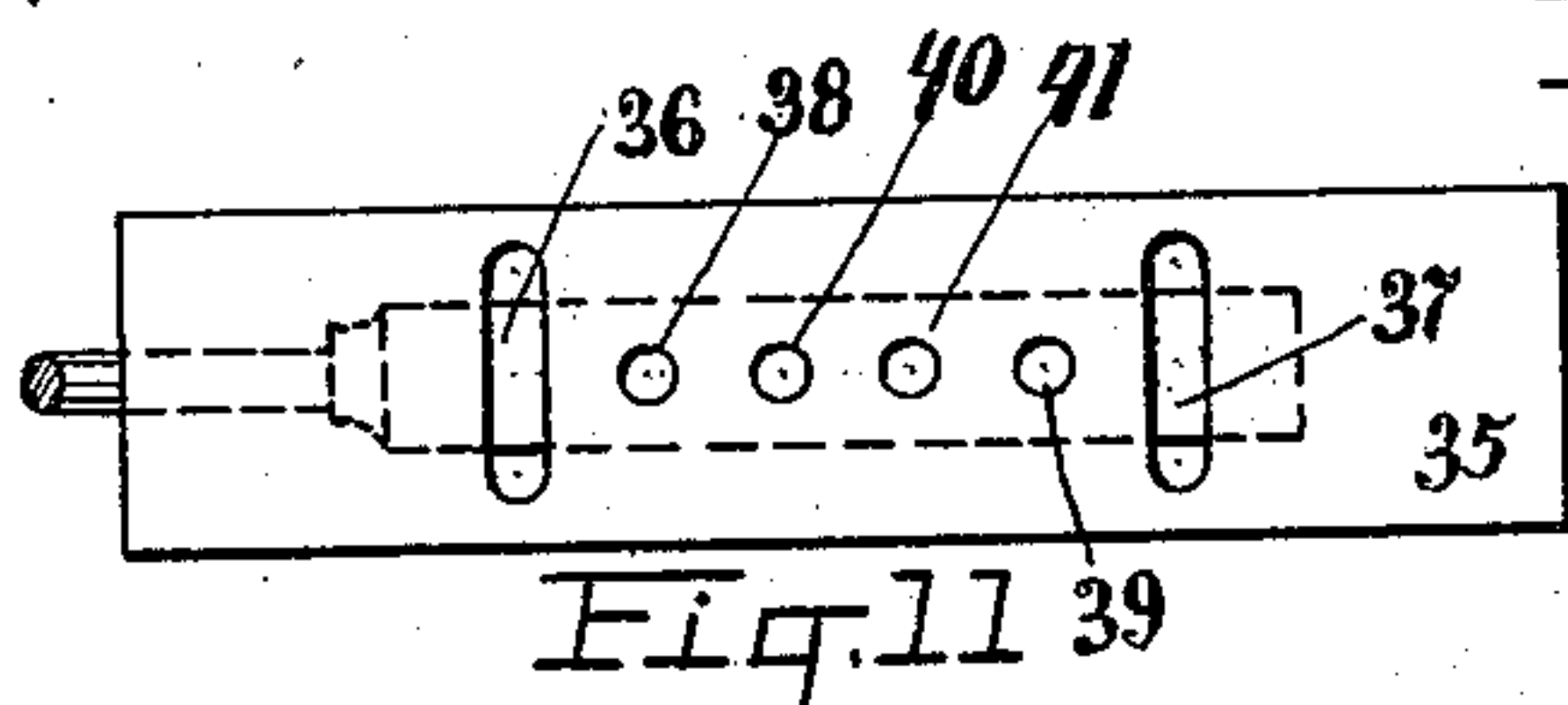
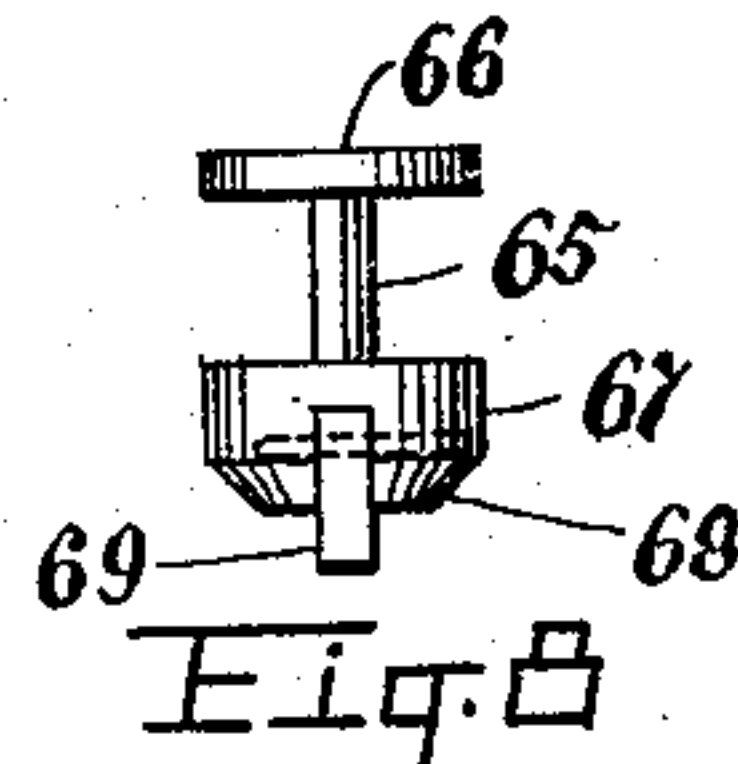
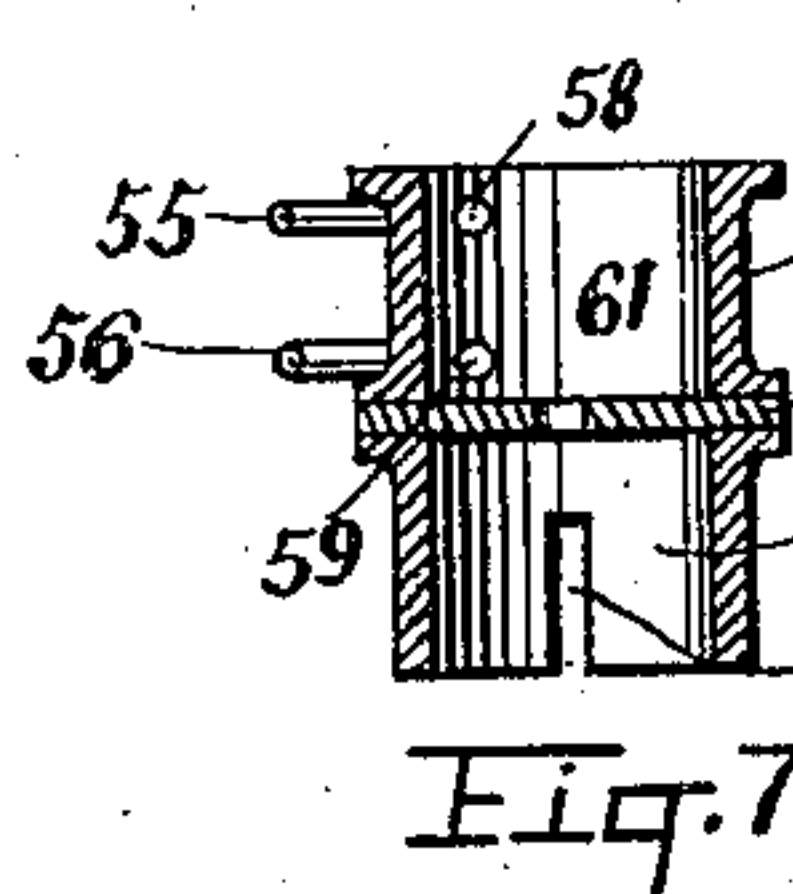
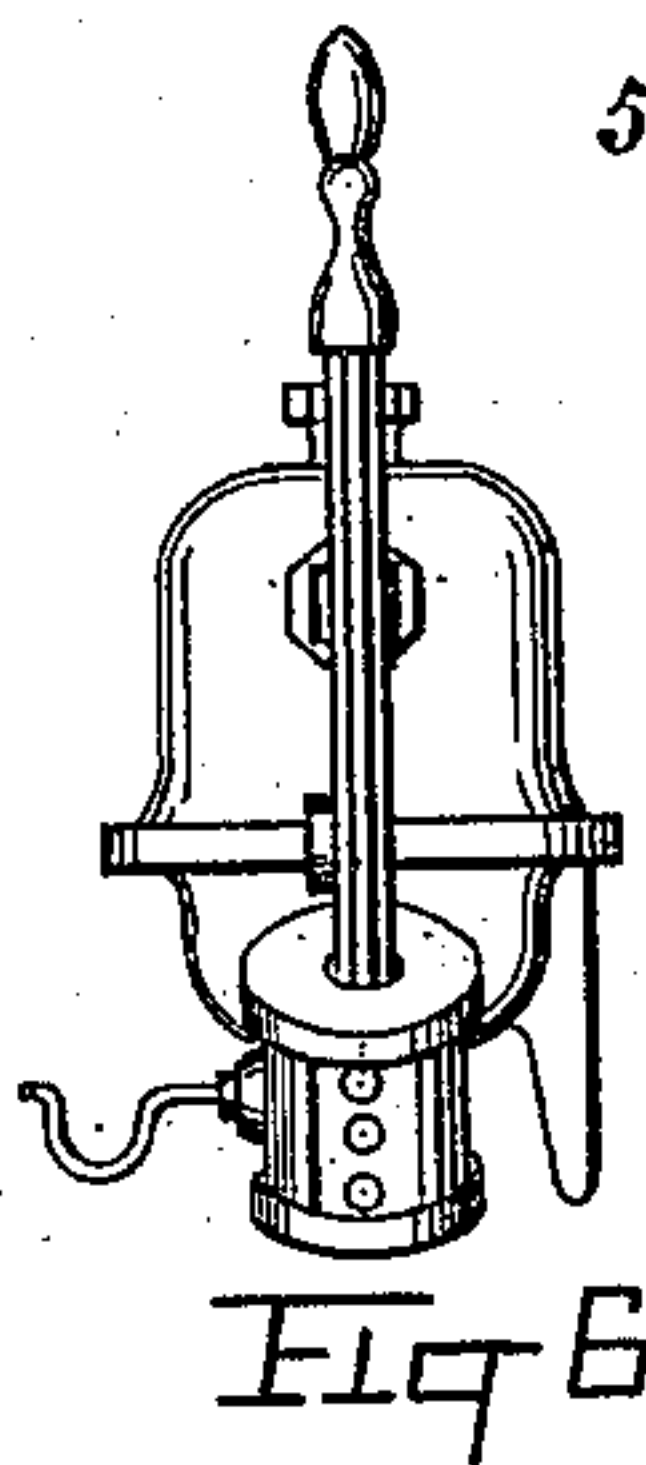
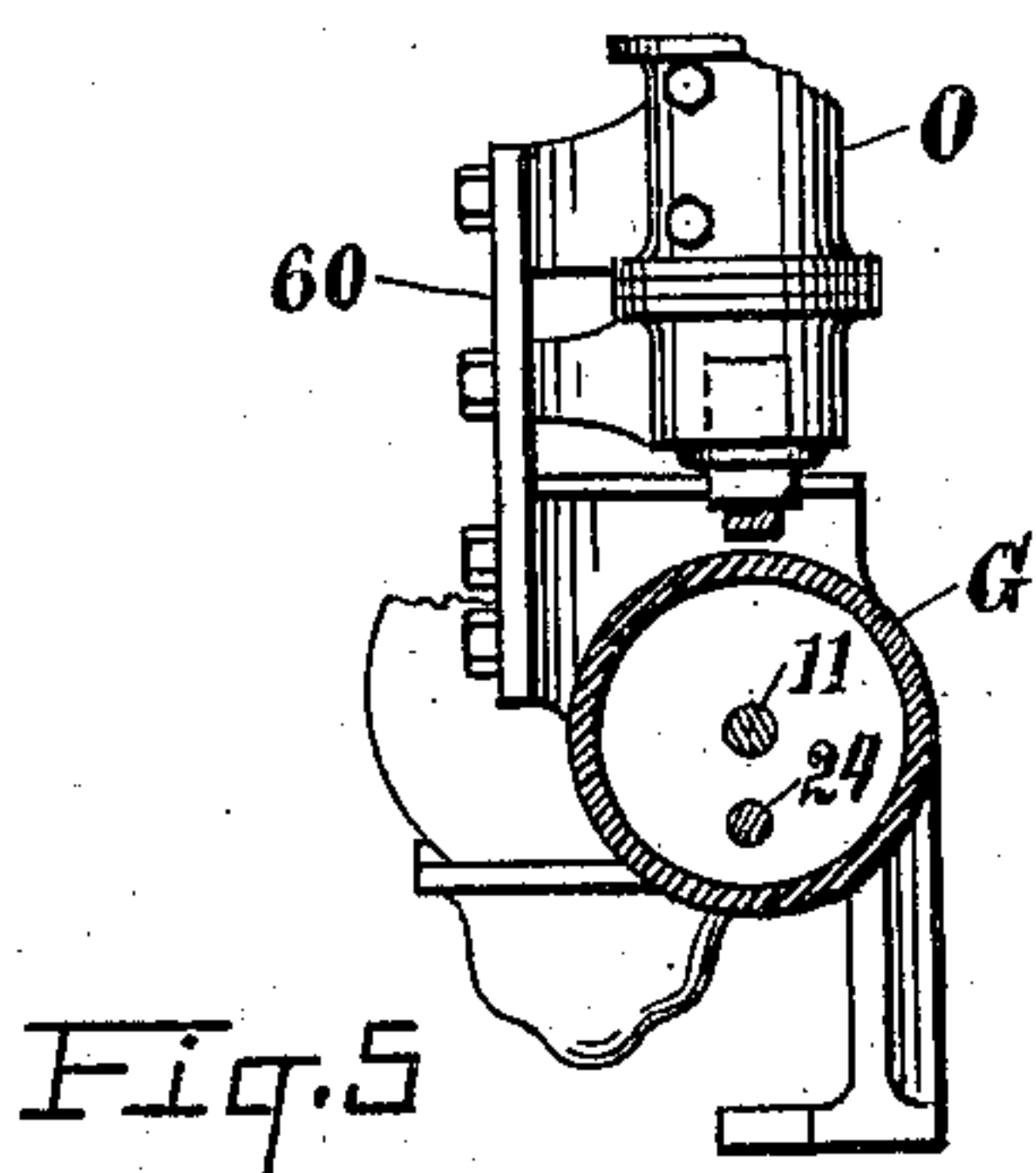
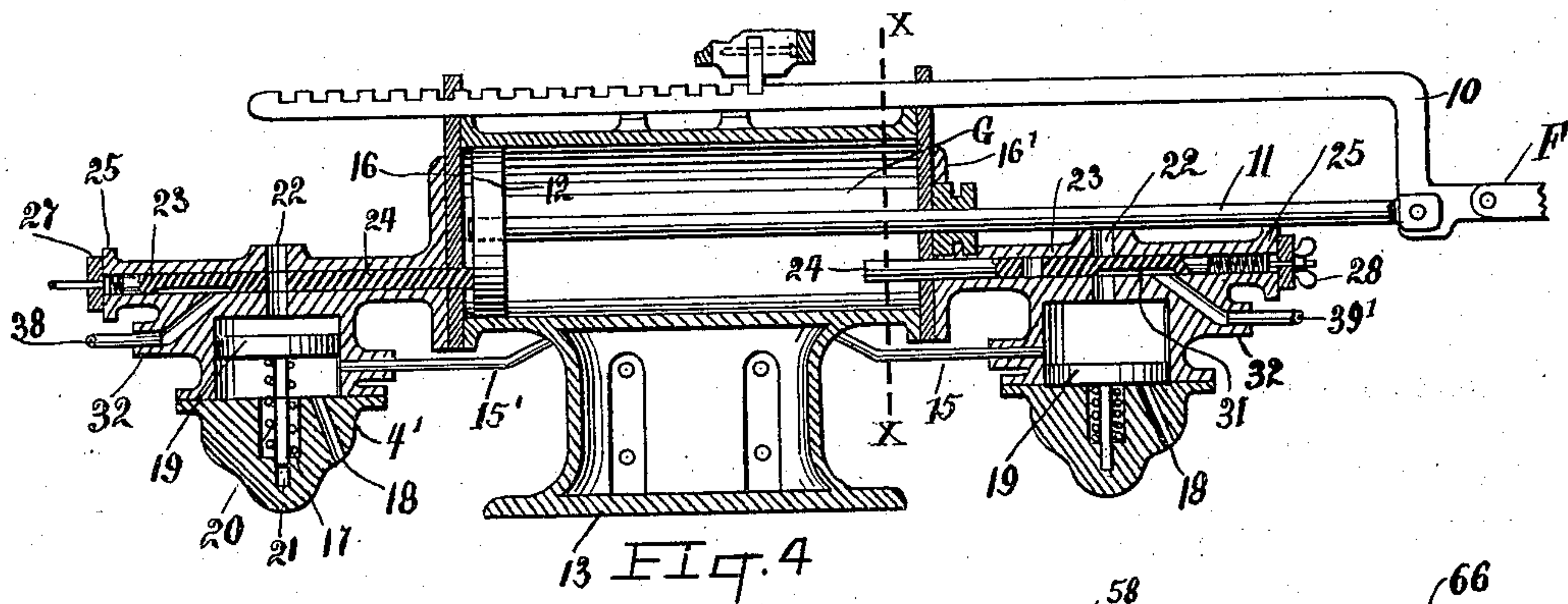
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WITNESSES

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UNITED STATES PATENT OFFICE.

GEORGE HENRY EBEL, OF ST. PAUL, MINNESOTA.

REVERSING-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 695,675, dated March 18, 1902.

Application filed August 15, 1901. Serial No. 72,087. (No model.)

To all whom it may concern:

Be it known that I, GEORGE HENRY EBEL, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Reversing-Gear Mechanism for Locomotives and other Engines, of which the following is a full and complete specification, such as will enable those skilled in the art to which it appertains to make and use the same.

The object of my invention is to provide a new and improved reversing-gear-actuating mechanism for locomotives and other engines by the use of which the reversing-gear may be operated by steam or other pressure.

To such ends my invention consists, in substance, of a toothed quadrant-bar, a link mechanism, mechanism connecting the quadrant-bar with the link mechanism in such manner that the reciprocation of the quadrant-bar will reciprocate the link mechanism, a cylinder, a piston and piston-rod reciprocating in the cylinder in actuating connection with the quadrant, a quadrant-locking cylinder, a piston reciprocating in the quadrant-locking cylinder, a locking-lug carried by the piston adapted to engage with the teeth of the quadrant-bar so as to lock the same in position, a pivoted valve-casing, a feed-pipe forming a connection between the quadrant-locking cylinder and the pivoted valve-casing, a second pipe also forming a connection between such cylinder and valve-casing, an exhaust-orifice for the valve-casing, a feed-pipe in communication with the valve-casing and with a fluid-pressure supply, a valve-plate for regulating the flow of such pressure fluid to and from the valve-casing and quadrant-locking cylinder reciprocating in the valve-casing, a valve-plate rod for reciprocating the valve-plate, a lever for vibrating the valve-casing, a bell-crank pivoted to the valve-casing lever and to the valve-plate rod, a toothed quadrant or rack bar coacting with a tooth or lug carried by the valve-plate rod for locking the pivoted cylinder in position, a main slide-valve casing provided with an inlet and an exhaust and two outlets, a slide-valve reciprocating in the casing provided with two steam-cavities or side ports, a valve-rod in communication with the slide-valve and with the valve-

casing vibrating lever, a pipe forming a communication between the main-valve casing and a fluid-pressure supply, a spring-valve casing located adjacent to either end of the quadrant-cylinder, a pipe forming a communication between the upper portion of each of such spring-valve casings and the opposite end of the quadrant-cylinder, an air inlet and escape passage forming a communication between the lower portion of the spring-valve chamber and the atmosphere, a spring-actuated piston-valve located in each of such spring-valve casings, an exhaust-passage formed in the upper wall in each of the spring-valve casings, a slide-valve chamber formed in the upper wall of each of such spring-valve casings and cutting the exhaust-passage transversely, a slide-valve having an exhaust-passage through the same and an inlet-port slot formed in one side thereof located in each of the slide-valve chambers and extending into the cylinder, a spring for normally forcing each of such slide-valves into the cylinder, and an inlet-pipe forming a communication between each of the slide-valve chambers and one of the outlet-pipes of the main slide-valve and a like pipe forming a like communication between the other slide-valve chamber and the other outlet-port of the main slide-valve, although it is not to be understood that the invention is limited to a machine necessarily comprising at once all of the devices or mechanism before mentioned, for the invention consists in certain various combinations or arrangements of devices and parts and the construction of certain devices and parts, all substantially as hereinafter more fully set forth in the description and pointed out in the claims.

In the accompanying drawings, forming part of this specification, in which like characters of reference designate corresponding parts in the several views, Figure 1 is a side view in elevation of a locomotive-engine provided with my improved form of link actuating mechanism. Fig. 2 is a top plan view of the main portion of such mechanism. Fig. 3 is a detail view, on an enlarged scale, of a portion of the toothed quadrant, the quadrant-locking lug, cylinder, and piston. Fig. 4 is a view in detail, on an enlarged scale, in central vertical section thereof of the main cylinder of

the device. Fig. 5 is an end view of the main cylinder shown in Fig. 1 in vertical cross-section on the line $x x$ of Fig. 1 looking to the left. Fig. 6 is an end view in detail of the vibrating cylinder and lever and locking mechanism for the same and the main slide-valve actuated simultaneously therewith. Fig. 7 is a front view in central vertical section of the body portion of the locking-cylinder. Fig. 8 is a side view in elevation of the cylinder and locking-lug reciprocating in such cylinder. Fig. 9 is a view in perspective of the cross-head and locking-lug of the locking-piston. Fig. 10 is an end view in perspective of the cylinder looking from the right in Fig. 4. Fig. 11 is a top plan view of the floor of the main-valve casing, showing the various ports therein. Fig. 12 is a bottom view of the valve-slide of the main valve. Fig. 13 is a side view in detail of one of the spring slide-valves removed from its chamber in partial vertical section thereof; and Fig. 14 is a side view of the main valve and vibrating valve-cylinder and actuating mechanism, such main valve and the vibrating valve-cylinder being shown in central vertical section.

In the drawings, A designates the locomotive-boiler, and B the cab thereof, and located under the forward end of the boiler is an air-pressure-cylinder supply-drum C, supplied with compressed air by means of a suitable air compressor or pump of the form used in air-pressure brakes, situated at any desired point on the engine. (Not shown.) D designates the link mechanism, which is of the ordinary well-known form of construction, actuated by a bell-crank lever E, moved by a connecting-rod F. This connecting-rod F is connected at its rear end with the toothed quadrant-bar 10, reciprocated by a piston-rod 11, secured to the piston-head 12, reciprocating in the main cylinder G, which main cylinder G is carried by a base 13, firmly bolted to the main frame of the locomotive by bolts 14.

Bolted upon either end of the main quadrant-cylinder G are spring-valve casings H and H', the valve-chambers of which are in communication, from a point slightly above the centers thereof, by means of pipes 15 and 15', with the ends of the cylinder G at the points 16 and 16', respectively. The spring-valve casings H and H' are closed at the bottom by a lower piece 17, usually of the form shown, bolted or otherwise secured thereto in any other desired manner, in the wall of which are formed air-passages 18 in free communication with the atmosphere, and reciprocating up and down in the upper portion of such valve-casings are piston-valves 19 of the form shown normally forced upward in the valve-chamber by means of suitable springs 20 surrounding the piston-rods 21 of such piston-valves 19. The construction, comparative sizes, and arrangements of the various parts of this spring-valve are such that when forced downward by the steam-pressure exerted upon the top the piston 19 will be forced down-

ward below the outlet-pipes 15 and 15' and that when forced upward by the springs 20 they will be forced upward beyond such steam-pipes, as shown at H' on the left of Fig. 4. Formed in and through the top wall of the spring-valve casings H and H', at or about the center thereof, is in each case an exhaust-passage 22, and formed in such top wall of the casing transversely of such exhaust-passage 22 is a slide-valve chamber 23, in which is located a spring slide-valve 24, (shown in detail in Fig. 13,) the inner end of which extends inward a short distance into the cylinder G and is normally forced forward into such cylinder by means of a spring 25, surrounding the end rod 26 thereof, which reciprocates through a nut 27, the tension of the spring 25 being regulated by means of a thumb-screw 28, screwed upon the rod 26, as shown at the right in Fig. 4. This spring slide-valve is usually of the form shown, consisting of a rod cylindrical in cross-section provided adjacent to the center with the exhaust-passage 30 and between the same and the spring-carrying rod 26 with a side steam-port passage or slot 31, which passage or port 31 is in communication at all times with the inlet 32 and when in the inward position shown upon the right in the spring-valve H in Fig. 4 is also in communication with the upper portion of the spring-valve chamber by way of the exhaust-passage 22.

Located in the cab adjacent to the driver's seat is the main slide-valve casing K in communication with the boiler A or any other suitable pressure-supply source by means of a pipe 33 in communication therewith at the top, as shown in Fig. 1 and in detail in Fig. 14, which pipe is usually provided with a stop-cock 34. The bottom or floor piece 35 of this main slide-valve K is provided adjacent to either end with the transverse port-slots 36 and 37, with the outlet-orifices 38 and 39 and with the two exhaust-orifices 40 and 41, joining together into a single exhaust-orifice 42, in communication with an exhaust-pipe 43. Reciprocating upon the floor 35 of the slide-valve casing K is the slide-valve L, provided with the rear port-chamber 43 and a forward port-chamber 44, such slide-valve L being reciprocated in the casing K by a rod 45, connected to a lever 46, pivoted to the valve-casing K, as shown at 47, to which lever 46 is rigidly secured the vibrating valve-casing M, in which valve-casing M reciprocates up and down the slide-valve piece N, so moved by a rod 48, reciprocated by a bell-crank lever 49, pivoted to the lever 46, which rod 48 is provided with a tooth 50, adapted to engage with the teeth of a curved rack-bar 51, carried by the valve-casing K, as shown in detail in Fig. 14.

The vibrating valve-casing M is in communication, usually slightly above the center, as shown at 52 in Fig. 14, by means of a pipe 53, with a pipe 54, in communication with the compressed-air reservoir C, or in some cases

the same may be in communication with the boiler or with any other desired pressure-fluid-supply source, and such valve-casing is provided adjacent to the top with an outlet-pipe 55 and adjacent to the bottom with an outlet-pipe 56, between which is located the exhaust-outlet orifice or pipe 57, the pipe 55 being in communication with the top inlet-orifice 58, the pipe 56 in communication with the lower inlet-orifice 59 of the locking-piston O, which is rigidly secured to the cylinder G by means of a frame 60, firmly bolted thereto, as shown in Figs. 1 and 5. This locking-cylinder O consists of an upper part 61, closed at the top, and a lower part 62, open at the bottom, divided at the center by a diaphragm 63, having a central orifice 64, through which passes the piston-rod 65, upon the top of which is secured the piston-head 66, such piston-rod 65 having rigidly secured thereto at the bottom the cross-head 67, to which, in a slot formed therein to receive it, is secured, by means of a bolt or screw 68, the lock-lug 69, one end of which reciprocates up and down in a slot 70, formed in the lower portion 62 of such locking-cylinder O, so as to prevent turning or twisting of the same therein. The situation and arrangement of the locking-cylinder O is such that the locking-lug 69 will when the piston 66 is forced downward enter the hollows of the teeth of the quadrant-bar 10, as shown in Fig. 4, so as to lock such quadrant, and consequently the bar F and reversing-gear B, against movement.

While I have shown the vibrating valve-cylinder N as in connection with the compressed-air cylinder C and the main slide-valve casing K as in communication with the boiler, it is evident that any other suitable pressure-supply sources may be provided for use therewith. While I have shown the device as more particularly applied to locomotives, it is evident that with but slight changes the same may be adapted for use with marine or stationary engines.

The operation of the device is as follows: The main slide-valve L being in the position shown in Fig. 14 and such slide-valve being so narrow as to leave the ends of the port-slots 36 and 37 in the floor of the valve-casing uncovered, as shown in dotted lines in Fig. 11, it will be seen that the steam admitted to the valve-casing K by way of the pipe 33 will pass by way of the port-slots 36 and 43 to the outlet-port 38, and thence by way of the pipe 38' to the inlet-orifice 32 of the spring-valve casing H' on the left end of the main cylinder G, and that if the piston 12 be in the extreme leftward position shown in Fig. 4, so that the same will by the pressure exerted upon the end of the slide-valve 24 force such slide-valve against the tension of the spring 25 into the position shown at the left of such Fig. 4, so that the port-slot 31 of such slide-valve will be out of communication with the exhaust orifice 22 of the spring-valve casing H and the exhaust-orifice 30 in communica-

tion therewith, that constantly the flow of steam to the cylinder G will be stopped by the position of such spring slide-valves 24. If then it be desired to shift the links of the reversing mechanism D into the position which will cause a reversal of the rotation of the driving-wheels, this may be quickly and easily brought about by lifting the valveplate or slot N of the vibrating valve-cylinder M into the upper position shown in dotted lines in Fig. 14, so as to bring the port-slot 75 of such valve-slide N over the ends of the pipes 55 and 57, whereby the orifice 58 of the locking-cylinder O in communication therewith above the locking-piston will be brought into communication with the atmosphere by way of such pipes 55 and 57 and port-slot 75, while at the same time the end of the pipe 56 being uncovered will allow free passage of the compressed air admitted to the vibrating-cylinder M by way of the orifice 52 and pipe 54 from the air-reservoir C to the lower part of such locking-cylinder O by way of the pipe 56 and orifice 59, which compressed air will force the piston-head 56 upward, so as to release the locking-dog 69 from the teeth of the quadrant-bar 10, so as to permit of free reciprocation thereof. Then by means of the hand-lever 46 the main slide-valve L is forced inward into the position shown in dotted lines in Fig. 14, so as to cover the port-slot 36 and bring the port 38 into communication with the exhaust 40 by way of the port-slot 43, and at the same time the port 41 is covered and the port-slot 37 is brought into communication with the port by way of the port-slot 44, whereby steam will be admitted to the left end of the main cylinder G by way of the port 16, pipe 15, spring-valve casing H, port-slot 31 of the slide-valve 24, passage 32, and pipe 38', such steam upon its first entrance into the upper portion of the spring-valve chamber forcing the piston 19 of such valve down into the position shown at the right of Fig. 4 at H, so as to clear the end of the pipe 15, so that such steam will have free passage by way of such pipe 15 to the port 16, and passing through which port such steam will force the piston 12 to the right until the same comes in contact with the end of the slide-valve 24, which projects into such cylinder G, and its continued leftward movement will carry back such spring slide-valve 24, so as to bring the exhaust-orifice 30 thereof into registry with the exhaust-orifice 22 of the spring-valve casing, and at the same time to cut the port-slot 31 off from communication with the exhaust-orifice 22, and as soon as the exhaust-orifices 22 and 30 are in registry the steam escaping into the atmosphere, and thus releasing the piston 19 from such downward pressure, will permit the spring 20, actuating such piston, to throw such piston into the upward position shown at H' in said Fig. 4, so that the same will be above the points where the pipe 15 communicates with such valve-casing by which the interior of the cylinder

G will be brought into free communication with the atmosphere by way of such pipe 15, the lower part of the spring-valve casing, and exhaust-passage 18, whereby clearance 5 from the exhaust air or steam and of the water of condensation upon the return movement of the piston 12 is provided for, and such reverse movement, it will be seen, may be easily brought about by a reverse movement of the main slide-valve L. It is also 10 evident from an examination of the drawings that the piston 12 may be by proper manipulation of the slide-valve L stopped at any desired point, and by the downward 15 movement of the locking-piston 66 be located therein by the forcing downward of the locking-lug 69 into contact with the teeth of the quadrant-bar 10, and the engine-valve gearing thus be "cut back" to any desired point, as 20 is the case with the ordinary form of hand-actuated reversing-gear now in use upon locomotives of the ordinary type.

Having thus fully described my invention, what I claim as new, and desire to secure by 25 Letters Patent, is—

1. In an engine, the combination with a reversing-gear, of a toothed quadrant-bar in actuating connection therewith, a main cylinder 30 adjacent to the quadrant-bar, a piston reciprocating in the cylinder in actuating connection with the quadrant-bar, a fluid-pressure supply, means for bringing such fluid-pressure supply into and out of communication with the two ends of the cylinder so as 35 to reciprocate the piston therein, and means for locking the toothed locking-bar in any required position, substantially as shown and described.

2. In an engine, the combination with a reversing-gear, of a toothed quadrant-bar in actuating connection therewith, a main cylinder 40 adjacent to the quadrant-bar, a fluid-pressure supply, means for bringing such fluid-pressure supply into and out of communication with the two ends of the cylinder so as to reciprocate the piston therein, and means for 45 locking the toothed locking-bar in any required position, substantially as shown and described.

3. In an engine, the combination with a reversing-gear, of a toothed quadrant-bar in actuating connection therewith, a main cylinder 50 adjacent to the quadrant-bar, a piston reciprocating in the cylinder in actuating connection with the quadrant-bar, a locking-cylinder adjacent to the quadrant-bar, a piston reciprocating in the locking-cylinder, a locking-lug carried by the piston adapted to co-act with the teeth of the quadrant so as to 55 lock the same in position, a fluid-pressure supply in communication with the main cylinder, a fluid-pressure supply in communication with the locking-cylinder, and means for regulating the flow of the fluid to and from 60 such cylinders, substantially as shown and described.

4. In an engine, the combination with a re-

versing-gear, of a toothed quadrant-bar in actuating connection with the reversing-gear, 70 a main cylinder, a piston reciprocating in the main cylinder in actuating connection with the reversing-gear, a main cylinder, a piston reciprocating in the main cylinder in actuating connection with the quadrant-bar, a main-valve casing in communication with a fluid- 75 pressure supply and with both ends of the main cylinder, a slide-valve reciprocating in the casing, a locking-cylinder, a piston reciprocating in the locking-cylinder, a locking-lug adapted to coact with the teeth of the quad- 80 rant-bar to lock the same against movement carried by the locking-piston, a vibrating valve-cylinder in communication with the fluid-pressure pipe, two pipes forming a communication between such valve-cylinder and 85 the locking-cylinder, a valve-slide reciprocating in the vibrating cylinder, a valve-rod for actuating the valve-slide, a lever for vibrating the vibrating valve-cylinder, a toothed rack for locking the same in position, a rod 90 connecting such lever with the valve-slide of the main valve, and means for locking such lever at any desired point upon the toothed rack, substantially as shown and described.

5. In a device of the class described, the 95 combination with a cylinder of a piston reciprocating in the cylinder, a spring-valve chamber located at either end of the cylinder in communication therewith, the chamber at one end being in communication with the op- 100 posite end thereof, a piston-valve located in each of such valve-chambers, a spring for normally forcing such spring-valve in one direction, an exhaust-passage for each of such valve-chambers, a slide-valve chamber in the 105 spring-valve casing cutting the exhaust-passage transversely, an exhaust-passage through the slide-valve, an inlet recess or port formed in one side of the slide-valve, a fluid-pres- 110 sure-supply pipe in communication with the slide-valve chamber so as to form a communication with the steam-valve by way of the side port and exhaust-passage when the same is in the proper position, a spring for normally 115 keeping the slide-valve in position so that the side port is in communication with the exhaust passage and inlet, and means for forcing such slide-valve in the opposite direction upon the reciprocation of the piston to that 120 end of the cylinder, substantially as shown and described.

6. In a device of the class described, the combination with a cylinder, of a piston reciprocating in the cylinder, a spring-valve 125 chamber located at either end of the cylinder in communication therewith, a piston-valve located in each of such valve-chambers, a spring for normally forcing such spring-valve in one direction, an exhaust-passage for each of such valve-chambers, a slide-valve 130 casing cutting the exhaust-passage transversely, an exhaust-passage through the slide-valve, an inlet-recess or port-slot formed in one side with a slide-valve, a fluid-pressure-

supply pipe in communication with the slide-valve chamber so as to form a communication with the steam-valve chamber by way of the side port and exhaust-passage when the same
5 is in the proper position, a spring for normally keeping the slide-valve in position so that the side port is in communication with the exhaust passage and inlet, and means for forcing such slide-valve in the opposite direction upon the reciprocation of the piston
10

to that end of the cylinder, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of the subscribing witnesses, this 6th 15 day of August, 1901.

GEORGE HENRY EBEL.

Witnesses:

F. KNAUFT,
AUGUST SCHULZ.