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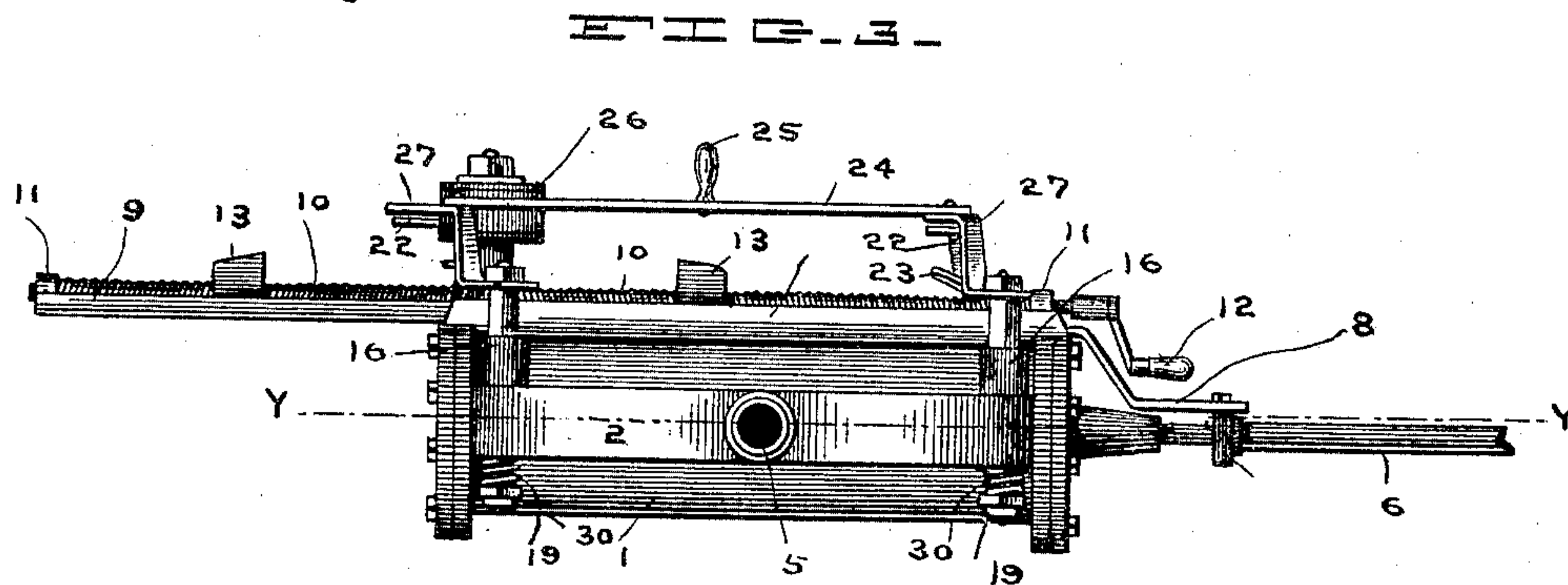
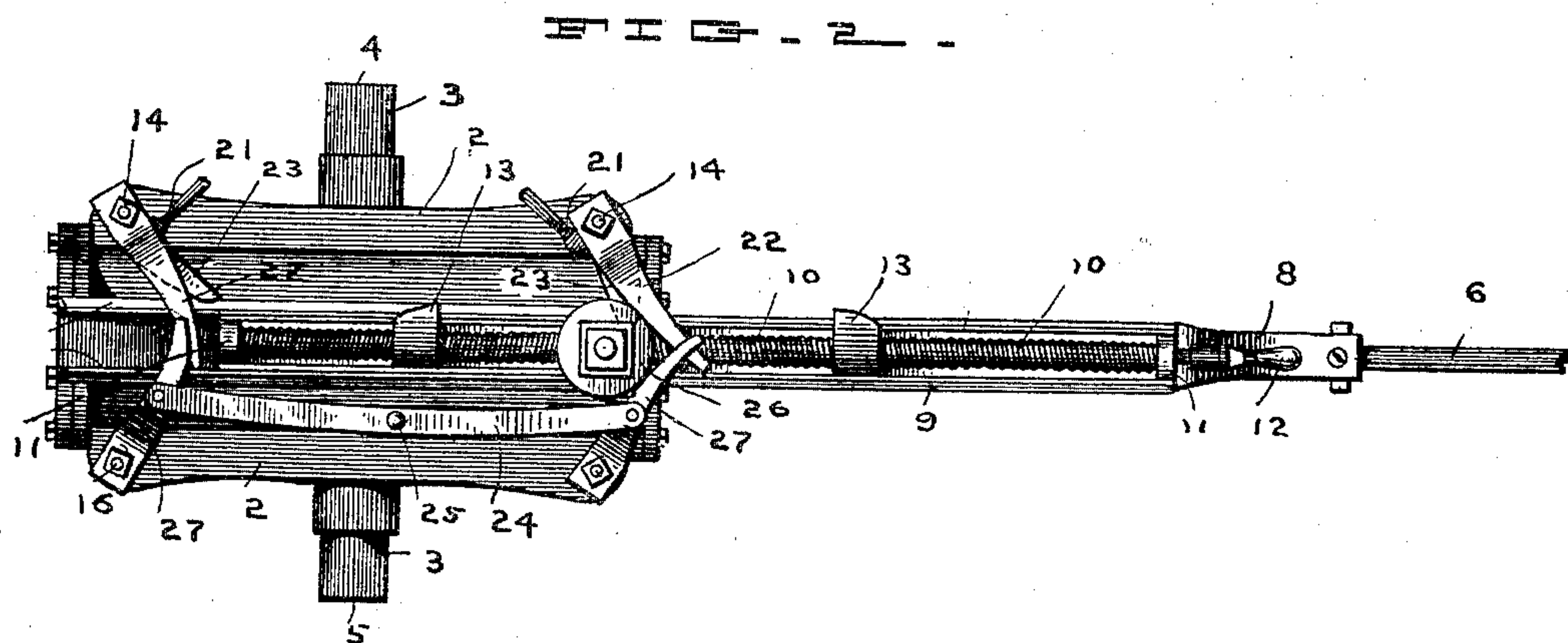
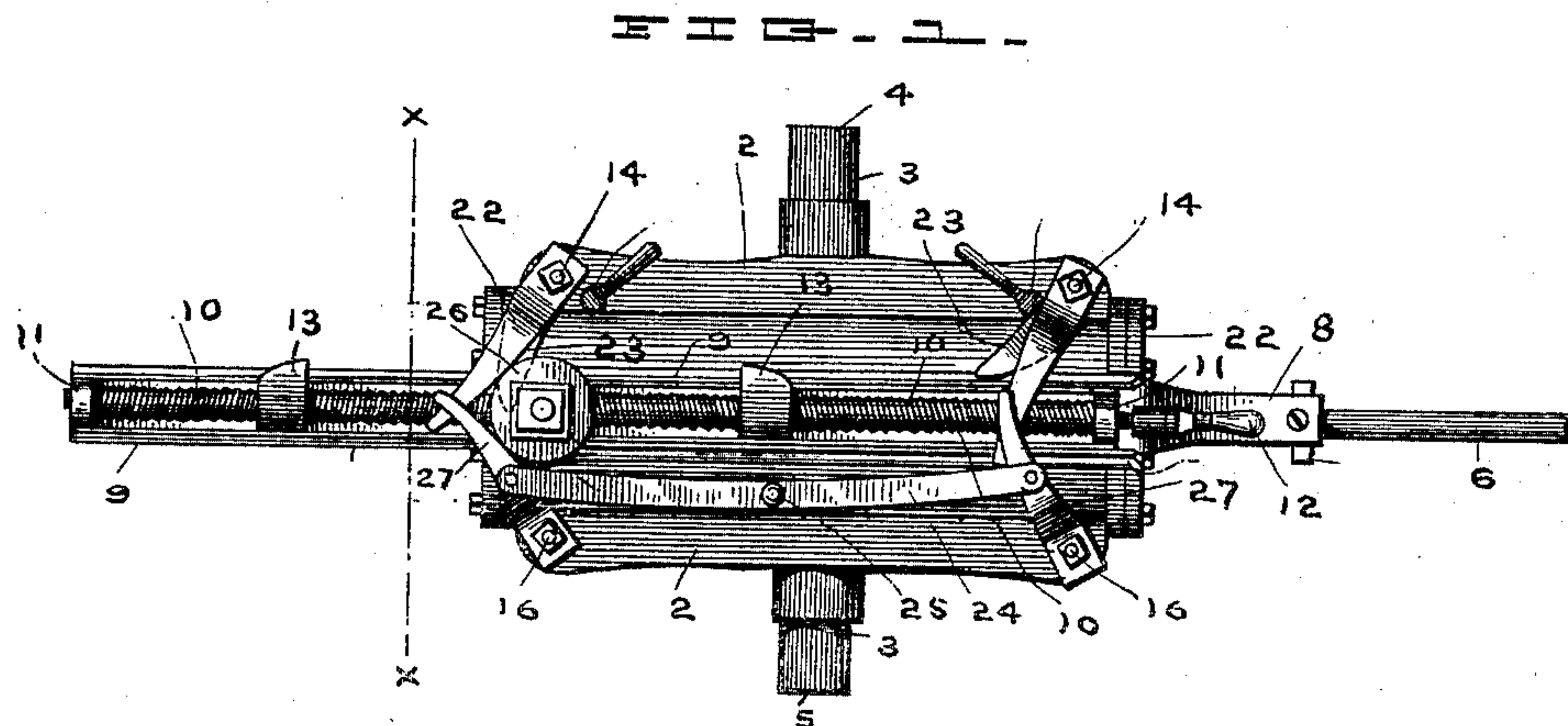
2 Sheets—Sheet 1.

E. J. CHAPIN.

CUT-OFF MECHANISM FOR STEAM ENGINES.

No. 444,773.

Patented Jan. 13, 1891.



Witnesses

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(No Model.)

2 Sheets—Sheet 2.

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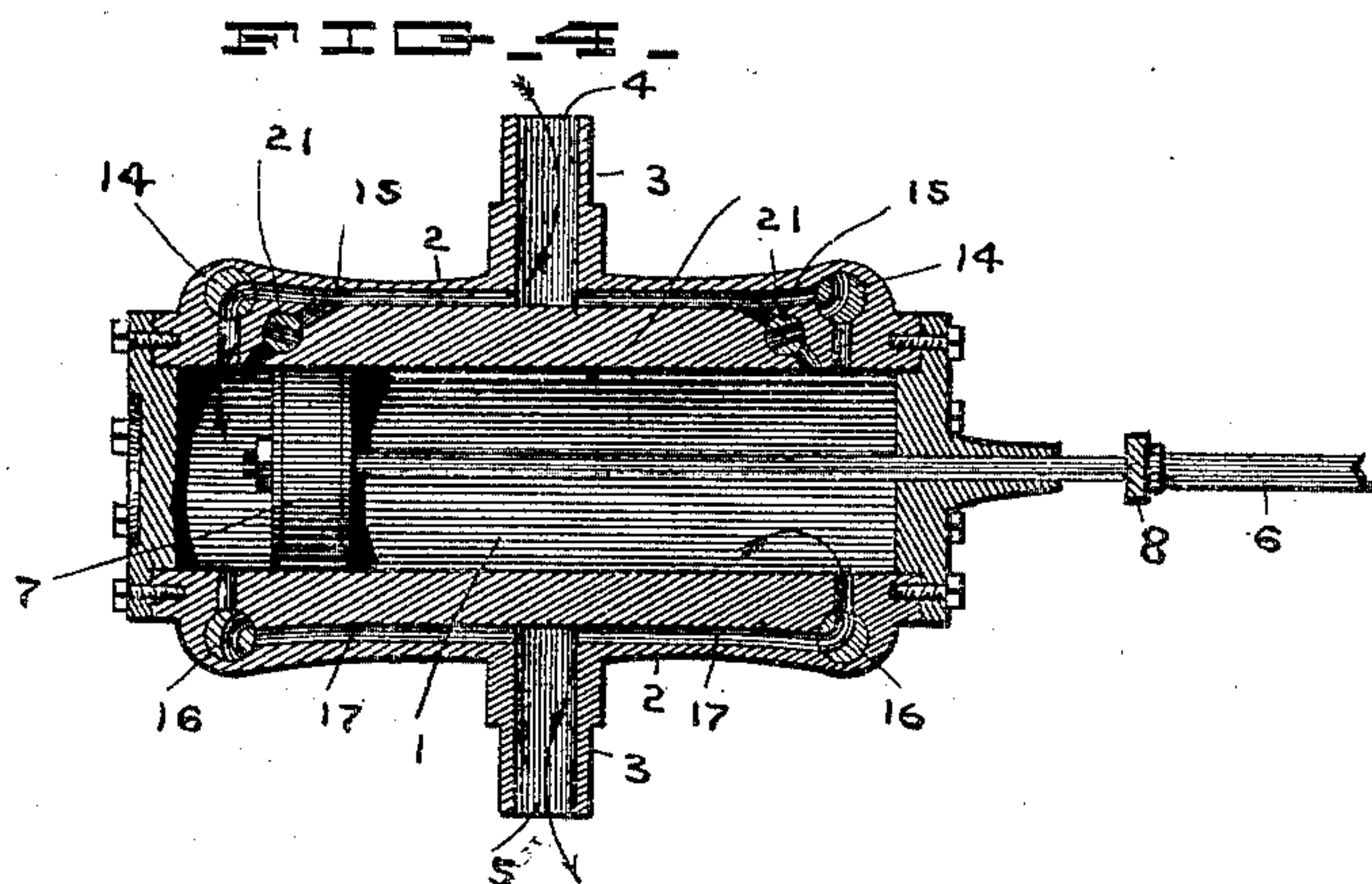


FIG. 5.

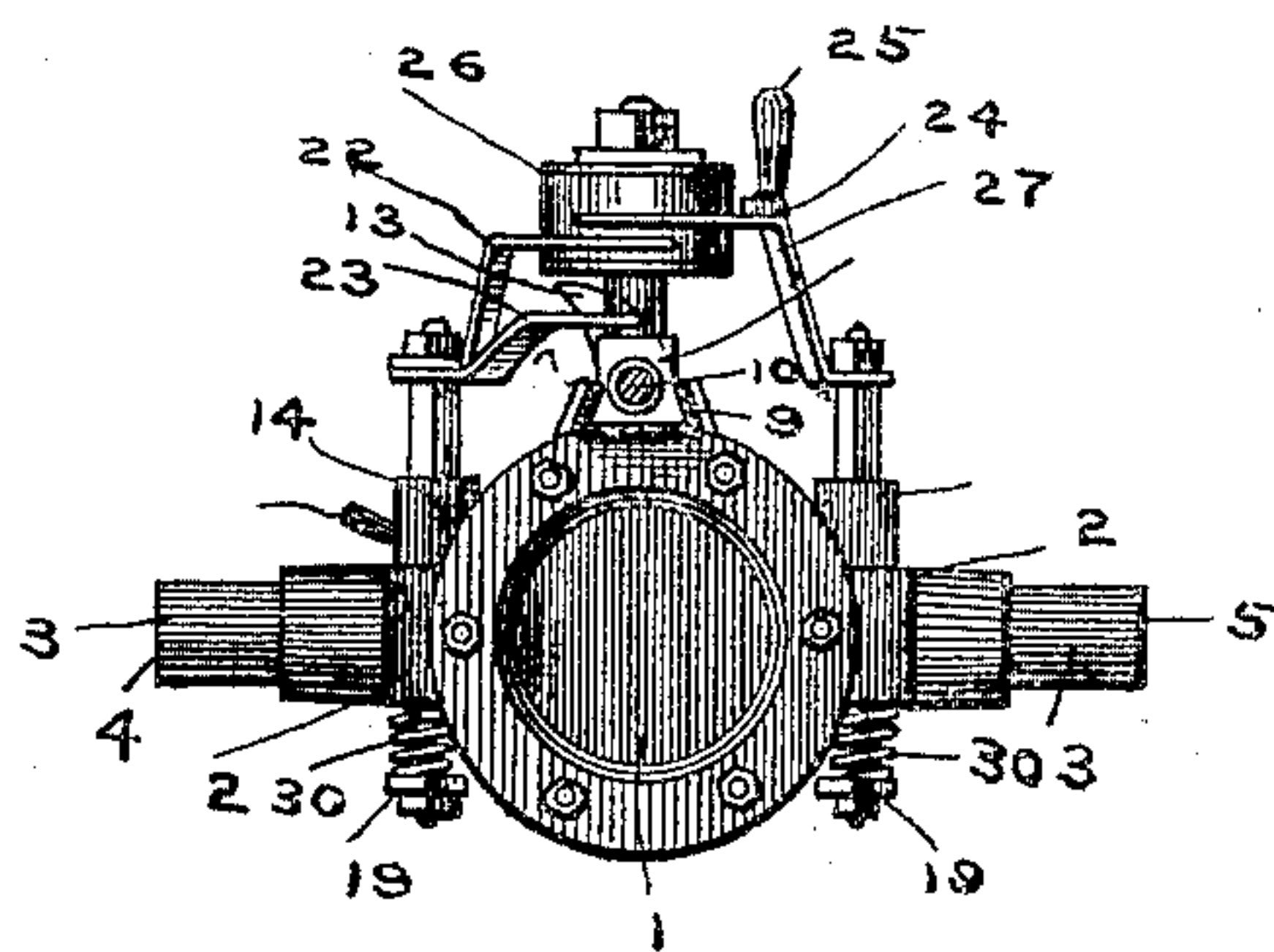


FIG. 6.

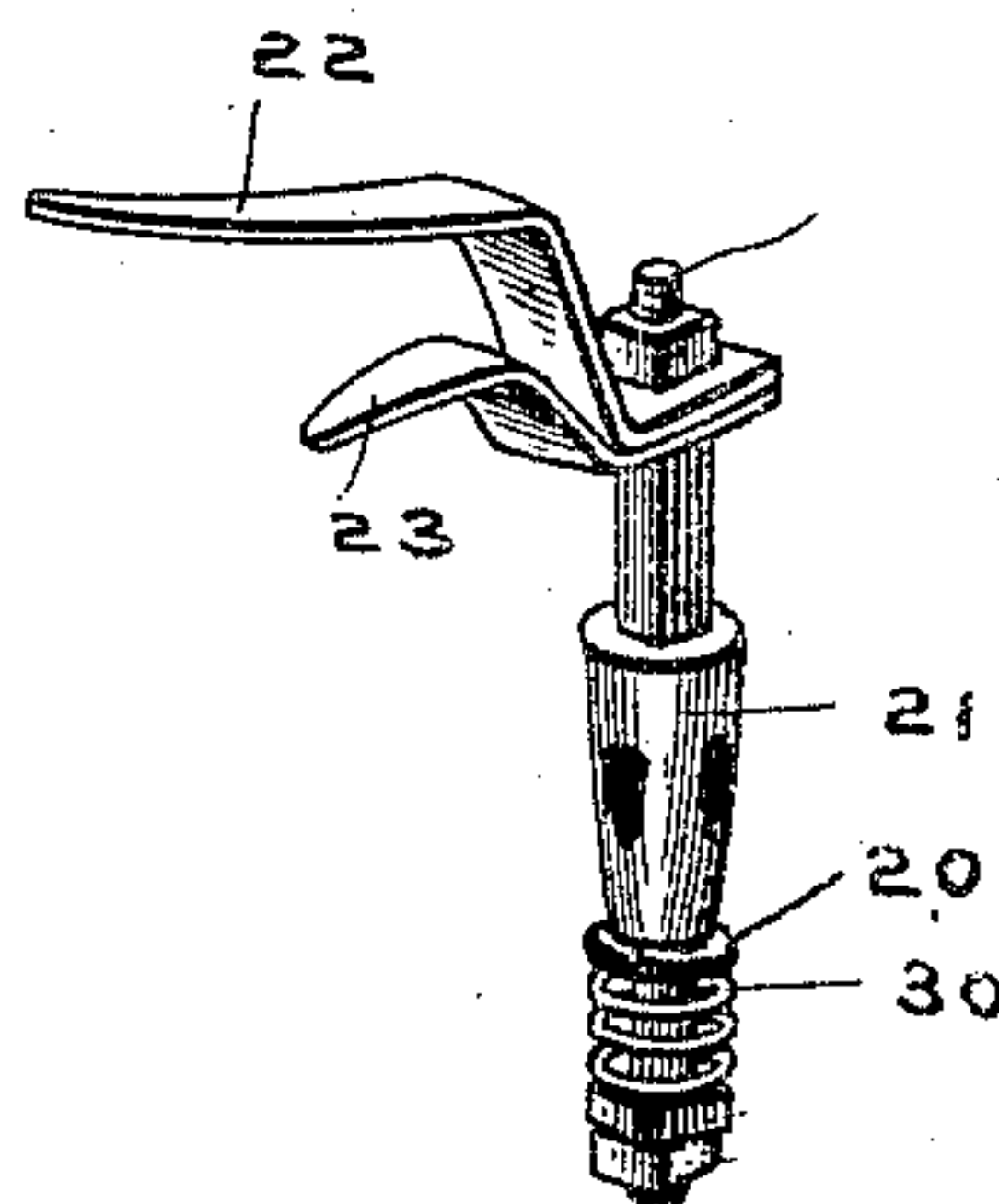
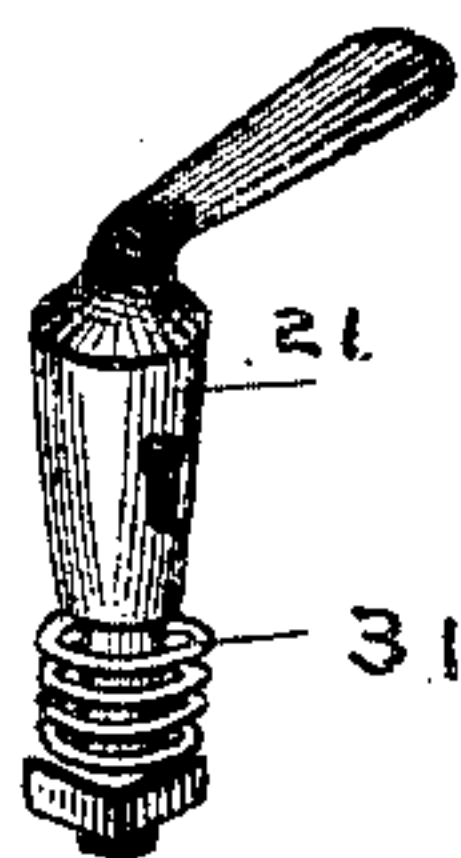


FIG. 7.



Witnesses

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# UNITED STATES PATENT OFFICE.

EDWARD J. CHAPIN, OF INDIANAPOLIS, INDIANA.

## CUT-OFF MECHANISM FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 444,773, dated January 13, 1891.

Application filed September 27, 1890. Serial No. 366,409. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD J. CHAPIN, of Indianapolis, county of Marion, and State of Indiana, have invented certain new and useful Improvements in Automatic Cut-Off Mechanism for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which like figures refer to like parts.

My invention relates to the construction of devices for automatically cutting off steam in cylinders and for reversing the engine while the machine is running, and will be understood from the following description.

In the drawings, Figure 1 is a top view showing the position of the parts when the piston is at the outer end of the cylinder. Fig. 2 is a similar view showing the position of the parts when the piston is at the opposite end of the cylinder. Fig. 3 is a side view of Fig. 1, showing the exhaust-ports. Fig. 4 is a longitudinal section of the cylinder, showing the ports and position of the port-valves. Fig. 5 is an end view on the line  $x x$ , Fig. 1. Fig. 6 is an enlarged detail view of one of the valve-cocks. Fig. 7 is a similar view of the auxiliary valve-cock which is to be used when the engine is to be reversed.

In detail, 1 is the cylinder, having ribs 2 formed on the sides. 3 3 are trunnions connected thereto, which are hollow, the former serving as the inlet 4 and the latter as the exhaust 5 for the cylinder.

6 is a piston-rod connected to the piston 7, and to this is secured a bent arm 8, which is formed integral with a grooved slide 9, fastened on the top of the cylinder.

10 is a right and left hand screw-rod journaled in bearings 11 at each end of the slide 9, the outer end of this rod being provided with a crank 12.

13 are shifting blocks mounted on the screw-rod, having projections at the bottom which fit beneath flanges of the grooved slide, and by turning the crank 12 these blocks may be set forward or backward upon the right and left screws of the rod 10.

Inlet-valves 14 are set in ports 15, leading from inlet 4, and exhaust-valves 16 are set in ports 17, leading to the exhaust 5. Coiled springs 18 are mounted on a lower extension

of the stems of these valves, and lock-nuts 19 work on the threaded lower ends, by which the tension of the spring may be increased or diminished, the upper end of the spring bearing against washers 20, and by this means any looseness of fit of the valve in its seat may be readily taken up. A somewhat similar arrangement is shown in Fig. 7 upon the auxiliary reversing-valve 21.

Upon the upper ends of the stems of the inlet-valves 14 are two projecting levers, one 22 preferably longer than the other 23 and secured in place by a nut. (See Fig. 6.) These levers project inward and directly over the screw-rod 10, as shown in Fig. 1. The exhaust-valves 16 are provided with but one each 27; but these are connected by a cross-bar 24, which is provided with a pin 25, over which an operating-lever may be dropped. This pin might be formed on the lever and a hole made in the cross-bar, which would be an equivalent construction, the object of this being to provide a means of attachment for the lever by which the reversal of the engine is to be accomplished. The auxiliary reversing-valves 21 are connected directly with the ports 15, leading from the inlet, as shown in Fig. 4. The movement of the piston-rod 6 directly actuates the screw-rod 10, and as this latter reciprocates the shifting blocks 13, which it carries, will necessarily come in contact with the levers connected to the inlet and exhaust valves; but to secure beyond peradventure a sufficient contact of the parts to operate the valves an additional shifting block 26 is connected to the screw-rod between the blocks 13, and this is preferably of a circular form, but of such diameter that its periphery will necessarily come in contact with the upper and longer levers 22 of the inlet-valves and also with the levers 27 of the exhaust-valves, and the cutting off of the steam at a certain point of the stroke is accomplished by means of these shifting blocks in the manner I will now describe. To illustrate this the position of the parts in Fig. 2 is such that the piston is at the inner end of the cylinder beneath the central shifting block 26. The left-hand inlet-valve is now closed and the right-hand inlet-valve is open. The left-hand exhaust-valve is open and the right-hand exhaust-valve is closed. As the piston-rod 6



now begins its forward movement in the cylinder, driven by the steam which comes in from the right-hand inlet-valve, it pushes forward with it the screw-rod with its shifting blocks, and as the forward block reaches the valve-levers at the outer end of the cylinder its rounded side allows it to pass by the lower one 23 of these levers; but the point of the inner block, which is reversed with reference to that of the outer block, will strike the inner lower lever of the right-hand inlet-valve, forcing it inward, turning the valve-cock so as to cut off the steam at the moment when the point of the block passes the lever, and the expansion of the steam in the cylinder will do the rest of the work, carrying the central shifting block 26 onward and bringing it in contact with the upper lever 22 of the left-hand inlet-valve and the lever 27 of the left-hand exhaust-valve, closing the exhaust and opening the inlet valve on the outer end of the cylinder, and through the connection of the lever of the left-hand exhaust with that of the right-hand exhaust valve will open the latter, thus throwing all the parts in the position shown in Fig. 1. Steam is now admitted through the left-hand inlet-valve, the exhaust-valve directly below being closed. The piston is driven backward and the outer shifting block will strike the lower lever of the inlet-valve, closing it, cutting off the steam at that point; but, the piston still moving inward, the central shifting block 26 strikes the levers of both the inlet and exhaust valves on the inner end of the cylinder, opening the former and closing the latter, thus providing for the return movement of the piston. This process is continued as long as the engine is running. If it is desired to cut the steam off a little earlier or a little later in the stroke, this is easily accomplished while the machine is running by turning the crank 12, which operates the screw-rod and changes the position of the shifting blocks 13 thereon. The shifting block 26 remains, however, in its central position without change, this block being carried on a support having an opening below, in which the screw-rod moves loosely. If, now, it is desired to reverse the engine while it is running, the operator drops the reversing-lever over the pin 25 and at the same time opens one of the auxiliary valves 21 with his hand. He opens the valve on that side which will admit steam in the proper direction, these valves being simply the equivalents in action of the inlet-valves 14, and are provided so that the latter need not be affected during the reversal of the mechanism. The opening of either one of the auxiliary valves serves to allow the steam a direct communication through the ports 15 into the cylinder, care being taken when the piston is moving backward to open the inner auxiliary valve, and vice versa. As this valve is turned the operator, by means of the lever on the pin, throws the cross-bar 24 backward, and

this movement shifts the levers of the exhaust-valves, closing one and opening the other. As soon as this is done, he closes the auxiliary valve which he had opened and the piston moves forward in the opposite direction without strain upon the parts. The single lever upon the exhaust-valve cocks is about on a line with the upper and longer lever on the inlet-valve, and the central shifting block 26 is raised somewhat above the shifting blocks 13, and the latter therefore are not adapted to operate the upper levers of the valves; but these are operated only by the central shifting block 26. The exhaust therefore will not be completely closed or open until the longer levers of the valves are substantially in a straight line with each other, and this keeps the exhaust-valve open during the greater part of the travel of the piston, and thus provides for a free and complete exhaust of the steam in the cylinder, and there is little or no danger of any back-pressure.

The piston herein shown is provided with trunnions, and is therefore primarily intended for an oscillating engine; but inasmuch as these trunnions are hollow and contain the inlet and exhaust ports of the cylinder the latter is adapted to be used in other forms of engines, and in such case the trunnions would only be used as steam-ports and would be set so as to be stationary in any suitable manner. It will be seen, therefore, that I provide, first, for the cutting off of the steam at any desired point of the stroke by means of shifting blocks mounted on a rod on the top of the cylinder, the rod being connected to and actuated by the piston-rod itself, the shifting blocks operating upon levers connected with the inlet and exhaust valves, the latter being connected as shown; second, I also provide for the adjustment of these shifting blocks upon the rod which carries them by means of the right and left hand screw crank, whereby the steam may be cut off at different points of the stroke, as desired by the engineer; third, I also provide for the reversal of the engine by means of the lever which operates the exhaust-valves independently of the other mechanism and by the use of auxiliary inlet-valves, as shown; fourth, I also provide means for taking up the wear of the valves in the valve-seats by means of a coiled spring, nuts, and washers mounted on the lower end of the valve-stems. These are the principal features of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is the following:

1. In combination, a steam-cylinder having suitable inlet and exhaust openings, inlet-valve cocks set in openings on one side of such cylinder and adapted to open or close ports leading from the inlet, levers upon the upper end of such valves outside the cylinder, a screw-rod carried in bearings moving in a grooved slide upon the top of such cylinder, and adjustable shifting blocks mounted on



such rod, the latter connected by an arm to the piston-rod, whereby the movement of the latter actuates the shifting blocks upon the screw-rod and operates to open and close the inlet-valve cocks of the cylinder, substantially as shown and described.

2. In combination, a cylinder having inlet and exhaust openings, exhaust-valve cocks upon one side of such cylinder, having levers connected to their upper ends, such levers connected by a cross-bar to secure the simultaneous action of such exhaust-valves, such levers operated by shifting blocks carried on a rod on the top of such cylinder, and such rod actuated by the piston-rod, substantially as shown and described.

3. In combination, a steam-cylinder having suitable inlet and exhaust openings, inlet-valves set in one side of such cylinder, exhaust-valves upon the opposite side thereof, levers connected to the top of such inlet and exhaust valves and extending inward toward each other and over the top of the cylinder, and a rod carrying shifting blocks moving in a grooved slide on the top of such cylinder and connected to the top of the piston-rod, whereby the movement of the latter operates to carry the shifting blocks in contact with the levers of the valve and alternately open and close them, substantially in the manner shown and described.

4. In combination, a steam-cylinder having suitable inlet and exhaust openings, inlet-valves set in one side of such cylinder and at the ends, exhaust-valves set in the opposite side of such cylinder and at the ends, ports leading from such valves to the inlet and exhaust openings, levers connected to the top of the valve-stems outside the cylinder, and a rod carrying shifting blocks for engaging with

such levers, reciprocating in a grooved slide upon the outside of the cylinder, such rod connected to and actuated by the piston-rod, whereby the movement of the piston in the cylinder operates alternately to open and close the inlet and exhaust valves, substantially as shown and described.

5. A steam-cylinder having inlet-valve cocks set in openings upon one side and at the ends, exhaust-valve cocks set in openings at the opposite side and ends of such cylinders, the exhaust-valves connected by a link or bar to insure simultaneous action, the inlet-valves provided with long and short levers and the exhaust-valve with a single lever, a right and left screw-rod carrying shifting blocks thereon adapted to reciprocate in a grooved slide upon the top of the cylinder and connected to the piston-rod and actuated thereby to open and close the valves by means of the contact of the blocks with the levers, and means for adjusting the blocks upon their rod, all combined substantially as described.

6. In a steam-cylinder having inlet and exhaust openings, steam and exhaust valves at the ends and on opposite sides thereof, and levers mounted on the upper end of the valve-stems actuated by a reciprocating screw-rod carrying blocks for engagement with such lever, with means, such as a crank, connected to such rod, for adjusting the blocks on the screw-rod so as to cut off the steam at any point of the stroke, substantially as described.

In witness whereof I have hereunto set my hand this 16th day of September, 1890.

EDWARD J. CHAPIN.

Witnesses:

E. B. GRIFFITH,  
C. P. JACOBS.