

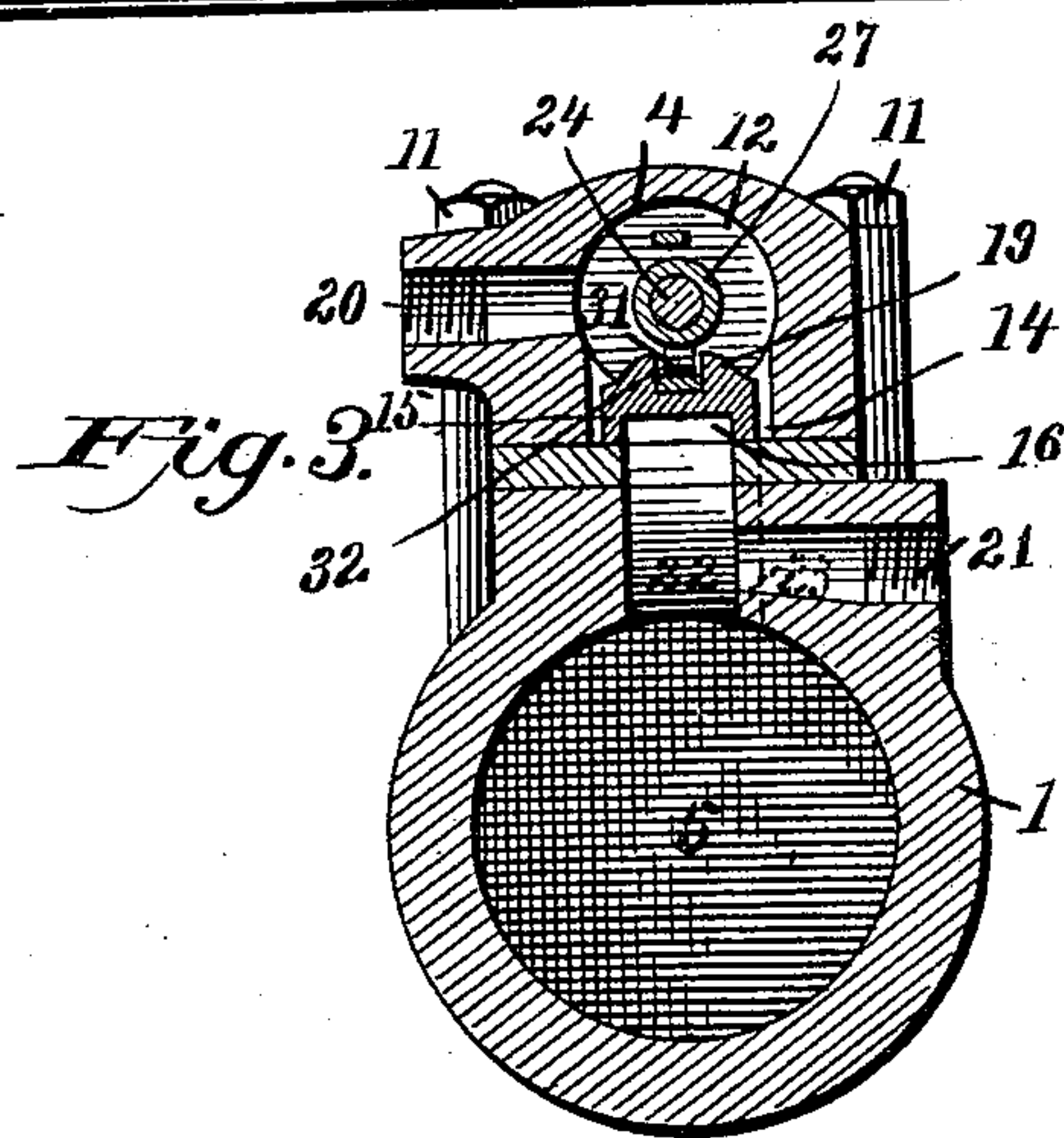
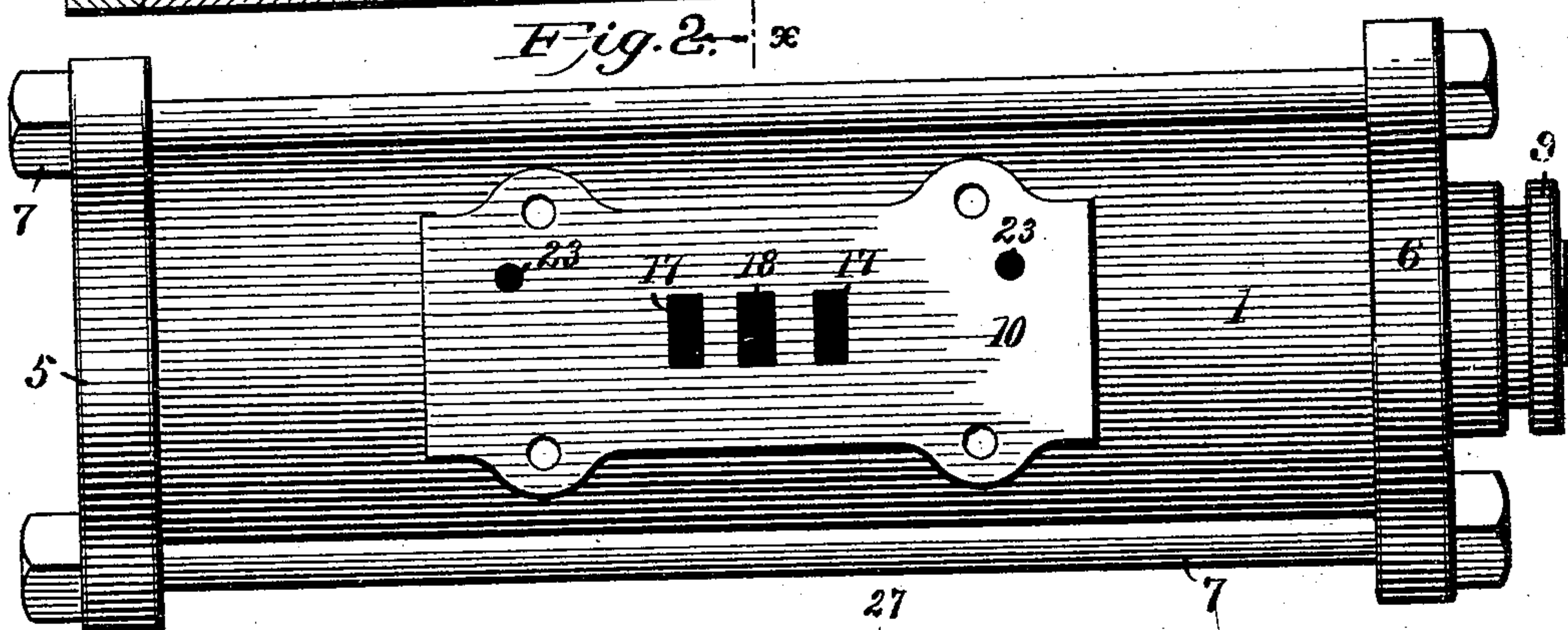
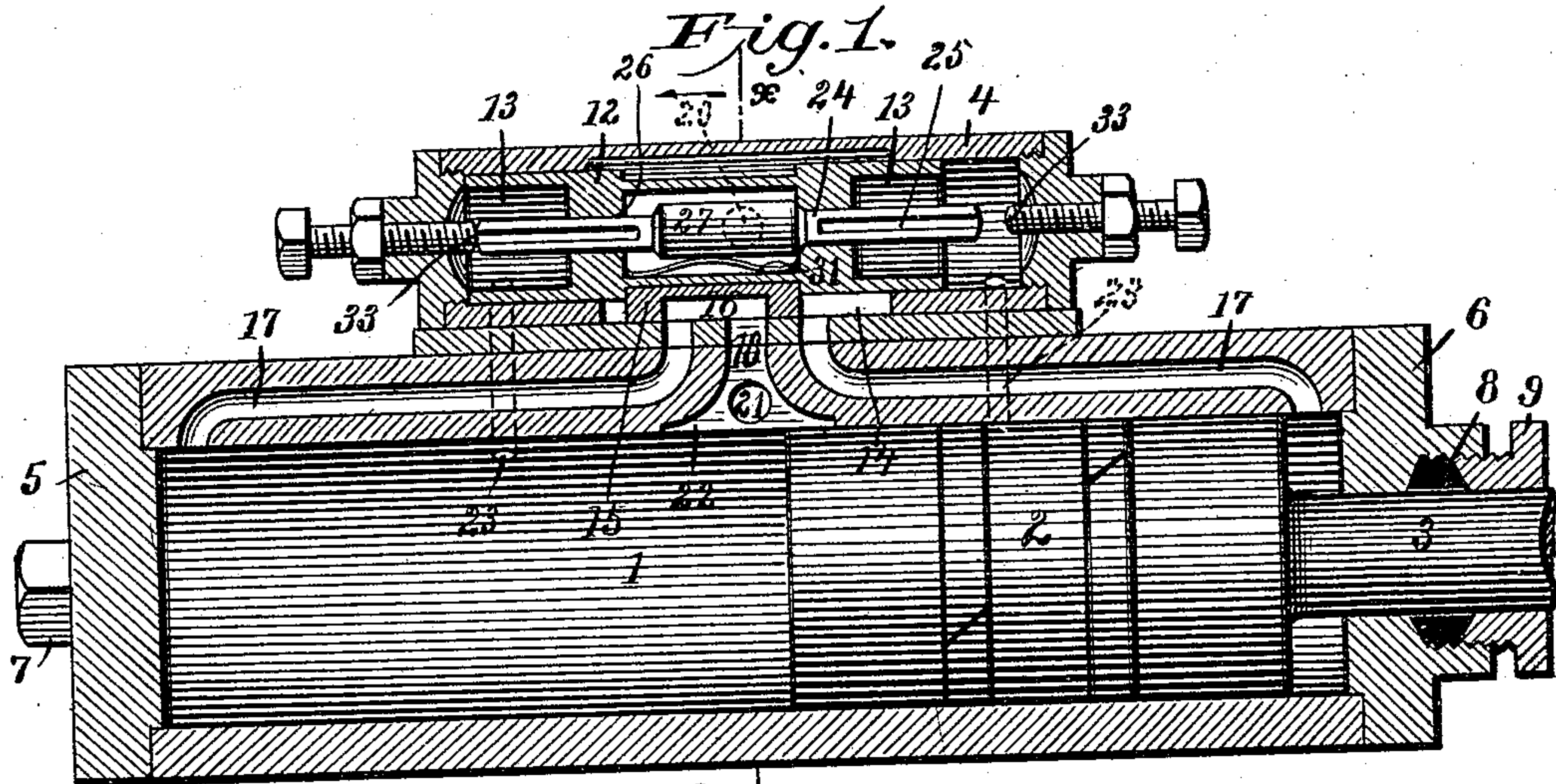
(No Model.)

2 Sheets—Sheet 1.

H. BALL.
VALVE MECHANISM FOR ROCK DRILLS.

No. 455,090.

Patented June 30, 1891.



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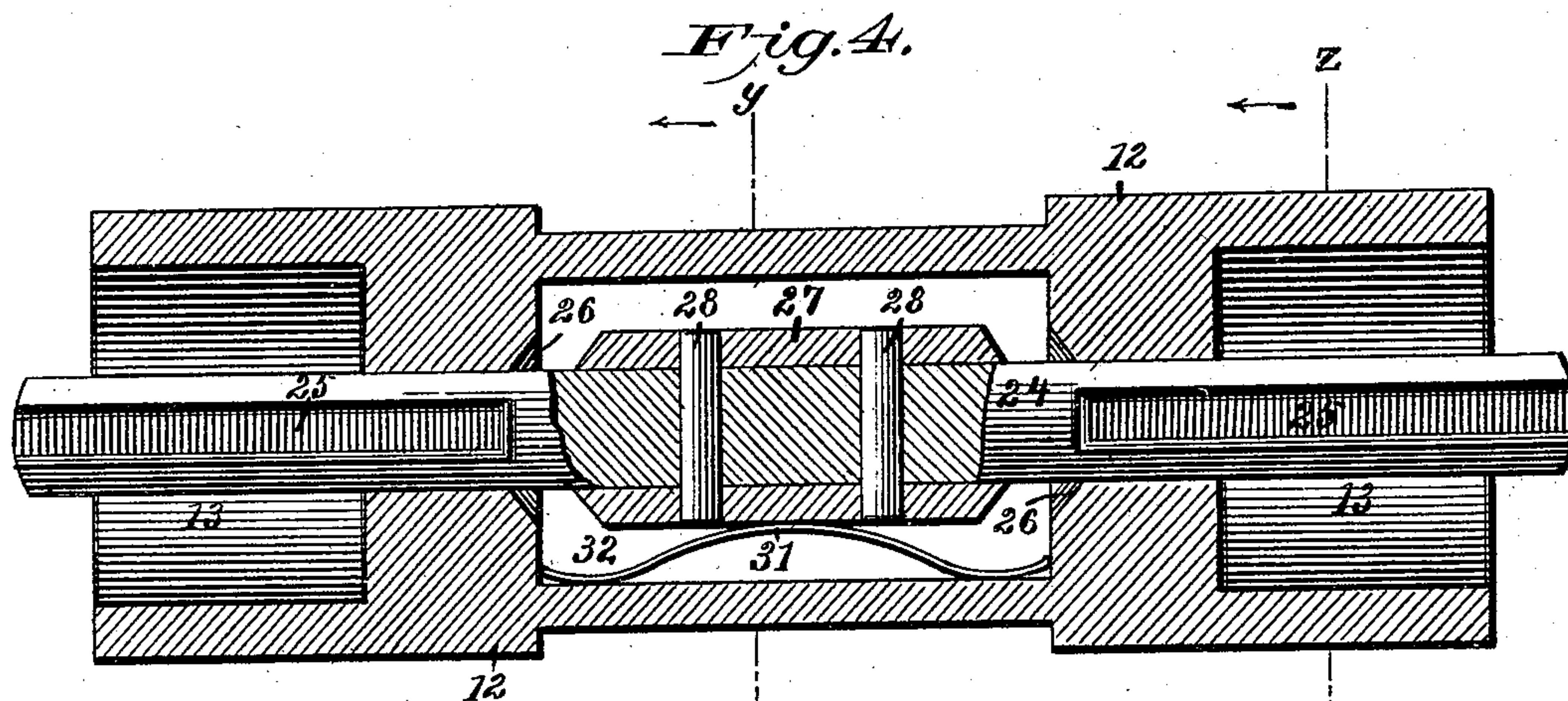


Fig. 5.

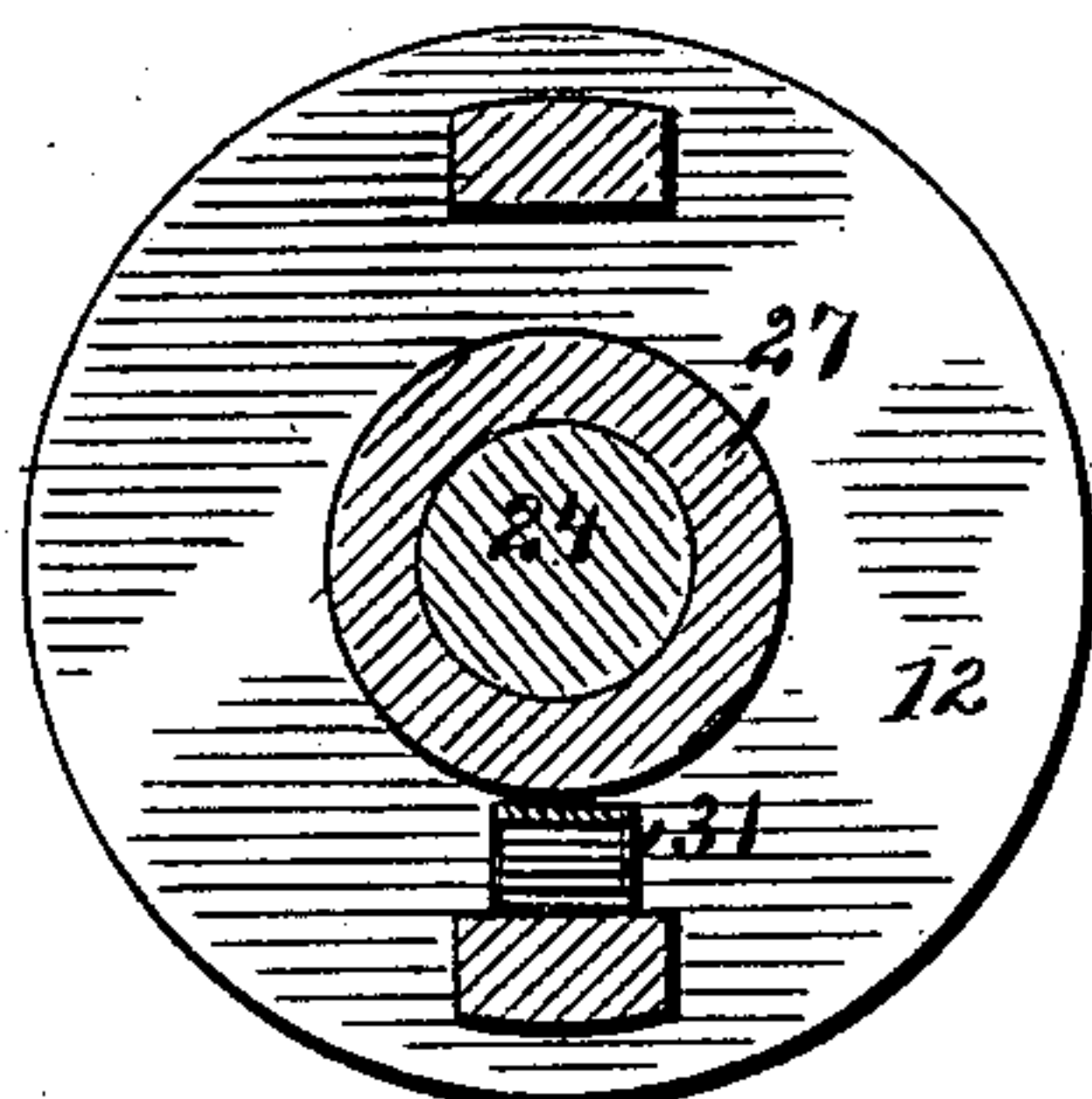


Fig. 6.

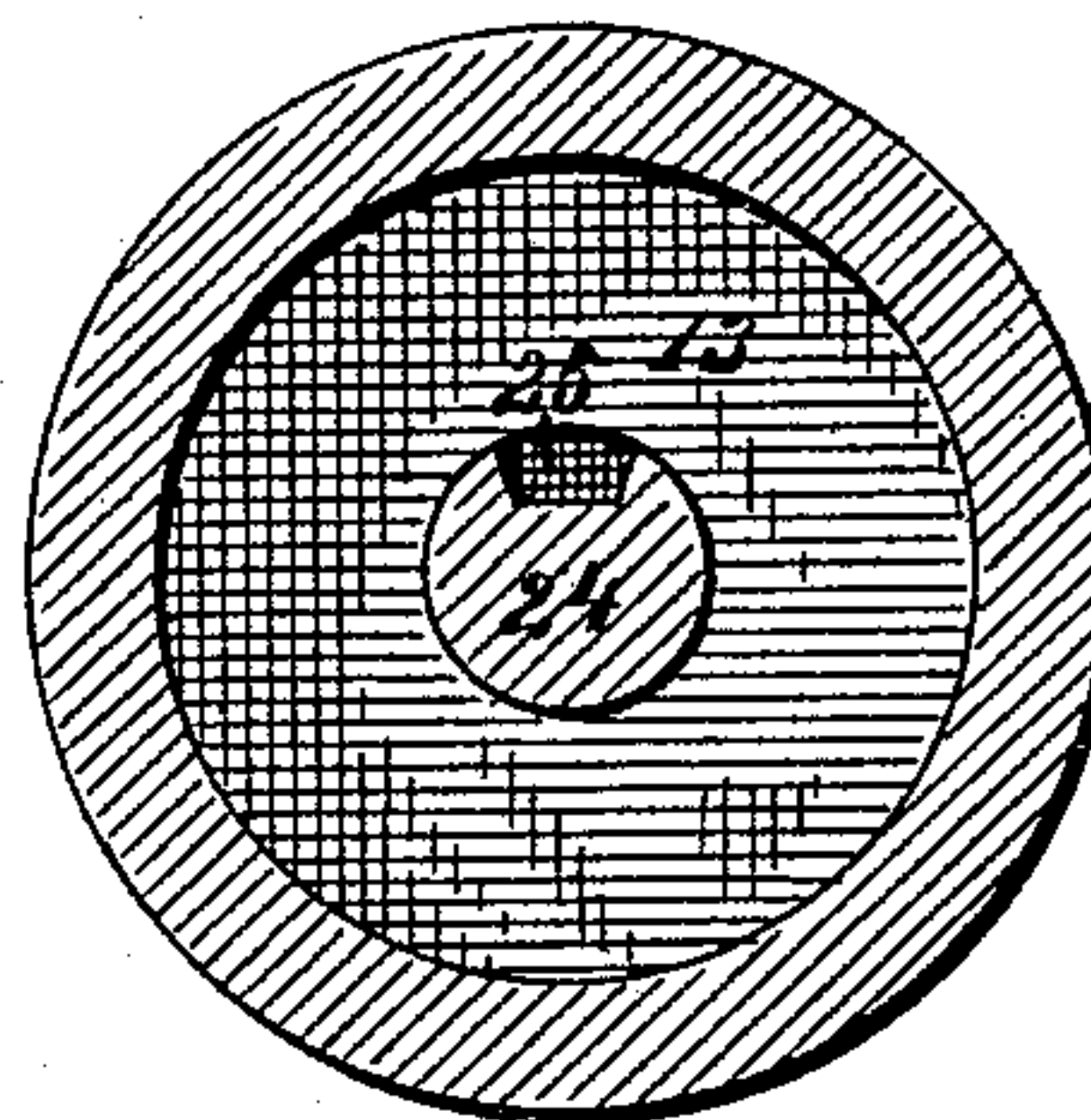
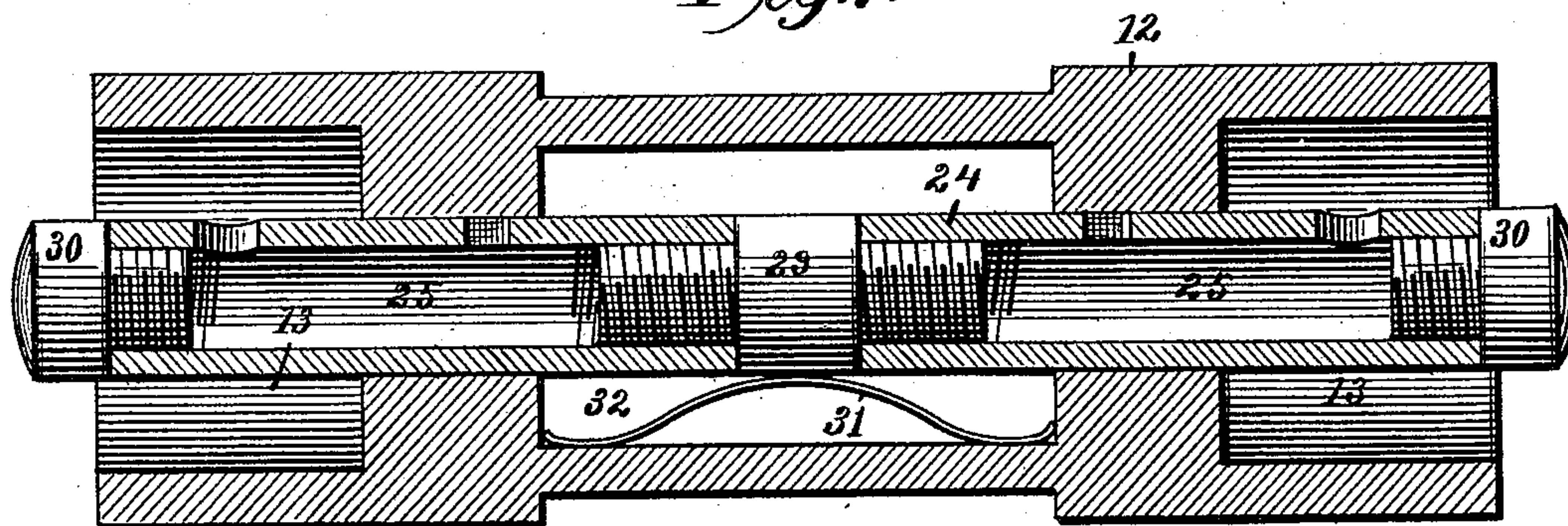


Fig. 7.



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VALVE MECHANISM FOR ROCK-DRILLS.

SPECIFICATION forming part of Letters Patent No. 455,090, dated June 30, 1891.

Application filed January 17, 1891. Serial No. 378,066. (No model.)

To all whom it may concern:

Be it known that I, HARRY BALL, a citizen of the United States, residing at Stamford, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Valve Mechanism for Rock-Drills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention is applicable to direct-acting engines generally, whether operated by steam or compressed air, and is especially applicable to the type of engines of which a rock-drill is a prominent example. I have therefore illustrated my invention as applied in connection with a steam-actuated rock-drill, the object being to secure rapidity and certainty of operation in all positions in which the drill can be placed, these points being secured in a simple and economical manner, all complicated details of construction being avoided.

With this end in view I have devised the simple and novel construction of which the following description, in connection with the accompanying drawings, is a specification, numerals being used to denote the several parts.

Figure 1 is a vertical longitudinal section of the cylinder and steam-chest, the piston being in elevation, the auxiliary piston in section, and the automatic slide-valve in elevation; Fig. 2, a plan view of the cylinder with the steam-chest removed; Fig. 3, a vertical transverse section of the cylinder and steam-chest on the line $x x$ in Fig. 1, looking toward the left; Fig. 4, an enlarged sectional view of the auxiliary piston and automatic slide-valve; Fig. 5, a section of the auxiliary piston and automatic slide-valve on the line $y y$ in Fig. 4; Fig. 6, a similar section on the line $z z$ in Fig. 4, looking toward the left; and Fig. 7 is a view corresponding with Fig. 4 and illustrating a modified form of automatic slide-valve.

1 denotes the cylinder; 2, the piston; 3, the piston-rod, and 4 the steam-chest. The special construction of these parts not being of

the essence of my invention, it is obvious that the details may be varied greatly in practice.

5 denotes the upper head of the cylinder, and 6 the lower head, said parts being ordinarily secured together by longitudinal bolts 7, the lower head being provided with the usual recess to receive a packing 8, held in position by a screw-plug 9, through which the piston-rod passes. Upon the top of the cylinder is a flat surface 10, over which the steam-chest is placed, and secured in place by bolts 11. Within the steam-chest is an auxiliary piston 12, said piston being preferably constructed substantially as shown in the drawings, the heads of said piston being provided with recesses 13 and the central portion being entirely open, it being simply necessary to provide sufficient metal between said heads to connect them together rigidly. In the under side of the steam-chest is an opening 14. Within this opening is a valve 15, having in its under side an opening 16. This valve is adapted to reciprocate in opening 14 and to cover steam-passages 17 and exhaust-passage 18. Upon the upper side of this valve are wings or projections 19, the purpose of which will presently be explained, the valve itself engaging between the heads of the auxiliary piston, as is clearly shown in Fig. 1, so that each movement of the auxiliary piston must carry the valve with it. Steam is taken at a port 20 and exhausted at a port 21, said exhaust-port connecting with passage 18 and with an elongated opening 22, leading into the cylinder. The object of elongating this opening 22 is to permit the steam to exhaust directly through port 21 during the last portion of the stroke of the piston in each direction, and also to prevent back-pressure on the piston at the instant the forward movement commences. It will be apparent from Fig. 1 that the elongation of this opening must relieve the pressure before the piston for an instant after the forward movement commences in either direction, as the steam is free to pass directly out at the exhaust-port. This construction enables me to greatly increase the power exerted by the piston with a given consumption of steam, and also to increase the speed.

23 denotes steam-passages leading from the opposite ends of the steam-chest into the cylinder-passages 17, leading from opening 14 in the under side of the steam-chest to the opposite ends of the cylinder, and passages 23 opening into the cylinder approximately midway between the exhaust-opening and the openings of passages 17 into the cylinder. Opening 16 in the under side of the valve is of sufficient length to permit perfect communication between one of the steam-passages 17 and the exhaust-passage 18 at all times.

24 denotes an automatic slide-valve, which extends longitudinally of the auxiliary piston, central openings therefor being made through the heads, as clearly shown in the drawings. This automatic slide-valve is provided with steam-passages 25, which admit steam from the center of the steam-chest to recesses 13 (see Fig. 1) to drive the auxiliary piston forward, and which also act to exhaust the steam therefrom into the center of the steam-chest when the auxiliary piston moves in the opposite direction. The precise construction of this automatic slide-valve is not of the essence of my invention. It may be made from a solid rod, with steam-passages grooved out therefrom, as in Figs. 1 and 4, or, if preferred, it may be made from tubes joined together by a central plug and plugged at the ends, as in Fig. 7. It will be noticed that the central portion of the steam-chest is cored out, but that both ends of the auxiliary piston fit the steam-chest closely.

In the form illustrated in Figs. 1 and 4 the heads of the auxiliary piston on their inner sides are provided with beveled recesses 26, which surround the automatic slide-valve. At the center of this valve and in the open central portion of the auxiliary piston is a sleeve 27, the ends of which are beveled to engage recesses 26. This sleeve is rigidly locked in position upon the automatic slide-valve by pins 28. The form of automatic slide-valve illustrated in Fig. 7 consists of tubes, the inner ends of which are screwed or riveted to a central plug 29 and the ends of which are closed by plugs 30. The steam-passages in this form consist of two openings into the tubular portion at each end of the valve.

31 denotes a friction-spring lying in a suitable recess 32 in the auxiliary piston, which bears against the automatic slide-valve with just sufficient friction to hold it in any position in which it may be placed by the action of the steam.

In Fig. 1 the auxiliary piston, valve, and automatic slide-valve are all shown at the extreme of their movement toward the left. In this position of the parts steam will pass from the steam-chest through the right passage 17 into the right end of the cylinder to drive the piston toward the left and steam will exhaust from the left end of the cylinder through the left passage 17 under the valve and into the exhaust through passage 18. At the opposite

extreme of the movement of the valve steam will pass through the left passage 17 into the left end of the cylinder and the exhaust will be from the right end of the cylinder through the right passage 17.

The operation of the valve mechanism is as follows: The steam in the steam-chest in the position shown is free to pass through the left steam-passage 25 in the automatic slide-valve into the recess 13 in the left head of the auxiliary piston, its action being to drive the auxiliary piston toward the right, carrying valve 15 with it, but not changing the position of the automatic slide-valve, owing to the fact that the steam-pressure upon this valve is perfectly balanced, and, furthermore, that it is retained in position by the spring. As the movement of the auxiliary piston toward the right continues, however, the left head of the auxiliary piston will come in contact with the left end of sleeve 27 and will force the automatic slide-valve toward the right also, the movement of the automatic slide-valve in each direction being checked by suitable stops 33 at each end of the steam-chest. The movement of the auxiliary piston continues after the movement of the automatic slide-valve has been checked by the stop, as is shown at the left in Fig. 1. As the auxiliary piston moves in either direction, the steam at the end of the steam-chest toward which it is moving exhausts through the passage 23 into the cylinder until the exhaust is cut off by the auxiliary piston itself, after which the steam at that end of the steam-chest acts as a cushion and prevents the auxiliary piston from coming forcibly in contact with the end of the steam-chest. The effect of the continued movement of the auxiliary piston after the movement of the automatic slide-valve has been checked is to uncover steam-passage 25 again, so that steam from the center of the steam-chest can pass through said passage to the recess 13 in the head of the auxiliary piston to drive it in the opposite direction, these movements being continually repeated in use.

It will of course be understood that the beveled recesses 26 in the heads of the auxiliary piston and the corresponding bevels upon sleeve 27 are not essential features of construction.

I preferably, however, form recesses 26 and bevel the ends of the sleeve, as the valve-like action of these parts assists in preventing the escape of steam in either direction through the openings in the heads in which the auxiliary piston slides. When the valve is constructed as in Fig. 7, the result in use is precisely the same. In this form, supposing the automatic slide-valve to have reached the extreme of its movement toward the left and the movement of the auxiliary piston to be toward the left, an instant later the auxiliary piston will have moved far enough, so that the right opening at the left end of the automatic slide-valve will be uncovered, which will per-

mit the steam to pass through the opening 25 into the recess 13 at the head of the auxiliary piston to drive it in the opposite direction again.

5 Having thus described my invention, I claim—

1. The combination, with a steam-chest, an auxiliary piston, and a valve carried thereby, of an automatic slide-valve lying longitudi-
10 nally of the auxiliary piston and provided with steam-passages, whereby steam is admitted from the center of the steam-chest to the ends thereof to drive the auxiliary piston and the valve.

15 2. The combination, with a steam-chest having adjustable stops 33 at its ends and an auxiliary piston moving therein, said auxiliary piston having recesses 13 in its heads, of an automatic slide-valve lying longitudinally of
20 the auxiliary piston and provided with steam-passages, whereby when said automatic slide-valve engages either of the stops the continued movement of the auxiliary piston will uncover the steam-passages and admit steam to
25 the recesses 13 to drive the auxiliary piston in the opposite direction.

3. In a mechanism of the class described, the auxiliary piston having heads 12, provided with recesses 13 in their outer ends and
30 beveled recesses 26 in their inner ends, in combination with an auxiliary piston socketed

in the heads and provided with steam-passages through which steam passes to said recesses, and a central sleeve 27, beveled to engage recesses 26, substantially as described. 35

4. In a mechanism of the class described, the auxiliary piston having heads 12, provided with recesses 13, in combination with an auxiliary piston socketed in the heads and provided with steam-passages through which
40 steam passes to said recesses, and a friction-spring 31, engaging said automatic slide-valve, whereby it is retained in any position in which it is placed.

5. The combination, with the steam-chest, 45 auxiliary piston, and valve 15, of the cylinder having steam-passages 17 and an exhaust-passage 18 and the piston, said exhaust-passage having an elongated opening 22, leading into the cylinder, so that steam is permitted to ex-
50 haust directly from the cylinder during the last portion of the stroke in either direction, and back-pressure upon the piston is prevented at the instant the forward movement commences. 55

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

HARRY BALL.

Witnesses:

E. M. BELL,
E. VANDERWERKEN.