No. 631,265. Patented Aug. 15, 1899.

J. F. MOWATT.

VALVE MECHANISM FOR ENGINES.

(Application filed Feb. 14, 1899.)

(No Model.) 2 Sheets—Sheet 1.

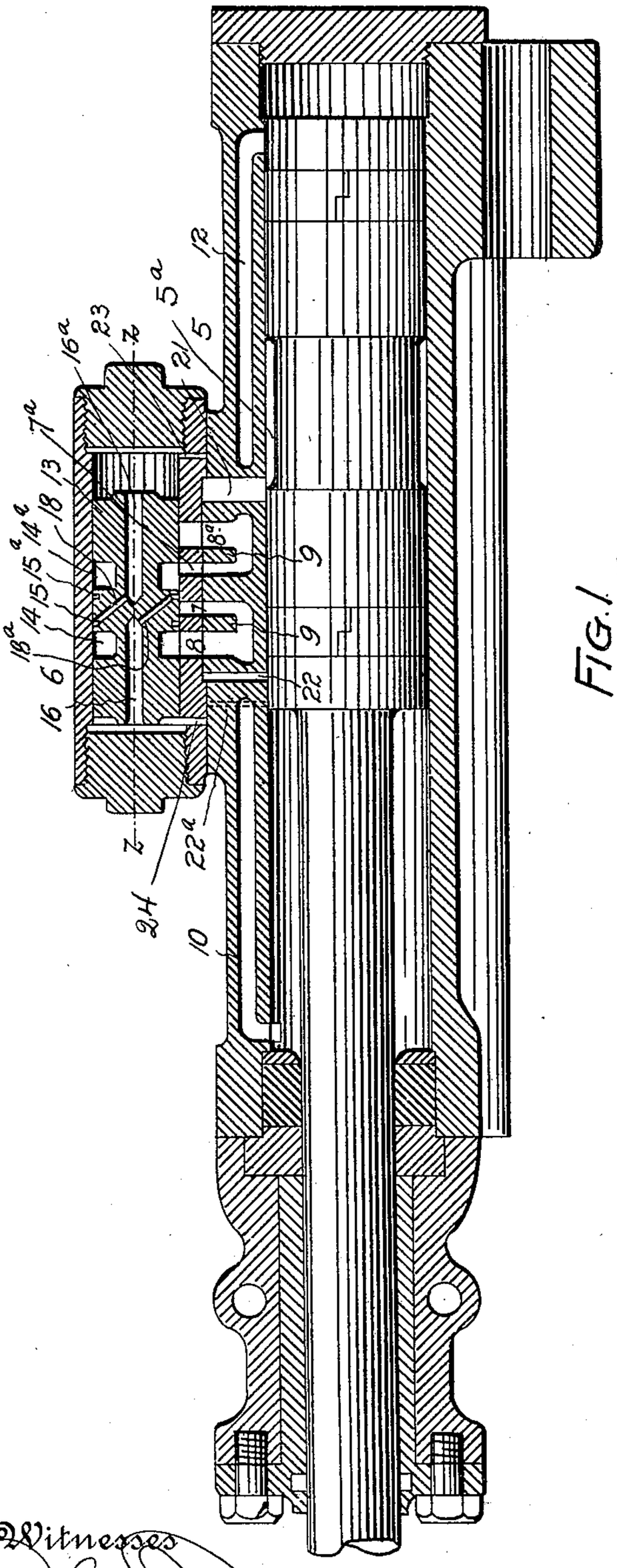

FIG. 1.

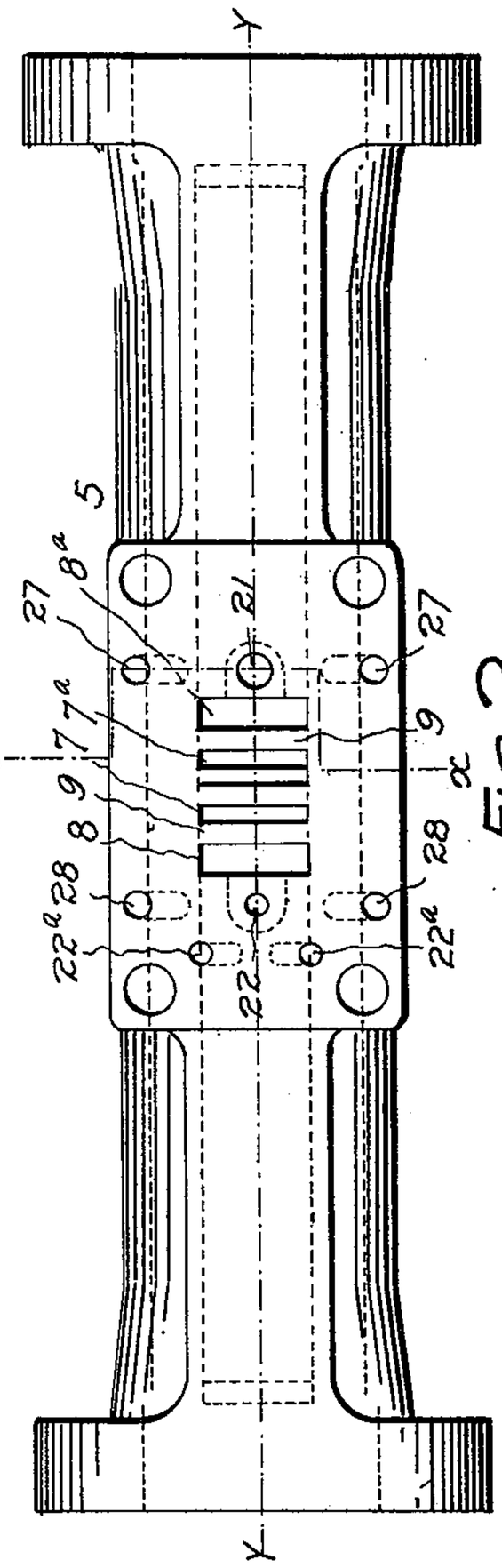

FIG. 2.

Witnesses
P. J. Coleman
Nellie G. Daniels

Inventor
J. F. Mowatt.
By his Attorney
Baldwin & Baldwin

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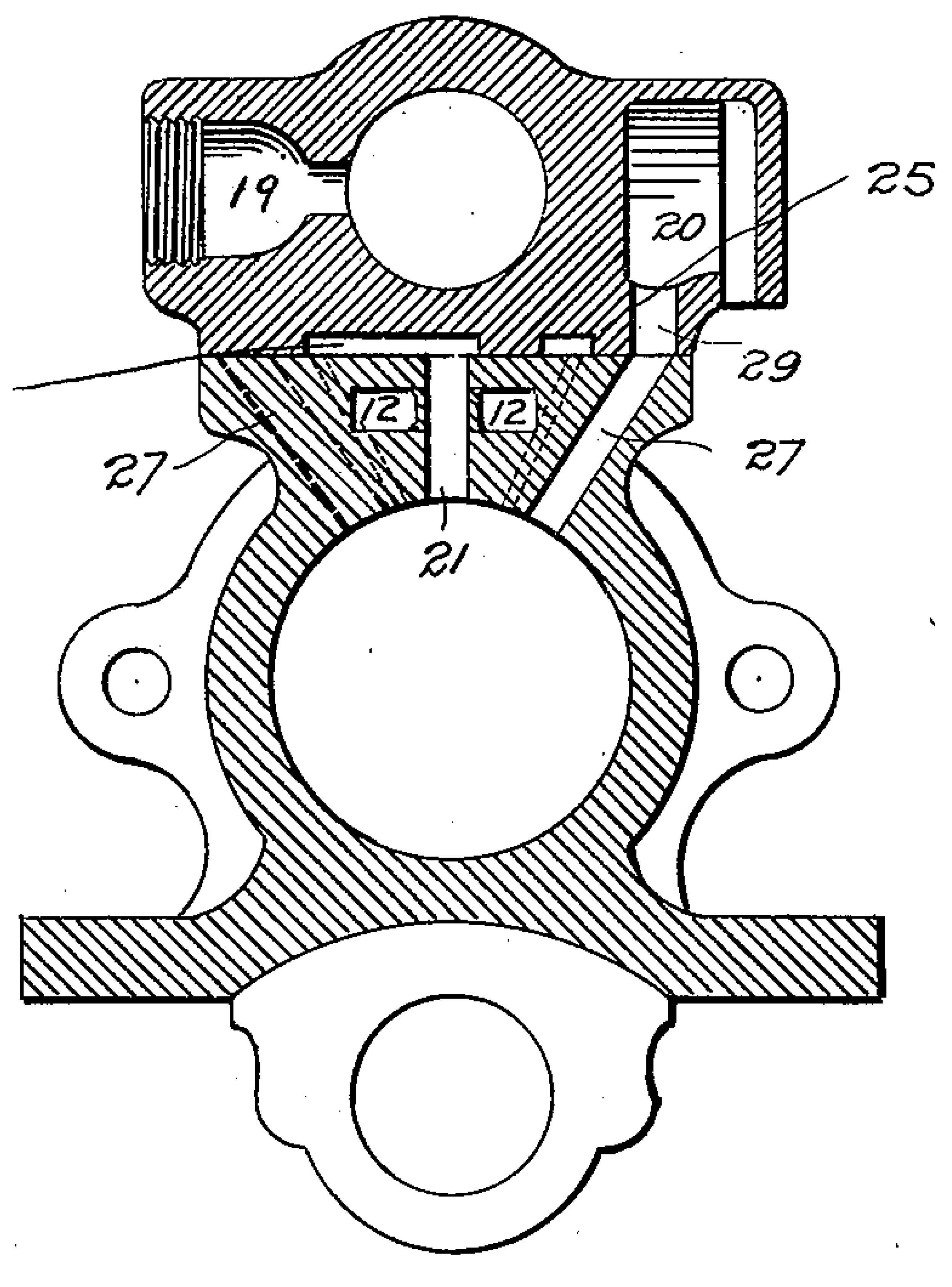


FIG. 3

FIG. 4

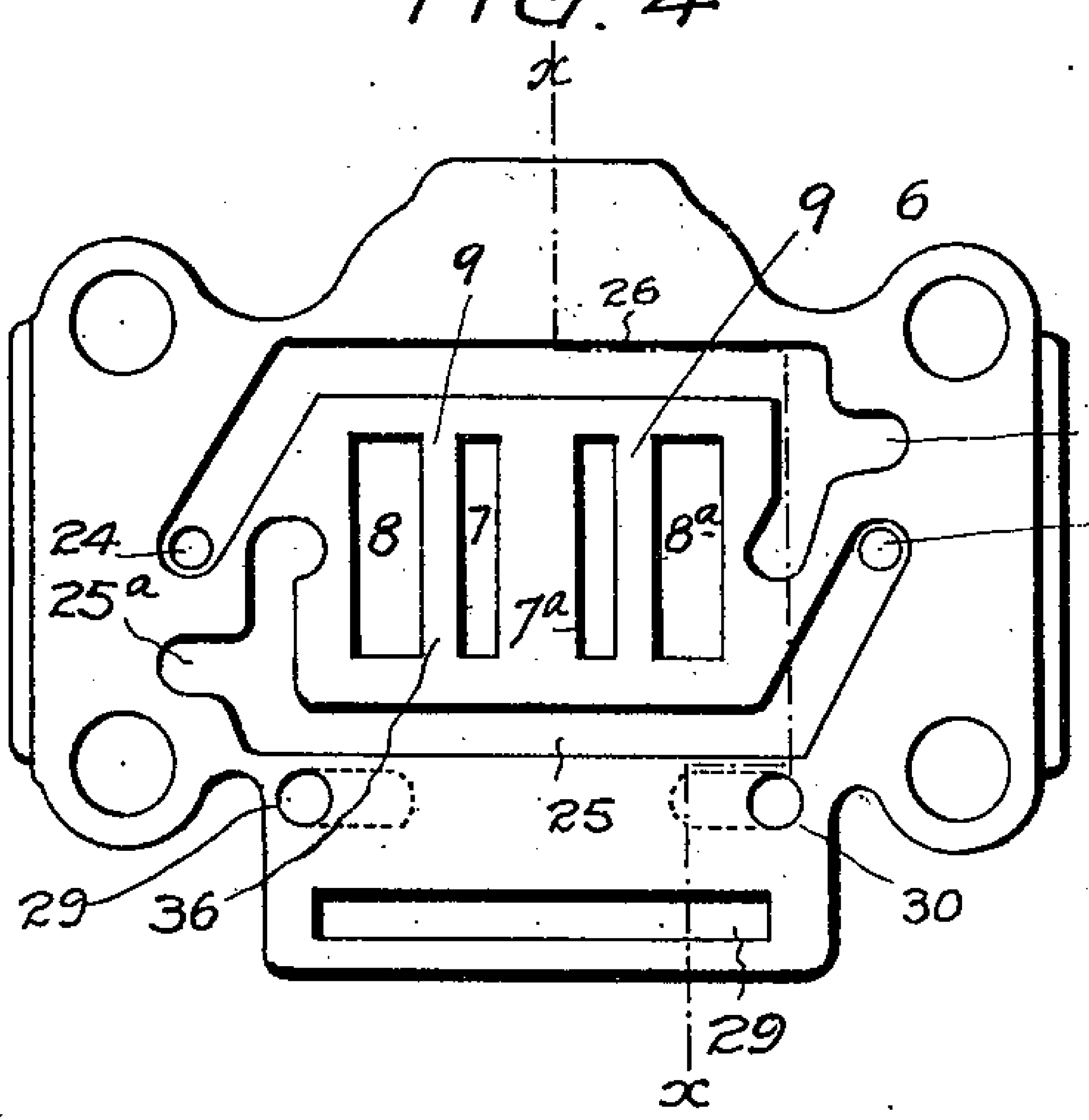
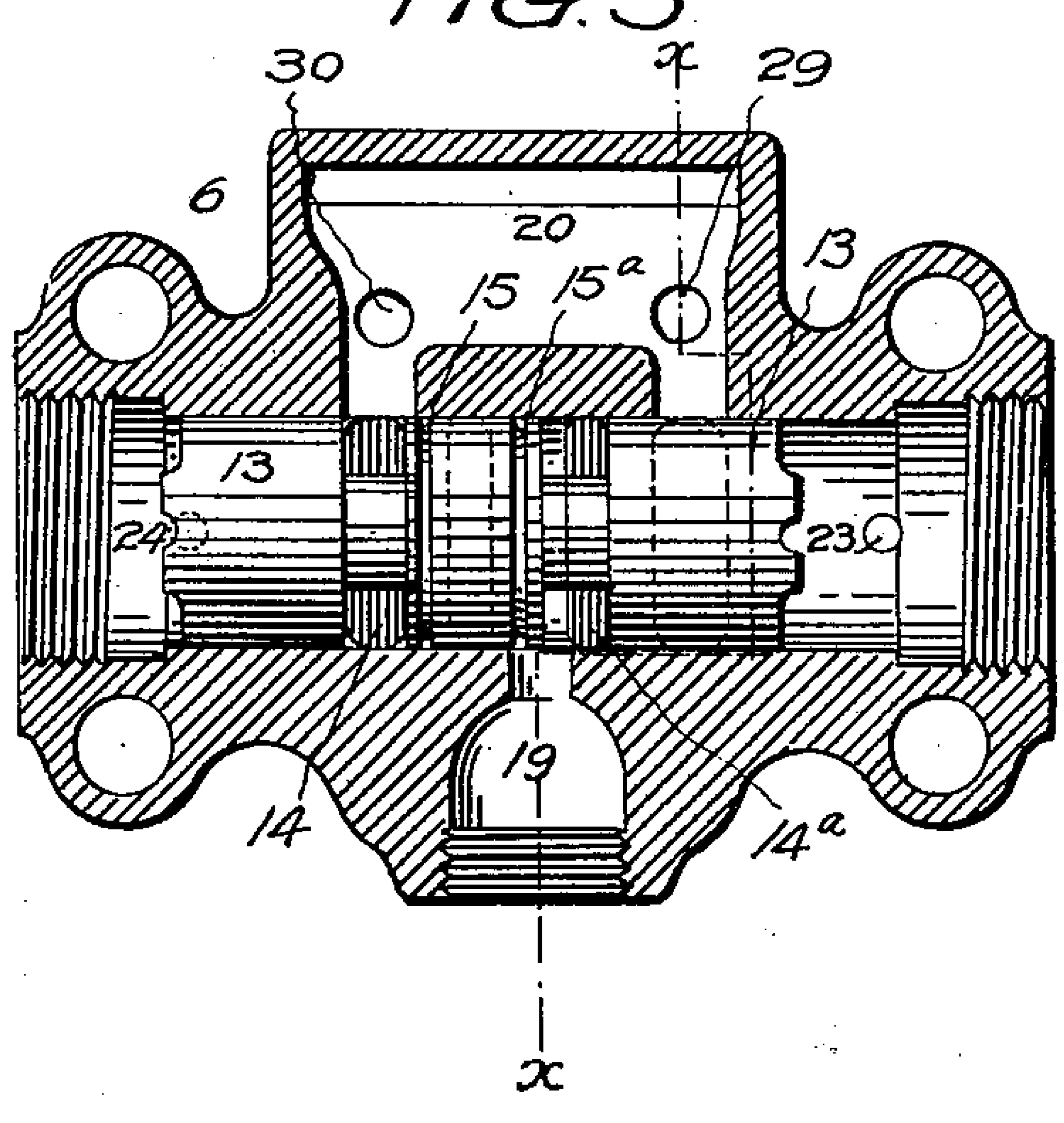


FIG. 5



Witnesses
P. J. Ollandet
Nellie G. Daniels

By his Attorney

Inventor
J. F. Mowatt.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN FRANKLIN MOWATT, OF DENVER, COLORADO, ASSIGNOR OF ONE-HALF TO DAVID P. McNEIL, OF SAME PLACE.

VALVE MECHANISM FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 631,265, dated August 15, 1899.

Application filed February 14, 1899. Serial No. 705,514. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRANKLIN MOWATT, a citizen of the United States of America, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Valve Mechanism for Direct-Acting Engines; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in valve mechanism for direct-acting engines, and will be considered in this application more especially with reference to its use for rock-drilling purposes, though it is evident that its utility is not limited thereto and that it may be employed to equal advantage in many other relations.

My object is to provide an apparatus of this class which shall be simple in construction, economical in cost, reliable, durable, and efficient in use; and to these ends the invention consists of the features, arrangements, and combinations hereinafter described and claimed, all of which will be fully understood by reference to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a vertical longitudinal section taken through my improved valve mechanism and the cylinder upon which it is mounted. This section is taken on the line Y Y, Fig. 2. Fig. 2 is a top view of the cylinder, shown in detail, the valve casing or chest being removed. Fig. 3 is a vertical cross-section taken on the line X X, Figs. 2, 4, and 5. Fig. 4 is an underneath view of the valve chest or chamber. Fig. 5 is a horizontal section taken through the valve-chest on the line Z Z, Fig. 1.

Similar reference characters indicating corresponding parts in the views, let the numeral 5 designate the cylinder, provided on top with a flat smooth face or table forming a seat for the bottom of the valve-chest 6. The top of the cylinder and the bottom of the valve-chest are provided with induction or supply ports 7 and 7^a and eduction or exhaust ports 8 and 8^a. The expansive fluid, as air or steam, enters the cylinder by way of the ports 7 and 7^a alternately and escapes or exhausts therefrom alternately through the ports 8 and 8^a. The adjacent ports 7 and 8, as well as the ports 7^a and 8^a, are united underneath separating-partitions 9 and at these points communicate with the long channels or passages 10 and 12, respectively, whose opposite extremities communicate with the extremities of the cylinder-chamber. The air or other expansive fluid enters the cylinder and exhausts therefrom through these passages.

The valve 13, located within the casing or chest 6, is provided with two large circumferential grooves 14 and 14^a, one being located on each side of its center. Adjacent the grooves 14 and 14^a are two shallow grooves 15 and 15^a, located between the grooves 14 and 14^a. The grooves 15 and 15^a also extend entirely around the valve. The valve is further provided with two central longitudinal passages 16 and 16^a, each leading from a point near the center of the valve to its extremity, where the passage is open. Each extremity of the valve is cut away around its central portion, which is grooved to allow the air or steam to escape when the valve is at the extremity of the chamber. From the grooves 15 and 15^a lead ducts 18 and 18^a, respectively, to the inner extremities of the passages 16^a and 16. The valve chest or casing is provided with a central inlet-opening 19 on one side and an exhaust-opening 20 on the opposite side. The top of the cylinder is provided with two ports 21 and 22, centrally located at opposite ends of the space occupied by the inlet and exhaust ports. The port 21 is the larger and located in the rear of the port 22 or farther toward the right, referring to Figs. 1 and 2. The extremities of the valve-chest are respectively provided with two ports 23 and 24. The port 23 leads downward to a passage 25, formed in the bottom of the valve-chest and extending forward around the inlet and exhaust ports to the port 22, leading to the cylinder-chamber. The port 24 leads downward to a passage 26, formed in the bottom of the valve-chest and

extending rearward on the opposite side of the inlet and exhaust ports to the port 21, leading to the cylinder-chamber. The channel or passage 25 is also arranged to communicate with a small port 22^a, located forward of the port 22. When one port 22 or 22^a is used, the other must be plugged or stopped. The cylinder is provided with ports 27 and 28, through which the exhaust passes from the extremities of the valve-chamber. These ports register with ports 29 and 30, formed in the valve-chest.

In the use of my improved engine the air enters the valve chest or chamber by way of an opening 19. Assuming that the valve is in the position shown in Figs. 1 and 5 and that the piston is in the position shown in Fig. 1, the air as it enters the opening 19 (see Fig. 5) will pass to the grooves 14^a and 15^a. From the groove 15^a it passes by way of the duct 18^a (see Fig. 1) to the central passage 16, thence to the end of the valve-chest, thence through the port 24, thence through the passage 26 of the valve-chest to the port 21 of the cylinder, thence around the reduced portion 5^a of the piston to the port 27 of the cylinder, and thence through the port 29 of the valve-chest and out to the atmosphere by way of the exhaust-opening 20. By reason of this exhaust from or reduction of pressure in the forward extremity of the valve-chest the valve will remain in its present position until the conditions are changed. At the same time air or steam enters the groove 14^a of the valve, passes through the registering ports 7^a in the bottom of the valve-chest and the top of the cylinder into the passage 12 of the cylinder, and thence into the rear extremity of the cylinder behind the piston, driving the latter forward. During the forward movement of the piston the latter closes the port 21 and opens the port 22, cutting off the exhaust from the forward extremity of the valve-chest and opening an exhaust-passage from the rear extremity of the valve-chest by way of the port 23 of the valve-chest and the passage 25, the port 22 of the cylinder, the space around the reduced portion 5^a of the piston, the port 28 of the cylinder, the port 30 of the valve-chest, and the outlet-opening 20. Hence the valve will immediately move to the rear extremity of the valve-chest, bringing the grooves 14 and 15 into communication with and cutting off grooves 14^a and 15^a from the air or steam entering at the opening 19. Thus the rear extremity of the cylinder is cut off from air or steam, while the forward extremity of the cylinder is brought into communication with such air or steam by way of the ports in the valve-chest and cylinder and the passage 10 of the cylinder. At the same time the rear extremity of the cylinder is brought into communication with the atmosphere for exhaust purposes by way of the passage 12, the ports 8^a, the groove 14^a, and the exhaust-passage 20, the exhaust being simultaneously cut off from the front end of the cylinder. The piston is now driven again to its rearward limit of movement, closing the port 22 and opening the port 21, thus cutting off the exhaust from the rear extremity of the valve-chest and opening the exhaust-passage leading from the forward extremity of the chest. The valve will now return to the forward extremity of the chamber, permitting the air or steam to enter the rear extremity of the cylinder and opening an exhaust-passage from the forward extremity of the cylinder by way of the passage 10, the ports 8 in the cylinder and valve-chest, the groove 14, and the exhaust-opening 20 in the valve-chest.

It will be observed that the apparatus is so arranged that the position of the valve-chest may be reversed without interfering with the working of the mechanism. Hence the cylinder is provided with a port 27 and a port 28 on each side. (See Fig. 2.) Only one port 27 and one port 28 are in use at any time. The two sets of ports 27 and 28 are so arranged that one set will always register with the ports 29 and 30, respectively. The channels or passages 25 and 26, as well as the ports 7 7^a and 8 8^a, are also correspondingly constructed and arranged, whereby whether the valve-chest is turned side for side or end for end there will be no difference in the working of the mechanism.

The grooves 14 and 14^a, as well as the grooves 15 and 15^a, of the valve 13 are equidistant from its extremities. The passages 16 and 16^a are exactly alike, as well as the ducts 18 and 18^a, while the extremities of the valve are of the same pattern. Hence the valve may be reversed in the valve-chest without interfering in any way with the working of the parts.

In order to get the best results or the most powerful blow from a machine of this class, it is necessary that the ports shall be so arranged that the air or steam is only admitted to the front of the cylinder just before the piston has reached its forward limit of movement. When drilling soft rock and the most powerful blow is not required, the port 22 is used and the port 22^a, located in front of it, is closed, because the reduced portion 5^a of the piston will reach the port 22 first and open the exhaust-passage communicating with the rear extremity of the valve, resulting in the shifting of the valve and the admission of air or steam to the cylinder in front of the piston. Of course the earlier this occurs the more the forward movement of the piston is retarded and the less forceful the blow delivered. Hence if the rock is very hard the port 22 is plugged or stopped and one of the ports 22^a employed, which admits the air or steam to the front of the piston an instant later than the port 22 and to the extent of this delay diminishes the retarding action of the air, steam, or other expansive fluid and allows the machine to strike the most powerful blow possible. There are two ports 22^a, one on each side of the cylinder, one of which will always register with the extremity 25^a of

the passage 25 or the extremity 26ª of the passage 26, according to the position of the valve-chest.

During the interval between the closing of the port 21 and the opening of the port 22 or 22ª, as the case may be, the valve remains inactive and perfectly balanced, since there is no exhaust from either extremity of the valve-chamber, and the pressure of the expansive vapor is equal in both directions.

Having thus described my invention, what I claim is—

1. In a direct-acting engine the combination of the valve-chest, the valve located therein, the cylinder, and the piston located therein, the valve-chest being provided with inlet and exhaust ports, a passage being formed from the inlet of the valve-chest through the valve, the bottom of the valve-chest into the cylinder, through the cylinder-chamber, and through the cylinder and valve-chest to the exhaust-port of the latter, another passage being formed from the inlet of the valve-chest, through the valve, the bottom of the valve-chest, through the cylinder to one end of the cylinder-chamber, the parts being so arranged and connected that, through the instrumentality of these passages, there is an exhaust from either extremity of the valve-chest simultaneously with the initial admission of the air or steam to the opposite extremity of the cylinder.

2. In a direct-acting engine, the combination of the valve-chest, the valve located therein, the cylinder, and the piston located therein, the valve-chest being provided with inlet and exhaust ports, a passage being formed from the inlet of the valve-chest through the valve to each extremity of the valve-chamber, thence through the valve-chest and through the cylinder into the cylinder-chamber, thence through the cylinder and valve-chest to the exhaust-port of the latter, another passage being formed from the inlet of the valve-chest through the valve to each extremity of the valve-chamber, thence through the valve-chest and through the cylinder to each extremity of the cylinder-chamber, the parts being so arranged and connected that, through the instrumentality of these passages there is an exhaust from each extremity of the valve-chest simultaneously with the initial admission of the air or steam to the opposite extremity of the cylinder.

3. The combination with the valve-chest, the cylinder and the piston, of a valve having two large and two small circumferential grooves, two longitudinal passages and two ducts leading in opposite directions from the small grooves to the longitudinal passages respectively, a port being formed in each extremity of the valve-chest leading downwardly, the bottom of the valve-chest having a passage leading from the rear port forward and another passage leading from the forward port rearward, the cylinder having ports communicating with the respective extremities of the said passages, the cylinder being constructed to open and close the said ports to permit an exhaust therethrough alternately from the opposite extremities of the valve-chest, and suitable means for alternately delivering air or steam to, and exhausting it from, the opposite ends of the cylinders by way of the large grooves of the valve.

4. The combination with the valve-chest, the cylinder and the piston, of a valve having two small circumferential grooves, two longitudinal passages and two ducts leading in opposite directions from the small grooves to the longitudinal passages respectively, a port being formed in each extremity of the valve-chest leading downwardly, the bottom of the valve-chest having a passage leading from the rear port forward and another passage leading from the forward port rearward, the cylinder having ports communicating with the respective extremities of the said passages, the cylinder being constructed to open and close said ports to permit an exhaust therethrough alternately from the opposite extremities of the valve-chest.

5. The combination, with the valve-chest and cylinder provided with double induction and eduction ports arranged in pairs, an induction-port and an eduction-port of each pair having their upper extremities separated and their lower extremities united and communicating with a passage leading to one extremity of the cylinder, and a valve provided with circumferential grooves arranged to cooperate with the induction and eduction ports of the valve-chest and cylinder.

6. The combination with the valve-chest, a cylinder provided with suitable induction and eduction ports, a valve provided with circumferential grooves coöperating with these ports, passages leading from these ports to the opposite extremities of the cylinder, provision being made for an exhaust through the cylinder from each extremity of the valve-chest simultaneously with the admission of air or steam to the opposite extremity of the cylinder.

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

JOHN FRANKLIN MOWATT.

Witnesses:

J. H. BOCKENFELD,

NELLIE G. DANIELS.