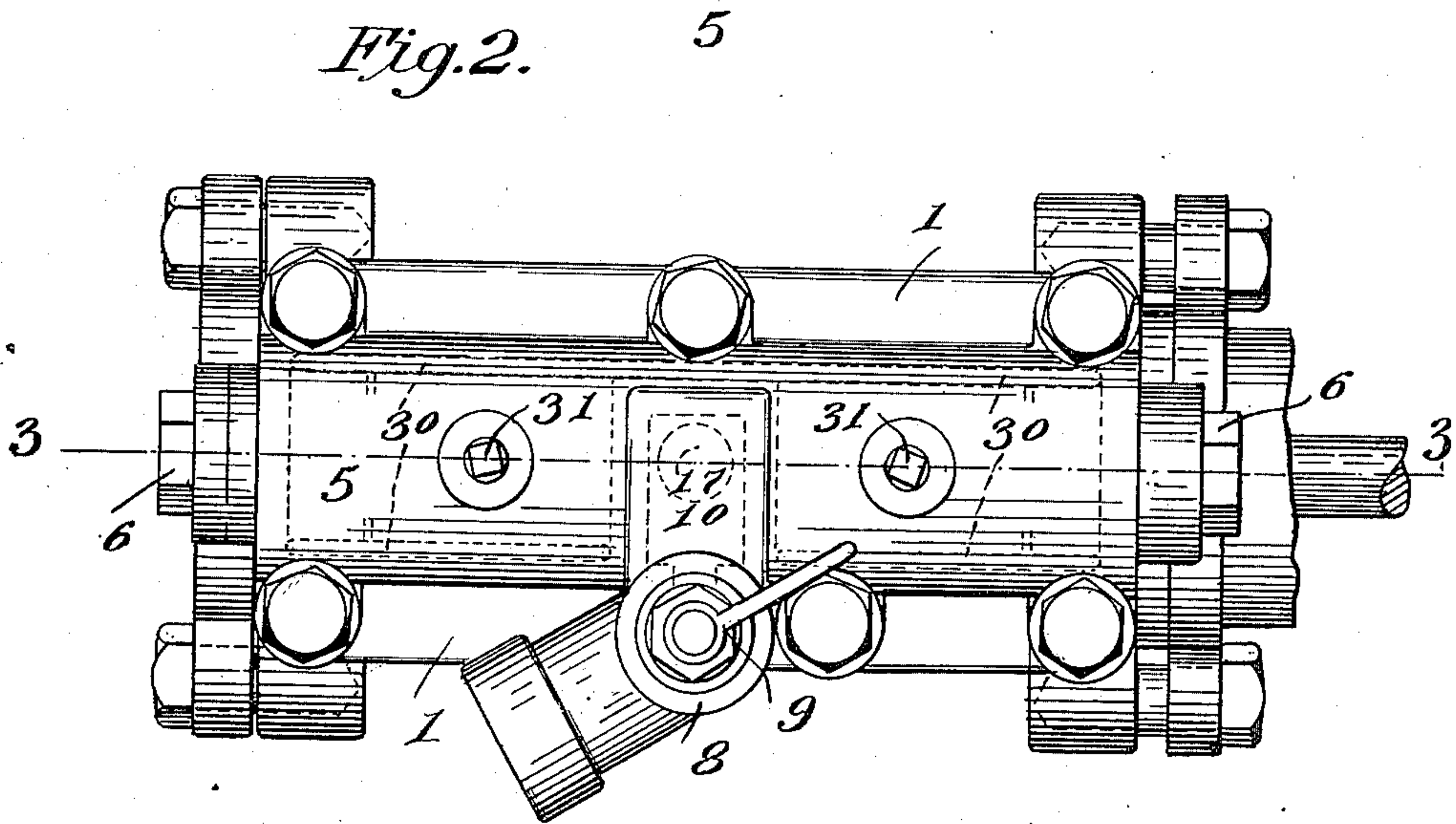
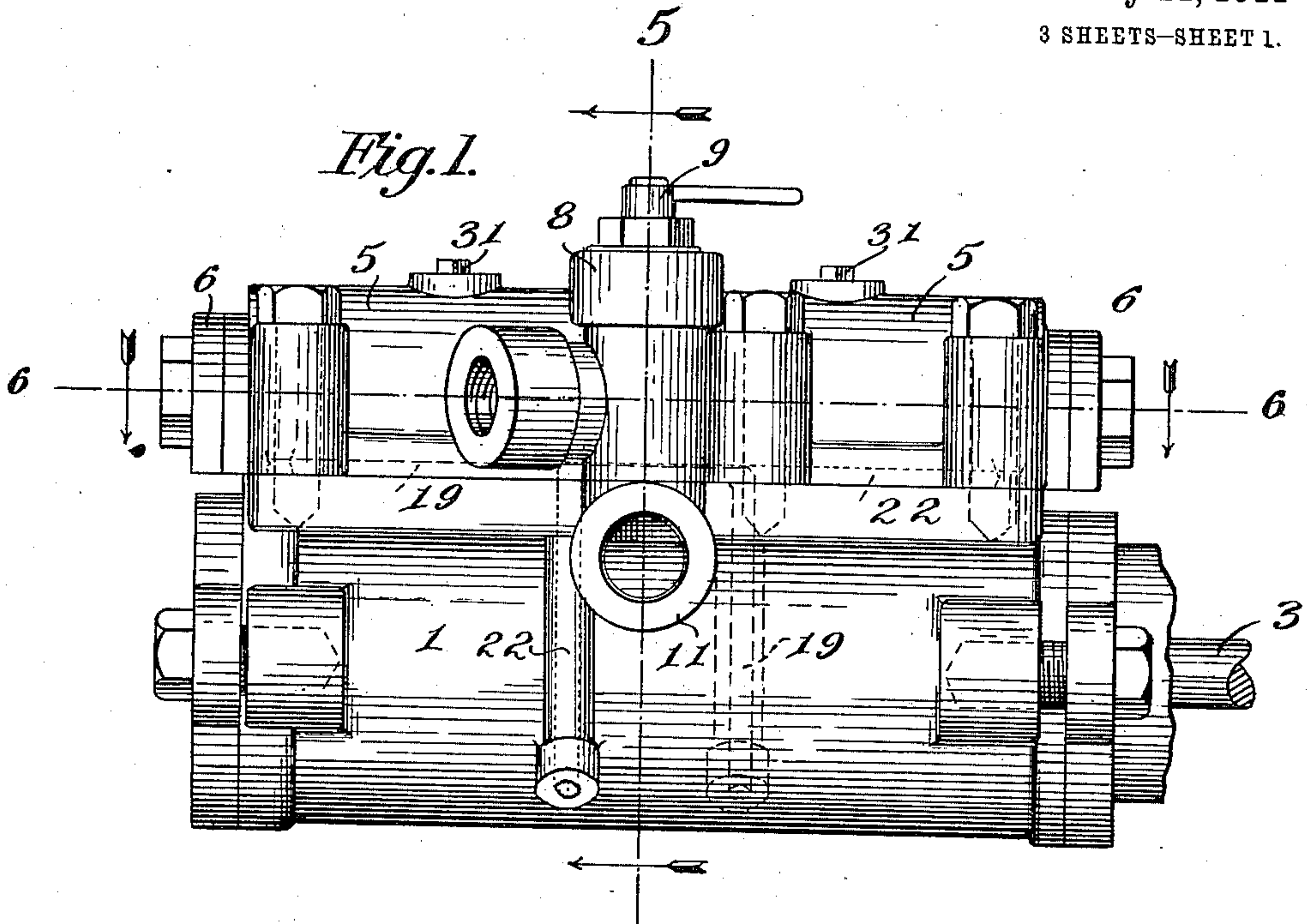


E. PENBERTHY.
MINING MACHINE.
APPLICATION FILED DEC. 15, 1909.

997,698.

Patented July 11, 1911

3 SHEETS—SHEET 1.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

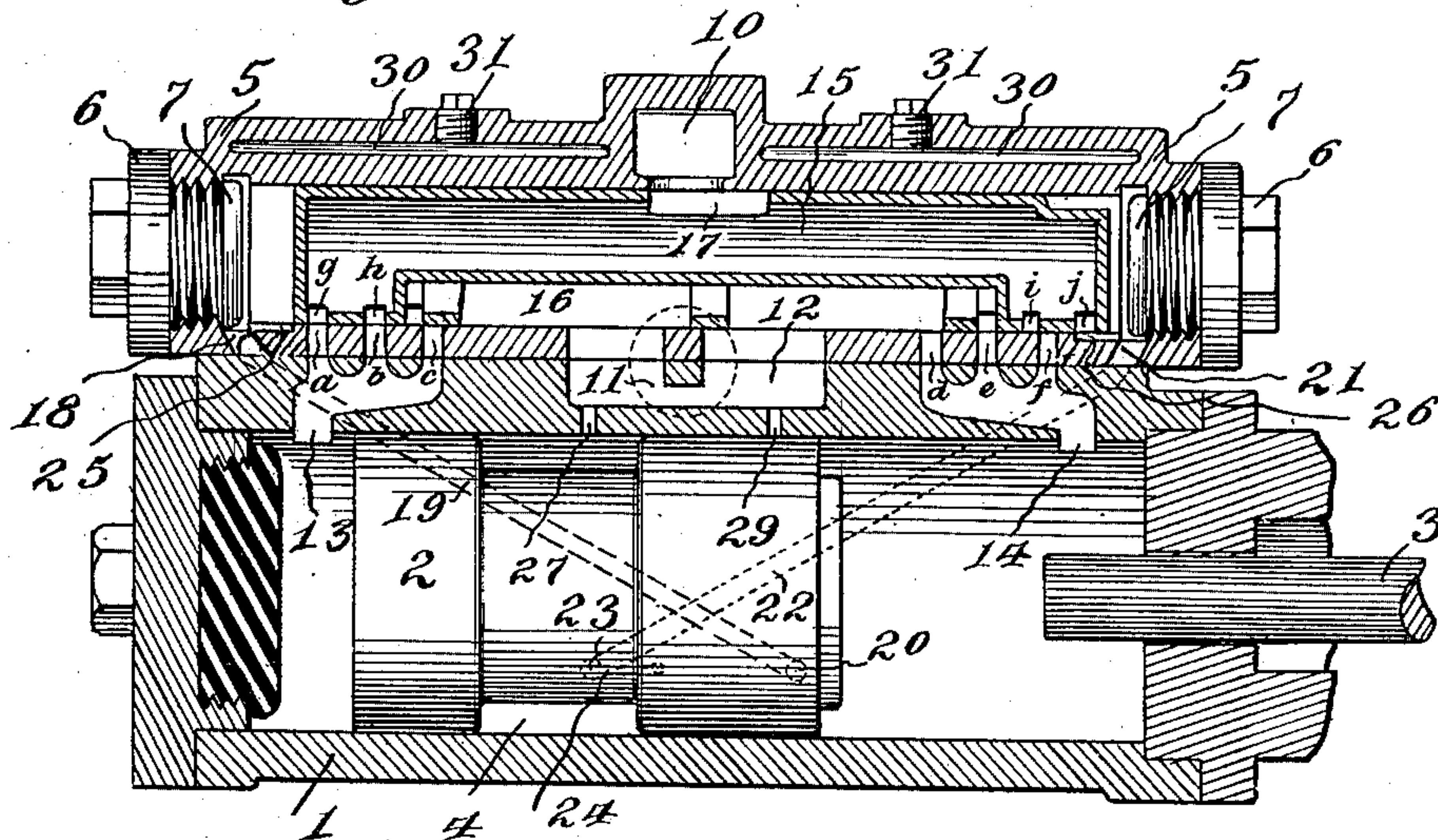
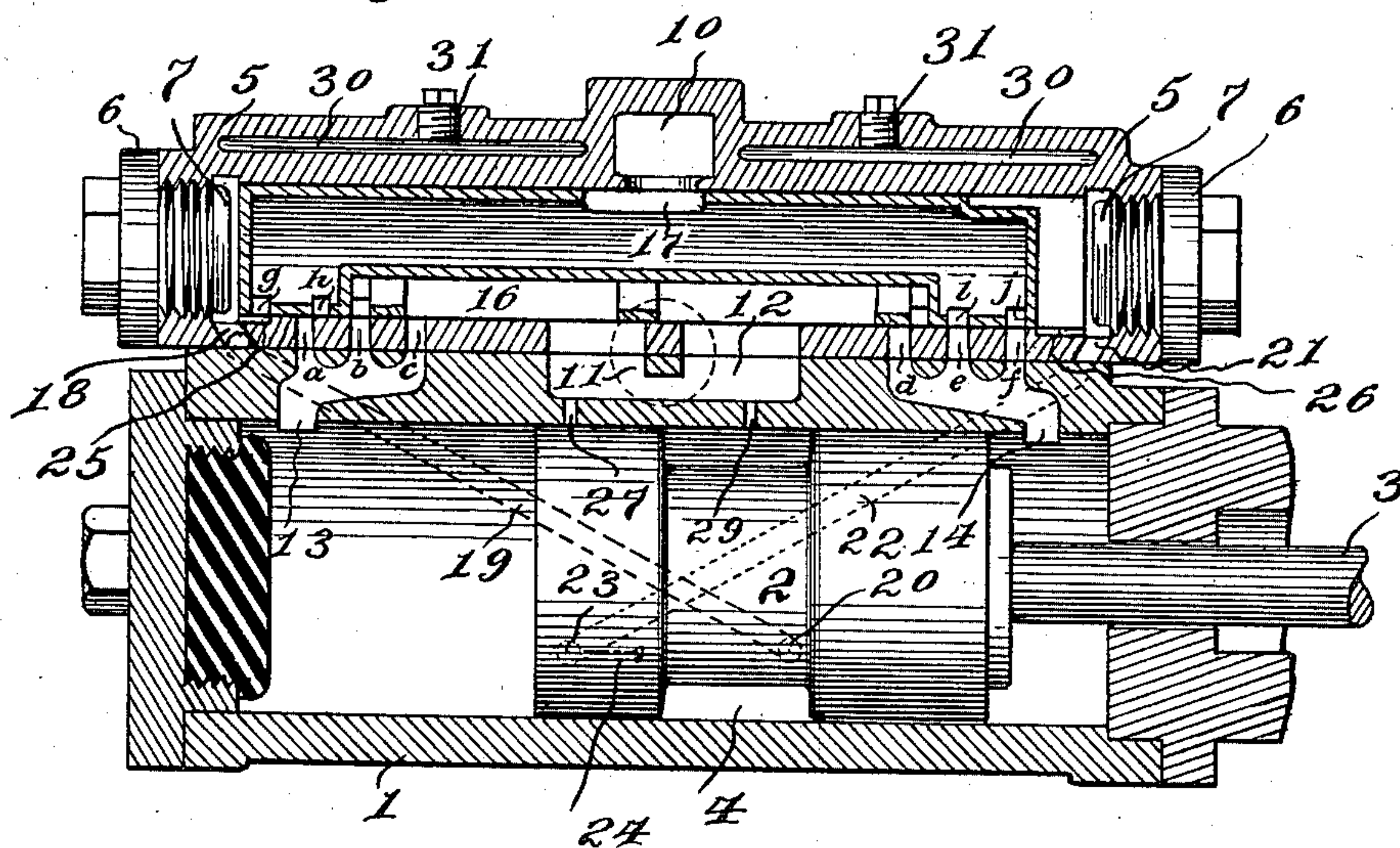


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

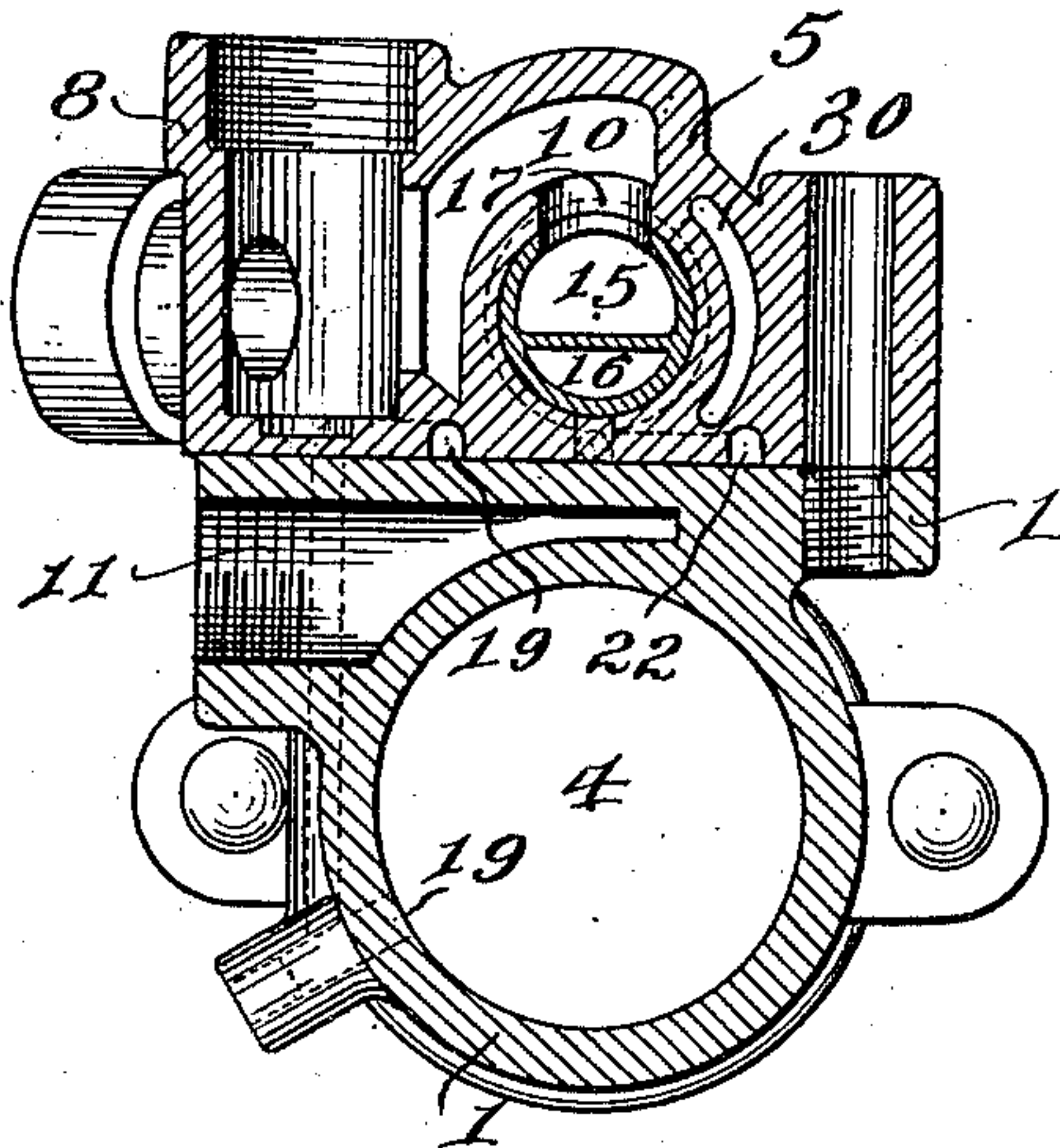
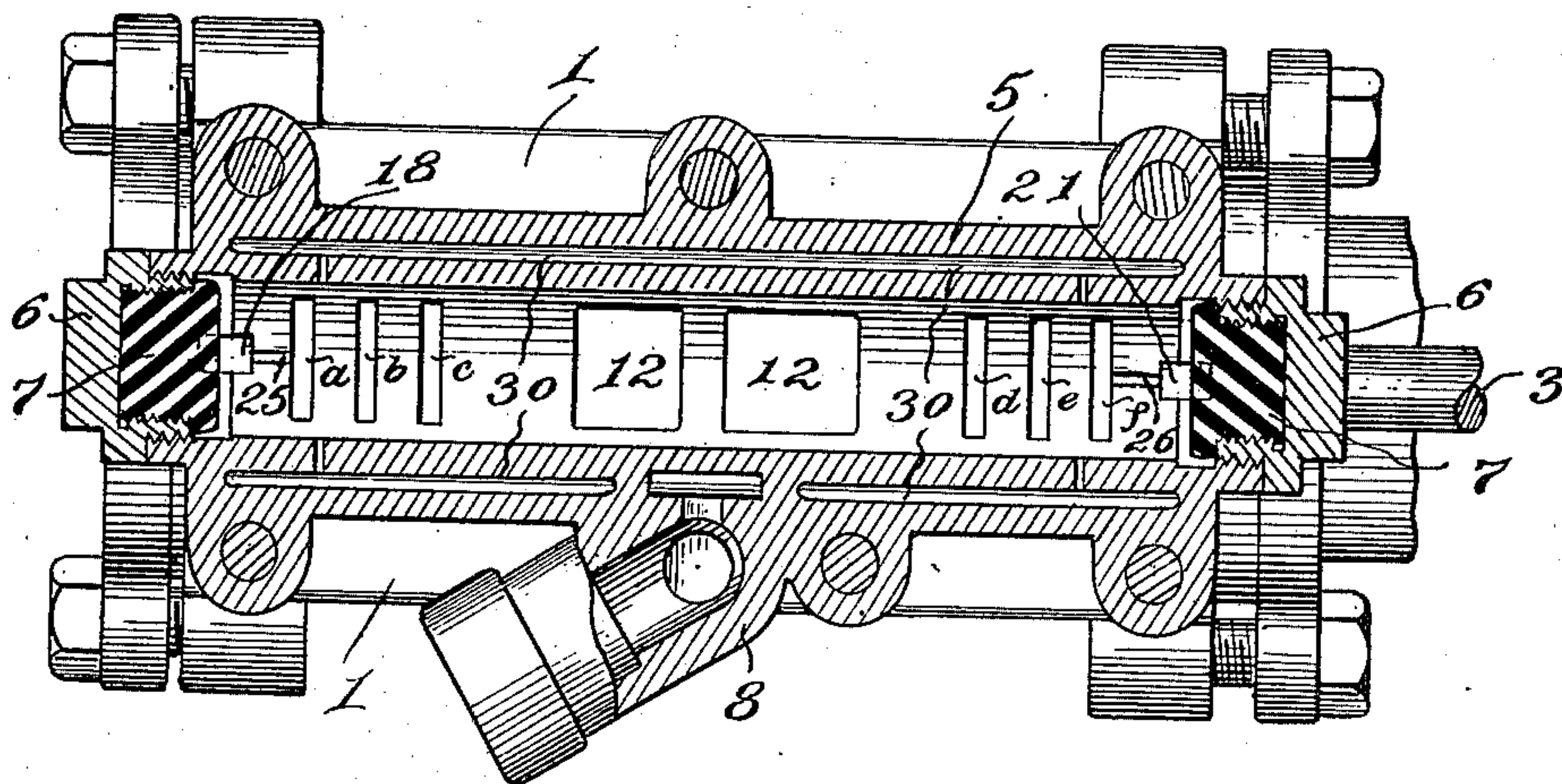


Fig. 6.



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UNITED STATES PATENT OFFICE.

ERNEST PENBERTHY, OF PAINESDALE, MICHIGAN.

MINING-MACHINE.

997,698.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNEST PENBERTHY, a citizen of the United States, residing at Painesdale, in the county of Houghton and State of Michigan, have invented new and useful Improvements in Mining-Machines, of which the following is a specification.

This invention has relation to mechanism for actuating the drill used in mining operations and for boring rock in blasting work, the purpose being to provide drill operating means embodying a cylinder, a piston hammer arranged to operate within the cylinder, and a valve mechanism for controlling the supply and the exhaust of the motive medium, whereby the piston hammer is caused to reciprocate in its cylinder.

The invention is designed to provide a novel valve mechanism in which the valve is practically balanced and which will admit of the ports being of a minimum length, which is essential to the successful operation of mechanism utilizing compressed air as the motive medium for operating the piston hammer, so as to prevent freezing of the medium in the ports and passages.

The invention also has for its object to provide a novel arrangement of passages and ports, whereby the valve is positively shifted in each direction by the motive medium, the latter being controlled in its admission and exhaust from the chest by the piston, and the valve in turn controlling the supply to the cylinder and the exhaust of the spent motive medium therefrom.

The invention also has for its object to construct a valve and to arrange the same to have a minimum throw to provide a maximum amount of port opening and a minimum length of passage, whereby the compressed air will not obstruct the passages by congealing therein and whereby the mechanism is rendered certain and positive in operation.

The invention consists of the novel features, details of construction and combination of parts, which hereinafter will be more particularly set forth, illustrated in the accompanying drawings, and pointed out in the appended claims.

Referring to the drawings, forming a part of the specification, Figure 1 is a side view of a mining machine embodying the invention. Fig. 2 is a top plan view thereof. Fig. 3 is a vertical central longitudinal section on the line 3—3 of Fig. 2, the valve

being in position to admit the motive medium into the left hand end of the cylinder to drive the piston hammer forward. Fig. 4 is a view similar to Fig. 3, showing the valve reversed and the piston hammer at the limit of its forward stroke. Fig. 5 is a transverse section on the line 5—5 of Fig. 1, looking in the direction of the arrows. Fig. 6 is a horizontal section on the line 6—6 of Fig. 1.

Corresponding and like parts are referred to in the following description, and indicated in all the views of the drawings, by the same reference characters.

The cylinder is designated by the numeral 1 and the piston hammer by the numeral 2. A tool holder 3 is mounted loosely in a head of the cylinder and is adapted to receive the impact of the piston hammer when the latter is driven forward. The piston hammer is reduced at a point between its ends, as indicated at 4, to provide an annular space for escape of the motive medium from opposite ends of the chest. The chest 5 extends approximately the full length of the cylinder and is preferably separate therefrom and secured thereto in any well known manner. Plugs 6 close the ends of the chest and are connected thereto by screw threads. The inner ends of the plugs 6 are recessed and receive rubber blocks 7, which act as buffers to relieve jar upon the valve in the event of the same overthrowing. The buffers 7 may be of any resilient material capable of neutralizing shock. The buffers 7 are headed and are threaded into the recesses of the plug 6 to admit of their replacement when desired and also to guard against displacement by vibration or shock. The chest is formed with an extension 8, which constitutes a casing for a valve 9 by means of which the compressed air or motive medium is controlled in its supply to the cylinder. The inlet passage is indicated at 10 and communicates with the extension or valve casing 8. The exhaust port is shown at 11 and communicates with a space 12 formed in a side of the cylinder or the part of the chest adjacent thereto. As shown most clearly in Figs. 3 and 4 the space 12 is formed partly in the chest and cylinder. A port 13 communicates with the left hand end of the cylinder and is provided with three branches *a*, *b*, and *c*. A port 14 communicates with the right hand end of the cylinder and is provided with three outlets or branches *d*, *e*

and *f*. The several ports *a*, *b*, *c*, *d*, *e*, and *f* extend through the wall of the chest and are adapted to register with openings or ports formed in the valve.

5 The valve 15 is hollow and fits snugly within the chest 5 and its middle portion is contracted upon the side opposite or facing the cylinder so as to form a space 16, which at all times communicates with the space 12
10 and with the exhaust port 11 and which is adapted to alternately communicate with the ports *b* and *c* and *d* and *e* at opposite ends of the cylinder. The valve 15 extends nearly the entire length of the chest and has
15 a limited throw sufficient to cover and uncover the ports. By having the valve hollow the motive medium exerts an equal pressure upon its inner walls, with the result that the valve is practically balanced and is
20 not forced upon its seat by pressure of the motive medium. As a result the valve may be easily moved from one position to another. An opening 17 is formed in the outer or top side of the valve and registers
25 with the inlet 10 so as to admit the motive medium into the valve when the throttle 9 is open. Openings or ports *g* and *h* are formed in the left hand end of the valve 15 and openings or ports *i* and *j* are formed in
30 the right hand end of the valve. The openings *g* and *h* are adapted to register with the openings or ports *a* and *b* when the compressed air or motive medium is passing to the left hand end of the cylinder, as indicated in Fig. 3. The ports or openings *e*, *f*,
35 and *i* and *j* register when the motive medium is passing into the right hand end of the cylinder, as shown in Fig. 4. When the motive medium is passing into the left hand
40 end of the cylinder the air or motive medium confined in the right hand end of the cylinder is adapted to escape through the port 14 and openings *d* and *e* into the spaces 16 and 12, thence out through the exhaust 11.
45 This is shown most clearly in Fig. 3. When the motive medium is passing into the right hand end of the cylinder the air or spent motive medium in the left hand end of the cylinder is adapted to escape by way of the
50 ports 13 and *b* and *c* and the spaces 16 and 12 and out through the exhaust 11, as indicated in Fig. 4.

A port 18 is provided near the left hand end of the chest 5 and a passage 19 leads
55 therefrom to an opening or port 20 at one side of the cylinder near the bottom thereof. A port 21 is provided near the right hand end of the chest 5 and a passage 22 leads therefrom to an opening 23 upon the opposite side of the cylinder near the bottom
60 thereof, said opening or port 23 having a passage 24 extending therefrom toward the port or opening 20. The ports or openings 20 and 23 are located upon opposite sides of
65 a central point of the cylinder and are

adapted to be alternately closed by the heads or end portions of the piston hammer, as shown most clearly in Figs. 3 and 4. A passage 25 is adapted to connect the port 18
70 with the port *g* and a passage 26 is adapted to connect the port 21 with the port *j*. As a result of the provision of the several ports and passages 18, 25, 19, 20, 26, 22, and 23, the motive medium is alternately supplied
75 to opposite ends of the cylinder and exhausted therefrom, the same being controlled by the piston hammer. When the piston hammer and valve 15 are in the positions indicated in Fig. 3 the opening 20 is closed by
80 the piston and the opening 23 is uncovered and the ports *g* and *h* are in register with the ports *a* and *b*, and the port *j*, passage 26 and opening 21 are in communication, and the motive medium entering the left hand
85 end of the cylinder through the port 13 drives the piston to the right. The passages 19 and 22 being comparatively small but very little of the motive medium escapes into the space 4, thence into the space 12
90 and out through the opening 11. When the piston reaches the limit of its stroke to the right, as indicated in Fig. 4, the port 20 is uncovered and the port 23 and passage 24 closed, thereby preventing escape of the motive medium entering the passage 22, said
95 motive medium accumulating in the right hand end of the chest and forcing the valve 15 to the left, as indicated in Fig. 4, with the result that the ports *i*, *j*, *e* and *f* are caused to register and the motive medium supplied to
100 the right hand end of the cylinder through the port 14, thereby driving the piston to the left. The spent motive medium in the left hand end of the cylinder escapes through the port 13 and ports *b* and *c* into the space
105 16. When the valve moves to the left the spent medium in the left hand end of the chest escapes through the passage 25, opening 18, passage 19, opening 20, space 4, opening 29, space 12, thence through the exhaust
110 11. When the piston reaches the left hand end of the cylinder, as indicated in Fig. 3, the port 20 is closed and the motive medium accumulates in the left hand end of the chest and drives the valve 15 to the right,
115 when the operation is repeated. When the piston hammer is moving to the right the passage 22 is not closed suddenly because of the provision of the passage 24, hence the piston is permitted to deliver a maximum
120 blow without being cushioned, since the passage 24 is not closed until the piston is about to reach the limit of its throw to the right when the passage 22 is completely closed and the motive medium permitted to accumulate in the right hand end of the chest to
125 cause movement of the valve 15 to the left. When the parts are in the position indicated in Fig. 3 the motive medium is prevented from accumulating in the right hand
130

end of the chest by the opening 23 being uncovered, the motive medium passing out through the opening 27 into the exhaust space 12. When the parts are in the position indicated in Fig. 4 the motive medium is prevented from accumulating in the left hand end of the chest by escaping through the passage 19 and opening 20 into the space 4, thence through opening 29 into the space 12. The openings 20 and 23 communicate with the cylinder at a point below the center of the piston, hence the pressure of the motive medium upon the piston when said openings are closed is upward, thereby tending to lift the piston and prevent excessive wear upon the lower portions thereof and the cylinder. Moreover the weight of the piston will tend to hold the same close upon its seat.

The chest 5 has a space 30 formed in its walls for reception of a lubricant and distribution thereof to the valve. The space 30 may be cored or provided in any manner and communicates with the interior of the chest through small openings formed in opposite sides. Oil is supplied to the space 30 through openings which are normally closed by plugs 31. The oil from the chest may pass into the cylinder to lubricate the piston hammer through the space 12 and ports 27 and 29.

It is observed that the ports and passages are of a minimum length because of the length of the valve, hence the compressed air quickly passes from the chest into the cylinder without tending to choke the passages which would be the case if passages of any length were provided for conducting the compressed air to the cylinder. It is further noted that by having the valve hollow it is adapted to be easily moved in the chest and because of the plurality of ports the length of movement is comparatively small, hence a saving of energy and material results.

From the foregoing description, taken in connection with the accompanying drawings, the advantages of the construction and of the method of operation will be readily apparent to those skilled in the art to which the invention appertains, and while I have described the principle of operation of the invention, together with the device which I now consider to be the embodiment thereof, I desire to have it understood that the device shown is merely illustrative, and that such changes may be made when desired as are within the scope of the claims appended hereto.

Having thus described the invention what is claimed as new, is:—

1. In a mining machine, the combination of a cylinder having ports and passages leading from the ports, one of the ports having a narrow passage extending there-

from toward the opposite port and opening into the cylinder, a piston comprising longitudinally spaced portions arranged to operate within the cylinder and to alternately close said ports and the narrow passage, a chest having an inlet and an outlet and provided with ports communicating with opposite ends of the cylinder and with the passages thereof, and a valve arranged to operate in the chest to control the supply of motive medium to the cylinder and in turn moved by said motive medium which is controlled by the piston.

2. A mining machine comprising a cylinder having end and intermediate ports and having passages leading from the extreme ports and opening into the cylinder at a point below a plane passing horizontally through the axis of the cylinder, one of said passages being narrow and elongated at the outlet in a direction toward the outlet of the other passage, a piston arranged to operate in the cylinder and having its middle portion reduced to form an annular space, a chest having openings in register with the ports communicating with the cylinder and having end openings in communication with the aforesaid passages, and a hollow valve arranged within the chest and extending nearly the entire length thereof and provided near its ends with ports to register with the ports of the chest and cylinder, and having its middle portion reduced on the side facing the cylinder to form a space in communication with the exhaust.

3. In combination a cylinder, a piston arranged to operate in the cylinder and provided intermediate of its ends with a space, a chest having communication with opposite ends of the cylinder and with a middle portion thereof and having passages establishing communication between the extremities of the chest and the middle part of the cylinder, one of said passages having a narrow passage opening lengthwise into the cylinder, the several openings being controlled by the piston, and a hollow valve arranged to operate in the chest and having ports to register with the ports in communication with opposite ends of the cylinder, said valve being automatically moved and retarded in its movement in one direction by the narrow passage opening into the cylinder and gradually closed by the piston.

4. In combination a cylinder having passages 19 and 22, openings 27 and 29, ports 13 and 14 and passages 25 and 26 in communication with the respective passages 19 and 22, a piston arranged to operate in the cylinder and having its intermediate portion contracted to provide a space to alternately register with the openings 27 and 29 and the passages 19 and 22, a chest having an inlet and an outlet and having communication with the several passages and ports,

and a hollow valve snugly fitting within the chest and having a portion cut away to span the openings 27 and 29 and to alternately communicate with the ports 14 and
5 15 and the passages 25 and 26, said valve controlling the supply of motive medium to the cylinder and in turn automatically actuated by the motive medium which is con-

trolled in its supply thereto by means of the piston.

10

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

ERNEST PENBERTHY.

Witnesses:

J. F. HAMBITZER,
IDA PENBERTHY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."
