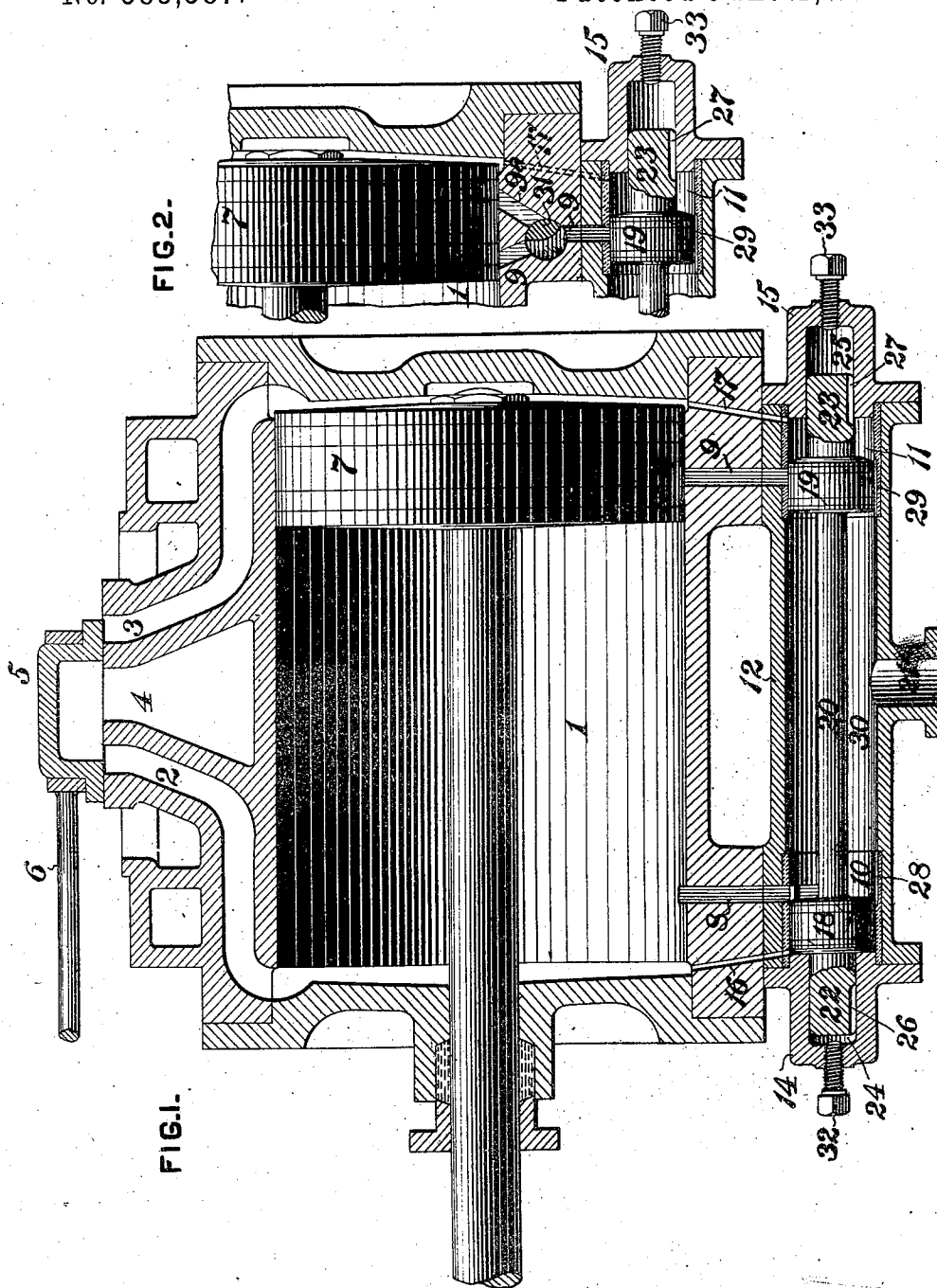


(No Model.)

H. H. WESTINGHOUSE.
FLUID PRESSURE MOTOR.

No. 583,587.

Patented June 1, 1897.



WITNESSES:

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UNITED STATES PATENT OFFICE.

HENRY HERMAN WESTINGHOUSE, OF PITTSBURG, PENNSYLVANIA.

FLUID-PRESSURE MOTOR.

SPECIFICATION forming part of Letters Patent No. 583,587, dated June 1, 1897.

Application filed February 3, 1896. Serial No. 577,773. (No model.)

To all whom it may concern:

Be it known that I, HENRY HERMAN WESTINGHOUSE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented or discovered a certain new and useful Improvement in Fluid-Pressure Motors, of which improvement the following is a specification.

15 The object of my invention is to provide means for effecting an independent exhaust of motive fluid from the cylinder of a fluid-pressure motor and for controlling and limiting such exhaust of motive fluid; and to this
25 end my invention consists in the combination, with a fluid-pressure motor provided with means for the admission of motive fluid to the cylinder, or with any of the usual distribution-valve devices, of an independent exhaust-
30 valve device which is operated by the pressure in the cylinder for controlling the release of motive fluid therefrom through a passage or passages independent of the usual drainage or relief passages; and my invention
25 further consists in certain combinations and features of construction, all as hereinafter fully set forth:

In the accompanying drawings, Figure 1 is a central longitudinal section through the distribution-valve and main cylinder of a fluid-pressure motor with my improvement applied thereto, and Fig. 2 a similar section showing a part of the main cylinder and a modification of my improvement.

35 In the application of my invention I employ, in addition to the usual ports or passages for draining the cylinder, independent exhaust ports or passages for the escape of steam or other motive fluid from the main
40 cylinder, which ports are opened by the action of the fluid which is being admitted to or compressed on one side of the main piston to effect an exhaust of the steam or other motive
45 fluid from the other side of the piston when the pressure of the fluid which is being admitted or compressed is in excess of the pressure of the fluid on the other side of the piston.

The independent exhaust-passages are preferably so located that their inner ends, or the
50 ports through which they open into the main cylinder, are in position to be covered by the

main piston as it approaches the end of its stroke, and the outer ends of the independent exhaust-passages are controlled by a valve device which is operated by the difference of
55 pressures in the opposite ends of the cylinder.

In the construction shown in Fig. 1 the main motor-cylinder 1 is provided with the usual admission ports or passages 2 and 3 and with an exhaust port or passage 4, and
60 the distribution of fluid is controlled by the slide-valve 5, which is operated by the movement of the stem 6. The valve-casing is not shown in place, but in this respect and in the construction and relation of the valve 5 and
65 ports 2, 3, and 4 the motor may be similar to any of the usual forms.

In addition to the usual passages for draining the cylinder of water of condensation I employ the independent exhaust-ports 8 and
70 9, which open into the main cylinder 1 at some distance from its opposite ends and communicate with piston-chambers 10 and 11, which are formed in a casing 12, secured to the main cylinder. The chambers 10 and 11
75 are closed at their outer ends by caps 14 and 15, and communicate with the ends of the main cylinder through the small passages 16 and 17.

Piston-valves 18 and 19 are fitted in the
80 chambers 10 and 11 and are connected together by means of a rod 20, so that the two pistons will move together. Pistons or cylindrical extensions 22 and 23 on the piston-
85 valves 18 and 19 fit into and are adapted to slide in the chambers 24 and 25, formed in the caps 14 and 15.

The piston-valves 18 and 19 control the independent exhaust-passages 8 and 9 and are actuated by fluid from the main cylinder,
90 which is admitted through the small passages 16 and 17 to the chambers 10 and 11 outside of the beveled outer ends of the piston-valves 18 and 19.

When the parts are in the positions shown
95 in the drawings, the steam on the left of the piston 7 will be exhausted through the ports 2 and 4 and through the independent exhaust-port 8, and live steam will be admitted through the port 3 to one end of the main cylinder
100 and through the passage 17 to the chamber 11, where it will act on the piston-valve 19

and move the valves 19 and 18 into position to close the independent exhaust-port 9 and open the exhaust-port 8.

When the main piston 7 has moved a portion of its stroke to the left, the admission of steam through the port 3 will be cut off by the valve 5, and as the piston 7 continues to move to the left the steam on the right of piston 7 will expand and gradually reduce in pressure until the port 3 is connected with the exhaust-port 4, when the steam will begin to exhaust from the right side of the piston 7 through the ports 3 and 4, and a more rapid reduction of pressure on that side of the main piston will be effected. The same reduction of pressure will be effected in the chamber 11 on the right of the piston-valve 19; but the piston-valves 19 and 18 will remain in the positions shown until the pressure of the steam on the right of the piston 7 is less than the pressure of the steam in the other end of the main cylinder.

As the piston 7 approaches the end of its stroke to the left the exhaust through the ports 2 and 4 will be cut off by the valve 5, and the piston 7 will close the port 8. The confined steam in the left-hand end of the main cylinder will then be compressed, and when the pressure in that end of the main cylinder and in the passage 16 and chamber 12 on the left of piston-valve 18, becomes great enough to overbalance the pressure on the right of the piston-valve 19 the valves 18 and 19 will be shifted so as to close the independent exhaust-port 8 and open the independent exhaust-port 9, and fluid on the right of the main piston 7 will exhaust through the independent exhaust-port 9, as well as through the main valve 5.

As the main piston 7 approaches either end of its stroke the main valve 5 may cut off the exhaust through the port 4 before the piston 7 covers the independent exhaust-port 8 or 9, toward which it is moving. If compression begins early in the stroke of the piston on account of an early closure of the main exhaust-passages and the capacity of the independent exhaust-ports is small, a sufficient degree of pressure may be attained to shift the exhaust-valves 18 and 19 before the piston 7 covers the exhaust-passage 8 or 9, toward which it is moving. If, however, the capacity of the independent exhaust-passages is sufficiently great, a high degree of compression, or such a degree of pressure as may be necessary to shift the independent exhaust-valves, may be prevented until after the main piston is in position to cover the exhaust-port 8 or 9, toward which it is moving, and the increase in pressure effected after the closing of the independent exhaust-port by the main piston will be less than would have been effected without the employment of the independent exhaust-passages.

Under some conditions of operation the pressure of the compressed steam may not be sufficient to move the exhaust-valves 18 and

19, and then the movement of these exhaust-valves will not be effected until live steam is admitted through the main steam-admission port.

The closure of the independent exhaust-port by the piston before reaching the end of its stroke insures a certain increase of pressure at the end of the stroke, and the amount of this increase will depend to some extent on the distance of the inner ends of the independent exhaust-passages from the end of the stroke of the piston.

The independent exhaust-passages, if made sufficiently large, may prevent any compression of the fluid before the main piston covers the passage toward which it is moving, and no matter how small it is it will permit an exhaust of fluid in addition to that permitted by the main valve 5, and the reduction in the back pressure effected by it will reduce the compression of the fluid below what it would be when controlled by the main valve only.

The pistons or extensions 22 and 23 on the piston-valves 18 and 19 are provided on the lower portions of their surfaces with grooves 26 and 27, which connect the chambers 24 and 25 with the chambers 10 and 11, respectively, when the piston-valve 18 or 19 is moved away from the head 14 or 15 to the limit of its stroke. The grooves 26 and 27, when open to the chambers 10 and 11, permit the admission of steam into the chambers 24 and 25 and are of such length that they are closed by the outward movement of the extensions 23 and 23, respectively, and sufficient steam will be confined in the chambers 24 and 25 by the closing of the grooves 26 and 27 to form a cushion for preventing or reducing shocks when the piston-valves 18 and 19, respectively, are moved toward the heads 14 and 15. When open, the grooves 26 and 27 also permit any water that may be in the chambers 24 and 25 to drain into the chambers 10 and 11. The chambers 10 and 11 are provided with grooves 28 and 29, the ends of which are adapted to be uncovered by the pistons 18 and 19, and to then permit the escape of water of condensation from the chambers 10 and 11 into the space 30 between the piston-valves, which may open to the atmosphere or elsewhere through the passage 21.

If at any time it is desired to operate the motor without exhausting through the exhaust-ports 8 and 9, the piston-valves 18 and 19 may be locked in position to close those ports by means of the screw-threaded bolts 32 and 33, which may be screwed up until they bear on the extensions 22 and 23 and prevent movement of the valves 18 and 19 in either direction.

In Fig. 1 of the drawings the main piston 7 is at one end of its stroke. The pressure of the fluid on the right of the main piston, which is admitted to the chamber 11 through the passage 17, has moved the pistons 18 and 19 to the left against the pressure on the left

of the main piston, which is admitted to the chamber 10 through the passage 16. The passage 9 is closed by the main piston and by the piston-valve 19. The passage 8 is opened by the piston-valve 18, and the steam and water of condensation on the left of the main piston is escaping through the passage 8, chamber or space 30, and passage 21, and steam is exhausting through the ports 2 and 4.

In Fig. 2 I have shown the auxiliary exhaust-passage 9 connecting with a branch passage 9^a, which opens into the main cylinder at a point nearer to the cylinder-head than the inner end of the passage 9, and provide a plug-valve 31, which may be turned into position to connect the passage 9^a with the inner end of the passage 9 and with the chamber 11 and to cut off communication between the inner and outer ends of the passage 9. By this means the time of closing the passage 9 by the movement of the main piston 7 may be regulated. It will be understood that such a construction may be employed at each end of the cylinder and that the plug-valve 31 may be employed to control any number of passages leading from the interior of the cylinder in position to have their inner ends closed by the main piston and to be separately connected with the auxiliary exhaust-passage, which opens into the chamber 10 or 11.

My improvement is not limited in its application to a motor having a single distribution-valve, as shown in the drawings, but is adapted to be applied to any of the usual forms of motor in which one or more main valves are employed for admitting and exhausting steam or in which the admission and exhaust of steam are controlled by separate valves, or my improvement may be employed in combination with a valve device or devices which control only the admission of motive fluid to the cylinder, and the independent exhaust-valve device will then constitute the main exhaust-valve device.

It will be seen that when either of the exhaust-passages 8 or 9 is open to the space 30 and passage 21 there will be a free passage for the discharge of water of condensation from that end of the main cylinder with which the open passage connects, and a more limited discharge of water of condensation may at the same time take place from the opposite end of the main cylinder through the passage 17, chamber 11, and groove 29 or through the passage 16, chamber 10, and groove 28.

In horizontal engines the ports 8 and 9 and the auxiliary exhaust-valve device are preferably located, as shown, on the lower side of the main cylinder in order to provide for more perfect drainage and to prevent leakage around the piston through the ports 8 and 9 when covered by the piston 7.

I claim as my invention and desire to secure by Letters Patent—

1. In a fluid-pressure motor, the combination, with a cylinder and piston, of a main valve, or valves, controlling the admission of

fluid to the cylinder, an independent valve device actuated by fluid admitted to the cylinder by the main valve, or valves, and controlling passages other than the usual drainage or relief passages for releasing fluid from the cylinder, and means for closing the passages before the piston reaches the end of its stroke, substantially as set forth.

2. In a fluid-pressure motor, the combination, with a cylinder and piston, of a main valve, or valves, controlling admission of fluid to the cylinder, and an independent valve device, for exhausting motor fluid from the cylinder through a passage, or passages, other than the usual drainage or relief passages, and which is actuated by the difference in pressures in the opposite ends of the main cylinder, the parts being arranged so that the independent valve device may be shifted by fluid-pressure before the piston reaches the end of its stroke, substantially as set forth.

3. In a fluid-pressure motor, the combination, with a cylinder and piston, of a main distribution valve, or valves, controlling the admission and exhaust of fluid to and from the cylinder and an independent or auxiliary valve device, which is actuated by the difference in pressures in the opposite ends of the cylinder, for exhausting motive fluid from the cylinder through a passage, or passages, other than the usual drainage or relief passages whereby the exhaust of fluid from the cylinder is modified in accordance with variations in the cut-off of the admission and release of fluid by the main valve, substantially as set forth.

4. In a fluid-pressure motor, the combination, with a cylinder and piston, of a main distribution valve, or valves, controlling the admission and exhaust of fluid to and from the cylinder, an independent auxiliary valve device for releasing fluid from the cylinder through a passage or passages other than the usual drainage or relief passages, which is actuated by the difference in pressures in the opposite ends of the cylinder, and means for cushioning, or preventing shock by the movement of the auxiliary valve device as it approaches the end of its stroke in either direction, substantially as set forth.

5. In a fluid-pressure motor, the combination, with a cylinder, a piston, and a main distribution-valve mechanism, of an auxiliary valve device for releasing fluid from the cylinder through a passage, or passages, other than the usual drainage or relief passages, which is subjected to the opposing pressures of the fluid admitted to the opposite ends of the cylinder by the main distribution-valve, and which is adapted to be moved by the pressure in one end of the cylinder to open a port in the opposite end of the cylinder before the piston reaches the end of its stroke, substantially as set forth.

6. In a fluid-pressure motor, the combination, with a cylinder, a piston, and a distribution-valve mechanism, of a main exhaust-

passage, an auxiliary exhaust-passage near one end of the cylinder, in position to be covered by the piston before reaching the end of its stroke, a valve device controlling the
5 auxiliary exhaust-passage, and passages through which fluid is admitted from opposite sides of the piston to operate the valve device, substantially as set forth.

7. In a fluid-pressure motor, the combination, with a cylinder, a piston, and a distribution-valve mechanism, of a main exhaust-passage, auxiliary exhaust-passages leading from near the opposite ends of the cylinder,
10 a valve device controlling the auxiliary exhaust-passages, passages leading from the op-

posite ends of the cylinder to the opposite sides of the valve device, whereby the valve device is exposed to and adapted to be operated by the pressures in the opposite ends of the cylinder, and means whereby the valve device may be locked in position to close the auxiliary exhaust-passages, substantially as set forth.

In testimony whereof I have hereunto set my hand.

HENRY HERMAN WESTINGHOUSE.

Witnesses:

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