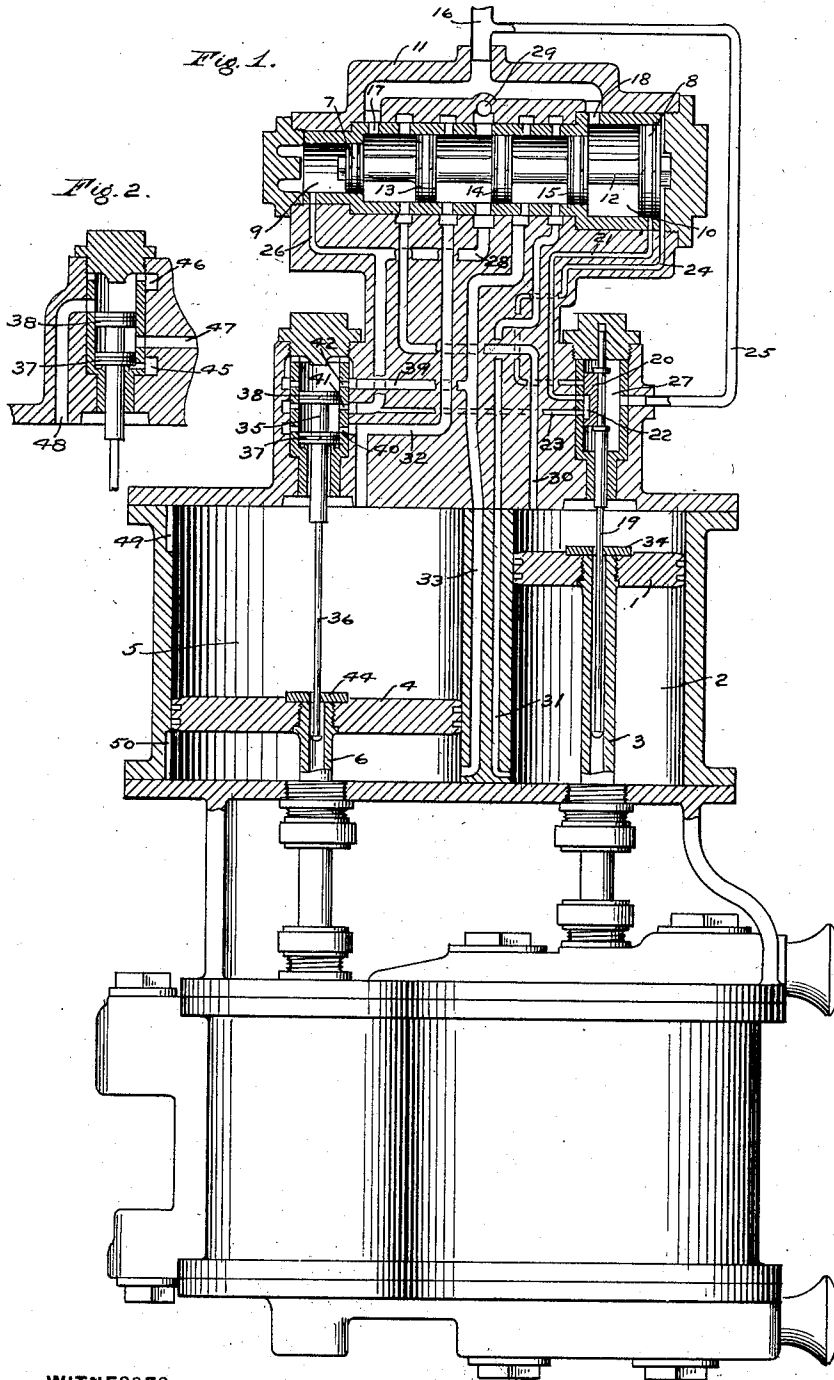


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COMPOUND STEAM PUMP.
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COMPOUND STEAM-PUMP.

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To all whom it may concern:

Be it known that I, ROBERT C. AUGUR, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented new and useful Improvements in Compound Steam-Pumps, of which the following is a specification.

This invention relates to compound steam pumps, and more particularly to that type employed to compress air for railway brake systems, wherein the compressing pistons are directly connected with the steam pistons, which latter are not mechanically connected to operate together, but are capable of movement independent of each other.

In steam pumps of this character, the exhaust or low pressure steam from the high pressure cylinder is admitted to the low pressure cylinder to operate the low pressure piston.

Should leakage of live steam occur, past the piston packing rings, or the main distribution valve, or various other parts of the pump, of which there is some liability, especially as the pump becomes worn, an excessive degree of steam pressure may accumulate on the low pressure or exhaust side of the high pressure piston, which tends to retard its movement, and to accelerate the movement of the low pressure piston. A like accumulation of steam pressure may also occur when the pump is cut out and steam is being admitted to the pump through the usual small opening in the governor, which is provided for the purpose of keeping the pump warm, to prevent freezing and sticking of the pump.

In order to secure an efficient pump, it is highly desirable that a sufficient differential between the high and low steam pressures acting upon opposite sides of the high pressure piston be maintained, whereby the pump stroke shall be rapid and positive regardless of leakage.

The principal object of my invention is to provide a compound steam pump having the above features, and it comprises, for this purpose, means governed by the movement of the low pressure piston, for relieving pressure on the low pressure side of the high pressure piston and other parts of the pump subject to low pressure.

Another object of my improvements is to

provide an improved auxiliary exhaust device for the low pressure steam cylinder.

Another object is to provide an auxiliary exhaust valve device adapted to be actuated by steam pressure in case it is not shifted by the movement of the low pressure piston; and a further object is to provide an improved distribution valve mechanism for compound steam pumping engines which shall be of simple and durable construction and efficient and reliable in its operation.

In the accompanying drawing, Figure 1 is an elevational view, partly in section, of a compound steam pump, with a preferred form of my invention applied thereto, and Fig. 2 a central sectional view of a slightly modified construction of the auxiliary exhaust valve device.

Although my invention may be generally employed in connection with compound steam pumps, I have illustrated the same as applied to a proposed form of compound pump for compressing air, wherein, as shown in Fig. 1 of the drawing, a high pressure steam piston 1, contained in cylinder 2, is connected by rod 3 to the low pressure air piston, and a low pressure steam piston 4, in the steam cylinder 5, is connected by a rod 6 to the high pressure air piston.

For controlling the admission and exhaust of steam to and from the steam cylinders, a main distribution valve device is provided, comprising the differential piston heads 7 and 8, contained in the respective piston chambers 9 and 10, of a valve casing 11, which may be mounted on top of the steam cylinders.

The differential piston heads are connected by a valve rod 12, for actuating the main distribution valve, which preferably consists of the valve pistons 13, 14 and 15.

Live steam is supplied to the main valve device through the steam inlet 16, in constant open communication through ports 17 and 18 with the respective chambers formed by piston heads 7 and 13 and the piston heads 15 and 8. The heads 13 and 8 are of greater area than the heads 7 and 15 respectively, so that the steam pressure in the intermediate chambers tends to shift the main valve device to the position as shown in Fig. 1.

The main valve controls ports 30 and 31, leading to opposite sides of the high pres-

sure steam piston 1, and ports 32 and 33 leading to opposite sides of the low pressure piston 4, and also exhaust port 29, open to the atmosphere.

5 The outer face of the piston head 7 is open substantially at all times, to the atmosphere, being connected by a port 26 to a passage 28, which is open to the exhaust port 29, the port 26 being preferably set
10 in as shown, so as to be closed by the piston head 7 and thereby provide a certain amount of air cushioning for said piston.

The large piston head 8 is open at its outer face to ports 21 and 24, for controlling the fluid pressure on said piston head
15 to operate the same, the port 21 being preferably located so as to be closed by the movement of the piston head outwardly, to provide an air cushion for the main valve device upon its movement in this direction.
20 Ports 21 and 24 are controlled by a reversing valve 20, contained in valve chamber 27, and adapted to be operated by a reversing valve rod 19, actuated by the traverse of the high pressure piston 1 in the usual manner.
25

In the position of parts as shown in Fig. 1, steam flows from the chamber intermediate the heads 7 and 13 through the port
30 30 to the upper face of the high pressure piston 1, which thereupon makes its downward traverse. The reversing valve 20 in this position connects the port 21 with a passage 23, through a cavity 22, the passage 23 being in constant communication
35 with the atmosphere, as by connecting the same with the passage 28.

As the high pressure piston 1 reaches the end of its traverse, the striking plate 34
40 thereon, engages the usual button on the reversing rod 19, and the valve 22 is thereby shifted, opening the port 24 to the valve chamber 27. The chamber 27, being subject to steam pressure by way of the supply pipe 25, steam is admitted to the outer
45 face of the piston head 8. The main valve device is thereby driven to its opposite position, in which ports 32 and 30 are connected, so that the low or exhaust pressure from the upper side of the high pressure
50 piston is admitted to the upper face of the low pressure piston, causing the same to make its downward traverse. The port 31 is at the same time open to the steam chamber 10, and steam is admitted
55 to the lower face of the high pressure piston 1. As the high pressure piston moves upwardly to the end of its traverse, the striker plate 34 engages the usual shoulder of the valve rod 19, thereby shifting the
60 reversing valve so that the steam port 24 is closed and the exhaust port 23 is connected through cavity 22 to the port 21, venting the fluid pressure on the outer face
65 of the piston head 8, the constant steam

pressure in the chamber between the ports 17 and 18 acting on the greater area of piston head 8 then operates to shift the main valve to the position shown in Fig. 1, and
70 as the port 33 is now connected with port 31, the exhaust or low pressure steam from the lower face of the high pressure piston is admitted to the lower face of the low pressure piston to actuate the same.

The opposite face of the low pressure piston is now open to the exhaust port 29,
75 through port 32, so that the exhaust steam is exhausted therefrom to the atmosphere. The operation of the pump so far as described is similar to the proposed construction
80 hereinbefore referred to.

In order to insure the desired rapid action of the pump under various conditions, such as leakage past the steam pistons or
85 the main valve, or in fact, whatever tends to retard the prompt and positive movement of the steam pistons, I provide means governed by the movement of the low pressure piston for relieving pressure on the low
90 pressure side of the high pressure piston as well as other parts subject to such pressure. A preferred construction for accomplishing this purpose is shown in Fig. 1, and comprises a piston valve 35, having two
95 heads 37 and 38, mounted on a valve rod 36, and adapted to be actuated upon the traverse of the low pressure piston in either direction by means of said valve rod.

The outer faces of the heads 37 and 38 are constantly subject, respectively, to the
100 pressures at the upper and the lower sides of the low pressure piston 4. For this purpose a passage 39, leading from the port 33, may be extended to open into the chamber above the piston head 38, while the
105 lower face of the piston head 37 may be connected to the upper piston chamber, by a direct passage along the valve rod 36. The piston valve 35 controls port 40, leading to passage 32, port 41 leading to passage 28, and port 42, leading to passage 39.
110

When the high and the low pressure pistons operate normally, the valve device 35 serves as an auxiliary or additional exhaust
115 for venting the exhaust steam from the low pressure piston. The operation being as follows: In Fig. 1 the low pressure piston is moving upwardly and the high pressure piston downwardly and the relief valve device 35 connects the ports 40 and 41, so that
120 the exhaust steam from the piston chamber above the piston 4 exhausts through said valve device and the passage 28 to the exhaust port 29, in addition to the usual exhaust of steam through the main exhaust
125 port 32. As the piston 4 makes its upward traverse the shoulder of the valve rod 36 is engaged by the striking plate 44, and the same is shifted outwardly, so that the ports 41 and 42 are connected. Similarly, upon
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the down stroke of piston 4, the main distribution valve having been shifted in the manner previously described, steam is exhausted from the lower side of low pressure piston 4 through port 33 to the exhaust port 29 and in addition is exhausted from port 33 through passage 39, port 42, and port 41, which leads to the auxiliary exhaust port 28.

Should the stroke of the high pressure piston be retarded or delayed, as for example, when the high pressure piston 1 is making its down stroke, the low pressure piston moving upwardly completes its stroke first, so that the valve device 35 is shifted, thereby connecting the ports 41 and 42 to open the exhaust to the lower side of the low pressure piston. But as the main valve has not been shifted, the ports 33 and 31, are still in communication, and consequently, steam pressure is released from the lower side of the high pressure piston, by way of the port 33 and passage 39. The high pressure piston being now subject to a greater differential of steam pressures, rapidly completes its traverse; thereby causing the main valve to be shifted by the action of the reversing valve 20.

It will now be apparent that, ordinarily, the relief valve device 35 serves as an auxiliary exhaust valve for the low pressure cylinder, but whenever the high pressure piston is delayed, for any cause, such as leakage of high pressure steam, then steam is also released from the low pressure side of the high pressure piston, which results in accelerating its action.

If the valve rod 36 should break or become otherwise disabled, or whenever the high pressure piston completes its stroke and causes the distribution valve to shift before the low pressure piston has completed its stroke and actuated the auxiliary exhaust valve, the auxiliary exhaust valve device will then be actuated by steam pressure, for the reason that the opposite faces of the valve piston heads 37 and 38 are subject to the pressures existing at the opposite sides of the low pressure piston, so that the same is shifted, as the pressures on the opposite sides of the low pressure piston are reversed, by the operation of the main distribution valve.

The steam pressures acting on the release valve device 35 also serve to insure the positive movement thereof, thus preventing accidental movement, such as might be occasioned by the rubbing of the valve rod against the striker plate, and the like. If desired, however, the relief valve device, may be constructed as shown in Fig. 2, wherein the opposite faces of the valve piston heads 37 and 38 are in constant open communication with exhaust ports 45 and 46, respectively, and control port 47, leading to the lower side of the low pressure

piston and port 48, leading to the upper side of said piston.

In one position of the relief valve the port 48 is open to the exhaust port 46 and in the opposite position the port 47 is open to the exhaust port 45.

The operation of this form of my invention is substantially the same as that of the construction illustrated in Fig. 1, except that in this case, as outer faces of the piston heads 37 and 38 are in constant open communication with the atmosphere, there is no provision for actuating the same, in case of breakage of the valve rod, nor for preventing accidental movement thereof should the valve rod stick.

As another means for providing an auxiliary exhaust for the low pressure cylinder, by-pass ports such as 49 and 50 may be so formed as to open communication around the low pressure piston 4 when the same moves to either end of its stroke, and thereby permit the exhaust of the steam from the opposite side of said piston to the exhaust. These by-pass ports may be employed in conjunction with the auxiliary exhaust valve device or either may be used independently for this purpose as desired.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In a compound pump, the combination with a high pressure steam piston and cylinder, a low pressure steam piston and cylinder and valve mechanism for controlling the supply and exhaust of steam to and from the high pressure cylinder, of means governed by the low pressure piston for relieving pressure on an exhaust or low pressure side of either piston.

2. In a compound pump, the combination with a high pressure steam piston and cylinder, a low pressure steam piston and cylinder, and a distribution valve mechanism governed by the high pressure steam piston for controlling the steam pressure on said pistons, of means governed by the low pressure piston for relieving pressure upon the low pressure side of the high pressure piston.

3. In a compound pump, the combination with a high pressure steam piston and cylinder, a low pressure steam piston and cylinder and valve means governed by the high pressure piston for controlling the admission and exhaust of fluid to and from said cylinders, of means actuated by the low pressure piston in completing its traverse for relieving pressure on one side of said high pressure piston.

4. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a main valve device controlled by the high pressure piston and adapted in one position to establish communication

from one side of said high pressure piston to one side of said low pressure piston and valve means operated by the low pressure piston in completing its traverse, for relieving steam pressure on said communicating sides of the pistons.

5. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a main valve mechanism operated by the movement of the high pressure steam piston for admitting high pressure steam to one side of said piston and for establishing communication from the other side thereof to one side of the low pressure steam piston, and a relief valve device operated upon the movement of the low pressure piston to the end of the stroke, for relieving steam pressure from the low pressure side of the high pressure piston.

6. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a main distribution valve mechanism governed by the movement of the high pressure piston for opening communication from the low pressure side of the high pressure piston to one side of the low pressure piston, and means operated by said low pressure piston in completing its traverse for relieving steam pressure from the low pressure side of said high pressure piston, when said communication is open.

7. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a main valve for controlling the admission and exhaust of steam to and from said high and low pressure steam pistons and a relief valve device operated by the low pressure piston for controlling an additional exhaust port from the low pressure piston.

8. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a main valve for controlling the

admission and exhaust of steam to and from said high and low pressure steam pistons and a relief valve device operated by the movement of the low pressure piston for also relieving the pressure from the exhaust side of the low pressure piston.

9. In a compound steam pump, the combination with high and low pressure cylinders, independently movable pistons therefor, and operating means for said pistons controlled by the high pressure piston, of means governed by the movement of the low pressure piston in completing its stroke, for opening an exhaust from the opposite side of the low pressure piston.

10. In a compound steam pump, the combination with high and low pressure cylinders, and independently movable pistons therefor, of an auxiliary exhaust valve device for the low pressure cylinder, and means for actuating said auxiliary exhaust valve by the movement of the low pressure piston.

11. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a valve device operated by the movement of said low pressure piston for controlling the exhaust of steam therefrom and means operated independently of said low pressure piston, for also actuating said valve device.

12. In a compound pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of a valve device operated by the movement of said low pressure piston for controlling the exhaust of steam therefrom and means subject to the opposing pressures on opposite sides of said low pressure piston for also actuating said valve device.

In testimony whereof I have hereunto set my hand.

ROBERT C. AUGUR.

Witnesses:

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