

R. C. AUGUR.
STEAM PUMP.
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1,061,970.

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Fig. 1.

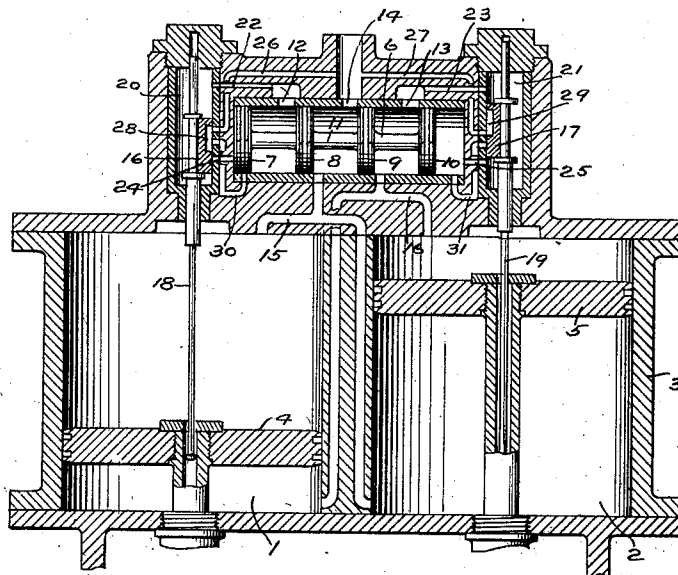
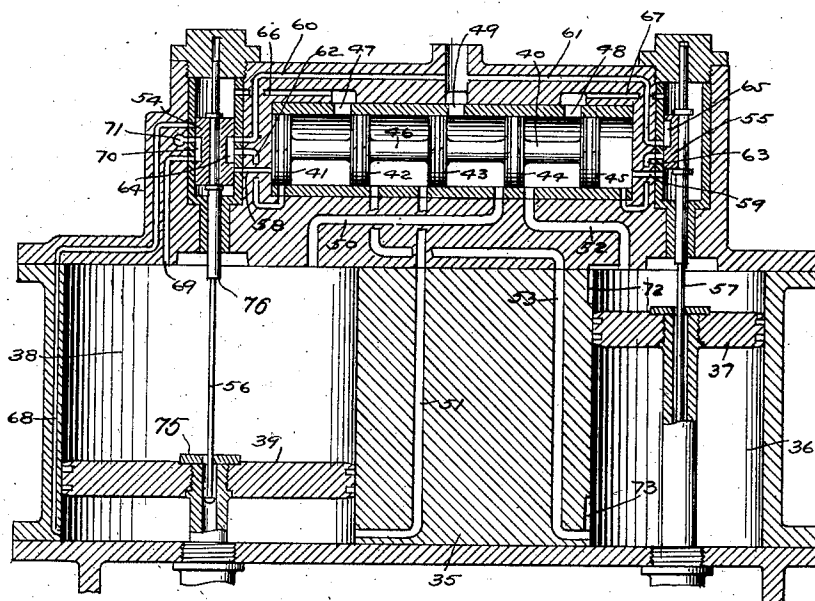


Fig. 2.



WITNESSES

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UNITED STATES PATENT OFFICE.

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STEAM-PUMP.

1,061,970.

Specification of Letters Patent.

Patented May 20, 1913.

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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 Steam-Pumps, of which the following is a specification.

This invention relates to steam pumps, and more particularly to those having two or more steam cylinders and independently movable pistons, such as the duplex steam pump, wherein each steam piston is actuated by direct live steam pressure, and the compound steam pump, in which the exhaust steam from the high pressure cylinder is admitted to the low pressure cylinder to actuate the piston therein by the expansive force of the steam.

It is the principal object of my present invention to provide an improved pump of the above character having a large capacity for a given size. In order to attain this object, my invention contemplates a construction wherein the steam pistons move at the same time, and having means for governing the operation of the main distribution valve which controls the admission and exhaust of steam to and from the steam cylinders, whereby the main valve is actuated only when both steam pistons complete their respective strokes, so that the positive and full stroke of each piston is assured.

Another object is to provide an improved compound steam pump having means adapted to assist the low pressure piston in making its first stroke at starting, and to accelerate its movement in case the piston is delayed or retarded while in action.

Another feature of my improvement comprises a combined reversing and auxiliary exhaust valve operated by the movement of the low pressure steam piston.

In the accompanying drawing, Figure 1 is a central sectional view of a duplex steam pump, the compressor cylinders being omitted, showing a preferred form of my improvements applied thereto, and Fig. 2 a similar view of a compound steam pump with one form of my invention applied thereto.

According to Fig. 1 of the drawing, I have illustrated my invention as applied to a duplex steam pump comprising a casing

3, having steam cylinders 1 and 2 containing steam pistons 4 and 5 respectively. The admission and exhaust of steam to and from the steam cylinders is governed by a main distribution valve 6, which may consist of the valve piston heads 7, 8, 9 and 10, mounted on a valve rod 11. The chambers intermediate the heads 7 and 8 and heads 9 and 10 are in constant communication with steam inlet ports 12 and 13 respectively, and the chamber between heads 8 and 9 is in constant communication with the exhaust port 14. Port 15 leads from the main valve seat to the chamber above piston 4 and to the chamber below piston head 5, while a port 16 leads from said valve seat to the chamber below piston 4 and above piston 5. The movement of the main distribution valve 6 is governed by the conjoint action of reversing valves 16 and 17, operated by valve rods 18 and 19, respectively, the valve rods being actuated by the respective movements of the steam pistons 4 and 5. The valve chambers 20 and 21 of the reversing valves 16 and 17 are in open communication with the steam supply, by way of passages 22 and 23 respectively, so that steam may be admitted, by the movement of the reversing valves, to the respective outer faces of the valve pistons 7 and 10, ports 24 and 25 being provided for that purpose. The reversing valves 16 and 17 also control exhaust ports 26 and 27 respectively, being provided with cavities 28 and 29 for connecting said exhaust ports to ports 30 and 31, leading to the outer face of the valve pistons 7 and 10 respectively. The ports 30 and 31 are preferably located a little in advance of the end of the piston chamber, so that communication is closed there-through before the main distribution valve reaches the end of its stroke, thereby providing an air cushion for the same, to prevent undesirable pounding of the valve.

In the position of the parts illustrated in Fig. 1, steam being supplied to the inlet ports 12 and 13, and the port 13 being open to the chamber between the heads 9 and 10, steam is admitted to the upper face of steam piston 5 and the lower face of piston 4. The piston 5 thereupon moves downwardly and at the same time the piston 4 moves upwardly. The reversing valve 17 is now

in its upper position, in which the steam port 25 is uncovered, so that steam is admitted to the outer face of the piston head 10, and as the opposite reversing valve 16 is in its lower position, in which the steam port is closed, the main distribution valve is so far maintained in its position as shown. As the piston 5 reaches the end of its traverse, however, the striker plate engages the shoulder on the valve rod 19 and the reversing valve 17 is shifted, closing the steam port 25 and connecting exhaust port 27 with port 31, through the cavity 29. The outer face of the piston 10 is therefore connected to the exhaust. In a similar manner, as the piston 4 moves upwardly to the end of its traverse, the reversing valve 16 is shifted, closing the exhaust port 26 and opening the steam port 24 to the outer face of the piston head 7. Steam pressure on said head thereupon shifts the main distribution valve to the opposite end of its traverse. It will be noted that the port 31 is closed by the movement of the piston head 10, so that an air cushion is provided to prevent pounding of the valve. If, for any reason, one of the steam pistons is retarded in its movement so that the other piston reaches the end of its traverse first, then the main valve will not be actuated until the retarded piston also completes its stroke. For example, suppose that piston 5 is delayed in its down stroke, then as the other piston 4 finishes its traverse, the reversing valve 16 opens the steam port 24, as before described, but as there is also steam pressure on the outer face of the opposite piston head 10, the reversing valve 17 not having been shifted, the opposing pressures acting on the main valve are balanced and the main valve is not moved. As soon as the retarded piston 5 completes its traverse, however, the valve 17 is shifted and the outer face of the piston head 10 is opened to the atmosphere, permitting the steam pressure on the piston head 7 to shift the main valve and reverse the steam connections. If the piston 5 should be the first piston to complete its traverse, then the reversing valve 17 is shifted, to connect the outer face of piston head 10 with the atmosphere, but as the outer face of the head 7 is still at atmospheric pressure no movement of the main valve is effected. But as soon as the piston 4 completes its stroke, steam is admitted to the piston head 7, driving the main valve to its opposite position, as will be clearly understood. It will now be apparent that the main valve is not shifted until both steam pistons have completed their respective strokes.

My improvements may also be applied to a steam pump of the compound type, such as that shown in Fig. 2, for example. The pump here illustrated comprises a main cas-

ing 35, having a steam cylinder 36, containing high pressure steam piston 37, and steam cylinder 38, containing low pressure steam piston 39. The casing 35 may be provided with a valve chamber, containing a main distribution valve device 40, comprising valve pistons 41, 42, 43, 44 and 45, mounted on a valve rod 46. The chambers intermediate piston heads 41 and 42, and the heads 44 and 45 are in constant open communication with steam inlet ports 47 and 48 respectively. The main valve 40 controls an exhaust port 49, ports 50 and 51 leading to the opposite side of the low pressure piston 39; and ports 52 and 53, leading to opposite sides of the high pressure steam piston 37. Reversing valves 54 and 55 are controlled by valve rods 56 and 57, operated by the low pressure and high pressure pistons 39 and 37 respectively. As in the construction shown in Fig. 1, the reversing valves 54 and 55 control steam ports 58 and 59, and exhaust ports 60 and 61, which latter ports are adapted to be connected to ports 62 and 63 respectively, by cavities 64 and 65 in the reversing valves. The valve chambers of the valves 54 and 55 are also connected respectively with the steam supply by way of steam passages 66 and 67. In the position of parts shown, the steam port 52, leading to the upper side of high pressure steam piston 37, is open to the steam inlet port 48, so that steam is admitted thereto, causing the piston to move downwardly. The main valve also connects the port 53, leading to the lower side of high pressure piston 37, with port 51, leading to the lower side of the low pressure piston, so that the exhaust steam from the previous stroke of the high pressure piston is admitted to the low pressure piston, to effect its upward movement, and port 50, leading to the upper side of piston 39, is open to exhaust port 49. Without describing the operation in detail, it will now be apparent that the same result is attained in this case, as that described in connection with Fig. 1, that is to say, both pistons must complete their respective strokes before the main valve is shifted to reverse the connections to the steam pistons. In order to assist the movement of the high pressure piston in case it lags behind, an auxiliary exhaust may be provided, similar to that covered in my co-pending application, Serial No. 406,020. For this purpose additional exhaust ports 68 and 69 may be provided, leading respectively from the lower and the upper sides of the low pressure steam piston 39. The reversing valve 54 is provided with a cavity 70, which is adapted to connect the port 69 with an exhaust port 71 in its lower position, and port 68 with said exhaust port in its upper position. Thus, for example, should the low pressure steam piston com-

plete its up stroke before the high pressure piston completes its down stroke, the reversing valve is shifted to its upper position by the engagement of the striker plate 75 of the low pressure piston 39 with shoulder 76 on valve rod 56, connecting the port 68 with the exhaust port 71, and thereby also the lower side of the high pressure piston 37, the ports 53 and 51, being now in communication. The consequent exhaust of steam from the lower side of the piston 37 causes the same to move more rapidly to the end of its traverse, thus insuring the prompt action of the pump. The traverse of the low pressure piston in the opposite direction connects the port 69 with the exhaust port to accomplish the same result as above described in the opposite direction. In order to further insure positive strokes and aid the pump in starting under various conditions, I may provide a by-pass adapted to establish a communication around the high pressure piston at the opposite ends of its travel, such as the by-passes 72 and 73. When the pump is started, if the high pressure piston is at the lower limit of its travel, and steam is admitted above the piston, for example, the by-pass 73 establishes communication from the upper or steam side of the piston to the port 53, and consequently live steam is supplied through said port 53 and the port 51 to the lower side of the low pressure steam piston 39, causing the latter to make its up stroke and shift the reversing valve. It is obvious that various other means may be employed for establishing communication around the high pressure piston at the end of its stroke, but it is not deemed necessary to illustrate more than one construction for that purpose. The by-pass 72 will, of course, serve a similar purpose when the high pressure steam piston is in its upper position.

It will now be seen that by means of my invention both steam pistons are in substantially constant action while the pump is running, all of which results in an increase in the capacity of the pump for a given size. It will also be apparent that my invention may be readily applied to various forms of air pumps, or to water or vacuum pumps.

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

1. In a steam pump, the combination with two steam cylinders and pistons therein adapted to operate independently, of valve means governed by the conjoint action of both pistons, for controlling the simultaneous admission and exhaust of steam to and from both of said steam cylinders.

2. In a steam pump, the combination with two steam cylinders and independently movable pistons, of a main distribution valve device for controlling the simultaneous admis-

sion of steam to said steam cylinders and pistons, and means actuated only by the movement of both pistons to the end of their respective traverses, for governing the operation of said main distribution valve.

3. In a steam pump, the combination with two steam cylinders and pistons, of a main valve for controlling the admission and exhaust of steam to and from said cylinders, a valve device operated by each piston, and means, necessitating the movement of both of said valve devices, for effecting the actuation of said main valve.

4. In a steam pump, the combination with two steam cylinders and independently movable pistons therefor, of a valve device for controlling the simultaneous admission and exhaust of steam to and from said cylinders, and means operated by the final movement of both pistons in completing their respective strokes, for governing the action of said valve device.

5. In a steam pump, the combination with two steam cylinders and independently movable pistons therefor, of a valve device for controlling the admission and exhaust of steam to and from said cylinders, and a reversing valve operated by each piston for conjointly governing the action of said valve device.

6. In a compound steam pump, the combination with high and low pressure steam cylinders and independently movable pistons therefor, of a main distribution valve for controlling the admission and exhaust of steam to and from said cylinders, and reversing valves actuated by both the high and low pressure pistons, for conjointly governing the action of the main distribution valve.

7. In a compound steam pump, the combination with high and low pressure steam cylinders and independently movable pistons therefor, of a main distribution valve for controlling the admission and exhaust of steam to and from said cylinders, and a combined reversing and auxiliary exhaust valve actuated by the movement of the low pressure steam piston.

8. In a steam pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, the pistons being independently movable, of means for accelerating the movement of the low pressure piston when said piston is delayed.

9. In a steam pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of means for hastening the movement of the low pressure piston when said piston is retarded.

10. In a steam pump, the combination with a high pressure steam piston and cylinder and a low pressure steam piston and cylinder, of means governed by the movement

of the high pressure piston for admitting live steam to the low pressure piston to assist its movement.

11. In a steam pump, the combination
5 with two steam cylinders and pistons therein adapted to operate independently, of a valve mechanism for controlling the admission and exhaust of steam to and from said steam cylinders and means operative only upon a

predetermined movement of both pistons for 10 controlling said valve mechanism.

In testimony whereof I have hereunto set my hand.

ROBERT C. AUGUR.

Witnesses:

WM. M. CADY,

EDITH B. MACDONALD.

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