(No Model.) 2 Sheets—Sheet 1.

J. L. McGIFFIN.

VALVE FOR STEAM PUMPS.

No. 558,199. Patented Apr. 14, 1896.

Fig. 9.

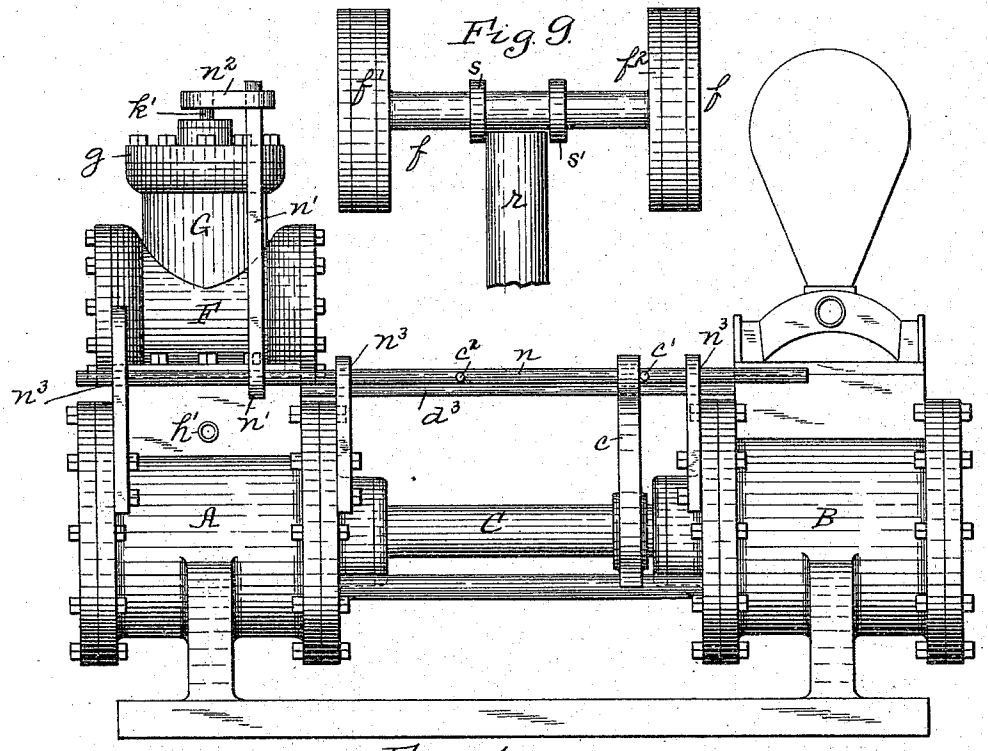

Fig. 1.

Fig. 7.

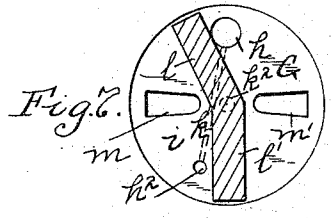

Fig. 8.

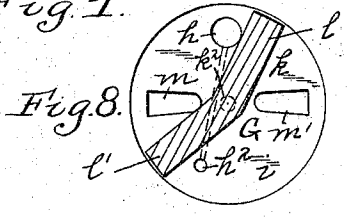

Fig. 2.

Witnesses:
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(No Model.) 2 Sheets—Sheet 2.

J. L. McGIFFIN.

VALVE FOR STEAM PUMPS.

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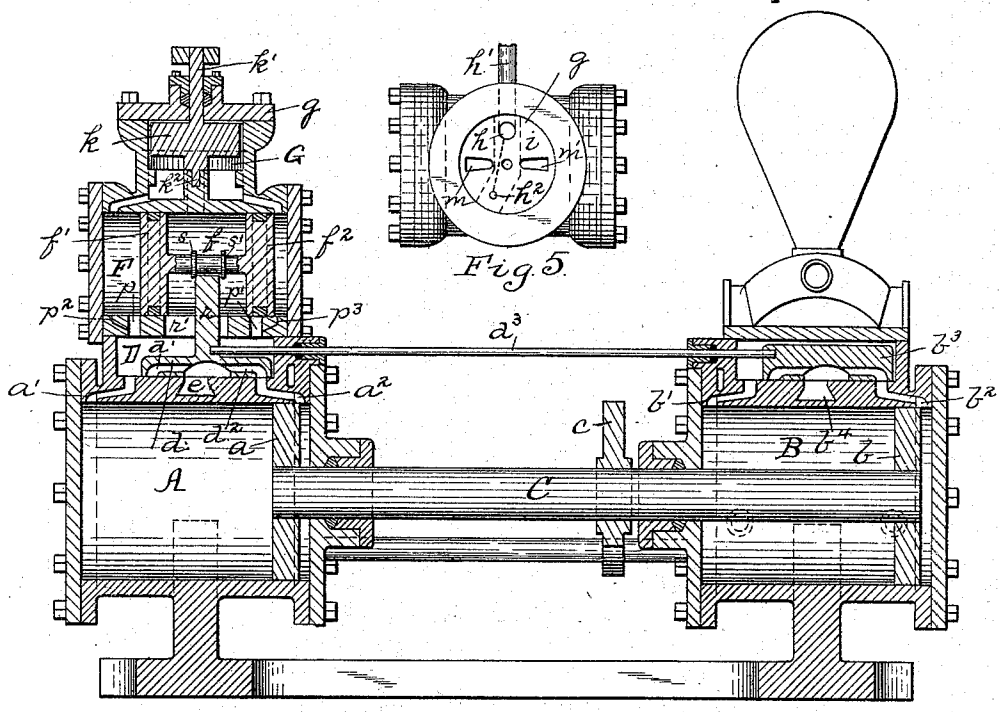

Fig. 5.

Fig. 3

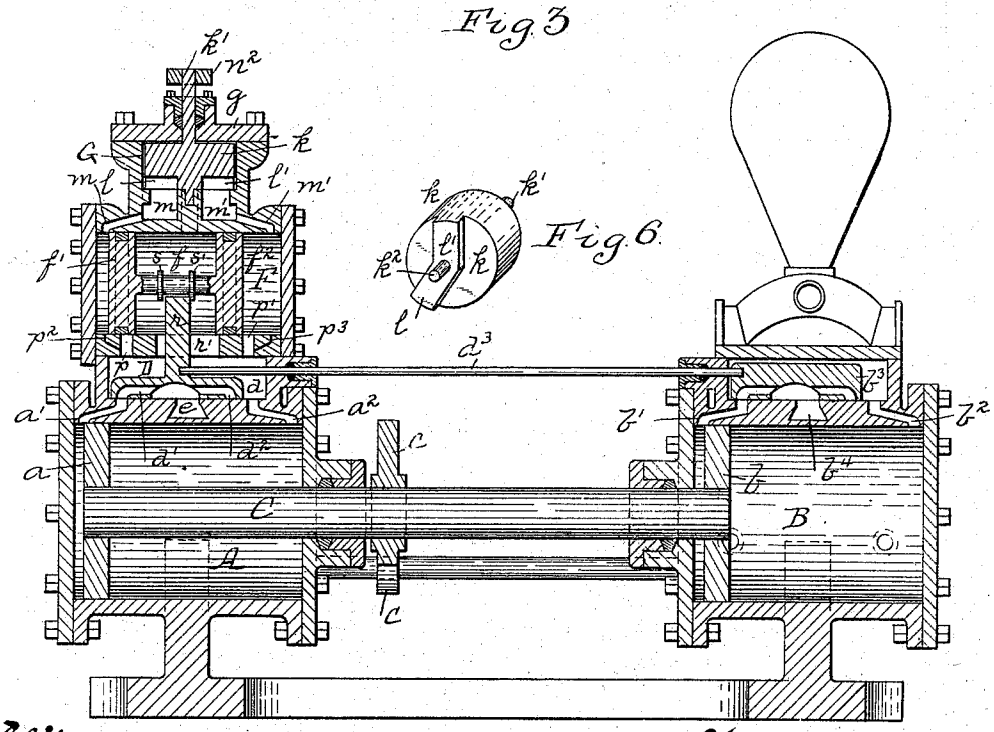

Fig. 6.

Fig. 4.

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UNITED STATES PATENT OFFICE.

JOHN L. McGIFFIN, OF SCOTTDALE, PENNSYLVANIA.

VALVE FOR STEAM-PUMPS.

SPECIFICATION forming part of Letters Patent No. 558,199, dated April 14, 1896.

Application filed March 1, 1894. Serial No. 501,919. (No model.)

To all whom it may concern:

Be it known that I, JOHN L. McGIFFIN, a resident of Scottdale, in the county of Westmoreland and State of Pennsylvania, have invented a new and useful Improvement in Valves for Steam-Pumps; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to steam-pumps, its object being to provide an economical pump, and especially economical in the fact that it can be run at an exceedingly slow speed and yet operate so that there is no dead-point, so providing for the running of the pump with the consumption of a small amount of steam, while, on account of its slow speed, the pump is adapted for boiler-feed use, and in feeding the ordinary boiler can be kept running continuously, so maintaining an even supply to the boiler and an even temperature of the water and steam, respectively, therein.

In my improved pump I employ a primary tappet-valve and an auxiliary piston controlled by said tappet-valve and operating the main slide-valve, the steam-inlet communicating with the primary tappet-valve chamber and that valve controlling the flow of steam to the auxiliary piston, which in turn controls the ports to the main valve-chamber, so that the steam in its course to the main valve-chamber is controlled by both the primary valve and the tappet-valve, it being possible through the employment of the three valves to provide such lead to the valves as to do away with any dead-points in the operation of the pump or its valves, and so provide for the operation of the pump with an exceedingly slow movement. The special points desired to be covered will be hereinafter set forth and claimed.

To enable others skilled in the art to make and use my invention, I will describe the same more fully, referring to the accompanying drawings, in which—

Figure 1 is a side view of a pump embodying the same. Fig. 2 is a top or plan view. Fig. 3 is a longitudinal central section showing the valves and pistons in one position. Fig. 4 is a like view showing the valves and pistons in another position. Fig. 5 is a view of the valve-chamber for the rotary reciprocating valve, the valve being removed. Fig. 6 is a perspective view of the rotary reciprocating valve. Figs. 7 and 8 are diagram views illustrating the respective positions of the rotary reciprocating valve with the ports to its valve-chamber, and Fig. 9 is an enlarged view of the connection between the secondary valve and the sliding valve controlling the ports to the steam-cylinder to illustrate the lead.

Like letters of reference indicate like parts in each view.

My invention is illustrated in connection with an ordinary boiler feed-pump, in which A is the steam-cylinder, B the pumping-cylinder, C the piston-rod carrying the piston a in the steam-cylinder and the piston b in the pumping-cylinder, and a knocker-arm c, hereinafter referred to. The steam-cylinder has the cylinder-ports a' a^2, controlled by the slide-valve d, which has the ordinary ports d' d^2 therein communicating with the exhaust-port e. The pumping-cylinder has the ports b' b^2, the slide-valve b^3 controlling said ports and communicating with the exhaust-port b^4, the construction of these valves and other parts of the pumping-cylinder being the same as that in any ordinary reciprocating pump, so that it requires no further description. The two slide-valves d and b^3 are rigidly connected with each other by the rod d^3, which extends through stuffing-boxes, so as to enter the valve-spaces in which the slide-valves move. The slide-valve d moves in the slide-valve chamber D. Above the valve-chamber D is the cylindrical valve-chamber F, in which the auxiliary piston or valve f, having the valve-heads f' f^2, moves, the said valve-heads being suitably packed within the chamber, and above said valve-chamber F is the valve-chamber G, in which the primary tappet-valve k moves, said valve k controlling the entrance of the steam from the steam-supply pipe h' and the passage of the steam to the auxiliary piston f, which in turn controls the slide-valve d, and through the rod d^3 the slide-valve b^3 of the pumping-cylinder.

I will now proceed to describe in detail the construction of the different valves and ports and the method in which power is applied to the valves to operate them, so as to make the movement of the pump and its valve mechanism clear. The valve-chamber G is preferably located above the valve-chamber F,

though if desired it may be located at the side thereof. It is a cylindrical valve-chamber closed by the cap g, the valve-stem k' of the valve k extending through a stuffing-box in the cap or being otherwise made steam-tight, so that power can be applied to the valve-stem to turn the valve. The valve k is held to the valve-seat i, formed by the base of the valve-chamber G, by means of this plate g or by any suitable adjusting mechanism, which it is not necessary to describe. In the said valve-seat i is the steam-supply port h, with which the steam-supply pipe h' communicates, and also a cushioning-port h^2, which is supplied with steam by a small inlet-port leading from the supply-port h. Opening through the valve-face i are the ports m m', which open into the respective ends of the valve-chamber F to supply steam to the respective ends of the auxiliary piston f. The valve k is centered at its lower end by a stem k^2, which may be part of the stem k', if desired, the valve being centered by the stems k' k^2, and it has on its lower face the valve-seats l l', which contact with the lower face i of the valve-chamber G and fit over the supply-port h and the cushion-port h^2, respectively, so that by the movement of this valve k steam is admitted from the supply-port h to one or the other of the ports m or m' and thence to the secondary valve-chamber F. This rotary reciprocating valve k is moved by means of the tappet-arm c carried on the piston-rod C, and engaging with the tappet-bar n, sliding in grooves n^3 on the steam-cylinder and pumping-cylinder, and having tappets or lugs c' c^2 with which the tappet-arm c engages, the tappet-arm moving this tappet-bar n as it approaches the end of its stroke. Connected to the tappet-bar n is the bar n', which extends up to the top of the primary valve-cylinder G and connects by a lever n^2 with the valve-stem k' and operates to turn the valve, the operation being more clearly shown in Fig. 3 and the diagram views, Figs. 7 and 8. The position indicated by dotted lines in Fig. 3 shows the midway position of this valve k, showing its valve seats or faces l l' covering the steam-supply port h and cushioning-port h^2, though that position is not normally a position of rest for the valve. The valve either occupies the position shown in Fig. 7, when the steam passes from the steam-supply port h to the port m' and thence to one end of the cylinder into the secondary valve-cylinder F, or the position shown in Fig. 8, when the steam passes from the steam-supply port h to the port m to the opposite end of the secondary cylinder F. During the movement of this valve through the tappet-arm the pressure of the steam through the port h^2 will act to cushion the valve through its face l', and when that valve-face passes off the port it will be seen that this cushioning-port communicates with the port m or m' opposite to that with which the steam-supply port h communicates, so that the steam can pass down through such port and assist in cushioning the auxiliary piston f in the chamber F. The chamber F communicates with the main valve-chamber D by means of the main ports p p', which are controlled by the valve-heads f' f^2 of the valve f, so that when the steam passes into one or the other end of the secondary valve-chamber F it will force the piston over until it exposes the port p or p' and permit the steam to pass from the secondary valve-chamber F into the slide-valve chamber D. To provide for positive cushioning of the valve f, I also provide the small cushioning-ports p^2 p^3 leading from the ports p p' into the ends of the valve-chamber F.

The piston f moves the slide-valve d by engaging with the extension r thereof, which rises through the opening r' into a proper position to contact with the piston f, between the heads f' f^2 thereof, and the piston f moves the valve d by means of collars or shoulders s s' thereof, engaging with the extensions r, there being a slight "lead" between the two valves, the shoulders s s' having slightly more space between them than the thickness of the extension r with which they contact, and so providing for this lead. The amount of lead will of course vary in different pumps, but for the ordinary feed-water pump a lead of about one thirty-second of an inch is sufficient.

The operation of the pump embodying the above improvements is practically as follows: The steam entering through the steam-supply pipe h' passes through the port h into the valve-chamber g and thence either to the port m or m'. Supposing that it passes to the port m, it will then pass into the auxiliary piston or valve chamber f at the end beyond the piston-head f' and force the piston f to the right until the piston-head f' uncovers the port p, when the steam will pass down through that port into the slide-valve d. In the movement of the valve f its shoulder s will strike the extension r of the slide-valve and carry the slide-valve with it until it uncovers the cylinder-port a' communicating with the left end of the cylinder A, at the same time through the rod d^3 imparting a like movement to the slide-valve b^3 of the pumping-cylinder. The steam will then force over the piston a and with it the piston-rod C and the piston b in the pumping-cylinder, forcing the water through the port b^2 to the exhaust-port b^4, and sucking the water in through the port b' into the cylinder B. This continues until the tappet-arm c strikes the tappet c^2 and draws over the tappet-bar n, and through the bar n' and lever n^2 moves the valve k into the position shown in Fig. 7, the valve being carried by the tappet-arm and connections, so that its seat or face l passes over the steam-supply port h and beyond said port, permitting the steam to pass from said port into the port m' to the right thereof. The steam then passes through the port m' to the right end of the auxiliary piston-cylinder F, and by pressure on the piston-head f^2 moves

the piston f until the port p' is uncovered. This piston f, having a slight lead, as above described, will move a short distance (according to that lead) and then strike the extension r of the slide-valve d and carry it over so as to uncover the cylinder-port a^2, and through the port d' in the valve form a communication between the cylinder-port a' and the exhaust e. At the same time, through the rod d^3, the valve b^3 of the pumping-cylinder will have a like movement imparted to it. Steam will then enter through the cylinder-port a^2 at the right of the steam-cylinder, and carrying over the piston a within said cylinder, giving the regular movement to the piston within the cylinder and to the pumping-piston within the pumping-cylinder, the valves remaining in the position above indicated until the tappet-arm c strikes the tappet c' on the tappet-bar n, when, through the bar n' and lever n^2, the valve k is moved to the position shown in Fig. 7, forming communication between the steam-supply pipe h and the port m, and permitting the steam to pass into the left end of the auxiliary piston-chamber F and to act upon the piston-head f' of the piston f, giving the movement above described, the piston f, after the lead is taken up through the lug s, striking the extension r of the slide-valve d and carrying the slide-valve d and the slide-valve b^3 of the pumping-cylinder with it.

Through the employment of the three different valves, which operate the one after the other, I am enabled to do away entirely with the dead-point, as the tappet-arm moves the primary valve k while the supply-port is still open, and it in turn admits steam to the auxiliary piston f, which by its lead has the initial movement imparted thereto before it moves the slide-valve, the three valves in this way insuring the necessary movements, so that there is no dead-point to the pump; and for that reason the pump can be run with an exceedingly slow movement and a saving of a large proportion of steam be effected. This slow movement of the pump enables me to regulate the same to run at any desired speed and makes the pump especially applicable to the feeding of boilers, because it can be run so slow that it can be kept in continuous operation for the feeding of the boiler and the desired height of water therein be maintained without stopping the pump, which, by maintaining an even height of water, prevents the chilling of the boiler and enables me to maintain an even temperature of the water and of the steam, respectively, therein.

It is obvious that instead of placing the primary valve-chamber G on the top of the auxiliary piston-chamber F it may be placed at the side thereof, and that instead of employing a cylindrical rotary reciprocating valve operated by the tappet and connections therefrom, a slide-valve may be employed for the same purpose. It is also evident that the pump may be operated by compressed air or other fluid under pressure as well as by steam, the valves and ports being proportioned accordingly.

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

1. The combination with a steam-cylinder, of a main slide-valve controlling the ports thereof, a primary tappet-valve operated by tappet connections from the piston-rod, and an auxiliary piston operating the main slide-valve, the steam-inlet communicating with the primary tappet-valve chamber which controls the flow to the auxiliary piston and the auxiliary piston controlling the ports of the main valve-chamber, substantially as set forth.

2. The combination with a steam-cylinder, of a main slide-valve controlling the ports thereof, a primary tappet-valve operated by tappet connections from the piston-rod, and an auxiliary piston moving the main slide-valve, and a single steam-inlet opening into the primary valve-chamber, said auxiliary piston having solid piston-heads and being operated from ports controlled by the primary valve and said piston-heads controlling the ports to the main valve-chamber, substantially as set forth.

3. The combination with a main cylinder A having the piston a, the piston-rod C carrying the tappet-arm c, a rotary reciprocating tappet-valve k operated by connections from the tappet-arm, and mounted in the valve-chamber G, with which the steam-supply pipe communicates, ports m m' leading therefrom to the auxiliary piston-cylinder, which has ports p p' communicating with the slide-valve chamber, the auxiliary piston-valve f mounted in the chamber F and having solid piston-heads, the main slide-valve d in the main valve-chamber, and moved by the auxiliary piston, and controlling the main cylinder-ports a' a^2, substantially as set forth.

4. The combination of the valve-chamber G having ports leading therefrom to the chamber F, and having the steam-supply port h and cushioning-port h^2, rotary reciprocating valve k mounted in the said chamber and having the valve-faces l l' controlling the ports h h^2, and mechanism for moving said valve k, substantially as set forth.

5. The combination of a steam-cylinder A, piston-rod C having the tappet-arm c, valve-chamber G having the rotary reciprocating valve k mounted therein and provided with a valve-stem extending through the cap of the valve-chamber, tappet-bar n having tappets thereon with which the tappet-arm c engages, the bar n' and the lever n^2 connected to the valve-stem, substantially as set forth.

In testimony whereof I, the said JOHN L. MCGIFFIN, have hereunto set my hand.

JOHN L. MCGIFFIN.

Witnesses:
D. L. NULL,
GEO. PLUMER.