G. B. GATES.

VALVE MECHANISM FOR STEAM PUMPS.

APPLICATION FILED APR. 15, 1908. RENEWED MAY 13, 1911.

997,616. Patented July 11, 1911.

2 SHEETS—SHEET 1.

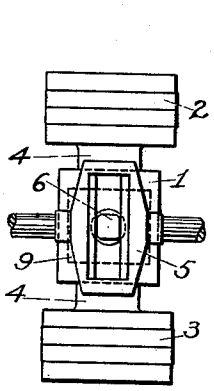

Fig. 3.

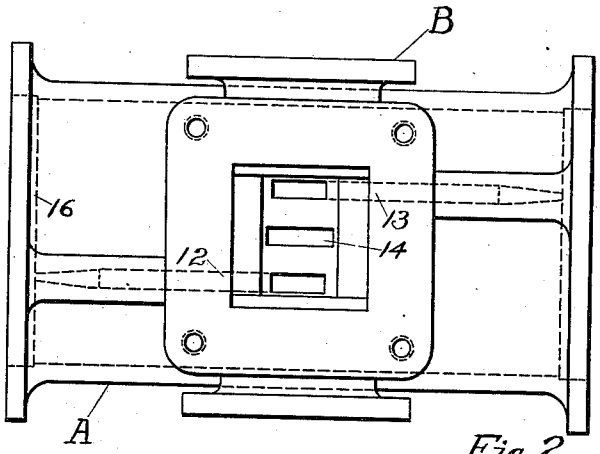

Fig. 2.

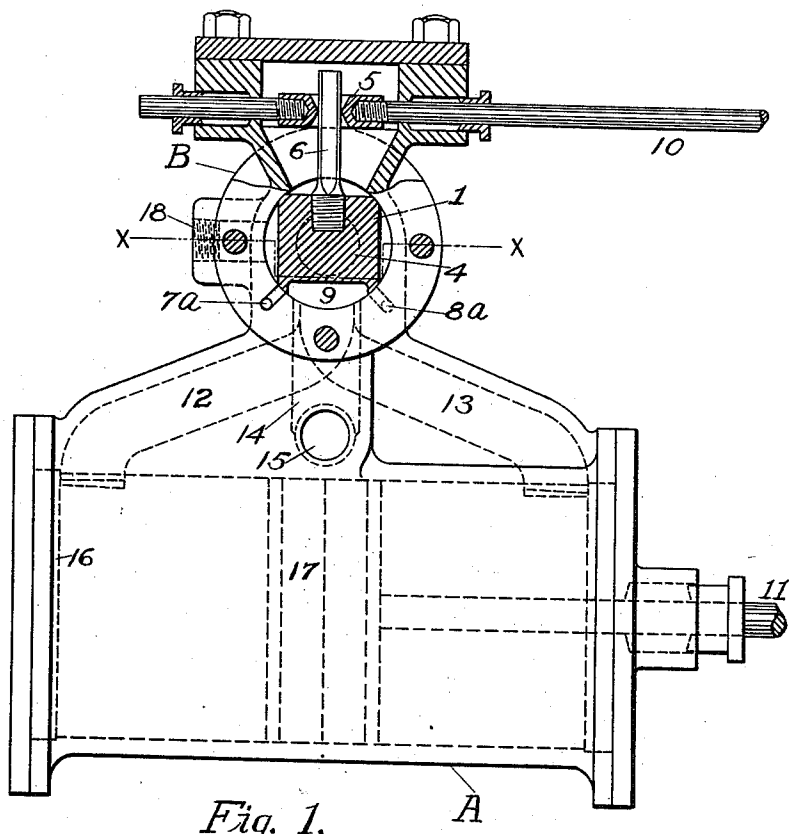

Fig. 1.

Witnesses.

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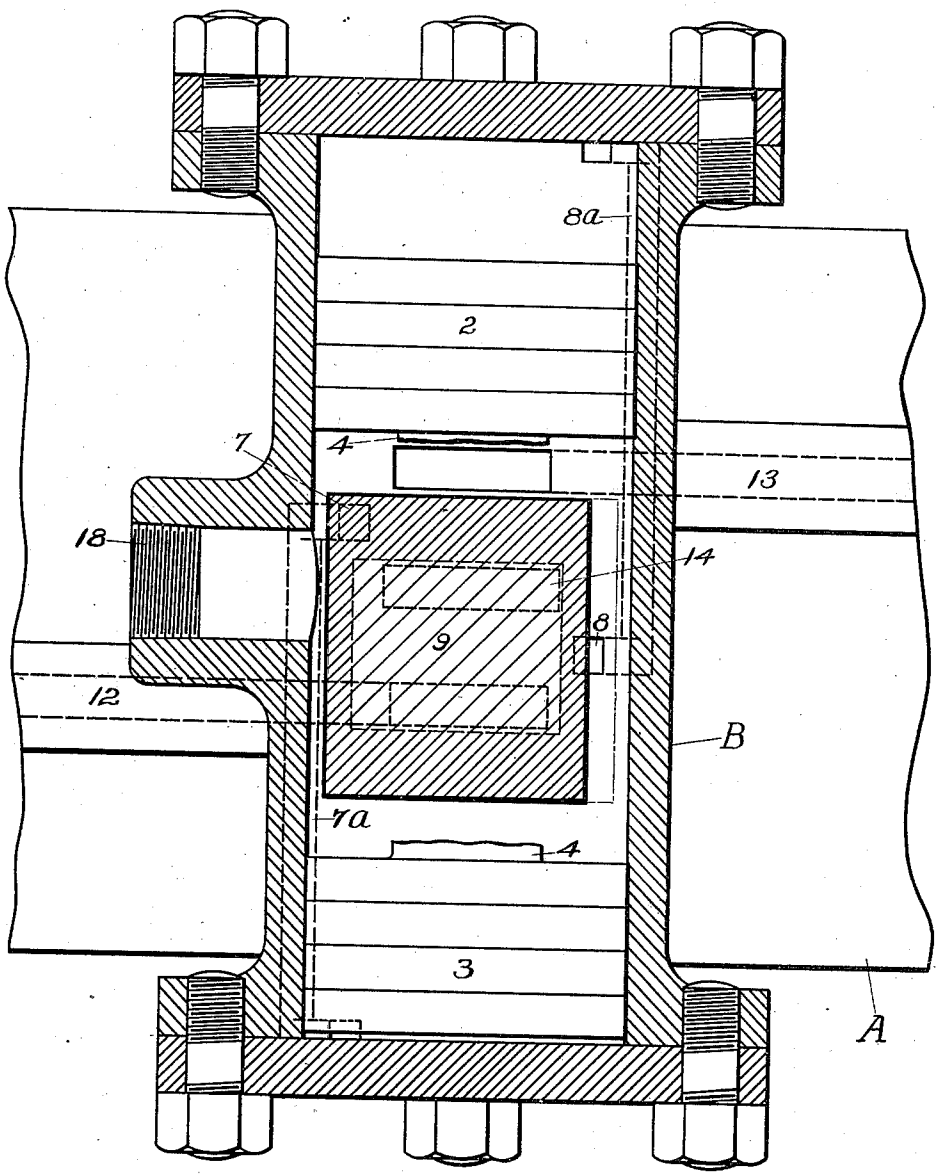

Fig. 4.

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UNITED STATES PATENT OFFICE.

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VALVE MECHANISM FOR STEAM-PUMPS.

997,616. Specification of Letters Patent. Patented July 11, 1911.

Application filed April 15, 1908, Serial No. 427,290. Renewed May 13, 1911. Serial No. 627,076.

To all whom it may concern:

Be it known that I, GEORGE B. GATES, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Valve Mechanism for Steam-Pumps, of which the following is a specification.

My invention relates to improvements in steam pumps and it relates chiefly to the valve mechanism of such pumps. In pumps of this class to which my invention relates, the valve which controls the entrance of the steam to the main steam cylinder is operated by a double headed piston reciprocating longitudinally in a cylindrical steam chest, and carrying the valve for opening and closing the main ports. This double headed piston is itself reciprocated by steam taken from the space between the pistons and conveyed to the ends of the cylindrical steam chest through auxiliary ports controlled by the same valve which controls the main ports, the valve being given a lateral reciprocation mechanically for the purpose of controlling these ports.

The objects of my improvement are, first, to so locate the auxiliary ports that there may be used a simple common form of valve which is easily understood, repaired or renewed without expert knowledge, and having the minimum of face area to perform the necessary functions; second, to provide a mechanism for its operation that will be practically free from sliding friction under pressure, and therefore of great durability, insuring against improper operation due to wear; and, third, to so form and locate the main port openings into the cylinder that cushioning of the main piston ensues upon its rapid approach to the end of its reciprocating stroke. I accomplish these results by the means hereinafter described and claimed.

I illustrate my invention by means of the accompanying drawing, in which is shown a steam pump of the type described, constructed according to my invention.

In the drawing Figure 1 is an end elevation of the valve mechanism with the main cylinder in side elevation and with the valve mechanism in section. Fig. 2 is a plan view of the cylinder stripped of all removable parts. Fig. 3 is a top view of the valve and connecting mechanism and Fig. 4 is an enlarged horizontal section taken on the line X—X of Fig. 1.

In the drawing A represents the main steam cylinder of the pump; 17 the steam piston, 11 the piston rod, B the cylindrical valve chest; 18 the steam inlet; 12 and 13 the main supply ports, leading from the valve chest to the ends of the main cylinder; 14 the exhaust port leading to the exhaust outlet 15, and 16 the counterbore at each end of the cylinder; 2 and 3 are the two heads of the double ended piston which connect with the valve by the cylindrical bosses 4. The above parts are old and well known in such steam pumps and need no further description, my invention residing in the parts hereinafter described.

The valve ends of the ports 12, 13 and 14 are disposed in a line in the center and longitudinally of the cylindrical valve chest and the exhaust port, 14, between the supply ports 12 and 13 as usual. The valve 1, slides longitudinally with the motion of the valve pistons and it is provided on its lower face with an exhaust cavity 9, which alternately connects the supply ports 12 and 13 with the central exhaust port 14. The auxiliary ports which supply the two ends of the cylindrical steam chest with steam are located one on each side of the line of main ports but offset from each other, each of the auxiliary ports being connected by a steam passage with the end of the cylinder farthest from it, for the reason hereinafter stated. As here shown the auxiliary ports 7 and 8 are placed just outside of the line of the main ports and longitudinally so that they are unequally distant from either end of the valve chest and are alternately connected with the steam space of the steam chest and the exhaust cavity 9 in the valve 1 by the lateral movement of the working face which extends along the side of the valve, substantially parallel with the axis of the valve chest. The auxiliary ports are so located that each is alternately over run by the edges of the exhaust cavity at the ends of the valve when at or near the end of its longitudinal stroke. The exhaust space is thus substantially rectangular, the ends being at right angles to the sides as shown in Fig. 4, where the lightly hatched portion of the valve shows the form of the exhaust cavity.

Means are provided for giving a lateral reciprocating or rocking motion to the valve, for the purpose of opening the ports 7 and

8 to the supply and exhaust. As here shown I insert a pin 6 in the upper part of the valve and connect it with valve stem 10, which extends through the casing of the valve at right angles to the axis of the valve chest B. The valve stem may be given a longitudinal motion by the usual reducing motion lever and tappets from a crosshead on the piston rod 11. The connection between the pin 6 and the valve stem 10 is such as to rock or reciprocate the valve laterally and with little friction. As here shown, I provide a yoke 5 which is connected with the valve stem and has a rectangular space through which the pin 6 passes. This space in the direction of the axis of the valve chest is long enough to allow the pin to reciprocate with the motion of the piston longitudinally and laterally it is about the width of the pin, the sides of the space which contact with the pin being cut away or chamfered to reduce the bearing to practically a rolling contact, so that as the yoke rocks the pin there will be no appreciable sliding friction.

The lower ends of the ports 12 and 13, where they open into the main cylinder A, near its ends are oblong in section having their greatest length in the direction of the axis of the cylinder and the width is decreased toward the outer end to effect a gradual reduction of the exhaust area as the piston approaches the end of its stroke. To more perfectly effect the cushioning of the main piston, the ports have their outer termination at the inner end of the counterbore, which constitutes the only outlet for the exhaust after the piston enters the counterbore space.

The operation of my valve mechanism will be readily understood from its construction. As shown in Fig. 4 the valve 1 is at one end of its stroke having opened the main port 13 to the steam space and connected the port 12 with the exhaust port 14 through the exhaust cavity 9. The valve has been rocked to the left by the action of the yoke and pin uncovering the auxiliary port 8 through which steam is being supplied to the farther end of the valve chest, through the steam passage 8^a. The auxiliary port 7 which had been open into the exhaust cavity 9 during the greater part of the longitudinal motion of the valve has been overrun near the end of the stroke by the working face at the end of the valve thus cutting off the exhaust and cushioning the momentum at the end of the stroke. The main piston having approached the end of the stroke, the valve stem 10 throws over the valve in the other direction, the port 7 is opened to the steam, transmitting the steam through the passage 7^a, to the other end of the valve chest, the port 8 is open to the exhaust, and the piston moves in the other direction.

It will be seen that by this construction the valve used is the common and well known form, it has a minimum of wearing surface by reason of using the same edge to control the exhaust from the auxiliary port that is used to control the exhaust from the main ports. The location of the auxiliary ports is easily determined, the cushioning of the pistons 2 and 3 is perfectly effected, the valve is reciprocated laterally without appreciable sliding friction under pressure, and the main piston is effectively cushioned by a simple but effective arrangement of ports.

I claim:—

1. In a valve mechanism for steam pumps, the combination of a valve chest having a line of supply and exhaust ports arranged longitudinally, a double ended piston in said valve chest, a valve carried by said piston having an exhaust cavity of substantially rectangular form, with lateral working edges substantially parallel with the axis of the chest, means for oscillating the valve laterally at the end of each stroke, an auxiliary port connecting with one end of the steam chest, formed at each side of the line of main ports, said auxiliary ports being so placed as to be alternately opened to the steam space and the exhaust space as the valve oscillates laterally, and to be alternately overrun by the ends of the valve at or near the end of its longitudinal stroke.

2. In a valve mechanism for steam pumps the combination of a valve chest having a line of supply and exhaust ports arranged longitudinally, a double ended piston in said valve chest, a valve carried by said piston having an exhaust cavity with lateral working edges substantially parallel with the axis of the valve chest, means for oscillating the valve laterally at the end of each stroke, an auxiliary port formed in the valve chest on each side of the longitudinal and transverse centers, each of said auxiliary ports being connected with the farthest end of the valve chest and so located as to be alternately opened to the steam space and exhaust space by the lateral working edge of the valve, as the latter oscillates, and to be cut off from exhaust by the end of the valve at or near the end of its longitudinal stroke.

3. In a valve mechanism for steam pumps the combination of a steam chest, a double ended piston therein, a laterally rocking valve carried by said piston, main ports being formed in said valve chest, controlled by the longitudinal reciprocation of said valve, and auxiliary ports controlled by its lateral oscillation, a pin projecting from said valve, a valve stem adapted to reciprocate longitudinally of its own axis and a yoke on said valve stem having a substantially rectangular opening embracing said pin and adapted to oscillate the valve laterally.

4. In a valve mechanism for steam pumps the combination of a valve chest, a double ended piston therein, a laterally rocking valve carried by said piston, main ports being formed in said steam chest, controlled by the longitudinal reciprocation of said valve, and auxiliary ports controlled by its lateral oscillation, a pin projecting from said valve, a valve stem adapted to reciprocate longitudinally of its own axis, and a yoke on said valve stem having a substantially rectangular space through which said pin passes, said space having a length sufficient to allow the pin to move through the longitudinal stroke of the piston and a width sufficient to allow contact with the pin on each side, the contacting surface on each side being cut away to present a rolling contact.

In testimony whereof I have affixed my signature, in presence of two witnesses.

GEORGE B. GATES.

Witnesses:
S. W. BATES,
E. H. EDWARDS.