

T. H. BOURKE.
PISTON VALVE.

Patented Feb. 7, 1888.



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UNITED STATES PATENT OFFICE.

THOMAS H. BOURKE, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO WILLIAM H. TEARE, THOMAS R. TEARE, AND JOHN T. BOURKE, ALL OF SAME PLACE.

PISTON-VALVE.

SPECIFICATION forming part of Letters Patent No. 377,599, dated February 7, 1888.

Application filed April 29, 1887. Serial No. 236,558. (No model.)

To all whom it may concern:

Be it known that I, THOMAS H. BOURKE, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented new and useful Improvements in Piston-Valves for Steam-Engines, of which the following is a specification.

My invention relates to duplex connected piston-valves for steam-engines; and the objects of my improvements are to provide for readily and quickly adjusting by expansion the wearing-rings of the connected pistons without the necessity of removing either of the heads of the steam-chest.

The improvement consists in provision for adjusting the piston-heads upon the piston-rod; for adjusting the wearing-rings of each valve-piston from without the steam-chest; for taking up wear and accommodating them to any inequalities in the valve-seat; in provisions for adjusting both piston wearing-rings simultaneously and the same distance, so that each is expanded alike and one not more than the other; in provisions for locking the packing-rings to the piston-heads and the latter to the piston-rod in such manner that the piston-heads are adapted for longitudinal movement upon the piston-rod independent of the piston proper, formed by the wearing-ring and the piston-plates.

The improvement also consists in providing means for evenly spacing the pistons of the valve, so that they will at all times remain in the same relative position to each other upon the valve-rod and will reciprocate within the cylindrical valve-seat at the same distance from each other and in the same track worn in it by them.

These objects are attained by the construction which I will now describe, referring by letters to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a vertical central sectional view of a steam-chest, valve-seat, and a duplex connected piston-valve embodying my invention. Fig. 2 is a side view of the duplex connected piston-valve. Fig. 3 is an edge view of the packing-ring. Fig. 4 is a side view of the same. Fig. 5 is a side view of the expanding

ring. Fig. 6 is an edge view and section of the same. Fig. 7 is an axial sectional view of the piston-head. Fig. 8 is a face view of the piston-head; and Fig. 9 is the adjusting-rod, which fits in the bore of the piston-rod, which itself is shown in elevation in Fig. 10.

The steam-chest, composed of the shell or casing A, the heads A' A², provided with the stuffing-boxes a², and the cylindrical valve-seat B, having the steam-ports a and the exhaust-port b, and the cylinder or bed of the engine C, provided with the steam-ports a' and the exhaust-port b', corresponding with the steam and exhaust ports of the valve-seat, respectively, may be of any approved construction in connection with my improvements.

The valve-rod D extends entirely through the steam-chest and through the stuffing-boxes in its heads A' A², and it is tubular for a portion of its length, the bore d of this tubular portion beginning a short distance from the head A' and extending through to the end of the rod projected beyond the head A². The piston-rod has slots 2 2, which correspond with the position of the adjustable piston-heads 3 and extend through the tubular portion of the piston-rod at right angles to each other, as shown in Fig. 10. The adjusting-rod 4, placed within the bore of the rod D, has transverse openings 5 5, (see Fig. 9,) which correspond with the openings 2 2 in the piston-rod, to permit the passage of the pins or keys e, Fig. 1, which extend through the openings in the piston-rod and in the adjusting-rod and through diameter-openings e', Figs. 7 and 8, in the piston-heads, for locking these parts together and with the expanding rings. The openings or slots 2 in the piston-rod extend in the direction of its length and are considerably longer than the width of the keys e, which fit snugly within the openings e' of the piston-heads, so that the piston-heads and keys move together when the latter are adjusted upon the piston-rod.

The adjusting-rod 4 projects beyond the end of the tubular portion of the piston-rod, and this projected end is threaded and receives the adjusting-nuts 6 and 7 for moving the rod longitudinally relative to the piston-rod and locking it in a fixed position therein. The nut 7

is the adjusting-nut, and the nut 6 is the jam or lock nut.

The piston-heads 3 are conical-shaped and the expanding rings *c*, fitted thereon, are correspondingly conical-shaped on their inner sides. The expanding rings *c* are made in halves and the ends do not come together, so that a space is left between the approximate ends of the halves composing each ring to receive the keys, which are longer than the diameter of the piston-heads, so that their ends which project beyond the conical sides of the piston-heads enter these spaces and prevent these ring-sections from turning about the piston-heads, as seen in Fig. 6. The packing-rings 8, fitted upon the expanding rings *c*, are split and are provided with openings *h*, Fig. 4, preferably formed by notches in the split ends of each ring, which openings receive ribs *g*, projected from the outer surface of one of the sections of the expanding rings, thereby locking the two rings *c* 8 together.

By having the conical piston-heads held upon the piston-rod by means of the keys so that they cannot turn, and by having the expanding rings held from turning by means of the ends of the keys fitting into the spaces between the ends of the ring-valves and the packing or wearing rings held from turning by the ribs upon the expanding rings fitting into the slots or openings *h* in the said wearing-rings, the pistons will have all their parts prevented from turning within the cylindrical valve-seat, so that when the pistons have worn themselves into a seat they cannot be turned and wear out new places, but will remain in the same relative positions in the seat and may be expanded only sufficient to fit them snugly in their old fit.

By having the openings in the wearing-rings formed in the joints of the free ends of the same the ribs upon the expanding rings will serve to form tight joints between the said joints, breaking the same, and will also serve to strengthen the joints, preventing the frictional resistance between the valve-seat and the wearing-rings from dislocating the joined ends of the latter.

The packing and expanding rings are confined between a pair of plates or disks, 9 9, held upon the piston-rod so that the rings can have no longitudinal movement independent of the piston-rod. The piston-heads 3 are located between the plates 9 of each pair and have a limited movement between said plates. The sleeve *J*, mounted upon the piston-rod and located between the inner plates, holds them at a fixed distance apart, and the nuts 10 and 11, screwed upon the piston-rod and bearing against the exterior plates of each pair, hold them in position, as will be readily seen in Fig. 1.

In the event of wear or from other causes the piston-valve works too loosely and it becomes necessary to take up this wear, the nut 7 on the end of the adjusting-rod 4 is screwed up, which draws the said rod out and the

piston-heads keyed therewith, and forces the expanding and packing rings *c* and 8 radially outward. When the desired adjustment is obtained, the jam-nut 6 is turned down upon the nut 7 and locks the bar in position.

The packing-rings are cut so that they may besprung to fit upon expanding seat-rings, and both these rings are wider than the piston-head and are held in fixed relation to each other between the piston-plates 9 9 while the piston-head can be adjusted upon the piston-rod between these plates to expand both the rings *c* and 8.

The valve can be adjusted, if desired, while the engine is running by the means which I have described, and in the employment of such provision the valve is kept tight, steam is saved, and no time is lost in tightening the valve wearing-rings upon their seats, which open into the steam-chest.

The piston-heads proper, it will be seen, are movable upon and in the length of the piston-rod, and are separately inclosed by the plates 9 9 and the expanding rings, while the latter are inclosed by the packing-rings, and the transverse openings 2 in the piston-rod, the transverse openings 5 in the adjusting-rod, and the transverse openings *e'* in the piston-heads are all inclosed by the plates 9 9 and the packing-rings *c* and 8, so that no steam can escape through these openings into the steam-chest. The piston-plates 9 9 are clamped upon the piston-rod, the inner plates upon the abutting ends of the sleeve *J*, and the outer plates against a shoulder, *f*, Fig. 9, on the piston-rod by the jam-nuts 10 and 11; but the piston-heads and their packing-rings are properly fitted and locked to each other before the outer plates are clamped upon the piston-rod. In this fitting of the parts the edges of the packing and adjusting rings have steam-tight joints with the inner sides of the plates 9 9, so that while the piston proper is formed by the packing-rings and the plates these parts also form a closure for the adjustable piston-heads, while the piston-rod forms a closure for the rod by which the piston-heads are adjusted both together upon the piston-rod, each within its respective closure, from the outside of the steam-chest, and secured in such adjustment by a simple lock-nut device.

It will be seen that by having the tubular portion of the piston-rod and the adjusting-rod slotted at right angles the said rods will not be so much weakened as they would be with both sets of slots in the same plane, and the strain upon the adjusting-rod will fall in two planes at right angles to each other, dividing the strain upon the said rod where it is drawn out to tighten the packings, and preventing any binding or twisting of the said rod.

I claim—

1. The combination, with a steam-chest having a cylindrical valve-seat and having stuffing-boxes at its ends in the line of the axis of the seat, of a double-piston valve having its rod

sliding in the stuffing-boxes and having expandible wearing-rings upon the pistons, and a bar extending outside through one end of the steam-chest and provided with means for simultaneously expanding the wearing-rings, as and for the purpose shown and set forth.

2. The combination, with a steam-chest having a cylindrical valve-seat and having stuffing-boxes in its ends, of a double-piston valve within the seat, having its rod sliding in the stuffing-boxes, and having means for expanding its packing-rings from without the steam-chest without opening the latter, as and for the purpose shown and set forth.

3. The combination, with the steam-chest having a cylindrical valve-seat and stuffing-boxes in its ends in the line of the axis of the seat, of a double-piston valve within the seat, having its rod sliding in the stuffing-boxes and formed with the bore extending out through one end and having expandible wearing-rings, and an adjusting-rod in the core of the valve-rod, provided with means for adjusting it longitudinally in the said bore and with means for simultaneously expanding the wearing-rings of the piston by its longitudinal adjustment, as and for the purpose shown and set forth.

4. The combination, with a steam-chest having a cylindrical valve-seat and stuffing-boxes in its ends in the axial line of the seat, of a double piston valve having expandible wearing-rings upon the pistons and having its rod sliding in the stuffing-boxes of the steam-chest and formed with a bore extending from one end to the end of the piston farthest from the hollow end of the rod, an adjusting-rod within the core of the valve-rod having adjusting-nuts at its outer end bearing against the end of the valve-rod, and expanding heads sliding upon the valve-rod within the pistons and the expandible wearing-rings and rigidly connected to the adjusting-rod, as and for the purpose shown and set forth.

5. The combination of a valve-rod having two outwardly-facing shoulders and having screw-threaded portions extending to the shoulders, two inner piston-plates fitting upon the rod with their central apertures, a spacing-sleeve upon the rod separating the inner plates, two outer piston-plates fitted with their central apertures upon the rod and against the faces of the shoulders, and jam-nuts upon the screw-threaded portions of the valve-rod bearing against the outer piston-plates, as and for the purpose shown and set forth.

6. The combination of a valve-rod having two outwardly-facing shoulders and having screw-threaded portions extending to the shoulders, two inner piston-plates fitting upon the rod with their central apertures, a spacing-sleeve upon the rod separating the inner plates, two outer piston-plates fitted with their central apertures against the shoulders of the rod, expandible wearing-rings placed between the piston-plates and forming tight joints with their edges against the facing sides of each pair of piston-plates, and jam-nuts upon the screw-

threaded portions of the rod clamping the outer plates against the edges of the wearing-rings, as and for the purpose shown and set forth.

7. The combination, in a double-piston valve, of the rod, the pistons upon the rod formed by two pairs of plates separated by means of a sleeve upon the rod bearing with its ends against the inner plates and having two expandible wearing-rings placed between the two plates of each pair and having jam-nuts securing the outer plates, and cone-shaped expanding heads sliding within the pistons upon the rod and having means for simultaneously adjusting them within the pistons, as and for the purpose shown and set forth.

8. The combination, with the steam-chest having a cylindrical valve-seat, of a hollow valve-rod having bearings in both heads of the steam-chest, piston-heads loosely mounted upon the piston-rod, an adjusting-rod keyed to the piston-heads and extending outside of the steam-chest, and expandible wearing-rings, as and for the purpose shown and set forth.

9. The combination of a hollow valve-rod having transverse slots, truncated conical piston-heads longitudinally movable upon the rod, an adjusting-bar longitudinally movable within the bore of the rod and having keys sliding in the slots of the rod and secured to the piston-heads and having means for adjusting it in the bore of the rod, and expandible packing or wearing rings, as and for the purpose shown and set forth.

10. The combination, with a valve-rod, plates fixed upon the rod, and expanding and wearing rings held between the plates, of a truncated conical piston-head mounted longitudinally adjustable upon the valve-rod between the plates, as and for the purpose shown and set forth.

11. The combination, with a valve-rod, truncated conical piston-heads loosely mounted and longitudinally adjustable upon the rod, and expandible wearing-rings, of an adjusting-bar keyed to the piston-heads and having means for longitudinally adjusting and locking it, as and for the purpose shown and set forth.

12. The combination of a valve-rod having a tubular end portion provided with transverse slots, an adjusting-bar within the rod and having openings corresponding with the slots, adjusting and lock nuts upon the end of the bar, truncated conical piston-heads, divided expanding rings, keys passing diametrically through the piston-heads and through the slots in the rod and openings in the bar and having their ends projecting between the ends of the divided expanding rings, and split wearing-rings upon the outside of the expanding rings, as and for the purpose shown and set forth.

13. The combination of a valve-rod having a tubular end portion formed with transverse slots, two pairs of plates upon the rod, a sleeve interposed upon the rod between the two pairs of plates, nuts securing the outer plates, an adjusting-bar within the rod and having openings corresponding with the slots, adjusting

- and locking nuts upon the end of the bar, truncated conical piston-heads, divided expanding rings, keys passed diametrically through the piston-heads and through the slots in the rod and openings in the bar and having the ends projecting between the ends of the divided expanding rings, and split wearing-rings upon the outside of the expanding rings, as and for the purpose shown and set forth.
- 10 14. A slide-valve consisting of two pistons, each composed of a packing-ring, an expanding ring, a conical piston-head, and inclosing-plates secured upon a hollow valve-rod and
- 15 15. The combination, in a double-piston valve, of a valve-rod made hollow with longitudinal slots in planes at right angles to each other, an adjusting-rod within the valve-rod having openings corresponding to the slots and having means for longitudinally moving and
- 20 16. In an expansible piston-valve, the combination of a split packing or wearing ring and a slot in one side with an expanding ring having a rib upon one side fitting into the slot of the wearing-ring, as and for the purpose shown and described.
- 25 17. In an expansive piston-valve, the combination of a split packing or wearing ring having its ends notched to form a slot, with an expanding ring having a rib upon one side fitting into the slot formed by the notches locking the ends of the ring and closing the joint, as shown and described.
- 30 18. In a piston-valve for steam-engines, the split packing-ring 8, having its ends notched, as at *h*, and the two-part ring *c*, of wedge shape in cross-section, one part whereof has the outer surface rib or projection, *g*, in combination with the conical piston-head 3, having a diameter-opening, *e'*, the hollow piston-rod *D*, having the cross-slot 2, the rod 4, having the cross-slot 5, the locking-key *e*, and the adjusting and locking nuts 7 6, placed upon the rod 4 exterior to the steam-chest against the exterior hollow end of the piston-rod, substantially as described, for the purpose specified.
- 35 40 45 50 55 60

17. In an expansive piston-valve, the combination of a split packing or wearing ring having its ends notched to form a slot, with an expanding ring having a rib upon one side fitting into the slot formed by the notches locking the ends of the ring and closing the joint, as shown and described.

18. In a piston-valve for steam-engines, the split packing-ring 8, having its ends notched, as at *h*, and the two-part ring *c*, of wedge shape in cross-section, one part whereof has the outer surface rib or projection, *g*, in combination with the conical piston-head 3, having a diameter-opening, *e'*, the hollow piston-rod *D*, having the cross-slot 2, the rod 4, having the cross-slot 5, the locking-key *e*, and the adjusting and locking nuts 7 6, placed upon the rod 4 exterior to the steam-chest against the exterior hollow end of the piston-rod, substantially as described, for the purpose specified.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

THOMAS H. BOURKE.

Witnesses:

S. Q. KERRUSH,
W. S. KERRUSH.