(No Model.)

N. G. HERRESHOFF.

STEAM ENGINE VALVE.

No. 280,312. Patented June 26, 1883.

Fig: 1.

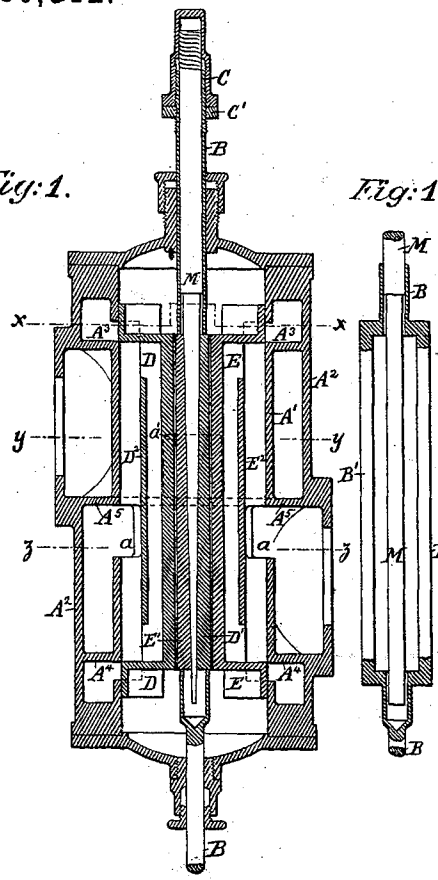
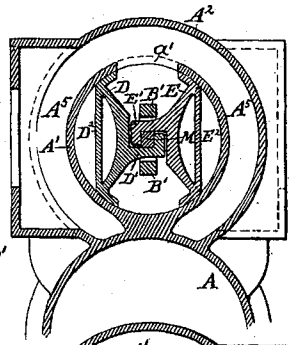


Fig: 1ª

Fig: 3.



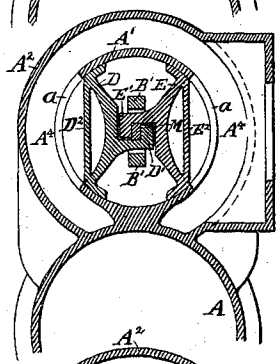
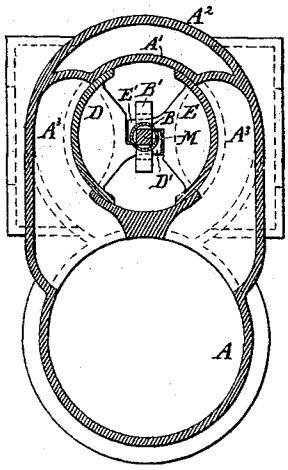


Fig: 4.

Fig: 2.



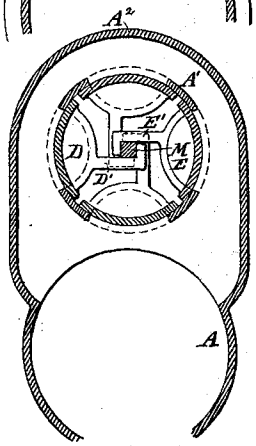


Fig: 5.

Witnesses:
M. F. Boyle.

Inventor:
Nathaniel G. Herreshoff

By his Attorney: Simon D. Peterson

UNITED STATES PATENT OFFICE.

NATHANIEL G. HERRESHOFF, OF BRISTOL, RHODE ISLAND, ASSIGNOR TO THE HERRESHOFF MANUFACTURING COMPANY, OF RHODE ISLAND.

STEAM-ENGINE VALVE.

SPECIFICATION forming part of Letters Patent No. 280,312, dated June 26, 1883.

Application filed January 5, 1883. (No model.)

To all whom it may concern:

Be it known that I, NATHANIEL G. HERRESHOFF, of Bristol, in the county of Bristol and State of Rhode Island, have invented certain new and useful Improvements in Steam-Engine Valves, of which the following is a specification.

I have devised a form and arrangement of slide-valve and of passages whereby the pressure of the steam on one valve or part is caused to balance that on a corresponding valve or part arranged opposite thereto. I will describe the invention as having only two valves or parts thus balanced, and as working within a chamber which is cylindrical; but there may be four or other desired number, and they may work within a chamber which is of rectangular or octagonal form in cross-section, if desired. I provide for delicately adjusting the conditions by means of a very slightly tapering wedge, arranged not to force apart but to draw together the valves or parts. When this wedge is too much withdrawn the steam forces the valves apart and causes them to press tightly on their respective seats. By forcing the wedge inward they are drawn together and the friction on the seats is relieved. I provide easy means for adjusting the wedge with great delicacy. It may be adjusted while the engine it running. I construct the parts so braced that they will avoid springing under the great strains to which they are subjected.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a central vertical section through the valve and its immediate connections. Fig. 1ª represents the operating-yoke and adjusting-wedge detached. It is an elevation partly in section at right angles to the view in Fig. 1. Fig. 2 is a horizontal section on the line *x x* in Fig. 1. Fig. 3 is a horizontal section on the line *y y* in Fig. 1. Fig. 4 is a horizontal section on the line *z z* in Fig. 1. Fig. 5 represents a modification. It is a horizontal section in a plane corresponding to *x x* in Fig. 1.

Similar letters of reference indicate like parts in all the figures.

A is the main cylinder, in which works the main piston. (Not represented.) Parallel to this is a peculiarly-constructed casing of cast-iron or other suitable material, which is cast in one therewith or firmly bolted thereto, the whole being designated by A, with additional marks of reference, as A′ A², &c.

A′ is a cylindrical shell, smoothly finished on its inner face and provided with apertures, as will appear further on. In its interior two smoothly-finished valves are moved longitudinally by the action of the engine, communicated through suitable valve-gear. (Not represented, but which may be the ordinary link-motion.)

The valve-stem is marked B, certain portions being designated, when necessary, by additional marks of reference, as B′. The stem B is finished round and smooth where it passes out through suitable stuffing-boxes. Its upper end is hollow, and receives a wedge, M, which extends out through the upper end of the stem B, and is finished with a left-handed screw-thread. The upper end of the stem B has a right-handed screw-thread.

C is a thumb-nut adapted to engage both the left-hand screw-threads on M and the right-hand screw-threads on B. By turning it one way and the other the right and left threads shift the wedge M up and down relatively to the stem B, while both B and M are actively reciprocated endwise, giving a corresponding motion to the valves D and E. The reciprocating motion is communicated to the latter by the square internal shoulders of the yoke B′. The outer sides or faces of the valves D and E are accurately finished to match steam-tight against the interior of A′. The parts D and E, which I will continue to term "separate" valves, although they work together as a single valve, are each formed with a stout rib, D′ E′, of L-section, extending up and down near the center of its back. The wedge M stands between these ribs, as plainly indicated in Figs. 2, 3, and 4. The surface being finished so that the inclined sides of the long and tapering wedge M apply fairly, one side against the L part or hook part on the rib D′ and the other inclined side against the L part or hook part of the rib E′.

Exterior to the cylindrical casing A′ is a casing, A², which is approximately cylindrical. The space between the inner shell, A′,

and the outer shell, A^2, is divided by three horizontal partitions. The upper one is marked A^3, the lowest one A^4, and the middle one A^5. The space above A^3, at the upper end, communicates with the upper end of the steam-cylinder A. The space below the bottom partition, A^4, communicates with the bottom of the main cylinder A. Two narrow ports are formed through the shell A′, above the partition A^3. Two similar ports are formed below the partition A^4. The tight-fitting faces of the valves D and E are, by the action of the engine, communicated through the rod B and yoke B′, moved alternately above and below these ports. The interior of each end of the inner shell, A′, is kept filled with steam. The faces of D and E are hollow-throated, and receive the exhaust-steam from the ports and convey it away. The space between the partitions A^3 and A^5 is kept filled with steam from the boiler. The space below A^5 and between it and A^4 is in free communication with the exhaust-pipe. The hollow throats of the valves D and E communicate with the space below A^5 through ample passages *a*. The spaces at the ends of the valves D and E, and the spaces between the latter surrounding the webs D′ E′ and surrounding the yoke B′ and the wedge M, are supplied with steam from the space above A^5 through an ample passage, *a′*. (Shown in strong lines in Fig. 3 and in dotted lines in Fig. 1.) The pressure of the steam between the valves D and E tends to force them apart and to press each with great violence against its respective side of the interior of the shell A′. This force is resisted by the wedge M engaging and fitting fairly against the continuous offsets or hooks of the respective parts D′ E′.

In starting the engine the first time it is well to have the wedge M rather too highly elevated, so as to let the valves D and E bear too forcibly against their respective seats on the interior of the shell A′. This involves great friction, but need be endured only a few strokes, the throttle-valve (not shown) being opened slightly, so as to give but a moderate pressure of steam and induce only a slow movement of the engine. The nut C is turned by hand or otherwise to force down the wedge M and haul both valves slightly away from their seats. A little practice shows, by following the sound, when the valves are just sufficiently lifted from their seats to make them go easily. Then the throttle is opened wider, giving full pressure either suddenly or gradually, and if the wedge M requires any further adjustment up or down it is done. Then a jam-nut, C′, is tightened up against C, and the valves are held as thus adjusted, balancing each other and moving with just steam-tight contact with their seats. My experiments indicate that the friction and wear will be very slight. The great area of opening obtained is very desirable for quick-working engines.

The hollow throat of each valve D and E is formed with a straight tie across, as indicated by D^2 E^2. These greatly stiffen the valve and allow it to withstand a high pressure without changing its form. It is made with the openings, and especially with a liberal opening near each end, which allow the exhaust-steam to circulate freely. The construction affords very liberal passages for the steam to traverse without wire-drawing.

Modifications may be made in the forms and proportions. I can make the inner casing, A′, square instead of cylindrical. In such case the faces of the valves D and E would be plane, and would correspond in appearance as well as in function to the ordinary hollow-throated flat slide-valve. I can employ more than two valves, D and E. I propose in large engines to employ four. Fig. 5 is an outline showing such modification. It is taken on a line corresponding to *x x* in Fig. 1. In such modification the ribs corresponding to D′ E′ cannot be continuous, but will be replaced by hooks which extend out at intervals along the backs of the several valves and engage with the wedge M. The wedge M in such modification should taper in both directions. In other words, it should have no parallel faces such as are shown in Fig. 1^a, but both views of the wedge would show the tapered outline indicated in Fig. 1. I have shown the four valves occupying so large a portion of the circumference that there is not so much space for the steam to flow to each end from a central connection. I prefer to branch the steam-pipe (not shown) and lead a branch to each end of the casing. Hooks at intervals, instead of continuous webs, may be employed when we have only two valves, D and E. In such case the wedge M may be tapered rapidly at the points where it is in contact with the hooks, and may have parallel surfaces or a form devoid of taper at the intermediate point.

I claim as my invention—

1. The nut C, having right and left hand threads, the wedge M, having one thread, and the sleeve B, having the other thread, corresponding with said threads in the nut C, in combination with each other and with the yoke B′ and valves D D′ E E′, and securing means C′, arranged for joint operation relatively to each other and to the stuffing-box around the sleeve B, substantially as herein specified.

2. In a steam-engine, the valves D and E, of large area, balanced, as shown, by each other, and each formed with a hollow throat braced across by a rigid tie, as D^2 E^2, to avoid the springing of the metal under the strain, as herein specified.

3. In combination with the main cylinder A of a steam-engine, the casings A′ A^2, arranged as shown, and provided with the transverse partitions A^3 A^4 A^5, adapted to serve with valves D E, as and for the purposes herein specified.

4. In combination, the main cylinder A, parallel casing A′, exterior casing A^2, trans-

verse partitions A^3 A^4 A^5, two or more separate valves, D E, with their engaging ribs or hooks D′ E′, wedge M, yoked valve-stem B B′, and means, as C C′, for adjusting and firmly securing the adjustment of the balancing force, all arranged for joint operation as and for the purposes herein specified.

In testimony whereof I have hereunto set my hand, at Bristol, Rhode Island, this 28th day of December, 1882, in the presence of two subscribing witnesses.

NATHL. G. HERRESHOFF.

Witnesses:
JOHN F. SMITH,
P. SKINNER, JR.