

(No Model.)

2 Sheets—Sheet 1.

F. W. RICHARDSON.  
BALANCED SLIDE VALVE.

No. 266,721.

Patented Oct. 31, 1882.

Fig. 1.

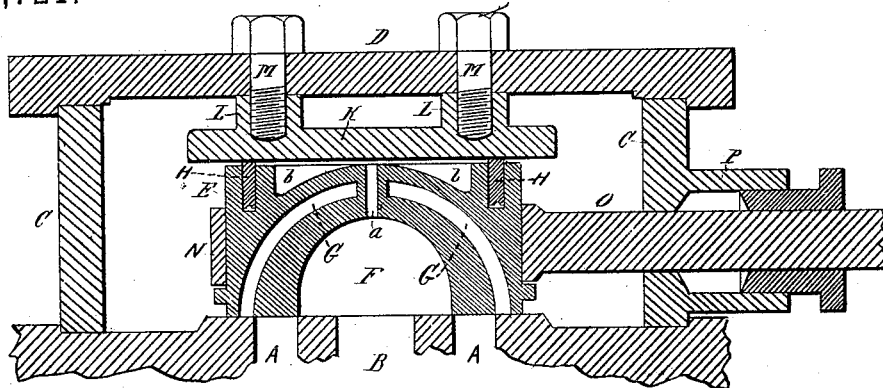


Fig. 2.

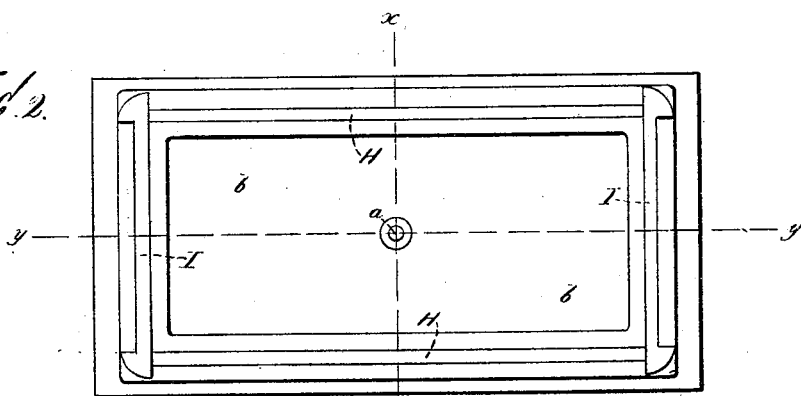
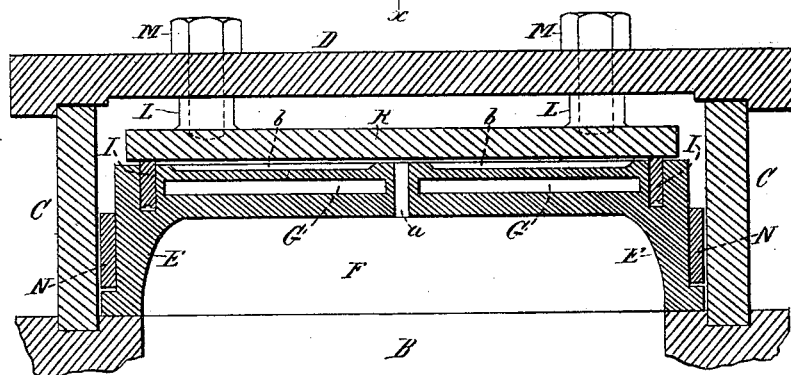


Fig. 3.



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(No Model.)

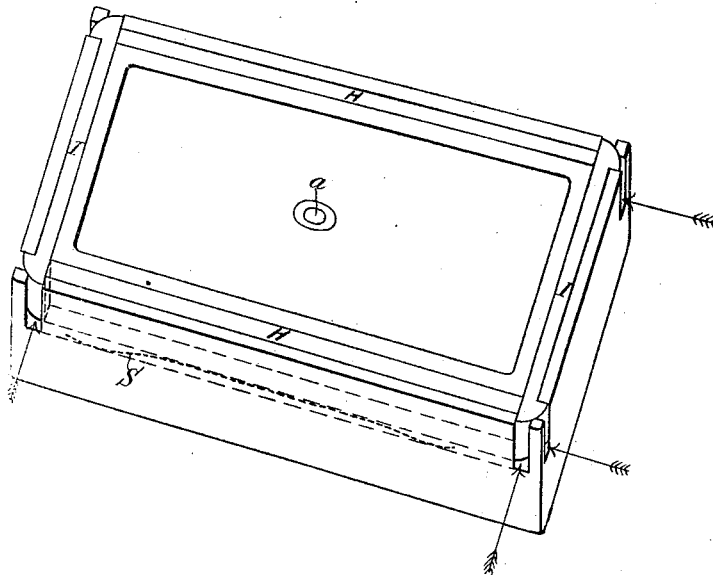
2 Sheets—Sheet 2.

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FIG. 4.



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# UNITED STATES PATENT OFFICE.

FRED W. RICHARDSON, OF TROY, NEW YORK.

## BALANCED SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 266,721, dated October 31, 1882.

Application filed August 16, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, FRED W. RICHARDSON, of Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Balanced Valves for Steam-Engines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention has relation to slide-valves for steam-engines; and among the chief objects of my said invention are the production of a simple, cheap, and efficient valve, which shall afford a high initial pressure of steam in the cylinder at the commencement of the stroke of the piston, at the same time require a reduced travel of the valve necessary to accomplish its work, be effectually balanced against the pressure of live steam in the steam-chest, whereby the amount of wear is reduced, and setting of the valve for the "cut-off" rendered easy, be capable of use in any situation where the ordinary D-valve is now employed, and be efficient in operation without "wire-drawing" when cutting off short.

To accomplish these objects my improvements involve certain novel and useful peculiarities of construction and relative arrangements or combinations of parts, all of which will be herein first fully described, and then pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical section through the steam-chest and adjacent parts of the cylinder upon a plane through the axis of motion of the valve in the direction of line *xx* of Fig. 2. Fig. 2 is a plan view of the upper part of the valve; and Fig. 3 a sectional view upon a plane at right angles to that of Fig. 1, through line *yy* of Fig. 2, showing the steam-chest and adjacent parts of the cylinder. Fig. 4 is a perspective view of the valve detached, showing the passages by which steam enters the space beneath the packing-strips, and indicating by dotted line one form of spring which may be employed in connection with said strips. These figures illustrate the construction and arrangements of the valve and its appendages constructed in accordance with my improvements, and in all the figures like letters of reference, wherever they occur, indicate corresponding parts.

A A are the inlet-ports leading to the cylinder, and B is the exhaust-port.

C C are the walls of the steam-chest, erected upon the cylinder, and these, with the top plate, D, inclose the valve.

The valve E is in general form like any ordinary slide-valve, and is provided with the usual exhaust-cavity, F, but differs from the ordinary valve in having a supplemental steam port or channel, G, cored out between the exhaust cavity and the exterior or wall of the valve-shell. The valve and valve-seat are so proportioned with respect to each other that when the steam-port in the cylinder begins to open past the edge of the valve the edge of the supplemental port G also opens past the edge of the valve-seat. Thus a port of double the area of that afforded by the ordinary slide-valve is obtained, insuring a high initial pressure of steam in the cylinder at the commencement of the stroke of the piston, and this with a reduced travel of the valve. These features are very important upon high-speed engines, as upon locomotives, inasmuch as in "cutting off" short the opening of the ports is greatly reduced, thus obviating wire-drawing of the steam, which is a common disadvantage. As the valve continues to travel the port will continue to open until the valve commences to move in the opposite direction, when this port begins to close; but during the time the port has remained open it has had a double port-opening to the position where the valve is traveling short or "linked up."

In designing the valve for any engine care should be taken to lay out the valve and seat so that steam may not blow through the supplemental port into the exhaust when the valve is at its extreme limit of travel in either direction. The valve with the supplemental port is necessarily heavier than the common valve, and the increased size of the ports also causes an increase of friction. To obviate this it becomes important to effectually balance the valve against pressure of steam in the steam-chest, and this I accomplish in a convenient, simple, and effective manner by cutting four channels in the top of the valve, (being careful not to cut through into the supplemental port,) two on the sides and two at the ends for the reception of four independent strips of cast-iron.

(Shown at H H I I.) For the accommodation of these packing-strips, and to obviate cutting through into the supplemental steam-port, a square frame is cast on the upper part of the valve, as shown. This frame increases the general height of the valve, and in it are cut the grooves or channels which receive the packing-strips. The longer strips H H are plain rectangular pieces; but the shorter strips I I are made with gib-shaped ends to retain them in place. All the strips may be provided with light springs, as at S, Fig. 4, to hold them against the balance-plate when steam is shut off.

Beneath the cover or top plate, D, is located the balance-plate K, against which the packing strips H H I I are made to wear. This balance-plate has a plane under surface of sufficient area to cover the space inclosed by the packing-strips at all positions of the valve, and is preferably secured by use of the hollow studs L L and the bolts M M, passing through the top plate and entering the studs; but obviously in some instances the balance-plate might be otherwise bolted to the top plate or cover or might be cast directly therewith.

Steam from the steam chest has access to the under sides of the packing-strips and forces them at all times during use of the engine snugly up against the balance-plate, thus effectually excluding live steam from the rectangular space inclosed by the said packing-strips. The valve will thus be relieved of an enormous down-pressure, equivalent to the pressure of the steam in the steam-chest upon an area equal to that inclosed by the strips, and may thus move more easily and quickly and with less friction than otherwise and be more easily shifted to afford the required cut-off. The valve will be balanced to the extent of the surface inclosed by the strips. The packing-strips are held in steam-tight contact with the inner surface of the grooves or channels, planed to receive them, (as well as with the balance-plate,) by direct steam-pressure, the joint being made complete by the abutting of the ends of the long sections against the inner surfaces of the gibbed sections at the four corners.

The upper part of the valve is slightly dished, as plainly shown in Fig. 3, and the shallow chamber *b*, thus formed between it and the balance-plate, communicates with the exhaust-cavity through a small perforation, *a*, always open, (but not opening into the supplemental port.) This perforation relieves the top of the valve of any pressure due to steam which may escape past the packing-strips, and it also presents this area of the valve (inclosed by the packing-strips) to the atmosphere *via* the exhaust-pipe. The wall of the perforation *a* extends up to a level with the top of the valve.

When running with steam shut off (as in the case of the locomotive) the partial vacuum in the steam-chest causes the valve to hug the balance-plate, and thus closes the perforation *a* against admission of foreign matter—as dust, &c.—which might otherwise be drawn into the cavity *b*, to the detriment of the packing. N represents a yoke, by which the valve is moved through the medium of the valve-rod O passing through a stuffing-box, P.

The valve constructed and arranged substantially in accordance with the foregoing explanation has been found in practice to admirably answer the several purposes and objects of the invention, as previously stated.

I do not claim a balanced valve or packing-strips in a valve for effecting the balancing; nor do I claim a supplemental steam-port, broadly, in a steam-engine valve. I am aware that these features, when separately considered, have before been explained.

I am also aware that in a balanced valve a channel for exhaust-steam has been cored out around the ordinary exhaust-cavity, which channel does not carry live steam, and is not arranged to operate in connection with the steam-ports, so as to afford the supplemental supply of live steam, after the manner above explained. The supplemental port shown herein in connection with my improved valve must be so located that it will take and conduct live steam from the valve-chest in the manner and at the times as above set forth.

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

1. In combination with the supplemental port, a balancing device, and an exhaust-cavity in a valve for steam-engines, the perforation or channel connecting the exhaust with the shallow chamber on top of the valve, said perforation being made through a centrally-located stud, substantially as and for the purposes set forth.

2. The combination and arrangement of the slide-valve having the supplemental channel for conveying live steam in the manner explained, the four packing-strips located in grooves cut in the top of the valve, the central perforation connecting the exhaust-cavity, and a shallow chamber formed in the top of the valve, and the balance-plate, substantially as shown and described.

In testimony that I claim the foregoing I have hereunto set my hand in the presence of two witnesses.

FRED W. RICHARDSON.

Witnesses:

WM. W. TURNER,  
E. H. VAN DEUSEN.