

J. C. BRYAN.  
Balanced Slide-Valves.

No. 205,723.

Patented July 9, 1878.

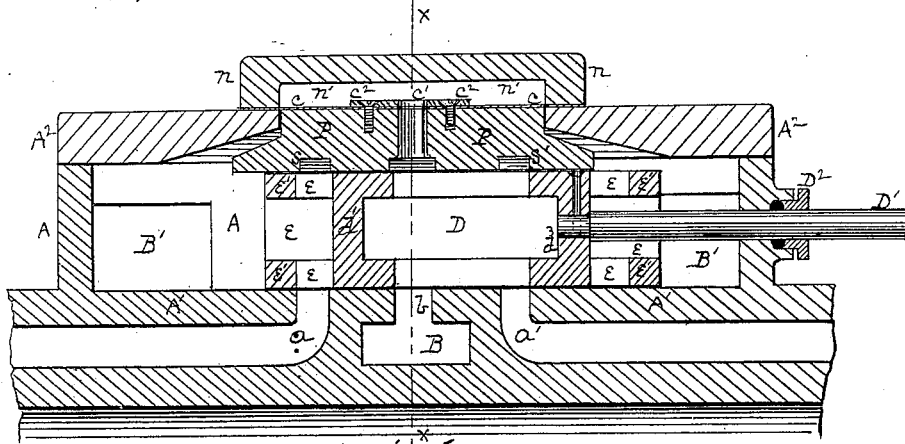


Fig. 1.

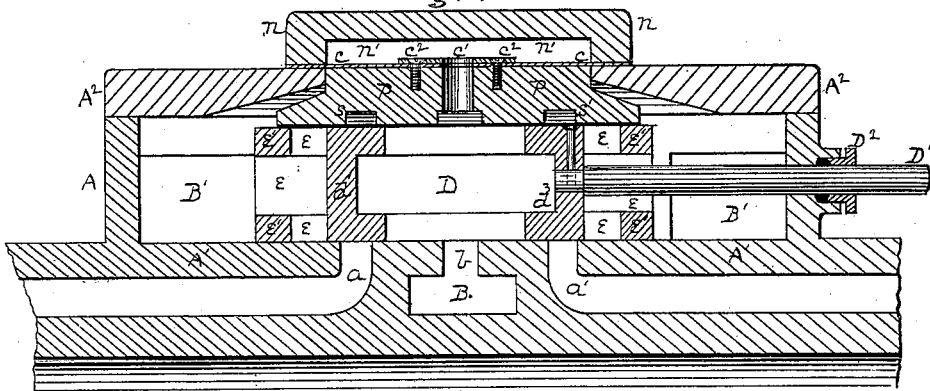


Fig. 2.

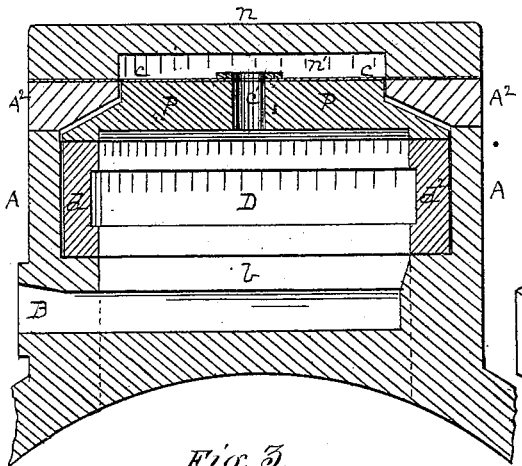


Fig. 3.

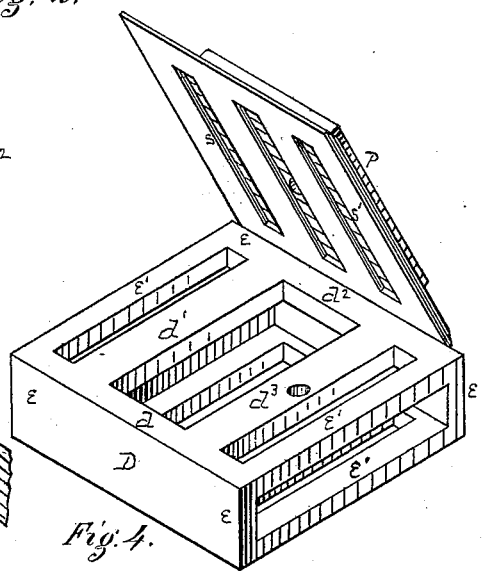


Fig. 4.

Witnesses  
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# UNITED STATES PATENT OFFICE.

JOHN C. BRYAN, OF TITUSVILLE, PENNSYLVANIA.

## IMPROVEMENT IN BALANCED SLIDE-VALVES.

Specification forming part of Letters Patent No. **205,723**, dated July 9, 1878; application filed April 29, 1878.

*To all whom it may concern:*

Be it known that I, JOHN C. BRYAN, of Titusville, county of Crawford, and State of Pennsylvania, have invented or discovered a new and useful Improvement in Balanced Slide-Valves; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing, making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a longitudinal vertical sectional view of a steam chest, valve, and ports, illustrative of my improvement. Fig. 2 is a like view, showing the valve in a different position relative to its ports. Fig. 3 is a cross-section in the plane of the line *x x*, Fig. 1; and Fig. 4 is a detached view, in perspective, of the valve, and showing the lower face of the relief or balancing plate.

The side walls of an ordinary steam-chest are shown at *A*, the bottom at *A*<sup>1</sup>, and the top plate at *A*<sup>2</sup>.

The steam-ports *a a'*, of the usual or any known construction, lead to the opposite ends of the cylinder. Steam is admitted from the steam-generator at *B*, and passes into the valve by the port *b*. The live steam admitted by this port passes alternately by ports *a a'* to the cylinder, and the exhaust-steam goes into the steam-chest and out by the exhaust-ports *B' B'*.

My improved valve *D* has a middle part, open at top and bottom, but inclosed laterally all around by walls *d d<sup>1</sup> d<sup>2</sup> d<sup>3</sup>*. Thus far the valve is believed to be old. Above it is a relief or balancing plate, *P*, having rabbeted edges, as shown, which underlie the edges of a hole made in the top plate *A*<sup>2</sup> of the steam-chest. The upper face of the balancing-plate *P* is, by preference, made so as, in its usual position, to be about flush with the upper or outer face of the steam-chest cover, so as to permit of the use of a flexible gasket or plate, *c*, which overlaps the joints, and is secured at its edges outside the joints by a cover, *n*, chambered out on its under side, as at *n'*. The gasket *c* consists of a thin plate of copper, or other suitable material, and its elasticity is such, and the construction of the plate *P* is such, that the latter may have a slight vertical motion of, say, the one-sixteenth of an

inch, more or less. A hole, *c*<sup>1</sup>, is made centrally through the balancing-plate *P* for the admission of live steam to the chamber *n'*, and the gasket is fastened down around the hole by a washer and screws, as shown at *c*<sup>2</sup>.

The parts described are so proportioned that the area of surface on the under side of the balancing-plate *P* subject to steam-pressure through the open top of the valve shall be somewhat less than the area of its upper surface included within the chamber *n'* subject to downward steam-pressure, so that, in the manner well known in the art, the valve will be held down to its seat with the proper degree or amount of force or pressure. The rules governing this are too well known to skilled engine-builders to need further statement.

Further features of improvement are designed to obviate certain practical difficulties, which I have found to exist in this class of balanced valves. First, when the valve begins a stroke either way, one foot or lower face of the valve commences to cut off the supply of live steam to one end of the cylinder. While that part of the valve is passing that particular port, the expansive force of the steam, acting back through the port, tends to lift that end of the valve and thus tilt it on its transverse axis, thus causing it to leak and subject the gasket *c* to an irregular breaking-strain. To remedy this, I lengthen the valve *D* by extending its side walls at each end, as at *e*, and, by preference, connect the extreme upper and lower faces of the end extensions *e* by means of cross-bars *e'*, and make the upper face of the upper bar and extension and the lower face of the lower bar and extension preferably in the plane of the upper and lower valve-faces, respectively.

The extensions thus formed bear on the valve-seat below while the valve is subjected to the lifting effect referred to on the balancing-plate above, or on the extended edge of the same, and outside of the vertical plane of the upward pressure. Such extension of the valve, in its relation to the bearing-surfaces, has the effect to prevent or lessen the tilting referred to, in accordance with principles of leverage well understood in mechanics.

Another practical difficulty which I obviate results from the upward pressure of the valve

ends, already referred to, against the ends of the balancing-plate, which, in addition to evils already mentioned, causes undue friction and cutting at such points. To prevent or lessen this, I pack or cushion the upper faces of the valve ends while passing the ports on return strokes by means of live steam. For this purpose I make recesses  $s s'$  in the lower face of the balancing-plate P, one directly over the mouth of each port  $a a'$ , and of about the same area.

As shown in Fig. 1, while the port  $a'$  is taking steam the recess  $s'$  will also be filled with live steam, or steam under expansion. As the valve makes its return stroke and comes to the position shown in Fig. 2, it will cut off steam from  $a'$ , and also will confine a small quantity of live steam in the recess  $s'$ , the effective downward pressure of which will nearly or exactly counterbalance the upward pressure of steam against the bottom of the valve through the port  $a'$ . Hence the effect of back-pressure on the valve-foot will be wholly eliminated, or, by lessening the area of the recess, partially so, as may be preferred. Also, by enlarging such recess and giving the top of the valve a greater lap thereon, a slight preponderance of downward pressure can be secured, when desired. After the valve passes the recess, the steam confined therein goes to the exhaust. The same operation takes place at the other end of the valve on its return stroke, and so on alternately.

While the balancing device thus described is sufficiently secure in its place, and, by its connections, to perform with certainty the objects sought, it is also so far free of bolts, clamps, or interlocking parts as to adapt itself readily to all the varying conditions of use. For example, if it be necessary to reverse the engine while taking steam at either end, danger of accident will be materially lessened, from the fact that under the excessive pressure resulting therefrom the valve or balancing-plate, or both, may lift or yield sufficiently to allow of enough leakage of steam to prevent explosion or other injury.

Other appliances, as usual with slide-valves, are to be added, such as valve-stem  $D^1$ , stuffing-box  $D^2$ , and also other desired devices, not usual, may be added.

The terms "top" and "bottom," "upper" and "lower" are used herein in a relative sense, so that I do not limit myself in the invention to a horizontally-working valve arranged in a valve-chest on the upper side of a cylinder.

The object of rabbeting the edge of the balancing-plate is, in part, to limit the possible upward movement of the plate, and partly to lessen the possible limit of its tilting motion, and at the same time render the construction more compact.

The slide-valve shown and described also

differs from other valves in other respects of like construction, in that the steam is exhausted endwise between the cross-bars, which, as shown, constitute a part of the end extension.

I make no claim of exclusive right to anything shown or described in either of the patents granted to John Baird, April 5, 1864, or George Rieseck, March 31, 1863.

In my improvement it will be observed that the end extension of a vertically-moving balancing-plate, in combination with the end extension of the valve, presents both novelty and utility in a patentable sense, since the plate thereby better prevents the lifting of the end of the valve, while the balancing effect is still secured.

I claim herein as my invention—

1. The balancing-plate P, working like a piston, with a slight range of motion, through a hole in the top plate of the steam-chest, and with its lower surface underlying the edges of the hole in the top plate, in combination with a slide-valve having a bearing-extension at each end beyond the valve-foot proper, whereby the balancing-plate, while free to perform its function as such, also bears on the whole, or nearly the whole, upper surface of the valve when the latter is at the ends as well as at the middle of its stroke, substantially as set forth.

2. The balancing-plate P, working in the top plate of the steam-chest, as described, and overlapping the end extensions of the valve, as described, and having a steam-port through or past the same, in combination with a flexible gasket to cover the joint of the balancing-plate and cover, and also in combination with a valve having an open top and end extensions, substantially as set forth.

3. The balancing-plate P, having a slight vertical, but no longitudinal, motion, made with a hole through or past the same, and recesses  $s s'$  in its lower face, immediately over the open ends or mouths of the cylinder-ports, in combination with the described valve and gasket, substantially as set forth.

4. The valve D, having the end extensions described, in combination with central steam-port B, end exhaust-ports  $B' B'$ , and balancing-plate P, having end extensions, substantially as set forth.

5. A slide-valve having a bearing-extension at each end, which projects beyond the valve-foot proper, and having also an end opening through such extension for an endwise exhaust from the valve, substantially as set forth.

In testimony whereof I have hereunto set my hand.

JOHN C. BRYAN.

Witnesses:

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