(No Model.)

3 Sheets— [illegible] 1.

T. POORE.

Balance Slide Valve.

No. 239,057. Patented March 22, 1881.

Fig 1.

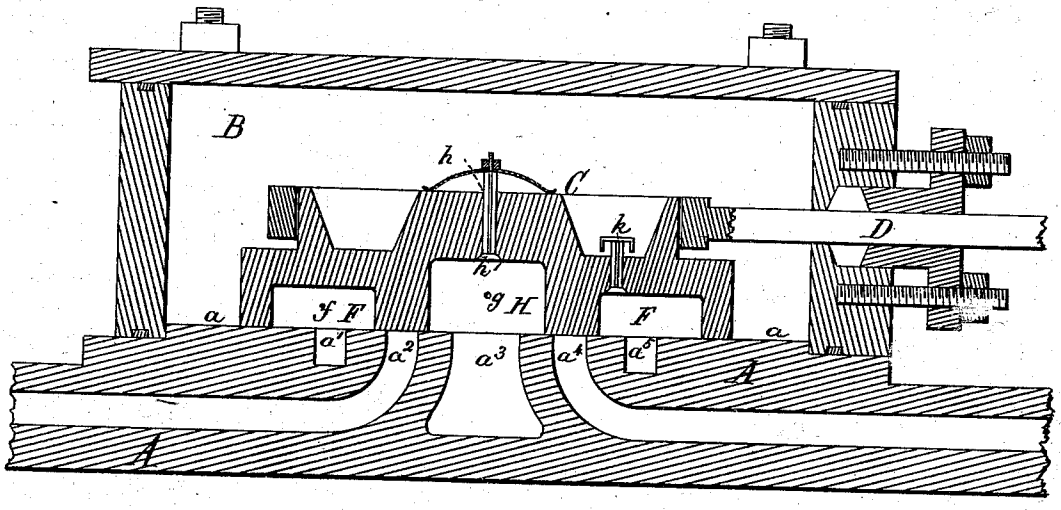
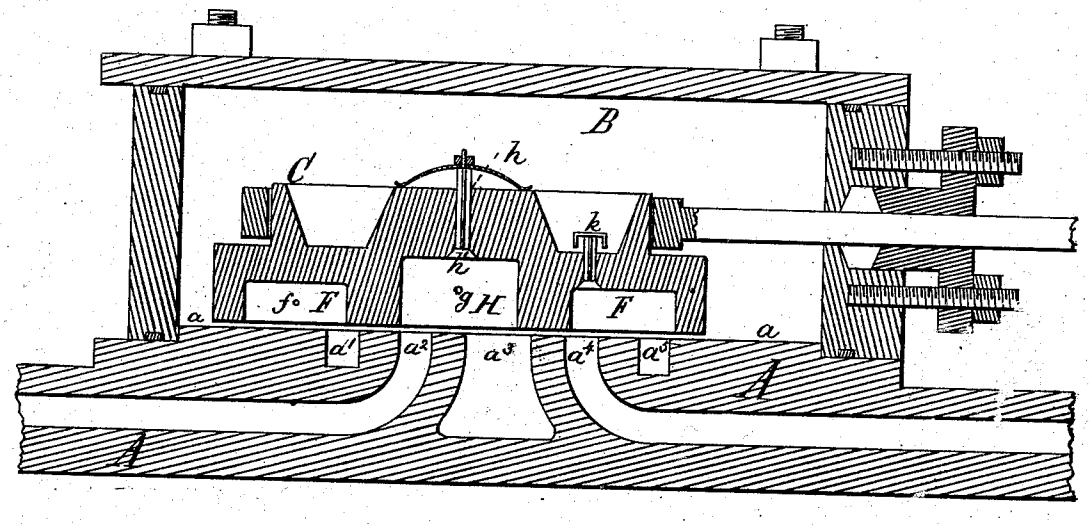


Fig 2.



Witnesses:

Thos. Fothani,

J. P. Theo. Lang.

Inventor:

Townsend Poore,

by Munn Fennick & Sumner,

Attorneys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 2.

T. POORE.

Balance Slide Valve.

No. 239,057. Patented March 22, 1881.

Fig 3.

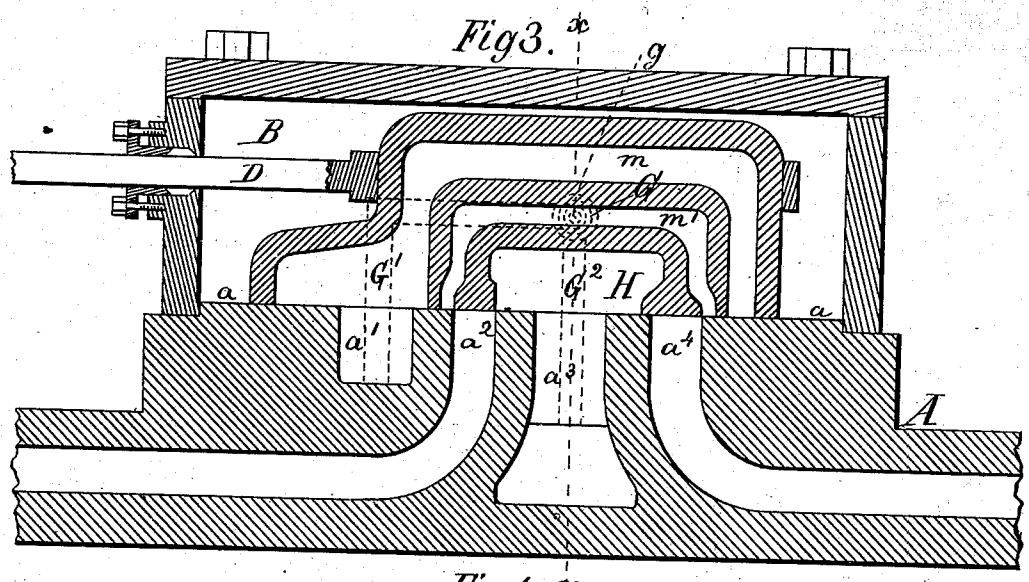
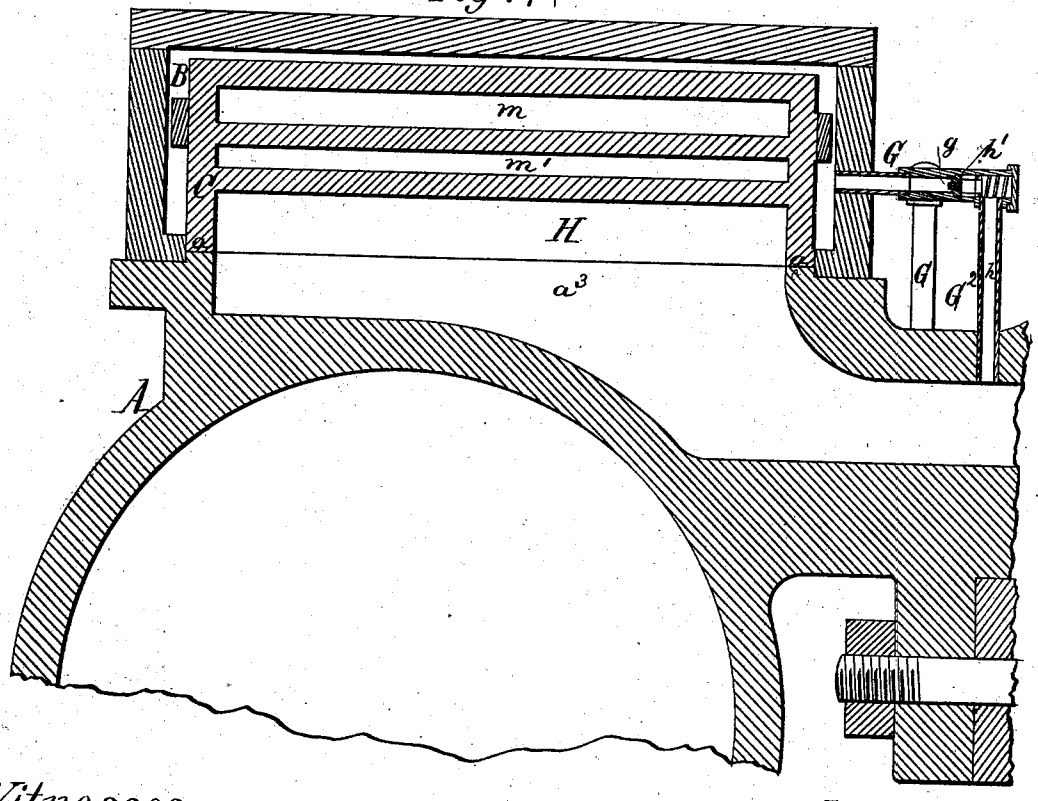


Fig 4.



Witnesses:
Thos Fitzgerald
J. P. Theo. Lowry.

Inventor:
Townsend Poore,
by
Munn & Fennwick Hamm
Attorneys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 3.

T. POORE.

Balance Slide Valve.

No. 239,057. Patented March 22, 1881.

Fig 5.

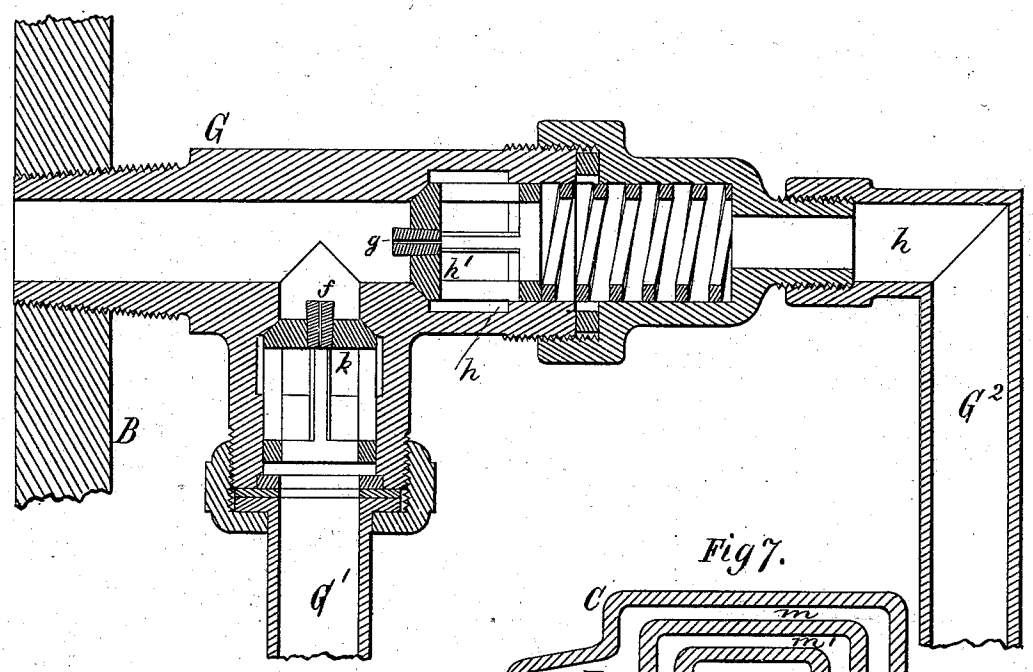


Fig 7.

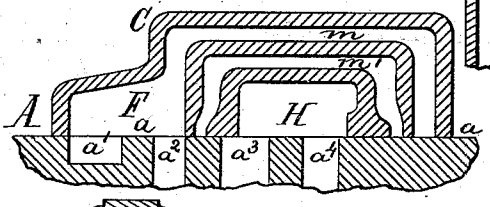


Fig 6.

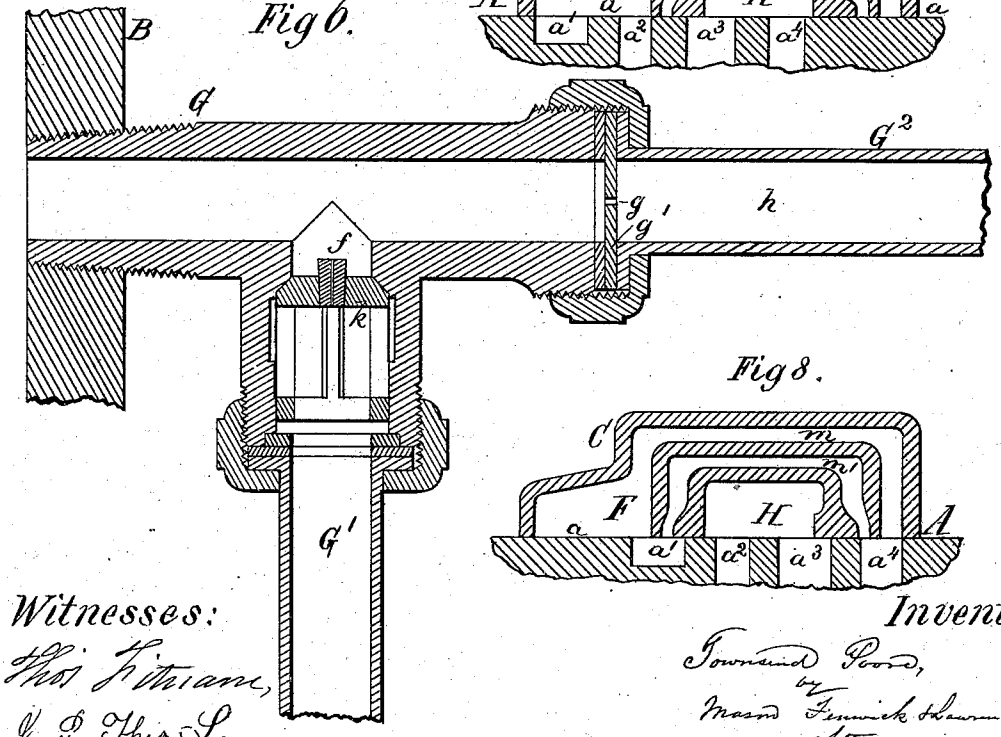


Fig 8.

Witnesses:

Thos Fitziam,

J. P. Thos. Lang,

Inventor:

Townsend Poore,

by Munn Fennick & Howson,

Attorneys.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

TOWNSEND POORE, OF SCRANTON, PENNSYLVANIA.

BALANCE SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 239,057, dated March 22, 1881.

Application filed September 7, 1880. (No model.)

To all whom it may concern:

Be it known that I, TOWNSEND POORE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented a new and useful Improvement in Slide-Valves for Steam Engines and Pumps, of which the following is a specification.

My invention relates to balanced slide-valves, and especially to that description of slide-valve which completely covers the ports of the valve-seat at all times; and my improvement consists, first, in means whereby steam is admitted into the steam-chest for producing pressure upon the back of the valve, and a portion of such steam is allowed to escape from the steam-chest into the exhaust-passage or into the open air, and thus the pressure of the steam from the boiler upon the under side of the valve is balanced by the pressure of the steam upon the back of the valve in the steam-chest, and the valve is caused to work on a balance, or as nearly so as desired; second, in a relief-valve, in combination with the slide-valve, provided with a passage or vent for admitting steam into the chest, and with a relatively larger passage or vent for permitting a portion of such admitted steam to exhaust, whereby is avoided an undue accumulation of pressure on the back of the slide-valve, which undue pressure is caused by leaks, or by a lifting of the valve from its seat when the steam is first applied; and, third, in a valve, in combination with the slide-valve, provided with a passage or vent for admitting steam into the chest, and with a relatively larger passage or vent for permitting a portion of such admitted steam to exhaust, whereby the slide-valve is relieved from the effects of a vacuum caused by the continuation of the movement of the engine after the steam is shut off at the throttle-valve, as in case of a locomotive moving downgrade, or a steamship in motion after the steam is shut off.

The object of my invention is to make a balanced valve without employing the ordinary complicated packings, and to have such valve capable of automatically controlling the balancing-pressure on its back or in the steam-chest, notwithstanding that the boiler-pressure may vary; also to have it self-relieving in the event of too great pressure being exerted in the steam-chest from any cause, and to prevent binding and grinding away of the slide-valve and its seat when a vacuum is caused below the valve by the shutting off the steam from the engine at the throttle-valve. I attain these objects by the mechanism illustrated in the accompanying drawings.

Figure 1 is a vertical central longitudinal section of a portion of an engine provided with my invention. This view shows the valve down upon its seat. Fig. 2 is a similar section, showing the valve raised from its seat to a slight extent, as occurs at times in the operation of the engine. Fig. 3 is a vertical central longitudinal section of a valve-seat and valve and steam-chest of a modified construction, my invention being applied to the same. Fig. 4 is a vertical transverse section of the same in the line *x x* of Fig. 3. Fig. 5 is an enlarged sectional view, showing a modification of the relieving and balancing devices. Fig. 6 is an enlarged sectional view, showing a modification of Fig. 5. Fig. 7 is a reduced detail view, in section, of the valve shown in Fig. 3, but here shown in one of its extreme positions. Fig. 8 is a similar view, showing the valve in its opposite extreme position.

A, Figs. 1 and 2, represents part of a steam-engine cylinder, on which is formed the valve-seat *a*.

B is a steam-chest used for receiving and holding the balancing-steam, but not for receiving the supply-steam for the cylinder of the engine.

C is a slide-valve, and D its stem. The valve-seat *a* may be provided with ports a' a^2 a^3 a^4 a^5, the ports a' a^5 being induction-ports, the ports a^2 a^4 steam-ports, and the port a^3 the exhaust-port. The valve C is extended at each end so that all the ports of the valve-seat *a* are continually covered by the valve, whether the valve is at rest or moving. In each of the extended portions of the valve a cavity, F, is formed, and between the cavities F F an exhaust-cavity, H, is formed. Either of the cavities F may be provided with a small vent-hole, *f*, and the exhaust-cavity with a larger vent-hole, *g*. The vent-holes *f* and *g*, as shown in Figs. 1 and 2, are, respectively, in communication with the live-steam ways a' a^5 and with the steam-chest B, and with the

steam-chest B and the exhaust-passage a^3, the vent-hole f serving for leading steam from the steamways a' or a^5 into the steam-chest for the purpose of having it exert a pressure upon the back of the slide-valve, and the vent-hole g serving, by its greater area, to conduct off a portion of the steam admitted by the vent f into the exhaust-passage a^3, and thereby reduce the pressure of the steam to such a degree below the pressure of the steam beneath the slide-valve that the said valve will work on a balance, or as nearly so as desired. The area of the vent-hole f in cavity F would, in ordinary cases for a locomotive, be about one sixty-fourth of an inch in diameter, and the vent g would be of such a diameter—say one-sixteenth of an inch—relatively thereto as to reduce the pressure of the steam on the back of the valve to the extent desired. The induction-ports a' a^5 are suitably connected, by a steam-pipe, with the steam-boiler of the engine, and the parts of the engine not shown in the drawings may be of any approved known construction.

An additional vent, h, is provided in the exhaust-cavity H of the slide-valve C, and this vent is provided with a spring-valve, h', which opens inward from the top of the valve C. This valve h' affords relief to the valve C when the pressure on its back becomes too great, from leakage of steam into the steam-chest or from other causes. The valve h' should be constructed to open whenever it is subjected to any pressure greater than is required on the back of the slide-valve for balancing it to the extent desired. The valve C is also provided with another valve, k, which serves to relieve valve C from the effects of a vacuum in the cylinder when the steam is shut off at the throttle-valve of the engine. This valve also opens downward into either of the steam-cavities F, and it is always under pressure when steam is applied, and it will operate and remain closed without aid of a spring; but a very light spring might be used for balancing the weight of the valve k. This valve k opens instantly when the steam is shut off at the throttle-valve, and relieves the back of the valve C from pressure due to a vacuum being formed in the cylinder and steam-passages below the valve, and thus undue wear and grinding down of the valve C and its seat a are avoided at times when the engine is moving downgrade and the steam cut off from its cylinder.

With the construction shown in Figs. 1 and 2, the supply-steam enters the steam chambers or cavities F through the induction-ports a' a^5, and from these ports it alternately enters the steam-ports a^2 a^4, and is alternately exhausted into the exhaust-port a^3, in the same manner as in ordinary steam-engines, and a portion of the supply-steam continually escapes through the vent f into the steam-chest, and this steam leaves the chest through the vent g, passing into the exhaust-passage. The area of the vent f being less than that of the vent g, the steam in the chest cannot maintain the same pressure it had in the cavities or chambers F; but while this is so, this steam, with its decreased pressure, is enabled, owing to acting upon the upper steam-exposed surface of the valve, which surface is of greater area than the lower steam-exposed surface thereof, to balance, or nearly so, the upward pressure of the steam below the valve; and thus it will be seen that by making the vents f and g of sizes proportionate with the upper and lower steam-exposed surfaces of the valve as perfect a balance of the valve as may be desired can be secured.

Another way of employing my invention upon an engine is shown in Figs. 3, 4, 5, 7, and 8 of the drawings. In this construction the steam is all received at one end of the cylinder, and one of the induction-ports, a^5, is dispensed with, and the valve C is provided with the usual exhaust-cavity, H, and an extension with a steam-cavity, F, and also with two steam-channels, m m', which extend over the two working-ports a^2 a^4 and exhaust-port a^3 of the valve-seat, as shown.

In Fig. 3 one position of the valve is shown, ports a^2 a^4 being closed, and in Figs. 7 and 8 the two opposite extreme positions are shown.

In Figs. 3, 4, and 5 of the drawings, a modification of the vents f and g and of the valves h' and k are shown. The valves h' and k being applied to a pipe, G, screwed into the steam-chest B and connected with the steamway a' of the engine by a branch pipe, G′, and also with the exhaust-passage a^3 by means of another branch pipe, G^2. The branch pipes G′ G^2 are shown by dotted lines in Fig. 3. The vent f, for admitting steam into the chest B, is formed in a removable plug set in a conical valve, k, which valve is kept closed by the pressure of the steam from the boiler, but opens downward when a vacuum is formed in the cylinder by cutting off the steam at the throttle-valve. This conical valve combines in one piece the vent f and the valve k shown in Figs. 1 and 2.

In the pipe G, which screws into the chest B, another conical valve, h', is applied for relieving the slide-valve from the effects of an undue accumulation of pressure in the chest B from leaks or a lifting of the valve from its seat a. This valve acts against a spring in opening, the same as the valve h' in Figs. 1 and 2, it operating on the same principle, and being furnished with a vent, g, similar to the vent g in Figs. 1 and 2, which vent permits a portion of the steam supplied through vent f to escape into the exhaust-passage a^3, and thereby relieve the back of the valve from too great pressure.

In Fig. 6 the valve h' is dispensed with, and the vent g is formed in a disk or diaphragm, g', of the pipe G. In all other respects this figure of the drawings corresponds to the plan shown in Fig. 5. The construction shown in Fig. 6 is a modification of the first feature or part of my invention.

It is also proposed to admit steam directly

from the boiler into the steam-chest by a pipe of very small diameter, and to exhaust a part of the steam into the passage a^3, or into the open air by another pipe of larger diameter, while the steam to the cylinder is supplied in the usual manner from the boiler. This plan would be a modification of the one shown in the drawings as the principle of employing a very small vent for admitting steam above the valve and a proportionately larger vent for exhausting a portion of such steam would be embodied in such construction.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A slide-valve provided with a vent, *f*, for admitting steam into the steam-chest, and a vent, *g*, of larger diameter, for exhausting a portion of this steam from the chest while steam is being conducted from the boiler to the cylinder of the engine, substantially as and for the purpose described.

2. The combination of a relief-valve, *h'*, with the balanced slide-valve C, provided with vents *f* and *g*, and the exhaust-port of the seat *a*, substantially as and for the purpose described.

3. The combination of the valve *k* with the balanced slide-valve C, provided with the vents *f* and *g*, and the steamways of the valve-seat *a*, substantially as and for the purpose described.

TOWNSEND POORE.

Witnesses:
J. BOYD SMITH,
G. F. BENTLEY.