A. Buchanan,

Steam Slide Valve.

No. 14,709. Patented Apr. 22, 1856.

Fig. 2.

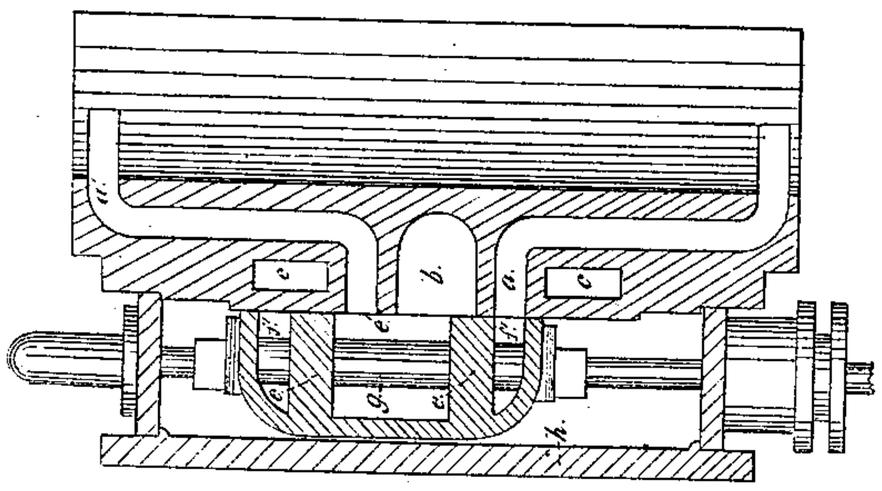


Fig. 4.

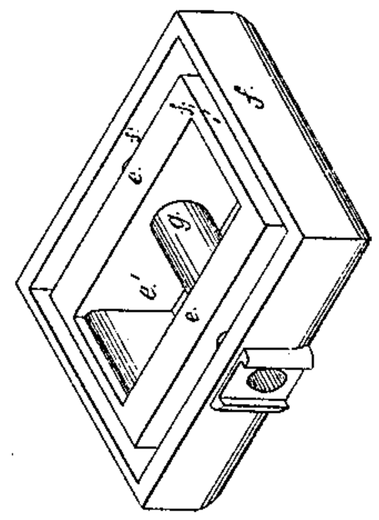


Fig. 1.

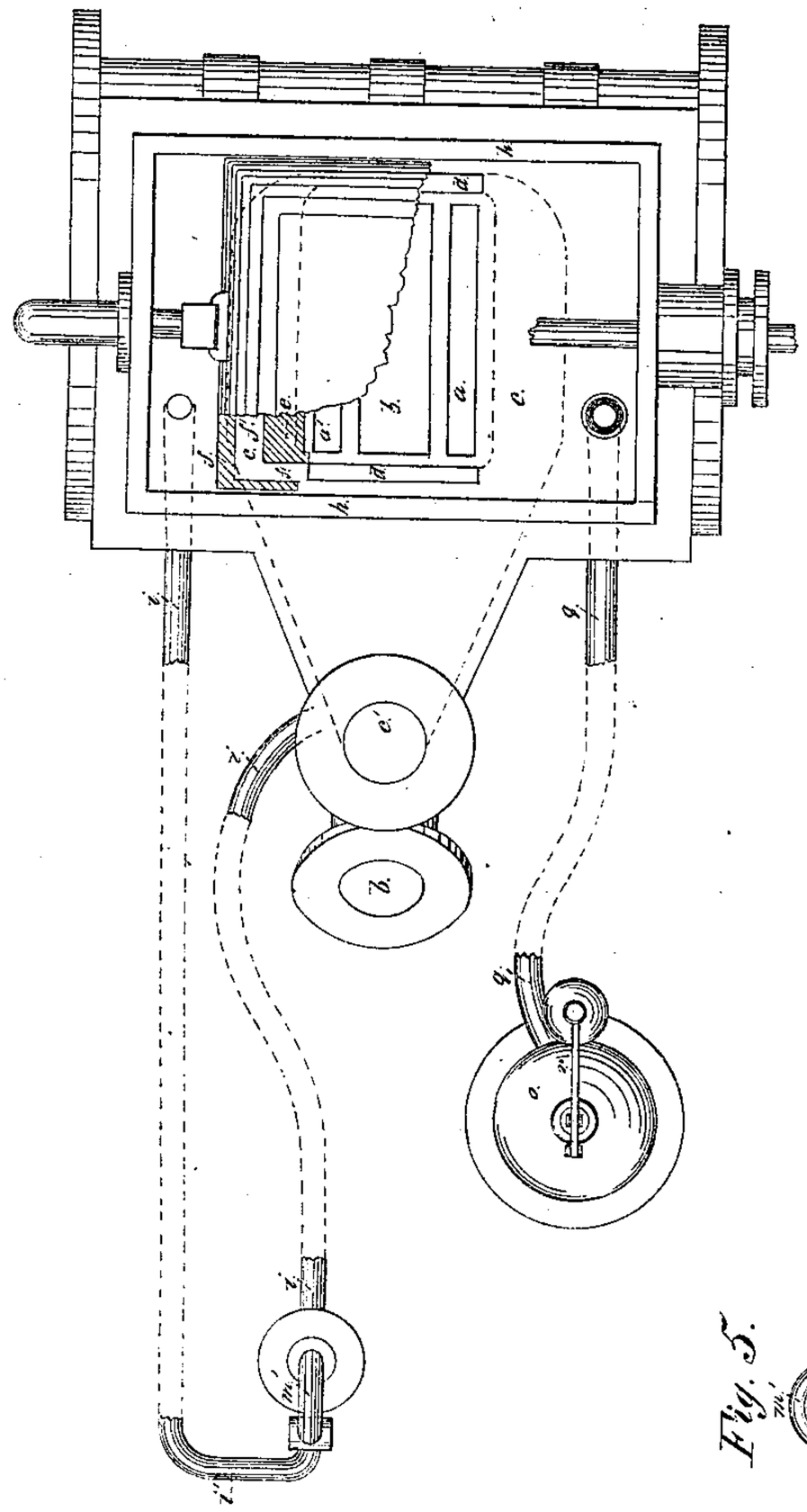


Fig. 3.

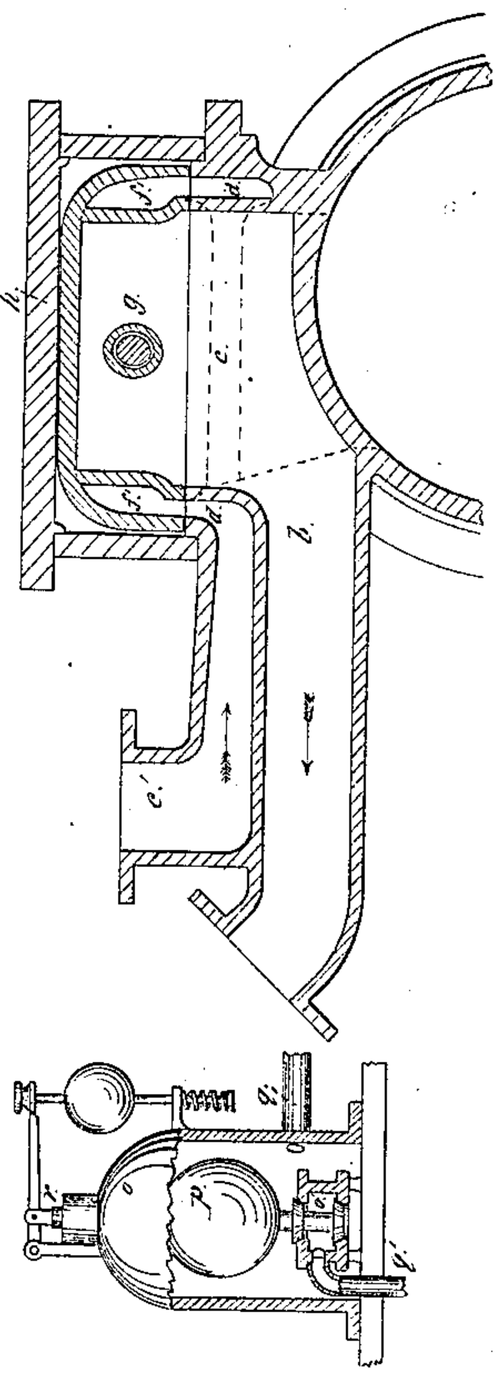
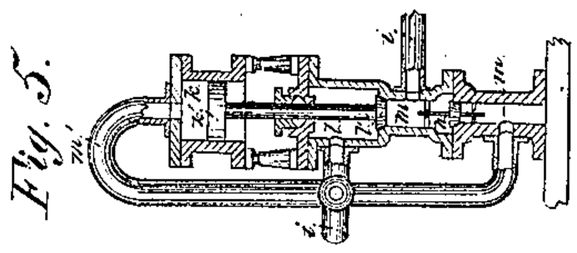


Fig. 6.

Fig. 5.



UNITED STATES PATENT OFFICE.

ALEXANDER BUCHANAN, OF NEW YORK, N. Y.

BALANCED SLIDE-VALVE FOR STEAM-ENGINES.

Specification of Letters Patent No. 14,709, dated April 22, 1856.

To all whom it may concern:

Be it known that I, ALEXANDER BUCHANAN, of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Slide-Valves for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being made to the annexed drawing, making a part of this specification, in which—

Figure I is a top view partly in section and having the cover removed; Figs. II and III are longitudinal and transverse vertical sections; Figs. IV, V and VI are of parts in detail; and similar letters indicate similar parts throughout.

My invention is for certain improvements in balance slide valves and the principle of my said invention consists in a peculiar application of the steam, whereby the pressure of steam on one side is neutralized by an equivalent force or pressure on the opposite side.

In the theoretical operation of my valve a perfect equilibrium is produced, but in practice it is required that there shall always be sufficient pressure upon the valve to keep it in its seat, all of which is readily accomplished by my improvement. Inasmuch also as the surface under the valve is much less than the upper, the pressure of the steam upon these must be different in the proportion of the areas exposed in order to produce an equality, and to accomplish this by steam taken from the same boiler constitutes a material part of my invention, as will be made apparent in the following description of the construction and operation of my said valve. In that operation the steam is admitted to the ports from the under side, the exhaust being also from that side. Consequently were nothing interposed to prevent, the valve would be forced up from its seat and the operation of course be ended. To obviate this, steam pressure is applied to the opposite surface and sufficiently in excess to keep down the valve as before mentioned. All this is accomplished by self regulating parts operating automatically. I shall therefore describe first the construction of the valve and the manner in which the steam passes for operating the engine, and afterward the application of the balancing force.

In Fig. II is a sectional view of a portion of the cylinder, its steam and exhaust ports, together with the valve and the case inclosing it, which latter although resembling the ordinary steam chest, is not strictly such, as the latter is found within the valve itself.

At (a a') are the steam ports and channel ways in the cylinder, and (b) the exhaust passage.

At (c) are shown steam ways, cast in the metal of the cylinder, and running across the same outside of and parallel with the two steam channels (a a'), to these, on one side of the cylinder, is attached the steam nozzle (c') as in Figs. I and III and they are also connected to two others which form the outlet, as shown at (d) Figs. I and II. The valve is of such shape as to cover these outlets as well as the regular steam ports (a) and (a').

In Fig. IV a perspective view of the valve is given exhibiting its under side; in Fig. I a portion of its top is shown, and in Figs. II and III longitudinal and transverse sections are also shown. The parts (e) and (e') form a valve of the ordinary construction, and this is inclosed by a cover (f) sufficiently large to leave a channel or space (f') between. When the valve therefore is on its seat upon the cylinder, in whatever position it may be, this cover part (f) will always embrace the two steam ports (a) and (a') at its end, as well as the two channel openings (d d) Figs. I and III at the sides. The steam which passes through the pipe (c') will therefore discharge by (d) into the channel (f') and will thence pass into the cylinder by the ports (a) or (a') according to the position of the valve, and as represented in Fig. II. The passage (d) is always open to (f') because the motion of the valve is in a direction parallel therewith, and thus the space (f') becomes in fact the steam chest. The part (g) is a tube cast in the valve to admit the passage of a stem or rod by which it receives its motion, in the usual way. The means for balancing the valve and keeping it down on its seat will now be described. It is apparent from what has been set forth that the valve would be blown upward, by the steam passing through (d), with a force due to the pressure of the steam and the surface exposed to that pressure, which is, the area of the channel (f'), and it will therefore require a like force applied to the top of the valve to keep it in place. This I ac-

complish by the application of steam, and the valve therefore is enveloped in a steam tight case (h) of sufficient strength to withstand the pressure. It will be seen that as the area exposed by the outside of the valve is very much greater than the area of the channel (f'), steam of less pressure will be required within the case (h) to overcome the force of that exerted in the channel, and the difference will be as the respective ratios of (f) and (f'); for example, if the area of (f') be ten square inches, and the area of (f) one hundred square inches then will steam of ten pounds to the square inch in (h) balance the force of steam of one hundred pounds to the square inch in (f'). To apply and maintain the steam in (h) at such relative pressure to that in (f') as will insure the full balancing of the valve, constitutes one of the important features of my invention.

In Figs. V and VI are views of apparatus connected with the operation of the valve. That shown in Fig. V is the instrument for effecting the maintenance of the proper pressure of steam in (h) and Fig. VI shows an apparatus for discharging the water from the condensed steam in the case (h). The manner in which these are connected with the valve is shown in Fig. I. The steam from the boiler must pass through the regulator Fig. V in its way to the steam case (h) and the operation of the regulator is such as to allow only so much to pass as will accomplish the balancing of the valve. In the figure the steam is represented as being taken out of the steam pipe (c') leading to the engine as at (i) Fig. I; after passing through the regulator it flows into (h) by the pipe (i'). The regulator is constructed as follows.

At (k) Fig. V is a cylinder fitted with a piston (k') the rod of which passes downward through a stuffing box into another chamber (l) where it terminates with a valve (l') fitting in an aperture leading to said chamber. Beneath the valve (l') a pipe (m) continues downward some distance, out of which two pipes lead, the upper one being the pipe (i) before named. Out of the chamber (l) the pipe (i') forming practically a continuation of (i) leads and connects with the steam case (h) as in Fig. I. The other pipe in (m) starts near the bottom and turning upward intersects the pipe (i') and terminates at its other end in the cylinder (k). Between (i) and (m') is a valve (n) opening upward as shown. The apparatus Fig. VI is constructed as follows: At (o) is a vessel, water tight, in the bottom of which is a balanced valve (o') to the stem of which valve is attached a float (p).

At (q) is a pipe leading from (o) to the steam case (h) Fig. I; at (q') is a discharge pipe and at (r) is a safety valve of common construction.

The operation will now be as follows: It is understood that the valve (f) is operated in the ordinary vibratory manner; steam entering through (c') flows on and enters the channel (f') as before set forth, from this it passes into the ports (a) or (a') according to the position of the valve, the exhaust through (b) being as usual; steam will also flow through the pipe (i) into (m); here it escapes by raising the valve (l') and thence passes into the steam case (h) through (i') but unless means were taken to prevent it the pressure in (h) would soon be equal to that in (f') and of course, as before mentioned as the outer surface of the valve exposed to the pressure of the steam is much greater than that on the under side it would be forced down upon its seat, and would in consequence require considerable power to move it. To balance the great pressure of the direct steam beneath in (f') a much less is required in (h). This is obtained by shutting off the flow of steam through (i') so soon as enough has entered (h) to accomplish the object, and this is effected by means of the piston (k') Fig. V where it will be seen that a branch pipe (m') leads a portion of the steam off from (i') into the cylinder (k) and acting on the piston (k') forces down the valve (l') and stops the further influx of the steam through (i). But it will be seen that unless the area of the piston (k') was greater than that of the valve (l') no such effect would take place. And this is precisely the condition of the two, for the areas of the piston (k') and valve (l') are to each other, as the respective areas of the outside of the valve (f) and of the channel (f') so that the low pressure of the steam in (i'), or what is the same in the case (h), is sufficiently powerful to force down the valve (l') against the greater pressure of the steam in (i). The moment therefore the steam in (h) gets below the requisite pressure to maintain the valve in its seat, the equilibrium between (l') and (k') is destroyed and (l') is raised whereby more steam enters. In practice, as the steam in (h) must be all the time condensing and therefore diminishing in volume, the valve (l') will be always raised just so high as to permit the requisite flow of steam to supply this source of waste and maintain the equilibrium of the valve. I have described the piston (k') and valve (l') as having the same relative difference in area that the two steam surfaces of the main valve have. In theory, this would be correct, but in practice it will be well to have a slight pressure upon the valve in order to insure its fitting closely to the seat; the piston (k') will therefore be less in proportionate area to that of the

valve (l') than the proportion the inner side of the slide valve bears to the outer, and thus a greater pressure of steam will be required to force down the valve (l') than would be required to balance the steam on the underside of the main valve. Hence it would be worked under a pressure proportionate to that difference, which difference may be whatever in practice will be found most advantageous. The use of the valve (n) is to permit the steam to flow back into (i) in case from any cause there should be an excess of pressure in (h) and by this flowing back it would be relieved. This is however an occurrence which can seldom happen.

As the water from the condensed steam accumulates in (h) it must be removed. This may be done by a cock attached to (q) opened so far as to allow of a slight continuous blow off, or otherwise by means of the apparatus Fig. VI. As the water rises it flows by the pipe (q) into the chamber (o) and so soon as it has filled it sufficiently to raise the float (p) the valve (o') will be lifted and the water discharged as shown, no steam escaping thereby.

What I claim is—

The means for maintaining the differential pressure on the two sides of the valve necessary for balancing the same, that is to say, the combination of an apparatus substantially as described under Fig. V, with the valve as set forth.

ALEXANDER BUCHANAN.

Witnesses:

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S. H. MAYNARD.