(No Model.)

4 Sheets—Sheet 1.

J. D. OLDS.

BALANCED SLIDE VALVE.

No. 332,279. Patented Dec. 15, 1885.

Fig. 1.

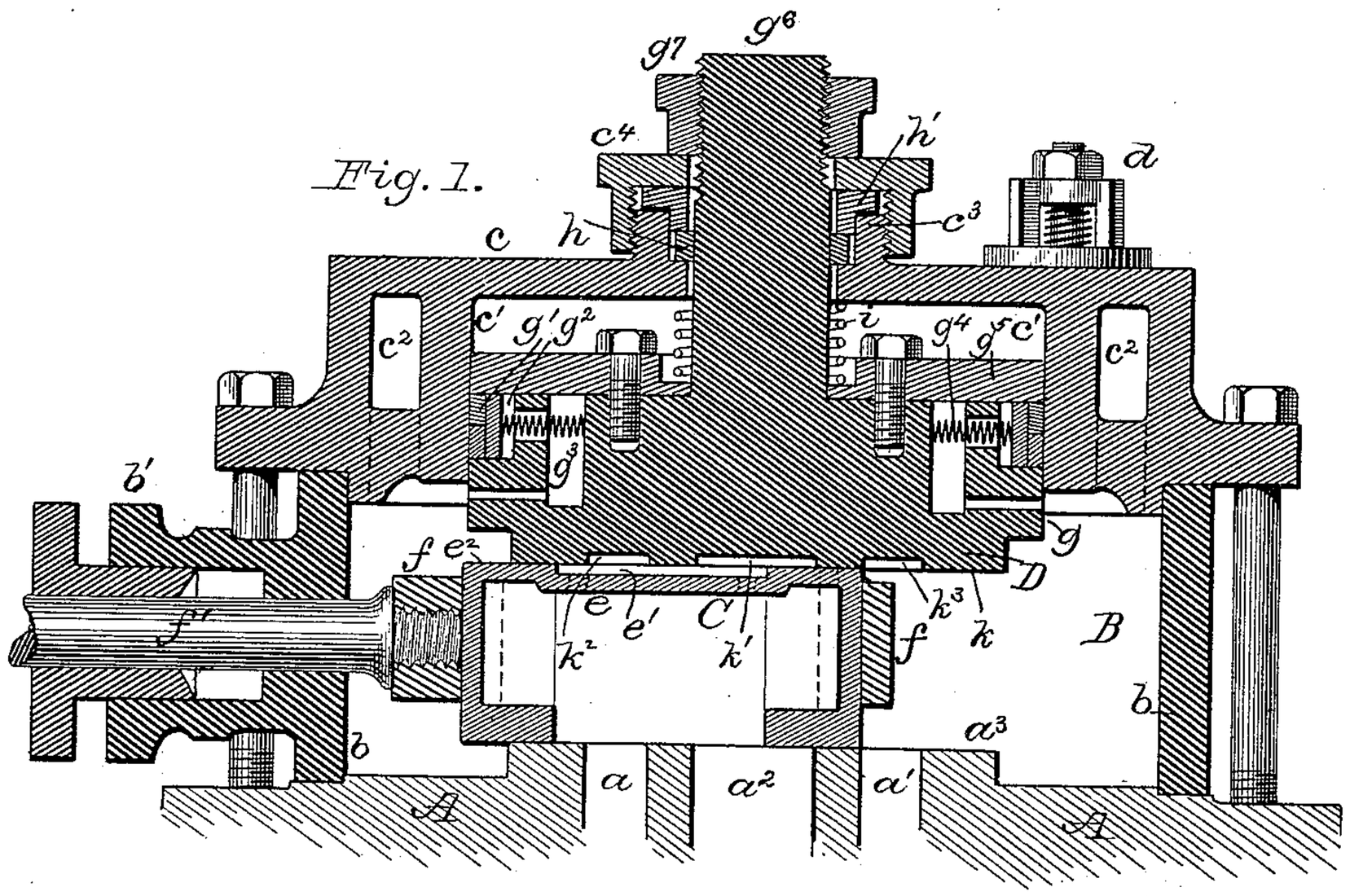
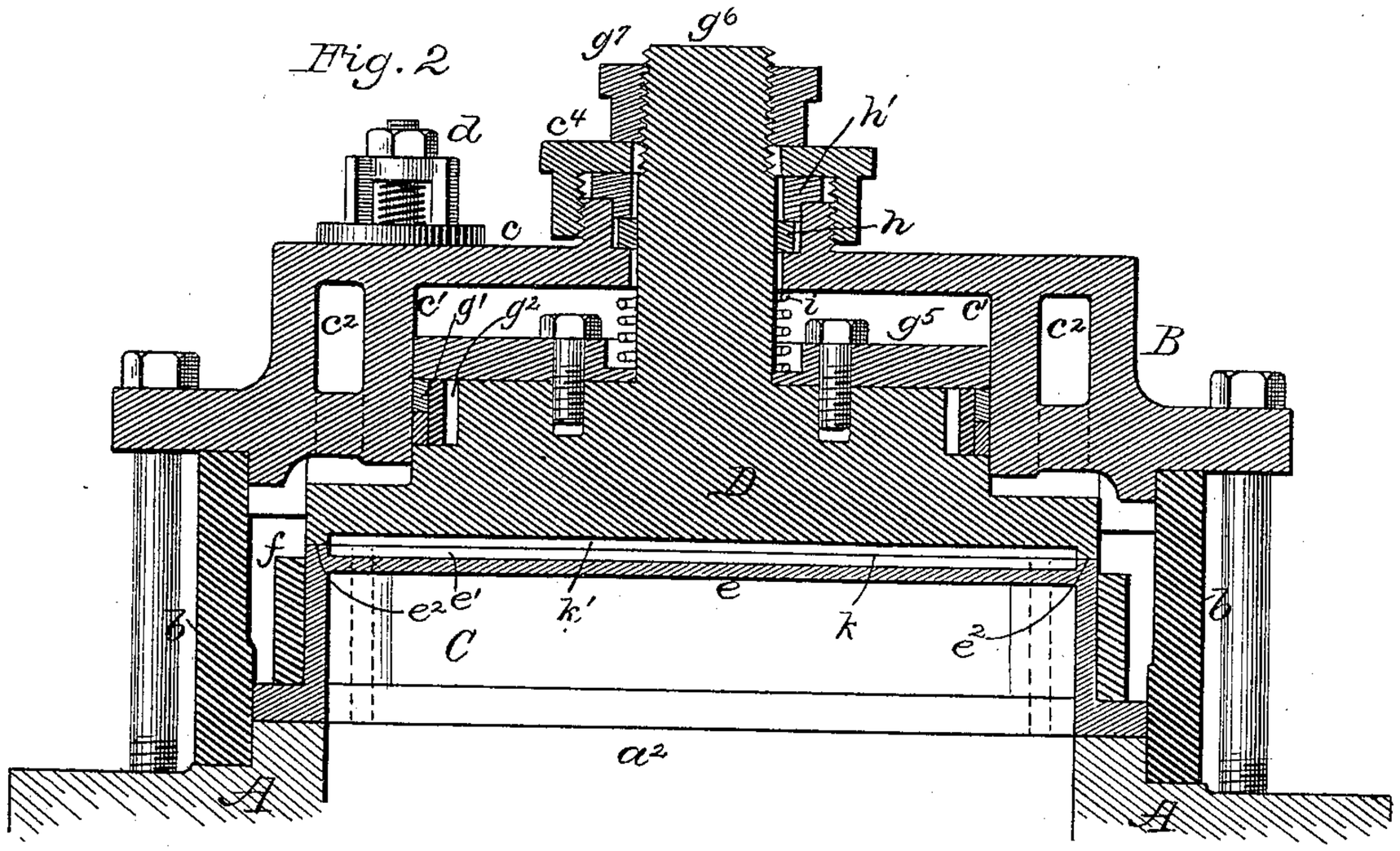


Fig. 2



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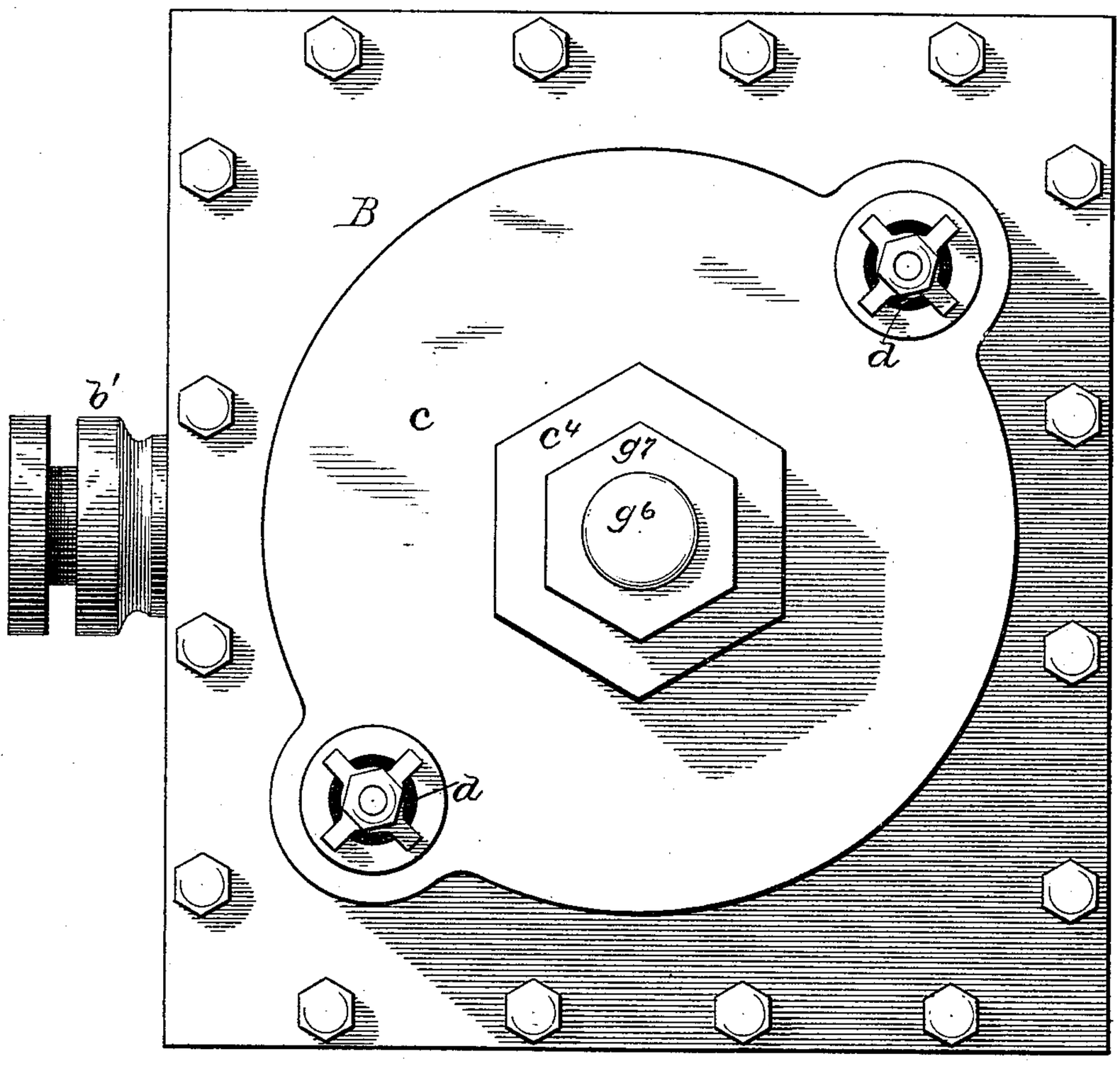
(No Model.) 4 Sheets—Sheet 2.

J. D. OLDS.

BALANCED SLIDE VALVE.

No. 332,279. Patented Dec. 15, 1885.

Fig. 3.



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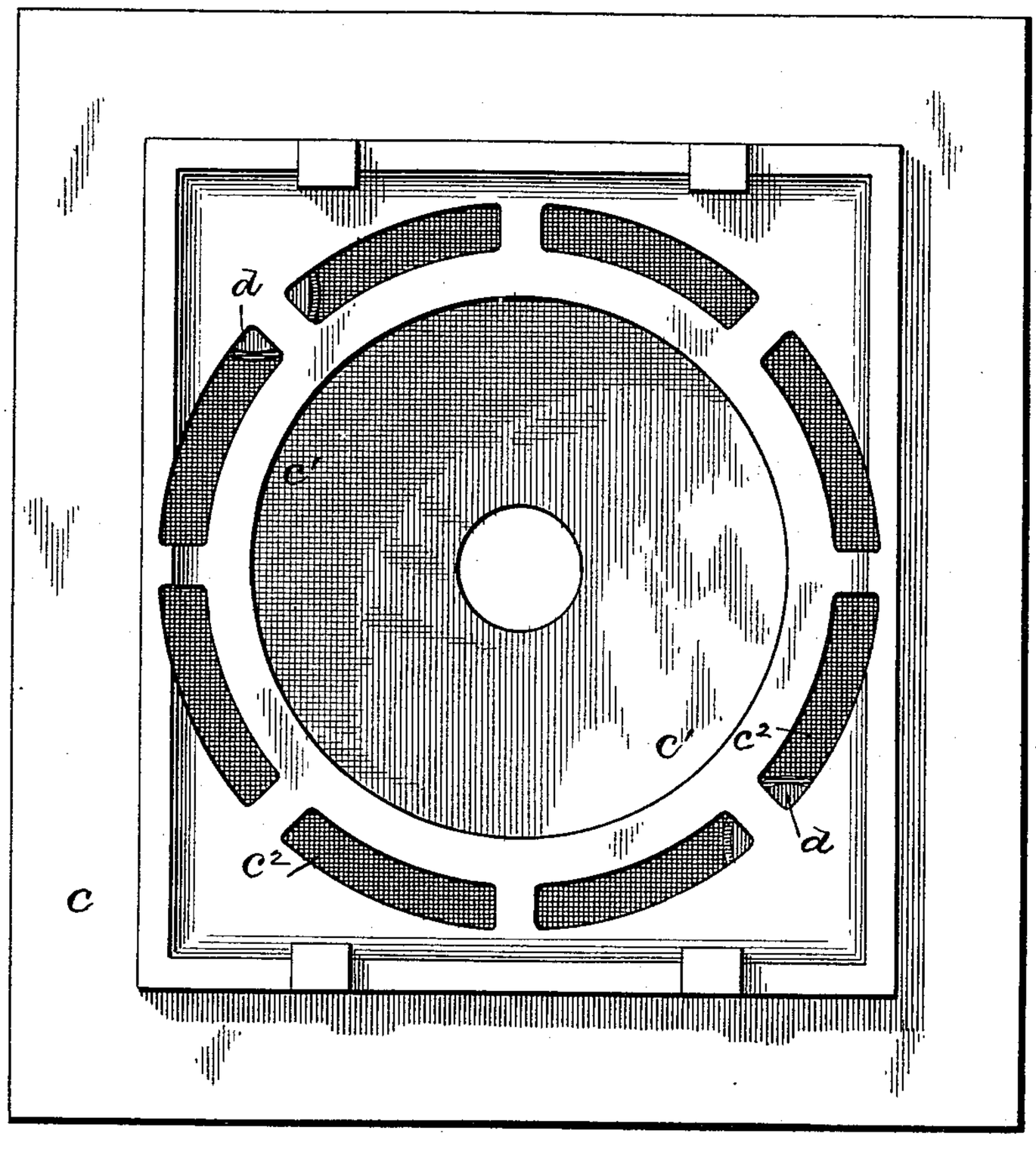
(No Model.) 4 Sheets—Sheet 3.

J. D. OLDS.

BALANCED SLIDE VALVE.

No. 332,279. Patented Dec. 15, 1885.

Fig. 4.



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4 Sheets—Sheet 4.

J. D. OLDS.

BALANCED SLIDE VALVE.

No. 332,279. Patented Dec. 15, 1885.

Fig. 5.

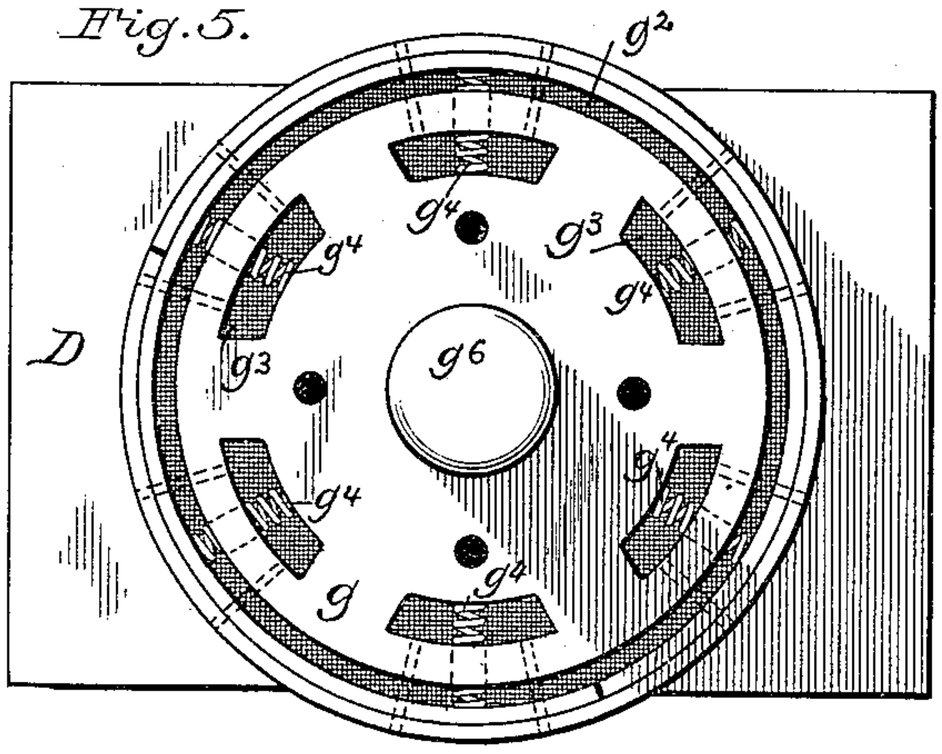


Fig. 6.

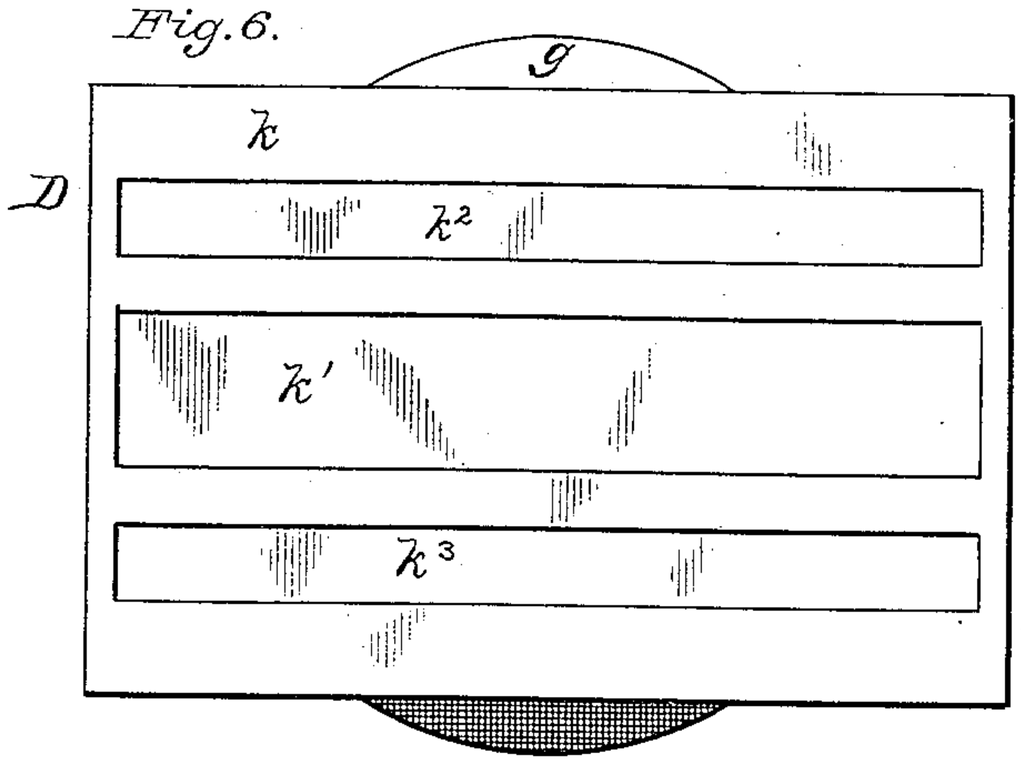


Fig. 7.

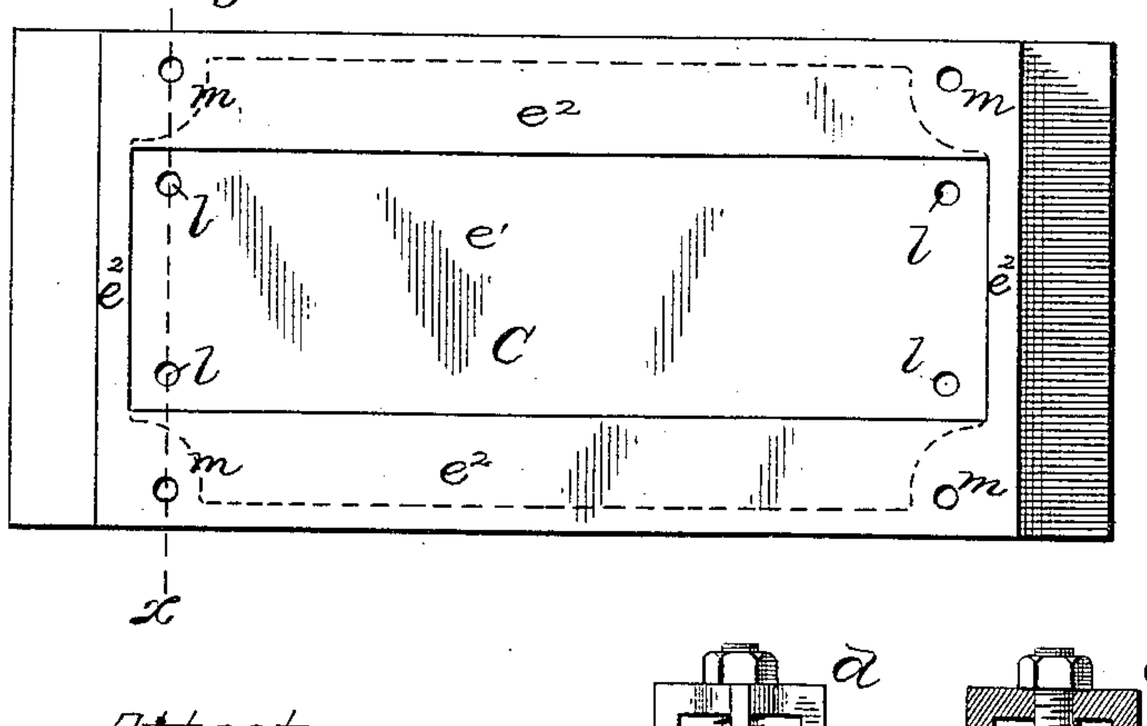


Fig. 8.

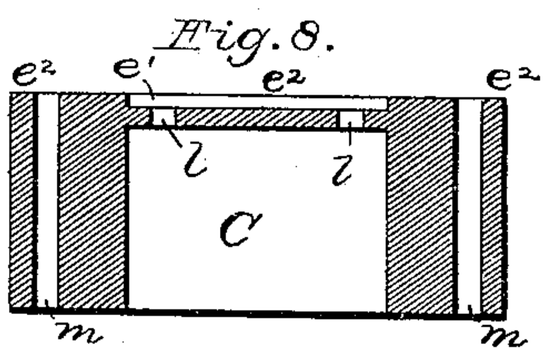


Fig. 9.

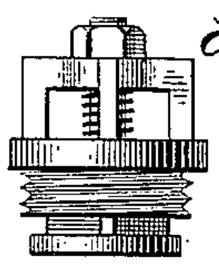
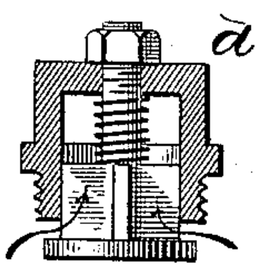


Fig. 10.



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UNITED STATES PATENT OFFICE.

JOHN D. OLDS, OF FORT WAYNE, INDIANA.

BALANCED SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 332,279, dated December 15, 1885.

Application filed March 25, 1885. Serial No. 160,101. (No model.)

To all whom it may concern:

Be it known that I, JOHN D. OLDS, of Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Balanced Slide-Valves; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

In my improved balanced valves I employ between the face of the balance-plate and the back of a box-valve, three independent steam-spaces, which communicate with passages extending through the valve from its back, and this feature in construction has heretofore been embodied in connection with prior valve-plates which were either confined in position by locking-bolts or open to live steam at their backs, and also in connection with valve-plates backed by a flexible metallic diaphragm and having a chamber back of said diaphragm always in communication with the interior of the valve and the exhaust-passages. As constructed and arranged by me, there is a cylindrical chamber at the back of the balance-plate, which is not accessible either to live steam or to exhaust-steam, and said chamber is cylindrical, and is partially occupied by a packed cylindrical piston which forms the back of the balance-plate, and the latter has a central stem which extends through the cover of the valve-chest. With this organization the expansive force of steam interposed between the balance-plate and the valve can obviously more effectually lessen their frictional contact than when the back of the plate is exposed to live steam, or is in direct communication with the exhaust-passages by way of the interior of the valve, or when the plate is confined in its position by locking-bolts.

Another portion of my invention relates to balance-plates which have a piston within a cylinder, and its object is to enable such a plate to be readily moved toward and from the valve, and to afford to the piston complete freedom of movement in its cylinder without impairing the packed joint between them. I have heretofore nearly obtained said desired freedom by relying upon metallic packing-rings and bearing-springs, as set forth in my application for Letters Patent filed June 23, 1884, Serial No. 135,767, and with that organization the pressure of the packing against the wall of the cylinder is uniform, and therefore the springs must be heavy enough to serve the required purpose under the maximum pressure of steam, and are consequently much heavier than is required under lesser pressures. It is obvious that the expansion and contraction of the valve, the plate, the piston, the packing, and adjacent parts, necessitate complete freedom of movement within certain limits, and also a practically perfect-packed joint between the cylinder and piston, and to attain these seemingly antagonistic ends I now employ light springs, which are relied upon merely to locate the metallic packing-rings concentrically, and I rely upon steam-pressure for setting said rings against the cylinder, and thus for the first time, as I believe, in this connection provide for a packing-contact which is always proportioned to the pressure of steam within the steam-chest, and it will be obvious that the presence of steam at the back of the packing-rings will in no manner interfere with the free tilting or rocking movement of the balance-plate and piston during their adjustment to the valve.

I am aware that steam has heretofore been employed for controlling metallic packing in steam-engine cylinders; but I am the first, as I believe, to organize a balance-plate piston, so that steam could be relied upon for controlling the packing, with results not accruing from its use with an engine-cylinder piston. This portion of my invention has been devised for use with a box slide-valve, and will be illustrated and described in that combination; but it will be obvious that it may be used in connection with any variety of slide-valve with which a balance-plate is desirable.

It will be observed that I have sought to provide for the balance-plate piston a certain freedom to tilt or rock in all directions, and it will be obvious that such means as are or may be provided for externally controlling the balance-plate must also be so organized as to not impair said rocking or tilting capacity, and that properly-packed joints at the necessary openings through the steam-chest must

also be provided for. I have therefore constructed the balance-plate piston with a rigid stem, which loosely extends through a gland in the steam-chest side or top, as the case may be, and is provided in said gland with metallic packing having contact surfaces which are at right angles to the stem, and also with contact surfaces at the periphery of the stem, and also with the interior of the gland, these being alternated, so that the stem can be canted or tipped in any direction without impairing the packed joint when considered as a whole. For moving the balance-plate from the valve the outer end of the piston-stem is threaded and provided with a nut, which has its bearing on the outer end or cap of the gland.

Balance-plates as heretofore constructed, both with and without pistons, have been provided with stems or bolts and nuts, and even with a single rigid central stem and nut, and also with a swiveled central bolt; but none of said prior organizations known to me will serve my purposes.

Another portion of my invention relates to automatic means for the free discharge of air from the steam-chest upon the initial introduction of steam, or, as in a locomotive, while in motion, without the use of steam in the chest or engine-cylinder. The prime value of this portion of my improvement is in a combination including a balance-plate having a piston and metallic packing-rings, because it is desirable that all the parts be speedily heated and expanded with uniformity, and to that end I employ one or more check-valves which are normally open and are held open by springs at, say, from ten to fifteen pounds pressure, but which will close under greater pressures, so that the air will be promptly expelled. In this same connection I have also devised another feature by which the undue condensation of steam within the balance-plate piston and its cylinder is practically obviated, and this is accomplished by providing the cylinder which contains the balance-plate piston with an inclosing-shell which affords an annular steam-space, thereby keeping said cylinder and its contents at as high a temperature as possible.

To more particularly describe my invention, I will refer to the acccompanying four sheets of drawings, in which—

Figure 1 is a vertical central longitudinal section of a valve-chest and a balanced valve embodying my improvements, and illustrates in section a portion of a steam-engine cylinder. Fig. 2 is a vertical central cross-section of the same. Fig. 3 is a top view of the steam-chest. Fig. 4 is a bottom view of the steam-chest cover detached. Fig. 5 is a top view of the balance-plate, its piston, and stem, but with the piston-follower removed. Fig. 6 is a plan view of the bearing-face of the balance-plate. Fig. 7 is a top view of the slide-box valve. Fig. 8 is a sectional view of said valve on line *x*, Fig. 7. Figs. 9 and 10 are respectively side and sectional views of one of the air-check valves detached from the steam-chest cover.

A valve embodying my improvements is used in connection with such a steam-engine cylinder, A, as is provided in a usual manner with induction-ports *a a'* and passages through which steam is entered to opposite ends of the cylinder, and also through which it is exhausted into the central exhaust-port, a^2, and its passage, these ports being located in the raised valve-seat a^3, formed either integrally with the cylinder or upon a separate plate thereon. The steam-chest B, or "valve-chest," as it is sometimes called, has a rectangular rim, *b*, constituting sides and ends, and at its front a gland, *b'*, for a valve-rod. The cover *c* of the steam-chest may be either the side or top thereof, according to circumstances, and it is bolted to the cylinder in the usual manner, thus confining the rim *b* in position. This cover at its inner side has a cylinder, *c'*, substantially as heretofore; but as a novel feature it is surrounded by an annular steam-space, c^2, between said cylinder and the vertical wall of the cover, which serves as an outer shell for the cylinder. This steam-space is divided into several spaces by webs, as shown, but these latter may, if desired, be perforated so as to open communication from space to space. Upon the cover are two check-valves, *d*, which guard openings through the cover into said steam-space, and they are provided with comparatively light springs, which keep said valves normally open for the free passage of air from the steam-chest until the steam-pressure therein is sufficient to close them, thus providing for the free discharge of air and the prompt heating of the metal parts in the steam-chest, and a consequent uniform expansion thereof. At the center of the steam-chest cover there is a gland having an externally-threaded recessed neck, c^3, and an internally-threaded sleeve nut or cap, c^4. The slide-valve C is of a well-known box form, having sides, ends, and back or top *e*, and has no flange at its front or rear side, as shown in Fig. 1, but has end flanges at its ends, which overlie corresponding portions of the valve-seat, as shown in Fig. 2. This valve is loosely inclosed by a rectangular strap, *f*, to which the valve-rod *f'* is attached. Instead of this strap, as in very short steam-chests, the valve-rod is sometimes passed through the valve within a tubular web, which loosely receives the rod. The top or back *e* of the valve contains a novel feature in construction, in that it has a central recess, *e'*, surrounded by a bearing-surface, e^2. Ribs or bars affording bearing-surfaces have heretofore been employed at the backs of such valves; but I know of none so arranged as to afford an inclosed central recess.

The balance-plate D embodies various novel features. It has a piston, *g*, which occupies the cylinder *c'*, and for the first time, as I believe, is provided with metallic packing-rings *g'*, having back of them steam-spaces g^2 and

steam-passages g^3, which afford communication between said spaces and the interior of the steam-chest, as clearly shown in Figs. 1 and 5. Light expansive springs g^4 are also employed for keeping the metal rings normally concentric with the piston, but the pressure of steam forces said rings into packing contact with the cylinder. A follower, g^5, is secured on the back of the piston, and properly guides the packing-rings. The stem g^6 of the balance-plate piston is rigid, cylindrical, and smooth, except at its outer end, where it is threaded for a short distance and has a nut, g^7, fitted thereto. The hole in the chest-cover is larger than the stem, and so, also, is the hole in the sleeve nut or cap c^4 of the gland. Within said gland, in a recess in the neck c^3, there is a flat packing ring or washer, h, which snugly fits the stem g^6, but loosely occupies the interior of the gland-neck c^3, and on said ring h there is a flanged packing-ring, h', which loosely incloses the stem g^6, but snugly occupies the interior of the neck c^3. The coincident surfaces of the gland-cap, flanged ring, flat ring, and bottom of the neck-recess are truly parallel, and engage with steam-packing contact when the cap c^4 is lightly screwed down; but the stem is free to be rocked or tilted because it is closely engaged only by the flat ring, which at its periphery does not closely engage with the interior of said neck c^3. In some cases I also use a second flat ring or washer, tightly fitting the stem between the flanged ring and the cap, but loosely occupying the latter.

Between the follower g^5 and the coincident surface of the top of the cylinder c', I employ an expansive spiral spring, i, which encircles the stem and enables the balance-plate to be more readily advanced by endwise pressure on the stem; but while this spring is desirable, it may be dispensed with without departure from my invention.

The bearing-face k of the balance-plate D, as heretofore with other forms of balance-plate, has three parallel flat side ribs and flat end ribs connecting them, thus forming a central recess, k', and two side recesses, k^2 and k^3, which respectively correspond in area with the exhaust-port a^2 and the steam-ports a and a'. It will be readily seen that when in position on the valve these recesses form closed chambers, and that as the valve is moved to and fro (see Fig. 1) the chambers k^2 and k^3 are alternately placed in communication with the central recess, k', by way of the recess e' in the back e of the valve, and that at a certain position of the valve all of said recesses are closed, but that the two side recesses, k^2 k^3, are alternately opened to the space within the steam-chest. The recess e' in the back of the valve opens into the interior of the valve by way of one or more (four, preferably) passages, l, as clearly shown in Figs. 7 and 8, so that whichever recess or chamber k', k^2, or k^3 the recess e' may be in communication with the pressure therein will correspond with the condition as to pressure within the valve, and therefore with condition as to pressure (be it more or less or a partial vacuum) as is or may be present in the valve-ports a, a', and a^2 when either two of them communicate with the interior of the valve. The valve has also two or more other steam-passages, m, preferably four, as shown in Figs. 7 and 8, which extend from the back of the valve through to its face near its sides, and are so located in the bearing-surface of the valve that while they will at times be coincident with their respective steam-ports a a' they will never be coincident with the central or exhaust port, a^2.

It will be readily seen that as the valve is moved the pressure between the balance-plate and the valve within the chambers k^2 and k^3 will alternately correspond with the varied pressure of steam within the cylinder, and that steam will be alternately exhausted from each of said side chambers into the central chamber, k', and thence into the interior of the valve, thus, as I believe, for the first time with a box-slide valve providing for a substantially equal pressure on both sides thereof, because I have for the first time employed these intervening steam-chambers with a balance-plate having a piston within a cylinder or chamber, which is neither accessible to live steam nor in communication with the exhaust-passages by way of the interior of the valve.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination, substantially as hereinbefore described, of a balance-plate having a packed cylindrical piston at its back within a cylinder, non-accessible either to live or to exhaust steam, a slide-box valve, steam spaces or chambers between said valve and plate, and passages extending through the valve toward its face and communicating with said chambers during the sliding movement of the valve.

2. The combination, substantially as hereinbefore described, of a balance-plate having at its back a packed cylindrical piston within a cylinder, and also having at its face three recesses to serve as parallel steam spaces or chambers, a three-port valve-seat, and a slide-valve recessed at its back and provided with one or more passages from its back recess to its interior, and one or more passages from its face to its back outside of its back recess.

3. The combination of a steam-chest having a circular chamber or cylinder, a slide-valve, and a balance-plate having a piston provided with metallic packing, and with steam-spaces back of said packing which communicate with the interior of the steam-chest, substantially as described, whereby the pressure of the packing is graduated to the pressure of steam in the chest, and said balance-plate enabled to freely tilt or rock during its adjustment, as set forth.

4. The combination, with a box-slide valve, a steam-chest having a suitable cylinder in its side or cover, and a balance-plate having a steam-packed piston within said cylinder and capable of tilting in all directions therein, of a partially-threaded central rigid stem on said

piston, which extends loosely through the side or cover of the steam-chest, and is provided with a packing-gland, and a nut, substantially as described, whereby the pressure of the plate upon the valve is limited without impairing its capacity to tilt in all directions in adjusting itself to the coincident surface of the valve, as set forth.

5. The combination, with a steam-chest containing a balance-plate piston and metallic packing, of one or more normally-open check-valves, which will close under the working-pressure of steam, substantially as described, whereby air is readily discharged from the chest and the metallic parts therein speedily heated and expanded with uniformity, as set forth.

6. The combination, with a steam-chest and a cylinder therein for receiving the piston, of a balance-plate and an outer shell for affording an annular steam-space between it and said cylinder, substantially as described, whereby said cylinder and its contents can be maintained at a high temperature and condensation obviated therein, as set forth.

JOHN D. OLDS.

Witnesses:
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HOWELL BARTLE.