No. 730,428. PATENTED JUNE 9, 1903.

J. T. WILSON.

BALANCED SLIDE VALVE.

APPLICATION FILED JULY 30, 1900.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

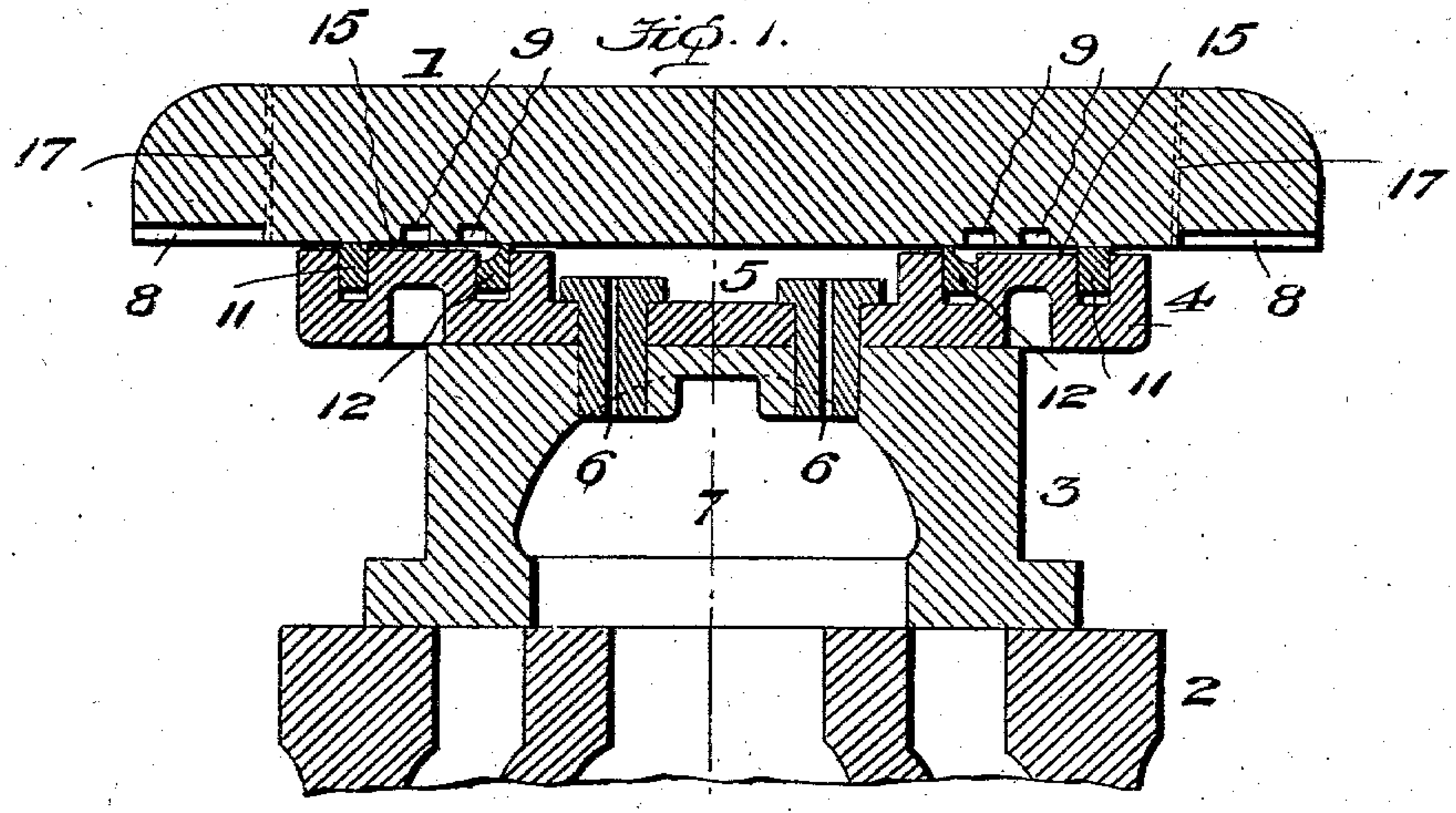


Fig. 2.

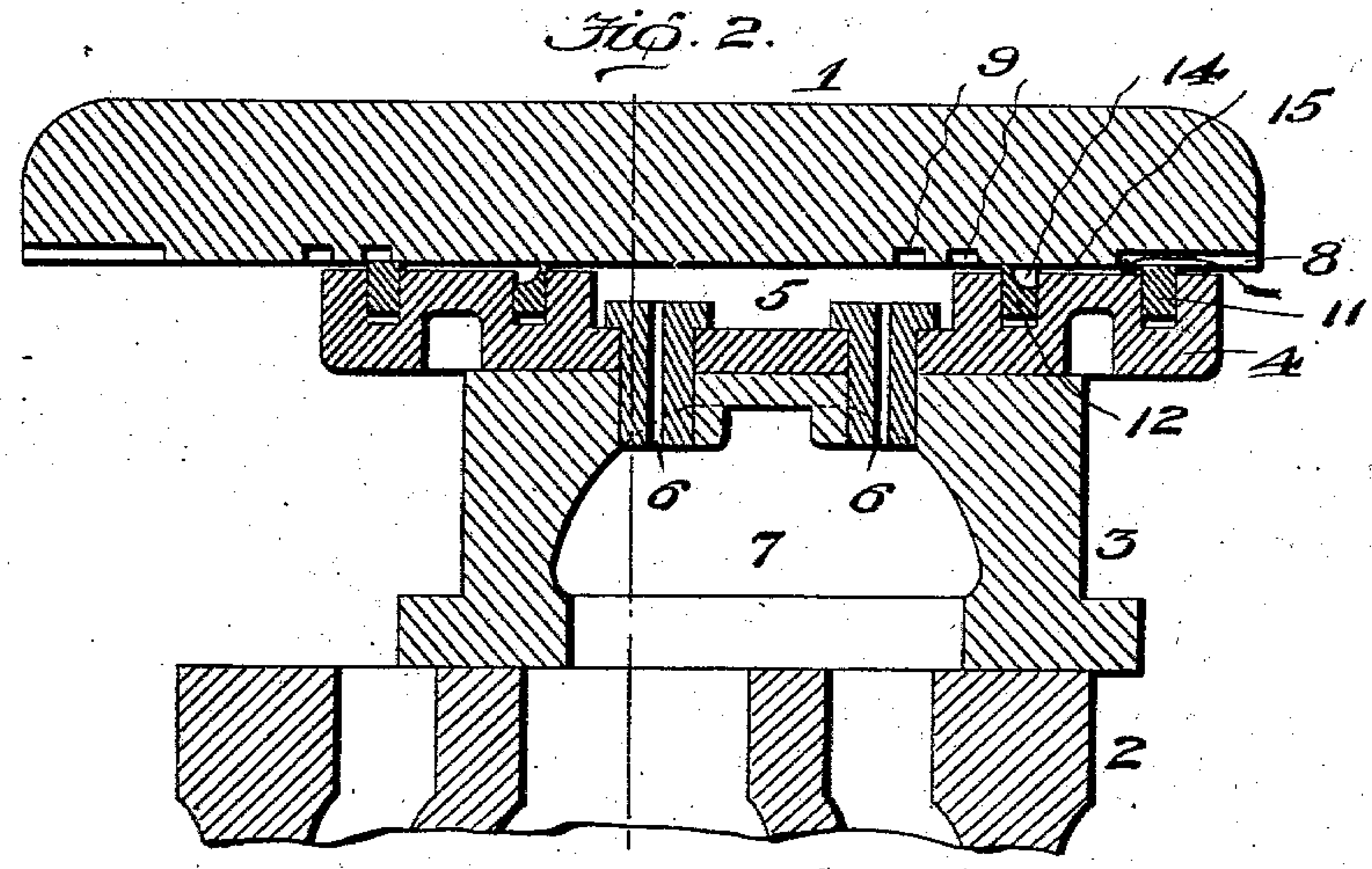
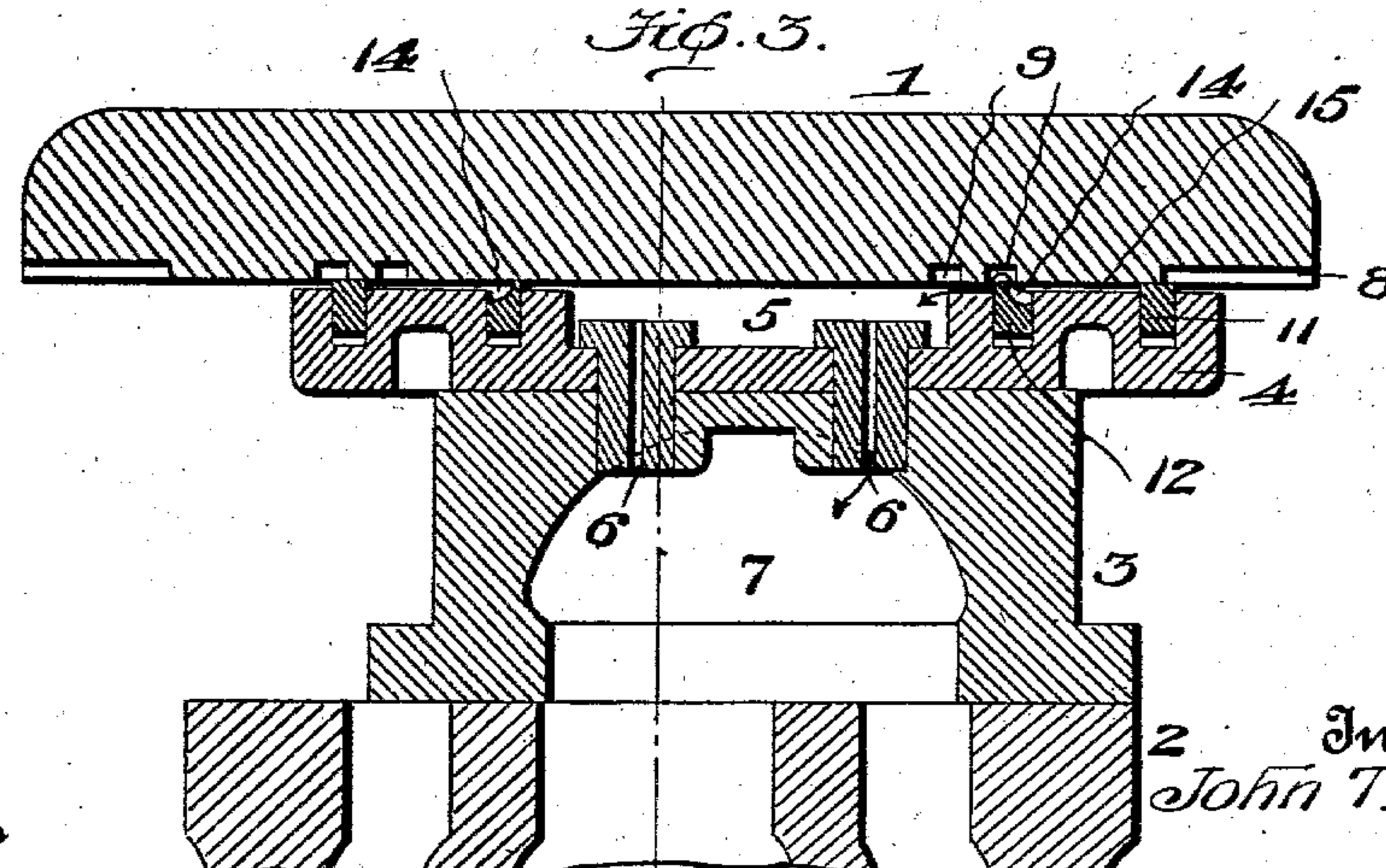


Fig. 3.



Witnesses

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NO MODEL. 4 SHEETS—SHEET 2.

Fig. 4.

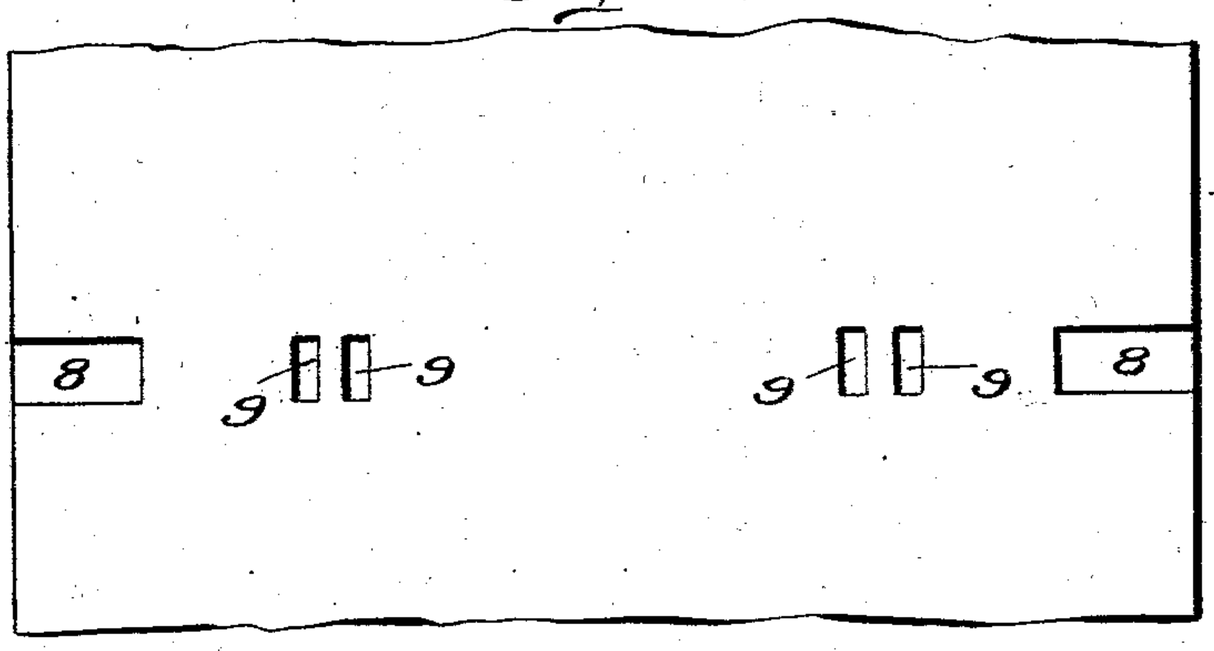


Fig. 5.

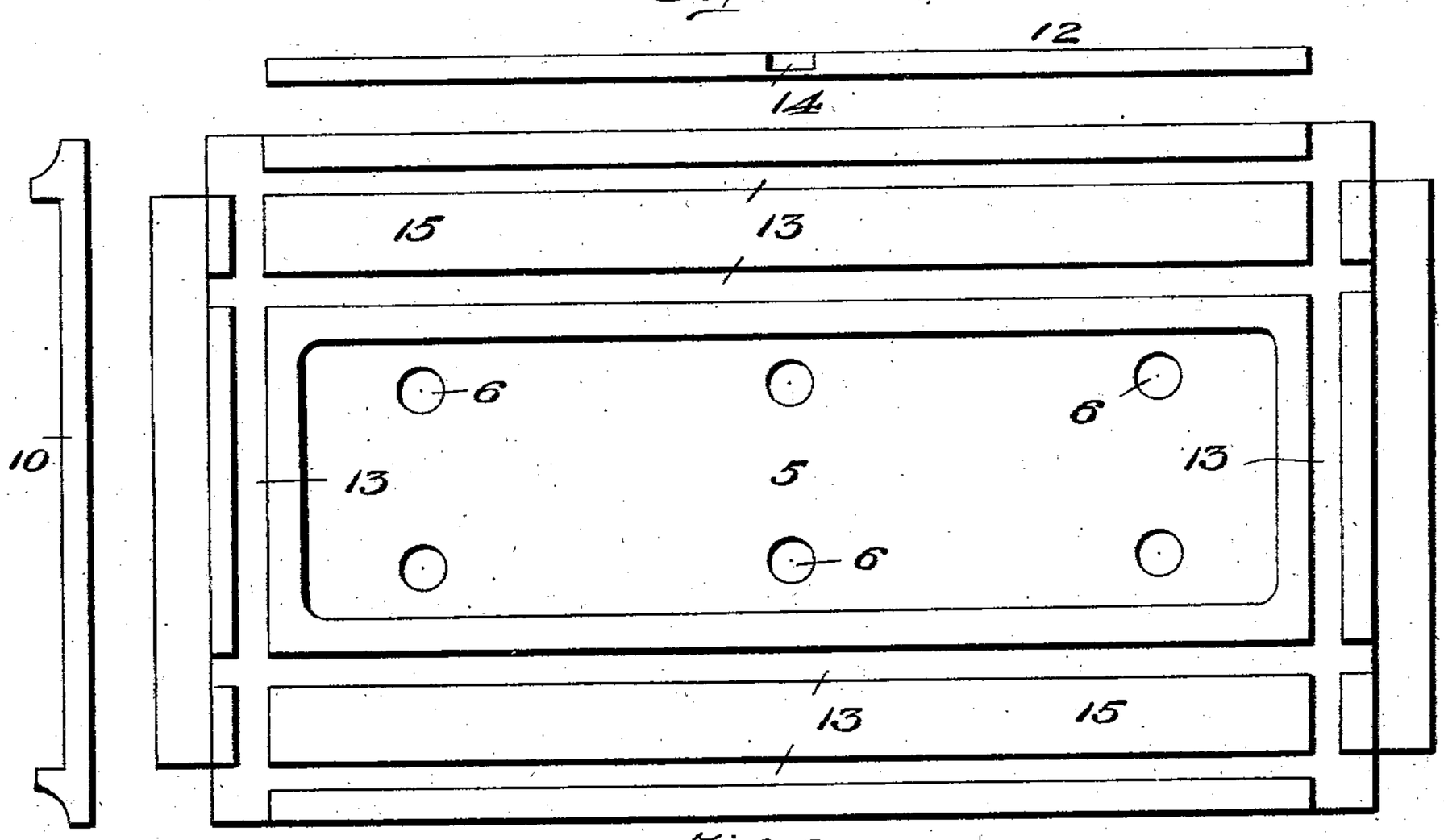
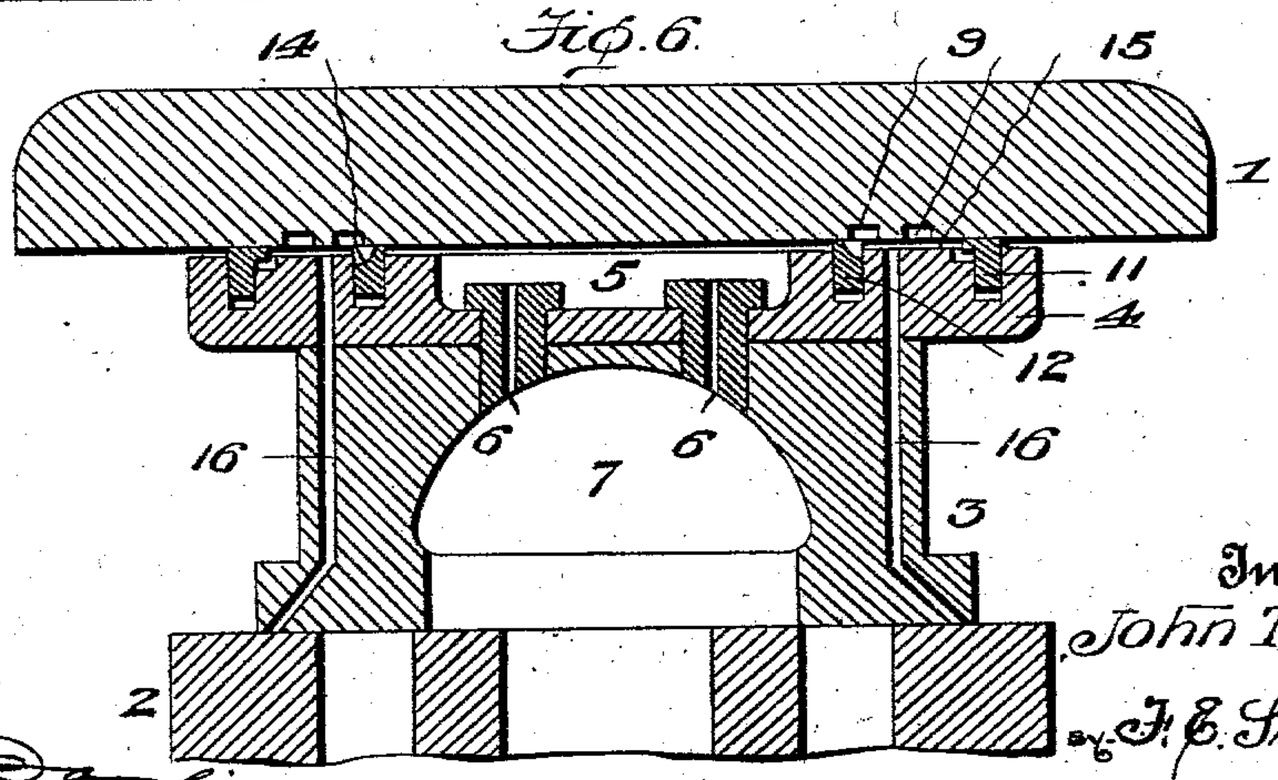


Fig. 6.



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NO MODEL. 4 SHEETS—SHEET 3.

Fig. 7.

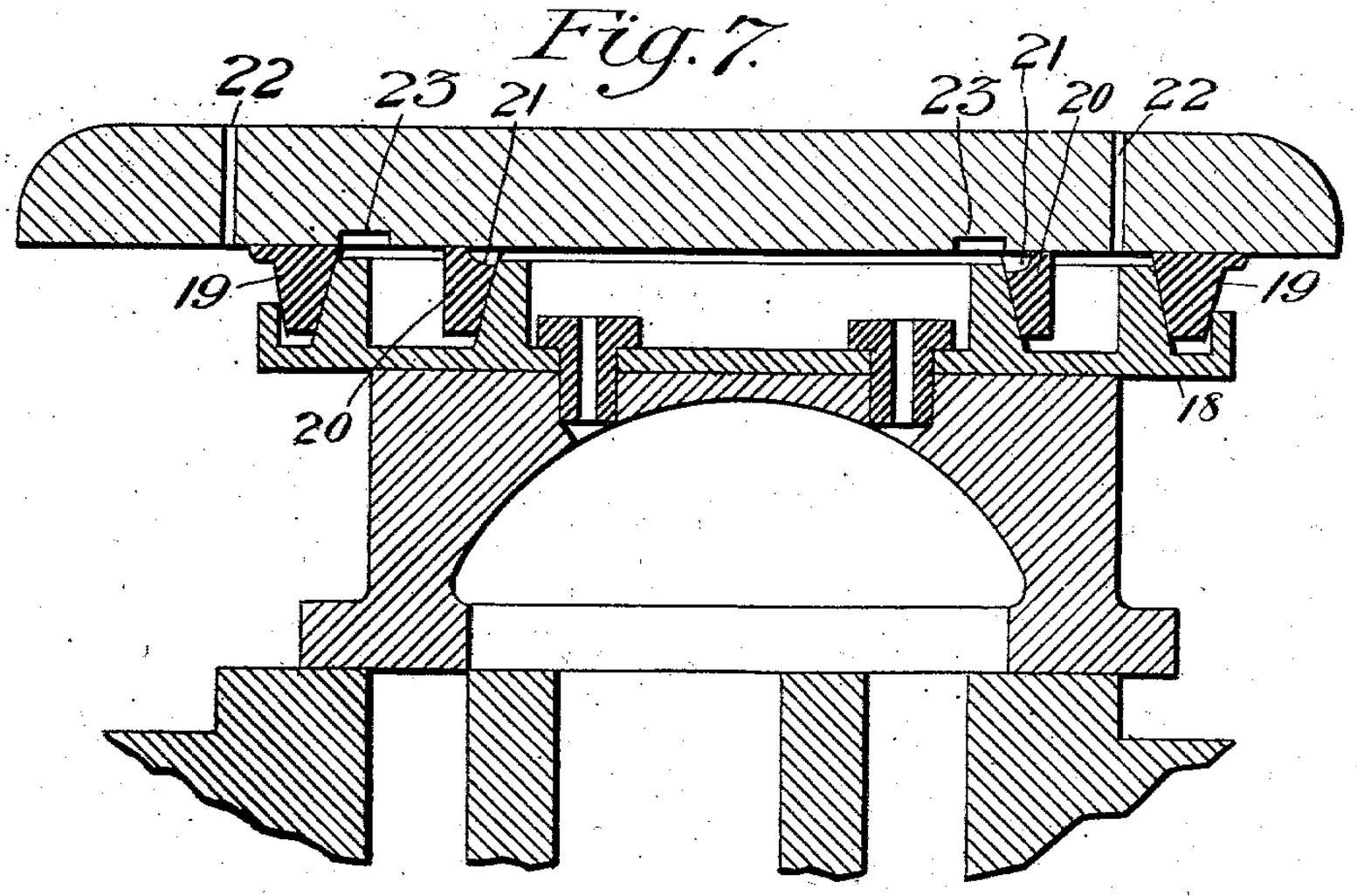
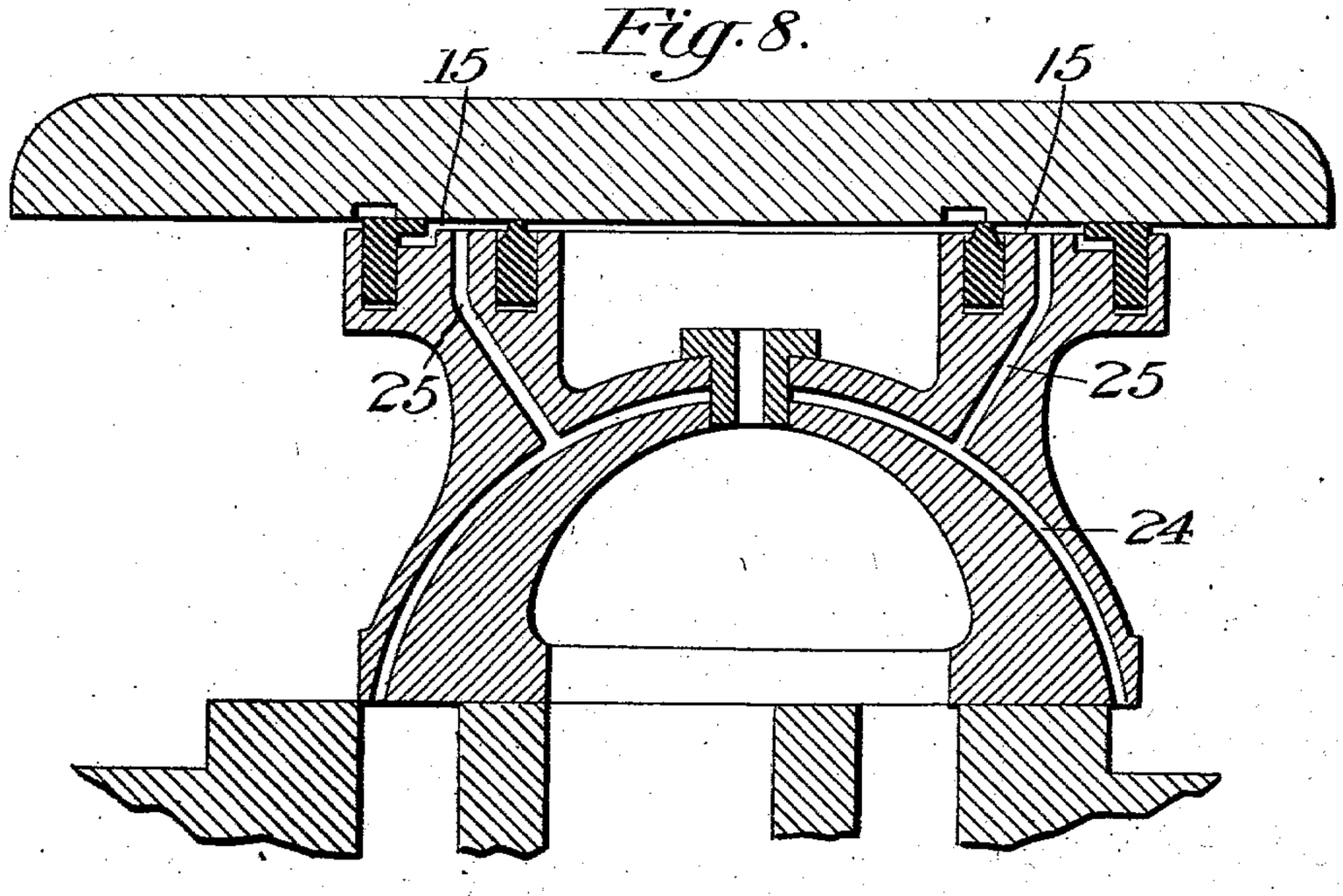


Fig. 8.



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No. 730,428. PATENTED JUNE 9, 1903.

J. T. WILSON.

BALANCED SLIDE VALVE.

APPLICATION FILED JULY 30, 1900.

NO MODEL. 4 SHEETS—SHEET 4.

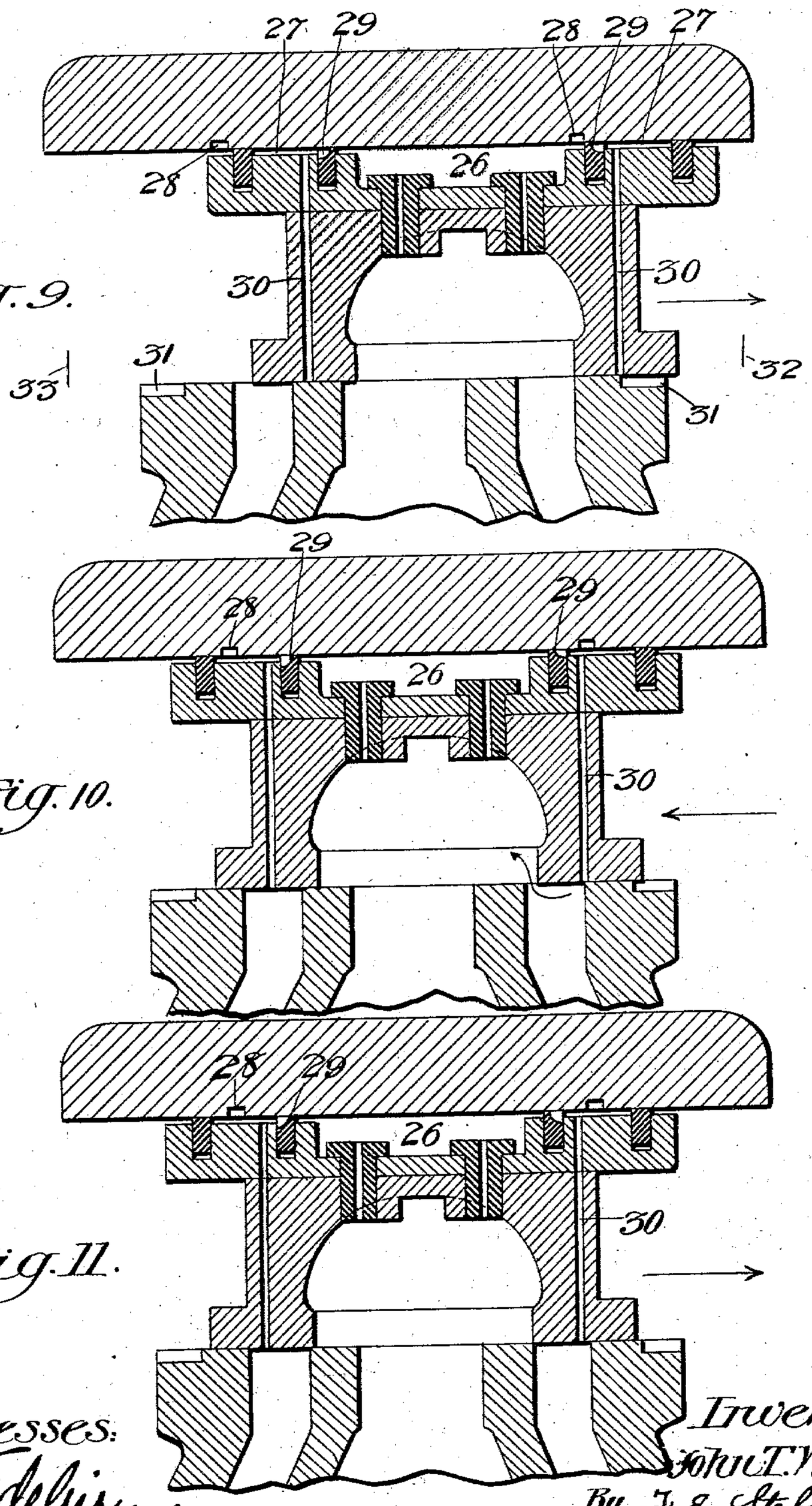

Fig. 9.

Fig. 10.

Fig. 11.

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No. 730,428. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

JOHN T. WILSON, OF JERSEY SHORE, PENNSYLVANIA.

BALANCED SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 730,428, dated June 9, 1903.

Application filed July 30, 1900. Serial No. 25,310. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. WILSON, a citizen of the United States, residing at Jersey Shore, in the county of Lycoming and State of Pennsylvania, have invented certain new and useful Improvements in Balanced Slide-Valves; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to balanced slide-valves, and in particular to that type in which a certain area at the back of the valve is normally isolated or shut off from the action of steam or other motive-fluid pressure, my object being the provision of means whereby this area may be varied in extent to correspond with certain positions which the valve may occupy relative to the valve-seat.

My invention consists, *imprimis*, in a valve having a valve-seat, a valve-body provided with a top surface located in a horizontal plane, and a steam-chest cover or bearing-plate provided with a lower surface located in a horizontal plane and parallel with the top surface of the valve-body, there being between the two said surfaces two or more inclosed areas from which motive fluid is entirely excluded during a certain portion or portions of the valve travel and to one or more of which inclosed areas motive fluid can be admitted during a certain portion or portions of the valve travel when overlapping its seat, steam being admitted to the areas from the steam-chest.

Further, it consists in a valve having three inclosed areas or spaces at the back, one being at the center and one at each side, and to which side areas or spaces motive fluid is admitted from the steam-chest when the valve leaves its central position and overtravels its seat and from which it is exhausted as the valve travels toward a central position upon its seat.

Further, it consists in a valve having three inclosed areas or spaces at its back, one being at the center and one at each side, and to one of which side areas or spaces motive fluid is admitted from the steam-chest when the valve leaves its central position and overtravels its seat and from which space motive fluid is exhausted as the valve returns toward its central position.

Finally, it consists in certain novelties of construction and combinations of parts hereinafter set forth, and specified in the claims.

The accompanying drawings illustrate five examples of the physical embodiment of my invention constructed according to the best of the several modes I have so far devised for the application of the principle.

Figure 1 is a sectional elevation view of a well-known type of slide-valve, called the "Richardson," with my improvements added, showing the valve in its central position relative to the seat. Fig. 2 is a view similar to Fig. 1 with the valve occupying a position in which steam is being admitted to a previously-inclosed space or area at the back and at one side of the valve. Fig. 3 is a similar view in which steam is being exhausted from the aforesaid space or area to the exhaust-cavity of the valve. Fig. 4 is a fragmentry plan view of the under surface of the bearing-plate or steam-chest cover of Fig. 1. Fig. 5 is a top plan view of the top plate, showing the packing-strips removed and two of them alongside of the plate. Fig. 6 illustrates a second example or form of valve in which motive fluid is admitted to the inclosed spaces by passages from the face of the valve. Fig. 7 is a section of the valve having a round top plate and two circular packing strips or rings. Fig. 8 is a section of a valve having an Allen port and passages therefrom to the inclosed spaces or areas at the back of the valve. Figs. 9, 10, and 11 illustrate a valve in which motive fluid is admitted to the inclosed area or space at the back of the valve by way of the face and valve-seat and partially or wholly exhausted at the valve-seat.

Referring to Figs. 1, 2, 3, 4, and 5, the numeral 1 designates the bearing-plate or steam-chest cover; 2, the valve-seat; 3, the body of the valve; 4, the top plate; 5, a central inclosed space at the back of the valve. 6 designates exhaust-passages. 7 is the exhaust-cavity. 8 designates slots in the under surface of the valve-plate or steam-chest cover; 9, pockets in the under surface of the bearing-plate or steam-chest cover; 10, end packing-strips; 11, outside longitudinal packing-strips; 12, inside longitudinal packing-strips; 13, chan-

nels made in the top surface of the top plate or valve itself to receive the packing-strips; 14, recesses in the inside packing-strips, each made by cutting away a portion of the body of the same and leaving a strip which is of less width than the width of a pocket in the bearing-plate or steam-chest cover, and 15 designates areas or inclosed spaces from which live steam is excluded when the valve occupies a central position upon its seat, but to which steam is admitted when the valve moves toward the right or left.

In Fig. 6 the numeral 16 designates two passages leading from the inclosed areas or spaces 15 to the face of the valve, with openings adjacent to the edges thereof.

In Fig. 1 the dotted lines 17 represent holes through the bearing-plate, which can be employed in lieu of slots 8 for the admission of motive fluid to the spaces 15 between the packing-strips.

In Fig. 7 the numeral 18 designates a circular top plate; 19, an outside circular packing-ring having a suitable lap-joint; 20, an inside circular packing-ring having a suitable joint-plate. 21 designates recesses in the edge of the inside packing-ring; 22, holes through the plate or steam-chest cover, and 23 designates pockets in the under surface of the bearing-plate or steam-chest cover. This example has only two inclosed spaces or areas at the back, to one of which only motive fluid is admitted. However, any number of spaces may be provided, and the single space shown may be divided into two spaces, one at the right and the other at the left of the valve.

In Fig. 8 the numeral 24 designates a passage in the body of the valve, which is known as an "Allen" valve, and 25 designates passages leading from the passage 24 to the space 15 between the packing-strips.

In Figs. 9, 10, and 11 the numeral 26 designates the central inclosed space at the back of the valve; 27, the inclosed spaces at the sides of the valve; 28, the pockets in the surface of the bearing-plate or steam-chest cover; 29, the packing-strips, cut away; 30, the passages from the face of the valve to the inclosed spaces 27; 31, grooves in the valve-seat; 32, the point of extreme travel of the valve toward the right; 33, the point of extreme travel toward the left.

The *modus operandi* of the valve shown in the first five figures is as follows: Assuming that the valve is balanced, as is usual in all positions of its travel when the face of the valve does not overlap the valve-seat, any projection beyond the edge of the seat will expose a given area of the valve-face to an upward steam-pressure. To balance this pressure, steam is admitted to the space or area 15 at the right by way of the slot 8, as shown by arrow in Fig. 2. Steam-pressure is retained in the space 15 during the further outward travel of the valve and its backward travel to the point where the recess 14 of the inside packing-strip 12 registers with a pocket 9. In this latter position of the valve steam in the space 15 will be exhausted into the space 5 at the back of the valve and thence to the exhaust-cavity, as indicated by the arrows in Fig. 3. As the valve travels farther toward the left steam is successively exhausted through the remaining pockets of the series. When the valve travels toward the left, the same operation is repeated. The action in the second example shown in Fig. 6 is the same, except that steam is admitted to a space or area 15 through a passage 16 from the face of the valve when it overtravels its seat.

The action in the example shown in Fig. 7 is substantially the same as that set forth in the first example, except that steam is admitted to the space between the packing strips or rings through the holes 22 and to a single inclosed space or area. The action in the example shown by Fig. 8 is substantially similar to that set forth in the second example, except that motive fluid is admitted to both spaces or areas 15 simultaneously.

The operation of the example shown in Figs. 9, 10, and 11 is as follows: When the valve moves from its central position toward the right and reaches the position shown in Fig. 9, motive fluid is admitted to space 27 by way of groove 31 and passage 30. Steam remains in space 27 while the valve travels to the point 32 and backwardly to a position where the packing-strips 29 register with pocket 28, when part of the steam is exhausted. When the valve reaches the position shown in Fig. 10, the passage 30 is open to the exhaust by way of the cylinder-port, as shown by the arrows. As the valve travels still farther toward the left the steam-port will be opened before the passage 30 is closed by contact with the valve-seat and some steam will be admitted to the space 27, which will balance the lifting effect of the steam in the cylinder-port. As the valve travels farther toward the left the steam last admitted to the space 27 will obviously be exhausted into the exhaust-cavity. When the valve has traveled to the extreme position 33 and the operation described above has been in part repeated on the left-hand side of the valve-seat and as the valve approaches its central position and just before cut-off, steam is again admitted to space 27 from the cylinder-port at the right, which has previously taken steam. The steam admitted remains in space 27 until the valve reaches the position shown in Fig. 11, where the port is about to be opened to the exhaust.

From the foregoing it will be seen that I have produced a slide-valve which is balanced at all positions of its travel relative to the valve-seat.

While I have illustrated only five examples of the physical embodiment of my invention, I do not thereby intend to limit the scope of the same to such examples, inasmuch as it may be embodied under other forms and by different modes of applying the principle. Modifications and changes in the construc-

tion and location of parts may also be made at will without constituting a substantial departure. For instance, in lieu of the slots 8 in the under surface of the bearing-plate or steam-chest cover I may use a slot or a hole, as indicated in dotted lines, Fig. 1, or a series of holes extending entirely through the plate. The number of pockets in the bearing-surface may be increased or diminished and differently located. The spaces or areas 15 may be enlarged or contracted. The number of spaces or areas to which motive fluid may be admitted at certain positions of the valve travel may be increased and many other changes be introduced. Live steam may be admitted to the space or area 15 at any time when desired; but in several of the examples illustrated it should be admitted only when the valve overtravels the seat—for instance, when the edge of the valve reaches one-eighth or one-fourth of its travel—and it may be exhausted at any point or points of its backward travel. If the engine is doing the greater part of its work at short cut-off, the valve will act under its normal balance for the greater part of the time; but when the engine is working extremely heavy, as in starting a train or under other conditions requiring a longer stroke and the valve overtravels the seat and becomes unbalanced, motive fluid will be admitted to the previously-inclosed space or spaces and the balance be restored.

The value of my improvements will be appreciated by those familiar with the damage, annoyance, and numerous deleterious effects caused by slide-valves which are not properly balanced. In the first and second examples it will be noted that steam is admitted to the space 15 only, which is above the overlapping edge of the valve. In the third example steam is admitted to both sides of the top plate of the valve, and in the fourth example steam is simultaneously admitted to both spaces 15 at the right and left of the valve. In all the examples packing-strips or packing-rings are employed which bear directly against the under surface of the bearing-plate or steam-chest cover.

What I claim is—

1. A slide-valve having a steam-chest cover or bearing-plate with a horizontal under surface, a valve-body with a top horizontal surface, packings forming a plurality of spaces between the bearing-plate and the top surface of the valve-body which spaces are closed to fluid-pressure when the valve-body occupies the central position of its travel; means for admitting steam to an inclosed space when the valve overtravels its seat; and means for exhausting steam from the inclosed space as the valve returns toward its central position.

2. The combination with a valve having a plurality of spaces between the steam-chest cover or bearing-plate and top surface of the valve-body formed by packing strips or rings bearing against the horizontal under surface of the steam-chest cover or bearing-plate, of means for introducing motive fluid from the steam-chest to one or more of said spaces at certain positions of the valve travel; and means for discharging said motive fluid from said space or spaces into the exhaust-cavity at other positions of the valve travel.

3. The combination with a balanced slide-valve having inclosed spaces on opposite sides thereof between the horizontal under surface of the bearing-plate and the horizontal top surface of the valve-body, of means for introducing motive fluid from the steam-chest to one of said spaces as the valve moves from its central position, and means for exhausting said motive fluid as the valve returns to its central position, said means for introducing motive fluid and said means for exhausting motive fluid being located on the same side of the valve as the space to which the motive fluid is admitted and from which it is exhausted.

4. The combination with a slide-valve having inclosed areas on opposite sides thereof at the back, of means for introducing motive fluid to one or more of said spaces when the edge of the valve in its travel overlaps the edge of the valve-seat and becomes unbalanced, and means for exhausting the said motive fluid from the space or spaces when the valve returns to its seat.

5. The combination with a slide-valve having a normally inclosed space between the under horizontal surface of the bearing-plate and the top horizontal surface of the valve-body, of means for introducing steam to said space from the steam-chest direct when the edge of the valve overlaps the valve-seat, and means for exhausting the steam to the exhaust-space when the valve returns to its seat.

6. A balanced slide-valve having a bearing-plate with an under horizontal surface; a valve-seat; a valve-body with a horizontal top; packings forming an inclosed space between the top of the valve-body and the under surface of the bearing-plate; means for introducing live steam to the space when the valve-body overtravels the edge of the valve-seat; and means for exhausting the steam in the space to the exhaust-cavity when the valve-body returns to its seat, said exhaust means being located between the top of the valve-body and the under surface of the bearing-plate.

7. A slide-valve having between the top of the valve-body and the under surface of the bearing-plate inclosed spaces 15, 15, means between the top of the valve-body and the under surface of the bearing-plate for introducing steam to a space 15 when the valve becomes unbalanced, and means also at the surface of the top of the valve-body and under surface of the bearing-plate for exhausting the steam from a space 15 to the exhaust-cavity.

8. A slide-valve having an inclosed space

at the back from which live steam is excluded, and a space or spaces external of the first-mentioned space to which steam can be admitted by suitable means directly from the steam-chest, to balance the valve, when the edge of the valve-body overlaps the edge of the valve-seat and suitable means at the top of the valve-body to exhaust the steam when the valve-body returns to its seat.

9. A slide-valve having two inclosed spaces 15, 15, at its back; means for introducing motive fluid to one of said spaces when the valve overtravels its seat; and means for exhausting the said motive fluid, said inclosed spaces being formed by packing-strips 10, 11 and 12 seated within grooves in the top of the valve-body and bearing against the under horizontal surface of the bearing-plate.

10. A slide-valve having two inclosed spaces at its back formed by the packing-strips 10, 11, and 12; said strips 12 having recesses 14; as and for the purpose specified.

11. The combination in a slide-valve, of packing rings or strips dividing the space at the top of the valve into a plurality of inclosed spaces, said packing strips or rings bearing against a surface at the top; means for introducing steam to one or more of the said inclosed spaces when the valve moves to the right or left; and means comprising a packing strip or ring having its bearing edge narrowed, and a pocket or pockets in the under surface of the bearing-plate for discharging the said steam to the exhaust-cavity.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN T. WILSON.

Witnesses:
LEON E. WATSON,
WM. R. PEOPLES.