

No. 637,487.

Patented Nov. 21, 1899.

W. SELLERS & W. LEWIS.
ANNULAR SLIDE VALVE.

(Application filed Jan. 20, 1899.)

(No Model.)

5 Sheets—Sheet 1.

FIG. 2.

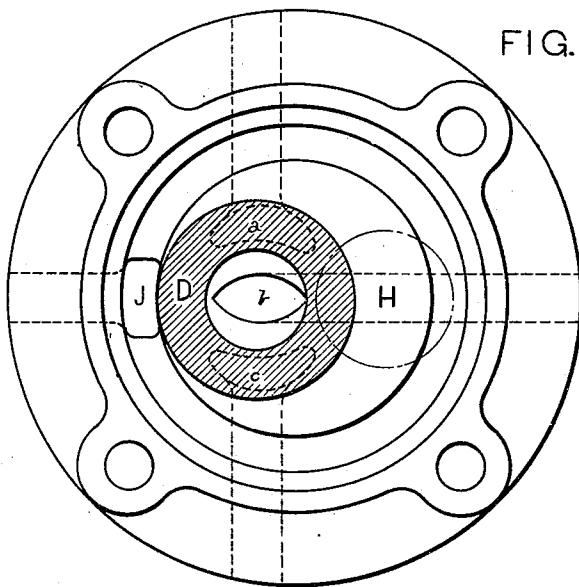
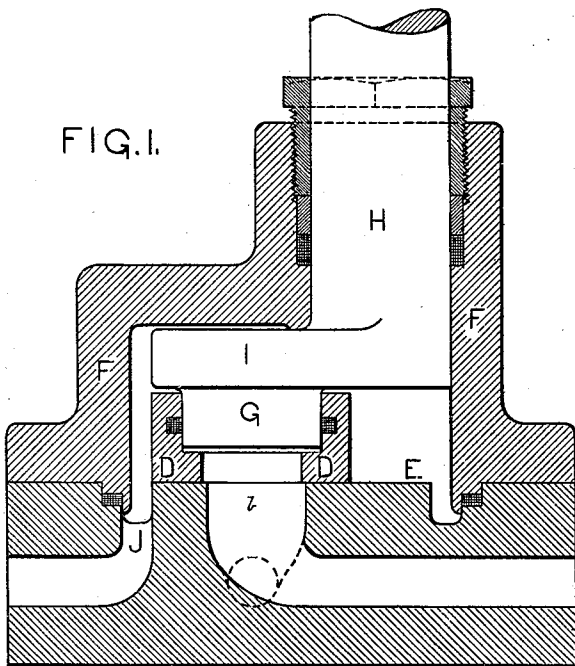


FIG. 1.



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5 Sheets—Sheet 2.

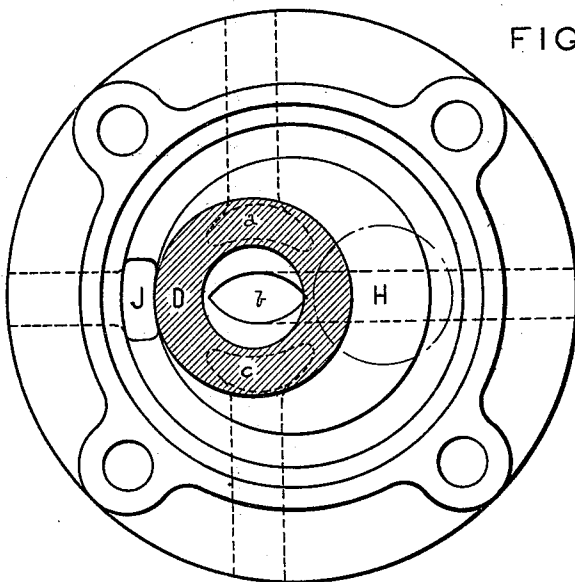


FIG. 4.

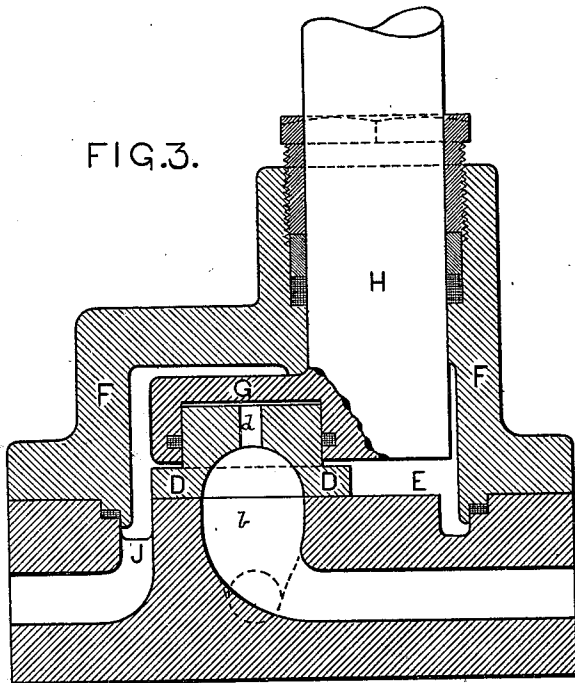


FIG. 3.

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5 Sheets—Sheet 3.

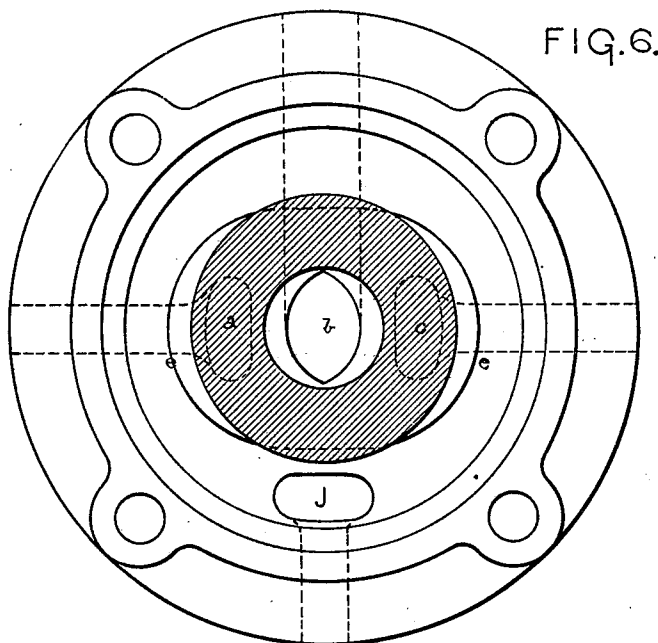
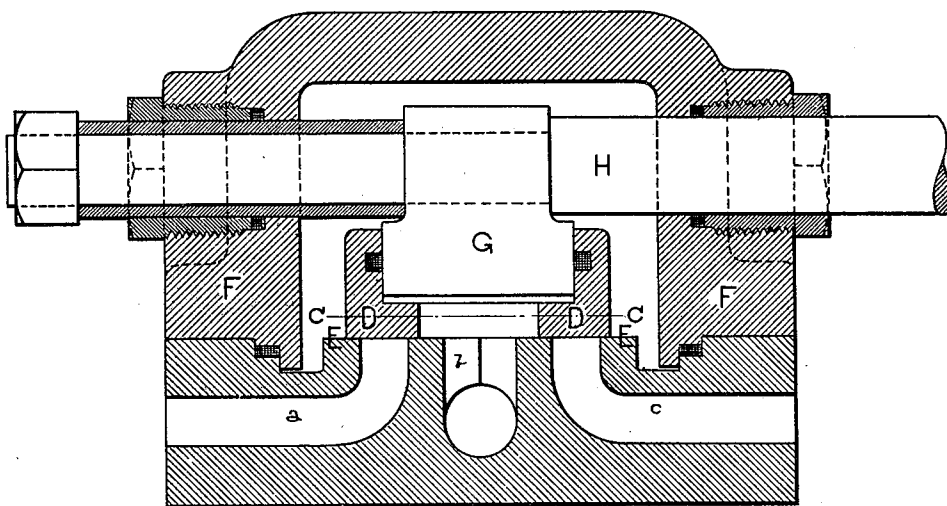


FIG. 6.

FIG. 5



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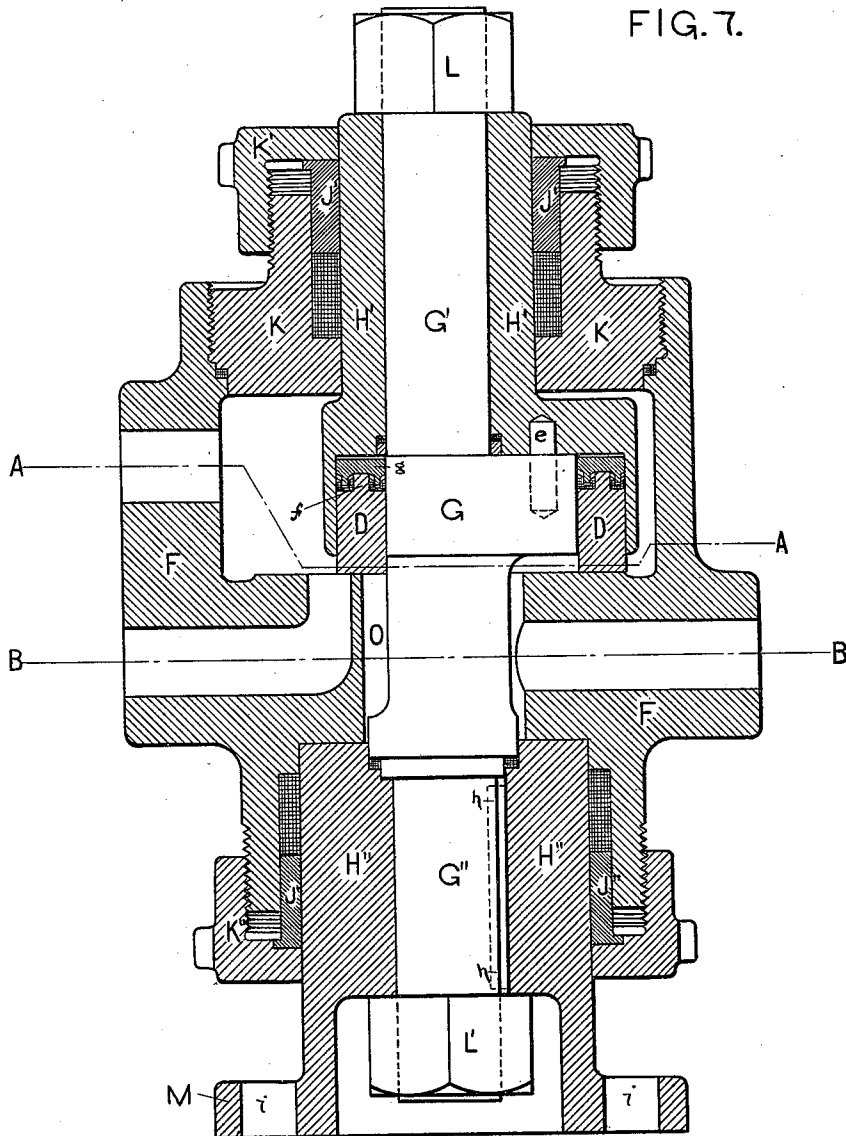
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FIG. 7.



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5 Sheets—Sheet 5.

FIG. 8.

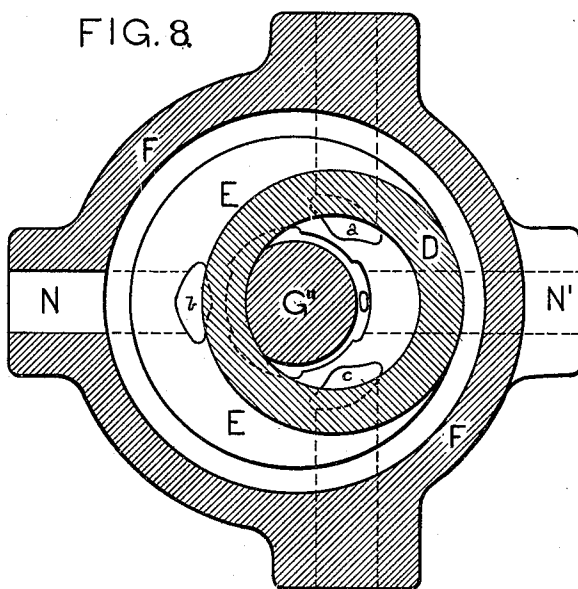
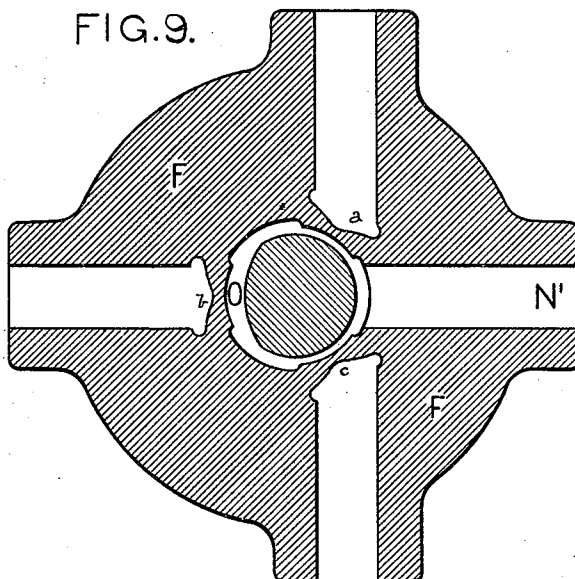


FIG. 9.



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ANNULAR SLIDE-VALVE.

SPECIFICATION forming part of Letters Patent No. 637,487, dated November 21, 1899.

Application filed January 20, 1899. Serial No. 702,805. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM SELLERS and WILFRED LEWIS, of the city and county of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Annular Slide-Valves, of which improvements the following is a specification.

The annular slide-valve has heretofore been constructed on one side of a disk which is provided with a cylindrical pin upon the other side by which the valve is moved back and forth over its ports, while at the same time it is free to rotate about this driving-pin. The use of this valve by reason of its large diameter in proportion to its port areas has been confined almost exclusively to hydraulic machinery, where the volume of water is small and the pressure is large, and, in fact, it is the only metallic valve for this purpose that will maintain without packing a tight joint between the metallic valve and its metallic seat. This is due to the mode of propulsion, which permits it to rotate freely about its axis while it is moving in a plane at right angles thereto, whereby if any part of its surface should tend to seize this would cause the valve to rotate about its axis, changing the direction of the sliding movement and preventing the threatened seizure. The use of such a valve has been further limited by the great pressure to which its sliding surface is subjected by reason of its unbalanced condition.

It is one object of our invention therefore to provide a simple and reliable means for measurably balancing the pressure upon the sliding surfaces of such valves.

It is a further object to balance the stem through which such a valve is operated.

It is a further object to utilize the annular valve for distributing the fluid to the several plungers *separatim* of a motor.

It is a further object to reverse the flow of fluid through such a valve, so as thereby to reverse the direction of rotation of said motor.

It is a further object to measurably balance such a distributing and reversible annular valve.

It is a further object to balance the driving member of such a valve; and it is a further object while so balancing the driving member to retain the necessary pressure upon the valve-face.

The means by which these objects are accomplished are shown in the accompanying drawings, which form part of this specification, in which similar letters refer to similar parts throughout the several illustrations.

Figure 1, Sheet 1, is a section through the axis of an annular slide-valve, its valve-seat, and valve-case, showing the valve-stem perpendicular to the valve-seat and partly in section. Fig. 2 is a plan of the valve-seat and valve, showing the ports to and from the valve-case. Fig. 3, Sheet 2, is a section through the axis of an annular slide-valve, its valve-seat, and valve-case, showing the valve-stem perpendicular to the valve-seat, with a modification of its connection with the valve. Fig. 4 is a plan of the valve, valve-seat, and ports. Fig. 5, Sheet 3, is a section through the axis of an annular slide-valve, its valve-seat, and valve-case, showing the valve-stem parallel to the valve-seat. Fig. 6 is a plan of this valve, valve-seat, and ports. Fig. 7, Sheet 4, is a section through the axis of a rotatable annular slide-valve and its driving member with receiving and delivery ports, the functions of which may be reversed by reversing the flow of the fluid-pressure. Fig. 8 is a section on the line A A, Fig. 7, and Fig. 9 is a section on the line B B, Fig. 7.

In Fig. 1, Sheet 1, D represents the annular slide-valve, E the seat, and F the case thereof. G is the driving member, which fits and closes the bearing on the interior of the valve D, which is rotatable about the driving member G. This driving member is united to the valve-stem H by the crank I, so that by vibrating the stem H about its vertical axis the valve D will be moved back and forth over the ports *a*, *b*, and *c*, which are shown by dotted and full lines on the plan Fig. 2, which also shows the inlet-port J. The driving member G being open to the face of the valve, which always covers the exhaust-port, the crank I, which supports it from the valve-

stem H, would be forced down upon the valve by the fluid-pressure in the valve-case F but for the same pressure over the area of the valve-stem H in the opposite direction, so that if the valve-stem and the driving member are of the same diameter they will balance each other. The driving member G is packed in the bearing of the annular valve to prevent any escape of the pressure fluid around this member to the exhaust-port, the area of which will relieve the valve itself from so much of this pressure. As this valve is moved back and forth over the ports it will be subjected to a varying pressure, dependent upon its position over the ports, and it must always be subject to enough pressure to prevent the escape of the pressure fluid between the valve-face and its seat, so that it is not possible to relieve it from all pressure toward its seat. Subject to this limitation the driving member G may be of any diameter, and to this extent the valve may be balanced in a simple and effective manner.

Figs. 3 and 4, Sheet 2, represent the same conditions as those above described, but the connection between the valve D and the driving member G is the converse of that shown in Fig. 1. The driving member in Fig. 3 is the crank I of Fig. 1, and the cylindrical projection in the axis of the valve D is the driving member G of Fig. 1. In the first instance the valve surrounds the driving member and in the second the driving member surrounds the valve, the operation of the driving member and the valve being the same in both. The driving member G, Fig. 3, fits the bearing on the exterior of the cylindrical projection of the valve D and closes it against access to the valve-face by the opening *d* in the same manner that the driving member in Fig. 1 closes access to its valve-face. The diameter of the cylindrical projection on the valve determines the amount of pressure from which the valve is relieved, and the diameter of the valve-stem compared with that of the projection determines whether this stem shall be entirely or only partially balanced. If the valve-stem is of less diameter than the projection, the driving member will press upon the valve, and if greater the crank I will be forced against the valve-case, or the valve-stem may have an outer support to receive this pressure. It is evident, therefore, that the areas of the bearing on the valve, its driving member, and the valve-stem may be varied to modify the balancing of both the valve and the valve-stem as desired.

Fig. 5, Sheet 3, represents a similar valve to that shown in Fig. 1; but the driving member G is supported by a valve-stem H, which moves parallel to the valve-seat and is balanced by passing through opposite sides of the valve-case. The diameter of this valve-stem must be such as to sustain the fluid-pressure upon the driving member G.

Fig. 6 is a plan of the valve-seat shown in Fig. 5, with a cross-section of the valve on the

line C C, Fig. 5, showing the ports *a*, *b*, and *c* under the valve and the inlet-port J. The outline of the valve-seat is shown by the line *e e* of such size and shape that the valve in its traverse will pass over the edge of its seat in every direction to avoid the formation by wear of any ridges exterior to the valve.

Fig. 7, Sheet 4, represents a rotatable annular slide-valve D, its seat E, and its case F for directing fluid-pressure to the several pistons of a motor. The driving member G fits and closes the bearing in the valve D and is rotatable about an axis eccentric to the axis of the valve. This driving member is extended in this eccentric axis beyond the valve on one side (marked G') and the valve-seat on the other, (marked G''). On the end G' is mounted a sleeve H', the outer end of which is of the same diameter as the bearing in the valve D, and the inner end is enlarged to cover and inclose the valve D. The sleeve H' is secured upon the driving member G by the pin *e*, so as to form a chamber between this member and the enlarged end of the sleeve H', which is filled by the valve D and in which this valve can turn freely about its axis. The side of the valve D opposite its seat is provided with a circular rib *f*, on each side of which a packing is mounted and held in place by the two circular ribs on the circular plate *g*. The effect of this arrangement is to permit pressure fluid to pass the packings either from the inside or from the outside of the valve; but from whichever side this fluid enters the space above the valve D it cannot pass out on the other side. The exterior of the sleeve H', which is of the same diameter as the bearing in the valve D, is fitted to the stuffing-box K, which is screwed into the valve-case F and packed below the screw-threads, as shown, to prevent the escape of fluid-pressure at this point. The outer end of this stuffing-box is provided with a recess for the packing, a follower J', and a packing-nut K', which operate in the usual manner, and the sleeve H' is sustained against the fluid-pressure in the valve-case by the nut L on the end of the extension of the driving member G'. The extension of the driving member G'', beyond the valve-seat and its ports, is provided with a sleeve H'', the outer diameter of which is equal to the outer diameter of the valve D and is supported by the valve-case F, in which it can rotate freely. It is secured upon the extension of the driving member G'' by the nut L' and the key *h*. The sleeve H'' is extended beyond the nut L' to form a face-plate M, provided with bolt-holes *i i* to secure it upon a similar plate on the motor which drives it or upon an attachment thereto rotating in the same time. The outer circumference of the sleeve H'' is packed by a stuffing-box, the follower J'', and a packing-nut K'' in the usual manner.

Fig. 8, Sheet 5, is a cross-section of the driving member G'', the valve D, and the valve-case F on the line A A, Fig. 7, in which N is

a port to the valve-chamber, and N' a port to the chamber O about the axis eccentric to the axis of the valve D, which chamber is open to the face of the valve. The ports *a b c* in the valve-seat are arranged concentrically about this eccentric axis, so that the rotation of the valve about this eccentric axis opens these ports alternately to the valve-chamber and to the chamber O about the eccentric axis, which is open to the face of the valve D.

Fig. 9, Sheet 5, is a cross-section of the valve-case F on the line B B, Fig. 7, and shows the three ports *a b c* with their outlets from the valve-case F, also the port N' from the chamber O to the exterior of the valve-case. Supposing the pressure fluid to be admitted to the valve-chamber by the port N, it will pass the packing on the outside of the rib *f*; but as it cannot pass the packing on the inside of this rib it will force the face of the valve D upon its seat by pressure upon its back, and at the same time will force the sleeve H' in the opposite direction; but as this sleeve is of the same diameter as the driving member G, which is open to the port N', in this case the exhaust, the outside pressure on the sleeve H' will be balanced, because the pressure is all over the interior of the valve-chamber, except the driving member G, which is of the same diameter as the sleeve H', and the pressure upon these being in opposite directions they balance each other. If now the pressure fluid is admitted to the valve D through the port N', it will pass the packing on the inside of the rib *f*; but as it cannot pass the packing on the outside of this rib it will force the face of the valve D upon its seat by pressure upon its back, and at the same time will force the sleeve H' in the opposite direction—that is, the fluid-pressure on that side will be all over the surface inclosed within the outer circumference of the valve, which will be balanced by the sleeve H'', which is of the same diameter, so that in whichever direction the fluid-pressure is admitted the driving member will be balanced, and the pressure upon the valve will be limited to the area of its annulus. This may be modified by increasing or decreasing this annulus in proportion to that of the valve-face, and by admitting the pressure fluid to the interior or to the exterior of the valve the direction of rotation of the motor which it supplies will be reversed.

Having thus shown and described our improvements in annular slide-valves, what we claim as new, and desire to secure by Letters Patent, is—

1. An annular slide-valve rotatable about its own axis on a bearing, an opening from the bearing to the face of the valve, and a driving member which fits and closes the bearing.

2. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing, an opening from the bearing to the face of the valve, a driving member which

fits and closes the bearing, and is supported by a valve-stem which passes out of the valve-case.

3. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing, an opening from the bearing to the face of the valve, a driving member which fits and closes the bearing and is supported by a valve-stem eccentric to the driving member, which stem passes out of the valve-case at right angles to the valve-seat.

4. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing and about an axis eccentric to the axis of the valve, an opening from the bearing to the face of the valve, a driving member rotatable about the eccentric axis which fits and closes the bearing, a chamber about the eccentric axis open to the face of the valve, and a plurality of ports in the valve-seat concentric with the eccentric axis, which by the rotation of the valve about the eccentric axis, are alternately opened to the valve-case and to the chamber about the eccentric axis.

5. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing and about an axis eccentric to the axis of the valve, an opening from the bearing to the face of the valve, a driving member rotatable about the eccentric axis which fits and closes the bearing, a chamber about the eccentric axis open to the face of the valve, an opening from this chamber to the outside of said valve-case, a plurality of ports in the valve-seat concentric with the eccentric axis, which by the rotation of the valve about the eccentric axis, are alternately opened to the valve-case and to the chamber about the eccentric axis.

6. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing and about an axis eccentric to the axis of the valve, an opening from the bearing to the face of the valve, a driving member rotatable about the eccentric axis which fits and closes the bearing, a chamber about the eccentric axis open to the face of the valve, an opening from this chamber to the outside of said valve-case, a plurality of ports in the valve-seat concentric with the eccentric axis, which by the rotation of the valve about the eccentric axis, are alternately opened to the valve-case and to the chamber about the eccentric axis, and means to balance the driving member when the pressure fluid is admitted either to the inside or to the outside of the valve.

7. A valve-case which incloses an annular slide-valve rotatable about its own axis, and about an axis eccentric to the axis of the valve, a plurality of ports in the valve-seat concentric with the eccentric axis, and means which balance fluid-pressure admitted to the inside or to the outside of the valve.

8. A valve-case which incloses an annular slide-valve rotatable about its own axis and

movable in a plane perpendicular to its axis of rotation, and means which balance fluid-pressure admitted to the inside or to the outside of the valve.

- 5 9. A valve-case which incloses an annular slide-valve rotatable about its own axis on a bearing, an opening from the bearing to the face of the valve, a driving member which fits and closes the bearing and covers two other

sides of the valve, with means adapted to maintain fluid-pressure on the side opposite the valve-face.

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Witnesses:

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It is hereby certified that in Letters Patent No. 637,487, granted November 21, 1899, upon the application of William Sellers and Wilfred Lewis, of Philadelphia, Pennsylvania, for an improvement in "Annular Slide-Valves," an error appears in the printed specification requiring correction, as follows: In line 125, page 3, the word "outside" should read *outside*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 5th day of December, A. D., 1899.

[SEAL.]

WEBSTER DAVIS,
Assistant Secretary of the Interior.

Countersigned:

C. H. DUELL,
Commissioner of Patents.