G. B. PETSCHE.

BALANCED ROTARY VALVE.

APPLICATION FILED AUG. 10, 1909.

993,401. Patented May 30, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

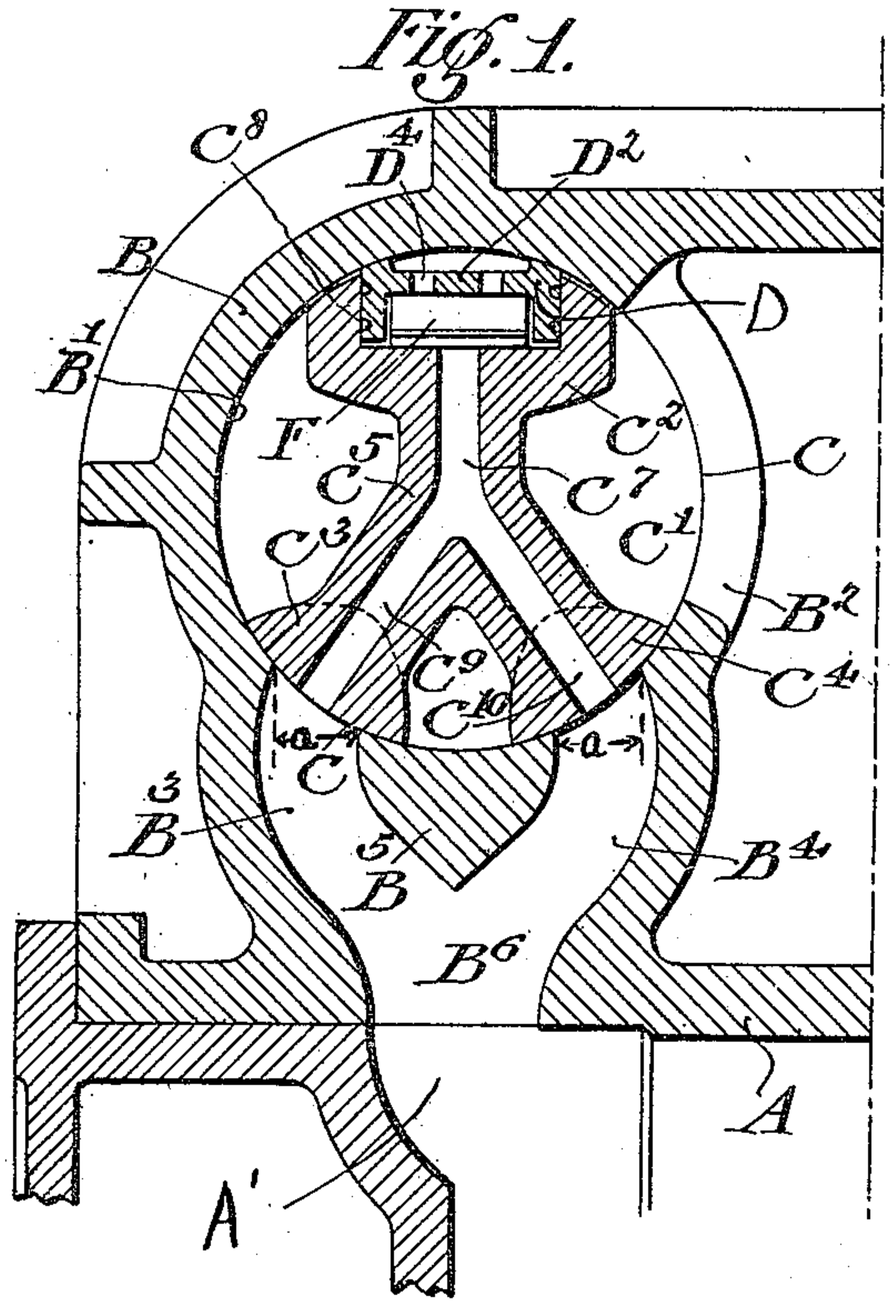


Fig. 2.

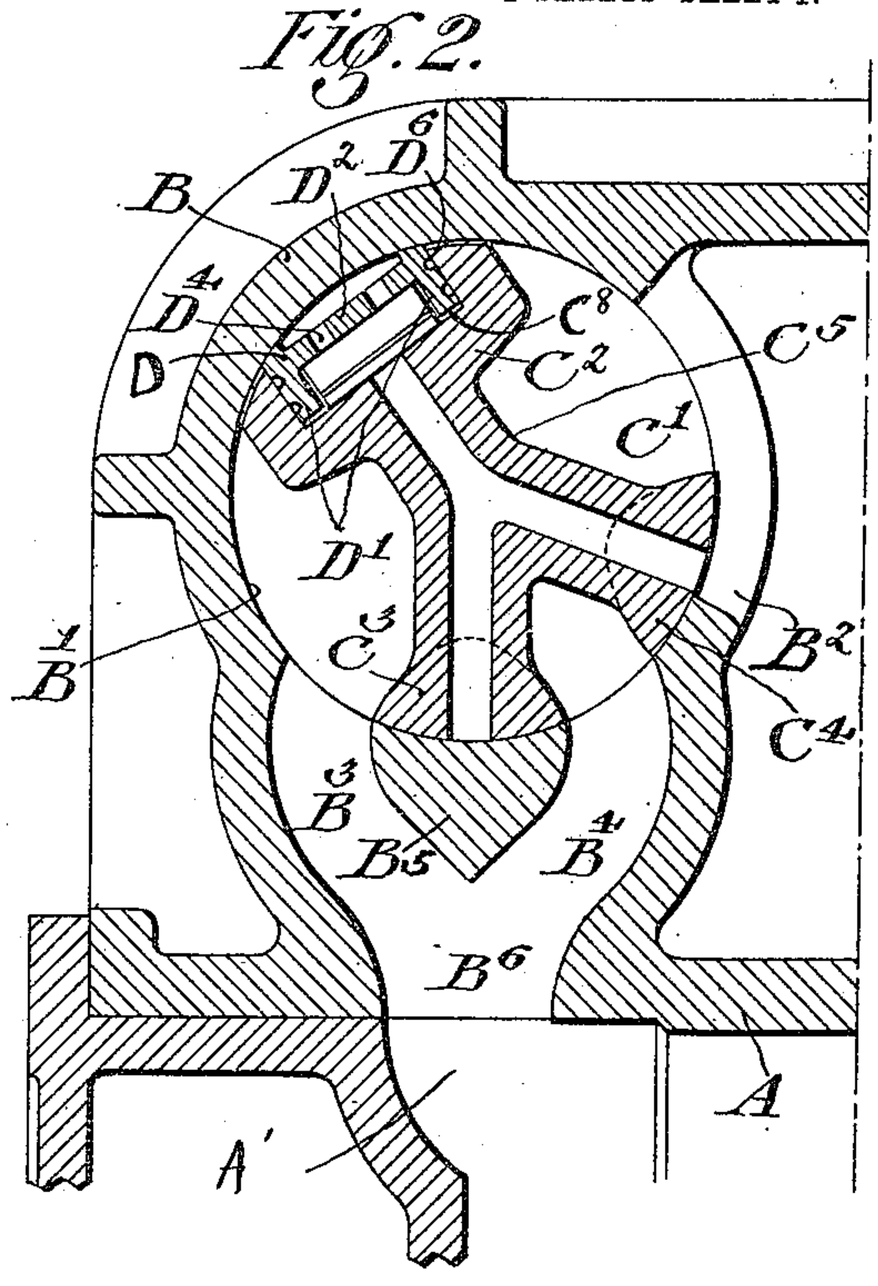


Fig. 3.

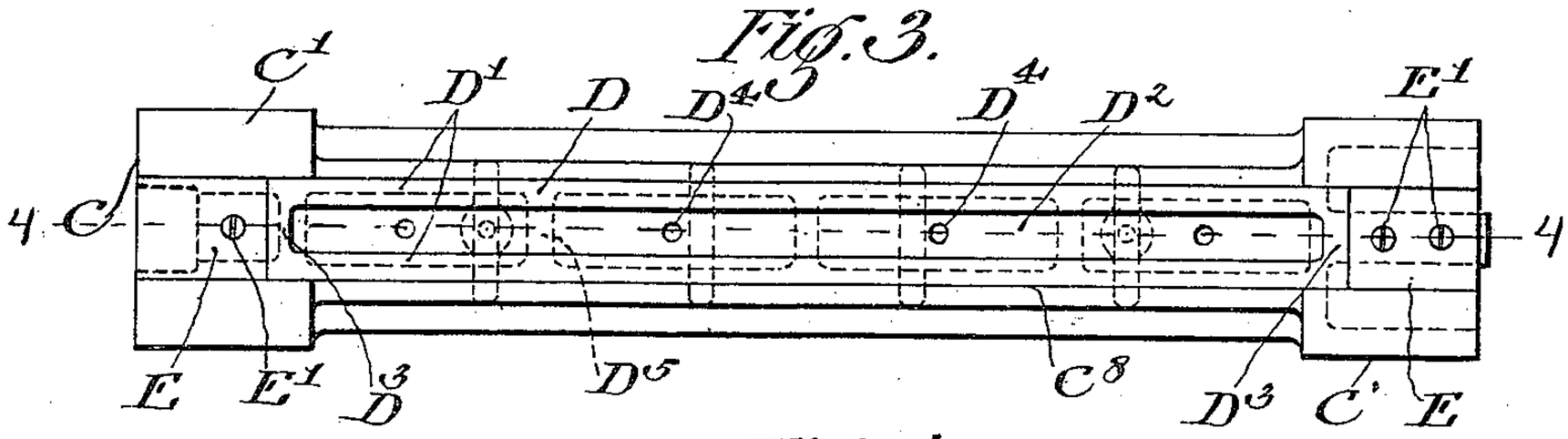


Fig. 4.

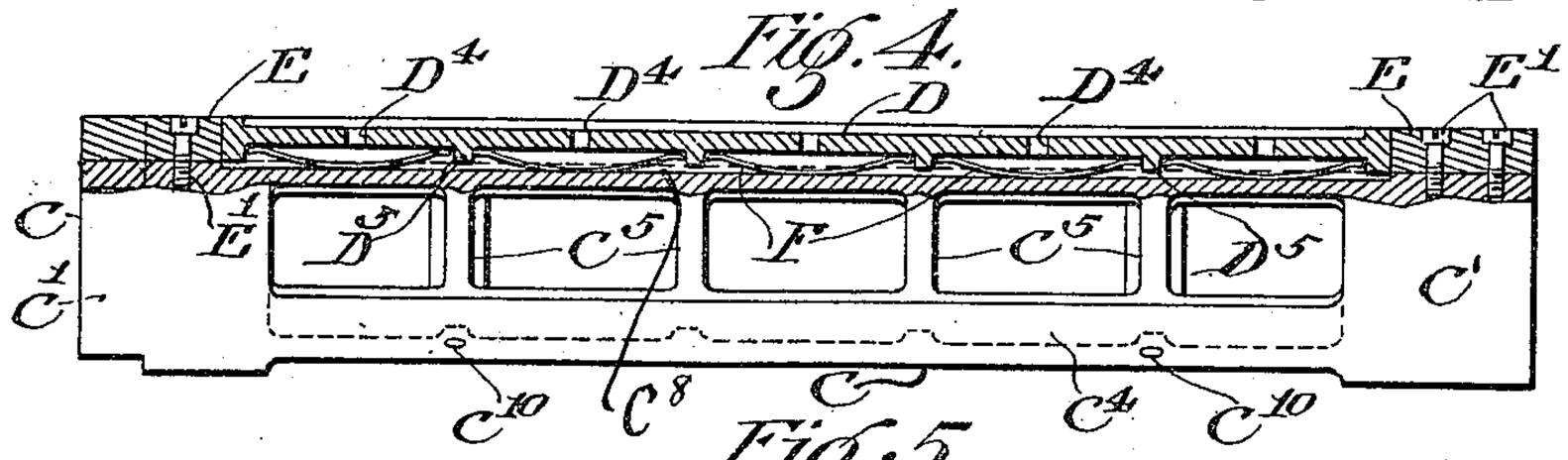
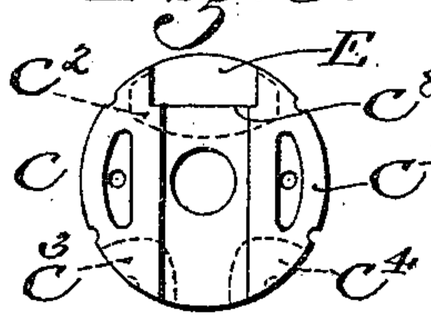


Fig. 5.



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2 SHEETS—SHEET 2.

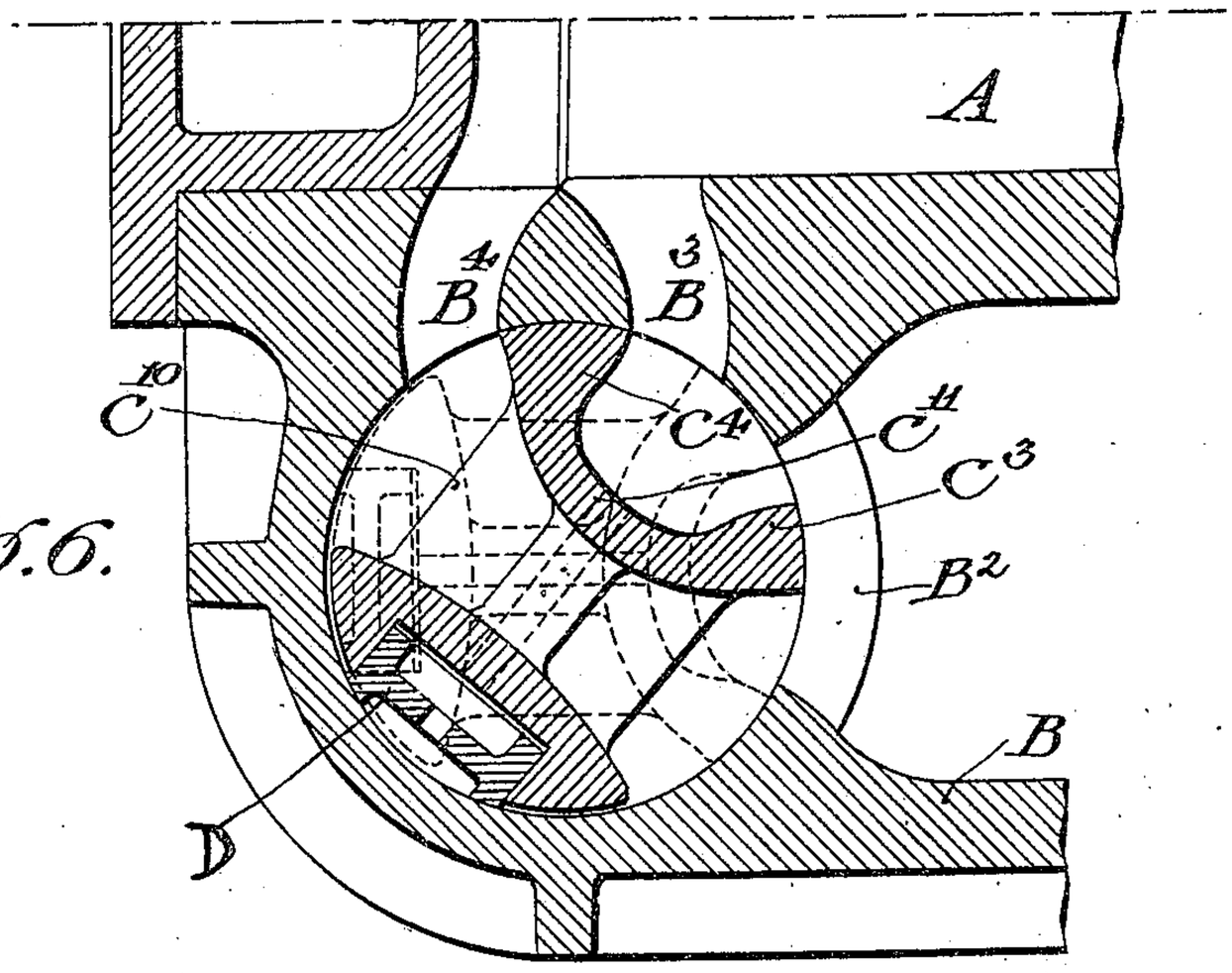

Fig. 6.

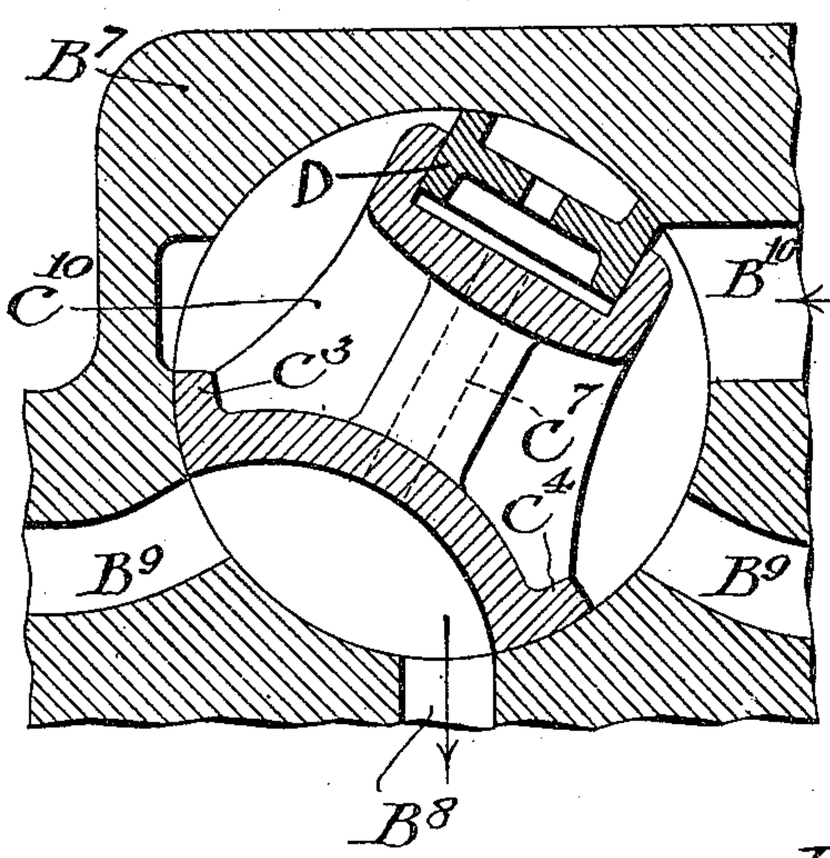

Fig. 7.

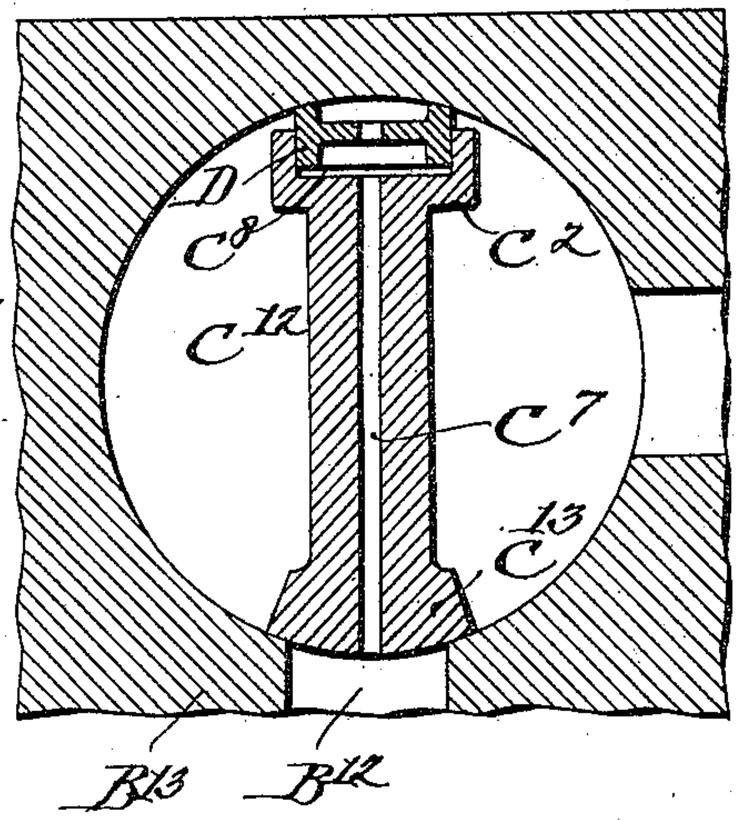

Fig. 8.

Fig. 9.

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BALANCED ROTARY VALVE.

993,401. Specification of Letters Patent. **Patented May 30, 1911.**

Application filed August 10, 1909. Serial No. 512,114.

To all whom it may concern:

Be it known that I, GUSTAV B. PETSCHE, a citizen of the United States, residing in the city and county of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Improvement in Balanced Rotary Valves, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part thereof.

My present invention relates to rotary valves and particularly to steam engine valves of the Corliss type.

The object of the invention is the production of a valve of the type specified, with simple and effective provisions for substantially balancing the valve under the varying conditions of operation and with the various parts of the valve structure so formed and arranged that the valve will be durable and reliable in operation, and simple and comparatively inexpensive to manufacture.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, and the advantages possessed by it, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described forms in which the invention may be embodied.

Of the drawings, Figure 1 is a sectional elevation through the valve chest and a portion of the steam cylinder of a steam engine, the section being taken transversely to the axis of rotation of the valve, and showing the valve in the closed position. Fig. 2 is a sectional elevation taken similarly to Fig. 1, showing the valve in the open position. Fig. 3 is a plan view of the rotary valve member employed in the construction shown by Figs. 1 and 2. Fig. 4 an elevation partly in section on the line 4—4 of Fig. 3. Fig. 5 an end elevation, of the rotary valve proper, of the construction shown in Figs. 1 and 2. Figs. 6, 7, and 8 are views taken similarly to Fig. 1, each showing a valve construction differing somewhat from those shown by the other figures of the drawings, and Fig. 9 is a perspective view of a spring which may be employed in the various valves illustrated.

In the drawings, and referring first to the construction shown in Figs. 1 to 5, inclusive, A represents the cylinder of a steam engine, B the valve chest of a Corliss valve, and C the rotary valve proper. The valve chest B is provided with an inlet port B^2 leading to the valve chamber B′, and with an outlet port B^6 which leads from the chamber B′ to the inlet port A′ of the cylinder A. The port B^6 is divided at one end into branches B^3 and B^4 which communicate with the valve chamber B′, the branches B^3 and B^4 being separated by a portion B^5 of the valve chest B extending parallel to the axis of the valve. The valve member C in the form shown comprises cylindrical end portions C′ which fit the ends of the valve chamber B′ and are connected by longitudinal portions C^2, C^3 and C^4. At intervals along the length of the valve the longitudinal portions C^2, C^3 and C^4 are connected by Y shaped spider members C^5. The valve portions C^3 and C^4 serve as the port opening and closing parts of the valve, and when the latter is in the position shown in Fig. 1, the cylindrical surfaces of the portions C^3 and C^4 close the branches B^3 and B^4, respectively, of the outlet port B^6. When the valve is in the position shown in Fig. 2, the valve portions C^3 and C^4 are in such position that both branches B^3 and B^4 of the outlet port are open to the valve chamber B′. The latter is at all times in communication with the inlet port B^2. The valve portion C^2 is provided with a cavity C^8 extending longitudinally of the valve and having parallel sides. This cavity, in the preferred construction illustrated, is in the form of a slot which can be accurately formed in a simple manner by through planing or milling cuts. The ends of this slot or groove are closed by blocks E which fit snugly in the ends of the slot and may also be secured in place by suitable retaining devices, as the screws E′. The blocks E are shaped to complete the cylindrical contour of the end portions C′ of the valve C. Between the slot closing end member E a movable member D is located in the cavity C^8. This block D comprises side members D′, extending parallel to the side walls of the cavity C^8, and connected together by a transverse web D^2 and by end portions D^3. The outer edges of the end portions D^3 and the side portions D′

unite to form a marginal rim portion curved to conform to the shape of the valve chamber B′. The piece D is formed at its underside, along its length, with transverse ribs D^5 which serve as positioning and spacing devices for bent leaf springs F which extend between the web B^2 and the bottom of the cavity C^8, and at all times urge the valve outward against the curved surface of the valve chamber. Ports D^4 are formed at intervals through the web D^2 so that the spaces between the side bars D′, and ends D^3, at the two sides of the web D^2 are in free communication. Grooves D^6 formed in the outer sides of the block D in a well known manner to assist in obtaining a steam tight joint between these sides and the side walls of the cavity, while at the same time permitting the block to have a reasonable freedom of movement in the cavity.

In some or all of the spider members C^5, ports are formed, the ports in each spider comprising a portion C^7 opening at one end into the cavity C^8 and communicating at its other end with the branches C^9 and C^{10} running to the port opening and closing faces of the valve portions C^3 and C^4. By this arrangement the fluid pressure in the cavity C^8 is maintained at all times equal to the fluid pressure to which the faces of the valve portions C^3 and C^4 are exposed. It will be observed that cavity C^8 is symmetrically disposed with respect to the valve portions C^3 and C^4, and when the valve is in the closed position shown in Fig. 1 is symmetrically disposed with respect to the outlet branch ports B^4 and B^5. Preferably, the cross sectional area of the member D on a plane extending transversely to the line of movement of the member, is substantially equal to the projections of the mouths of the ports B^4 and B^5 on that plane when the valve is in the closed position. In other words, in the form of apparatus disclosed, the width of the member D is equal to the sum of the two widths *a* shown in Fig. 1. Because of these provisions the valve shown is in substantially perfect balance, when open and when closed, for it is apparent that the fluid pressure exerted against the faces of the valve portions C^3 and C^4 by the fluid from the ports B^3 and B^4 when the valve is closed, is of course exactly balanced by the fluid pressure acting against the bottom wall of the cavity C^8, and it may be assumed that the pressure of the steam admitted to the valve chamber B′ through the port B^2 exerts a substantially balanced pressure on the remaining portions of the valve. This of course would be absolutely true if the valve portion C^3 and C^4 did not overlap the ports B^3 and B^4, and where the overlapping is small, it is usually assumed, and the assumption is substantially correct, that the overlapping valve portions are exposed to the full pressure in the valve chest. Similarly, when the valve is in the open position shown in Fig. 2, the valve is also in balance.

With the construction illustrated, it is obvious that the balancing provisions, including the slot C^8, the slot end closing portions E, the member D, and the spring F, can all be formed by simple mechanical steps and at comparatively slight cost. Because of the substantial size of the member D and the extended surfaces of its side walls and the side walls of the cavity C^8, in contact therewith, it is possible to obtain practically steam tight joints, while at the same time having the desired freedom of movement of the member D, in its cavity without any special packing devices other than the grooves D^6. Also it will be readily apparent to those skilled in the art that the valve as a whole will be durable and reliable in operation.

In Fig. 6 I have shown an outlet valve differing slightly from the inlet valve shown in Figs. 1 to 5, inclusive. In Fig. 6, B represents the valve chest, and A the cylinder, as before, and these parts are shown as identical with the cylinder and valve chest of Figs. 1 to 6, inclusive. The valve member C^{10} differs however in that the port C^7 is not bifurcated, but leads to the space between the valve portions C^3 and C^4, which, in this form of the invention, are connected by a web C^{11}. In this form of the invention the width of the member D should be substantially equal to the width of the port B^2, which, in the case of the outlet valve shown, is of course the outlet port of the chamber B′. When the valve is closed, as shown in dotted lines in Fig. 6, the pressure exerted against the outer side of the web C^{11} is balanced by the pressure exerted against the bottom wall of the cavity C^8.

It will of course be understood that the valves proper shown in Figs. 1 and 2, and in Fig. 6, may each be used either in an inlet or outlet valve structure. The invention can also be applied to a valve adapted to alternately control the admission to and exhaust from both ends of a single cylinder, and I have shown such a construction in Fig. 7 where the valve member C^{10} is identical with the valve member C^{10} of Fig. 6, while the valve chest B^7 is formed with an inlet port B^{10} for steam, and an exhaust port B^8, and with ports B^9 running to the opposite ends of the cylinder one of the ports B^9 is in communication with the exhaust port B^8 and the other port B^9 is in communication with the inlet port B^{10}. When the valve is in the second position (not shown), the port B^9, which was before connected to the outlet port B^8 is in communication with the inlet port B^{10}, and the other port B^9 is in communication with the exhaust port B^8, and when in an intermediate position the ports B^9 are both closed. In all positions the

valve is in more or less perfect balance owing to the provision of the block D and cooperating provisions. In this type of valve accurate balancing provisions are not as necessary or desirable as in some other types of valves. In consequence, where it is not convenient to make the width of the member D closely approximate the width of the space between the adjacent edges of faces C^3 and C^4, this need not be done.

While in the constructions shown in Figs. 1, 2, 6 and 7, the port opened and closed by the valve is bifurcated, and in consequence two port opening and closing valve surfaces are essential, the invention can obviously be applied where the port controlled by the valve is not bifurcated, and in Fig. 8 I have shown an arrangement in which the valve member C^{12} comprises two longitudinally extending, diametrically opposed, portions C^2 and C^{13}. The portion C^{13} serves to alternately open and close the port B^{12} in the valve casing B^{13}. From the cavity C^8 in portion C^2, one or more ports C^7 run to the face of the valve portion C^{13}.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is,

1. In combination, a valve casing having a cylindrical valve chamber and a port or ports opening into said chamber, a valve body rotatably mounted in said chamber and provided at one side with a surface adapted to close said port or ports when the valve is in the closed position, and at the other side with a cavity, and being formed with one or more passages leading from said surface to said cavity, a member fitting in said cavity and radially movable therein, formed with a marginal rim portion adapted to engage the wall of the valve chamber, and being perforated to place the space inclosed by said rim portion in communication with the inner end of said cavity, and resilient means for holding said block in engagement with the wall of said valve chamber.

2. In combination, a valve casing having a cylindrical valve chamber and a port or ports opening into said chamber, a valve body rotatably mounted in said chamber and provided at one side with a surface adapted to close said port or ports when the valve is in the closed position, and at the other side with a cavity, and being formed with one or more passages leading from said surface to said cavity, a member fitting in said cavity and radially movable therein, formed with a marginal rim portion adapted to engage the wall of the valve chamber, and being perforated to place the space inclosed by said rim portion in communication with the inner end of said cavity, the cross sectional area of said member on a plane transverse to its axis of movement being substantially equal to the projection on said plane, when the valve is closed, of the part or parts closed by the valve.

3. In combination, a valve casing having a cylindrical valve chamber and a port or ports opening into said chamber, a valve body rotatably mounted in said chamber and provided at one side with a surface adapted to close said port or ports when the valve is in the closed position, and at the other side with a slot extending longitudinally of the valve body and formed with parallel sides, blocks secured in and closing the ends of said slot, said valve body being formed with one or more passages leading from the bottom of said slot, between said blocks to said surface, a movable member mounted in said slot and engaging the side walls of the slot and the adjacent end surfaces of said blocks, said members having a marginal rim portion adapted to engage the curved wall of the valve chamber and an apertured connecting portion, and resilient means for holding said member in engagement with the wall of the valve chamber.

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