(No Model.) 2 Sheets—Sheet 1

J. L. BOGERT.

BALANCED ROTARY VALVE.

No. 298,063. Patented May 6, 1884.

Fig. 2.

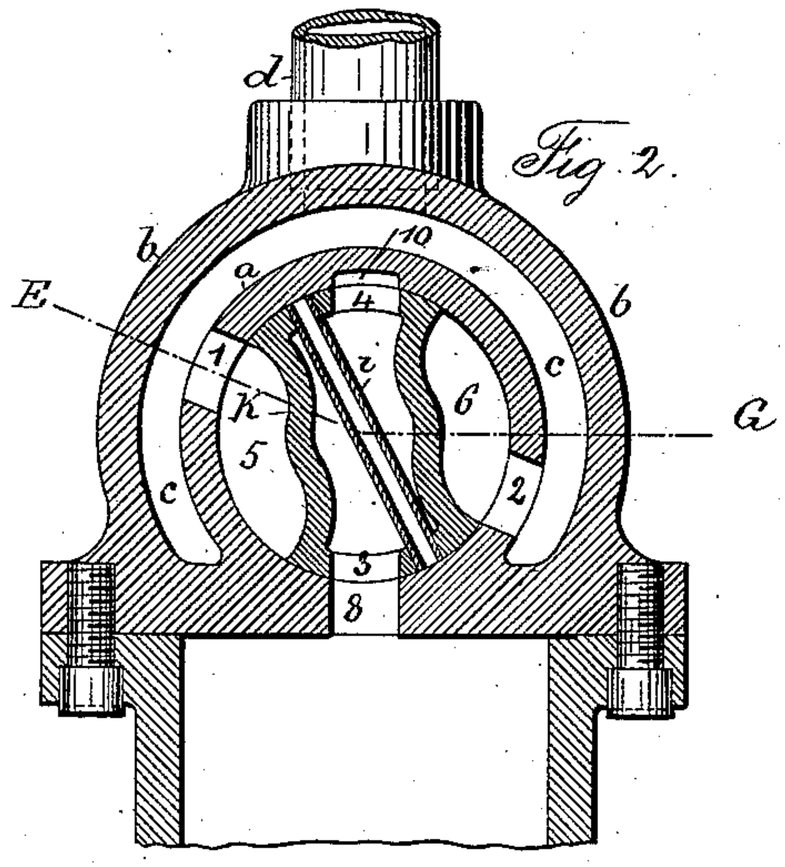


Fig. 9.

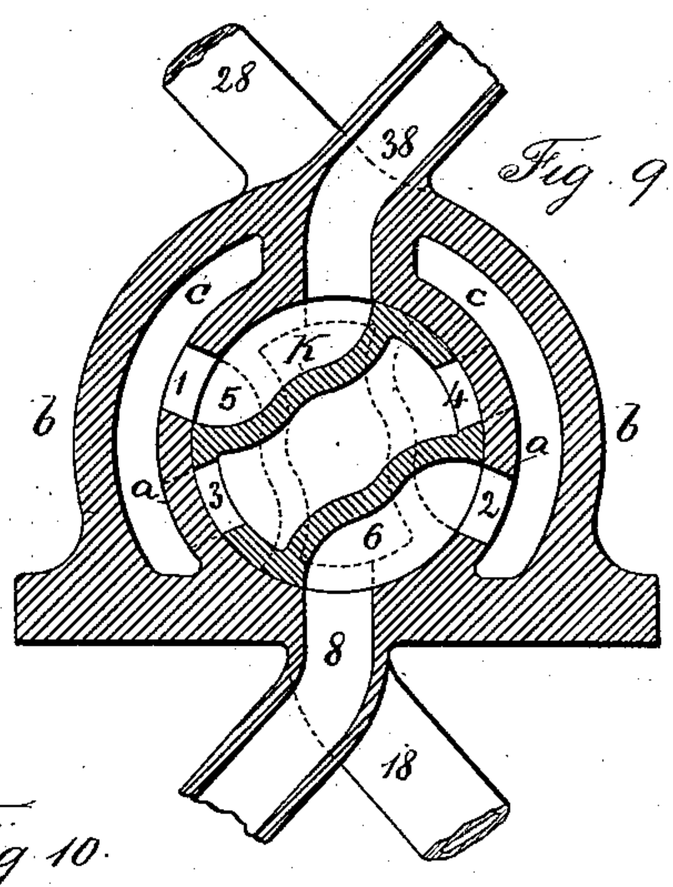


Fig. 10.

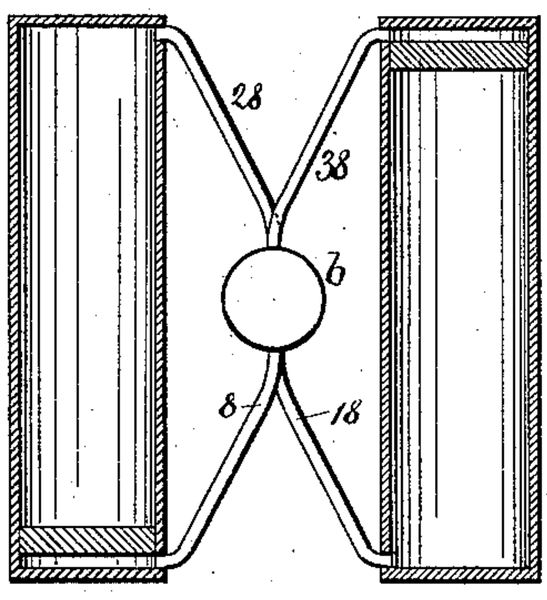


Fig. 1.

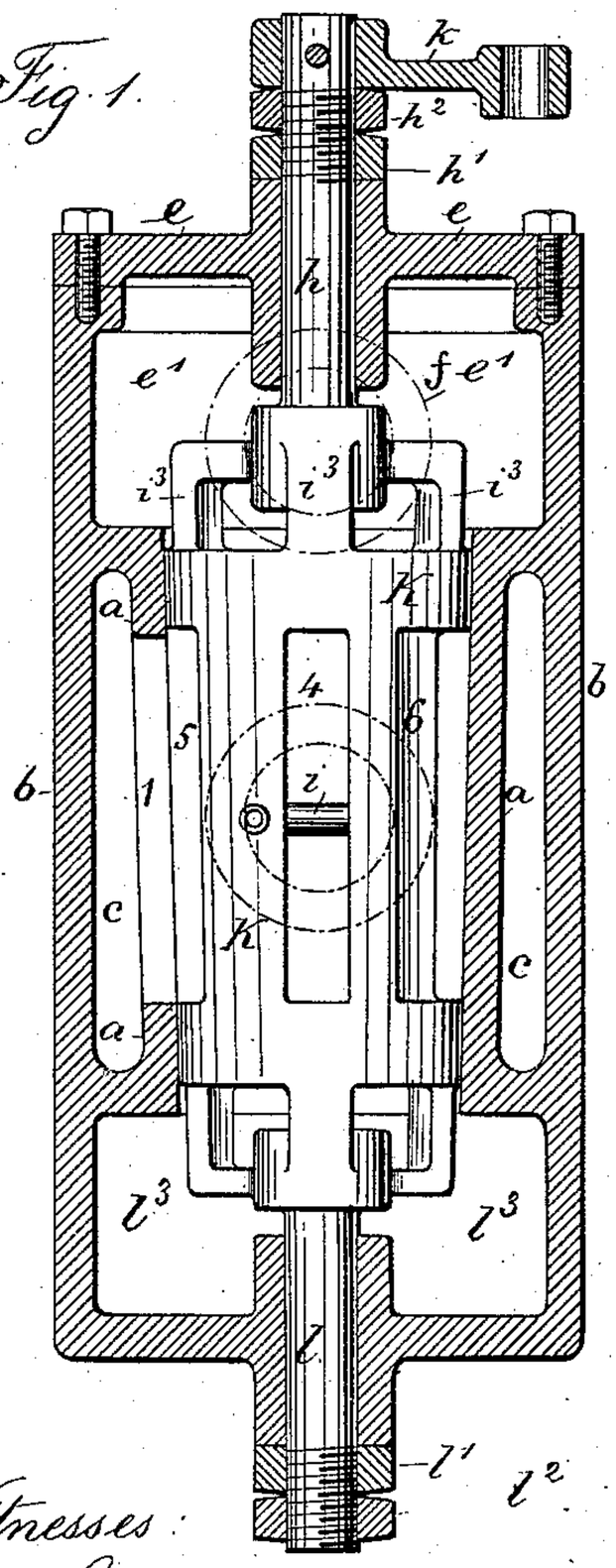
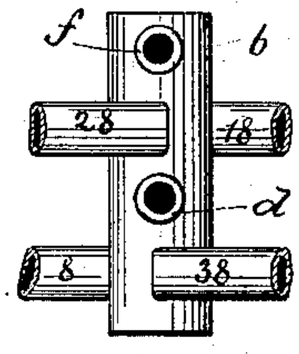


Fig. 11.



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(No Model.) 2 Sheets—Sheet 2.

J. L. BOGERT.

BALANCED ROTARY VALVE.

No. 298,063. Patented May 6, 1884.

Fig. 4.

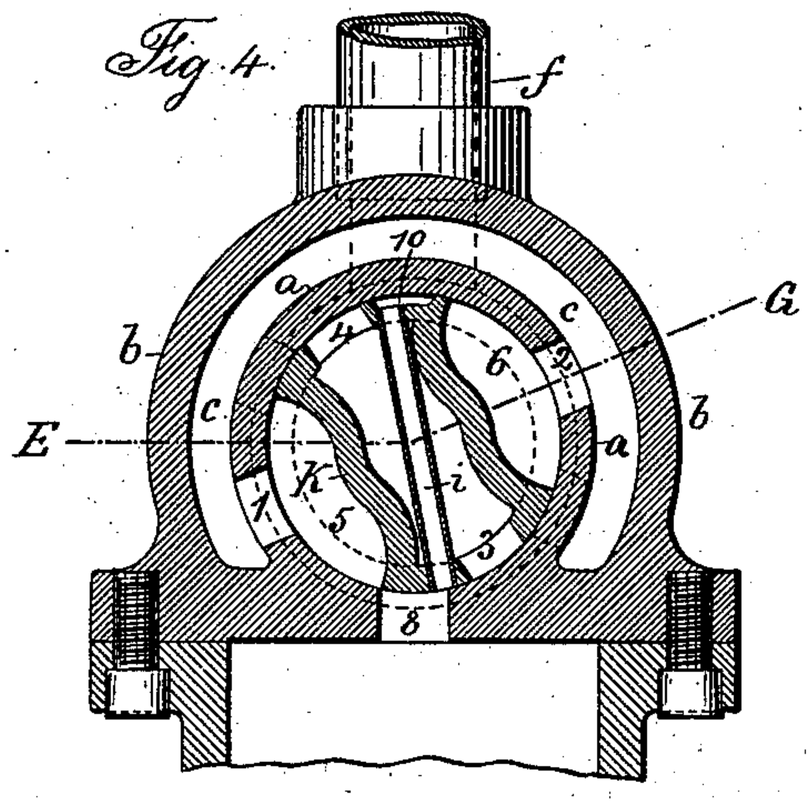


Fig. 5.

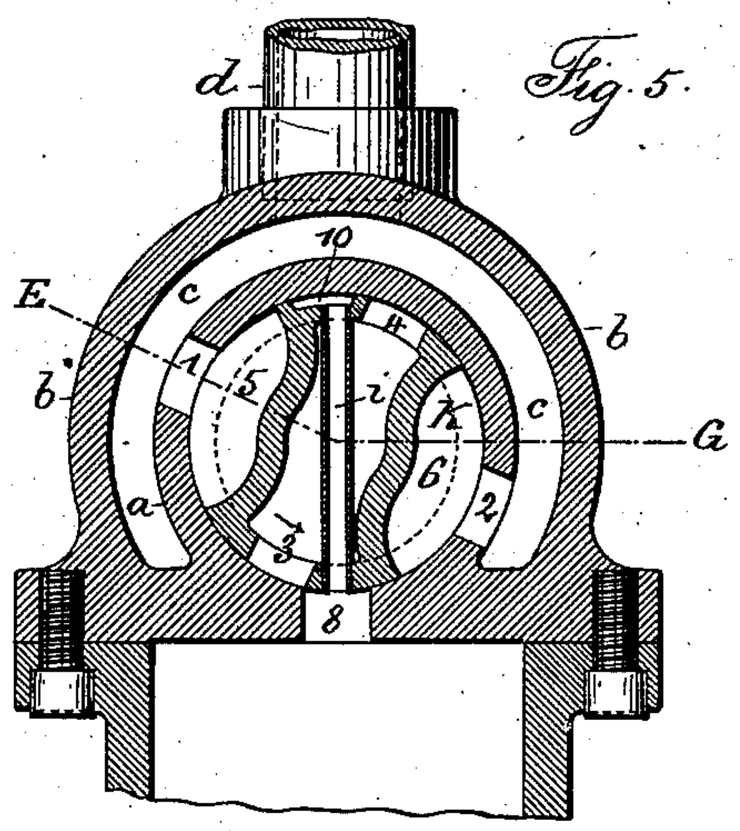
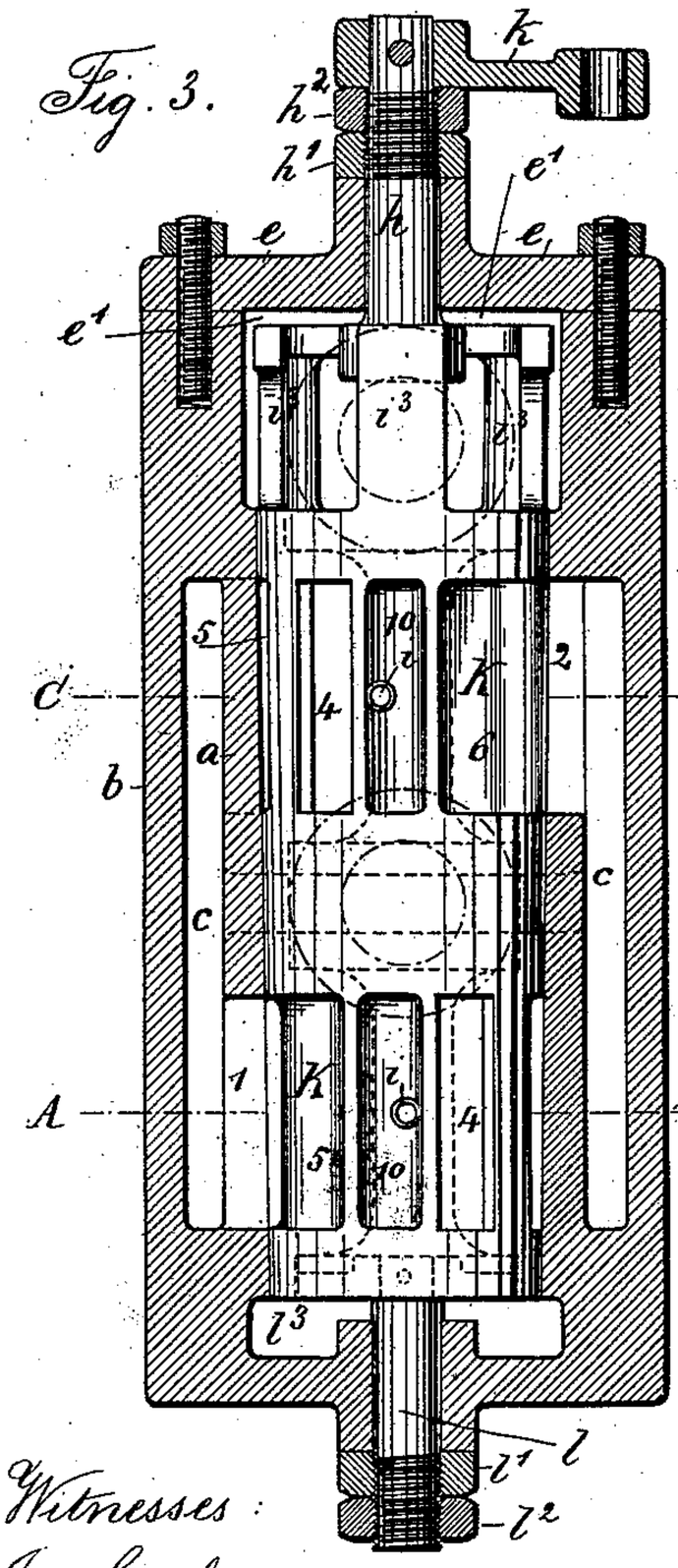
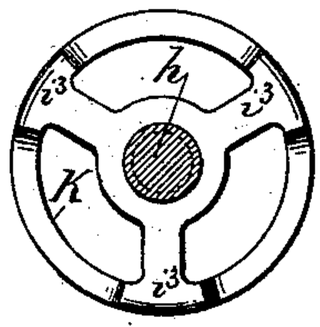


Fig. 3.





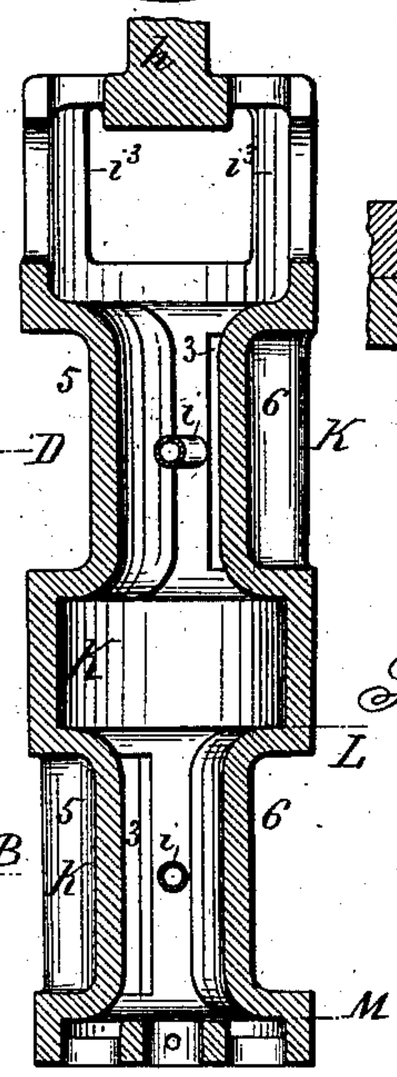


Fig. 7.

Fig. 6.

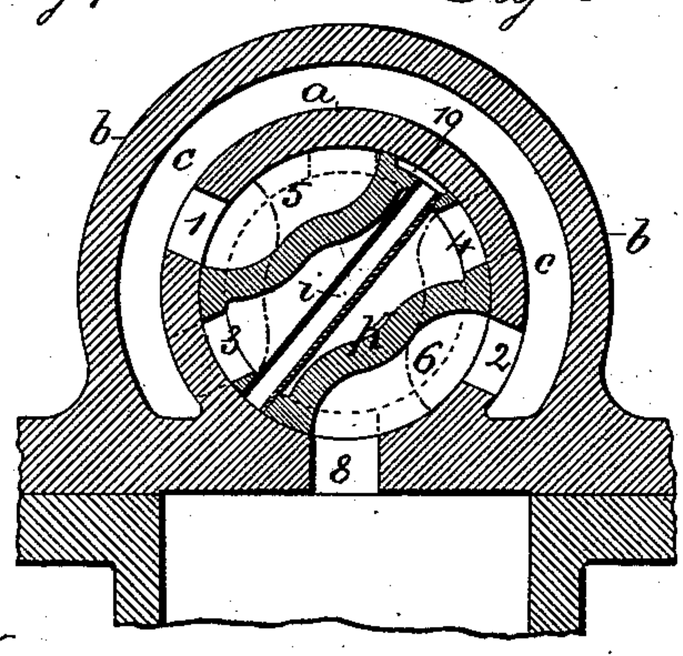


Fig. 8.

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UNITED STATES PATENT OFFICE.

JOHN L. BOGERT, OF FLUSHING, NEW YORK.

BALANCED ROTARY VALVE.

SPECIFICATION forming part of Letters Patent No. 298,063, dated May 6, 1884.

Application filed September 17, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN L. BOGERT, of Flushing, in the county of Queens and State of New York, have invented an Improvement in Balanced Rotary Valves for Steam-Engines, of which the following is a specification.

The object of this invention is to balance a cylindrical valve, and prevent greater pressure upon one side than the other, especially when covering a port in which steam-pressure exists, so that the rotative valve will turn within the valve-case with very little wear, and will require but little force to move it. This valve is available with double engines, when the steam acts only on one side of the piston, or with the ordinary reciprocating engine, in which the steam is admitted at alternate ends of the cylinder. In the latter case it is usually preferable to place one rotative valve near each end of the cylinder, so as to be as near the port into the cylinder as possible.

In the drawings I have represented the cylindrical valve in two forms—one adapted to a single engine, and the other to a double engine, in which the steam acts on one side only of each piston.

Figure 1 is a longitudinal section at the line E G, Fig. 2, of the valve-case adapted to a single engine, the valve being in elevation. Fig. 2 is a cross-section of the same. Fig. 3 is a longitudinal section of the valve-case at the lines E G, Figs. 4 and 5, the valve itself being in elevation, and adapted to a double engine. Fig. 4 is a section at C D, Fig. 3. Fig. 5 is a section at A B, Fig. 3. Fig. 6 is a section similar to Fig. 5, but with the valve at the extreme of motion in one direction. Fig. 7 is an end view of the valve. Fig. 8 is a longitudinal section of the valve for a double engine. Fig. 9 is a cross-section of the valve and case adapted for a double engine, the steam acting on both sides of the piston alternately. Fig. 10 is a diagram illustrating the connections between the valve and cylinders, and Fig. 11 is a plan view of the valve-case, Figs. 10 and 11 being in smaller size.

The valve-case is made with an inner cylinder, *a*, and an outer cylinder, *b*, with the intermediate steam-space, *c*, into which steam is supplied by a suitable pipe, *d*. At the end of the valve-case is the head *e*, bolted on, and there is an exhaust-steam chamber, *e'*, between the head *e* and the end of the portion of the case forming the inner cylinder, *a*, and from this the exhaust-steam passes by the pipe *f*. The cylinder *a* is bored out with accuracy and smoothness upon a gradual and regular taper, and the exterior of the cylindrical valve K is of a corresponding size and taper. The spindle *h* at one end of the valve passes through the head *e*, and is provided with lock-nuts *h' h²*; or a washer with a feather entering a slot in the spindle *h* may take the place of the nut *h'*, or may be used in addition to the lock-nuts *h h'*. The crank-shaft *k* is attached to this spindle *h*, and to it a rod is pivoted, that extends to a suitable eccentric crank-pin or cam, by which the valve receives a partial rotary motion of the required extent, and at the proper time, according to the engine that is to be operated. At the other end of the cylindrical valve there is a spindle, *l*, passing through the back end of the valve-chest, and provided with nuts *l' l²*, or a nut and washer similar to the lock-nuts *h' h²*.

It is to be understood that the cylindrical valve is to be introduced into its valve-chest until its end movement is arrested by the taper of its surface and of the portion *a* of the case. The head *e* is then to be secured in place, the nuts *h' h²* put upon the spindle and drawn up until the cylindrical valve is drawn endwise sufficiently to relieve its surface from the intimate contact resulting from the regular taper. I remark that the surfaces of the valve and valve-chest may be ground or scraped, if desired, after being turned or bored, to render them smooth, previous to being put together for use. The nuts *l' l²* are put on, and the surfaces of *l'* and *h'* may be ground where they take a bearing; or glands or packings might be employed under some circumstances. The object of the adjusting-nuts *h' h² l' l²* is to determine the position of the cylindrical valve endwise in its case, allow the same to be placed where it will turn freely, and will neither leak steam nor become bound by expansion or contraction of any of the parts. I remark that this cylindrical valve is hollow and open from end to end, and there is a cavity at *l³* in the casting, that allows exhaust-steam to pass in

at the back end of the valve and render equal the pressure of the exhaust-steam at both ends, so that the steam will not tend to move the valve endwise. When this valve is used to admit steam or to exhaust from one port only, the valve will be made with only one operative section, as seen in Fig. 1, and it will be the same as if the valve and case were shortened by the removal of the portion between the lines L M, Fig. 8. I will therefore describe the valve as made with a single operative section, and then explain how the valve is made to operate with two ports by increasing its length to contain a second section.

In the case *a* there are two opposite inlet steam-openings, 1 and 2, and in the sides of the tubular valve there are two opposite ports, 3 and 4, and there are opposite depressions in the sides of the valve to form steam-passages 5 and 6. These respective parts are as nearly as convenient exactly opposite each other, and of corresponding sizes and shapes, so that the steam acting within the depression 5 will press upon the same area as the steam acting in the depression 6, and hence the action on the valve will be balanced, and the ports 3 and 4 being of the same size and opposite to each other, there will be no inequality in the pressure of the exhaust within the tubular valve.

The port 8 leads to the engine, and by reference to Fig. 6 it will be seen that when the passage 6 is between 2 and 8, the steam passes freely into the cylinder, the equal pressure of the steam in the depression 5 perfectly balancing the valve. When the valve is partially rotated to shut off the steam, the steam within the port 8 will press against the side of the tubular valve, which is over the port, and would cause friction of the valve against the opposite side of the valve-case *a* were it not for the compensating device next described. I however remark that this compensating device may not always be used.

In the interior surface of the valve-case *a*, I form a recess at 10, Fig. 2, which is of a size corresponding to the size of the port 8 and directly opposite to it, and I connect a small pipe, *i*, across the tubular valve, its end opening through the cylinder of the valve. When the valve has been partially rotated, so as to close the port 8, the pipe *i* is simultaneously opened at both ends and the steam passes from the port 8 through the pipe *i* and acts in the recess 10 with the same pressure that it exerts at the opposite side of the valve in the port 8; hence the pressure is balanced on the opposite sides of the valve during the time that the steam is expanding and the pressure is lessening.

In Figs. 3, 4, 5, and 6, I have shown the recess 10 in the surface of the valve instead of in the interior surface of the valve-case *a*. In this instance the pressure in 10 acts to balance any pressure in 8; but it does not act as perfectly as the form shown in Fig. 2, where the recess 10 is in the interior surface of the cylindrical valve-case *a*. When the movement of the valve uncovers the port 8 to the exhaust 3, as indicated in Fig. 5, the end of the pipe *i* remains open and the pressure in 10 and 8 remains equal during almost all the time the exhaust is opening and closing again. When steam is passing by the channel 6 into the port 8, the recess 10, when in the case *a*, as seen in Fig. 2, receives steam from the channel 5, and as the valve commences to close the port it also commences to cover the recess 10, and these are entirely covered simultaneously; hence the steam acts equally at both sides of the valve in all positions.

It is to be understood that a single valve such as described operates to admit, cut off, and exhaust the steam, and that the pressure is balanced throughout the movement; hence the valve wears but little and it is moved with great freedom. The exhaust passes off through the middle of the tubular valve and through openings or between the arms i^3 at the end without obstruction. One of these valves, such as shown in Figs. 1 and 2, may be placed at each end of an ordinary steam-engine directly upon the head of the cylinder or upon the side or top of the cylinder, as preferred. If desired, the valve can be made longer, so as to contain two sections such as described, the case being provided with the two ports leading to the respective ends of the same cylinder; or the valve may be made, as indicated in Figs. 3, 4, 5, and 8, with the respective parts adapted to admitting steam to the ends of separate cylinders, in which the piston-rods are connected to cranks at one hundred and eighty degrees to each other; hence the parts of the valve, when made in the relative positions shown in the drawings, will admit steam to one cylinder, as shown by the full lines, Fig. 6, the exhaust being open to the other cylinder, as indicated by the dotted lines, and then as the valve moves and assumes the positions of Figs. 4 and 5 the steam will be cut off and the exhaust closed, and then the exhaust on one cylinder will be opened, as in Fig. 5, simultaneously with the admission of steam to the other cylinder, as in Fig. 4. This valve may be placed between the cylinders of a double engine, as indicated by the diagram Fig. 10, the valve itself being shown in Fig. 9. The exhaust opens to opposite ends of the two cylinders simultaneously with the admission of steam to the other two ends of such cylinders. The port 8 opens to the lower part of one cylinder when the port 38 opens to the upper part of the other cylinder. At the same time the port 28 opens to the upper part of the first cylinder, and the port 18 to the lower part of the second. In this case, however, there will be an unnecessary expenditure of steam in filling the ports, which I avoid by placing a valve and chest directly over the port at the end of the cylinder.

It will be apparent that steam may be introduced into the chambers e' l^3 and pass into the

interior of the valve, thence to the engine-cylinder, and that the exhaust may be through the chamber *c* by the ports 8 6 2, the pressure of the exhaust being balanced in 1 and 5.

In some cases the valve may be made without a taper; but it will not last as long and will be more liable to leak. The other parts, however, remain unchanged.

I claim as my invention—

1. The valve-chest and hollow valve-case, with a steam-space between the two parts and with openings in the valve-case, in combination with a rotative valve within the case, with side depressions and ports and open ends, substantially as specified, whereby the steam is admitted by the side depressions, and the exhaust takes place through the center of the valve or the reverse, and the pressures are balanced, substantially as set forth.

2. The hollow cylindrical valve having two sets of depressions in the sides and openings, forming ports, one set being in the position described to the other set, in combination with the valve-case having ports for the admission of steam, and two ports longitudinally in line with each other, one leading to each end of the cylinder, substantially as specified, whereby the one rotative valve is adapted to exhaust and to admit steam alternately to the two ends of the cylinder, as set forth.

3. The combination, with the cylindrical valve and its case, having the respective depressions and ports, of the pipe *i*, extending from one side of the valve which covers the port 8 to the opposite side, for the purposes and substantially as set forth.

4. The combination, with the valve-case and tapering valve with depressions and ports, of valve-stems—one at each end—affixed to and moving with the valve, to support such valve centrally within its case and prevent the weight of the valve resting upon the surfaces, and screws and nuts to adjust the valve endwise, substantially as specified.

5. The hollow cylindrical valve having ports or openings through it and depressions in opposite sides, forming passage-ways, in combination with a steam-chest having an internally-cylindrical case and ports through the same, and the recess 10, for the purposes and substantially as set forth.

6. A rotative hollow cylindrical valve having two sets of ports and depressions in the sides thereof, in the relative positions described, in combination with a valve-chest and case having openings for the steam to pass to the valve, and four ports leading to opposite ends of two steam-cylinders, the ports being in pairs opposite to each other and in line longitudinally, substantially as set forth.

Signed by me this 12th day of September, A. D. 1883.

JOHN L. BOGERT.

Witnesses:

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WILLIAM G. MOTT.