(No Model.)

R. M. FRYER.

STEAM VALVE.

No. 528,537. Patented Nov. 6, 1894.

Fig. 1.

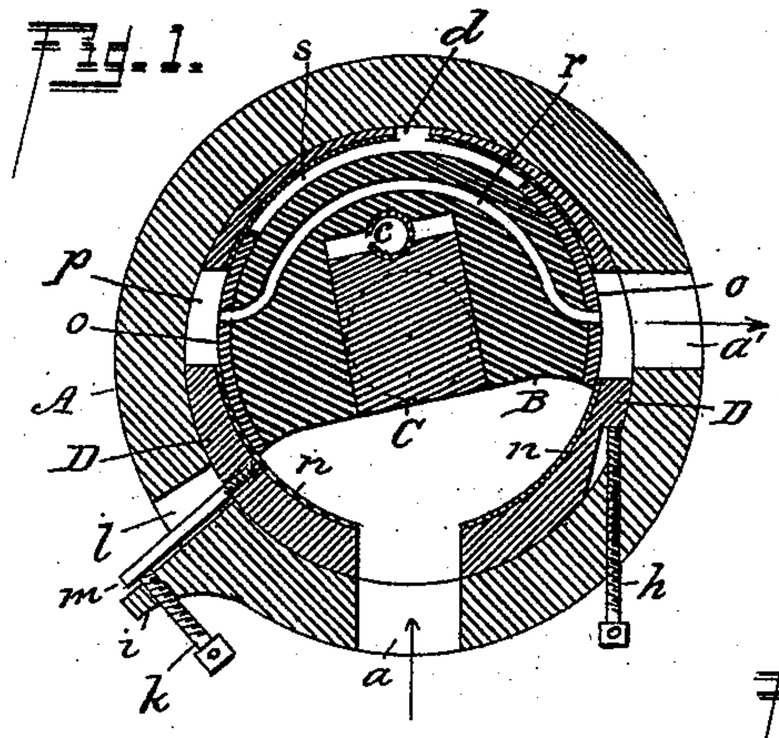


Fig. 2.

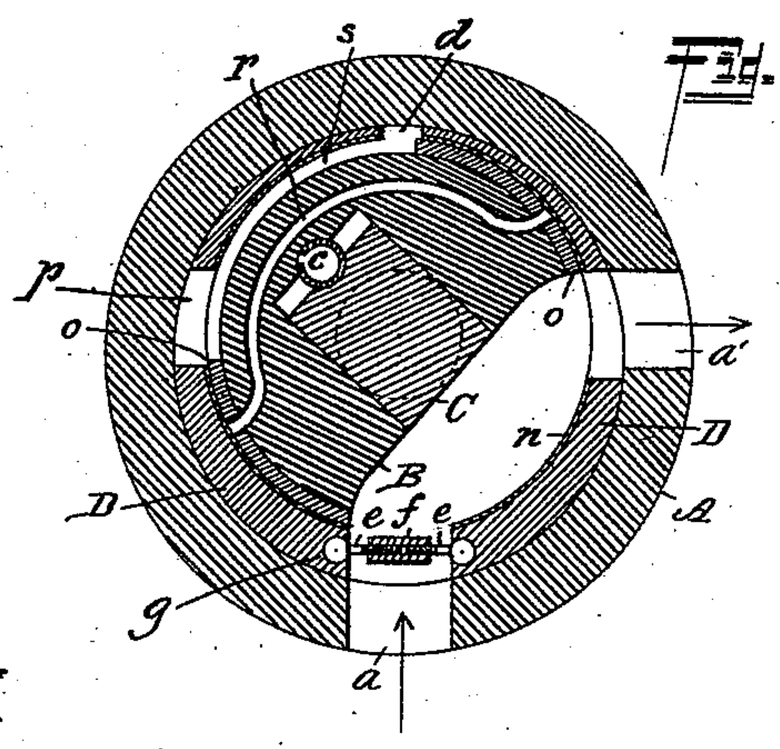


Fig. 5.

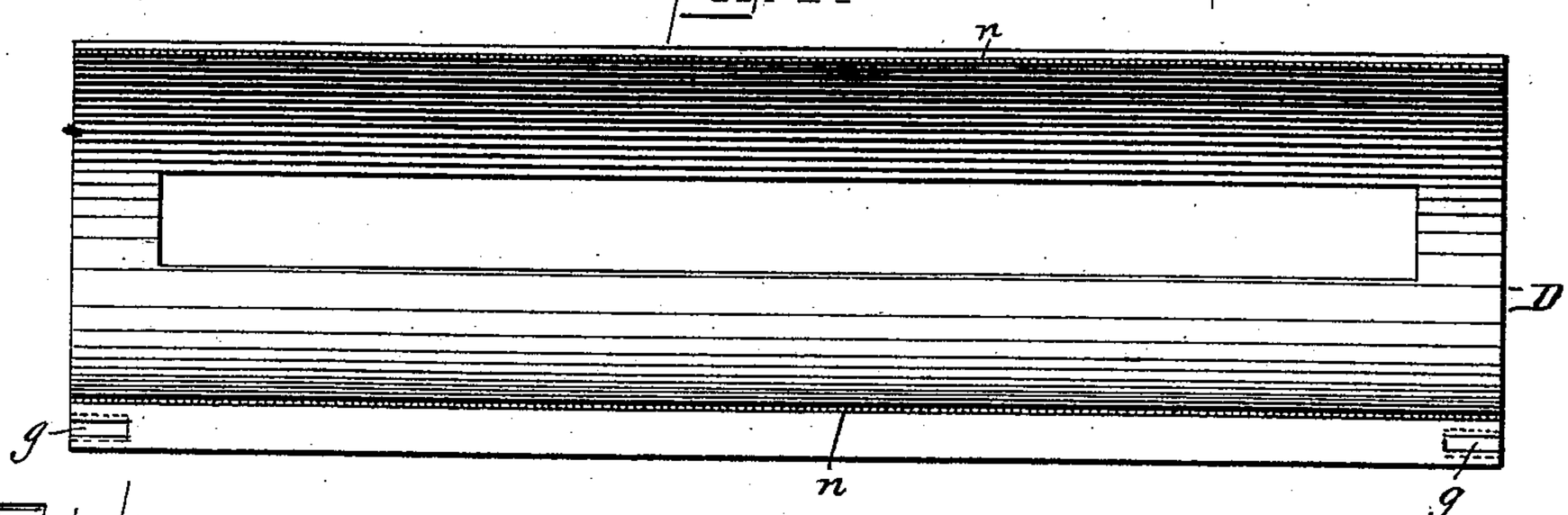


Fig. 4

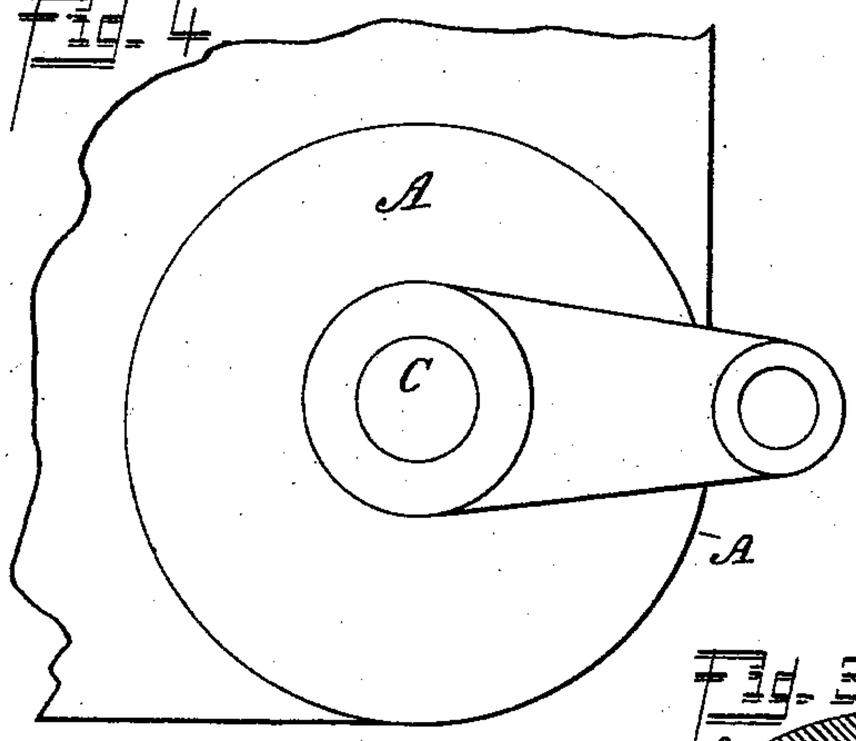


Fig. 7.

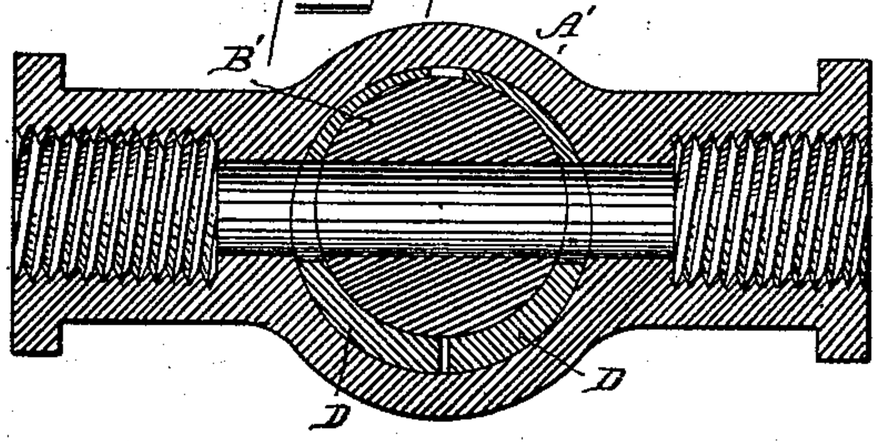


Fig. 6.

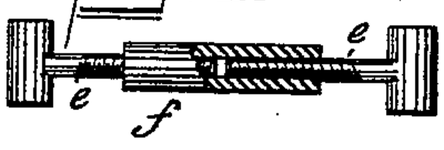
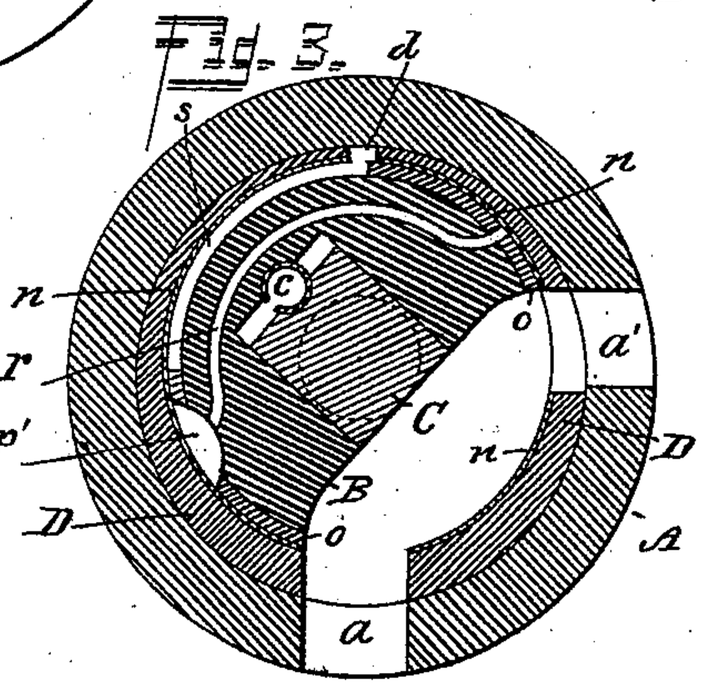


Fig. 3.



Witnesses
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UNITED STATES PATENT OFFICE.

ROBERT M. FRYER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO J. P. V. RITTER, A. S. JOHNSON, C. H. BURGESS, WILLIAM C. AVERY, B. E. EMMERT, AND GEORGE H. LA FETRA, OF SAME PLACE.

STEAM-VALVE.

SPECIFICATION forming part of Letters Patent No. 528,537, dated November 6, 1894.

Application filed December 26, 1893. Serial No. 494,749. (No model.)

To all whom it may concern:

Be it known that I, ROBERT M. FRYER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Steam-Valves; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

My invention relates particularly to rotary valves for steam engines, but is applicable in part to other purposes, as will be hereinafter fully explained.

The objects sought to be attained are—the production of a practically balanced rotary valve; to avoid the necessity for re-boring the valve chamber when the parts become worn; to provide simple and efficient means for compensating for wear and for adjusting the valve; and to provide for the convenient and economical renewal of the parts subject to wear.

To these ends the invention consists in the construction hereinafter described with reference to the accompanying drawings which form a part of this specification, and in which—

Figure 1 is a transverse section, showing the valve in its closed position. Fig. 2 is a similar view showing the valve open, and showing different means for adjusting the compensating devices. Fig. 3 is a similar view showing a slight modification of the means for balancing the valve. Fig. 4 is an end view of the valve chamber, showing the crank for operating the valve. Fig. 5 is an inner face view of one of the compensating wedges or valve seats. Fig. 6 is a plan view, partly in section, of one means for adjusting the compensating wedges or valve seats, and Fig. 7 represents a section through an ordinary stop-cock and its casing, with my compensating wedges applied thereto.

Referring to the drawings A designates the cylindrical valve casing, and B the rotary valve within the same. The casing is provided with longitudinal steam and exhaust ports *a*, *a'*, at substantially right angles to each other, and one side of the valve is cut away or flattened to form a passage between the ports, as usual in valves of this character. The valve is mounted on an oscillating shaft C, which extends longitudinally through the valve chamber and has bearings in the ends of the casing, the said bearings being slightly eccentric to the valve chamber.

The shaft C is rectangular in cross section, and the valve B is formed with a longitudinal groove or channel opening from the flat side to receive the shaft, the groove being of such depth as to permit a slight rising and falling movement of the valve. A tubular spring *c* interposed between the valve and its shaft sustains the valve and allows it to yield under pressure.

The valve is somewhat less in diameter than the interior of the casing, leaving an annular space between the two for the reception of removable valve seats D.

As above stated, the shaft C is slightly eccentric to the valve chamber, the axis being beyond the center from the steam port *a*, so that the annular space between the valve and its chamber is wider at the side of the steam port than at the side diametrically opposite, and therefore, to fill this space the valve seats D are made in the shape of concavo-convex wedges, of a width to extend from the steam port nearly around the valve, leaving an open space *d* at the top to permit either or both of the wedges to be set forward as required to tighten the valve or to take up wear.

I show different means for effecting the adjustment of the wedge shaped valve seats, but it is to be understood that any appropriate means may be employed and that this feature of the invention is not limited to the devices illustrated in the drawings.

In Figs. 2 and 6 is shown a screw toggle comprising two T-headed parts *e*, *e*, having their stems oppositely threaded, that is, one part having a right hand, and the other a left hand screw, the two stems being joined by a sleeve *f*, by the rotation of which the two members are forced apart or drawn together after the manner of an ordinary turn-

buckle. In the ends of the wedges D are formed sockets *g* each slotted through the base, which sockets receive the heads of the toggle pieces *e*, the stems projecting through the slots. When the sleeve *f* is turned in one direction the wedges are forced apart at the base and upward around the valve to tighten the latter, and when turned in the opposite direction they are drawn together to slacken the adjustment.

In Fig. 1, *h* designates a screw extending tangentially through the casing and working against a shoulder on the wedge.

At the left of Fig. 1 are shown a lug *i* formed on the casing and an adjusting screw *k* passing through said lug. Immediately above the lug *i* is a slot *l* in the casing through which projects an arm *m* of the wedge D. The screw *k* works against this arm and by turning the same in the proper direction the wedge is forced upward. It will be observed that in Fig. 1 no means are shown for drawing the wedges down. Ordinarily gravity and the natural tendency of the wedges to move backward and work loose will be sufficient, but if found necessary any appropriate means for positively moving them backward may be employed.

The principal objection heretofore urged against rotary valves is that when the parts become worn to an extent to impair the efficient working of the same it is necessary to rebore the chamber, the operation involving time, trouble, and expense. This objection is entirely avoided by the use of my removable and adjustable wedge-shaped seats, which as fast as the parts become worn and loose, are set forward to take up the wear and retighten the valve. When the seats, by continued use, are worn out, they may be removed and replaced by new ones, which may be kept in stock for use as occasion may require.

To still further reduce the expense of renewal I face the valve seats D with thin plates *n* of steel or other suitable material. These plates may be attached in any suitable or preferred manner—preferably with screws—and when worn out may be taken off and replaced by new ones, whereby the expense of renewal is reduced to a minimum. Manifestly the body of the faced seat is not subjected to wear and the only part requiring renewal is the steel face plate. The body portion may thus be cast of any cheap and inferior material which would otherwise be unsuitable for the purpose.

Manifestly the valve itself, as well as its seat, is subject to wear, and in ordinary constructions requires to be renewed or replaced by a new one from time to time as it becomes worn down. Such renewal also involves considerable expense and in order to avoid this, or at least to reduce the expense to a minimum, I provide the valve with removable surface plates *o* of steel or other suitable material, which, when they become worn may be taken off and replaced by new ones, thus avoiding the necessity of renewing the entire valve, and to that extent reducing the expense of renewal. The body portion of the valve may also be cast of cheap and inferior material, which, without the surface plates, would be unsuitable for the purpose.

From the foregoing it will be understood that when the valve becomes worn to an extent to impair its efficiency or proper working all that is necessary to restore it to its original operative condition is to remove the plates *n*, *o*—the only parts subjected to wear—and replace them with new ones, which may be accomplished in a very short time, and at a trifling expense as compared with the time and expense involved in re-boring the valve chamber or replacing the entire valve.

The plates *o* lie upon the convex surface of the valve, and their upper edges are separated so as to leave a space between them, forming between the body of the valve and the inner faces of the valve seats a chamber *s* of approximately the width of the flat side of the valve, which chamber communicates past the ends of the valve with the steam port *a;* from which it follows that the steam pressure on opposite sides of the valve is substantially equal, so that the valve is held against its seats by the spring *c* alone.

If the valve be made in one piece, that is, without separate or removable wear plates *o*, the chamber *s* will be formed by cutting down or lowering the upper surface, such construction effecting the same result.

Referring now to the means for firmly seating the valve when closed it will be observed that the exhaust port *a'*, which extends through the valve seat D on that side, is slightly above the axis on which the valve turns, and that directly opposite, in the other valve seat is an opening forming a chamber *p* between the valve casing and the valve. The openings in the two valve seats should correspond in size so that equal surfaces of the valve will be exposed therethrough, and they should be directly opposite each other,—both slightly above the center,—or so that a line passing from the center of one to the center of the other will pass above the axis of rotation.

The valve is formed with a passage *r*, through it from side to side, the ends or openings of said passage being so disposed that when the valve is in the closed position, as represented in Fig. 1, communication will be established between the exhaust port *a'* and the chamber *p*. This will equalize the pressure on opposite sides of the valve, causing it to work freely and smoothly and without undue friction on either side.

It is to be understood that the valve is not absolutely "balanced," but that it is held lightly against its seat by the spring *c*, this being sufficient under ordinary conditions to overcome the weight of the valve and hold it against its seats with an elastic or yielding

force sufficient to prevent jumping or "clattering." It is desirable that in its opening and closing movements the valve shall work freely, and that when fully closed it shall be held firmly against its seats. The first of these conditions is attained as above indicated, by so proportioning the strength of the spring *c* that its force shall be just sufficient to counterbalance the weight of the valve, and hold it lightly in place, while the second condition is attained by locating the exhaust port *a'* and the chamber *p* above the axis of rotation, the force with which it is held against its seats being proportional to the height of said port and chamber above said axis. Thus, when the valve is fully closed the additional pressure incident to exhausting the steam will firmly seat the valve. In other words, the partial vacuum resulting from the exhaustion will exert a lifting force upon the valve, which force, being exerted in radial directions from the axis of rotation through the centers of the exhaust port and the chamber *p*, will have a tendency to lift and hold the valve against its seats, the lifting force so exerted being proportional to the height of the port *a'* and chamber *p* above the center of the valve,—greater as the size of the radial angle is reduced, and less as it is increased.

Instead of forming the chamber *p* in the valve seat D as shown in Figs. 1 and 2, I may form it in the valve, as shown at *p'* in Fig. 3, the result being the same in either case.

It is common to interpose springs between the valve and the shaft on which it is mounted, and I do not therefore claim this feature broadly as being of my invention. Heretofore flat springs have been used in this connection, but I use a cylindrical spring formed by bending a sheet of spring metal into cylindrical or tubular form, leaving preferably an open space between the edges to permit compression by external pressure. The edges may, however, overlap each other, but I prefer the construction shown, for the reason that friction between the overlapping edges is avoided.

The spring is placed between the valve and its shaft, and has seats in rounded channels formed in the respective parts, the said seats corresponding in radius with that of the outer surface of the spring. The spring thus acts also as a "key" to hold the valve in its proper position and to prevent lateral movement of the valve on the shaft and to prevent unnecessary friction between the two.

I prefer the cylindrical form of spring shown, but it is to be understood that other forms may be used if preferred, the key action being the essential feature.

It is to be understood that I show and describe herein merely a preferred construction, and that the details of construction may be modified and varied without departing from the spirit of the invention. I therefore desire to have my claims so construed as to include all mere modifications capable of producing the same results in substantially the same way. As above indicated, certain features of my invention are adapted to be applied to other purposes than those hereinbefore described. This has special reference to the compensating wedges D which are shown in Fig. 7 in connection with an ordinary stop cock B' eccentrically located in its casing A'. When the cock becomes worn by continued use the wedges are set forward by any appropriate means, as above described, to take up the wear and tighten the parts.

An important advantage incident to the use of the steel face plates *n*, *o*, is that sharp edges are secured which give a more perfect action than the rough ragged edges of the coarser materials usually employed in the construction of valves; and a further advantage incident to the use of my adjustable valve seats is that the two ends of said seats may be independently adjusted to bring the sides of the ports into exact alignment with the edges of the valve to secure the instantaneous opening and closing of the valve throughout its entire length; or, if desired, one end may be set in advance of the other to secure a progressive opening and closing of the valve.

Having thus described my invention, I claim—

1. In a valve of the character described the combination of the cylindrical casing, the rotary valve therein eccentric to its chamber, and the compensating wedges movable in a circumferential direction between the valve and the walls of the chamber.

2. In a valve of the character described the combination of the cylindrical casing, the rotary valve therein eccentric to its chamber, the compensating wedges movable in a circumferential direction between the valve and the walls of its chamber, and means for adjusting said wedges.

3. In a rotary valve the combination with the valve casing and the valve therein, of movable valve seats adapted to be adjusted circumferentially to compensate for wear.

4. In a rotary valve the combination with the valve casing and the valve therein, of adjustable valve seats provided with separable face plates adapted to be removed and replaced.

5. In a rotary valve the combination with the valve casing and the valve therein, of adjustable valve seats within the casing, and means for independently adjusting said seats at either end.

6. In a rotary valve the combination with the valve casing provided with steam and exhaust ports in angular relation to each other, the rotary valve therein, a chamber between the valve and its casing on the side opposite the exhaust port, and a communicating passage arranged to connect said chamber with

the exhaust port when the valve is closed, the said chamber being so located relatively to the exhaust port that a straight line between the two will pass above the axis of the valve.

7. In a rotary valve the combination with the valve casing provided with steam and exhaust ports, the rotary valve therein, a chamber between the valve and its casing on the side opposite the exhaust port, and a communicating passage through the valve to connect said chamber with the exhaust port when the valve is closed, said chamber being so located relatively to the exhaust port that a straight line between the two will pass above the axis of the valve.

8. The combination with the valve casing, the valve therein, and the compensating wedges, of the means for adjusting said wedges, the same comprising the connecting pieces *e*, *e*, connected with the wedges and provided with oppositely threaded stems, and the nut or sleeve connecting said stems, whereby the wedges are adjusted back and forth, substantially as shown and described.

9. In a rotary valve the combination of the casing, the valve therein adapted to be moved in a radial direction, a spring to hold the valve to its seat, and means for applying a vacuum pressure through the exhaust port, when the latter is closed, to assist the spring in sustaining the valve.

10. The combination of the rectangular shaft C, the grooved valve B mounted thereon, the tubular spring *c* interposed between the shaft and the valve, the spring being seated in channels formed in the respective parts and corresponding in radius with the external diameter of the spring.

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

ROBT. M. FRYER.

Witnesses:
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LEOPOLD ARND.