May 7, 1935. E. C. CLARKE 2,000,822

SLIDE VALVE

Original Filed Jan. 30, 1934 4 Sheets-Sheet 1

Fig. 1

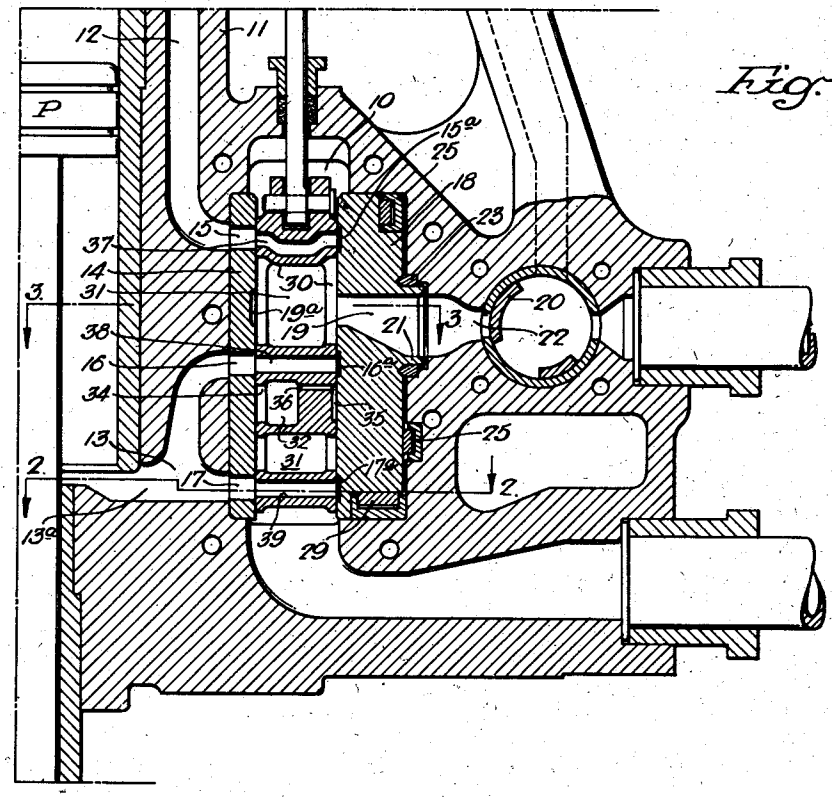

Fig. 2

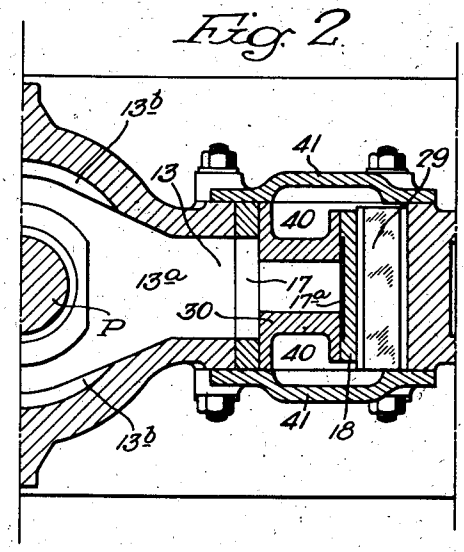

Fig. 3

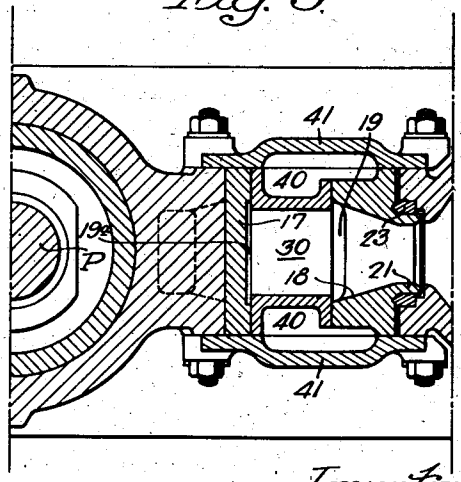

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Fig. 4.

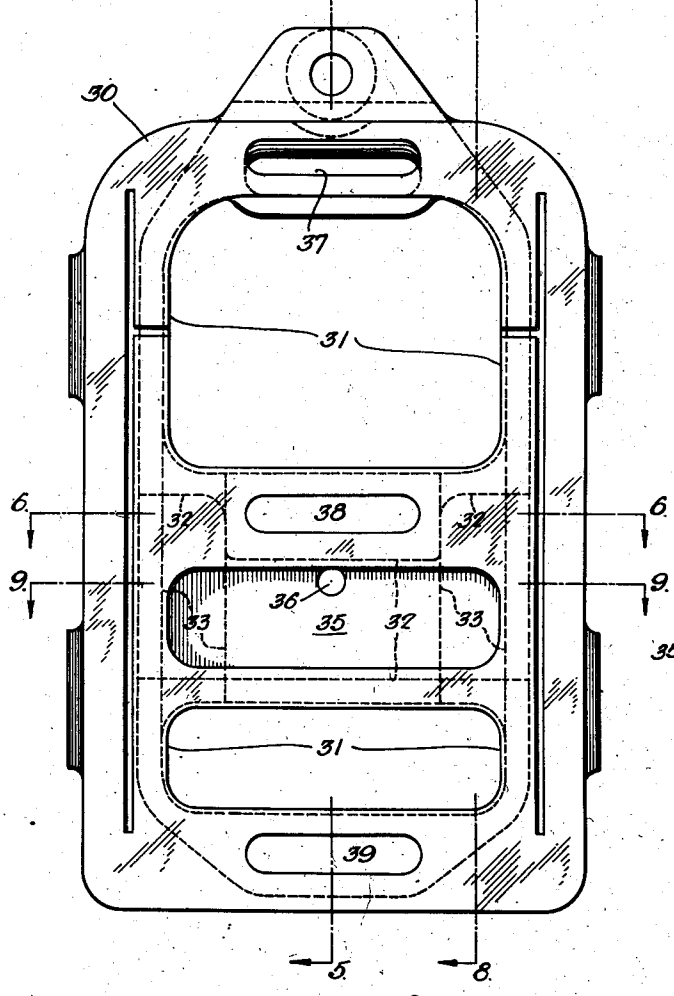


Fig. 5.

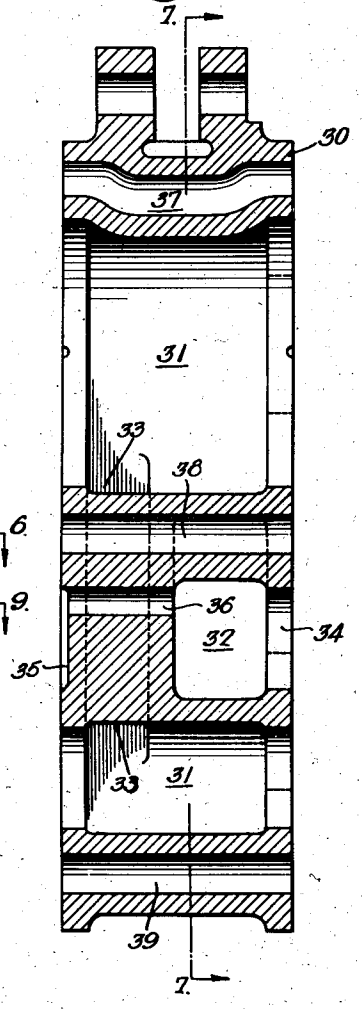
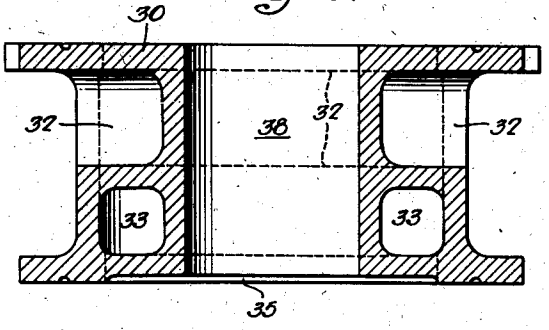


Fig. 6.



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SLIDE VALVE

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Fig. 7.

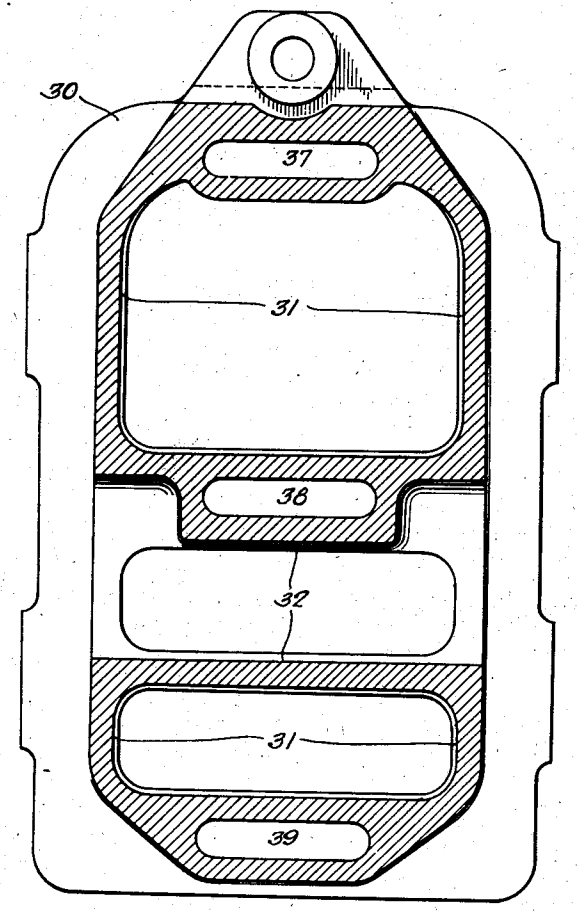


Fig. 8.

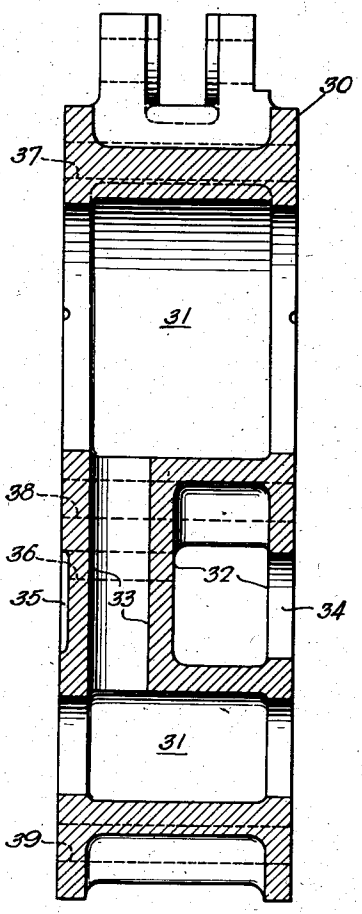
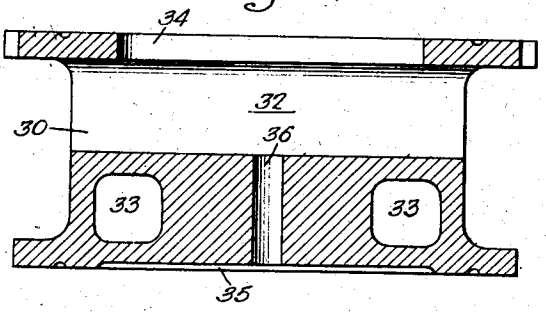


Fig. 9.



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SLIDE VALVE

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Fig. 10.

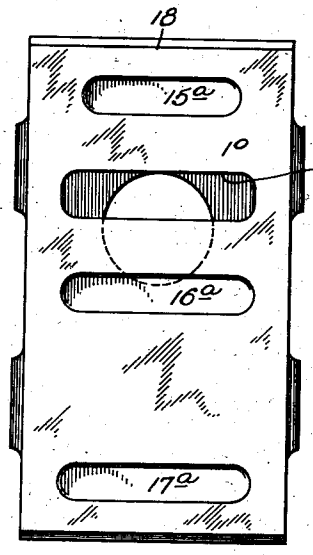


Fig. 12.

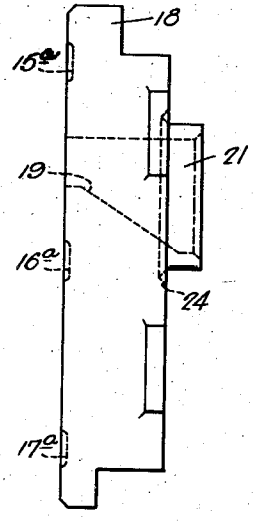


Fig. 11.

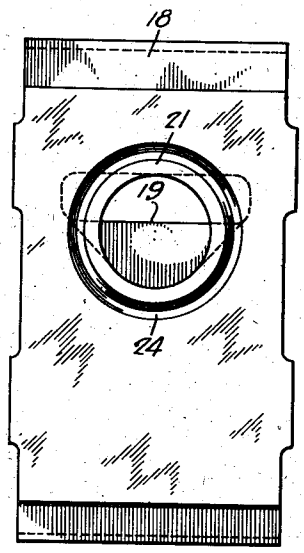
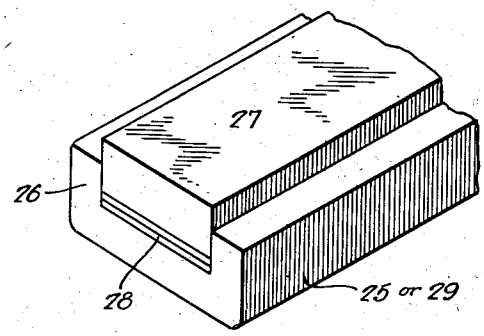


Fig. 13.



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Patented May 7, 1935 2,000,822

UNITED STATES PATENT OFFICE

2,000,822

SLIDE VALVE

Eugene C. Clarke, Chambersburg, Pa., assignor to Chambersburg Engineering Company, Chambersburg, Pa., a corporation of Pennsylvania

Original application January 30, 1934, Serial No. 709,034. Divided and this application July 5, 1934, Serial No. 733,892

9 Claims. (Cl. 121—21)

This invention relates to improvements in slide valves, and is a division of my copending application for patent on Steam hammer, Serial No. 709,034, filed January 30, 1934.

A specific object of the invention is the provision of a slide valve so constructed that wear is reduced to a minimum, operation of the valve facilitated, and adjustment of the valve to compensate for wear in operation is readily effected.

A further and more specific object of the invention is the provision of a simple and readily producible slide valve structure in which binding of the valve and consequent excessive wear in operation, together with difficulties in operation, due to unbalanced pressures upon the valve, are completely eliminated.

A still further object of the invention is the provision of a valve so constructed that adjustments may be compensated for and the valve inspected to determine the necessity for adjustments of its condition while it is under actual pressure.

A further object of the invention is the provision of a slide valve especially adapted for use in conjunction with steam hammers and other constructions wherein it is desirable that the valve be so constructed and mounted that it can move in at least one direction with practically no resistance.

In the steam hammers ordinarily constructed, due to the rapidity of action, it is desirable that reversal of intake and exhaust functions shall take place as rapidly as possible. Such hammers ordinarily incorporate ports at opposite ends of the cylinder for intake and exhaust, which ports are made of the same size, and accordingly will handle equal amounts of pressure fluid and exhaust with the same facility. Quite obviously, a steam hammer, due to the weight of the head, the supporting rod, and the piston, has severe gravity effects to overcome, gravity assisting in the downstroke, and resisting movement in the up-stroke. An important factor is, of course, to provide as rapid as possible a downstroke, and due to gravity effects, back pressure is set up unless the ports employed are of relatively large size, and even then noticeable back pressure effects occur. Since the larger the port, the greater the time required for valve movement to open and close the port; and this has resulted in the adoption of medium size ports providing, of course, an excess of pressure fluid inlet on the down-stroke, and an excess of back pressure on such stroke, and an inadequate inlet on the up-stroke.

An important object of this invention is the provision of a port arrangement such that the intake and exhaust on these strokes may be properly proportioned, thereby eliminating back pressure effects, and materially economizing in pressure fluid.

Since such a port arrangement necessarily radically differs from the ordinary port arrangement, and is incapable of control by the usual type of valve, a further object of the invention is the provision of a valve for controlling such port arrangement.

These and other objects I attain by the construction shown in the accompanying drawings wherein, for the purpose of illustration, I have shown a preferred embodiment of my invention and wherein:

Fig. 1 is a fragmentary sectional view showing my slide valve employed in conjunction with a steam cylinder construction such as illustrated in the prior application above identified;

Fig. 2 is a section on line 2—2 of Fig. 1;

Fig. 3 is a section on line 3—3 of Fig. 1;

Fig. 4 is an elevation showing one face of the valve;

Fig. 5 is a section on line 5—5 of Fig. 4;

Fig. 6 is a section on line 6—6 of Fig. 4;

Fig. 7 is a section on line 7—7 of Fig. 5;

Fig. 8 is a section on line 8—8 of Fig. 4;

Fig. 9 is a section on line 9—9 of Fig. 4;

Fig. 10 is an elevation of one face of the adjustable plate including the intake port;

Fig. 11 is an elevation of the opposite face thereof;

Fig. 12 is a side elevation thereof; and

Fig. 13 is a fragmentary perspective of one of the adjusting means for adjusting said plate.

Referring now more particularly to the drawings, the numeral 10 generally designates a valve chamber at present shown as a portion of the casting 11 of a steam hammer cylinder. The cylinder casting has formed therein upper and lower ducts 12 and 13 for the passage of fluid pressure delivered to the cylinder and exhausted therefrom. The lower passage 13 is relatively large as compared to the passage 12, and at its throat 13a or point of communication with the cylinder is flared so that it may be branched about opposite sides of the cylinder to retain its relative large area. The duct 12 communicates with the valve chamber 10 through relatively restricted port 15; while the duct 13 is branched and communicates with the valve chamber through ports 16 and 17 of the same approximate

size as the port 15, and entering the valve chamber at vertically spaced points. In the present instance that wall of the valve chamber through which the ports 15 to 17 enter is illustrated as provided with a wear plate 14 in which the ports are directly formed.

It will be obvious that with the restricted port area during the intake on the down-stroke, a relatively small amount of fluid pressure is admitted to the cylinder, just sufficient to give the hammer the needed impulse and velocity, and that during such down-stroke the relatively wide exhaust passage 13 provided will eliminate any back pressure effects. Conversely, on the up-stroke the passage 13 affords means for admission of a relatively large amount of fluid during a short period, thus giving the initial speed necessary on the up-stroke; while the restricted port 12 provides the necessary cushioning to prevent overrunning of the piston P and consequent damage to the cylinder.

As illustrated, the plate 14 forms one working face of the valve chamber, and the opposite working surface thereof is formed by an adjustable pressure plate designated at 18. This pressure plate has a centrally located port 19 communicating through any suitable throttle valve 20 with a source of motive fluid pressure. The plate 18 has a male joint connection at 21 with a port 22 leading from the throttle valve 20, this connection having about its periphery a seat for packing 23, providing the seal between the plate and the entry port for motive fluid. It will be noted that pressure of the motive fluid will be exerted against the pressure plate to urge the same toward the wear plate 14 through an area equal to the diameter of the joint connection at the periphery of the packing seat, minus the area of the port 19 at the point of communication with the plates between wear and pressure plates 14 and 18. Comparison of these areas may be readily had by an inspection of Fig. 11 in which the periphery of the pressure area at the outer face of the plate appears at 24 and the mouth of the port 19 is indicated in dotted lines.

Between pressure plate 18 and the wall of the chamber 10 are arranged adjusting means generally designated at 25 and engaging the outer face of the plate at points adjacent the upper and lower ends thereof. These adjusting means, as shown in Fig. 12, each comprises a trough-shaped element 26 adapted to engage one of the opposed surfaces, a bar 27 adapted to oppose the other of the surfaces, and shims 28 of desired thickness interposed between the element 26 and bar 27 within the trough. These elements determine the possible recession of plate 18 from plate 14. A further adjusting means 29 similar to the adjusting means 25 is employed to vertically locate plate 18 in the chamber. The plate 14 has formed therein a false port 19—*a* corresponding in size and location to the opening of port 19 through the inner face of plate 18. False port 19—*a* comes into operation only in event of overtravel of the valve which might occur either from improper setting or breakage in the mechanism attached to the valve. In such an event, this port functions to eliminate unbalanced areas. Plate 18 has false ports 15—*a*, 16—*a* and 17—*a* corresponding in size and location to the ports 15, 16 and 17 of plate 14.

Between the plates 14 and 18, the valve 30 is disposed, this valve comprising a flat-faced body adapted to slidably fit against the faces of the plates 14 and 18 and having formed therein intake and exhaust chambers 31 and 32. In the present type of valve construction, the intake chamber is divided into two sections which are connected by a vertically extending duct 33 formed in the valve body, see Fig. 6. Each of these chambers opens through opposite walls of the valve body through openings of equal area. The exhaust chamber 32 opens through one face of the valve through a port 34, through the sides of the valve, and has communication with a false port 35 of equal area with the port 34 and at the opposite face of the valve from the port 34, through a duct 36. The valve body has additionally formed therethrough ducts 37, 38 and 39, the purpose of which is to establish communication between each port 15, 16 and 17 and its corresponding false port 15—*a*, 16—*a* or 17—*a*. The port 19 is maintained in continual communication with its false port through the upper section of the intake chamber.

With a valve of the type illustrated positioned as shown in Fig. 1, when the valve is elevated, port 15 is placed in communication with port 19, and steam is admitted to the upper end of the cylinder; at the same time the chamber 32 is thrown in communication with port 16, and port 17 has access to the space around the valve from beneath the valve. When the valve is lowered, chamber 31 is thrown into communication with port 16 through its upper section, and the port 17 through its lower section; while port 15 is in communication with the space about the valve from above the valve.

It will be noted that since pressure areas on opposite faces of the valves are equal, and since plates 14 and 18 have corresponding pressure areas through which pressure may be exerted against the valve, the only pressure to which valve 30 will be subjected in operation will be the pressure resulting from adjustment of the plate 18, plate 14 being stationarily secured against the wall of the valve chamber. It will also be noted that the space about the valve designated at 40 is subjected only to exhaust pressures, and since this space extends entirely around the valve, there is no resistance of exhaust pressure to movement of the valve in either direction. Likewise, since only exhaust pressure exists about the valve, there is no necessity for heavily reinforced cover plates, and a light cover plate 41 may be employed which, when removed, will afford access to the valve without the necessity of cutting off the supply of motive fluid, so that the valve may be inspected in actual operation.

In order that the pressure exerted through plate 18 may be readily regulated and controlled to the setting afforded by the shims 28, the effective area of intake chamber 31 against plate 18 is made such that it exceeds the effective area of pressure application through the incoming steam, which tends to urge plate 18 from the plate 14. The steam pressure thus acts to force the plate 18 toward the intake port 22 and seat it firmly against the adjusting means 25. With this arrangement, it is possible to "set up" the valve to such an extent that there will be actual binding in the absence of fluid pressure, and the valve will be freed immediately upon the admission of pressure fluid to such an extent that it will drop by gravity. A valve construction of this character with proper adjustment of the means 25 will at all times operate by gravity on the down-stroke, thus making the construction especially adaptable to use in fluid-pressure-operated ham-

mer constructions by insuring a quick return of the hammer to its raised position following a working stroke.

Obviously, certain features of the valve may likewise be employed with equal facility in a number of other forms, as for example, in the slide valve mechanism of a locomotive. Since the valve must necessarily be changed as to its operating structure for adaptation to various types of cylinders, I do not wish to be understood as limiting myself to the particular arrangement herein illustrated except as hereinafter claimed.

I claim:

1. A slide valve comprising a reciprocatory valve body having equal fluid pressure distribution areas at its opposite faces, a pair of surfaces through one of which fluid pressure is admitted abutting said faces, said surfaces having equal pressure distribution areas confronting said valve, one of said surfaces comprising a face of a movable plate, means at the outer face of said plate for adjusting said plate toward the other of said surfaces, and means for maintaining a preponderance of fluid pressure against the inner face of said plate.

2. In a slide valve, a reciprocatory valve body, a surface against which one face of the valve slides, a plate opposing the opposite face of the valve and having a port for delivery of pressure to the valve body, said plate being mounted for movement toward and away from the valve body, adjusting means at that face of the plate which is remote from the valve body constructed and arranged to limit separation of the plate from the valve body, and means for maintaining a preponderance of fluid pressure against the valve body opposing face of the plate.

3. In a slide valve, a reciprocatory valve body, a surface against which one face of the valve slides, a plate opposing the opposite face of the valve and having a port for delivery of pressure to the valve body, said plate being mounted for movement toward and away from the valve body, adjusting means at that face of the plate which is remote from the valve body constructed and arranged to limit separation of the plate from the valve body, and means for maintaining a preponderance of fluid pressure against the valve body opposing face of the plate, said surface having distribution ports, each of said surface and plate having in its valve body confronting face false ports corresponding to the ports of the other thereof, said body constructed and arranged to maintain the ports in communication with their corresponding false ports and to maintain equal pressure areas in opposition to each port and its false port.

4. In a slide valve, a valve chamber having a fluid pressure port in one wall thereof and fluid pressure distribution ports in the opposite wall thereof, a valve body arranged between said walls and having an interiorly formed fluid pressure distribution chamber, a plate arranged between the inlet and the valve body and contacting with the valve body and sealed to said inlet, the plate having a port for conducting fluid pressure to the chamber of the valve body, and means for conducting exhaust fluids from one of the distribution ports through the valve body to the chamber about the valve.

5. In a slide valve, a valve chamber having a fluid pressure port in one wall thereof and fluid pressure distribution ports in the opposite wall thereof, a valve body arranged between said walls and having an interiorly formed fluid pressure distribution chamber, a plate arranged between the inlet and the valve body and contacting with the valve body and sealed to said inlet, the plate having a port for conducting fluid pressure to the chamber of the valve body, means for conducting exhaust fluids from one of the distribution ports through the valve body to the chamber about the valve, the first-named wall comprising a plate movable toward and away from the valve body, adjustable means at the outer face of said plate for limiting separation of the valve and plate, and means to maintain a preponderance of fluid pressure against the valve confronting side of said plate.

6. In a slide valve, a valve body, a chamber receiving the valve and including walls fitting against opposite faces of the valve, a supply port in one of said walls, distribution ports in the other of said walls, the remaining walls of the chamber defining an exhaust space about the sides of the valve, said distribution ports including a port permanently covered by the valve, a port in the valve body to place said permanently covered distribution port in communication with said exhaust space in one position of the valve body, and a second port in the valve body placing the said distribution port in communication with the supply port in a second position of the valve body.

7. In a slide valve, a valve body, a chamber receiving the valve and including walls fitting against opposite faces of the valve, a supply port in one of said walls, distribution ports in the other of said walls, the remaining walls of the chamber defining an exhaust space about the sides of the valve, said distribution ports including a port permanently covered by the valve, a port in the valve body to place said permanently covered distribution port in communication with said exhaust space in one position of the valve body, and a second port in the valve body placing the said distribution port in communication with the supply port in a second position of the valve body, said distribution ports including further ports, one of which is directly exposed to said space in each of said positions of the valve body.

8. In a slide valve, a valve chamber having a fluid pressure port in one wall thereof and fluid pressure distribution ports in the opposite wall thereof, a valve body arranged between said walls and having an interiorly formed fluid pressure distribution chamber, a plate arranged between the inlet and the valve body and contacting with the valve body and sealed to said inlet, the plate having a port for conducting fluid under pressure to the chamber of the valve body, means for conducting exhaust fluids from one of the distribution ports through the valve body to the chamber about the valve, and means to impart a movement of the valve alternately exposing the remaining distribution ports directly to the chamber about the valve.

9. In a slide valve, a valve chamber having a fluid pressure port in one wall thereof and fluid pressure distribution ports in the opposite wall thereof, a valve body arranged between said walls and having an interiorly formed fluid pressure distribution chamber, a plate arranged between the inlet and the valve body and contacting with the valve body and sealed to said inlet, the plate having a port for conducting fluid under pressure to the chamber of the valve body, means for conducting exhaust fluids from one

of the distribution ports through the valve body to the chamber about the valve, means to impart a movement of the valve alternately exposing the remaining distribution ports directly to the chamber about the valve, the first-named wall comprising a plate movable toward and away from the valve body, adjustable means at the outer face of said plate for limiting separation of the plate and valve, and means to maintain the preponderance of fluid pressure against the valve-confronting side of said plate.

EUGENE C. CLARKE.