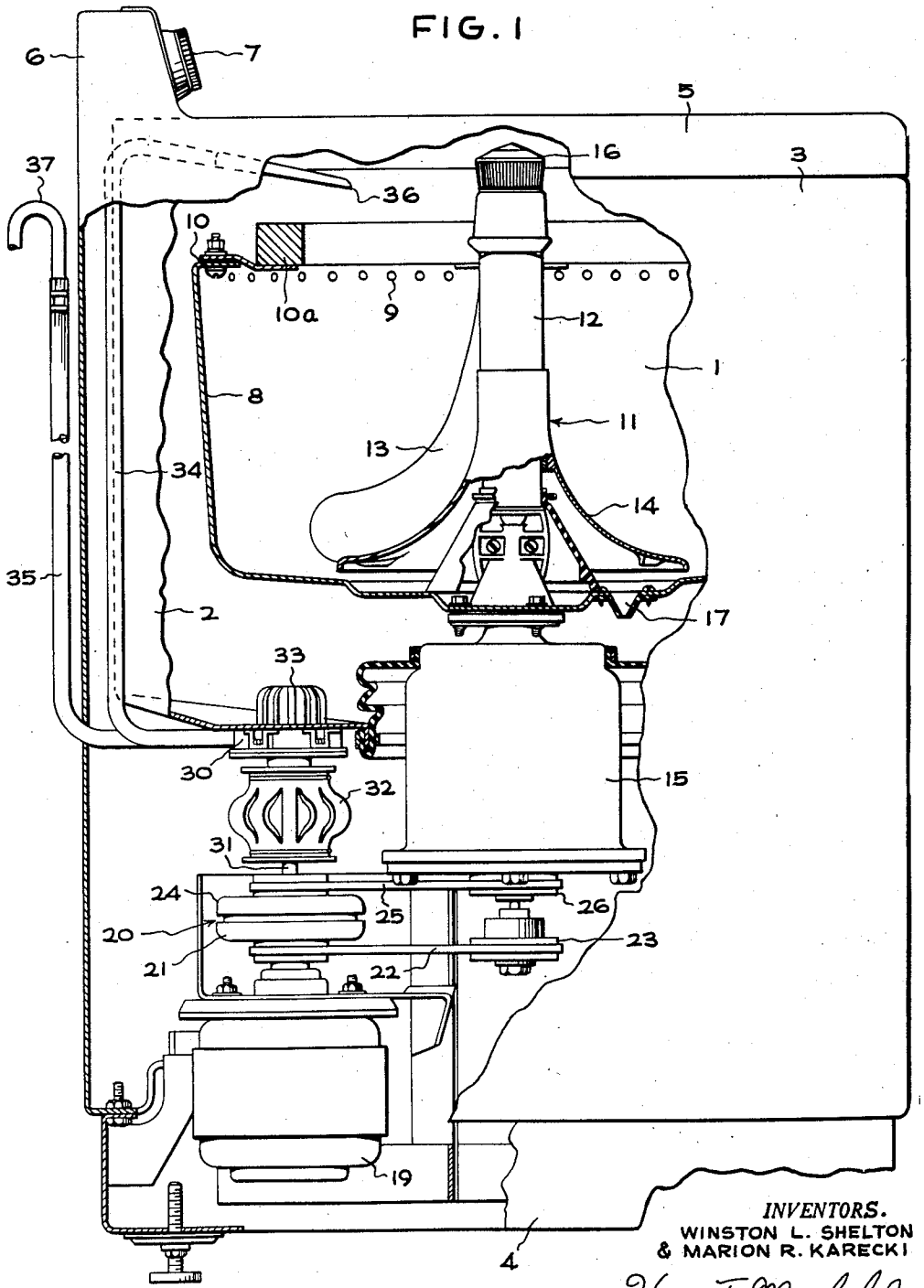
Dec. 16, 1958 W. L. SHELTON ET AL 2,864,312

TWO-WAY PUMP

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FIG. 1



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FIG. 2

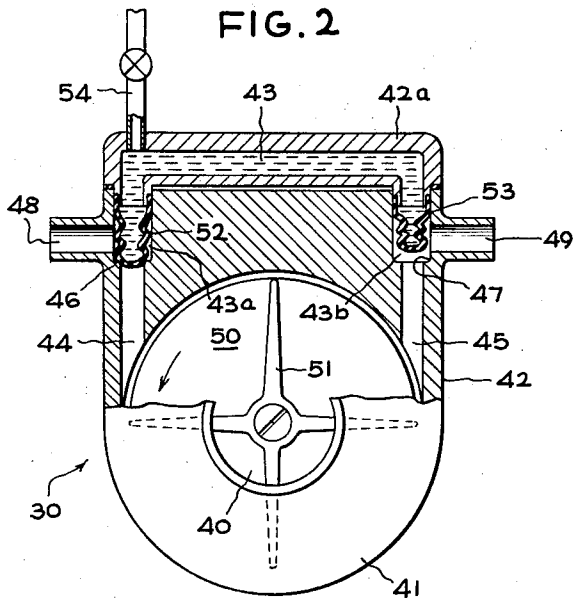


FIG. 4

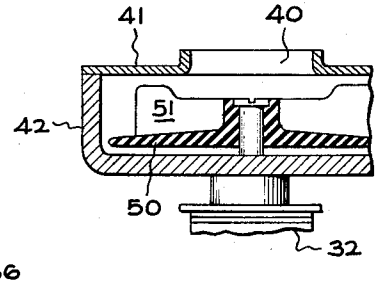
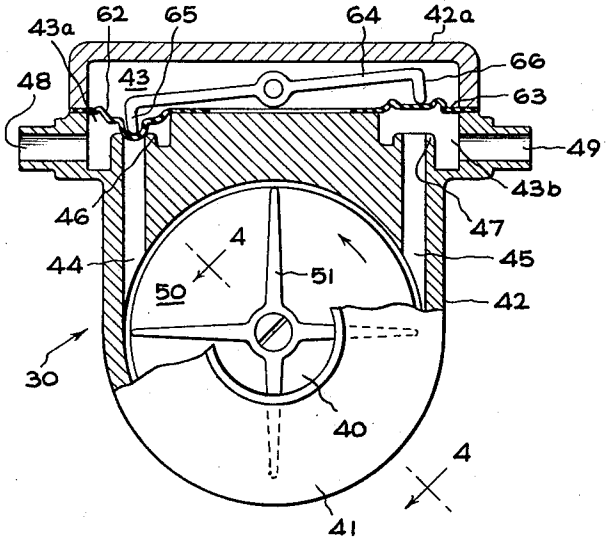


FIG. 3



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2,864,312

TWO-WAY PUMP

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Application November 21, 1955, Serial No. 548,039

1 Claim. (Cl. 103—3)

This invention relates to two-way pumps and more particularly to such pumps for use in the liquid flow systems of automatic clothes washing machines, and the like. In certain automatic washing machines a recirculation conduit is provided whereby the washing liquid is continuously circulated from the tub of the machine through the clothes basket during the washing operation. When the washing or agitation operation is completed, the flow from the tub is then directed into a drain conduit so that the dirty liquid is discharged from the machine during the centrifugal extraction stage. Our invention is directed to an improved apparatus for accomplishing this result, i. e. for selectively pumping the washing liquid from the tub into either the recirculation conduit or the drain conduit. However, in its broader aspects our invention is useful generally in any similar flow diversion system without being limited to laundry apparatus.

An object of the invention is to provide an improved two-way pump having linked valve means for governing the flow from the pump into alternate outlet conduits depending upon the direction of rotation of the pump.

In carrying out our invention we provide a centrifugal pump of the type having an impeller rotating within a pump chamber. The pump is provided with a centrally disposed inlet into the pump chamber and with two spaced, tangentially disposed outlets. A separate valve is provided for opening and closing each of the outlets, and the two valves are so linked together that opening movement of either of them is transmitted through the linkage into closing movement of the other. The valves are arranged so as to be operated by the opposite pressures developed by the pump depending upon its direction of rotation. One valve is opened by the pressure and the other valve simultaneously closed by the linkage when the pump is driven in one direction; and the other valve is opened by the pressure and the first one closed by the linkage when the pump is driven in the opposite direction. Thus the pump discharges into one outlet on one direction of rotation and into the other outlet on the other direction of rotation.

The pump is particularly useful in washing machines of the type including washing means within a centrifugal extraction basket, both of which are driven through a mechanism including a reversible drive motor. The pump can be used advantageously in such machines to pump water from the tub to a recirculation conduit or to a drain conduit depending upon the direction of rotation of the drive motor. The pump is preferably driven directly from the drive motor and one of its outlets is connected to the recirculation conduit and the other to the drain conduit. Thus upon one direction of rotation the pump is effective to recirculate washing liquid within the machine while the washing means are driven to perform a washing operation within the clothes basket; whereas upon reverse motor rotation the pump automatically becomes effective for discharging washing liquid to a drain while the basket is rotated at a high speed for centrifugal extraction.

The features of our invention which we believe to be novel are pointed out with particularity in the appended claim. The invention itself, however, both as to its organization and method of operation may be best understood by the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a side elevation, with certain surfaces broken away and partially in section, of an automatic clothes washing machine including a two-way pump embodying our invention;

Fig. 2 is a top plan view of the pump with a portion of the pump housing cover removed and showing the positions occupied by the valves during the rotation of the pump for drainage operation, one form of valve linkage being illustrated;

Fig. 3 is a view similar to Fig. 2 illustrating a second form of the valve linkage and showing the positions occupied by the valves during the rotation of the pump for drainage operation; and

Fig. 4 is a fragmentary sectional view taken on line 4—4 of Fig. 3.

Referring first to Fig. 1 there is shown an automatic clothes washing machine of the type having a rotatable clothes basket 1 mounted within an outer enclosing tub 2 which is supported within and enclosed by an exterior cabinet structure 3. The cabinet structure 3 includes a base assembly 4 secured to the cabinet by any suitable fastening means. The cabinet structure also includes a top 5 having a backsplash panel 6 upon which may be mounted appropriate control knobs 7 for adjusting and controlling the sequence of the machine operations.

The particular form of washing machine illustrated herein is of the well-known type in which the wash basket is adapted to contain the articles to be laundered and a charge of washing liquid. As shown, the side wall 8 of the basket 1 is inclined upwardly and outwardly and is provided with a plurality of overflow and discharge apertures 9 adjacent its upper edge at the region of maximum diameter. The uppermost edge of the basket is rolled inwardly at 10 and carries a balance ring and clothes retainer 10*a* for preventing flotation and projection of articles of clothing from the basket during washing and extraction operations. Within the basket there is mounted suitable washing or agitating means, the washing means being here shown in the form of an agitator 11 having a center post 12 and a plurality of radial agitating vanes 13 extending outwardly from the center post. The vanes 13 are joined at their lower ends to a downwardly and outwardly flared skirt 14 as shown.

Basket 1 and agitator 11 are independently rotatable. For example, in accordance with this arrangement it is contemplated that the agitator will be driven with an oscillatory motion to perform the washing operation in a substantially stationary basket; while for the extraction of liquid from the laundry articles, the agitator and basket are rotated together at a high speed. Correspondingly, the basket is secured by appropriate clamping means through a central basket hub to a spin tube (not shown) projecting upwardly from a drive mechanism 15 to form a conventional drive and basket mounting arrangement. Also in a conventional manner, agitator 11 is driven through an independent shaft (not shown) extending upwardly from the mechanism 15 to an appropriate driving connection adjacent the upper portion of center post 12. A nut 16 secures the agitator in position and completes the driving connection.

While the particular form of transmission assembly and mechanism 15 and the driving connections therefrom to basket 1 and agitator 11 form no part of the present invention, a construction suitable for practice in our invention is shown and described in Patent No. 2,639,618 issued to J. W. McNairy on May 26, 1953,

and assigned to General Electric Company, the assignee of the instant application.

The present invention is directed to that type of washing machine in which the washing liquid is constantly recirculated during the washing action. In such a recirculation system, washing liquid flows from wash basket **1** into outer tub **2** throughout the washing period and is pumped back into the wash basket. As a part of this recirculation system we have shown basket **1** as including an aperture **17** in the bottom wall thereof, through which a measured flow of washing liquid and small insoluble soil particles may pass into outer tub **2**. Also a substantial quantity of liquid is discharged through the upper apertures **9** in the basket during recirculation and washing action.

The power source for driving basket **1** and agitator **11** is shown as the electric motor **19**; and in accordance with the present invention, this motor is reversible, depending for example upon the relative polarities of connections to windings in the motor. The motor shaft is connected to a bi-directional centrifugal clutch assembly **20** such as that described in detail in the aforementioned McNairy Patent 2,639,618. This bi-directional clutch assembly, upon one direction of rotation, transmits torque from the motor shaft through the lower clutch half **21** integral with a first drive pulley to a flexible belt **22**, which in turn drives the agitator input drive pulley **23**. During drive through the lower clutch half **21** the upper clutch half **24** remains substantially stationary. However, upon reverse rotation of the motor shaft, the upper clutch half **24** is driven, thereby to transmit rotation through its integral second drive pulley and flexible belt **25** to an input pulley **26** for rotation of extraction basket **1**. This invention is not limited to the particular form of drive shown, since other types of transmission assemblies may be employed, which upon one direction of motor rotation operate agitation means within the washing receptacle, and which upon reverse motor rotation drive the washing receptacle or basket for centrifugal extraction.

For providing recirculation of washing liquid discharged into the outer tub, and for disposal of the washing liquid on conclusion of an operation, we provide a pump assembly **30** secured to the bottom wall of outer tub **2**. The pump is driven from motor **19** through a motor shaft extension **31** having thereon a lower drive coupling plate. Pump **30** has a similar and upper drive plate in generally aligned relationship, and these two plates are connected together by means of a flexible connection **32**. Pump **30** is also provided with an inlet baffle or strainer **33** extending within the tub to prevent entrance of undesirably large articles into the pump.

Pump **30** discharges either through a recirculation conduit **34** or a drain conduit **35**, depending upon the direction of motor rotation. As shown in Fig. 1 the upper end of the recirculation conduit is provided with an appropriate nozzle **36** discharging into wash basket **1**. The drain conduit may be provided with a goose neck **37** adapted to rest on the upper ledge of a stationary tub, drain standpipe, or the like.

With the construction as thus described, it will be understood that when motor **19** rotates in a first direction, providing drive through clutch half **21** to the agitator input pulley, the agitator is driven within basket **1** to provide the desired washing action. At the same time liquid discharges from basket aperture **17** and through overflow apertures **9** into the outer tub **2**, and is recirculated by pump **30** back to basket **1**. Upon conclusion of a washing operation, the direction of motor rotation is reversed, thereby providing a drive to rotate basket **1** at high speed for centrifugal extraction. At the same time the change in the direction of rotation of pump **30** renders it effective to discharge all liquid in the outer tub through drain conduit **35**.

In Figs. 2 and 3, the essential portions of pump **30** are shown, employing, respectively, two equivalent means of valve arrangements and with the pump functioning with either means to cause flow through recirculation conduit **34** when rotating in one direction and to cause flow into drain conduit **35** when rotating in an opposite direction.

The pump **30** is of the type having a generally axial inlet. Specifically, it includes an axial inlet **40** through the top **41** of the pump casing **42**. The pump casing further includes suitable outlet means comprising the inner legs **43***a* and **43***b* of a U-shaped space **43** provided by a lateral extension **42***a* of the casing. The outer or bight portion of the space **43**, as is explained hereinafter, serves to mount the valves and valve linkage means for controlling the output flow. The legs or chambers **43***a* and **43***b* are connected respectively to the cylindrically shaped pump chamber by a pair of tangentially disposed discharge passageways **44** and **45**. These discharge passageways are substantially diametrically spaced with repect to the cylindrically shaped pump chamber and they extend from the main pump casing into the chambers **43***a* and **43***b* terminating in valve seats **46** and **47** respectively. Extending exteriorly from chambers **43***a* and **43***b* on the downstream side of the valve seats and communicating, respectively, with the recirculation and drain conduits are outlet passageways **48** and **49**.

The pump impeller, as shown, is of a conventional type having a circular skirt **50** (Fig. 4) disposed adjacent the bottom of the pump casing and having upstanding radially projecting impeller vanes **51**. Rotation of the impeller results from its drive connection with motor **19** through shaft **31** and coupling **32**, as previously set forth. The pump shaft may be journalled with respect to the pump casing by any suitable antifriction bearing (not shown) and sealed with respect to that casing in any conventional manner.

As thus described, pump **30** acts generally in the manner of a centrifugal pump taking in liquid from the tub through the central or axial opening **40** and discharging with tangential flow, under substantial pressure, into both discharge passages **44** and **45**. Thus, if no arrangement were employed to control the flow, the pump would tend to discharge simultaneously through both discharge passages upon either direction of rotation. However, the pressure of discharge through both passages at the same time would not be of equal value because the centrifugal force of the moving mass of water is exerted to a greater extent within the confronting tangential outlet passage than within the other passage.

As a significant part of our invention we provide an arrangement of mutually linked valves for controlling the flow from the pump. Referring now to Fig. 2, there is shown a first modification of our two-way pump valve linkage comprising a first, or recirculation valve **52**, formed of imperforate, resilient material, such as rubber, or similar, flexible, plastic-like material. This valve is conveniently shaped in the form of a bellows closed at one end and open at the other end. The closed end is disposed above the valve seat **46**, and the open end is mounted on and sealed to the casing extension **42***a* so that the bellows forms a seal between the portion of the space **43** around the valve seat and the outer portion of the space. The interior of the bellows and the outer or bight portion of space **43** are in communication as shown. When fully distended the bellows is adapted to seat in sealing relation upon valve seat **46**, and when contracted is adapted to move out of contact with that valve seat.

In like manner, a second, or valve **53** of similar material and construction is mounted upon the pump casing extension for similar cooperation with valve seat **47**.

Completely filling the outer portion of the chamber **43** and the interior of the respective valve bellows **52** and **53** is a force transmitting medium comprising a flowable material such as a liquid, or a readily movable solid. In

general, we prefer to employ a liquid such as water or oil as the force transmitting medium. The force transmitting medium tends to bias both the valves **52** and **53** toward their respective valve seats. However, the quantity and pressure of the medium is insufficient to move both the valve bellows simultaneously into engagement with their valve seats. When the medium is in an equilibrium position so that the bellows valves are equally expanded, as may occur when the pump is at rest, neither of the bellows valves is in engagement with its valve seat.

When, however, the pump is placed in operation, the one bellows valve is subjected to a greater pressure from the pump than is the other valve. The bellows over the passageway confronting the pump as it rotates is subjected to a greater pressure than the bellows over the other passageway. This pressure compresses the one bellows valve and opens it from its valve seat still further. Simultaneously, the other bellows valve is closed against its valve seat through the action of the force transmitting medium. The compressing of the one bellows displaces the medium sufficiently that it causes an expansion of the other bellows into contact with its valve seat. Thus, with the pump rotating as shown in Fig. 2 to discharge water from the tub during the spin extraction operation of the washing machine, the valve **53** is forced from its valve seat **47** opening the passage **49** leading to drain conduit **35**. At the same time the contraction of bellows valve **53** displaces the force transmitting medium, causing the bellows valve **52** to be distended and to seat upon valve seat **46**, thus closing off communication between the pump housing and the recirculation conduit **34**. Conversely, when the pump impeller rotates in the opposite direction during the agitation or washing operation, valve **52** is opened and the force transmitting medium forces valve **53** into closed position. The recirculation conduit is thus connected to receive the pump discharge while the drain conduit is closed off from the pump. During the rotation of the pump impeller in either direction, the closed valve prevents the drawing of air into the pump casing from its corresponding conduit and thus enhances the efficiency of the pump. Suitable filling means indicated generally at **54** may be connected to the space **43** for filling or bleeding off the force transmitting medium for securing proper adjustment of the valves.

Referring now to Fig. 3, there is shown a second modification of our two-way pump valve linkage comprising a first, or recirculation valve, **62**, formed in the shape of an imperforate, resilient diaphragm from a material such as rubber or similar plastic-like material. This valve is mounted around its periphery upon the pump casing extension **42***a* and adjacent its central portion is adapted to seat upon valve seat **46**. In like manner, a second, or drainage valve **63**, of similar material and construction, is mounted upon the pump casing extension for similar cooperation with valve seat **47**. Disposed within space **43** and pivotally mounted adjacent its center is an elongated valve actuating lever **64**, having extensions **65** and **66** at each end adapted to engage the central portions of the diaphragm valves **62** and **63**, respectively. The length of these extensions and the resiliency of the valve diaphragm material are so chosen as to enable the extension associated with either valve to force that valve into sealing engagement with its valve seat when the lever is rocked in one direction and to permit the valve to be lifted from its seat when the lever is rocked in the other direction. The length of the extensions is such, however, that both valves can not be closed simultaneously. Rather when the lever is in its equilibrium position, as may occur when the pump is at rest, neither diaphragm valve closes off its valve seat.

When, however, the pump is placed in operation, the one diaphragm valve is subjected to a greater pressure from the pump than from the other valve. The diaphragm valve atop the passageway confronting the pump as it rotates is subjected to a greater pressure than the diaphragm atop the other passageway. This pressure flexes the one diaphragm valve forcing it further away from its valve seat and thereby opening the valve seat still further. Simultaneously, the other diaphragm is flexed in the opposite direction through the action of the lever. The flexing of the first valve causes a sufficient pivoting of the lever that the lever forces the other diaphragm against its valve seat, thereby closing it off. Thus, with the pump rotating as shown in Fig. 3 to discharge water from the tub during the spin extraction operation of the washing machine, the valve **63** is forced from its valve seat **47**, opening passage **45** to chamber **43***b* and the passage **49** leading to drain conduit **35**. At the same time, the lifting of the valve causes lever **64** to rock about its pivot causing projection **65** to force diaphragm valve **62** upon valve seat **46**, thus closing off communication between the pump housing and the recirculation conduit **34**.

Conversely, when the pump impeller rotates in the opposite direction during the agitation or washing operation, valve **62** is forced from its seat opening passage **44** to chamber **43***a* and passage **48**, and the lever **64** rocks in the opposite direction forcing valve **63** into closed position. The recirculation conduit is thereby connected to the pump while the drain passageway is closed off.

While our invention has been described by reference to two separate modifications of a direction responsive pump equipped with a valve linkage, it will be understood that other modifications may be made by those skilled in the art without actually departing from the invention. It is, therefore, the purpose of the appended claim to cover all such equivalent variations as come within the true spirit and scope of the invention.

What we claim as new and desire to secure by Letters patent of the United States is:

A centrifugal pump comprising a casing defining a cylindrical pump chamber, a laterally disposed housing having a space therein, a pair of substantially diametrically spaced outlet passages joining said chamber and said space and arranged tangentially with respect to said chamber, a valve seat at the entrance of each of said passages into said space, a conduit extending from said space adjacent each of said valve seats, an impeller for rotation within said chamber, one of said passages confronting flow within said chamber for one direction of rotation of said impeller, the other of said passages confronting flow within said chamber for the other direction of rotation of said impeller so that the fluid pressure is higher in said one passage for said one direction of rotation and in said other passage for said other direction of rotation, an axial inlet through which fluid enters said chamber, a pair of valves mounted within said space for movement to and from said valve seats respectively, said valves being operable by the pressure developed by said pump in said passages so that one valve is unseated during rotation of said impeller in one direction and the other valve is unseated during rotation of said impeller in the other direction, and force transmitting means arranged between said valves in said space for producing mutual movement thereof, said force transmitting means comprising a body of flowable material confined in said space between said valves in contact with each valve whereby the unseating of either valve causes the seating of the other valve.

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