

Dec. 6, 1966

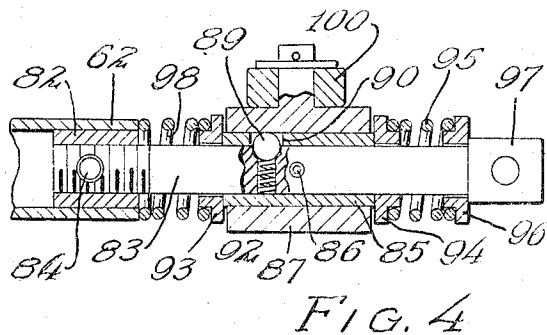
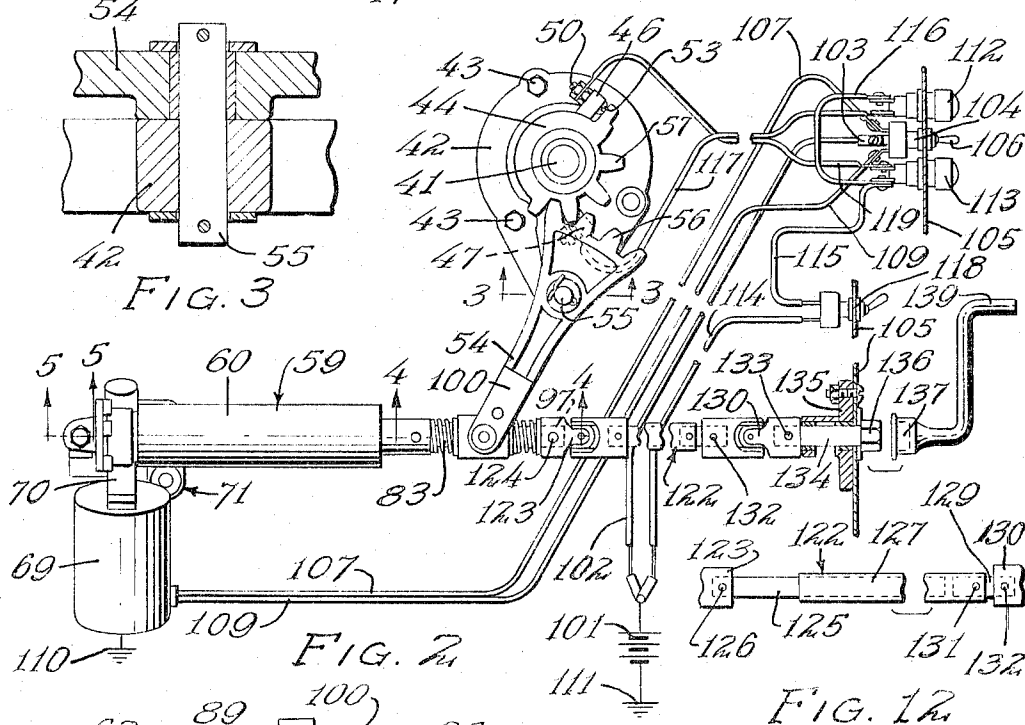
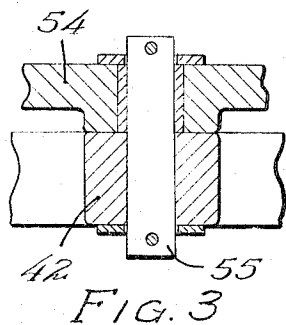
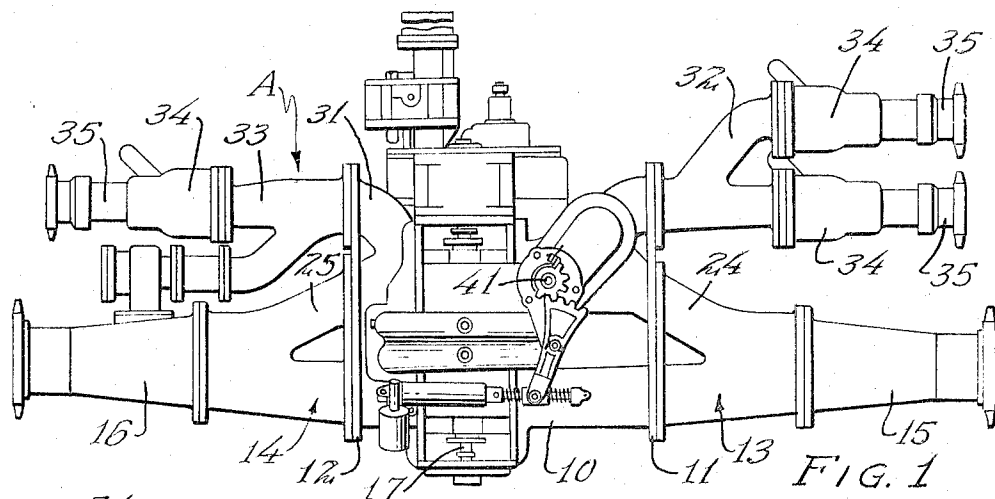
D. F. THOMAS ETAL

3,289,695

CENTRIFUGAL PUMP TRANSFER VALVE

Filed Nov. 16, 1964

3 Sheets-Sheet 1



INVENTOR
DAVID F. THOMAS
GEORGE A. RATHBURN
BY *Robert M. Dunning*
ATTORNEY

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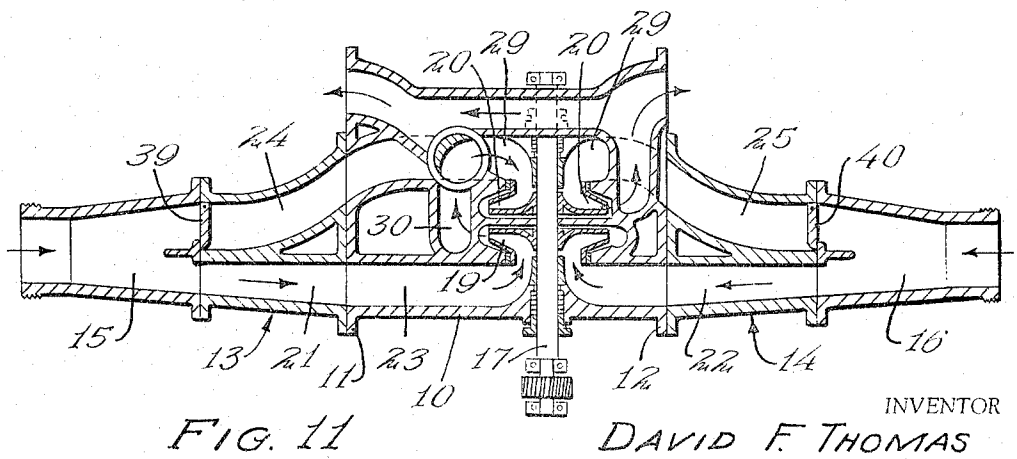
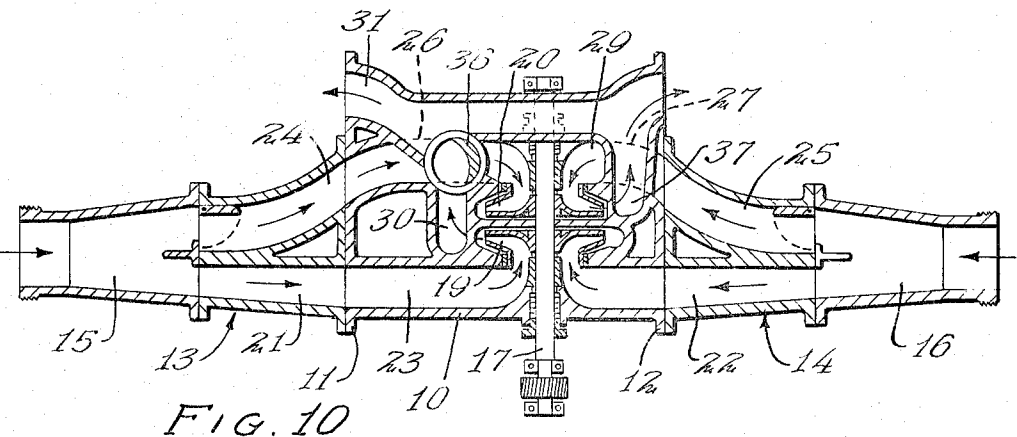
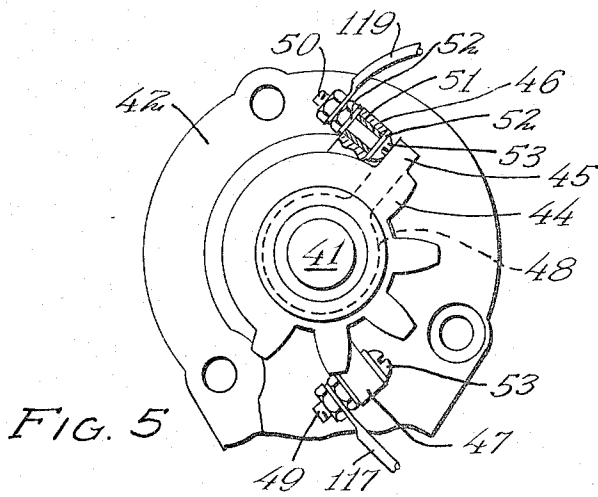
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CENTRIFUGAL PUMP TRANSFER VALVE

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3 Sheets-Sheet 2



INVENTOR
DAVID F. THOMAS
GEORGE A. RATHBURN
BY *Robert M. Dunne*
ATTORNEY

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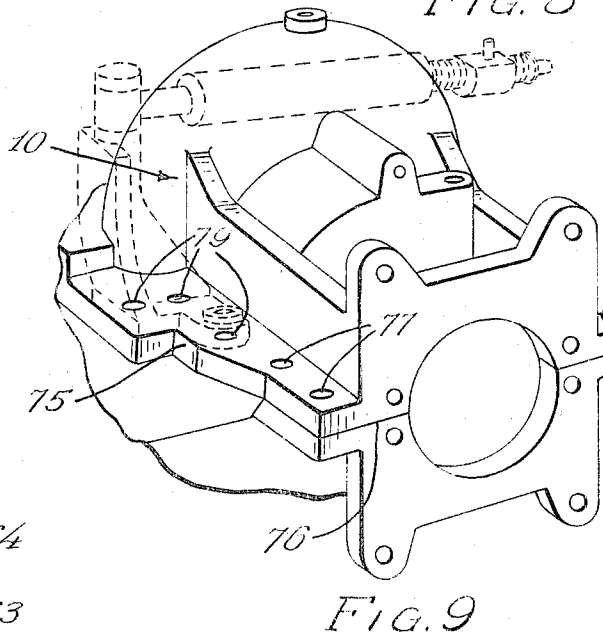
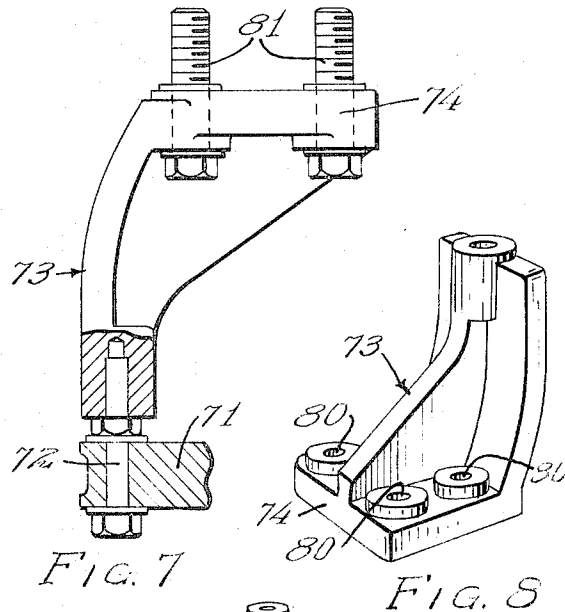
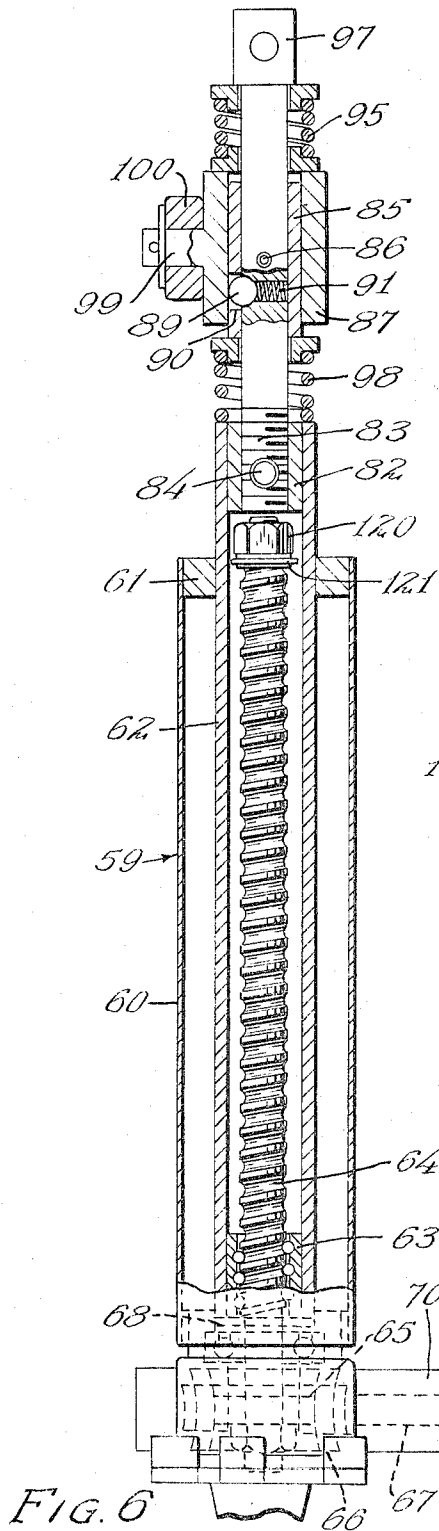
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CENTRIFUGAL PUMP TRANSFER VALVE

Filed Nov. 16, 1964

3 Sheets-Sheet 3



INVENTOR

DAVID F. THOMAS
GEORGE A. RATHBURN

BY

Robert M. Dunning

ATTORNEY

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3,289,695

CENTRIFUGAL PUMP TRANSFER VALVE

David F. Thomas, West St. Paul, and George A. Rathburn, St. Paul, Minn., assignors to Waterous Company, St. Paul, Minn., a corporation of Minnesota

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12 Claims. (Cl. 137-554)

This invention relates to an improvement in centrifugal pump transfer valve and deals particularly with a means of actuating the transfer valve of a series-parallel two-stage hydraulic pump.

In Patent 2,900,918, issued August 25, 1959, to David F. Thomas et al., a transfer valve actuating means was disclosed controlling the connection between the first and second stages of a centrifugal pump and capable of either directing the discharge from the first stage impeller to the pump discharge, or alternately to the inlet of the second stage impeller. The construction disclosed in the patent has been used successfully for some years. The present invention comprises an improvement over the previous structure. The improvement lies in simplifying the rather complicated electrical circuit of the previous structure, and also in reducing the effort required to manually operate the valve in the event the electrical actuator fails to function.

Fire pumps of the type for which the present transfer valve is designed must be extremely reliable and dependable. It is important that these devices be actuated automatically or by the use of power assists wherever possible to speed up the control. In order to accomplish this result, various types of electrical, hydraulic, and pneumatic controls have been produced for shifting the gears to connect and disconnect the drive motor from the pump, and also for actuating the valves which control the flow of fluid through the pump. These means may be actuated from a central control panel by a single operator. However, in the remote possibility of a failure in the power supply driving the actuators, it is essential that means be provided for manually operating the device. The present invention lies in the provision of an electrically operated transfer valve actuator which may, if desired, be actuated from the control panel manually in the event such manual operation becomes mandatory.

A feature of the present invention resides in the provision of an electric actuator which is controlled by a simplified control circuit. In place of the limit switches and relays used in the control of the transfer valve actuator in the patent above referred to, the actuator motor in the present case is controlled merely by a "momentary contact" double pull switch which can be operated to drive the motor in either direction. Circuits to actuate the signal lights are closed as the valve reaches either extreme position. Means is provided to prevent over-travel of the actuator to prevent injury to the parts in the event the actuator motor circuit remains closed for a period of time after the valve has been moved to an extreme position.

A further feature of the present invention resides in the provision of an actuator which may be so connected to the pump that the manual operating means may extend in a substantially straight path to the control panel.

A further feature of the present invention lies in the provision of a transfer valve having a gear segment mounted on the shaft of the valve and operable between two extreme positions. A gear lever comprising a co-operable gear segment provided with an extended operating end is pivotally supported adjoining the valve to operate the gear segment on the valve stem. An expandable and compressible actuator is connected through a swivel block to the gear lever. By expanding the actuator, the valve will be rotated in one direction, and by

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compressing the actuator, the valve will be pivoted in the opposite direction. Over-travel of the actuator is prevented by permitting the bushing on the actuator arm to rotate within the swivel block when the gear lever reaches its extreme position.

A further feature of the present invention resides in the provision of a system which may be manually operated with relative ease when and if required. The swivel block to which the gear lever is connected is supported for slight axial movement on a bushing mounted on the movable arm of the actuator. In either extreme position of the valve, the swivel block acts to compress a compression spring and accordingly there will be some original frictional resistance to reverse operation of the actuator either manually or by power. However, as soon as the actuator is moved slightly, this increased frictional force will be eliminated, and the actuator may be manually operated with comparative ease.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification;

FIGURE 1 is a bottom plan view of a fire pump showing the general arrangement of parts.

FIGURE 2 is a diagrammatic view showing the valve and the valve actuator, and showing the circuit connecting these elements.

FIGURE 3 is a vertical sectional view through the apparatus, the position of the section being indicated by the line 3-3 of FIGURE 2.

FIGURE 4 is a view through the connection between the actuator and the gear lever, the position of the section being indicated by the line 4-4 of FIGURE 2.

FIGURE 5 is a view showing the valve casing with the gear lever removed to show the means of limiting pivotal movement of the valve.

FIGURE 6 is a view similar to FIGURE 4 on an enlarged scale and showing the major portion of the actuator, a portion of the actuator being shown in the bottom plan view.

FIGURE 7 is an elevational view of the bracket connecting the actuator to the pump housing.

FIGURE 8 is a perspective view of the bracket shown in FIGURE 7.

FIGURE 9 is a perspective detailed view showing the under surface of the pump in inverted position, and showing the position of the actuator.

FIGURE 10 is a diagrammatic view of the pump in position for parallel operation.

FIGURE 11 is a diagrammatic sectional view through the pump when the valve is positioned for series operation.

FIGURE 12 is a detail view of a portion of the manual operating mechanism.

The pump A is of the series-parallel type commonly used in fire fighting equipment. While such pumps are well known in the art, FIGURES 10 and 11 of the drawings are submitted for the purpose of illustration. The pump body 10 is provided at opposite ends with attachment flanges 11 and 12 to which intake manifolds 13 and 14 are attached. Manifold extensions 15 and 16 are connected to the manifolds 13 and 14 respectively, and either or both of the extensions 15 and 16 may be connected to a source of water supply.

An impeller shaft 17 extends through the pump body 10 and supports a first stage impeller 19, and a second stage impeller 20. The manifolds 13 and 14 include branch passages 21 and 22 which lead directly to the intake chamber 23 of the pump housing 10 which communicate with the intake of the first stage impeller 19. The manifolds 13 and 14 also include branch passages 24 and 25 which communicate with passages 26 and 27 in the

pump housing 10 communicating with the intake chamber 29 of the second stage impeller 20.

A transfer valve 36 is operable between two extreme positions. When the valve 36 is in the position indicated in FIGURE 10 of the drawings, the discharge 30 of the first stage impeller 19 is connected to the discharge passage 31 and the discharge from the second stage impeller is similarly connected to the discharge passage 31 through the communicating passage 37. However, when the transfer valve 36 is in the position shown in FIGURE 11 of the drawings, the discharge 30 of the first stage impeller is connected to the intake chamber 29 of the second stage impeller 20 and the impellers are arranged for series operation. In this event, check valves 39 and 40 close the intake passages 24 and 25 leading to the second stage impeller from the intake manifold extensions 15 and 16 and the pressure of the water leaving the pump is correspondingly increased. As indicated in FIGURE 1 of the drawings, the discharge passage 31 is connected to oppositely directed discharge manifolds 32 and 33 communicating with discharge valves 34 and discharge connections 35.

The foregoing explanation, while not involving novel subject matter is made to provide a basis for describing the operation of the transfer valve 36 mounted on a substantially vertical valve shaft 41 extending through the removable closure plate 42 attached to the pump body 10 by any suitable means such as the bolts 43. As indicated in FIGURE 5 of the drawings, a gear segment 44 is mounted upon the valve shaft 41, the gear segment including a radially extending abutment 45. The arm or movable abutment 45 is located below the level of the gear segment 44, and extends radially from the hub 48 of the gear segment 44, as indicated in FIGURE 5 of the drawings, and is pivotal between two fixed abutments 46 and 47 mounted upon the cover plate 42. The fixed abutments 46 and 47 are below the level of the gear segment 44. Bolts 49 and 50 extend through the abutments 46 and 47, and are insulated therefrom by insulating sleeves such as 51 and insulating washers such as 52. Each of the bolts 49 and 50 is provided with a head 53 which is in the path of movement of the movable arm or abutment 45. When the movable abutment 45 is in engagement with the head of either of the bolts 49 and 50, a circuit to a signal light is closed, as will be later described in detail.

A gear lever 54 is pivotally supported by a pivot pin 55 mounted on the valve cover plate 42. The gear lever 54 is provided with angularly spaced teeth 56 which are in mesh with the teeth 57 of the gear segment 44. Oscillation of the gear lever 54 thus rotates the transfer valve 36 from one extreme position in which the impellers 19 and 20 are connected in parallel, to a second extreme position in which the impellers are connected in series.

The gear lever 54 is oscillated by means of an actuator indicated in general by the numeral 59. As indicated in FIGURE 6 of the drawings, the actuator 59 includes an outer tubular housing 60 including bearing means 61 for slidably supporting the housing 60 on a tubular actuator shaft 62. The tubular shaft 62 telescopes into and out of the housing 60 to extend or contract the length of the actuator. The tubular shaft 62 is moved axially by the engagement of a nut 63 and a threaded axial shaft or screw 64. Rotation of the screw shaft 64 normally moves the nut 63 axially with respect to screw shaft 64 and the housing 60, the nut 63 being secured from rotation with respect to the tubular shaft 62. The screw shaft 64 is supported by bearings, not illustrated, to extend axially of the tubular housing 60. A worm gear 65 is mounted on the screw shaft 64, and is selectively rotated in either direction by means of a worm 66 mounted upon the shaft 67 of a drive motor 69. The motor 69 is connected as a unit with the tubular housing 60 through a connecting housing 70 which encloses the motor shaft 67 and worm 66, and both elements are connected to a mounting bracket indicated in general by the numeral 71.

The entire unit is supported by a pivot bolt 72 which connects the unit to a supporting bracket indicated in general by the numeral 73. In the particular form illustrated, the bracket 73 includes a mounting flange 74 adapted to fit against the peripheral flange 75 at the center line of the pump body 10. FIGURE 9 of the drawings shows a portion of the body in a position which is inverted from the normal mounting of the pump, although the pump is so constructed that it can be mounted in either position. The numeral 76 designates the parting line of the pump which normally extends through the axis of the impeller shaft, the upper and lower pump sections being connected by bolts or cap screws extending into the apertures such as 77. Three of these apertures 79 are aligned with corresponding apertures 80 in the mounting plate 74 of the bracket 73 so that the bracket 73 may be anchored to the flange 75 by bolts such as 81.

With reference again to FIGURES 4 and 6 of the drawings, a spacer sleeve 82 is supported in the end of the tubular shaft 62 opposite that supporting the nut 63, and a rod or shaft 83 is supported within the spacer sleeve 82 and pinned to the tubular shaft as indicated at 84. A bushing 85 is pinned to the shaft 83 as indicated at 86. A swivel block 87 is rotatably and slidably supported upon the bushing 85. Relative rotation between the shaft 83 and the swivel block 87 is normally prevented by a ball 89 seated in a socket 90 in the bushing 85 and shaft 83 which ball is urged against the inner surface of the swivel block by a spring 91. In other words, the frictional engagement between the bushing 85 and swivel block 87 is greater than the frictional engagement between the nut 63 and the screw shaft 64 so that the tubular shaft 62 will be held from rotation during the time the tubular shaft is moving from one limiting position to the other.

The axial movement of the tubular shaft 62 in either direction is limited in any suitable manner. For example, in one extreme position the end of the hollow shaft 62 enclosing the nut 63 may engage a bearing washer 68 within the supported end of the housing 60. In its other extreme position the nut 63 may engage a washer 121 held in place near the end of the screw shaft 64 by a nut 120.

As is indicated in FIGURE 4 of the drawings, the bushing 85 is of slightly greater axial length than the swivel block 87. Bearing rings 93 and 94 encircle the shaft 83 and engage against opposite ends of the bushing 85. A compression spring 98 is interposed between the bearing ring 93 and the adjacent end of the tubular shaft 62. A second spring 95 is interposed between the bearing ring 94 and a third bearing ring 96 which bears against the enlarged diameter end 97 of the shaft 83. The springs 98 and 95 tend to hold the swivel block 87 substantially centered with respect to the bushing 85 so that the initial compressive force of the springs 98 and 95 is not exerted against the swivel block 87. However, as the bearing rings 93 and 94 are of greater diameter than the bushing 85, one spring or the other will be compressed by axial movement of the shaft 83 relative to the swivel block 87 after the valve 36 has reached an extreme position.

The swivel block 87 supports a pivot 99 which acts to pivotally connect the elongated operating end 100 of the gear lever 54 to the swivel block 87. The elongation of the actuator 59 will thus pivot the gear lever in one direction causing rotation of the transfer valve 36 in one direction, and the contraction of the actuator 59 will pivot the transfer valve to its opposite extreme position.

The simple operating circuit is incorporated in FIGURE 2 of the drawings. The battery 101 is connected by a conductor 102 to the center pole 103 of a momentary contact double pole switch 104 mounted on the control panel 105. The switch lever 106 may be used to connect the "hot" side of the battery 101 to either a first conductor 107 or with a second conductor 109. The other side of the motor circuit of the motor 69 is grounded as indicated at 110 and the other side of the battery 101 is also grounded as indicated at 111. When the switch lever

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106 closes contact with the conductor 107, the motor 69 will operate in one direction. When the switch lever 106 is operated to close contact from the outside of the battery to conductor 109, the motor 69 will rotate in the opposite direction.

A pair of indicating lights 112 and 113 are provided on the operating panel 105 and are designed to indicate when the valve 36 is in either extreme position. Conductors 114 and 115 connect the "hot" side of the battery 101 to one terminal of the light 113 through a switch 118 and through conductor 116 to one terminal of the light 112. The switch 118 may comprise the vehicle ignition switch, or may comprise a switch closed by the gear shift mechanism when the mechanism is in "pump" position so that the lights 112, 113 would be energized only under suitable conditions. The other terminal of the light 112 is connected by a conductor 117 to the screw 49 supported by, but insulated from, the abutment 47. The other terminal of the light 113 is connected by a conductor 119 to the screw head 53 of the screw 50 supported by the abutment 46.

In the operation of the apparatus, the normally open switch 104 controls the operation of the actuator 59. With the actuator in the position shown in FIGURE 2 of the drawings, operation of the switch 106 in the proper direction will close the circuit to the motor 69, and the motor will continue to function as long as the switch is held in this position. Operation of the motor 69 will cause rotation of the screw shaft 64 in a direction to move the tubular shaft 62 outwardly or to extend the length of the actuator. This action will cause the rotation of the gear lever 54 in a counter-clockwise direction and rotate the gear segment 44 in a clockwise direction until the valve 36 reaches its opposite extreme position.

As the gear segment 44 moves out of contact with the screw 50 in the abutment 46, the circuit which has been previously established to the signal light 113 will be extinguished, and both of the lights will be out. However, as the movable abutment 45 on the gear segment 44 moves into its other extreme position, the abutment 45 will engage the screw 49 completing the circuit to the signal light 112. This occurs as the gear segment 44 is grounded. The circuit extends from the battery 101 through conductors 114, 115, and 116 to one terminal of the light, and through conductor 117 to the contact screw 49 which is grounded when engaged with the movable abutment 45.

Rotation of the actuator 69 in the opposite direction will contract the actuator causing the gear lever 54 to move in a clockwise direction and the gear segment 44 to move in a counter-clockwise direction. As soon as the abutment 45 moves out of contact with the contact screw 49, the light 112 is extinguished, and both lights remain off until the movable abutment 45 engages the contact screw 50. This engagement closes the circuit from the battery 101 and conductors 114 and 115 to the signal light 113, the other terminal of which is connected by the conductor 119 to the screw 50.

The signal lights thus provide an indication when the valve 36 moves into either extreme position, and the lights serve as a signal to the operator to release the switch handle 106 of the switch 104 to open the motor circuit. However, as the over-travel of the actuator is virtually inevitable, the releasable engagement between the shaft 83 and the swivel block 87 is of importance to prevent damage to the working parts.

During movement of the actuator shaft 83 in either direction, the springs 98 and 95 have little effect upon the swivel block 87 as the force of the springs 98 and 95 is mainly resisted by the bushing 85. However, when the valve reaches either extreme position, the swivel block 87 is positively held from movement, and continued longitudinal movement of the shaft 83 and bushing 85 will cause one or the other of the springs 98 and 95 to be contracted. FIGURE 6 shows the actuator 59 after the actuator has compressed sufficiently to move the transfer valve to

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one extreme position, and after the motor 69 has continued to travel. It will be noted that the spring 95 has been compressed more than its initial amount by longitudinal movement of the shaft 63, spacer sleeve 82, and actuator shaft 83 in a direction which is downward as it appears in the drawings. Compression of the spring 95 will continue until the lowermost end of the tubular shaft 62 engages the bearing washer 68 at the supported end of the housing 60 preventing further axial travel of the tubular actuator shaft 62 and the connected parts. Further rotation of the screw shaft causes the nut 63 and tubular shaft 62 to lock with the screw shaft, causing the bushing 85 to rotate within the swivel block 87. This action continues until the manual switch 106 is released to break the motor circuit and the motor 69 stops rotation.

When the actuator rotates the valve 36 to its other extreme position, the washer 121 held by the nut 120 on the end of the screw shaft 64 is still somewhat spaced from the screw shaft nut 63. Continued rotation of the screw shaft then compresses the spring 98 until the washer 121 engages the nut 63. This causes the nut 63 to lock upon the screw shaft 64, and the tubular shaft 62 and its bushing 85 rotate within the swivel block 87 in unison with the screw shaft 64 until the manual motor switch 106 is released to open the circuit to the motor 69.

FIGURES 2 and 12 of the drawings diagrammatically illustrate means by which the actuator may be manually operated. An example shaft 122 is connected to the end 97 of the shaft 83, preferably through a universal joint 123.

The universal joint 123 is socketed to accommodate the shaft end 97 and is pin connected thereto as indicated at 124. The other end of the universal joint 123 is secured to the end of a square shaft 125 forming a part of the expandable shaft 122 as indicated at 126. The tubular square shaft 127 is in telescoping relation to the square shaft 125. A short section of square shaft 129 forms a connection between the shaft 127 and a second universal joint 130. The shaft 129 is pinned to the shaft 127 at 131 and to the universal joint 130 at 132. The universal joint 130 is pinned as at 133 to a short shaft 134 extending through a bearing 135 on the control panel 105. The multi-sided end 136 of the shaft 134 projects through the control panel and is adapted to accommodate the socketed end 137 of a crank 139 by means of which the shaft 83 may be manually operated. This structure permits the shaft 134 extending through the control panel to be out of direct alignment with the shaft 83, and compensates for the varying angularity of the actuator during its operation.

In the event of a power failure or if the actuator 59 should fail to function for any reason, the valve may be actuated by hand through the use of the crank 124. If the difficulty should occur when one of the springs 98 or 95 is compressed as indicated in FIGURE 6 of the drawings, the compressed spring will provide an added resistance to the manual rotation of the shaft 83 at the very start of the operation. However, as soon as the shaft has been rotated to a small degree, the bushing 85 will become generally centered with respect to the swivel block 87, and the frictional force of the spring 98 or 95 will be removed. As a result, the actuator may be easily operated to move the valve from one extreme position to the other by rotating the shaft 83, the tubular shaft 62, and nut 63 relative to the stationary screw shaft 64.

In accordance with the patent statutes, the principles of construction and operation of this improvement in centrifugal pump transfer valve have been described, and while an endeavor has been made to set forth the best embodiment thereof, it should be understood that changes may be made within the scope of the following claims without departing from the spirit of the invention.

We claim:

1. A device for pivoting a valve between two extreme positions, the device including:

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a pivotally supported member connected to said valve to pivot the same,
 means limiting the movement of said valve for motion between two extreme positions,
 an expandable and contractable actuator pivotally connected between a point on said pivotally supported member spaced from its pivot axis and a fixed point, said actuator including a tubular housing,
 a rotatable screw shaft within said housing,
 a tubular shaft slidably and rotatably supported by said housing in telescoping relation thereto and threadedly engaged with said screw shaft,
 a coaxial extension shaft secured to said tubular shaft, a swivel block rotatably supported on said extension shaft and forming the pivotal connection between said actuator and said pivotally supported member, means normally restraining said extension shaft from rotation relative to said swivel block,
 said screw shaft and said tubular shaft being relatively movable a distance in excess of the distance necessary to move said valve to either extreme position, means limiting relative movement of said screw shaft and tubular shaft between two limiting positions of said tubular shaft, and
 means for rotating said screw shaft in either direction, whereby when said tubular shaft reaches either limiting position continued rotation of said screw shaft will cause rotation of said extension shaft within said swivel block.

2. A valve operating device in combination with a pivotal valve, a housing enclosing said valve, and a valve stem on said valve extending through said housing, the device including:
 a lever means pivotally supported on said housing, cooperable means on said lever and on said valve stem for pivoting said valve upon pivotal movement of said lever,
 means limiting the pivotal movement of said valve for movement between two extreme positions,
 an expandable and contractable actuator including an elongated tubular housing having one end pivotally connected to said housing,
 a rotatable screw shaft supported longitudinally of said tubular housing and enclosed therein.
 a second shaft in telescoping relation with said screw shaft and threadedly connected thereto for axial movement,
 said second shaft projecting from the other end of said tubular housing,
 a swivel block supported by the projecting end of said second shaft and pivotally supported thereon,
 means frictionally resisting relative pivotal movement between said swivel block and said second shaft,
 means pivotally connecting said swivel block to said lever means at a point spaced from the pivot axis of said lever,
 said screw shaft and said second shaft being relatively movable a distance in excess of the distance necessary to move said valve to either extreme position, means limiting relative movement of said screw shaft and second shaft between two limiting positions of said second shaft,
 means for selectively rotating said screw shaft in either direction to move said second shaft axially and to pivot said lever means, and
 whereby continued rotation of said screw shaft after said second shaft has reached either limiting position will cause said second shaft to rotate with said screw shaft and relative to said swivel block.

3. A valve operating device in combination with a pivotal valve, a housing enclosing said valve, and a valve stem extending through said housing, the device including,
 a lever pivotally supported on said housing on an axis parallel to the valve stem axis,
 cooperable means on said lever and on said valve stem

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for rotating said valve upon pivotal movement of said lever,
 means limiting the pivotal movement of said valve for movement between two extreme positions,
 an expandable and contractable actuator having one end pivotally supported on an axis fixed relative to said housing and parallel to the axis of the valve stem,
 said actuator including two telescopically arranged shaft members threadedly connected together,
 means supporting said shaft members at said one end of said actuator and holding said one shaft member from axial movement whereby rotation of said one shaft member will move the other shaft member axially of the first shaft member,
 a swivel block rotatably supported on said other shaft member,
 pivot means on said swivel block having its axis parallel to the axis of the valve stem and connecting said swivel block to said lever at a point spaced from the pivot axis thereof,
 means frictionally restraining relative rotative movement of said other shaft member in said swivel block, and
 means connected to said one shaft member for rotating the same in either direction, and
 whereby rotation of said one shaft member will move said other shaft member axially a distance in excess of the distance necessary to rotate said valve to either extreme position,
 means limiting axial movement of said other shaft member between two limiting positions,
 whereby continued rotation of said one shaft member after said other shaft has reached either limiting position will cause said second shaft member to rotate with said one shaft member and relative to said swivel block.

4. The structure of claim 3 and including a bushing secured encircling said other member within said swivel block and of greater axial length than said swivel block, collars slidably supported on said other shaft member at opposite ends of said bushing and of larger diameter than said bushing,
 fixed abutments on said other shaft member in spaced relation to said collars, and
 springs encircling said other shaft member between each said abutment and a corresponding collar urging said collars against the ends of said bushing, whereby axial movement of said other shaft member after said valve has reached either extreme position will cause said swivel block to engage one of said collars and to further compress the adjacent one of said springs.

5. The structure of claim 3 and in which the means normally restraining said other shaft member with respect to the swivel block includes a spring urged ball.

6. The structure of claim 3 and including a manually operable element connected to said other shaft and by means of which said other shaft member may be rotated relative to said one shaft member to move said other shaft member in an axial direction.

7. The structure of claim 4 and including a manually operable means connected to said other shaft member for rotating the same relative to said one shaft member to move said other shaft member in an axial direction.

8. A device for pivoting a valve between two extreme positions, the device including:
 a pivotally supported member connected to said valve to pivot the same,
 means limiting the movement of said valve for motion between two extreme positions,
 an expandable and contractable actuator pivotally connected between a point on said pivotally supported member spaced from its pivot axis and a fixed point, said actuator including a tubular housing,

a rotatable screw shaft within said housing,
 a tubular shaft slidably and rotatably supported by
 said housing in telescoping relation thereto and
 threadedly engaged with said screw shaft,
 a coaxial extension shaft secured to said tubular shaft,
 a bushing secured to said extension shaft and encircling
 the same,
 a swivel block encircling said bushing and slidably
 and rotatably supported thereby, said swivel block in-
 cluding pivot means forming the pivotal connection
 between said actuator and said pivotally supported
 member,
 means normally frictionally restraining said extension
 shaft from rotation relative to said swivel block,
 said swivel block being slightly shorter in axial length
 than said bushing,
 bearing collars slidably supported on said extension
 shaft and being of greater diameter than said bushing,
 abutments on said extension shaft in spaced relation to
 said collars, and
 compression springs interposed between each bearing
 collar and a corresponding abutment to urge said
 collars against the ends of said bushing,
 said tubular shaft being movable axially of said screw
 shaft a distance in excess of the distance necessary
 to move said valve to either extreme position,
 means limiting axial movement of said tubular shaft
 relative to said screw shaft between two limiting
 positions of said tubular shaft,
 whereby continued rotation of said screw shaft after
 said position will engage one of said collars and fur-
 ther compress the adjacent spring, and
 whereby further rotation of said screw shaft moving
 said tubular shaft to either limiting position will cause
 said tubular shaft to rotate with said screw shaft and
 rotate said bushing within said swivel block.

9. The structure of claim 8 and including a manually
 operable means connected to said extension shaft and
 operable to rotate said extension shaft and tubular shaft
 relative to said screw shaft to contract or extend said
 actuator.

10. The structure of claim 3 and in which said coop-
 erable means on said lever and on said valve stem com-

prises a gear segment on said valve stem, and coop-
 erable gear teeth on said lever in engagement with said gear
 segment.

11. The structure of claim 10 and including a projec-
 tion on said gear segment and a pair of fixed abutments
 on said housing in the path of movement of said pro-
 jection, forming the means limiting pivotal movement of
 said valve.

12. A device for pivoting a valve between two extreme
 positions, the device including:

a valve,
 an electrically conductive housing enclosing said valve
 and having a valve stem extending through said hous-
 ing,
 an electrically conductive arm secured to said stem ex-
 ternally of said housing,
 lever means connected to said arm to actuate the valve,
 an electrically conductive projection on said arm,
 a pair of fixed abutments on said housing in the path
 of movement of said projection and acting to limit
 pivotal movement of said valve,
 each abutment including a contact insulated from the
 housing,
 a signal circuit for each abutment each including a
 source of electrical current one side of which is
 grounded to the housing and gear segment, a signal
 light, and a corresponding one of said insulated con-
 tacts,
 whereby engagement of said projection with either con-
 tact will complete a circuit from the power source to
 one of said signal lights.

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M. CARY NELSON, *Primary Examiner*.

H. KLINKSIEK, *Assistant Examiner*.