Sept. 14, 1948. A. E. KREMILLER 2,449,392

PULSATOR SYSTEM

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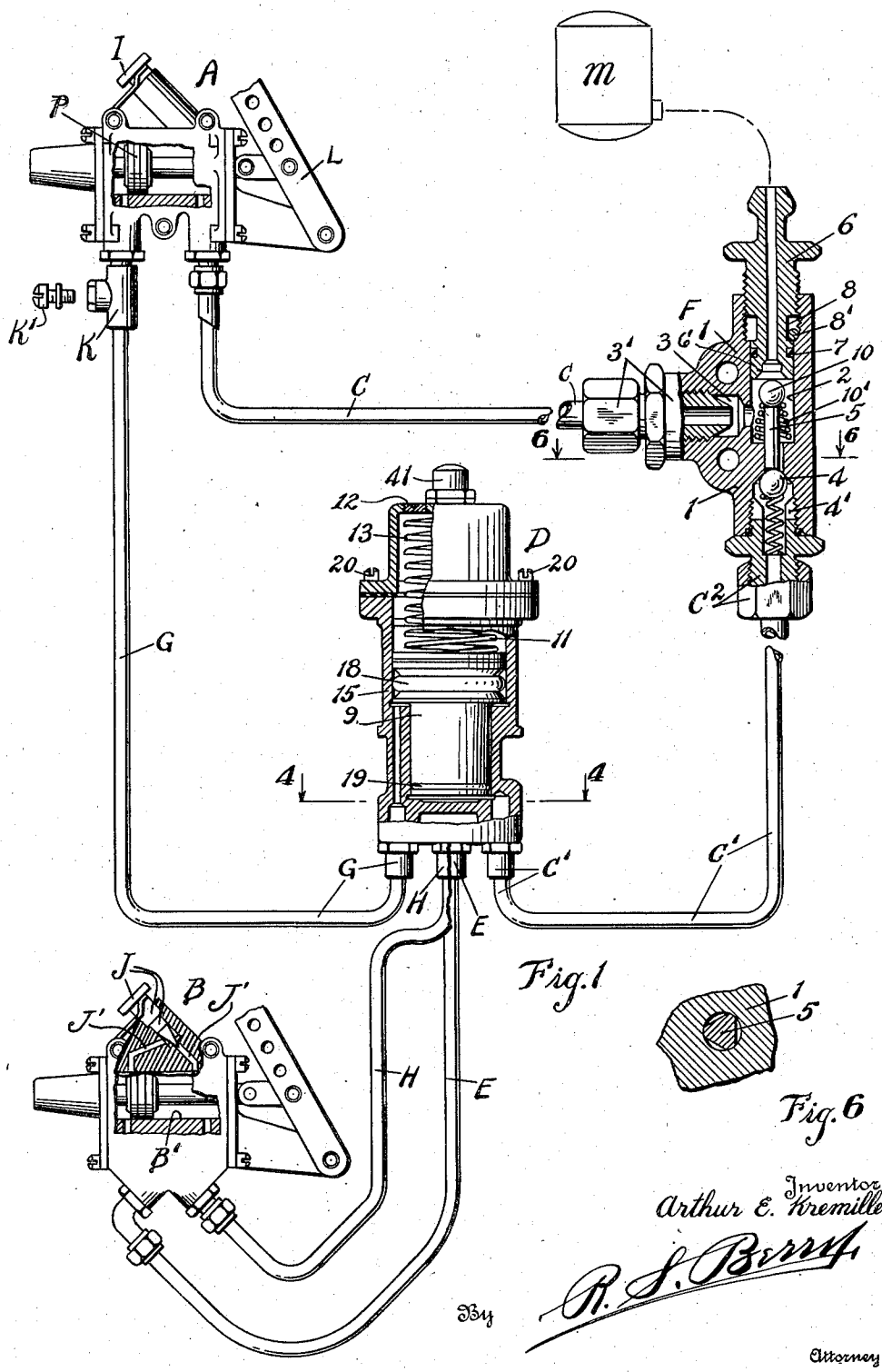


Fig. 1

Fig. 6

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Fig. 2.

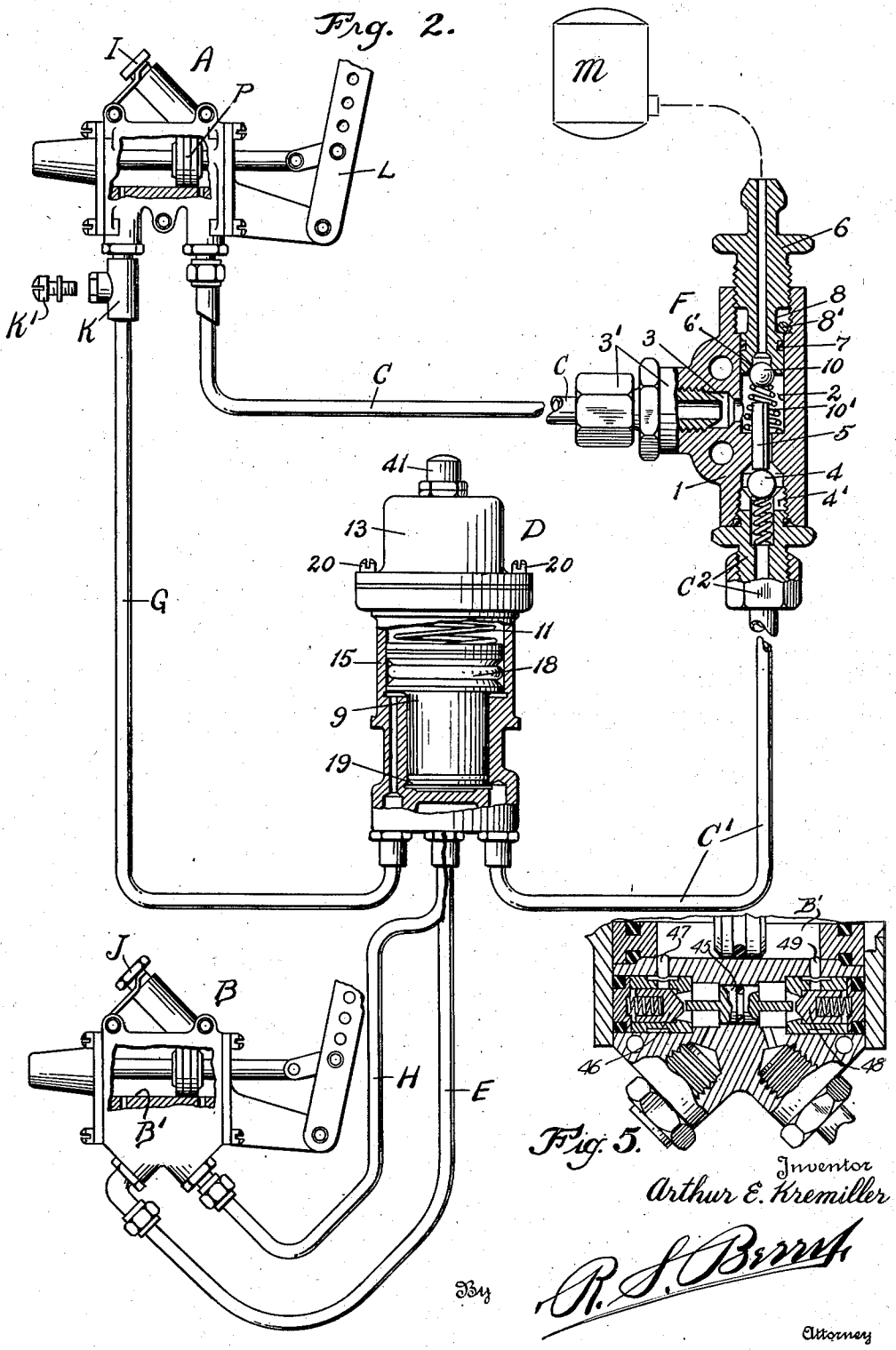


Fig. 5.

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Fig. 3

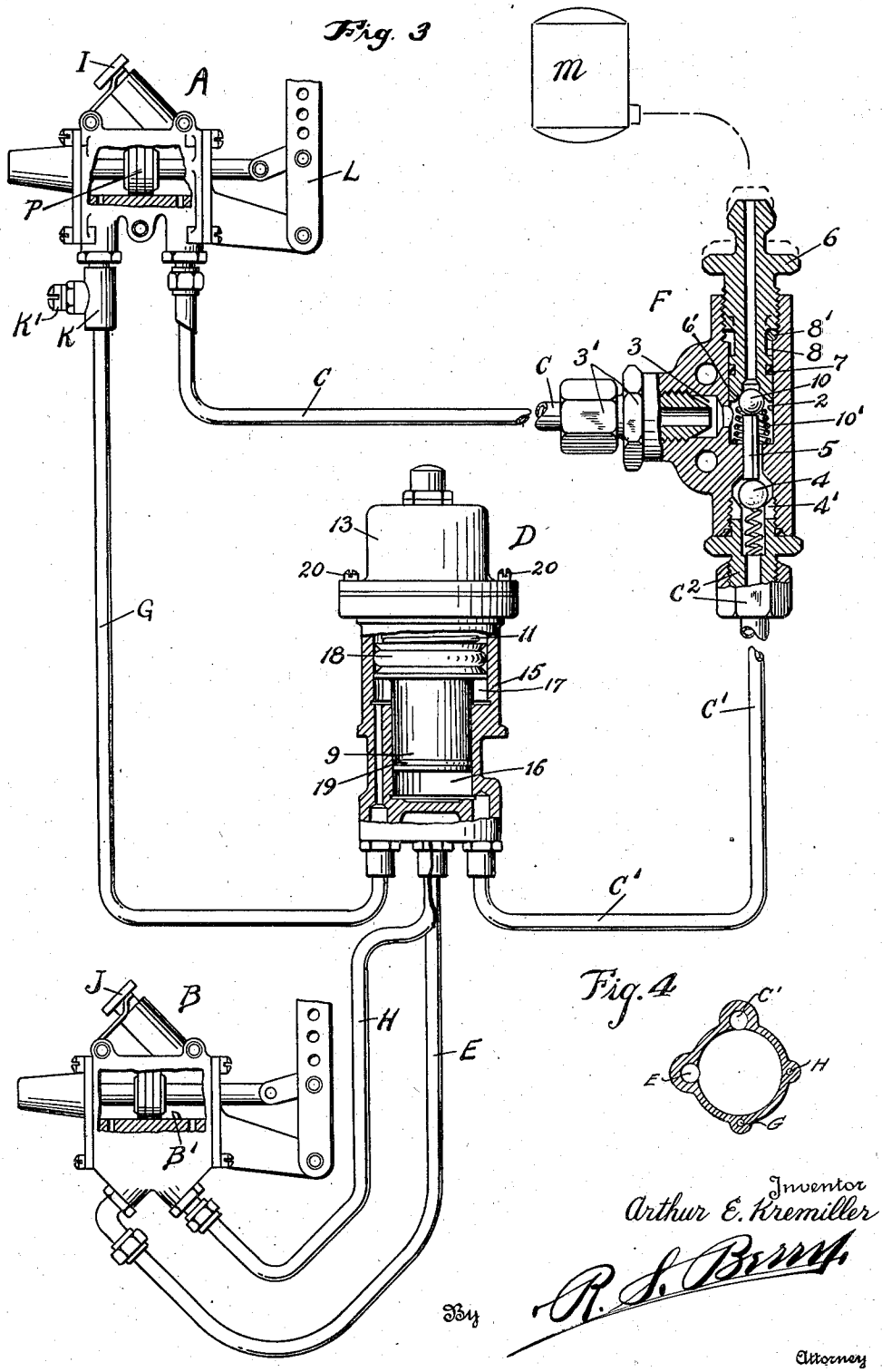


Fig. 4

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PULSATOR SYSTEM

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Application May 25, 1945, Serial No. 595,752

5 Claims. (Cl. 60—54.5)

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This invention relates to closed hydraulic systems in which a master unit is operable to transmit motion or power to a motor unit by means of a hydraulic fluid, and it has among its salient objects:

To provide in such a system means for filling or refilling the system with the hydraulic fluid without the necessity of disconnecting any of the parts or connections thereof;

To provide in such a system means whereby either the master or the motor unit may be utilized as the pump means for filling the system and creating the initial pressure under which the system operates.

To provide in such a system a pressure-equalizing mechanism connected thereinto in such a way as to automatically equalize the pressure of the fluid in the entire system during the filling or refilling process, and which also operates thereafter to compensate for any volumetric changes incident to thermal expansion or contraction of the hydraulic fluid in said system.

In order to fully explain the invention, I have shown it connected into such a closed hydraulic system, which I will now describe:

Fig. 1 is a schematic representation of a closed hydraulic system, with parts in section, embodying my invention, and in which the filling, and the pressure-equalizing mechanisms are shown; the operating parts being shown in the positions occupied during the initial, or in-take stroke of the filling process;

Fig. 2 is a similar view with the parts in the positions occupied on the filling or pressure stroke of said mechanism;

Fig. 3 is a similar view showing the positions of the parts during the pumping or pressure creating action of the filling operation;

Fig. 4 is an enlarged cross sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is an enlarged longitudinal sectional view of a lock valve mechanism, associated with the motor unit, and

Fig. 6 is an enlarged fragmentary sectional view taken on the line 6—6 of Fig. 1.

Referring to Figs. 1, 2 and 3, the closed hydraulic system here represented includes a master unit, designated as a whole A, a slave or motor unit, designated as a whole B, a pressure equalizing unit or mechanism, designated as a whole D, and a filler or supply valve mechanism, designated as a whole F.

One side of the master unit A is shown connected by means of pipes C and C′ through the supply valve mechanism F, and to one side of the

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pressure equalizer D. The other side of said pressure equalizer mechanism is shown connected by means of a pipe G with the other side of said master unit A. Said pressure equalizer mechanism D is also shown connected in series by the pipes E and H to opposite sides of the slave unit B. The master unit A, and also the slave unit B are provided with by-pass valve mechanisms I and J of known type.

The slave unit, however, is provided in its lower part with a hydraulic valve locking means, as shown in enlarged sectional view in Fig. 5, and which is described in detail in a pending application of the present applicant, Serial No. 502,343, now Pat. No. 2,436,009. This hydraulic locking means is interposed between the slave unit B and the pipes E and H connected therewith and controls the flow of fluid to and from the cylinder B′ of said slave unit. This is a pressure operated control and includes a floating piston 45 with a piston valve 46 at one end controlling a port 47 to said cylinder B′, with another piston valve 48 at the other end controlling a port 49, as clearly shown. Fluid entering from pipe connection E between piston 45 and valve 46 moves them apart, thus opening port 47 and allowing fluid to flow up into the cylinder B′. At the same time the pressure on and movement of piston 45 has also moved valve 48 to uncover port 49, thus allowing return of said fluid from the opposite end of cylinder B′. It will be understood, of course, that the by-pass valve J will have been opened during the filling, or refilling operation, and when the air is being forced out of the system through the bleeder fitting K, as before described, and this is being accomplished without disconnecting the system in any of its closed connections.

Referring first to the filler valve mechanism F, I will describe the construction thereof which is clearly shown in Figs. 1, 2 and 3, and comprises a body 1, having a longitudinal bore 2 therethrough, which varies in diameter as shown in said view. An intermediate or connecting bore 3 is also shown, to which the pipe C is connected with the usual coupling parts, designated as a whole 3′. The lower end of said valve body 1 is shown connected with pipe C′, as at C^2, and is provided therein with a spring-closed check valve 4, as shown. Said check valve 4, except when the system is being filled, as seen in Fig. 3, is held off its seat by a pin 5 of triangular form in cross section, mounted for reciprocation in the bore 2.

At its other end, said valve body 1 is provided

with a combination valve and filling connection element 6, in the form of a hollow nipple, threaded into the enlarged end of the bore 2. Below the threaded portion of said nipple, it is provided with a sealing ring 7.

Said nipple is also provided with an annular reduction, forming the neck portion 8, to provide clearance for a through pin 8' which operates to prevent the nipple from being completely withdrawn when it is turned outwardly. When said nipple is screwed down, as shown in Fig. 3, it forces a second valve element 10 downwardly against the triangular pin 5, and against the tension of the spring 10', and opens the valve element 4, whereby inflow from pipe C can pass downwardly around said pin 5, and out through the pipe C' to the pressure equalizer D, as shown. The inner end of the coupling member C^2 is provided with a transverse slot 4' so that when the valve 4 is seated on the end of the coupling member C^2 fluid flow from the pipe C to the pipe C' or vise versa will not be prevented. At the same time, this seating of the valve ball 4 and the engagement therewith of the ball valve 10 and rod 5 will create a firm seating of the ball valve 10 against the member 6 to prevent either the escape of fluid or the intake of air.

When it is desired to fill the system, the screw K' is removed from the bleeder fitting K, in the pipe line G, as shown in Figs. 1 and 2, and the by-pass screw J in the motor unit B is opened to permit flow of fluid from either end of the motor unit cylinder B', whereupon the spring 11, or other pressure, in the pressure equalizer D, will cause its piston 9 to move downwardly and expel the air or fluid contained therein with expulsion of a corresponding amount through said bleeder unit K. This pressure equalizer will be described in detail later.

The nipple 6 at the upper end of the supply valve mechanism F is unscrewed, releasing the ball valves 4 and 10 to operate as check valves and the nipple is then connected with a source of supply of hydraulic fluid, designated in a general way as a tank or reservoir M, connected with the nipple element 6.

Upon moving the operating lever L to the left, as seen in Fig. 1 which moves its piston P, fluid will be drawn from the supply M through the nipple element 6, and the check valve 10, and into the pipe C, as will be clear from the showing. When said operating lever L, and said piston P are moved to the other end of its stroke, as seen in Fig. 2, the fluid will be discharged from said cylinder and pipe C through the filler body 1 and the lower check valve 4, and through pipe C', to one side of the equalizer D and thence through the pipe E to the motor unit B in which it passes through the open by-pass J' to the pipe H to and through the other side of the equalizer D, and thence through pipe G to the opposite side of the master unit A. This constitutes a pumping action, as said operating lever L is operated back and forth for drawing fluid from the source of supply at M into one end of said filler mechanism F, and then forcing it out at the other end thereof, said double check valves 10 and 4 accomplishing this as suction and pressure are alternately applied to said body 1, through the pipe C and its connection with said body 1. This pumping action can be kept up until all the air is forced out of the entire system through the bleeder fitting K in the return pipe G, leading to the master unit A. After this is accomplished the screw K' is replaced in the fitting K, as in

Fig. 3, and the pumping action is continued. As the system is now closed, the effect of pumping additional fluid into the system will be to raise the piston 9 in the pressure equalizer D against the opposition offered by the spring 11, and since the equalizer is connected into the system in series by the pipes C' and E, and H and G, and since the two sides of the equalizer are interconnected through the pipe E and H upon the opening of the by-pass J', fluid will be supplied to both sides thereof. It will be understood that the equalizer here shown is in principle like that disclosed for example in applicant's above mentioned prior application in that a stepped piston and cylinder are provided, the diameters of which are so proportioned that for a given axial movement the same volumetric change is effected in each side of the equalizer. The pressure fluid is thus filled up therein to whatever predetermined height desired, and this can be determined or measured by inserting a measuring rod through the opening 12 in the cap 13 of the pressure equalizer and which is normally closed by a screw plug 14, after which the nipple element 6 and its valve seat 6' of said filler mechanism is screwed down into the body member 1 as far as it will go, and as seen in Fig. 3, wherein the valve 10 is closed against its valve seat 6' in the inner end of said nipple element 6, and the, other valve 4 is held away from its upper seat, and will be seated on the slotted upper end 4' of the coupling element C^2, whereby flow of fluid from pipe C and out through pipe C' to the pressure equalizer is not interfered with, as will be understood from the showing made in Figs. 1, 2 and 3.

I will now describe the pressure equalizer D connected into the system here illustrated for the purpose of equalizing the pressures on both sides of the system and for compensating for volumetric changes by reason of thermal expansion or contraction of the hydraulic fluid filling the system. This mechanism is shown in Figs. 1, 2 and 3 and includes a body 15 having therein two reservoir portions or piston chambers 16 and 17 of different diameters, as shown, with a piston 9 moving therein, and having two different portions adapted to the different parts of said piston chambers, whereby said chambers 16 and 17 are simultaneously, and equally increased and decreased in volume by the movement of said piston 9. Said piston 9 is provided with sealing rings 18 and 19 near its opposite ends. These operate in the two portions of said piston chambers 16 and 17.

A cap 13 is shown secured to the top of said body 15 by means of the screws 20, 20, and within which is a coiled spring 11 operating on the upper end of said piston.

The lower end of said pressure equalizer is provided with four connections as C', E, and H and G, with which the pipes C', E, H and G are connected in series through the two chambers 16 and 17 of said equalizer, as indicated in the sectional view in Fig. 3.

The pumping action incident to filling the system is continued with expulsion of fluid out of the bleeder port in the fitting K until it is certain that all entrapped air has been expelled after which the plug K' is replaced and more fluid pumped into the system against the spring imposed pressure of the equalizer as above explained. After the filling operation has been completed and the inlet closed by screwing down the fitting 6, the pistons of the master and motor

units are moved to the same end of their strokes after which the by-pass J' is closed by the valve J and thereafter the two units will move in synchronism.

Thus it is that there has been provided in a motion transmitting system, means whereby the reciprocations of one of the units (master or motor) may be utilized for introducing fluid into the system and for creating the necessary initial pressure in the system thus eliminating the necessity of providing auxiliary pumping means heretofore required for that function.

I do not limit the invention to the details of construction and arrangement shown and described for illustrative purposes, except as I may be limited by the hereto appended claims.

I claim:

1. In a pulsator system comprising a master unit, a motor unit connected thereto for actuation thereby, and a pressure maintaining and equalizing means connected in series between said units, the combination of valve means interposed between said master unit and said equalizing means comprising a body member having a port connected to said master unit, a second port communicating with said first port and connected to said equalizer, a third port communicating with said first port and adapted to be connected with a source of supply, a spring pressed check valve in said third port arranged to prevent outflow therethrough, a spring pressed check valve in said second port arranged to prevent flow therethrough from said equalizer to said master unit and means associated with said valve body constructed and arranged to unseat said last named check valve.

2. In a pulsator system comprising a master unit, a motor unit connected thereto for actuation thereby, and a pressure maintaining and equalizing means connected in series between said units, the combination of valve means interposed between said master unit and said equalizing means comprising a body member having a port connected to said master unit, a second port communicating with said first port and connected to said equalizer, a third port communicating with said first port and adapted to be connected with a source of supply, a spring pressed check valve in said third port arranged to prevent outflow therethrough, a spring pressed check valve in said second port arranged to prevent flow therethrough from said equalizer to said master unit and adjustable means associated with said check valves, operable in one position of adjustment to release said check valves with resultant conversion of said master unit to a pump means for filling said system and operable in another position of adjustment to disable said check valves with resultant operation of said master unit in its normal function of controlling the movement of said motor unit.

3. In a pulsator system, comprising a master unit including a cylinder, and a double acting piston reciprocable therein, a motor unit comprising a cylinder and a double acting piston reciprocable therein, fluid conduits connecting the ends of the master unit cylinder with the ends of the motor unit cylinder, the combination of valve means interposed in series in one of said fluid lines; said means comprising a valve body having ports connected to the fluid line in which it is positioned and a third port adapted to be connected with a source of fluid supply, check valve means in said valve body for controlling the flow of liquid through one of said first named ports and said third port and adjustable devices associated with said check valve means operable in one position of adjustment to release said check valves with resultant conversion of said master unit to a pump means for filling said system and operable in another position of adjustment to disable said check valves with resultant operation of said master unit in its normal function of controlling the movement of said motor unit.

4. A valve means adapted to be connected in series in one line of a hydraulic system, said means comprising a valve body having a pair of communicating ports adapted to be connected to the adjacent ends of said fluid line and a third port adapted to be connected to a source of fluid supply, a check valve disposed between said pair of ports, a second check valve associated with said third port arranged to permit fluid flow from said source of supply, and devices associated with said check valves operable in one position of adjustment to disable said first named check valve and to lock said second named check valve against its seat and in another position of adjustment to release both of said valves for free operation as check valves.

5. A valve means adapted to be connected in series in one line of a hydraulic system, said means comprising a valve body having a bore extending therethrough, one end of said bore being adapted to be connected to one end of said fluid line, means at the other end of said bore affording connection with a source of fluid supply, a second port in said valve body adapted to be connected to the adjacent end of said fluid line, and communicating with said bore, a valve seat, a spring pressed check valve engageable with said seat and operative when seated to prevent fluid flow from said first named end of said bore to said second port, an abutment in said bore at the side of said check valve opposite said valve seat, a second check valve, a seat for said second check valve associated with the other end of said bore and manually operable means threaded into said body effective in one position of adjustment to position said first named check valve against said abutment and to lock said second named check valve against its seat and effective in another position of adjustment to release said check valves for yielding engagement with said valve seats.

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