Dec. 5, 1950 J. L. RAY 2,532,856

LIQUID FEEDING SYSTEM

Filed July 13, 1946

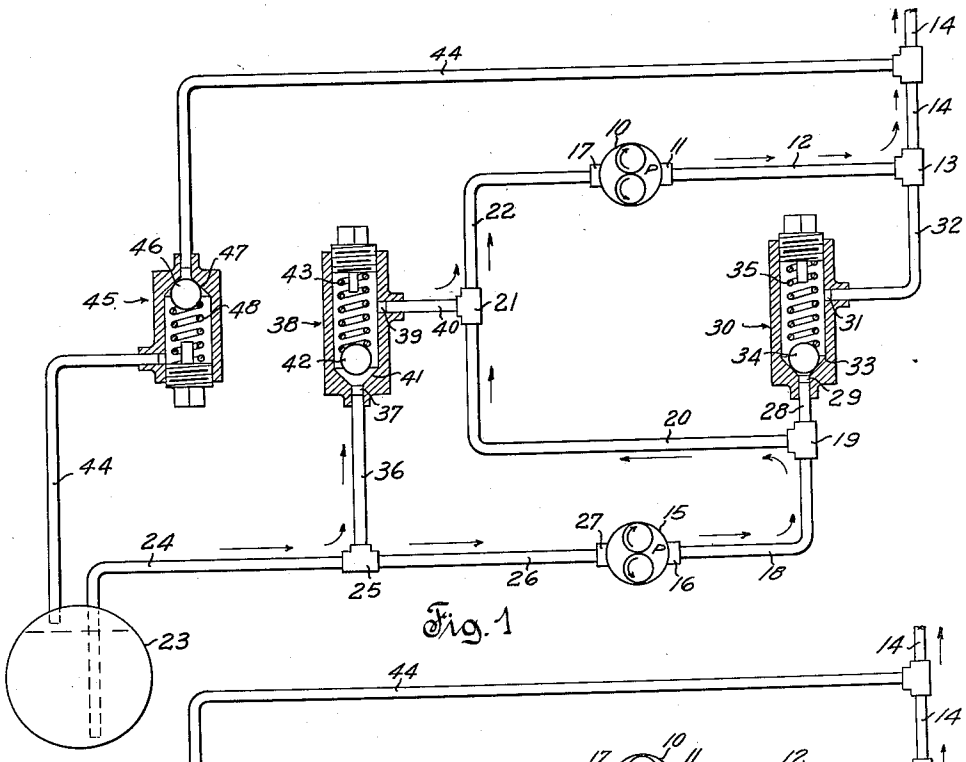


Fig. 1

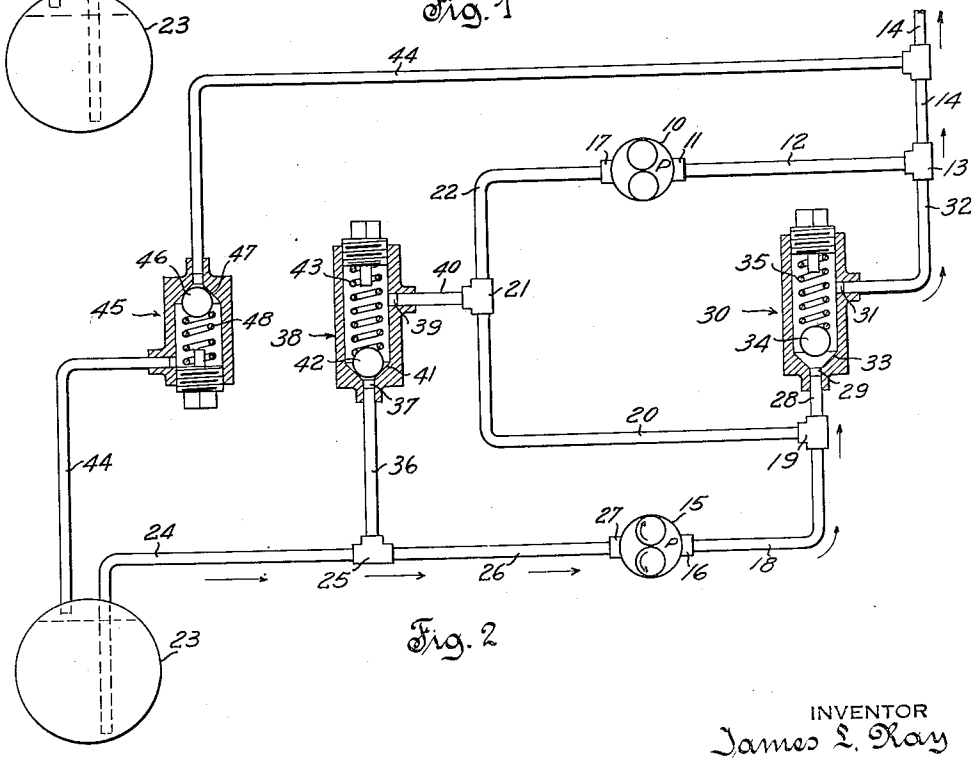


Fig. 2

INVENTOR
James L. Ray
BY
Harold S. Silver
ATTORNEY

Patented Dec. 5, 1950 2,532,856

UNITED STATES PATENT OFFICE

2,532,856

LIQUID FEEDING SYSTEM

James L. Ray, Long Beach, Calif., assignor to Allis-Chalmers Manufacturing Company, Milwaukee, Wis., a corporation of Delaware

Application July 13, 1946, Serial No. 683,356

9 Claims. (Cl. 103—11)

1

This invention relates to liquid feeding systems and the principal object of the invention is the provision of new and improved systems of this type.

Another object of the invention is the provision of a liquid feeding system in which continuity of liquid feed is maintained, and, more particularly, to a system comprising more than one pump means and in which continuity of liquid feed is maintained when one of the pump means fails.

Another object of the invention is the provision of a liquid feeding system in which an auxiliary pump means is caused to take the pumping load in response to failure of the primary pumping means.

Another object of the invention is the provision of a liquid feeding system in which an auxiliary pump means is in motion and in readiness to take over the pumping load but under normal conditions does a negligible amount of work and hence is not subject to the usual wear due to operation, nor subject to breakages of the parts of the pump means or its driving means, or failure of its driving means, and in general not subject to any conditions which are more likely to cause failure of any kind when the pump means is under full load.

Another object of the invention is the attainment of the foregoing objects with maximum simplicity, maximum certainty and a minimum of parts.

Other objects will appear as the description of the invention proceeds.

The novel features of the invention and how the objects are attained will appear from this specification and the accompanying drawing showing one embodiment of the invention and forming a part of this application, and all these novel features are intended to be pointed out in the claims.

In the drawings:

Fig. 1 is a principally diagrammatic view, certain of the parts being in section, of a system embodying the invention, the parts being in the position they assume when the system is in normal operation; and

Fig. 2 is a view similar to Fig. 1 but with the parts in the position they assume when the primary pump means has failed.

Referring first more particularly to Fig. 1, a primary pump means 10 is here shown as having its discharge outlet 11 connected by a conduit 12, through a connection 13, to a discharge conduit 14. The liquid may be fuel and the discharge

2

conduit 14 may lead to any apparatus in which the fuel is burned, but the liquid may be liquid other than fuel and be fed to any apparatus or place where the liquid is utilized or disposed of in any way.

An auxiliary pump means 15 has its discharge outlet 16 connected to the inlet 17 of the primary pump means 10. As here shown this connection comprises a conduit 18 connected, through a connection 19, to a conduit 20 which is in turn connected, through a connection 21, to a conduit 22 connected to the inlet 17 of the primary pump means 10. Liquid may flow from a source of liquid here shown as a tank 23, through a conduit 24, through a connection 25, to a conduit 26 connected to the inlet 27 of the auxiliary pump means 15.

The pump means 10 and 15 are preferably driven from separate shafts, and the primary pump means 10 has a somewhat greater capacity than the auxiliary pump means 15. Preferably the pump means 10 and 15 are of the positive displacement type.

Bypass conduit means is provided around the primary pump means 10, this bypass comprising a conduit 28 connected to the connection 19 at one end and to the inlet 29 of a check valve 30. The outlet 31 of the check valve has connected thereto one end of a conduit 32, the other end of which is connected to the connection 13. The check valve 30 is here shown as comprising a valve seat 33 with which a ball 34 is cooperable. The ball 34 may be biased to the seat 33 by a spring 35. The check valve 30 is constructed and arranged to prevent flow therethrough if the pressure at its outlet 31 is higher than at its inlet 29, and to permit flow therethrough when the pressure at its inlet 29 is greater than at its outlet 31. Any form of check valve for performing these functions is suitable.

Bypass conduit means is also provided around the auxiliary pump means 15, this bypass comprising a conduit 36 connected at one end to the connection 25 and at the other end to the inlet 37 of a check valve 38. The outlet 39 of the check valve 38 has connected thereto an end of a conduit 40, the other end of which is connected to the connection 21. The check valve 38 is here shown as comprising a valve seat 41 with which a ball 42 is cooperable. The ball 42 may be biased to the seat by a spring 43. The check valve 38 is constructed and arranged to prevent flow therethrough if the pressure at its outlet 39 is higher than at its inlet 37 and to permit flow there-

through when the pressure at its inlet 37 is greater than its outlet 39. Any form of check valve for performing these functions is suitable.

If desired, conduit means 44 connected to the discharge conduit at one end and leading to the tank 23 at the other, may be provided, a spring loaded valve 45 being interposed. The valve 45 is here shown as comprising a ball 46 pressed to a seat 47 by a spring 48. The spring 48 may be adjusted so that the ball 46 will not leave the seat 47 unless the pressure in the discharge conduit means 14 rises to a predetermined value in excess of a desired pressure in the conduit means. When the valve 45 opens, excess liquid flows back into the tank 23.

The operation of the system is as follows. Referring first to Fig. 1, in which the arrows indicate the flow of liquid and the direction of flow, and assuming that the primary pump means 10 has the capacity of delivering 100 units of liquid flow to the discharge conduit means 14 at the desired line pressure, and that the auxiliary pump means 15 has the capacity of delivering 90 units of liquid flow, it will be evident that, since the pump means 10 and 15 are connected in series by means of the conduits 18, 20 and 22, the auxiliary pump means 15 will deliver the liquid discharged thereby to the suction or inlet side of the primary pump means 10. The auxiliary pump means 15 draws then 90 units of liquid from the tank 23 through the conduits 24, 26, these 90 units being discharged into the conduit 18, thence into the conduit 20. The primary pump means 10 draws an additional 10 units of liquid from the conduit 24, into the conduit 36, thence through the check valve 38, through the conduit 40 into the conduit 22. The check valve 38 opens by reason of the negative pressure produced by the primary pump means 10 in the conduit 22. Thus there are 100 units of liquid flow in the conduit 22 and these 100 units are delivered to the discharge conduit 14. The check valve 30 is closed by reason of the higher liquid pressure in the conduit 32 than in the conduit 28, and hence flow is prevented in the bypass around the primary pump means 10. It will be evident that under the hereinbefore described conditions, illustrated by Fig. 1, the auxiliary pump means does a negligible amount of work.

Referring now to Fig. 2, this indicates the primary pump means 10 as out of operation, the auxiliary pump means 15 continuing in operation. The liquid flow is then as indicated by the arrows. The auxiliary pump means 15 now draws 90 units of liquid through the conduits 24, 26, discharging it through the conduit 18, through the now open check valve 30, into the conduit 32 and thence into the discharge conduit 14 at full line pressure. The check valve 30 opens and the check valve 38 closes because the primary pump means 10 is producing no difference in pressure as between the conduits 12, 22. The check valve 30 freely opens due to the pressure produced by the auxiliary pump means 15, and of course the check valve 38 prevents any flow from the auxiliary pump means 15 to the conduit 36.

The assumption that the ratio of capacities of the larger pump means to the smaller pump means is as one hundred to ninety was made merely for convenience in describing the operation, it being understood that this ratio may be made any other suitable value, either small or larger.

From the foregoing it will be apparent to those skilled in the art that the illustrated embodiment of the invention provides a new and improved liquid feeding system and accordingly accomplishes the objects of the invention. On the other hand, it will also be obvious to those skilled in the art that the illustrated embodiment of the invention may be variously changed and modified, or features thereof singly or collectively, embodied in other combinations than those illustrated without departing from the spirit of the invention, or sacrificing all of the advantages thereof, and that, accordingly, the disclosed embodiment is illustrative only, and the invention is not limited thereto.

It is claimed and desired to secure by Letters Patent:

1. A liquid feeding system, comprising: discharge conduit means; at least two pump means; conduit means for connecting said pump means in series to feed liquid to said discharge conduit means; bypass conduit means around a first of said pump means; check valve means, interposed in said bypass conduit means, so constructed and arranged that it prevents flow therethrough from the discharge side of said first pump means and permits flow in the opposite direction; second bypass conduit means around the second of said pump means; and check valve means, interposed in said second bypass conduit means, so constructed and arranged that it permits flow therethrough to the inlet side of said first pump means and prevents flow in the opposite direction.

2. A liquid feeding system, comprising: discharge conduit means; at least two pump means of different capacities for feeding liquid to said discharge conduit means; means for so connecting said pump means that when both of said pump means are in operation a negligible part of the work in feeding liquid to said discharge conduit means is done by one of said pump means; and means so constructed and arranged that upon failure of the other of said pump means all of the work done in feeding liquid to said discharge means is done by said one of said pump means.

3. A liquid feeding system, comprising: discharge conduit means; at least two pump means, one of said pump means being of smaller capacity than the other; means for so connecting said pump means that when both said pump means are in operation a negligible part of the work in feeding liquid to said discharge conduit means is done by said pump means of smaller capacity; and means so constructed and arranged that upon failure of the larger of said pump means all of the work done in feeding liquid to said discharge conduit means is done by said pump means of smaller capacity.

4. A liquid feeding system, comprising: discharge conduit means; at least two pump means; conduit means for connecting said pump means in series to feed liquid to said discharge conduit means, a first of said pump means being of larger capacity than the second of said pump means, said second pump means being connected to discharge to the inlet of said first pump means; and means so constructed and arranged that upon failure of said first pump means said second pump means is connected to discharge directly to said discharge conduit means.

5. A liquid feeding system, comprising: discharge conduit means; at least two pump means; conduit means for connecting said pump means in series to feed liquid to said discharge conduit means, a first of said pump means being of larger capacity than the second of said pump means, said second pump means being connected to dis-

charge to the inlet of said first pump means; bypass conduit means around said first pump means; check valve means, interposed in said bypass conduit means, so constructed and arranged that it prevents flow therethrough from the discharge side of said first pump means and permits flow in the opposite direction; second bypass conduit means around said second pump means; and check valve means, interposed in said second bypass conduit means, so constructed and arranged that it permits flow therethrough to the inlet side of said first pump means and prevents flow in the opposite direction.

6. A liquid feeding system, comprising: discharge conduit means; at least two pump means; conduit means for connecting said pump means in series to feed liquid to said discharge conduit means, a first of said pump means being of larger capacity than the second of said pump means, said second pump means being connected to discharge to the inlet of said first pump means; conduit means for providing a bypass around said first of said pump means; check valve means, interposed in said bypass conduit means, so constructed and arranged that it is normally closed and opens in response to fluid pressure generated by the other of said pump means when said first pump means fails.

7. A liquid feeding system, comprising: discharge conduit means; at least two pump means, one of said pump means being of smaller capacity than the other; means for connecting the pump means of smaller capacity to discharge to the inlet of the pump means of larger capacity so that when both said pump means are in operation a negligible part of the work in feeding liquid to said discharge conduit means is done by said pump means of smaller capacity; and means so constructed and arranged that upon failure of the larger of said pump means all of the work done in feeding liquid to said discharge conduit means is done by said pump means of smaller capacity.

8. A liquid feeding system, comprising: discharge conduit means; at least two pump means of different capacities in series for feeding liquid from a source to said discharge conduit means; means for so connecting said pump means that when both of said pump means are in operation

a minor part of the work in feeding liquid to said discharge conduit means is done by one of said pump means, said connecting means including bypass conduit means from the source to a point between said pump means, and check valve means biased to closed position, interposed in said bypass conduit means and so constructed and arranged that when both of said pump means are in operation said check valve is open; and means so constructed and arranged that upon failure of the other of said pump means said one of said pump means is connected directly to said discharge conduit means and all of the work done in feeding liquid to said discharge conduit means is done by said one of said pump means.

9. A liquid feeding system, comprising: discharge conduit means; at least two pump means in series for feeding liquid from a source to said discharge conduit means, a first of said pump means being of larger capacity than the second of said pump means, said second pump means being connected to discharge to the inlet of said first pump means; bypass conduit means from the source to a point between said pump means; check valve means biased to closed positioned, interposed in said bypass conduit means and so constructed and arranged that when both of said pump means are in operation said check valve is open; and means so constructed and arranged that upon failure of the larger of said pump means said smaller one of said pump means is connected directly to said discharge conduit means.

JAMES L. RAY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,218,565	Vickers	Oct. 22, 1940
2,366,388	Crosby	Jan. 2, 1945

FOREIGN PATENTS

Number	Country	Date
216,225	Switzerland	1941
703,569	France	1931