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[54] **PUMP ARRANGEMENT FOR CONSUMER APPARATUS**

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[58] **Field of Search** 417/8, 32, 38, 18, 417/430, 7

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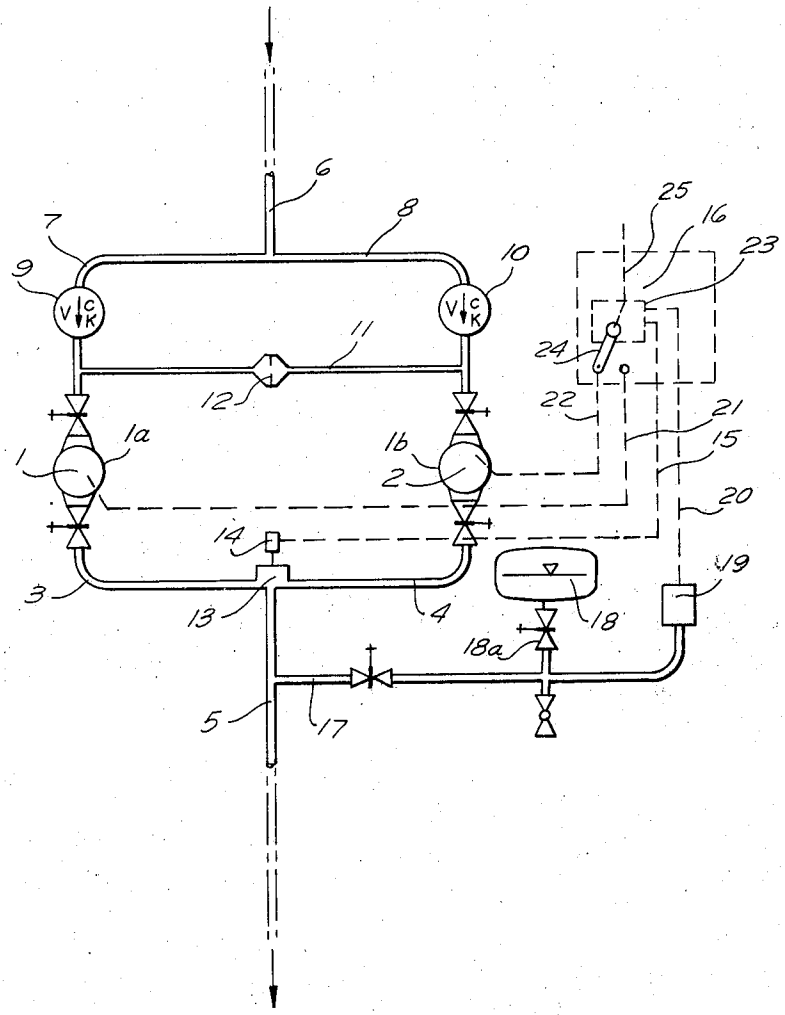
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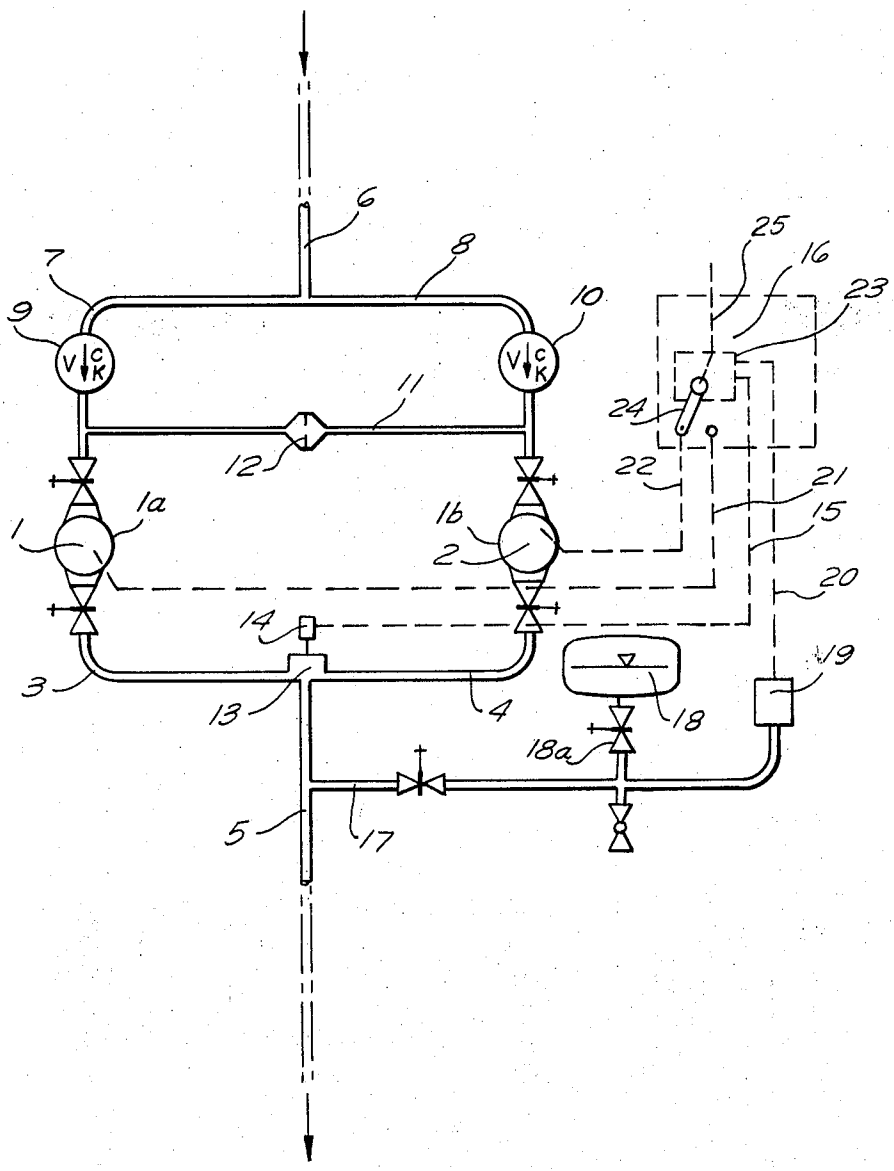
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[57] **ABSTRACT**

When the pressure in a consumer conduit drops, it is increased by one of two alternately operating pumps, whose drive motors are, respectively, actuated by a pressure responsive switch. A throttling conduit connects the suction inlets of the pumps, and both pump outlets are connected with the consumer conduit so that the fluid pumped by the operative pump is circulated through the throttling conduit and the respective other pump so that the operative pump is cooled when no fluid is taken through the consumer conduit. At the same time, the fluid in the other pump is exchanged. When the temperature of the circulated fluid becomes too high, the drive motor of the operative pump is disconnected.

9 Claims, 1 Drawing Figure




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PUMP ARRANGEMENT FOR CONSUMER APPARATUS

BACKGROUND OF THE INVENTION

The present invention relates to a pump arrangement for a consumer apparatus which includes two pumps connected in parallel between a supply conduit and a consumer conduit, and which are alternately operated for increasing the pressure in the consumer conduit when the same drops below a certain minimum pressure.

In accordance with the prior art, when the pressure in the consumer conduit drops due to consumption of fluid by a consumer apparatus, the pumps are started, and after sufficient increase of the pressure, the pumps are disconnected in the arrangements of the prior art. Usually, pressure accumulators are provided which are capable of receiving a predetermined volume of pressure fluid and supply the pressure fluid to the consumer conduit, when required. When water or other fluid is taken whose volume is below the accumulated volume of water in the accumulator, the pump which is at a standstill, is not yet started.

It is the purpose of the pressure fluid accumulator of the prior art to reduce the numer of starts and stops of the pumps, but the pressure accumulator of the prior art only performs its task in the pump arrangement to a degree determined by its volume. It follows that the volume of the pressure fluid accumulator should be as great as possible, which is a disadvantage.

Furthermore, since the possible maximum pressure of the arrangement depends on the pressure of the fluid supplied to the pumps, a reduction of the supply pressure may have the result, that the pressure required for disconnecting the pump, is not obtained. The water remaining in the pumps is now heated by the continuously running pump within a short time to such a high temperature that the consumer conduit receives water which is undesirably hot. This detrimental effect is avoided in apparatus of the prior art in which the disconnection of the operative pump is effected by a flap valve whose position depends on the flow thereto. However, this kind of disconnection of the pump, requires the use of a very large pressure accumulator, if the number of starts and stops of the pumps is reduced to a tolerable frequency.

SUMMARY OF THE INVENTION

It is one object of the invention to overcome the disadvantages of apparatus of the prior art serving the purpose of maintaining the pressure in a consumer conduit automatically constant.

Another object of the invention is to provide a pump arrangement which does not cause an undesirable temperature rise in the consumer conduit, without requiring frequent starting of the pumps.

The object of the invention obtained in a preferred embodiment by two parallel pumps which pump fluid into a common consumer conduit, and whose inlets are connected with each other by a throttling conduit and by check valves with the supply conduit. Where the two outlet conduits of the pumps are connected with the consumer conduit, a temperature depending switch is provided which, when a predetermined maximum temperature of the fluid in the outlet conduits is exceeded, effects the disconnection of the respective drive motor of the operative pump. A pump is again started when

pressure responsive means respond to a reduced pressure in the consumer conduit. During the operation of a pump, a small amount of fluid, such as water, is circulated through the non-operative pump, through the throttling conduit, and through portions of the inlet and outlet conduits. When water is consumed and flows out of the consumer conduit so that one of the pumps is started to supply pressure fluid to the consumer conduit, the circulation maintained through the respective non-operative other pump has a cooling effect on the operative pump while no fluid is taken through the consumer conduit and prevents the stagnation of water in the non-operative pump and in the conduits thereof.

In accordance with the invention, the same circulation is maintained even after the consumption of fluid has ended and the pressure in the consumer conduit has dropped. A heating of the operative pump and of the water in the respective operative pump is avoided in this manner. Due to the heat exchange taking place within the pumps and conduits, and also by radiation to the outside, it becomes possible to run the operative pump for a long period of time, and only after substantial delay, a temperature increase exceeding a predetermined maximum temperature, causes an operation by a temperature responsive switch which stops the respective operative pump. The duration of the period during which the pump operates after the consumer consumption has been terminated, it is in any case sufficient to bridge short intervals between separate consumption, without requiring a stopping of the pump due to the temperature increase. The frequency of starting and stopping operation of the pumps, is substantially reduced in this manner.

Due to the above-explained operation of the apparatus of the invention, it is not necessary to provide a large volume pressure fluid accumulator, only a small pressure accumulator is advantageously used for compensating leakage losses which may occur in the supply conduit which supplies the water to the pumps.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The single FIGURE of the drawing is a schematic and diagramatic view, illustrating a pump arrangement according to an embodiment of the invention in which two pumps alternately increase the reduced pressure in a consumer conduit to a desired pressure.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Two pumps **1** and **2**, driven by electric motors **1***a*, **2***a*, respectively, have two outlet conduits **3** and **4** whose ends are connected at **13** with one end of a consumer conduit **5** which discharges in the direction of the arrow and has a branch conduit **17** downstream of the region **13**, and connected at its end with a pressure responsive switch **19** which is electrically connected with an electric control means **16**. A pressure fluid accumulator **18** is connected by a valve **18***a* with a portion of branch conduit **17** located between the consumer con-

duit 5 and the pressure responsive switch 19. Pumps 1 and 2 have inlet conduits 7 and 8 in which check valves 9 and 10 are provided. The ends of the inlet conduit 7 are connected to the end of a supply conduit 6 through which fluid, such as water, is supplied to pumps 1 and 2 through check valves 9 and 10.

The throttling conduit 11 connects the inlets of pumps 1 and 2 downstream of check valves 9 and 10, and has a throttle 12 which permits only a small amount of fluid to flow through throttling conduit 11.

In the region 13 where the outlet conduits 3, 4 are connected with the consumer conduit 5, a temperature depending switch 14 is provided which, when predetermined maximum temperature is esceeded, transmits a pulse through the electric conductor 15 to the electric means 16, and more particularly to an electromagnetic means 23 by which the shiftable switch 24 is alternately shifted between two positions to alternately connect the drive motors 1*a* and 2*a* of pumps 1 and 2 through conductors 21, 22 with a source of voltage 25. The stop signal transmitted from the pressure responsive switch 19 through conductor 20 to the electric control means 16, has the effect of disconnecting the respective operative drive motor 1*a* or 2*a* from the voltage source 25.

OPERATION

When pumps 1 and 2 are at a standstill, and the respective electric motors 1*a* and 2*a* are not energized, water is taken, if required by the consumer apparatus, from pressure fluid accumulator 18, through a portion of branch conduit 17, and through consumer conduit 5. If the amount of water discharged in this condition exceeds the capacity of the pressure fluid accumulator 18, the pressure responsive switch 19 responds to the reduced pressure in the consumer conduit 5, and transmits an electric signal through conductor 20 to the electric control means 16, so that, depending on the position of switch 24, either electric drive motor 1a or electric drive motor 2*a* is energized and drives the respective pump 1 or 2. The arrangement is such that always the pump 1 or 2 is actuated which was at a standstill during the preceding operation during which switch 24 was in its other position.

Assuming that drive motor 1a of pump 1 is started when the pressure responsive means 19 senses the reduced pressure in consumer conduit 5, water is pumped through supply conduit 6, suction conduit 7, check valve 9, pump 1, outlet conduit 3, and into the consumer conduit 5 so that the pressure increases in the consumer conduit 5, while water is also pumped through branch conduit 17 into the pressure fluid accumulator 18 so that the same is filled to maximum capacity. When the pressure rises in consumer conduit 5 and branch conduit 17, pressure responsive switch means 19 returns to its initial position.

While pump 1 is driven and discharges into the consumer conduit 5, fluid is also pumped from outlet conduit 3 into outlet conduit 4, through the non-operative pump 2, and through the throttling conduit 11, 12 back to the suction inlet conduit 7 of pump 1, downstream of check valve 9. Only a comparatively small amount of fluid is circulated in this manner through the non-operative pump 2 due to the provision of the throttling conduit 11, 12.

The small amount of circulated fluid prevents a stagnating of the water filling the non-operative pump 2 and the conduits connected therewith, so that the water in pump 2 remains fresh.

When consumption by the consumer apparatus, not shown, out of consumer conduit 5 ends, the circulation through pump 2 is at first maintained, and a rapid heating of the water in pump 1 is prevented by the continuous heat exchange with pump 2 and the respective conduits. Furthermore, the pumps and conduits dissipate heat by radiation into the surrounding air. Only after pump 1 has run for a substantial length of time, during which no consumption is started through consumer conduit 5, the gradually rising temperature of the circulated fluid reaches a maximum temperature to which the temperature responsive switch 14 is set to respond so that a stop signal flows through conductor 15 to the electric control means 16 which effect through conductor 21, the disconnection of the respective electric motor 1a from the voltage source 22.

If leakage losses occur in the consumer conduits while the pumps are at a standstill, the leakage losses are compensated by water taken from the small pressure fluid accumulator 18.

During the next rise of consumption of water, the pressure in the consumer conduit 5 and branch conduit 17 is reduced so that the pressure responsive means 19 responds and causes starting of the drive motor 2a of the respective other pump 2, while pump 1 remains at a standstill. However, pump 2 circulates water through outlet conduit 4, outlet conduit 3, pump 1, and throttling conduit 11, 12 so that the water circulating through the non-operative pump 1 cools pump 2, and also maintains fresh water in the non-operative pump 1 until the temperature rises in the outlet conduits 3, 4 in the region 13 to such a degree that temperature responsive means 14 responds, and transmits a stop signal through conductor 15 to the electric control means 16 which cause stopping of drive motor 2*a* of pump 2.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of pump arrangements for consumer apparatus differing from the types described above.

While the invention has been illustrated and described as embodied in two alternately operating pumps connected by a throttle conduit so that water is circulated through the respective non-operative pump for cooling the operative pump, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt if for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

I claim:

1. Pump arrangement for consumer apparatus, comprising supply conduit means; consumer conduit means; first and second pumps having first and second inlet conduits connected with said supply conduit

means, and first and second outlet conduits connected with said consumer conduit means; first and second motors for respectively driving said first and second pumps;

first and second check valves in said first and second inlet conduits;

a throttling conduit connecting said first and second inlet conduits downstream of said first and second check valves, respectively;

control means for starting and stopping said first and second motors;

pressure responsive means connected with said consumer conduit means, and transmitting a start signal to said control means for starting one of said first and second motors when the pressure in said consumer conduit is less than a predetermined minimum pressure so that said one pump discharges into said consumer conduit means while circulating fluid through the other pump and said throttling conduit; and

temperature responsive means connected with said consumer conduit means and said outlet conduits, and transmitting at a predetermined maximum temperature a stop signal to control means for stopping the motor of said one pump.

2. Pump arrangement as claimed in claim **1,** wherein said control means include means responsive to alternate start signals to alternately start said first and second motors, and responsive to alternate stop signals to alternately stop said first and second motors so that said first and second pumps alternately discharge into said consumer conduit means, while the other pump has fluid circulated therethrough via its respective outlet conduit and the throttling conduit.

3. Pump arrangement as claimed in claim **1,** further comprising a pressure fluid accumulator connected with said consumer conduit means.

4. Pump arrangement as claimed in claim **1,** wherein said throttling conduit includes a conduit and a throttle in said conduit.

5. Pump arrangement as claimed in claim **1,** wherein said first and second outlet conduits have ends connected with the end of said consumer conduit means; and wherein said temperature responsive means are located in the region of said connected ends.

6. Pump arrangement as claimed in claim **1,** wherein said control means is an electric control means; wherein said pressure responsive control means includes a pressure responsive start switch connected with said electric control means; wherein said temperature responsive means includes a stop switch connected with said electric control means, and wherein said first and second motors include first and second electric motors connected with said electric control means.

7. Pump arrangement as claimed in claim **6,** wherein said electric control means includes means responsive to alternate start signals of said start switch to alternately start said first and second electric motors, and means responsive to alternate stop signals of said stop switch to alternately stop said first and second electric motors so that fluid is circulated through said throttling conduit and alternately through said first and second pumps.

8. Pump arrangement as claimed in claim **7,** wherein said consumer conduit means has a branch conduit; wherein said pressure responsive means is located at the end of said branch conduit; and wherein said pressure fluid accumulator is connected with said branch conduit upstream of said pressure responsive means.

9. Pump arrangement as claimed in claim **1,** wherein said first and second outlet conduits have ends connected with the end of said consumer conduit means; wherein said temperature responsive means are located in the region of said connected ends; wherein said consumer conduit means has a branch conduit downstream of said temperature responsive means; wherein said pressure responsive means is located at the end of said branch conduit; and wherein said pressure fluid accumulator is connected with said branch conduit upstream of said pressure responsive means.

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