US000001810H

United States Statutory Invention Registration [19]

[11] Reg. Number: H1,810

[45] Published: Nov. 2, 1999

Van De Velde

[54] **VALVE ASSEMBLY**

[76] Inventor: **Paul J. Van De Velde**, Bellingham, Wash.

[21] Appl. No.: **08/967,063**

[22] Filed: **Nov. 10, 1997**

[51] **Int. Cl.**[6] **F17D 00/00**

[52] **U.S. Cl.** **137/599**

[58] **Field of Search** 137/599.1, 595, 137/607, 599; 251/250.5

[56] **References Cited**

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Primary Examiner—Charles T. Jordan
Assistant Examiner—Meena Chelliah

[57] **ABSTRACT**

A valve assembly includes a first valve having a first valve stem configured for controlling operation of the first valve, and a second valve having a second valve stem configured for controlling operation of the second valve. A linkage is provided for interconnecting the first and second valve stems so that rotation of the first valve stem rotates the second valve stem, and thereby operates the first and second valves.

3 Claims, 2 Drawing Sheets

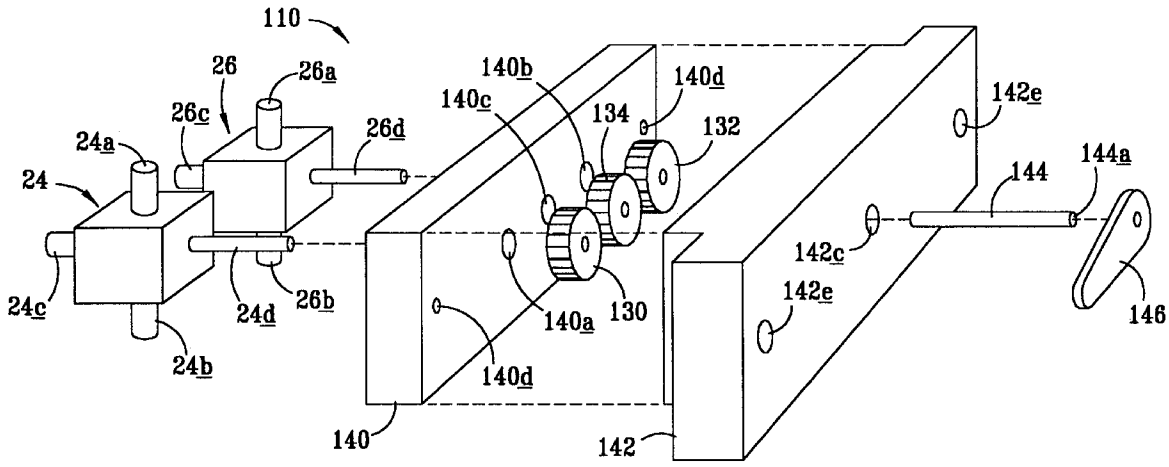


FIG. 1
(PRIOR ART)

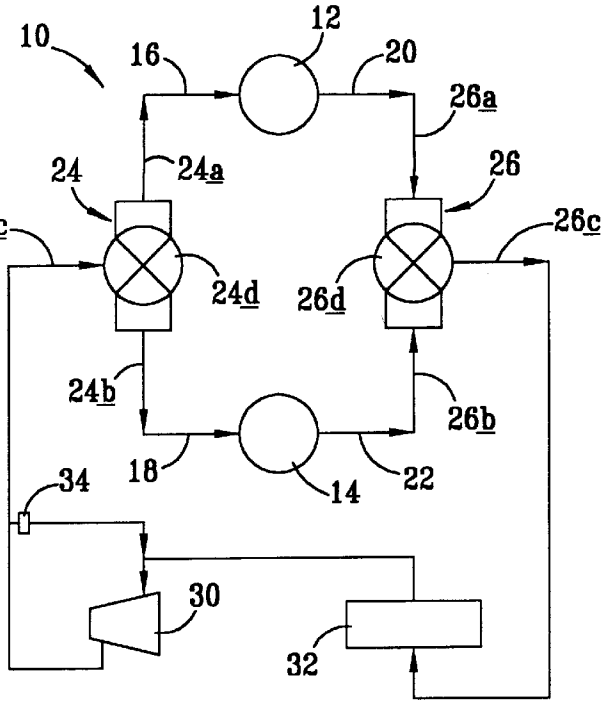


FIG. 2

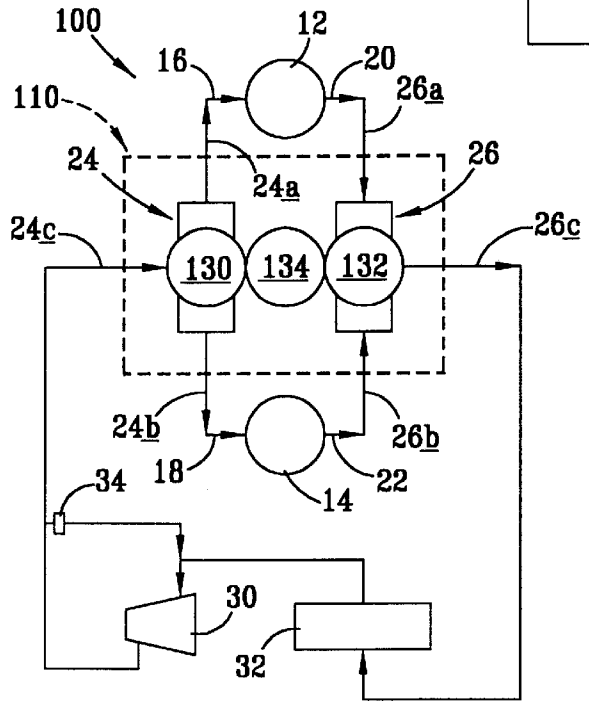
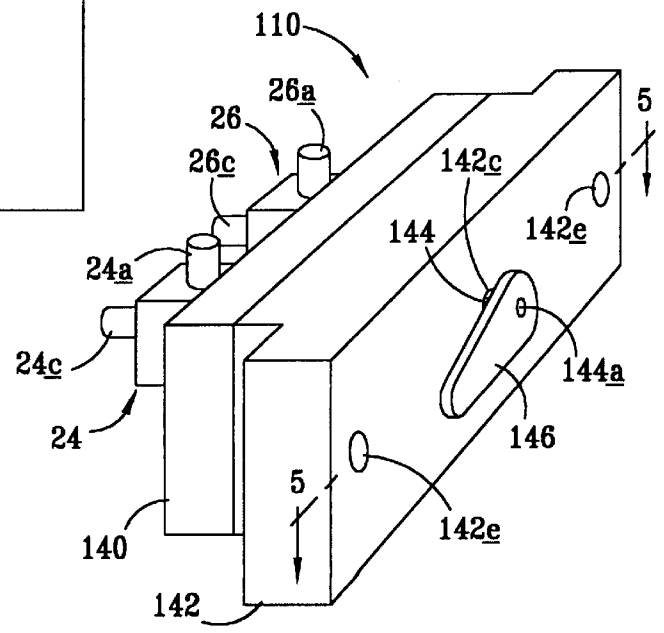


FIG. 3



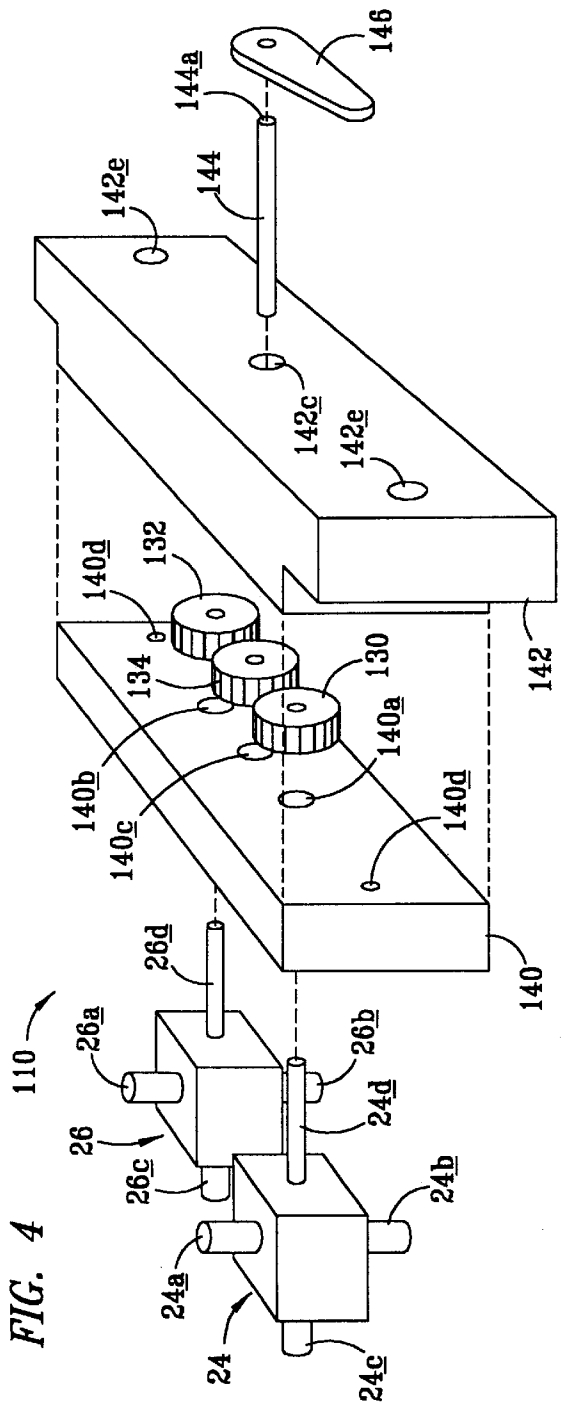

110
26
26a
26b
26c
26d
24
24a
24b
24c
24d
140
140a
140b
140c
140d
142
142c
142e
144
144a
146
130
132
134

FIG. 4

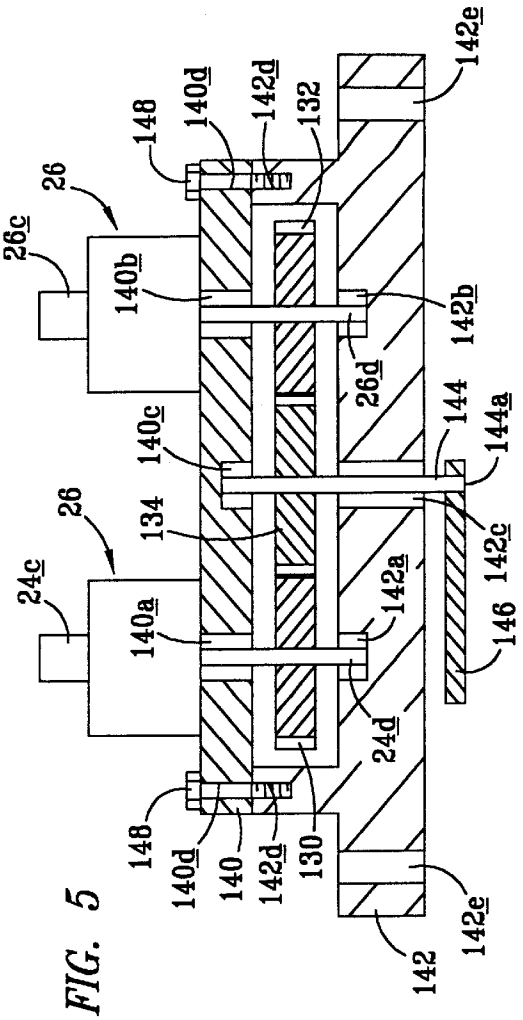

26
26c
24c
140
140a
140b
140c
140d
142
142a
142b
142c
142d
142e
144
144a
146
148
130
132
134
24d
26d

FIG. 5

VALVE ASSEMBLY

FIELD OF THE INVENTION

The invention relates generally to valves and, more particularly, to a plurality of valves assembled together for synchronized operation.

BACKGROUND OF THE INVENTION

Equipment with moving parts, such as rotating or reciprocating compressors, are generally provided with lubrication systems. Such lubrication systems typically comprise a pump that circulates lubricant through the equipment, and a filter that removes impurities that accumulate in the lubricant. When such equipment is to be continuously operated, the lubrication system must be particularly reliable and, to that end, often includes dual filters. When dual filters are used, one is typically on-line while the other is off-line. The on-line filter provides service to the equipment by filtering lubricant for the equipment, while the off-line filter is available for service if needed, or may be cleaned or replaced as necessary.

Dual filters are typically interconnected between the equipment and the pump through a network of lines and valves which control which filter is on-line and which filter is off-line. As shown in FIG. **1**, depicting the prior art, this may be achieved by a system **10** comprising conventional dual filters **12** and **14** interconnected via lines **16** and **18** to output ports **24***a* and **24***b* of a first three-way valve **24**, and via lines **20** and **22** to input ports **26***a* and **26***b* of a second three-way valve **26**. The valves **24** and **26** include input and output ports **24***c* and **26***c*, respectively, and valve stems **24***d* and **26***d*, respectively, operable for controlling flow through the respective output and input ports of the valves. A pump **30** and reciprocating compressor **32** are serially connected between the input port **24***c* and the output port **26***c*, and a rupture disc **34** is connected in parallel across the pump **30**. The pump **30** circulates lubricant through the first valve **24**, one of the filters **12** and **14**, the second valve **26**, and the compressor **32**. In operation, the valves **24** and **26** must both be synchronized for directing fluid, such as a gas, liquid, slurry, or the like, to flow through either filter **12** or filter **14** as the on-line filter. It can be appreciated that when the filters **12** and **14** are switched between being on-line and off-line, the valves **24** and **26** must be turned simultaneously and synchronously or the system will be blocked ("dead-headed"). As a consequence, pressure will build up and pop the rupture disc **34**, causing the system **10** to lose pressure. The compressor **32** would then not receive lubrication until the rupture disc **34** was replaced, thereby necessitating a shut down of the compressor **32** before it overheated and failed, resulting in substantial down-time costs.

Therefore, what is needed is a system and method wherein filters or subsystems thereof may switched between being on-line and off-line without incurring the risk that the system will be blocked and necessitate a shut-down of the system.

SUMMARY OF THE INVENTION

The present invention, accordingly, provides a system and method wherein sub-systems, such as filters, may be switched between being on-line and off-line without incurring the risk that the system will be blocked. Accordingly, the present invention comprises a valve assembly comprising a first valve having a first valve stem configured for controlling operation of the first valve, and a second valve having a second valve stem configured for controlling

operation of the second valve. A linkage is provided for interconnecting the first and second valve stems so that rotation of the first valve stem rotates the second valve stem, and thereby operates the first and second valves.

In further accord with the present invention, a method for synchronously operating a plurality of valves, each of which valves includes a valve stem configured for controlling the operation of a respective valve, comprises the steps of linking the valve stems together so that rotation of one valve stem rotates the other valve stems, and rotating one of the valve stems, thereby synchronously rotating all of the valve stems.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic view of a lubricating system of the prior art.

FIG. **2** is a schematic view of a system embodying features of the present invention.

FIG. **3** is a perspective view of a valve assembly employed by the system of FIG. **2**.

FIG. **4** is an exploded view of the valve assembly of FIG. **3**.

FIG. **5** is a cross-sectional view of the valve assembly of FIG. **3** taken along the line **5**—**5** of FIG. **3**.

DETAILED DESCRIPTION

In the discussion of the Figures, the same numbers will be used throughout to refer to the same or similar components. With reference to FIG. **2** of the drawings, the reference numeral **100** generally designates a system having a modified filter transfer valve assembly **110** comprising the first and second three-way valves **24** and **26**, respectively. As described above, the valve **24** includes output ports **24***a* and **24***b* which are connected via the lines **16** and **18** to the filters **12** and **14**, respectively, which filters are connected via the lines **20** and **22** to the input ports **26***a* and **26***b*, respectively, of the valve **26**. The valves **24** and **26** include input and output ports **24***c* and **26***c*, respectively, and valve stems **24***d* and **26***d* (not shown in FIG. **2**), respectively, operable for controlling flow through the respective input and output ports of the valves. The pump **30** and reciprocating compressor **32** are serially connected between the input port **24***c* and the output port **26***c*, and the rupture disc **34** is connected in parallel across the pump **30**. The pump **30** circulates lubricant through the first valve **24**, one of the filters **12** and **14**, the second valve **26**, and the compressor **32**.

In addition to the foregoing, the valves **24** and **26** of the filter transfer valve assembly **110** also include first and second gears **130** and **132**, respectively, -mounted on the valve stems **24***d* and **26***d*, respectively. As described in greater detail below, an intermediate gear **134** is mounted in the valve assembly **110** and meshes with both of the gears **130** and **132**, so that rotation of the intermediate gear **134** also rotates of each of the gears **130** and **132**.

FIGS. **3**, **4**, and **5** illustrate perspective, exploded, and cross-sectional views, respectively, of the filter transfer valve assembly **110**. As shown in FIGS. **3** and **5**, the valves **24** and **26** are mounted on a rear panel **140** of a housing **142**. As more clearly shown in FIGS. **4** and **5**, the rear panel **140** defines first and second bores **140***a* and **140***b*, respectively, and the housing **142** defines corresponding first and second recesses **142***a* and **142***b*, respectively, for rotatably receiving and seating the respective valve stems **24***d* and **26***d*. The first and second gears **130** and **132**, respectively, are mounted on the respective valve stems **24***d* and **26***d* within the interior of

the housing **142**. It is understood that, for the sake of clarity, the size of the bores **140***a* and **140***b* and of the recesses **142***a* and **142***b* with respect to the valve stems **24***d* and **26***d* is not drawn to scale, but is exaggerated, and that, because the internal workings of the valves **24** and **26** are well known, they not shown in the cross-section of FIG. **5**.

The rear panel **140** further defines an intermediate recess **140***c*, and the housing **142** further defines an intermediate bore **142***c*, for rotatably receiving and seating an intermediate shaft **144**. The intermediate gear **134** is mounted on the intermediate shaft **144** within the interior of the housing **142**, such that it meshes with the first and second gears **130** and **132**. The valves **24** and **26** are synchronized through the gears **130**, **132**, and **134** so that the ports **24***a* and **26***a* open and close together and, correspondingly, so that the ports **24***b* and **26***b* close and open together, and so that at all times either ports **24***a* and **26***a* are open or ports **24***b* and **26***b* are open. The intermediate shaft **144** includes an end **144***a* onto which is mounted a control lever **146** accessible to a user for rotating the intermediate shaft **144** and gear **134**, as described below. It is understood that, for the sake of clarity, the size of the bore **142***c* and of the recess **140***c* with respect to the shaft **144** is not drawn to scale, but is exaggerated.

As further shown in FIG. **5**, the rear panel **140** includes two bores **140***d* and the housing **142** includes two corresponding threaded recesses **142***d* for receiving bolts **148** for securing the rear panel to the housing. Additionally, the housing includes bores **142***e* through which bolts (not shown) may be extended for securing the filter transfer valve assembly **110** to a structure (not shown), such as a control panel.

In operation, and with reference to FIG. **2**, the pump **30** circulates lubricant through the valve **24**, one of the filters **12** or **14**, the valve **26**, and the reciprocating compressor **32**. Whether lubricant is circulated through the filter **12** or the filter **14**, ie., whether the filter **12** or the filter **14** is on-line, is determined by the filter transfer valve assembly **110** and, more specifically, by the position of the control lever **146**, and the synchronization of the valves with respect to the position of the control lever. When the control lever **146** is positioned as shown in FIG. **3**, the ports **24***a* and **26***a* are open, the ports **24***b* and **26***b* are closed, the first filter **12** is on-line, and the second filter **14** is off-line. To place the second filter **14** on-line, the control lever **146** is rotated approximately 180° to cause the gear **134** to rotate the gears **130** and **132** and the respective valve stems **24***d* and **26***d* so that, synchronously and simultaneously, the ports **24***a* and **26***a* are closed, and the ports **24***b* and **26***b* are opened, with the result that the first filter **12** is placed off-line and the second filter **14** is placed on-line. The first filter **12** may be placed back on-line, and the second filter **14** placed back off-line, by again rotating the control lever **146** approximately 180°. While the filter **12** or the filter **14** is off-line, it is available for service if needed, or may be cleaned or replaced as necessary.

The present invention has several advantages. For example, the filter transfer valve assembly **110** ensures that operation of the valves **24** and **26** is synchronized so that corresponding ports may be simultaneously opened and closed together, thereby preventing the potential for the system **100** to be "dead headed" (i.e., blocked), necessitating a shut-down of the system and costly downtime.

It is understood that the present invention can take many forms and embodiments. The embodiments described herein are intended to illustrate rather than to limit the invention. Accordingly, several variations may be made in the foregoing without departing from the spirit or the scope of the invention. For example, the valve assembly **110** may be used for controlling fluid flow through any of a number of different sub-systems other than the filters **12** and **14**, such as an arrangement of dual pumps or compressors. The valves **24** and **26** may comprise valves other than three-way valves, such as ball valves, plug valves, and gate valves. If two-way valves are used, and they open and close at different rates, the gears **130**, **132**, and **134** may be configured as non-circular or elliptical to account for the different rates. The intermediate gear **134** may be omitted from the invention and the first and second gears **130** and **132** be directly enmeshed, wherein the control lever **146** would be directly attached to the valve stem of one of the valves for controlling the operation of both valves. More than two valves may be interconnected using gears in the manner described herein. The valves may also be interconnected using mechanisms other than gears, such as mechanical or hydraulic linkages, chains, or belts.

Although illustrative embodiments of the invention have been shown and described, a wide range of modification, change, and substitution is contemplated in the foregoing disclosure and in some instances, some features of the present invention may be employed without a corresponding use of the other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the scope of the invention.

What is claimed is:

1. A method for providing a continuous supply of filtered lubricant to equipment, the method consisting essentially of:

(a) recovering used lubricant from the equipment;

(b) pumping the used lubricant through a first filter in fluid communication with a pump and with the equipment;

(c) passing the filtered lubricant to the equipment;

(d) redirecting the used lubricant through a second filter in fluid communication with the pump and the equipment when the first filter is removed from service;

(e) alternating the flow of used lubricant through the first filter or the second filter with a valve assembly comprising a first three-way valve upstream from the first filter and the second filter and having a first valve stem and a first gear mounted on the first valve stem, a second three-way valve downstream from the first filter and the second filter and having a second valve stem and a second gear mounted on the second valve stem, and an intermediate gear enmeshed with the first gear and the second gear and configured and positioned to simultaneously operate both the first valve and the second valve when the intermediate gear is rotated to direct the flow of lubricant through one of the first filter and the second filter.

2. A system for providing a continuous supply of filtered oil to equipment, the system comprising:

(a) a pump in fluid communication with a used lubricant outlet from the equipment;

(b) a first filter in fluid communication with a pump outlet and a lubricant inlet to the equipment;

(c) a second filter positioned in the system and adapted for fluid communication with the pump outlet and the lubricant inlet when the first filter is not in service; and

(d) a filter switching assembly comprising a first three-way valve in fluid communication with the pump and a lubricant inlet to the first filter and having a first valve stem and a first gear mounted on the first valve stem; a second three-way valve in fluid communication with a

lubricant outlet from the first filter and the lubricant inlet to the equipment and having a second valve stem and a second gear mounted on the first valve stem and an intermediate gear engaging the first gear and the second gear and operative to alternatively simultaneously move the first three-way valve into fluid communication with the pump and a lubricant inlet into the second filter and the second three-way valve into fluid communication with a lubricant outlet from the second filter and the lubricant inlet to the equipment or simultaneously move the first three-way valve into fluid communication with the pump and the lubricant inlet into the first filter and the second three-way valve into fluid communication with the lubricant outlet from the first filter and the lubricant inlet into the equipment upon rotation of the intermediate gear.

3. The system of claim **2** wherein the filter switching assembly is enclosed in a housing.

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