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Awad

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(54) **AUTOMOTIVE RADIATOR FLUSH SYSTEM AND METHODS OF USE**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 10/006,345, filed on Dec. 3, 2001, now Pat. No. 6,523,580.

(51) **Int. Cl.**[7] **B65B 1/04**
(52) **U.S. Cl.** **141/65**; 141/59; 184/1.5
(58) **Field of Search** 141/65, 67, 59, 141/301, 302, 98, 94, 95, 192, 198; 184/1.5

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,103,878 A 4/1992 Cassia
5,615,716 A 4/1997 Akazawa
5,649,574 A 7/1997 Turcotte et al.
5,845,684 A 12/1998 Fletcher, Jr. et al.
6,234,215 B1 5/2001 Klamm

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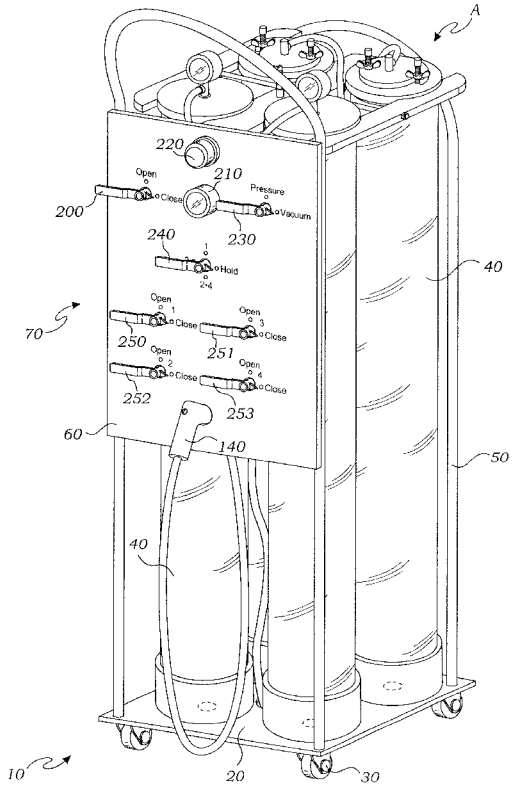
(57) **ABSTRACT**

A method of replacing radiator fluid in an automotive radiator includes providing two gas tight containers, a fluid conducting hose with a gas tight nozzle fitted into a radiator fill pipe nipple. The method further includes the steps of filling one of the containers with a fresh radiator fluid, drawing a high vacuum on a second one of the containers, drawing spent radiator fluid into the second one of the containers using only suction from the container, thereby leaving the automotive radiator under a partial vacuum and then drawing the fresh radiator fluid, from the first one of the containers, into the radiator using only suction from the partial vacuum in the radiator. A radiator flush step may also be applied following the same method, using two additional containers, one with initial high vacuum and the other containing flush fluid.

6 Claims, 11 Drawing Sheets



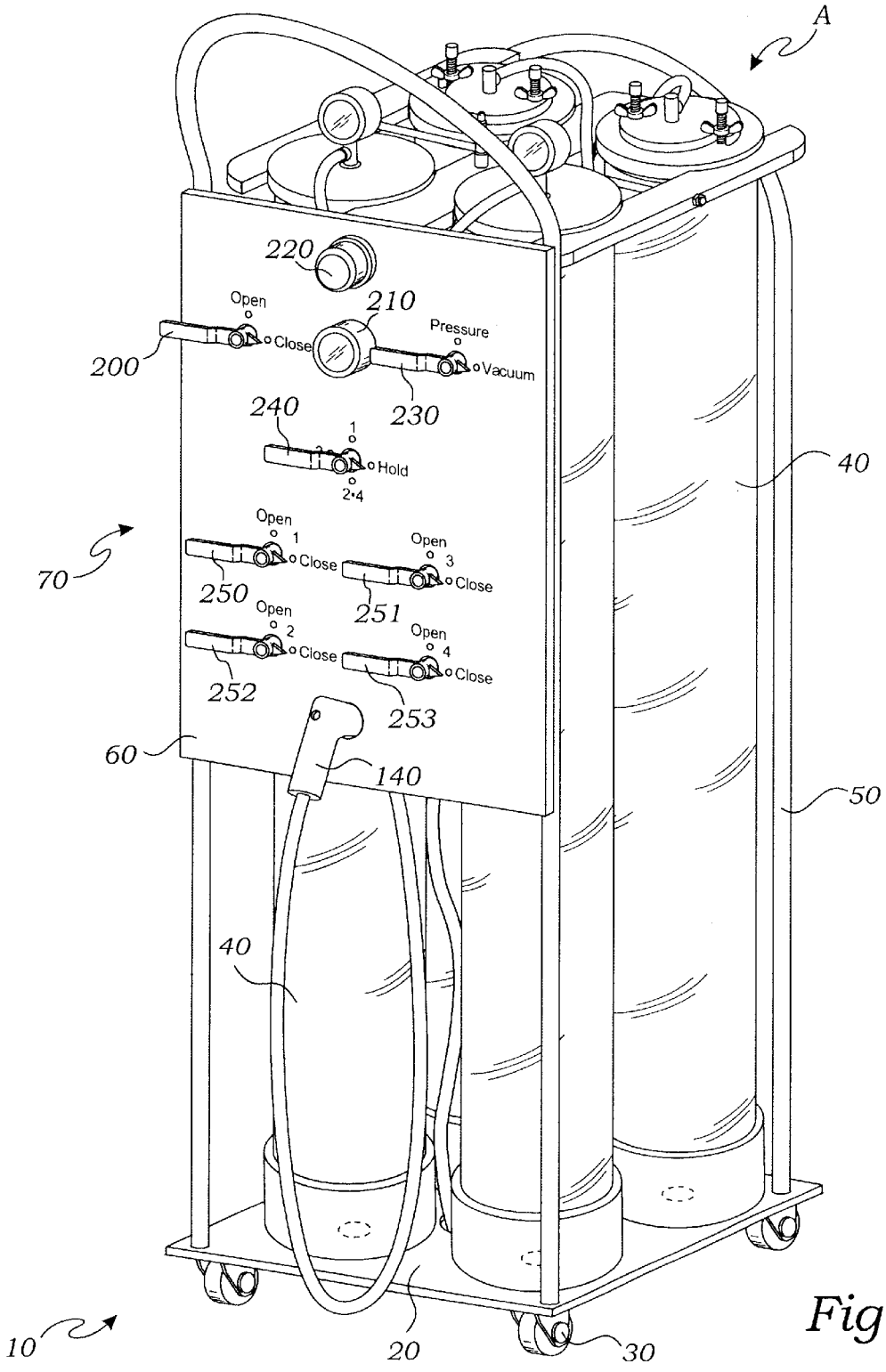

A
220
210
Open
Close
Pressure
Vacuum
200
230
240
1
Hold
2·4
40
70
Open 1
Close
Open 3
Close
250
251
Open 2
Close
Open 4
Close
252
253
60
140
50
40
10
20
30

Fig. 1

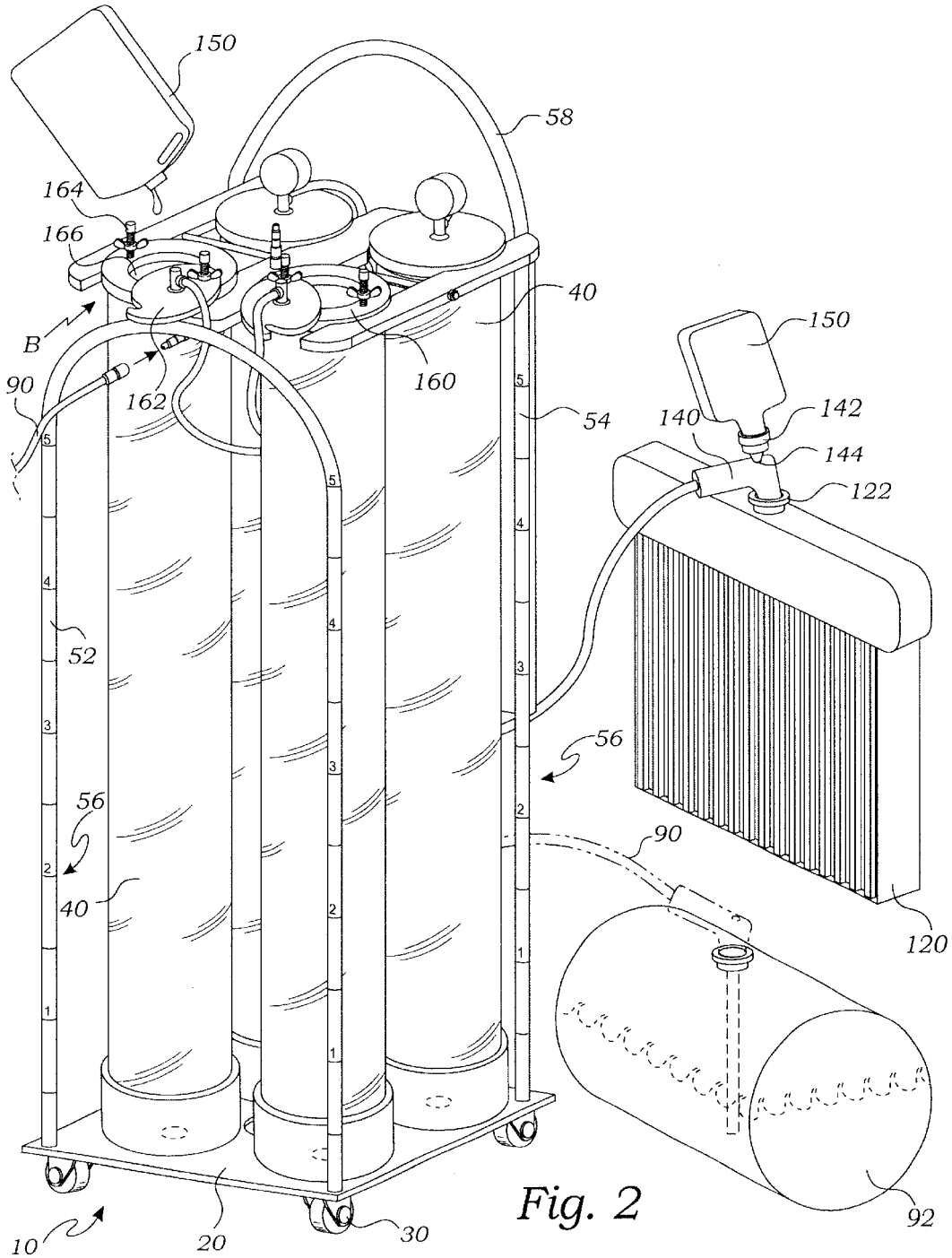

150
58
164
166
40
B
150
90
162
160
140
142
54
144
122
52
56
56
90
40
120
92
10
20
30

Fig. 2

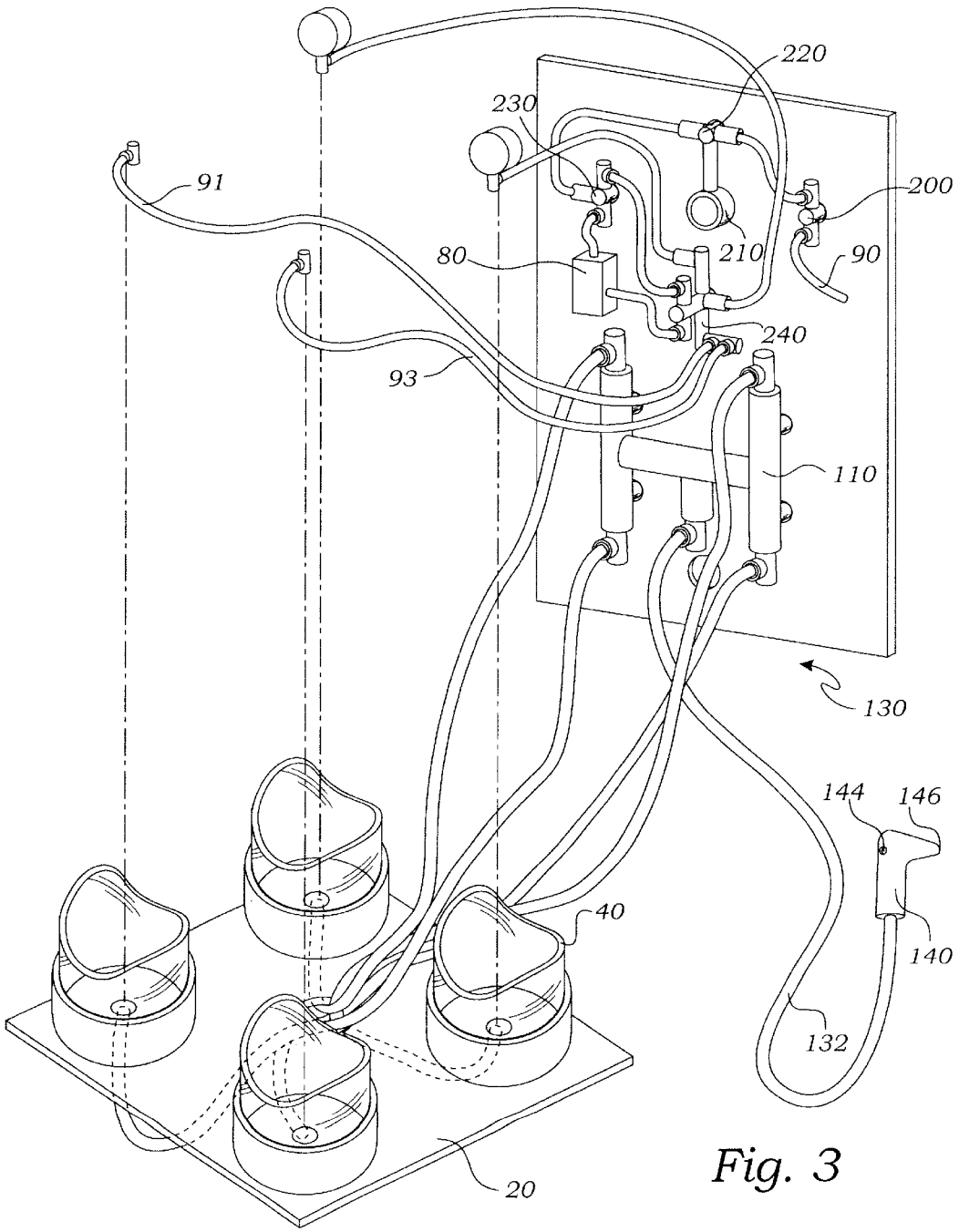


Fig. 3

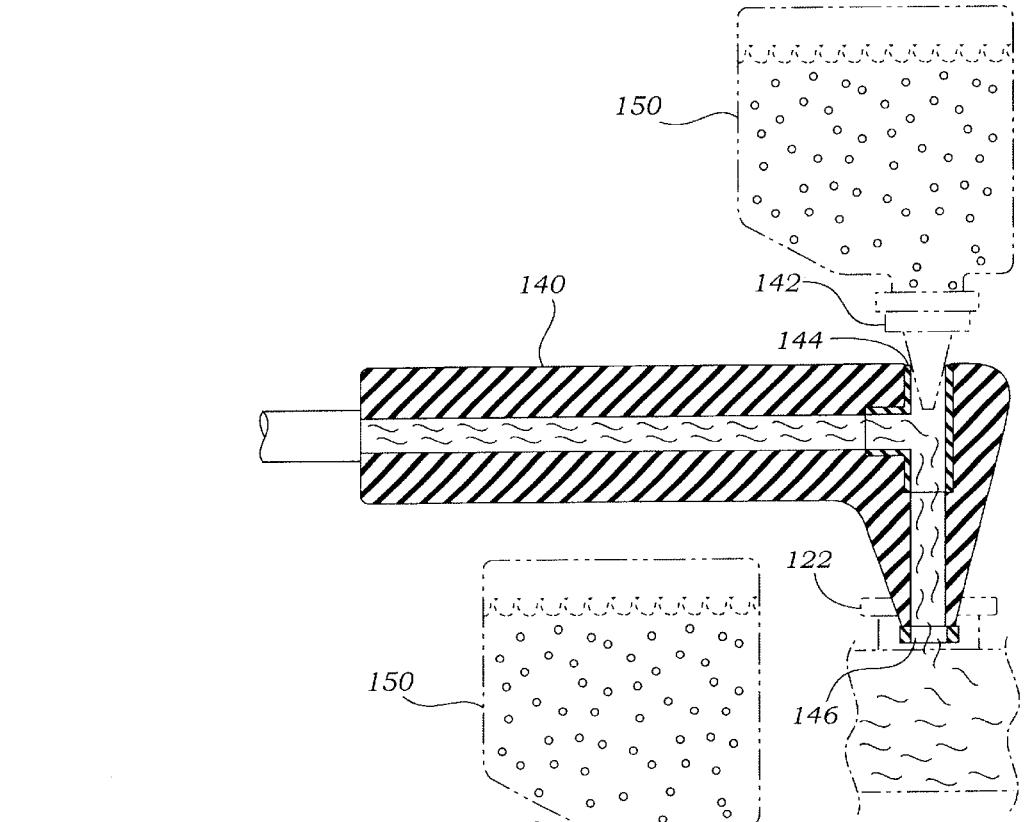


Fig. 4

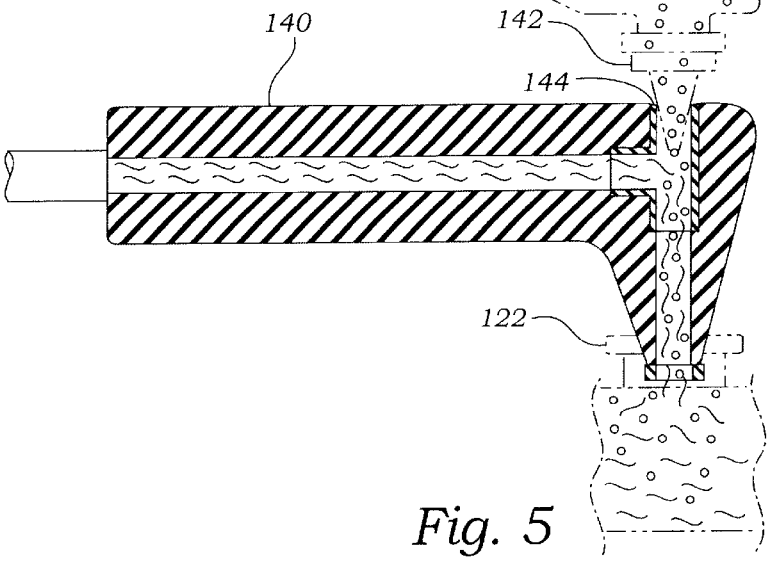


Fig. 5

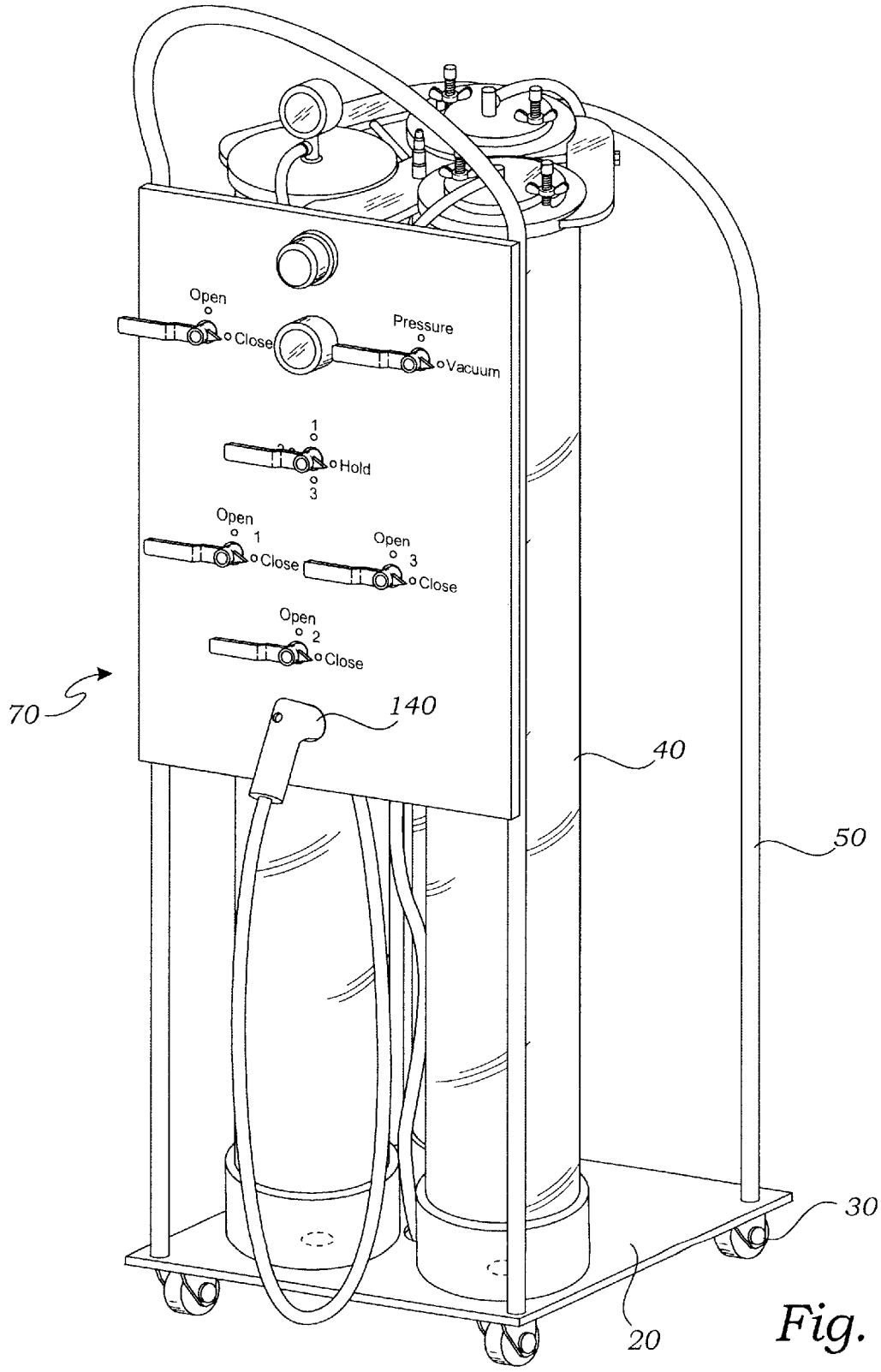

Open
Close
Pressure
Vacuum
1
2
3
Hold
Open
1
Close
Open
3
Close
Open
2
Close
70
140
40
50
30
20

Fig. 6

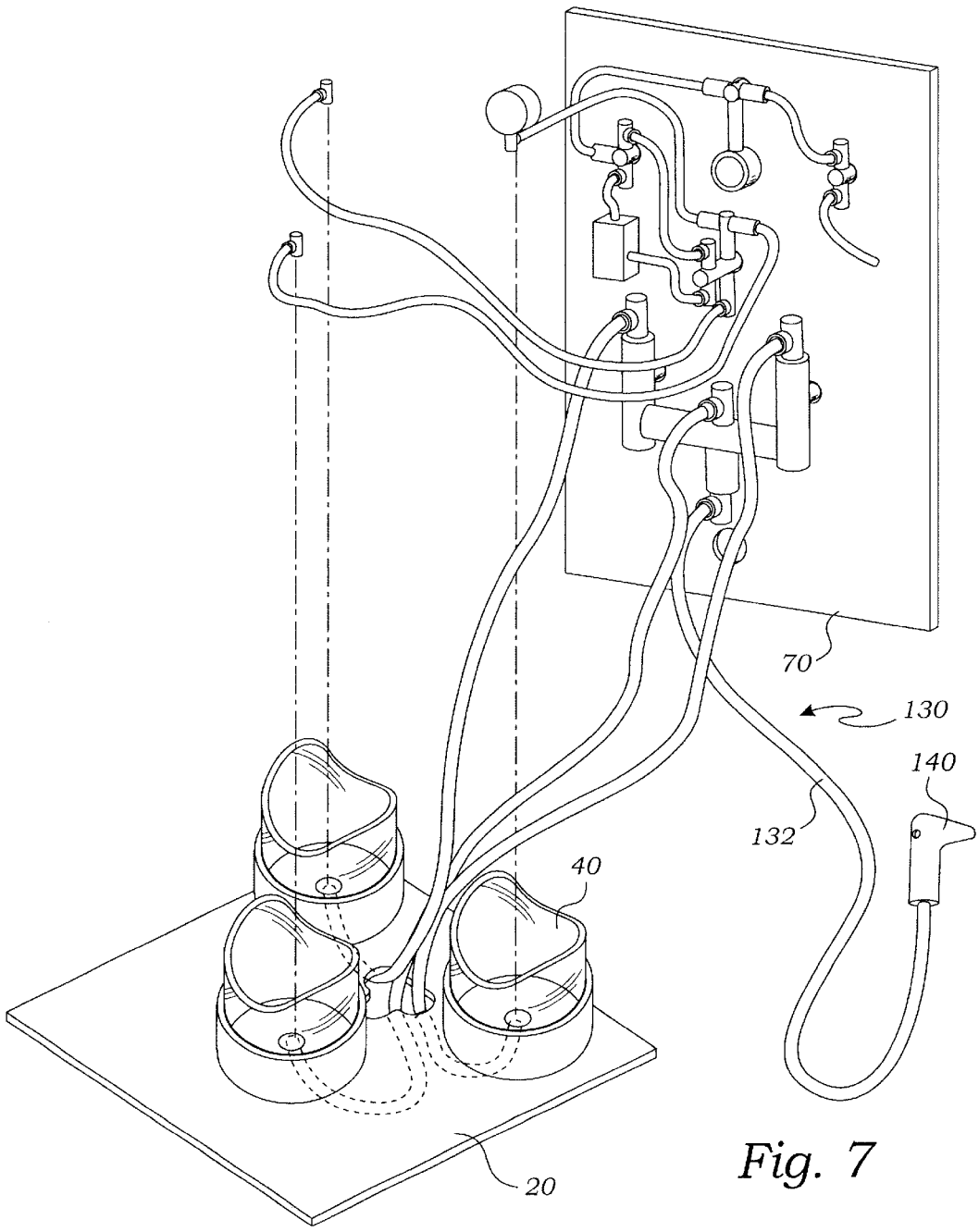


Fig. 7

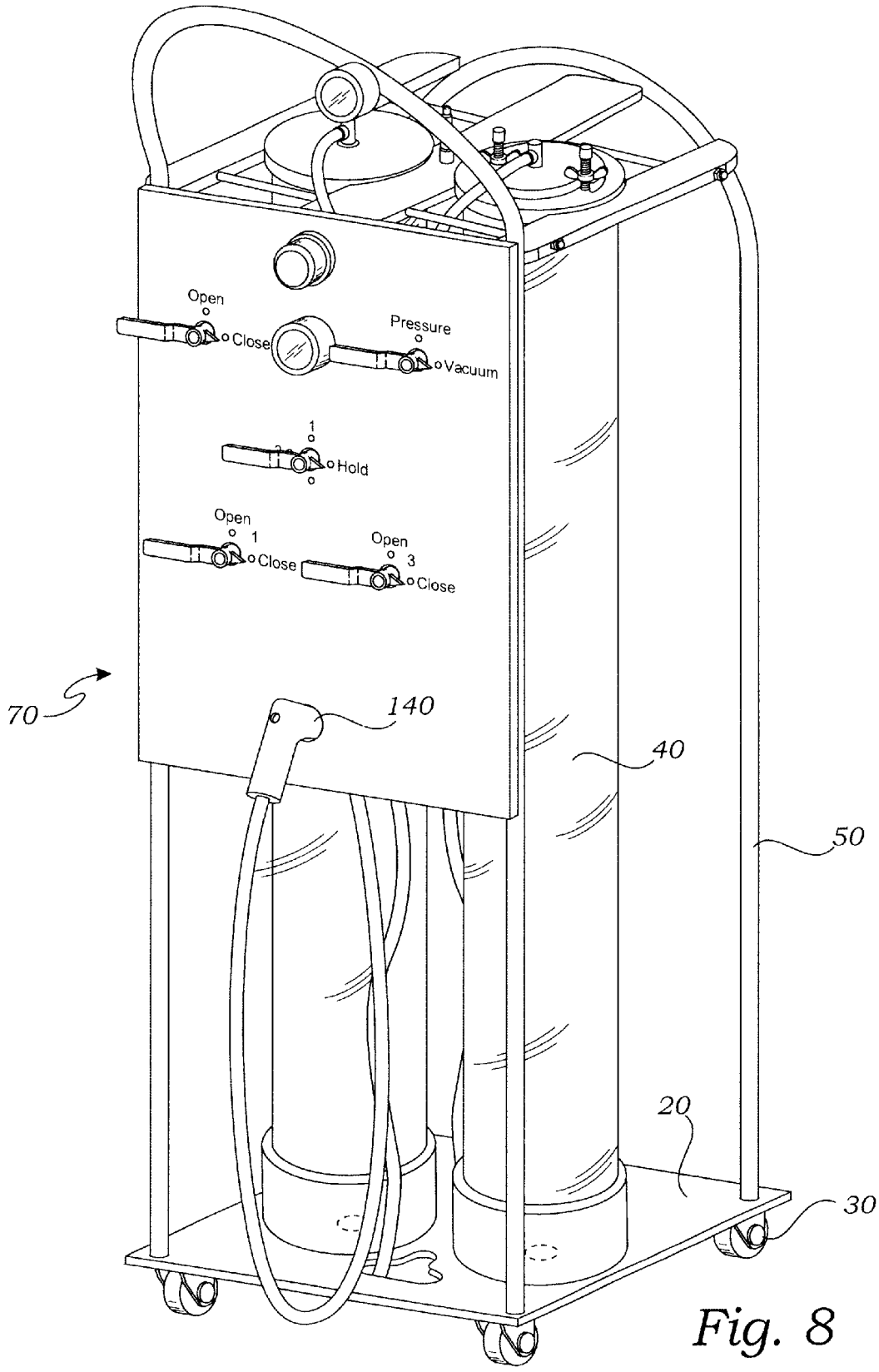

Open
Close
Pressure
Vacuum
1
Hold
Open
1
Close
Open
3
Close
70
140
40
50
20
30

Fig. 8

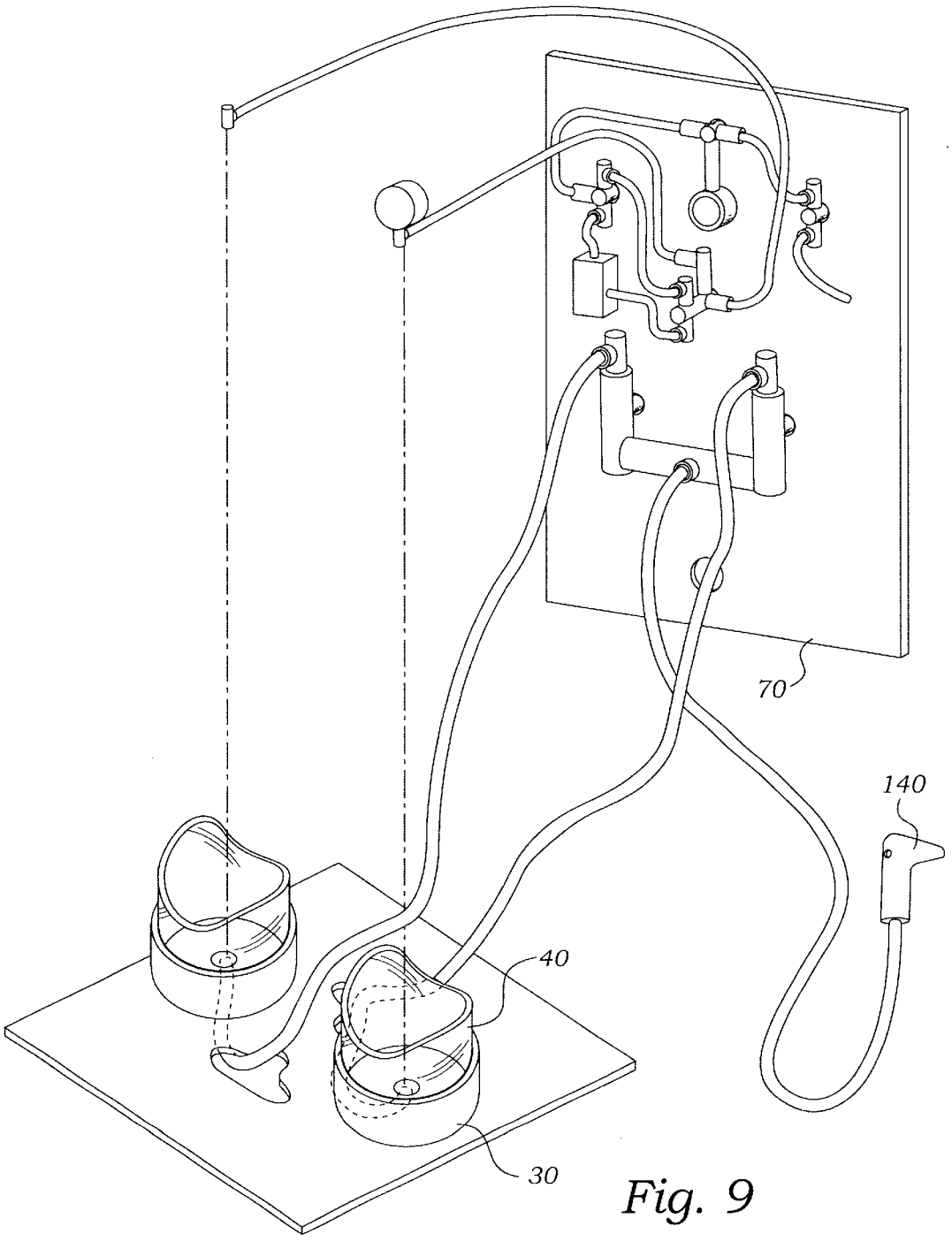


Fig. 9

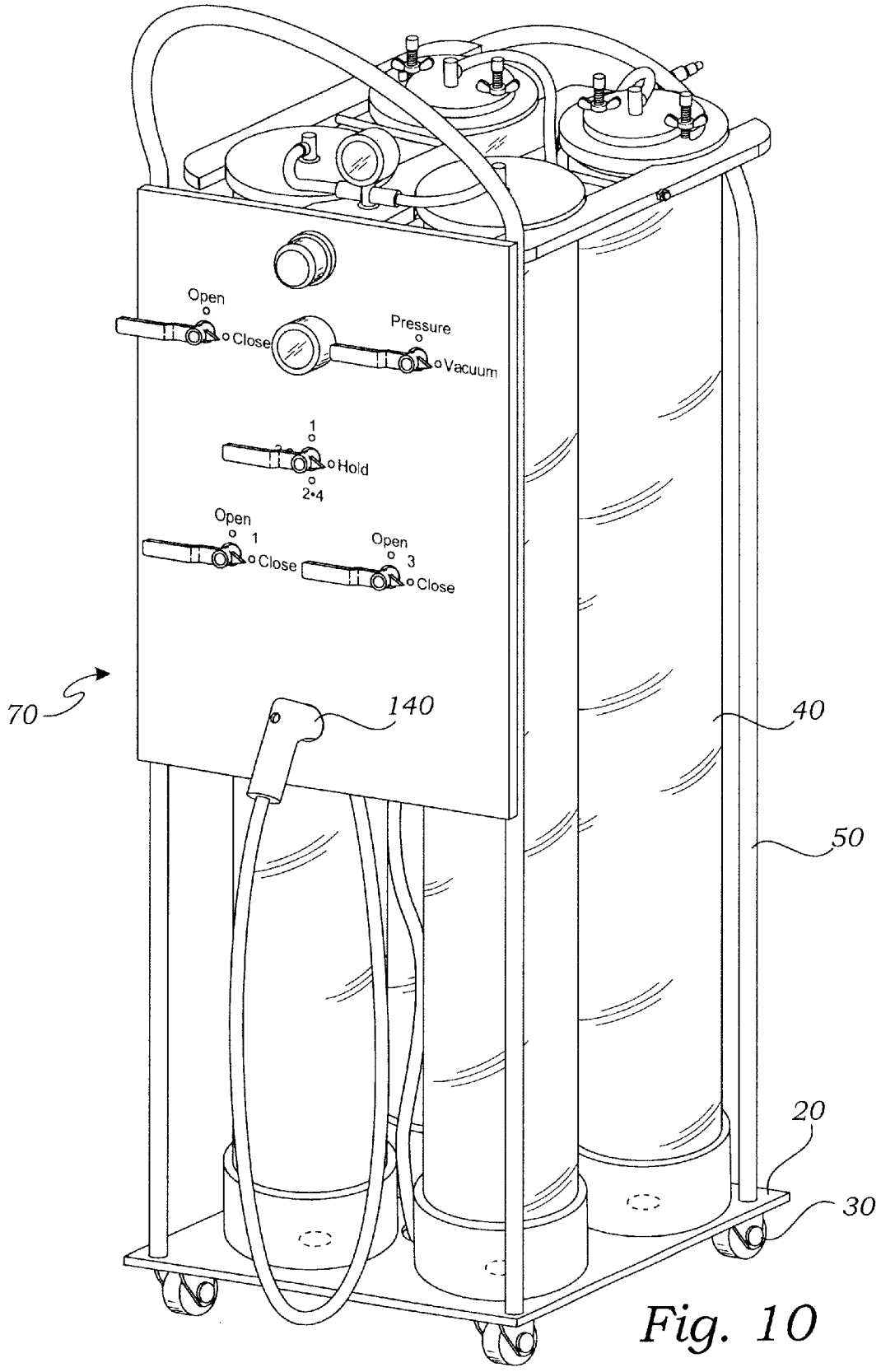

Open
Close
Pressure
Vacuum
1
Hold
2•4
Open
1
Close
Open
3
Close
70
140
40
50
20
30

Fig. 10

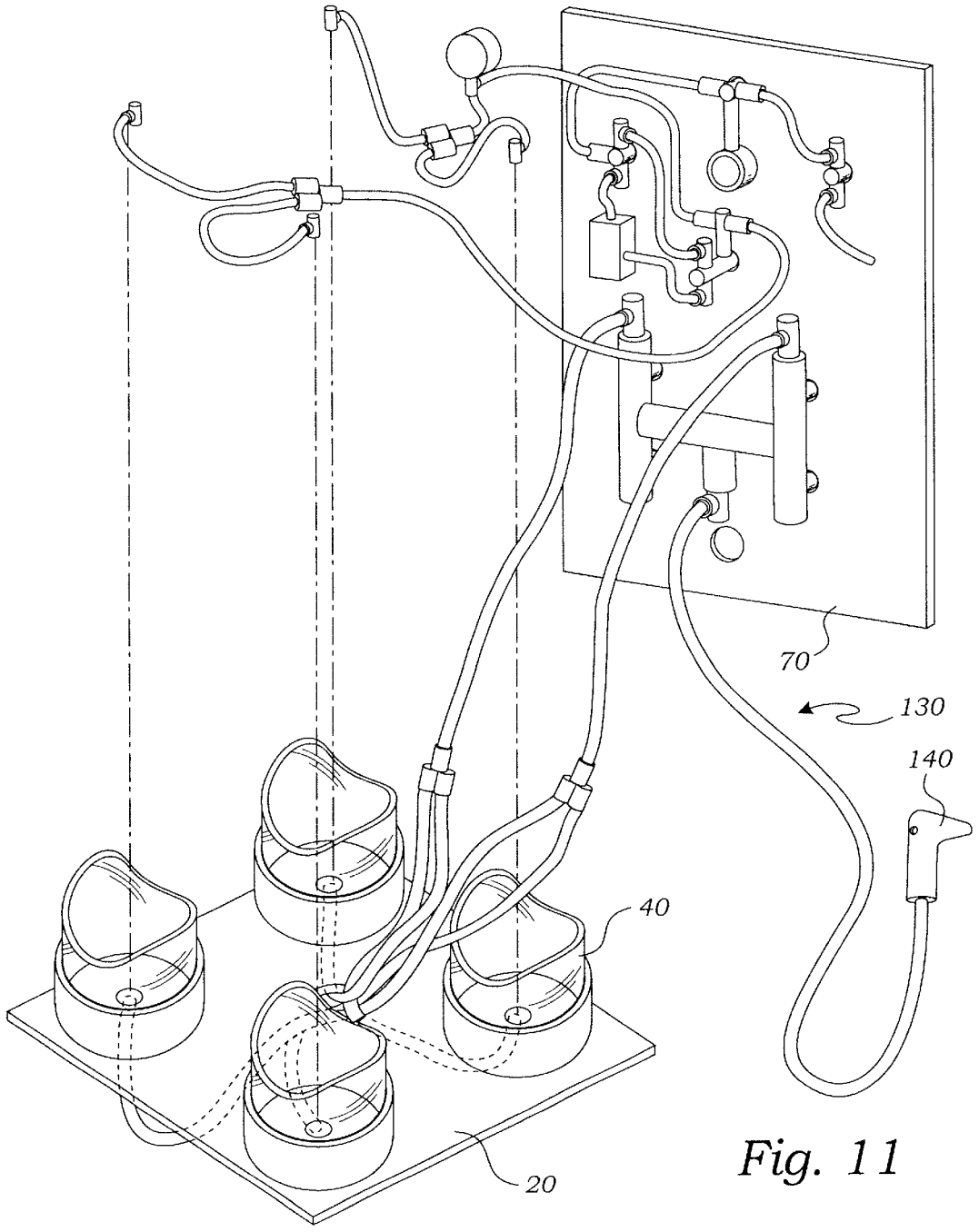


Fig. 11

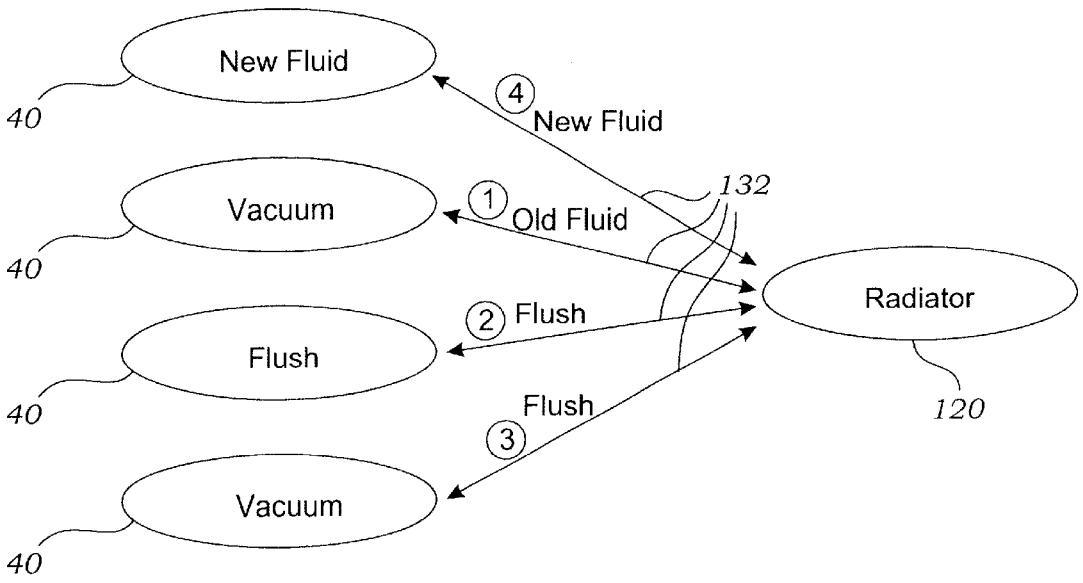

New Fluid
40
4
New Fluid
132
Vacuum
40
1
Old Fluid
Radiator
2
Flush
Flush
40
Flush
3
120
Vacuum
40

Fig. 12

AUTOMOTIVE RADIATOR FLUSH SYSTEM AND METHODS OF USE

RELATED APPLICATIONS

This is a continuation-in-part application of a prior filed application having Ser. No. 10/006,345, now U.S. Pat. No. 6,523,580, and file date of Dec. 3, 2001.

INCORPORATION BY REFERENCE.

Applicant(s) hereby incorporate herein by reference, any and all U. S. patents, U.S. patent applications, and other documents and printed matter cited or referred to in this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to automotive radiator flush systems and their methods of use and more particularly to an automated or manually operated such system and its methods and especially to such a system with controls for switching to various modes of operation.

2. Description of Related Art

The following art defines the present state of this field:

Cassia, U.S. Pat. No. 5,103,878 describes a flush cap for a vehicle cooling system wherein the flush cap has an inlet through which fresh water enters and an outlet through which dirty coolant leaves. The method employs the flush cap to flush the cooling system of the vehicle. The radiator cap can be adapted to drain a radiator using a hose attached to the outlet of the cap.

Akazawa, U.S. Pat. No. 5,615,716 describes an engine coolant changing apparatus for changing an engine coolant such as LLC (long-life coolant) in an engine coolant path containing a radiator, comprising coolant storing means possessing a pressure action port and a liquid inlet and outlet, detaching mechanism to be attached or detached to or from a filler port of a radiator, communicating device for communicating between the liquid inlet and outlet and the detaching device, and pressure action device for applying a negative pressure to the pressure action port to overheat the coolant to a low temperature by driving an engine when discharging the coolant from an engine coolant system, and applying a positive pressure to the pressure action port when feeding a fresh liquid, so that the coolant can be changed promptly in a short time, without requiring manipulation of radiator drain cock or jack-up of the vehicle.

Turcotte et al., U.S. Pat. No. 5,649,574 describes a removal and refill apparatus for use in removing and/or refilling coolant in an automotive cooling system. The automotive cooling system typically includes a radiator, overflow bottle, engine, water pump, and heater core elements. A method for utilizing the coolant removal and refill apparatus utilizing vacuum and pressure is described for use with the removal and refill apparatus.

Fletcher, Jr. et al., U.S. Pat. No. 5,845,684 describes a clean and easy-to-use, portable upright apparatus, and a method for its use, which can be used to flush and fill the radiator and coolant systems of motorized vehicles in approximately 15 minutes, the apparatus comprising a self-priming pump, a waste collection tank, a tank for holding new or recycled coolant, a filter assembly, and a wheeled support structure for conveniently and efficiently housing the pump, tanks, filter assembly, and the several hoses needed to perform the flush and fill procedure. Applications may include, but are not limited to, flushing coolant from automobile radiators and refilling them with new or recycled coolant.

Klamm, U.S. Pat. No. 6,345,215 describes an apparatus for adding coolant to a cooling system of a motor vehicle including a cap with a resilient sleeve that expands against the inside wall of a radiator filler neck to provide an air-tight connection. A valve attached to the cap controls the flow of air and coolant through the cap. A gauge on the cap indicates the pressure inside the radiator. A venturi assembly connected to the valve provides a source of vacuum for evacuating air from the cooling system. Thereafter, coolant is drawn through the cap by the vacuum created in the system.

Gayet, EP 1013908 describes a coolant fluid replacement device for an automobile, utilizing an open loop distribution circuit within the coolant loop during the replacement of the used coolant. The coolant loop comprises a radiator that includes an inlet from the engine and an outlet to the engine. During the coolant replacement process, the device is connected between the coolant pumps of the vehicle system. The new fluid is stored in a first reservoir. As the new fluid is pumped into the system, the old fluid is forced out into a second reservoir.

The prior art teaches the use of carts for providing automotive maintenance and especially in the field of radiator cleaning and refilling, but does not teach a combination cart with storage containers and a control panel all in wheeled portable configuration for easy selection of the maintenance steps to be taken. The present invention fulfills these needs and provides further related advantages as described in the following summary.

SUMMARY OF THE INVENTION

The present invention teaches certain benefits in construction and use which give rise to the objectives described below.

A method of replacing radiator fluid in an automotive radiator includes providing two gas tight containers, a fluid conducting hose with a gas tight nozzle fitted into a radiator fill pipe nipple. The method further includes the steps of filling one of the containers with a fresh radiator fluid, drawing a high vacuum on a second one of the containers, drawing spent radiator fluid into the second one of the containers using only suction from the container, thereby leaving the automotive radiator under a partial vacuum and then drawing the fresh radiator fluid, from the first one of the containers, into the radiator using only suction from the partial vacuum in the radiator. A radiator flush step may also be applied following the same method, using two additional containers, one with initial high vacuum and the other containing flush fluid.

A primary objective of the present invention is to provide an apparatus and method of use of such apparatus that provides advantages not taught by the prior art.

Another objective is to provide such an invention capable of moving fluids between containers and an automotive radiator for cleaning and refilling with only an initial vacuum drawn on one or more containers.

A further objective is to provide such an invention capable of quick and easy modification for various applications.

A still further objective is to provide such an invention capable of valving a fluid such as a cleaning or treatment agent, directly from a bottle into a nozzle fitted to an automobile radiator.

Other features and advantages of the present invention will become apparent from the following more detailed

description, taken in conjunction with the accompanying drawings, which illustrate, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the present invention. In such drawings:

FIG. **1** is a perspective view of a first preferred embodiment of the invention;

FIG. **2** is a similar view thereof showing its operation;

FIG. **3** is a similar view thereof showing the back of a control panel with cable interconnections of the invention;

FIGS. **4** and **5** are side elevational sectional views thereof showing operation of a nozzle of the invention;

FIG. **6** is a perspective view of a second preferred embodiment of the invention;

FIG. **7** shows the cable interconnections thereof;

FIG. **8** is a perspective view of a third preferred embodiment of the invention;

FIG. **9** shows the cable interconnections thereof;

FIG. **10** shows a modification of the first embodiment shown in FIG. **1**;

FIG. **11** shows the cable interconnections thereof; and

FIG. **12** is a graphical representation of the method of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The above described drawing figures illustrate the invention in at least one of its preferred embodiments, which is further defined in detail in the following description.

The present invention preferably uses an apparatus comprising a wheeled cart **10** made up of a platform **20** supported on a set of wheels **30** so that the cart **10** may be manually pushed from place to place. The platform **20** comprises a rigid plate having a flat upwardly facing surface. Mounted on the platform **20** is a plurality of containers **40** placed in adjacent upright attitudes as shown in FIGS. **1**, **2**, **6**, **8** and **10**. The containers **40** are preferably constructed as cylinders with capped ends and made of glass, polycarbonate plastic, fiberglass, or any other structural transparent substance so that one may view the contents of a contained fluid, as to color, level, quality and any other attributes. A support framework **50** is engaged with the platform **20** and supports an operator's panel **60** which provides operator's controls **70** as well shown in FIGS. **1**, **6**, **8**, and **10**. Preferably, the support framework **50** comprises a pair of U-shaped rods **52** and **54**, with the rod **54** extended for providing a handle **58**. The support framework **50** provides level indicating indicia **56** as shown in FIG. **2**. This is clearly shown in FIGS. **1**, **2**, **6**, **8** and **10**. The controls **70** are associated with a suction developing means **80** such as an ejector which is preferably a common, well known, device which uses the flow of a compressed gas to generate a minor negative suction through the venturi effect, a pressure developing means, which may be any source of gas pressure such as a compressor (not shown) and used in conjunction with a compressed gas storage tank **92** (FIG. **2**) and delivery hose **90** (FIG. **3**), conduit switching means **200** such as manual or automatic valves, and conduit manifolding means **110** such as the manifolds shown in FIGS. **3**, **7**, **9** and **11**. It is noted, that the suction developing means **80** is not necessary in carrying out the present invention methods defined herein and in the attached claims. In common use, in automotive shops and garages, a compressor is used for generating compressed air which is stored in a tank. The ejector may be used with such a supply of compressed air to generate an initial vacuum in one or more of the containers **40** whereupon the apparatus may be then moved to any remote location for completing its objectives of fluid exchange, and this without any further electrical or gas hookup. This is an important advantage in that the apparatus may be wheeled to a convenient location for beneficial use, for instance, in a parking lot. The prior art does not teach such application and advantage. In the present invention there is no need to raise a vehicle above floor level, no need to use garage space, and it is environmentally safe, no need to have a constant source of air pressure available or applied, or to take the time to generate vacuum. Clearly, all of these advantages provide significant saving of time, labor and energy.

The controls **70** are enabled for acting together to apply vacuum and pressure exertion on fluids for driving the fluids between any one of the containers **40** and an automotive radiator **120** through a system of conduits **130**. The arrangement of these controls **70** and conduits **130** may be made in accordance with any design for application of fluids and is able to provide movement of the fluids driven by gas pressure or by suction. For instance, a suction may be applied to the radiator **120** shown in FIG. **2**, to produce a negative pressure within this radiator **120**. By stoppering the radiator it then is possible to maintain the negative pressure and to use it to draw liquids from the containers **40** into the radiator **120**. Any number of fluids may thus be drawn and in any order. In the same manner it is possible to draw liquid fluids from the radiator **120** into any one of the containers. Selection is made via the control panel **70**. In the preferred embodiment, as shown in FIGS. **1** and **3**, air pressure is applied through conduit **90** to control **200**, an open-close valve. Pressure gauge **210** reads the pressure level as supplied. Regulator **220** adjusts the pressure as desired. Pressure-vacuum valve **230**, a three or four way valve, selects the mode desired, i.e., whether pressure or vacuum. Such is directed through valve **240** to selected containers **40**. When the operating effect or mode selected is "pressure," it is directed to the top of the appropriate container **40**, as shown, for example by conduits **91** and **93** in FIG. **3** and fluids are forced then from the bottom of the appropriate selected container **40** into manifold **110** and selected by valves **250**, **251**, **252**, and **253** to conduit **132** for delivery to the radiator **120**. When mode is "vacuum," it is applied for drawing fluid from the radiator **120** into one of the containers **40** and after all of the fluid is drawn therefrom, a partial vacuum condition remains in the radiator **120**. Therefore, in this mode, liquid is drawn from the radiator **120**, through nozzle **140** and delivery tube **132** to manifold **110** and thus into a selected container **40**. Suction is applied from selection valve **240** through, for instance, conduits **91** or **93**.

Preferably, conduit **132** terminates with the nozzle **140** adapted by its shape and elastic material properties for sealing a radiator fill pipe nipple **122** while exchanging the fluids therewith. This is clearly shown in FIG. **2**. The ability to seal the pipe nipple **122** is important so that suction may be held within the radiator **120** during fluid transfer as discussed above. The nozzle **140** may have incorporated within it, or removably receive an on-off valve **142** for admitting a fluid into the nozzle **140** through a nozzle aperture **144** situated above the nozzle's discharge point **146**. A fluid containing bottle **150** delivers chemicals such as cleaning and conditioning agents or other fluids to radiator **120**. The nozzle aperture **144** is adapted by its shape for engaging the valve **142** which is necessary to prevent loss of

suction when the fluid bottle **150** is placed in an inverted position for draining the fluid bottle **150** through the valve **142** into the nozzle **140** and thus to the radiator fill pipe nipple **122** and the radiator itself **120**. This is best seen in FIGS. **4** and **5**. It should be recognized that the present system works by reverse suction technique. The radiator is reduced to a low pressure by direct suction. Thereafter, the radiator provides suction for drawing fluids from the containers **40** and bottle **150**, into the radiator. Therefore, nozzle **140** and valve **142** play the important role of sealing the system while the bottle **150** is placed into the nozzle. This is possible only because the nozzle is made of a soft rubber with the property of forming a seal between the pipe nipple **122** and the valve **142**.

The containers **40** are preferably closed by a threaded connection or with tie-downs **164** on a disk-shaped metal cap **160**. The cap **160** provides a fastened cover **162** engaged with the cap **160** by the tie-downs **164**. The cover **162** is enabled, by this mounting for sliding movement between a closed position "A" for sealing the cap **160** as shown in FIG. **1**, and an open position "B" for exposing a cap aperture **166** for receiving fluids into the container **40** as shown in FIG. **2**.

Clearly, the apparatus may include any number of the containers **40** depending upon the application. In a 4 container configuration shown in FIGS. **1–3** and **10** the apparatus has the ability to receive spent coolant in one container **40** so as to empty the radiator **120**, discharge fresh water from a second container **40** along with a cleaning fluid from a bottle into the radiator **120** to flush the radiator, receive the spent flush in yet another of the containers **40** and, finally, discharge new coolant from a fourth of the containers **40** into the radiator **120**. Many other applications exist for the use of the invention in automotive maintenance. For instance, plural containers may be applied for large capacity cooling systems as one might find in large diesel engines for earth movers and such; and here the ability to bring the vacuum and pressure to the machine becomes an important advantage.

In the configuration shown in FIGS. **6** and **7**, the apparatus uses **3** containers **40** and is able thereby to receive spent coolant in one container **40**, flush with fresh water from a second container **40** and with cleaner from a bottle **150**, and install fresh coolant from a third of the containers **40**.

In the configuration shown in FIGS. **8** and **9**, the apparatus uses **2** containers **40** and is able thereby to receive spent coolant in one container **40**, and install new coolant from a second of the containers **40**. This shortcut approach is most applicable for new automobiles where the coolant system is not very dirty.

Obviously, the number of applications, fluids, containers and the method steps for providing radiator and other types of automotive and non-automotive maintenance is not limited to the few examples shown here, but is open to a vast number of potential situations and possibilities, the preferred methods described below.

A first preferred embodiment of the present invention method replaces the radiator fluid in the automotive radiator **120** and uses two containers **40** as shown in FIGS. **6** and **8**, each of the containers providing a means for sealing against gas leaks, as described above. The means for fluid conduction **132** (flexible hose), is integral with the nozzle **140** which is adapted by its shape and material for sealing the radiator fill pipe nipple **122**. The method includes filling a first one of the containers with a fresh radiator fluid; drawing a vacuum on a second one of the containers **40** as is fully described above; establishing suction, using the means for fluid conduction **132**, between the automotive radiator **120** which contains a spent radiator fluid, and the second one of the containers; drawing the spent radiator fluid into the second one of the containers using only suction from the second one of the containers, thereby leaving the automotive radiator **120** under partial vacuum; establishing suction, using the means for fluid conduction **132**, between the radiator **120** and the first one of the containers; and drawing the fresh radiator fluid, from the first one of the containers, into the radiator **120** using only suction from the radiator **120**. Clearly, this entire process may be performed in the field using only the partial vacuum carried into the field by the initial suction drawn on the second one of the containers **40**. This method uses the control valve **240** joined for fluid conduction between each of the containers and the means for fluid conduction **132**; and selecting first, the second ones of the containers **40** using the control valve **240** to enable suction on the automotive radiator **120**, and thereafter selecting second, the first one of the containers **40** using the control valve **240** to enable suction on the first one of the containers **40**.

In a further preferred embodiment of the present invention method, as shown in FIG. **12**, four containers **40** are used. Again, a first one of the containers **40** is filled with a fresh or new radiator fluid. A third one of the containers is filled with a radiator flush or cleaning fluid of any well known type. A partial vacuum is drawn on a second and a fourth ones of the containers **40** from any source of vacuum, such as described above. Suction is provided, using the means for fluid conduction **132**, between the automotive radiator **120** which contains the spent radiator fluid, and the second one of the containers **40**; drawing the spent (old) radiator fluid into the second one of the containers, through the fluid conduction means **132**, using only suction from the second one of the containers and thereby leaving the automotive radiator **120** under a partial vacuum. Next, suction is established, using the means for fluid conduction **132**, between the automotive radiator **120** and the third one of the containers for drawing the radiator flush into the radiator **120**, using only suction from the radiator **120** and, thereby, leaving the third one of the containers at atmospheric pressure, i.e., as flush is drawn out of the third one of the containers **40**, air is drawn in. Suction is next established, using the means for fluid conduction **132**, between the automotive radiator **120**, now containing the radiator flush, and the fourth one of the containers **40**, thereby drawing the radiator flush from the automotive radiator **120** into the fourth one of the containers **40**, through the fluid conduction means **132**, using only suction from the fourth one of the containers and, thereby, leaving the automotive radiator **120** under a partial vacuum. Finally, suction is established, using the means for fluid conduction **132**, between the automotive radiator **120**, and the first one of the containers for drawing the fresh (new) radiator fluid into the automotive radiator **120**, using only suction from the radiator **120** and thereby leaving the automotive radiator **120** clean and filled with fresh radiator fluid.

The control valve **240** is joined for fluid conduction between each of the four containers and the means for fluid conduction **132**. It is able to make selection as to which of the four containers is interconnected, at any one time, with the means for fluid conduction **132**. In the above method, first, the second one of the containers **40** is selected to enable suction on the automotive radiator **120**, and thereafter the third one of the containers **40** is selected to enable suction on the third one of the containers **40**. Next, the fourth one of the

containers **40** is selected, to enable suction on the radiator **120**, and finally, the first one of the containers **40** is selected to enable suction on the first one of the containers **40**.

In order to dispense with spent radiator fluid and flush, the invention method further may comprise the steps of: pressurizing the second one of the containers from a garage compressor, or example; establishing connection with the means for fluid conduction **132** between, in turn, the second one of the containers **40** and then the first one of the containers **40**, and a waste repository such as a waste container, etc., to enable dispensing of the spent radiator fluid and the used flush.

While the invention has been described with reference to at least one preferred embodiment, it is to be clearly understood by those skilled in the art that the invention is not limited thereto. Rather, the scope of the invention is to be interpreted only in conjunction with the appended claims.

What is claimed is:

1. A method of replacing radiator fluid in an automotive radiator, the method comprising the steps of: providing at least two containers, each of the containers providing a means for sealing against gas leaks from and into the container, a means for fluid conduction, the fluid conduction means integral with a nozzle adapted for sealing a radiator fill pipe nipple; filling a first one of the containers with a fresh radiator fluid; drawing a vacuum on a second one of the containers; establishing suction, using the means for fluid conduction, between an automotive radiator containing a spent radiator fluid, and the second one of the containers; drawing the spent radiator fluid into the second one of the containers using only suction from the second one of the containers, thereby leaving the automotive radiator under vacuum; establishing suction, using the means for fluid conduction, between the radiator and the first one of the containers; and drawing the fresh radiator fluid, from the first one of the containers, into the radiator using only suction from the radiator.

2. The method of claim **1** further comprising the steps of: providing a control valve joined for fluid conduction between each of the at least two containers and the means for fluid conduction; and selecting first, the second one of the containers using the control valve to enable suction on the automotive radiator, and thereafter selecting second, the first one of the containers using the control valve to enable suction on the first one of the containers.

3. The method of claim **1** further comprising the steps of: pressurizing the second one of the containers and establishing connection with the means for fluid conduction between the second one of the containers and a waste repository to enable dispensing of the spent radiator fluid.

4. A method of replacing radiator fluid in an automotive radiator, the method comprising the steps of: providing at least four containers, each of the containers providing a means for sealing against gas leaks from and into the container, a means for fluid conduction, the fluid conduction means integral with a nozzle adapted for sealing a radiator fill pipe nipple; filling a first one of the containers with a fresh radiator fluid; filling a third one of the containers with a radiator flush; drawing a high vacuum on a second and a fourth one of the containers; establishing suction, using the means for fluid conduction, between an automotive radiator containing a spent radiator fluid, and the second one of the containers; drawing the spent radiator fluid into the second one of the containers, through the fluid conduction means, using only suction from the second one of the containers, thereby leaving the automotive radiator under a partial vacuum; establishing suction, using the means for fluid conduction, between the automotive radiator and the third one of the containers; drawing the radiator flush into the radiator, through the fluid conduction means, using only suction from the radiator, thereby leaving the third one of the containers at atmospheric pressure; establishing suction, using the means for fluid conduction, between the automotive radiator containing the radiator flush, and the fourth one of the containers; drawing the radiator flush into the fourth one of the containers, through the fluid conduction means, using only suction from the fourth one of the containers, thereby leaving the automotive radiator under a partial vacuum; establishing suction, using the means for fluid conduction, between an automotive radiator, and the first one of the containers; drawing the fresh radiator fluid into the automotive radiator, through the fluid conduction means, using only suction from the radiator, thereby leaving the automotive radiator clean and filled with fresh radiator fluid.

5. The method of claim **4** further comprising the steps of: providing a control valve joined for fluid conduction between each of the at least four containers and the means for fluid conduction; and selecting first, the second one of the containers using the control valve to enable suction on the automotive radiator, and thereafter selecting second, the third one of the containers using the control valve to enable suction on the third one of the containers; and thereafter selecting third, the fourth one of the containers using the control valve to enable suction on the radiator; and thereafter selecting fourth, the first one of the containers using the control valve to enable suction on the first one of the containers.

6. The method of claim **4** further comprising the steps of: pressurizing the second one of the containers; establishing connection with the means for fluid conduction between the second one of the containers and a waste repository to enable dispensing of the spent radiator fluid; and establishing connection with the means for fluid conduction between the fourth one of the containers and a further waste repository to enable dispensing of the used flush.

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