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[54] **LUBRICANT DISPENSING MEANS AND SYSTEM**

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[52] **U.S. Cl.** **222/309,** 222/334

[51] **Int. Cl.** **G01f 11/06**

[58] **Field of Search** 222/129, 12, 309, 222/334, 250; 417/401, 403, 571

[56] **References Cited**

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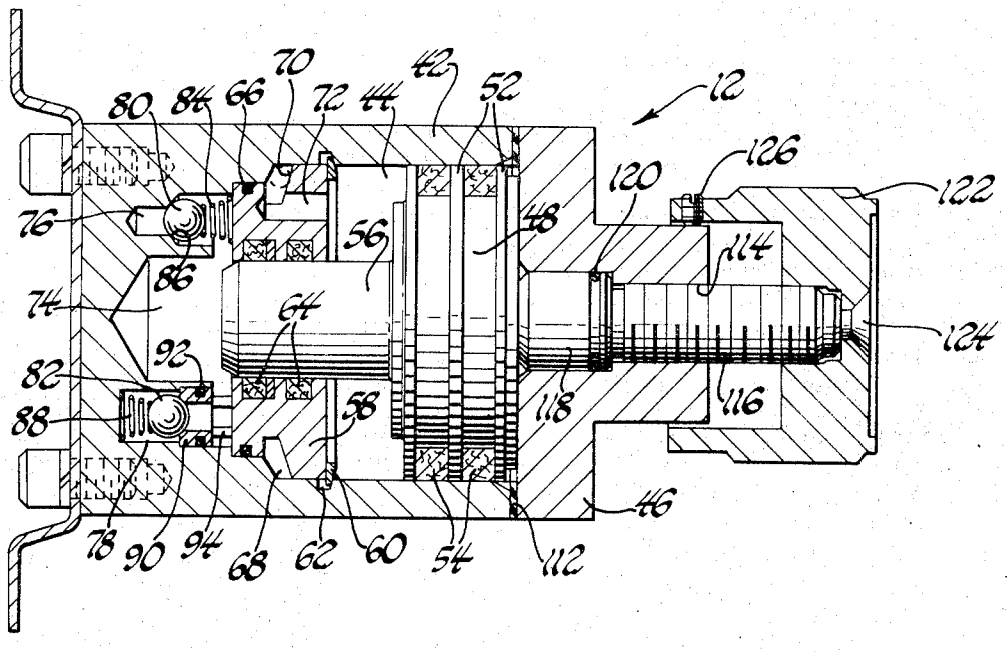
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[57] **ABSTRACT**

A means and method for dispensing a viscous fluid in metered amounts to provide lubricity for metal drawing in a forming press and which includes a positive displacement pump having an integral piston head and plunger construction, one-way ball check valves in inlet and outlet flow passages, spray nozzles connected to the pumps outlet ports by flexible conduit lines and swival mounted on magnetic mounting blocks for positioning ease, adjustment means on the pump for metering control by positioning an abutment stop within the piston chamber area, and a manually operated air valve for cyclic operation of the fluid pump in the normal operating use of the forming press.

6 Claims, 8 Drawing Figures



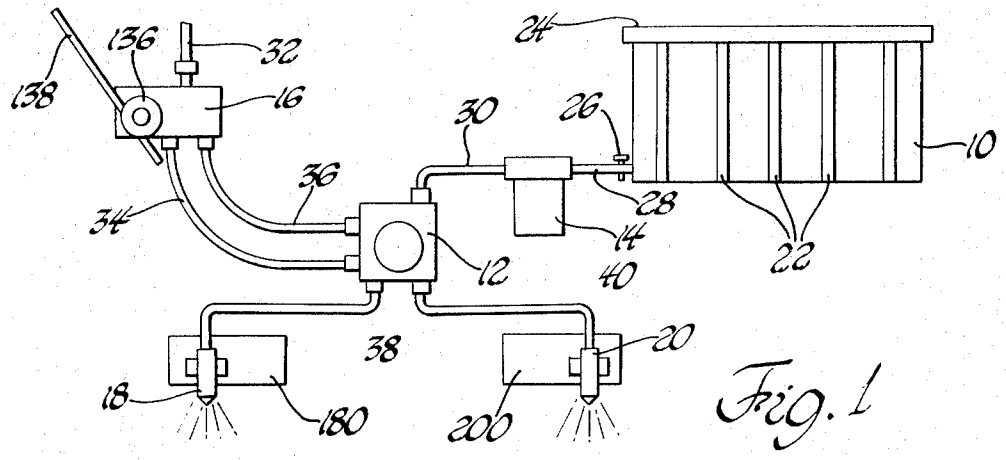


Fig. 1

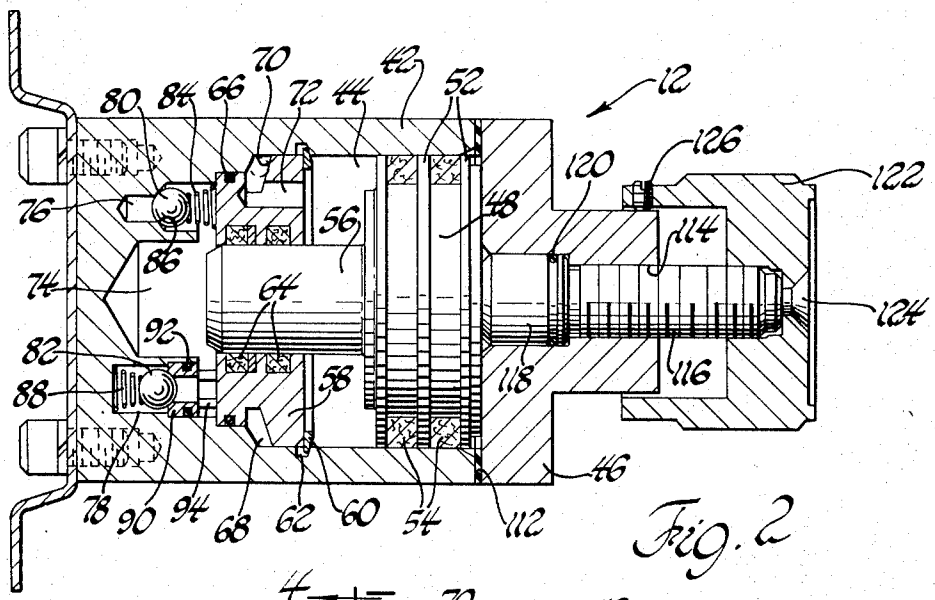


Fig. 2

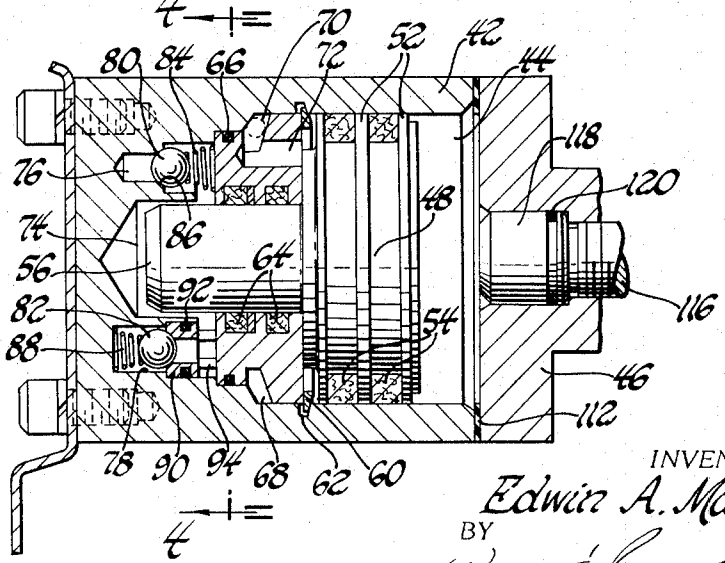


Fig. 3

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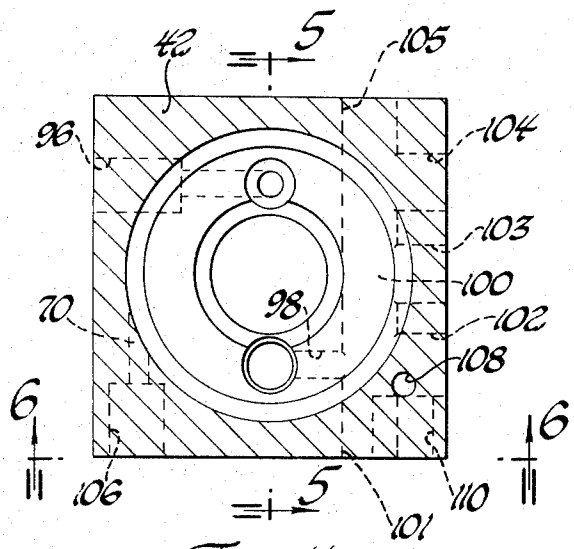


Fig. 4

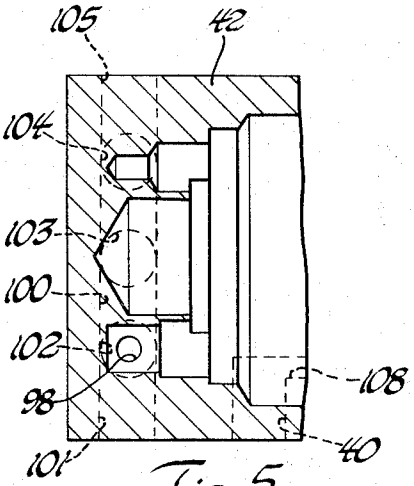


Fig. 5

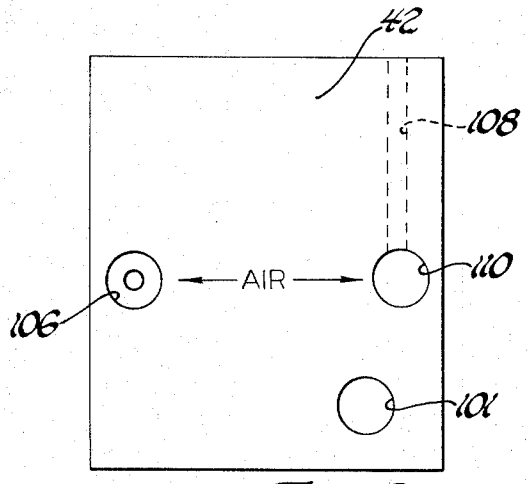


Fig. 6

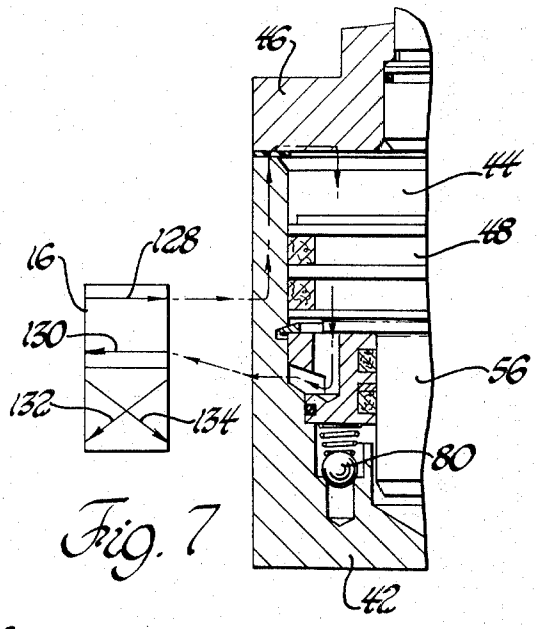


Fig. 7

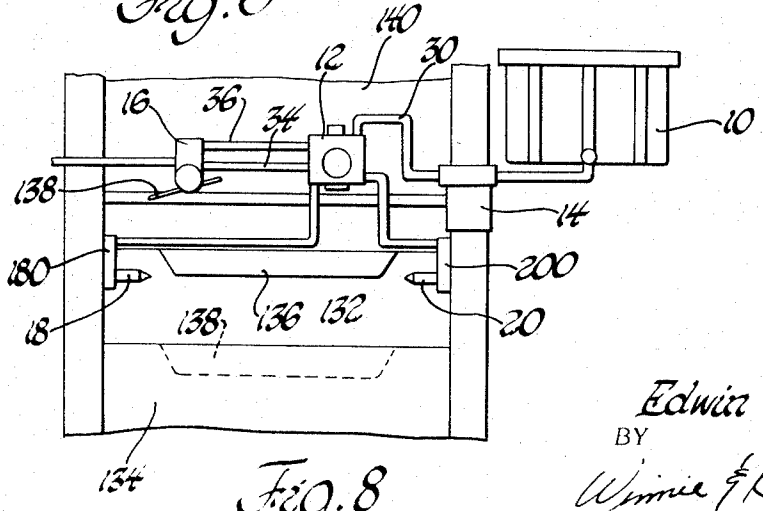


Fig. 8

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LUBRICANT DISPENSING MEANS AND SYSTEM

BACKGROUND OF THE INVENTION

Sheet metal that is used in a stamping press, to form work parts, where there is any draw of the metal in the forming operation, usually requires some preparation ahead of time. That is, the sheet metal usually needs to be sprayed, coated or otherwise treated with some type of lubricating material at least in the critical areas of the draw where tears or ruptures in the material due to frictional forces inhibiting proper metal flow might otherwise occur. These areas include corners and confined spaces, in the dies, and where the draw is relatively deep for the gauge or thickness of the sheet material that is used.

Spraying a lubricant into the dies or on the sheet metal in the dies, at the stress areas, is usually preferred to dipping, coating or other spot treatment because less lubricating material is used. In this regard, a solid stream or jet spray is better than an atomized spray since the latter involves overspray problems.

The better the directional control of the spray the less lubricating material that is required to do a job and the greater savings there is. This is true not only in the use of less lubricant but there is also a savings in the clean-up required afterwards.

The amount of lubricant required in any given situation depends on the lubricity needed, which in turn depends on the surface tension of the work material, the frictional forces generated in the draw, etc. No more should be provided than can be used in the draw or draws to be performed, to minimize or avoid clean-up problems afterwards. All these factors must be considered, but equally important is the system to meter and provide the precise amounts at the exact location where needed, irrespective of the viscosity of the lubricant, be it extremely light or heavy, or of the relative quantity or even different spot locations to be serviced.

Heretofore such systems have had to be tailored for each and every job, at considerable engineering and installation expense. No equipment has been available which would provide the capacity needed for a sufficiently wide range of applications to enable its use for a number of different situations, quantity, or viscosity requirements.

A duplication of systems is not the answer, since it merely doubles costs. Greater viscosity of itself should not require larger sized fluid lines, bigger nozzles, larger chamber areas, different fluid pumps. There is need for a jet spray system for metal forming operations and other uses that previously just have not been available.

SUMMARY OF THE INVENTION

The present invention is directed to a new and novel positive displacement pump and a fluid supply system that is particularly designed to handle lubricating fluids for metal forming uses.

The particular pump disclosed hereinafter is very small and compact in design, includes a minimum of separate parts and/or sub-assemblies so that it is very easy and inexpensive to manufacture and assemble for use. Means are provided for not only close but very precise metered flow control through the several different outlets that may be used, both by volume control means and by quick response flow control check valves.

Flexible flow control lines and jet nozzles mounted for swivel positioning on magnetic blocks, enable ready positioning and changes as needed for the best possible directional control on a job.

Air valve operation of the pump assures positive response and control for each call for lubricating fluid made by a stamping press in the course of its metal forming operation.

These and other features of the present invention will be more fully described in the description of a preferred embodiment which follows.

DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a diagramatic layout of the different component parts of the spray system of the present invention.

FIGS. 2 and 3 are cross-sectional views through the fluid pump showing the positive displacement piston part in different operative positions in the different figures.

FIG. 4 is a cross-sectional view taken from the preceding figure in the plane of line 4—4 therein and showing most of the fluid passages and passageways in the pump body.

FIG. 5 is a cross-sectional view of the lower part of the pump body as seen in the plane of line 5—5 in FIG. 4, to show a different view of certain of the fluid flow passages.

FIG. 6 is a side view of the pump, as seen in the plane of line 6—6 in FIG. 4, showing the air pressure inlet parts and passages, principally.

FIG. 7 is a cross-sectional view of a fragmentary part of the pump with the air valve operating means shown diagramatically therewith.

FIG. 8 is a side elevation of a stamping press with the hydraulic spray system of the present invention installed for use thereon.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The hydraulic spray system of the present invention includes a reservoir tank **10** to which is connected the positive displacement pump **12**, through a filter **14**. The pump **12** is controlled by a four-way air valve **16** and is shown connected to two separate spray nozzles **18** and **20**, in the first drawing figure.

The tank **10** is made of a translucent plastic material, so that the level of lubricant in it is always visible. It is also made with reinforcing ribs **22** which serve both structurally and as sort of sight gauges to show the amount of lubricating fluid that remains in the tank. A cover **24** closes the top of the tank and enables the reservoir tank to be used as the shipping container for the whole system, with the shutoff valve **26** at the outlet port removed and stored with the fluid lines and other parts in the tank.

Polypropolene or other suitable plastic tubing is used for all of the fluid lines, in whatever lengths are required. A short piece **28** connects the shut-off valve **26** on the tank to he filter **14** and another piece **30** connects the filter to the pump **12**. Air lines **32, 34** and **36** connect the air valve **16** to an air pressure supply source and the valve to the pump **12**. And, fluid lines **38** and **40** are from the pump to the spray nozzles **18** and **20**.

The positive displacement pump **12** is an important part of the overall system. It includes a body housing part **42** within which is provided a piston chamber area **44** that is closed by a cover part **46** which includes means for setting a stop that limits the stroke of the fluid dispensing piston in the pump.

The piston member in the pump includes an enlarged head end **48** fitted in the piston chamber area **44** and having suitable rings **52** and seals **54** to make it hold a good seal and be responsive to air pressure on opposite sides. The innermost end **56** of the piston member is smaller and made to fit through a sealing ring **58** held in the lower end of the chamber area **44** by a snap ring **60** in a receptive snap ring groove **62.** It has fluid seals **64,** through which the plunger end **56** of the piston extends, and its own O-ring seal **66** next to the chamber wall.

The sealing ring **58** is also formed to provide an annular space **68** between itself and the chamber wall which registers with an air passage **70** in the housing wall.

There is, in turn, a passage **72** through it that communicates with the underside of the piston head **48.**

The innermost end of the chamber space **44** is formed to provide a smaller area **74** within which the smaller end **56** of the pump piston is more closely received. There is, however, clearance space between the two to allow fluid flow between them, as best shown in FIG. **3.**

A blind passage **76** is formed under the retainer ring **58** on one side of the pump space **74** and another, identified as **78,** is formed across from it, on the other side. These are the inlet and outlet passageways, respectively, that connect to the pump space **74** and each has a one-way ball check valve **80** and **82** in it for the intended directional flow. A light spring **84** holds the check valve ball **80** down on a seat **86** formed in the passageway **76** while a spring **88** in the other passageway **78** holds its check valve ball **82** up against a seating ring **90.** The seating ring has an **0**-ring seal **92** around it, to prevent any by-pass fluid flow, and it is spaced apart from the retainer ring **58** by spacer parts **94** that are formed on it to allow fluid flow around and through it.

FIG. **4** shows the inlet passage **96** that the filter line **30** is connected to in providing fluid through ball check valve **80** to the pump **12.** It also shows the passageway **98** that connects to the outlet manifold passage **100** from which there are five separate outlet ports; identified **101, 102, 103, 104, 105.** In the first figure, only outlet parts **102** and **104** are in use, with supply lines **38** and **40** which connect to the two spray nozzles used in this particular embodiment.

Also shown in this drawing figure is the air inlet passage **70** that connects with the air inlet port **106** which has the air line **36** from the four-way valve connected, in turn, to it. A second air control passage **108** is provided in the housing body **42** between an inlet port **110** and the upper end thereof, just under the cover part **46** and inside of the air seal gasket **112,** so that it supplies air to the other side of the piston head **48.**

The cover member **46** for the pump housing **42** is fastened to it by four recessed socket head screws, one in each corner, not shown. It has a center opening **114** which is threaded and it has an adjustable stop **116** in it with head end **118** recessed into the cover part over the piston head **48,** when fully withdrawn. It also serves to restrict the stroke of the piston, and hence the amount of fluid that will be moved by the pump, when turned down into the chamber area **44.**

An O-ring seal **120** around the stop end **118** prevents blow-by and assures against pressure loss at the cover end.

A knob **122** is fastened to the threaded post **116** of the stop, by a screw **124,** and includes set screw **126** in its side wall flange, to hold and fix it in position (and hence the stop) in initially setting the pump requirements to specifications.

The four way valve connections to work the pump **12,** are shown diagramatically in FIG. **7.**

The air valve **16,** when energized, allows air flow through passage connections **128** and **130** to the flow lines **36** and **34** (reference FIG. **1**) which connect to the passages and ports on opposite sides of the piston head **48.** When the air valve is de-energized, the passage connections **132** and **134** in the valve connect to the flow lines **36** and **34** and the flow is in reverse, which retracts the piston and moves it toward its cover closure **46.**

The air valve **16** is operated, to accomplish the change from direct to cross flow, by means of a control **136** which has a rod **138** set through one side of it and which serves to operate it when the rod contacts, or is contacted, by something.

FIG. **8** shows the system as installed for use on a stamping press **130.**

The ram **132** is raised above the bed plate or platen **134** and shows the die form **136** over the reverse image die mold **138.** The reservoir tank **10** is mounted on one side of the press, as is the filter **14,** while the pump **12** and air valve **16** are disposed on part of the press frame **140** relatively over the ram **132.**

When the ram is raised, as shown, it contacts (or includes means for contacting) the lever rod **138** on the air valve **14** which energizes the valve and allows air flow through flow line **34** into the pump **12.** The air flow is via port **110** and passage **108** to over the piston **48,** as shown in FIG. **7.** Piston plunger part **56** pushes fluid from the smaller chamber space **74** through check valve **82,** passage **98** and into the outlet manifold passage **100** from which it passes into the two operative outlets **102** and **104.** These are connected by flexible flow lines **38** and **40** to the spray nozzles **18** and **20.**

The spray nozzles **18** and **20** are mounted in swival block supports on magnetic stay blocks **180** and **200** which enables them to be positioned where and as desired and to be moved and changed as necessary to obtain the very best spray distribution pattern possible.

When the stamping press ram begins its descent, the lever rod **138** is released and the air valve control **136** (under internal spring load) returns the valve to its de-energized position which connects the air pressure line to the pump line **36** and, in turn, via passages **70** and **72** to the underside of piston head **48.** This draws the piston plunger **56** out of the pump space **74,** allows fluid pressure to unseat the ball check valve **80,** and fluid to flow into and refill the pump space **74.**

As will be appreciated, the fluid line pressure, for the lubricating spray fluid, is not enough to unseat the check valve ball **82,** against the spring load holding it closed. It is only when the piston plunger **56** begins its descent and increases the unit pressure that the outlet ball check is popped open.

The piston member **48** in the pump is moved back towards the cover end **46** until it is stopped against the

cover or the stop 118 if the latter is set-out therebelow. The travel of the piston determines the amount of fluid the pump will move and so setting the stop 118 down into the chamber area space 44 to limit its stroke will accomplish this objective. Actually, once the number of spray nozzles is determined, what their fluid requirements will be, viscosity of the fluid is known, etc., the stop 118 is set by the knob 122 and its position is fixed by the set-screw 126. Its position is adjusted only in recalibrating the pump for the requirements of the system it serves.

I claim:

1. Apparatus for dispensing a viscous fluid in metered amounts and comprising; a one piece housing member having two contiginous chamber area spaces of respectively larger and smaller diametric size formed therewithin and from one end thereof, inlet and outlet passage means for viscous fluid formed in communication with said smaller chamber area space and having inlet and outlet check valves disposed respectively within the inner ends thereof, an intermediate member received and retained within said larger chamber area space and forming an end wall for both of said chamber area spaces and an abutment wall retentive of said check valves in said inlet and outlet passage means, passage means provided at opposite ends of said larger chamber area space for selective alternate communication with an air pressure supply source and an atmospheric vent, a differential piston member having its larger end received and guided within said larger chamber area space and its smaller end received and guided through said intermediate member and into said smaller chamber area space for inducing fluid flow thereinto and therefrom, and a cover member for closing the open end of said housing and having adjustable means provided therethrough and into said larger chamber area space for limiting the travel of the larger end of said differential piston member and thereby the volumetric induction and displacement of fluid by its smaller end within said smaller chamber area space.

2. The apparatus of claim 1, including chamber wall sealing means and sealing means receptive of the smaller end of said differential piston therethrough provided on and within said intermediate member for precluding air and fluid leakage between said chamber area spaces, and means received within said larger chamber area space and engaging the chamber wall thereof for retaining said intermediate member in relatively fixed relation therewithin.

3. The apparatus of claim 1, the passage means for air pressure supply and venting at the inner end of said larger chamber area space being provided at said intermediate member, said intermediate member having an annular space in communication with said passage means, and passage means provided in said intermediate member between said annular space and said larger chamber area space for communication therebetween.

4. The apparatus of claim 1, including an annular space of intermediate size formed within said housing between said larger and smaller chamber area spaces for providing a locating shoulder for said intermediate member, said check valves being disposed within the end wall of said annular space in abutting and retained engagement with said intermediate member, and said annular space providing open communication between said check valves and said smaller chamber area space.

5. The apparatus of claim 1, said housing member being rectilinear in shape and having a manifold passage formed wholly therewithin adjacent and normal to said smaller chamber are space, and said outlet passage means being connected to said manifold passage for providing multiple outlet connections therewith.

6. The apparatus of claim 1, including an annular space of intermediate size formed within said housing between said larger and smaller chamber area spaces for providing a locating shoulder for said intermediate member, said check valves being disposed within the end wall of said annular space in abutting and retained engagement with said intermediate member, and said annular space providing open communication between said check valves and said smaller chamber area space, an annular space provided within said intermediate member and for open communication with the air pressure supply and venting passage means at the inner end of said larger chamber area space, passage means within said intermediate member between said annular space and said larger chamber area space for communication therebetween, sealing means on and within said intermediate member for precluding air and fluid leakage between said chamber area spaces, means received within said larger chamber area space and engaging the chamber wall thereof for relatively fixing the location of said intermediate member, and a manifold passage provided wholly within said housing member and in communication with said outlet passage means for providing multiple outlet connections therewith.

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