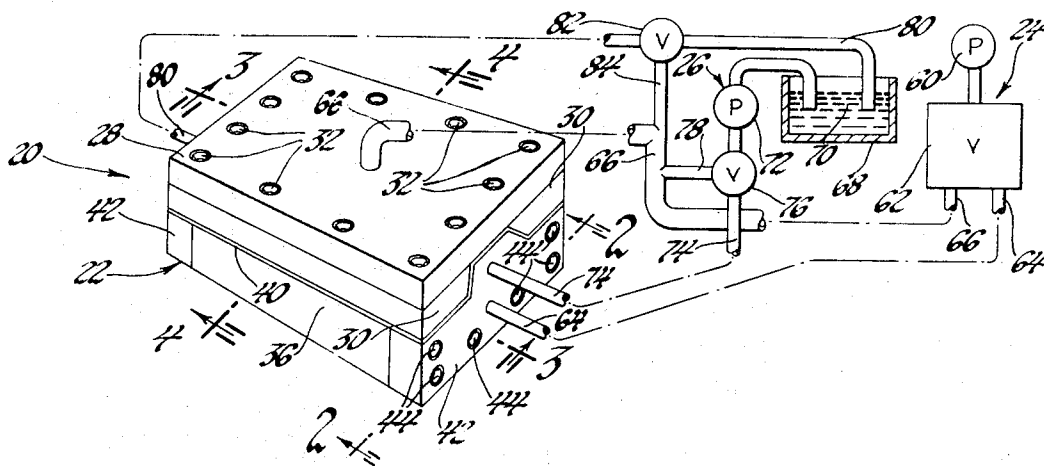
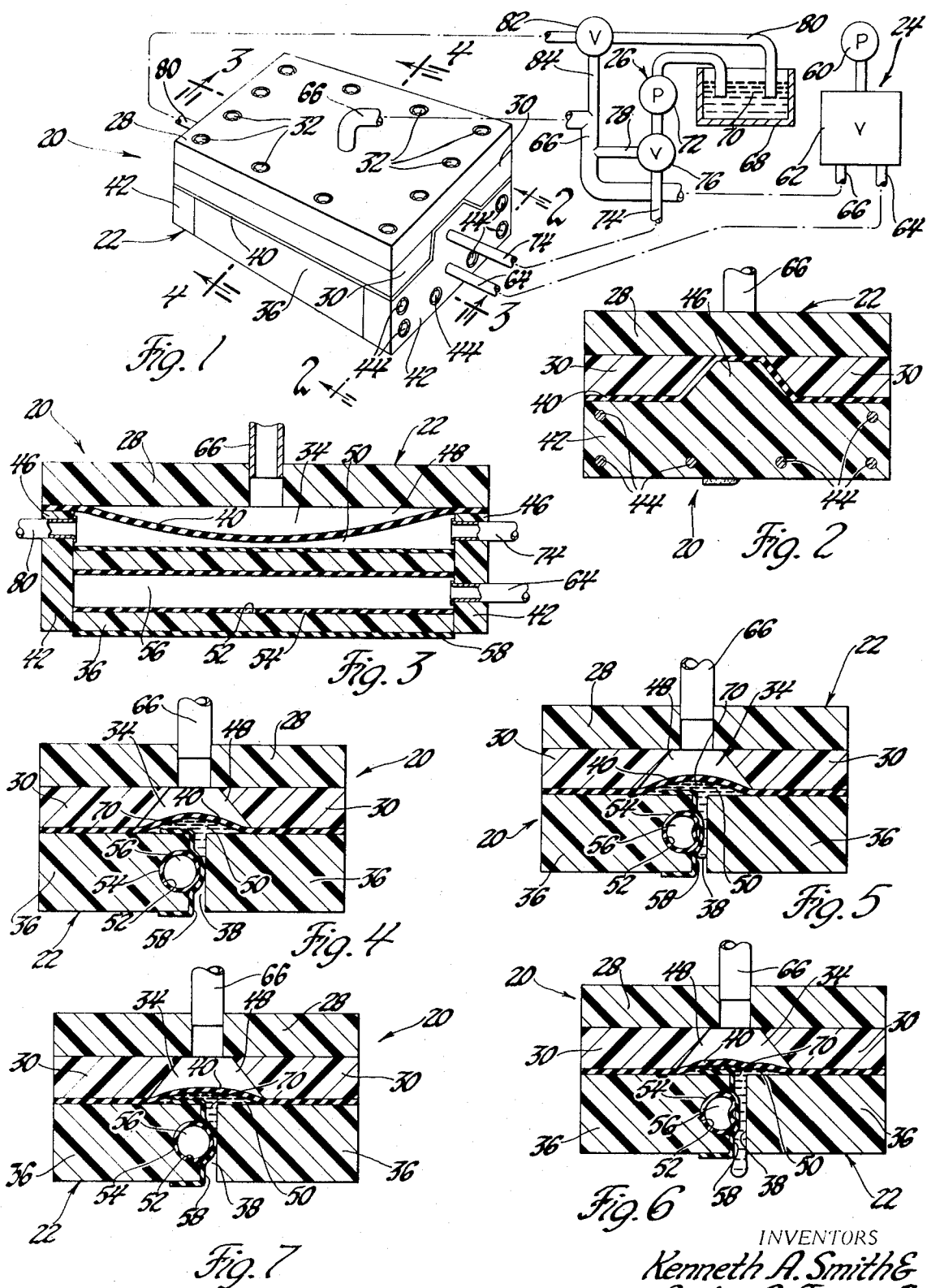


[54] **VISCOUS FLUID DISPENSER WITH VALVED CHAMBER RECEIVING CIRCULATING VISCOUS FLUID**[75] Inventors: **Kenneth A. Smith**, Washington;
Lester C. Teague, II, Utica, both of Mich.[73] Assignee: **General Motors Corporation**,
Detroit, Mich.[22] Filed: **Nov. 30, 1970**[21] Appl. No.: **93,528**[52] U.S. Cl.**222/318, 222/334, 222/372,**
222/386.5[51] Int. Cl.**G01f 3/20**[58] Field of Search.....222/333, 334, 386.5,
222/310, 319, 318, 335, 387, 388, 108, 109,
110, 111, 424; 251/5; 137/81.5, 599;
417/395; 272/372[56] **References Cited****UNITED STATES PATENTS**2,619,907 12/1952 Paterson.....417/395
3,213,903 10/1965 Armstrong 222/318*Primary Examiner*—Robert B. Reeves*Assistant Examiner*—James M. Slattery*Attorney*—W. E. Finken and Herbert Furman[57] **ABSTRACT**

A viscous fluid dispenser includes a dispenser housing with an elongated cavity divided into a pumping chamber and a viscous fluid chamber by a pumping diaphragm. An elongated dispensing slot in the housing communicates the viscous fluid chamber with the environment and is closed by a control diaphragm in response to fluid pressure supplied to a control chamber in the housing by a valved air pumping arrangement. A viscous fluid pumping arrangement circulates a viscous fluid through the viscous fluid chamber between a valve controlled inlet and a valve

controlled outlet when the dispensing slot is closed by the control diaphragm. The valved air pumping arrangement is actuatable to terminate the fluid pressure supplied to the control chamber, thus opening the dispensing slot, and to subsequently supply fluid pressure to the pumping chamber which causes the valves at the inlet and outlet of the viscous fluid chamber to close and isolate a quantity of the viscous fluid within the viscous fluid chamber. The fluid pressure supplied to the pumping chamber also causes the pumping diaphragm to deflect and force a predetermined amount of the quantity of isolated viscous fluid out of the viscous fluid chamber through the open dispensing slot thereby dispensing the predetermined amount of viscous fluid. In an alternate embodiment, the dispenser housing includes first and second tubular members positioned adjacent each other and opening to each other through an elongated dispensing slot in their common wall. A tubular pumping diaphragm received within the first tubular member divides the interior thereof into the pumping chamber and the viscous fluid chamber. A tubular control diaphragm received within the second tubular member defines the control chamber which receives fluid pressure from the valved air pumping arrangement to cause the control diaphragm to close the dispensing slot. When the valved air pumping arrangement is actuated, the supply of fluid pressure to the control chamber is terminated and transferred to the pumping chamber whereupon valves at the inlet and outlet of the viscous fluid chamber isolate a quantity of the normally circulated viscous fluid. The fluid pressure in the pumping chamber also defects the tubular pumping diaphragm and forces a predetermined amount of the quantity of isolated viscous fluid through the dispensing slot into the second tubular member and to the environment through a lower dispensing slot in the second tubular member. When the valved air pumping arrangement is deactuated, the control diaphragm expands and forces the viscous fluid remaining within the second tubular member outwardly thereof through the lower dispensing slot.

1 Claim, 13 Drawing Figures



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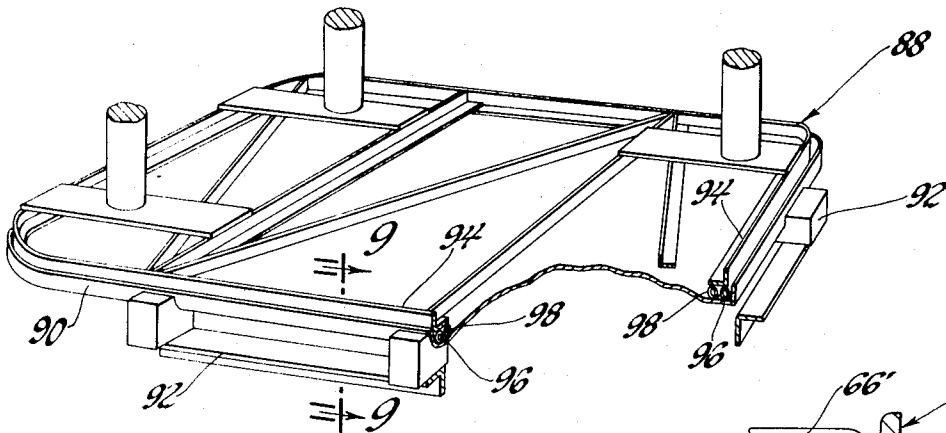


Fig. 8

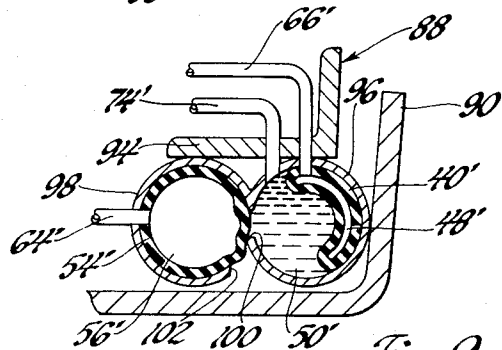


Fig. 9

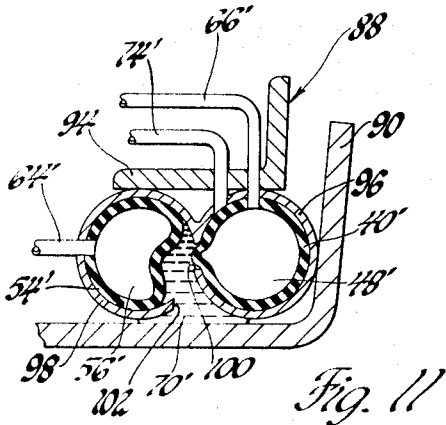


Fig. 11

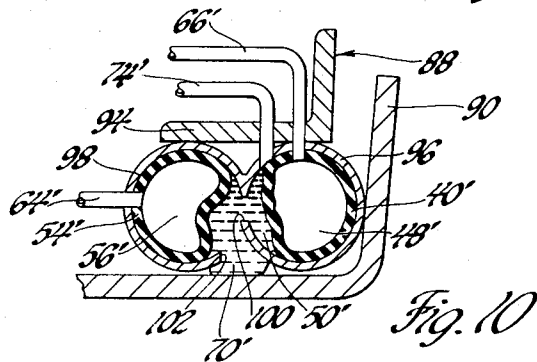


Fig. 10

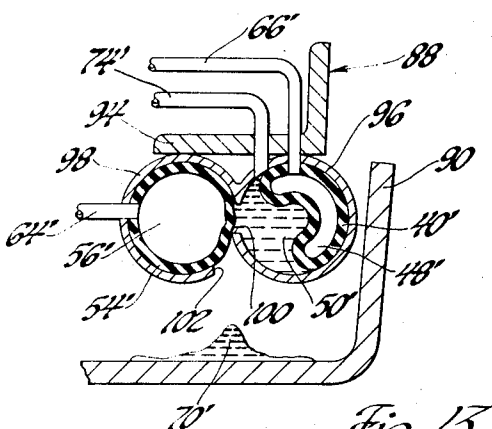


Fig. 13

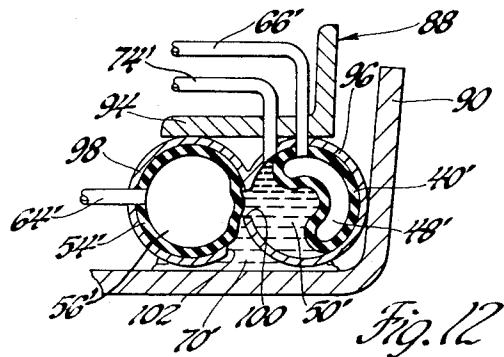


Fig. 12

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VISCOUS FLUID DISPENSER WITH VALVED CHAMBER RECEIVING CIRCULATING VISCOUS FLUID

This invention relates to a viscous fluid dispenser that dispenses a predetermined amount of viscous fluid without internal clogging in the dispenser housing.

It is well known to provide a viscous fluid dispenser for dispensing a predetermined amount of a viscous fluid such as adhesives, resins, heavy lubricants, etc. One manner in which this is accomplished is to pump the viscous fluid from a viscous fluid reservoir into a viscous fluid chamber in a dispenser housing and to subsequently force a predetermined amount of viscous fluid out of the chamber through a dispensing opening in the housing. Since many of these viscous fluids have a tendency to set when so isolated in the housing from the larger volume of viscous fluid within the reservoir, these dispenser housings have a tendency to clog internally thus preventing uniform dispensing of the predetermined amount of viscous fluid.

According, an object of this invention is to provide a viscous fluid dispenser for dispensing a predetermined amount of viscous fluid without internal clogging in the dispenser housing.

In carrying out this object, the dispenser includes a dispenser housing that defines the viscous fluid chamber and viscous fluid is circulated through the chamber between a valve controlled inlet and a valve controlled outlet to prevent internal clogging of the viscous fluid within the chamber. Upon an actuation of the dispenser, the inlet and outlet of the viscous fluid chamber are closed and a predetermined amount of viscous fluid is forced out of the chamber through a dispensing opening.

In the preferred embodiments, the housing includes a cavity divided by a pumping diaphragm to provide a pumping chamber and the viscous fluid chamber which is communicated to the environment by a dispensing opening that is closed by a control diaphragm when fluid pressure is supplied to a control chamber within the housing. A valved pumping arrangement supplies fluid pressure to the control chamber and is actuatable to terminate the supply to the control chamber and to supply fluid pressure to the pumping chamber which isolates a quantity of the viscous fluid within the viscous fluid chamber, by closing the valved inlet and valved outlet, and deflects the pumping diaphragm to force a predetermined amount of the quantity of isolated viscous fluid out of the viscous fluid chamber through the dispensing opening.

In one of the preferred embodiments, the cavity within the dispenser housing is elongated with a generally trapezoidal cross section and receives the pumping diaphragm which is mounted in a generally saddle-like configuration. In the other preferred embodiment, the dispenser housing is defined by first and second tubular members and has a generally figure eight-like cross section. This housing can be bent into various configurations to dispense the predetermined amount of viscous fluid in the desired pattern.

IN THE DRAWINGS:

FIG. 1 is a view of one embodiment of the dispenser with the dispenser housing shown in perspective and the pumping arrangements shown in schematic;

FIG. 2 is an enlarged sectional view of the dispenser housing taken generally along line 2—2 of FIG. 1;

FIG. 3 is an enlarged sectional view of the housing taken generally along line 3—3 of FIG. 1;

FIG. 4 is an enlarged sectional view of the housing taken generally along line 4—4 of FIG. 1 and showing viscous fluid circulating through the viscous fluid chamber of the housing;

FIG. 5 is a view similar to FIG. 4 showing the beginning of the dispensing operation;

FIG. 6 is a view similar to FIG. 5 showing a further stage of the dispensing operation;

FIG. 7 is a view similar to FIG. 4 after the completion of the dispensing operation with the viscous fluid again circulating through the viscous fluid chamber;

FIG. 8 is a partially broken away perspective view of another embodiment of the dispenser with the dispenser housing shown adjacent a workpiece on which the viscous fluid is to be deposited;

FIG. 9 is a sectional view of a portion of the dispenser housing and workpiece taken along line 9—9 of FIG. 8 and showing the viscous fluid circulating through the viscous fluid chamber;

FIG. 10 is a view similar to FIG. 9 showing the beginning of the dispensing operation;

FIG. 11 is a view similar to FIG. 10 showing a further stage of the dispensing operation;

FIG. 12 is a view similar to FIG. 11 showing the completed stage of the dispensing operation; and

FIG. 13 is a view similar to FIG. 12 showing the housing moved away from the workpiece.

Referring to the drawings, and more particularly to FIG. 1, a viscous fluid dispenser generally indicated by 20 includes a dispenser housing 22 whose operation is controlled by a valved air pumping arrangement 24 and a viscous fluid pumping arrangement 26. Referring additionally now to FIGS. 2 through 4, dispenser housing 22 includes a top plate member 28 secured to spaced side members 30 by suitable recessed bolts 32. The inboard elongated sides of members 30 taper inwardly, symmetrically about the longitudinal centerline of housing 22, and define the side walls of an elongated cavity 34 that has a trapezoidal cross section. The inboard upper sides of a pair of lower plate members 36 define the lower wall of cavity 34 and are spaced from each other to provide an elongated dispensing opening or slot 38 that communicates the lower side of cavity 34 with the environment adjacent the lower side of dispenser housing 22. Suitable recessed bolts, not shown, secure the plate members 36 to the respective side members 30 with the outboard edge portions of a pumping diaphragm 40 secured therebetween. A pair of end members 42 are secured to the ends of lower plate members 36 by recessed bolts 44 and include generally trapezoidal upper portions 46. The upper portions 46 cooperate with side members 30 and top plate member 28 to clamp the ends of pumping diaphragm 40 such that the pumping diaphragm assumes a generally saddle-like configuration within the cavity 34 while dividing the cavity into a pumping chamber 48 and a viscous fluid chamber 50. As seen in FIGS. 4 through 7, the left hand lower plate member 36 includes an elongated groove 52 that receives a tubular control diaphragm 54 which defines a control chamber 56. An elongated sealing diaphragm 58, whose upper and lower ends are adhesively bonded to the upper and lower sides of the left hand lower plate member 36, en-

gages the right hand lower plate member 36, as in FIGS. 4 and 7, when a fluid pressure is supplied to the control chamber 56. When the control chamber 56 is vented to atmosphere, the control diaphragm 54 has an elongated dimple that allows the sealing diaphragm 58 to assume the FIGS. 5 and 6 position in which slot 38 is open and communicates the viscous fluid chamber 50 with the environment adjacent the lower side of dispenser housing 22.

Air pumping arrangement 24 includes a conventional air pump 60 whose output is connected to an actuable valve 62. Valve 62 normally vents pumping chamber 48 to atmosphere and normally supplies the output of pump 60 to a conduit 64 which feeds the control chamber 56 and thus causes the control diaphragm 54 to expand and assume the FIGS. 4 and 7 position in which sealing diaphragm 58 engages the right hand lower plate member 36 closing slot 38. Actuation of valve 62 terminates the supply of fluid pressure to conduit 64, vents the control chamber 56 to atmosphere allowing slot 38 to open, and transfers the output of air pump 60 to a conduit 66 that feeds the pumping chamber 48 to dispense a viscous fluid as will be described.

Viscous fluid pumping arrangement 26 includes a viscous fluid reservoir 68 holding a viscous fluid 70. A viscous fluid pump 72 pumps the viscous fluid 70 out of the reservoir 68 and supplies a conduit 74 which feeds the viscous fluid chamber 50 when an inlet control valve 76 is open. A control conduit 78 that is connected to conduit 66 closes control valve 76 when air pumping arrangement 24 supplies fluid pressure to pumping chamber 48. The viscous fluid 70 leaves the viscous fluid chamber 50 through a return conduit 80 to return to the viscous fluid reservoir 68. An outlet control valve 82 in conduit 80 is normally open but is closed by a control conduit 84 when the air pumping arrangement 24 supplies a fluid pressure to the pumping chamber 48.

It is thus apparent that when the air pumping arrangement 24 supplies a fluid pressure to the control chamber 56, the slot 38 is closed and the viscous fluid pumping arrangement 26 circulates the viscous fluid 70 through the viscous fluid chamber 50, as in FIG. 4, between the open control valves 76 and 82 and prevents clogging of the viscous fluid 70 within the viscous fluid chamber. Actuation of the valve 62 transfers the output of air pump 60 to conduit 66 and thus supplies fluid pressure to the pumping chamber 48. This causes the control valves 76 and 82 to close and to isolate a quantity of the viscous fluid 70 within the viscous fluid chamber 50 while the control chamber 56 is vented to atmosphere to thus open the slot 38 as in FIG. 5. The fluid pressure in the pumping chamber 48 causes the pumping diaphragm 40 to deflect and move downwardly, as in FIG. 6, to force a predetermined amount of the quantity of isolated viscous fluid 70 out of the pumping chamber 50 through the slot 38. The amount of viscous fluid 70 that is forced out of the viscous fluid chamber 50 is a function of the rate of deflection of pumping diaphragm 40 in response to a pressure differential in pumping chamber 48 and of the pressure differential between the pumping chamber 48 before and after the actuation of valve 62. When the dispensing of the predetermined amount of viscous

fluid 70 is completed, the valve 62 is deactuated and the fluid pressure of air pump 60 is returned to conduit 64 to thus close the slot 38 and allow the viscous fluid pumping arrangement 26 to again circulate viscous fluid 70 through the viscous fluid chamber 50, FIG. 7.

The viscous fluid dispenser 20 thus allows dispensing of a predetermined amount of viscous fluid and circulates the viscous fluid through the viscous fluid chamber to prevent internal clogging within the dispenser housing.

FIG. 8 shows another embodiment of the dispenser housing generally indicated at 88 adjacent a workpiece 90 supported by a fixture 92. Dispenser housing 88 is connected to pumping arrangements 24 and 26 in the same way dispenser housing 22 is connected to the pumping arrangements and, as such, the similar portions are shown with like primed numerals. As seen in FIG. 9, the housing 88 includes an angle member 94 to which is welded or otherwise suitably secured first and second tubular members 96 and 98 that have a generally figure eight-like cross section. Tubular member 96 receives a tubular pumping diaphragm 40' that normally assumes the FIG. 9 kidney-like position and divides the enclosed portion of tubular member 96 into a pumping chamber 48' and a viscous fluid chamber 50'. The viscous fluid chamber 50' is communicated with the enclosed portion of the tubular member 98 by an elongated dispensing opening or slot 100 in the tubular members at their central elongated junction. An elongated tubular control diaphragm 54' is received within the tubular member 98 and closes the slot 100 when fluid pressure is supplied to the conduit 64', that feeds the control chamber 56', by the valved air pumping arrangement 24.

Upon actuation of the valve 62 of pumping arrangement 24, fluid pressure supplied to the conduit 66' feeds the pumping chamber 48' and also closes control valves in the conduit 74' and the return conduit, not shown, to terminate the circulation of viscous fluid 70' through the viscous fluid chamber 50'. The fluid pressure supplied to the pumping chamber 48' then deflects the pumping diaphragm 40' and forces the viscous fluid 70' through the slot 100 as in FIG. 10 and to the environment through a dispensing slot 102 in tubular member 98. When all of the viscous fluid 70' has been forced out of the viscous fluid chamber 50', as in FIG. 11, deactuation of the valve 62 causes the control diaphragm 54' to force any viscous fluid within the tubular member 98 downwardly through slot 102 and onto the workpiece 90 as in FIG. 12. A time delay control valve, not shown, in line 66' momentarily maintains pressure within the pumping chamber 48' such that the pumping diaphragm 40' is momentarily maintained in its FIG. 11 inflated position upon the deactuation of valve 62. This prevents any of the viscous fluid 70' from being forced back through the slot 100 into the viscous fluid chamber 50'. After the control diaphragm 54' has reached the FIG. 12 inflated position, the pressure in pumping chamber 48' decreases, the pumping diaphragm 40' moves to its kidney-like deflated position, and viscous fluid again begins to circulate through the viscous fluid chamber 50'. When the dispenser housing 88 is subsequently moved away from the workpiece 90, as in FIG. 13, the viscous fluid 70' remains on the workpiece 90.

The invention thus provides a viscous fluid dispenser in which possible clogging of the viscous fluid within the dispenser housing is minimized.

What is claimed is:

1. A viscous fluid dispenser comprising, a housing including a control chamber and a cavity, a first diaphragm dividing the cavity into a pumping chamber and a viscous fluid chamber, inlet means and first and second outlet means for the viscous fluid chamber, a second diaphragm for closing the first outlet means of the viscous fluid chamber when fluid pressure is supplied to the control chamber, a first pumping means for circulating a viscous fluid through the viscous fluid chamber when the first outlet means thereof is closed, a second pumping means for supplying a fluid pressure to

the control chamber to thus close the first outlet means of the viscous fluid chamber, the second pumping means being actuatable to terminate the supply of fluid pressure to the control chamber and to subsequently supply a fluid pressure to the pumping chamber, the fluid pressure in the pumping chamber deflecting the first diaphragm and forcing a predetermined amount of viscous fluid out of the viscous fluid chamber through the first outlet means thereof to thereby dispense the predetermined amount of viscous fluid, and valve means for closing the inlet means and second outlet means of the viscous fluid chamber upon actuation of the second pumping means.

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