July 25, 1967 R. A. SPENCER ETAL 3,332,580

FLUID APPLICATOR VALVE

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FIG. 1.

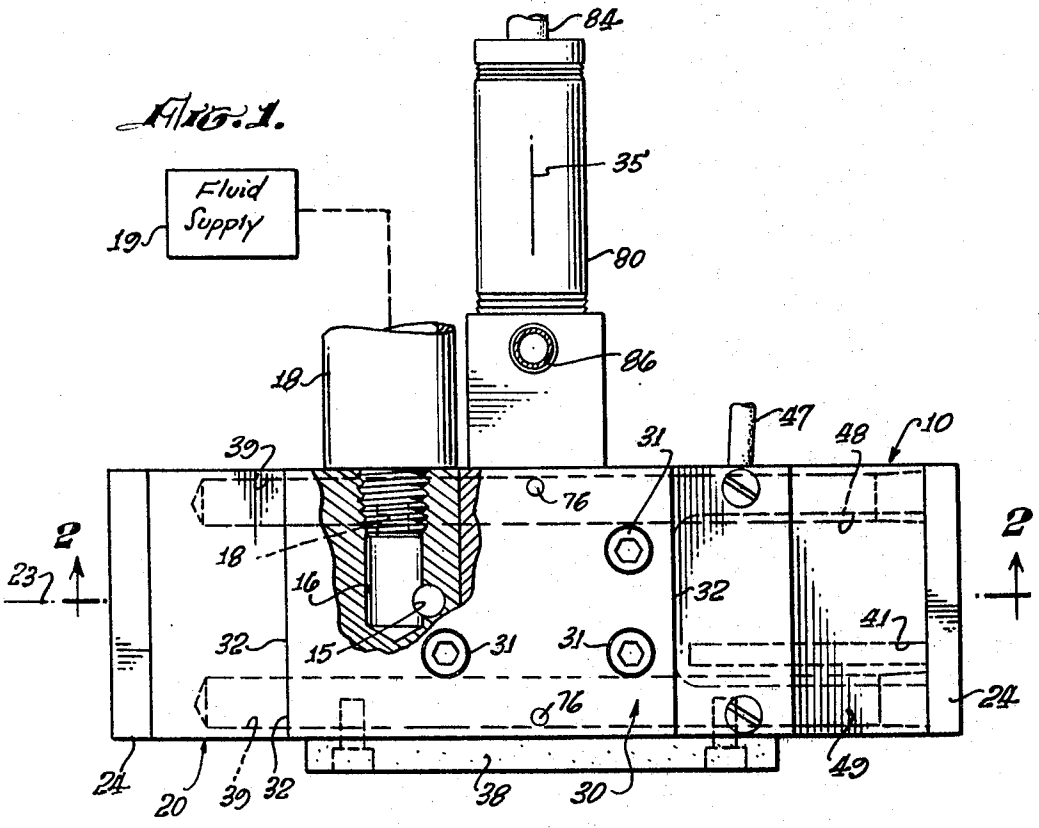
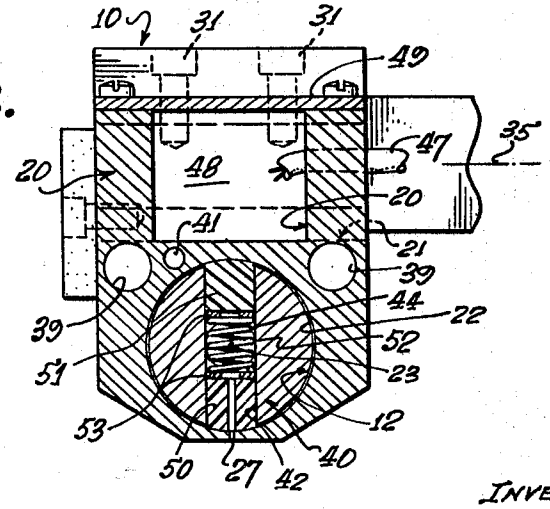


FIG. 3.



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FIG. 2.

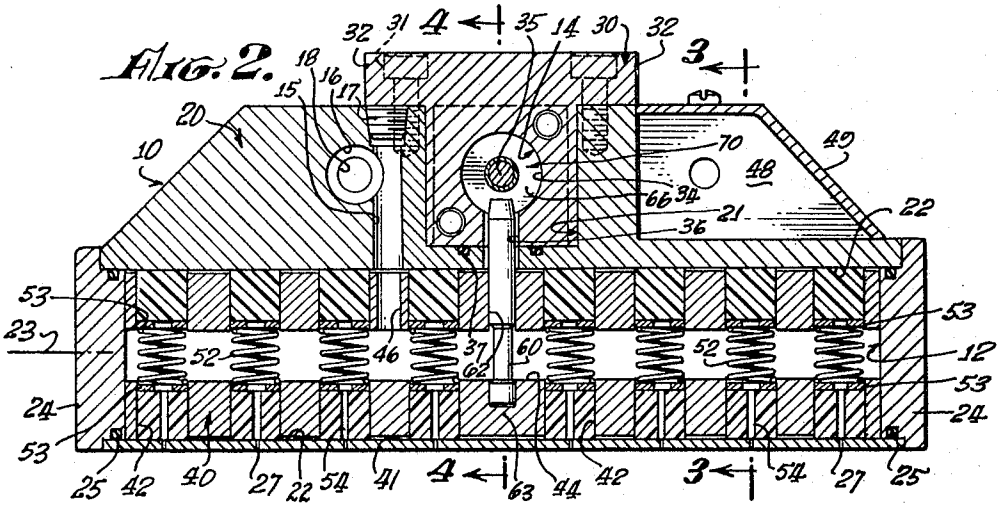


FIG. 6.

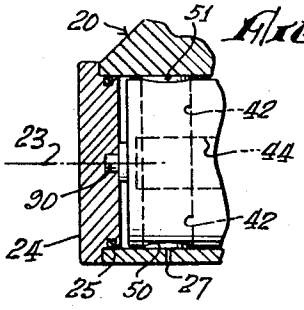


FIG. 5.

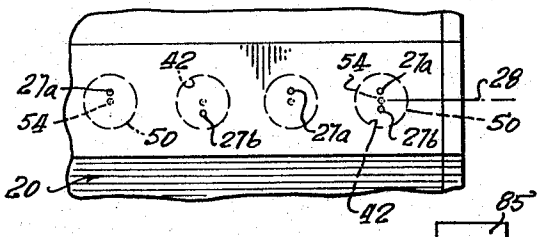
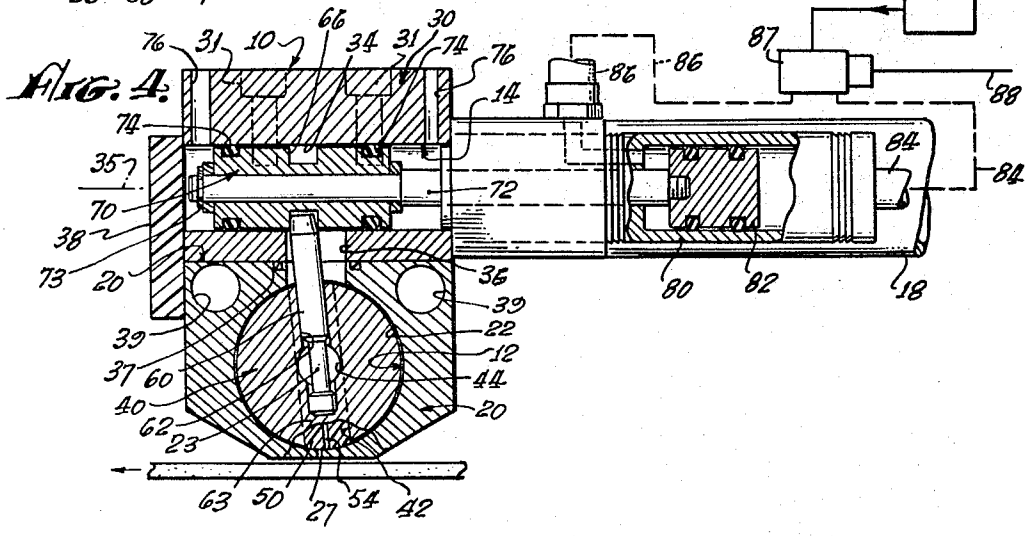


FIG. 4.



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FIG. 7.

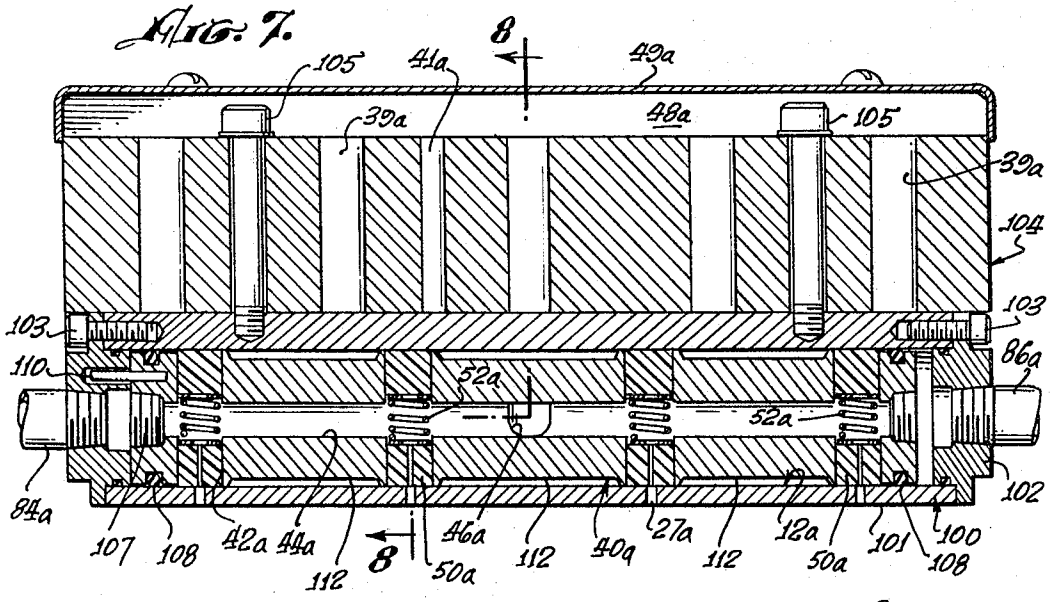


FIG. 8.

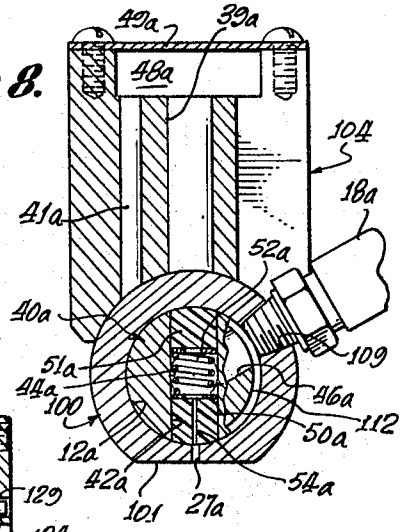
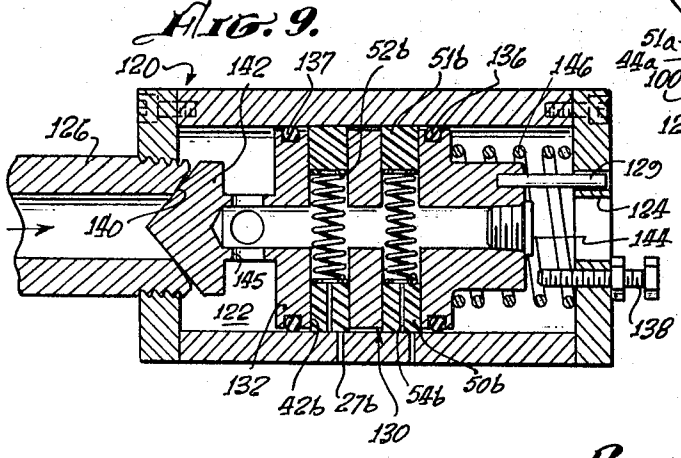


FIG. 9.



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FLUID APPLICATOR VALVE

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Filed Sept. 20, 1965, Ser. No. 488,377
16 Claims. (Cl. 222—146)

This invention provides valve structures that are particularly well adapted for dispensing relatively viscous fluid materials, and for the rapid and precise control of valve cycling between open and closed conditions.

The invention is particularly useful for such purposes as the application of hot melt adhesive to a work surface. For example, a fiber board carton blank that is to be formed into a box is typically folded and is then moved by a conveyer past one or more applicator heads which apply fluid adhesive in a predetermined pattern to the flap surfaces that are to be pasted. Such a pattern may comprise a two-dimensional array of dots or short lines. Maximum economy and reliability often require that the individual elements of such a pattern by uniformly and accurately defined, both as to the length of each element and the spacing between elements. When the pattern is defined by valve operation near the dispensing nozzle, the valve must be cycled rapidly and precisely. With conventional valve structures, such rapid and precise cycling is rendered difficult or impossible by the highly viscous nature of the adhesive material. Moreover, conventional valves that do not require a large operating force tend to leak under the high fluid pressures that are needed to produce sharp pattern elements.

The present invention provides a valve structure capable of handling fluids at pressures of the order of several hundred pounds per square inch with reliable, leak-free shut-off. Moreover, the valves of the invention typically require remarkably light operating force, even when handling highly viscous fluids. Further important advantages of the valve structures of the invention are relatively small inertia of the moving parts and the fact that only relatively small movements of the valve element are required to shift from full open to full closed position, greatly facilitating rapid and precise cycling.

A further important aspect of the invention is the provision of a unitary valve structure capable of controlling in desired coordination a plurality of mutually spaced dispensing orifices. For the described purpose of applying fluid in a predetermined pattern to a relatively moving work surface, such orifices typically comprise dispensing nozzles spaced transversely of the path of the work surface and operated typically in unison.

The valve structures of the invention are useful also in a wide variety of other applications for which the herein described properties are necessary or desirable.

A full understanding of the invention and of its further objects and advantages will be had from the following description of certain illustrative manners in which it may be carried out. The particulars of that description, and of the accompanying drawings which form a part of it, are intended only as illustration and not as a limitation upon the scope of the invention, which is defined in the appended claims.

In the drawings:

FIG. 1 is a plan representing an illustrative rotary valve structure in accordance with the invention, in position to dispense a fluid downwardly;

FIG. 2 is a section on the line 2—2 of FIG. 1, showing the valve member in open position;

FIG. 3 is a section on the line 3—3 of FIG. 2;

FIG. 4 is a section on the line 4—4 of FIG. 2, but showing the valve member in closed position;

FIG. 5 is a fragmentary bottom view, representing a modification;

FIG. 6 is a fragmentary section corresponding to a portion of FIG. 2, but representing a further modification;

FIG. 7 is an axial section representing an illustrative translational valve structure in accordance with the invention;

FIG. 8 is a section on the line 8—8 of FIG. 7; and

FIG. 9 is an axial section representing a further embodiment of the invention.

As illustratively shown in FIGS. 1 to 4, the present valve structure comprises a valve housing **10** defining a cylindrical valve chamber **12** and an actuator chamber **14**. The valve structure will be described with reference to the typical orientation in which it is shown, but without implying any limitaton to such orientation. The housing comprises the elongated main block **20** and the actuator block **30**. The actuator block is set into a transverse channel **21** of rectangular section cut in the upper central portion of the main block, and is secured by the screws **31** through the side flanges **32** of the actuator block. Valve chamber **12** is formed by a longitudinal through bore in the main block with cylindrical side wall **22** and axis **23**. The chamber ends are closed by the caps **24** with the suitable sealing means, indicated as the O-rings **25**. Actuator chamber **14** is formed by the cylindrical through bore **34** in the actuator block with axis **35**. That bore is transverse with respect to valve chamber **12** and is offset radially therefrom. The two chambers are connected by an open passage **36** which is radial with respect to both chambers and is formed by alined openings in both blocks. Passage **36** is of generally oval cross section, elongated in the direction of the axis of actuator chamber **34**. That passage is sealed against leakage along the interface between the two blocks by the O-ring **37**, which surrounds the passage and is received in a groove in one of the blocks.

A mounting plate for the housing is indicated at **38**. When the valve is to be used for hot melt materials such as adhesives, for example, electrical heaters are preferably inserted in bores on the main block, as indicated at **39**, and a thermostatic element may be similarly mounted at **41**. Electrical power for operation of the heaters is supplied via the cable indicated at **47**. Wiring connections may be made in a chamber **48** at one end of the main block and closed by a cover plate **49**.

A fluid inlet to the interior of valve chamber **12** is provided through the wall of main block **20**, as by the two connecting bores **15** and **16**. Bore **15** is radial with respect to the chamber, with its outer end closed by the plug **17**, normally covered by flange **32** of the actuator block. Bore **16** is parallel to actuator chamber **14**, and is threaded to receive a tubular fitting of any desired type for connection of a fluid inlet conduit **18**. That conduit may be heated in any conventional manner, to maintain hot melt adhesive or the like in fluid condition. The fluid to be dispensed by the valve is supplied under suitable pressure to conduit **18** from apparatus which may be of conventional design and is indicated schematically at **19** in FIG. 1. Fluid entering valve chamber **12** has access also to actuator chamber **14** via passage **36**.

The present valve housing is provided with a plurality of outlet orifices **27**, which may function directly as applicator nozzles for applying fluid to a work surface. Alternatively, each orifice **27** may communicate with a conduit of any desired type. As shown, the outlet orifices extend from chamber **12** through the relatively thin bottom wall of main block **20**. The orifices may be arranged in a wide variety of patterns, the valve member being designed accordingly. In the present structure orifices **27** are mutually spaced in a straight line parallel to the axis of valve chamber **12**. Although shown all of the same diameter, orifices **27** may differ in size if desired.

The valve member **40** is a generally cylindrical body of such length as to fit freely between chamber end plates **24**, which then define its axial position in the valve chamber. The valve body is typically generally cylindrical, but its diameter is preferably appreciably less than that of chamber **12**, and both its side and end faces may be relieved, in order to reduce viscous drag when rotated in the presence of a fluid of high viscosity. The diametral clearance **41** is somewhat exaggerated in FIG. 2 for clarity of illustration. Valve member **40** is provided with a plurality of axially spaced transverse through bores **42**, which are axially alined with the respective outlet orifices **27** and lie in a common axial plane, which is the plane of the paper in FIG. 2. Cross bores **42** are interconnected with each other by the axial bore **44**. As shown, that bore is open at both ends of the valve member, communicating with the portion of the valve chamber that is exterior of the valve member. However, one or both ends of bore **44** may be closed, if preferred, as illustrated in FIG. 6. Fluid from inlet passage **15** is admitted to the interior of the valve member, that is, to bore **44**, by the radial passage **46**, which is typically sufficiently large in section in the circumferential direction to connect with passage **15** throughout the range of valve body rotation.

Each of the transverse bores **42** of valve member **40** is provided with two shoes **50** and **51** which are of such size as to slide freely in their respective bores. Spring means, shown as the coaxial helical springs **52**, yieldingly urge the shoes of each pair in opposite direction into abutting relation with the cylindrical wall **22** of the valve chamber. One shoe **50** of each pair performs a valving function and engages the chamber wall at an outlet orifice. That shoe is provided with a passage **54**, typically coaxial, that opens at one end through the radially outer face of the shoe and that communicates at its other end with the interior of axial bore **44**. The radially outer faces of shoes **50** are of cylindrical form with a radius adapted to fit closely in sealing relation the cylindrical chamber wall. By virtue of that sealing fit, fluid flow is permitted from the interior of chamber **12** through each outlet orifice **27** whenever that orifice is alined with the shoe passage **54**, as in FIGS. 2 and 3; and such flow is positively cut off when rotation of the valve member shifts shoe passage **54** out of alignment with the outlet orifice and brings the working face of the shoe into sealing relation over the orifice, as in FIG. 4. The shoes **51** at the opposite ends of the respective cross bores **42** may be identical with shoes **50**, but are shown without passages **54**, and their outer end faces do not necessarily fit the curve of the chamber wall accurately.

The valving shoes **50** and the pressure shoes **51** are preferably formed, at least as to their working faces, of a material that is softer than that of the cylindrical wall of chamber **12**. Any lack of precision in the initial fit of the valving shoes against that wall then tends to be corrected as the valve is broken in, and continuing wear only improves such fit without significantly affecting the cylinder wall. A particularly effective material for the shoes has been found to be a polymerized resin material such as tetrafluoroethylene, which is available commercially under the trade name Teflon. Such material may be glass impregnated. A particularly suitable form of Teflon is that sold for use as bearings under the trade name Rulon. A metal washer **53** may be inserted as a spring seat between spring **52** and each of the shoes. Separate springs may be provided for each shoe, acting between the shoe and an axial shoulder formed in bore **42**. However, use of a single spring or spring assembly acting directly between the two shoes is simpler and has the advantage of insuring uniform force on both shoes.

Valve member **40** in the present embodiment is rotationally oscillated between its valve-opening and valve-closing positions by mechanism now to be illustratively described. An actuating pin **60** is freely received in the radial bore **62** in valve body **40**, and extends through passage **36** in spaced relation to the passage walls into actuator chamber **14**. Bore **62** typically extends across axial bore **44** but terminates within the valve body in an end wall **63**, which thus defines the axial pin position in a downward direction. The upper end of pin **60** is freely received in the peripheral channel **66** in the actuator spool **70**, limiting upward movement of the pin. Spool **70** is a generally cylindrical body movable axially of actuator chamber **14** in the manner of a piston. That movement is driven via the control rod **72**, the end of which is received in an axial bore in spool **70** and retained by a spring clip **73** or similar means. The spool and rod are thus fixedly related with respect to axial movement, but are preferably relatively rotatable about their respective axes.

Two moving seals are provided, extending between spool **70** and actuator block **30** on opposite sides of passage **36**. Those seals may comprise any suitable sealing structures that permit the required axial movement of the spool and that support the fluid pressure between them without exerting upon the spool any net axial force in either direction as a result of such pressure. In the present embodiment, the sealing formations for performing those functions comprise the two O-rings **74**, which are received in peripheral channels adjacent the opposite ends of spool **70** and slidingly engage the cylindrical wall of the actuator chamber. Those O-rings restrict the fluid to the small region of the actuator chamber that is outside the spool and between the O-rings. Hence no chamber end walls are required, and control rod **72** does not require any packing gland to prevent leakage of fluid. The sealing elements **74** are subject only to axial movement, which is the type of movement they are best adapted to sustain. Moreover, due to symmetry of the parts, axial spool movement does not cause any change of fluid volume such as might resist rapid movement of the spool. If the ends of the actuator chamber are closed, as is generally preferred to exclude dirt, for example, pressure equalizing vents to the atmosphere are preferably provided on both sides of the spool, as indicated at **76**.

Control rod **72** may be driven by any suitable type of actuator for providing the desired valve operation, typically timed in relation to relative movement of a work surface to be coated. Actuating mechanisms of many types, including mechanical electro-magnetic, hydraulic and pneumatic, are well known. For illustration, a pneumatic cylinder is represented schematically at **80** with driving piston **82**, and air inlet conduits **84** and **86**. Compressed air is supplied to the conduits from a source **85** via a solenoid controlled valve **87** which normally pressurizes conduit **84**, say and exhausts conduit **86** to the atmosphere, driving piston **82** to the left as seen in FIG. 4 to close the valve orifices **27**. Upon energization of solenoid valve **87** via the electrical connection **88**, the conduit connections are reversed, shifting piston **82** to the right to open the valve orifices. Control pulses of electrical voltage are supplied to line **88** in any convenient manner to produce the desired valve operation, for example by means of one or more switches operated mechanically in conventional manner in response to presence of the work surface in front of valve orifices **27**.

Alternatively, control spool **70** may, itself, be employed as driving piston, conduits **84** and **86** being connected to the opposite ends of operating chamber **14**, as at the apertures **76**, and rod **72** being omitted. As can be seen from FIG. 4, only a small range of movement of spool **70** is required for shifting the valve member between open and closed positions in the present embodiment. Abutment means of any suitable type, not explicitly shown, are preferably provided to positively define the limiting valve positions.

Actuating means are well known for shifting an element such as spool **70** selectively among several positions, rather than only two. An example of the utility of such multiple positions is represented in FIG. 5, which shows the valve delivery orifices **27** arranged in two groups **27a**

and **27***b* on opposite sides of the center line **28**. With that orifice arrangement, and with a valve member as already shown and described, the valve orifices are closed when the valve member is in the symmetrical position indicated at **50, 54**. A slight rotation of the valve member to one side of that position opens the orifices of one group while maintaining the shoes **50** in sealing relation over the orifices of the second group. Rotation of the valve member in the opposite direction from closed position opens the orifices of the second group, while keeping the first group closed. Arrangements of that type permit greater variety in the application patterns that can be produced. For example, one group of orifices may contain more apertures than the other, or the apertures of one group may be larger than those of the other. If it is preferred to have all delivery apertures in a common plane, similar results are obtainable by staggered arrangement of the shoes **50** in the valve member, or of the valving passages **54** in those shoes.

An important advantage of the present valve structure is that the valving action is performed at the inner periphery of the generally annular working face of each of the shoes **50**. Uniform contact pressure at those working faces is insured by the springs **52**, and does not require any precise dimensional tolerances. Accurate fit of the active surfaces of the shoes depends upon their form only, and is essentially independent of their linear dimensions, greatly facilitating manufacture and increasing the reliability of valve operation.

A further useful feature of the invention is the fact that the periphery of the valve member itself may be spaced from the cylindrical chamber wall, as already mentioned, and may have any convenient form. That freedom of design may be increased by providing pivot bearings **90** at the ends of the valve member, as shown in FIG. 6, to define its position both axially and radially entirely independently of the valve shoes. Such definition is especially desirable if the shoe diameter is less than about one third of the chamber diameter, and if fluids of high viscosity are to be handled so that a particularly large clearance is desired between the chamber wall and the periphery of the valve member. However, such bearings, if provided, do not require high precision and therefore add little to the cost or maintenance of the valve.

A further embodiment of the invention is represented in FIGS. 7 and 8, wherein similar parts are generally designated by the same numerals as in the previous embodiment, followed by the letter *"a."* In the modified structure, the valve body **40***a* moves axially in translation, and that movement is directly driven by air pressure. The driving spool **70**, coupling arm **60** and related structures of the previous form are omitted. The cylindrical valve chamber **12***a* is formed in a cylindrical member **100** typically flattened on its working face **101** and with end caps **102** secured by the screws **103**. That cylinder is mounted on the heater block **104** by the bolts **105**, with provision for electrical heaters **39***a* and thermostatic element **41***a*. A chamber **48***a* for electrical connections and leads is enclosed by the cover plate **49***a*.

The cylindrical valve member **40***a* is provided with transverse bores **42***a* connected by the axial bore **44***a* and each provided with a working or valve shoe **50***a* and a blank shoe **51***a* urged apart by the spring **52***a*, essentially as previously described. Valve orifices **27***a* are provided in cylinder block **100** in position to be alined with the bores of the respective valve shoes when the valve member is at one end of its travel. The rotational position of the valve member is defined in the present structure by the pin **110**, which is fixed in the valve member and slides freely in a bore in one of the cylinder caps **102**. The axial travel of the valve member is limited by direct contact with the cylinder caps, though adjustable stops may be provided if preferred, as by screws threaded through the caps parallel to the axis. In the present structure the valve member is sealed at both ends, as by the O-rings **108** which are of reciprocating type and the plugs **107** in the bore **44***a*. The pressurized fluid to be dispensed is supplied to the valve bore **44***a* via the radial bore **46***a* and the short radial bore **109** in the cylinder block, into which supply conduit **18***a* is threaded. In the present structure the dispensed fluid is projected as jets that are formed by the respective shoe bores **54***a*, which are appreciably smaller in diameter than the orifices **27***a* in the housing. The valve member diameter nearly equals the cylinder diameter at axial regions adjacent the several transverse bores, but is deeply relieved at **112** between those regions, reducing viscous drag as already described.

Valve member **40***a* may be moved between its open and closed position by means of any desired type, that shown illustratively being pneumatic. Air pressure is supplied selectively to opposite ends of the valve chamber, driving the valve member as a piston in that chamber. Conduits **84***a* and **86***a* for the controlling air pressure are typically connected coaxially at the cylinder caps **102**, corresponding in overall function to conduits **84** and **86**, respectively, of the previous form. Compressed air or other operating fluid may be supplied selectively to those conduits in the manner already described.

It is sometimes more convenient to control the outflow of fluid from an applicator valve by shifting the fluid supply pressure between a relatively high positive feed value and a low cutoff value. A further aspect of the present invention provides a valve that is responsive to such pressure alternations, giving sharp cutoff and complete freedom from leakage during the off periods. The valve opens promptly in response to a surge of supply pressure.

An illustrative valve structure of that type is shown somewhat schematically in FIG. 9. The housing **120** encloses the cylindrical valve chamber **122**, which is open to the atmosphere at **124** at its outer end and is provided with an axial inlet conduit connection **126** at its inner end. The valve member **130** comprises a cylindrical block **132** with two cross bores **134**, each bore having a valve shoe **50***b* and a blank shoe **51***b* urged in opposite directions by a spring **52***b*, in the manner previously described. Valve member **130** is axially movable in the valve chamber between an inner, valve closing position, shown in FIG. 9, and an outer, valve opening position defined by the positive stop screw **138**. The rotational position of the valve member is defined by any suitable device, shown as the pin **129**, which is fixed in the valve member parallel to the axis and offset therefrom and is slidingly received in a hole in the housing end wall. Outlet passages **27***b* are provided in the cylindrical housing wall in such position as to be alined with the bores in the respective valve shoes **50***b* when the valve member is in its outer position.

A live seal, shown as the O-ring **136**, is provided between the valve member and the cylindrical housing wall at least at the outer end of the member. That seal divides chamber **122** into an outer chamber, open to the atmosphere via aperture **124**, and an inner chamber filled with fluid supplied via conduit **126** and to be dispensed through valve orifices **27***b*. An additional seal **137** may be provided if desired at the inner end of the valve member.

In the present structure, an annular valve seat is formed at **140** surrounding the inlet from conduit **126** into the valve chamber, and an auxiliary valve is formed at **142** on the inner end of the valve member **130**, so dimensioned that it sealingly engages valve seat **140** when the valve member is in its inner position as illustrated. The valve seat thus forms a stop abutment for limiting the valve member movement. Access of fluid from chamber **122** to the valve shoes in cross bores **42***b* is insured by the axial bore **143**, closed at its outer end by the plug **144**, and the radial bores **145** in the neck portion of valve formation **142**. It is usually desirable to provide resilient means for urging the valve member toward its valve

closing position, as illustratively represented by the compression spring **146** working between an axially facing shoulder on the valve member and the end wall at the outer end of the chamber.

In operation of the described valve structure, when the supply pressure in conduit **126** is less than atmospheric pressure, or has a low positive value, valve member **130** is moved by atmospheric pressure and by spring **146** to the left as seen in FIG. 9 to the position illustrated, closing valve **142** and also closing the outlet valves at each orifice **27***b*. A pulse of positive pressure in conduit **126** of sufficient magnitude to overcome spring **146** then shifts the valve member to the right, admitting fluid to the valve housing via valve **142** and also opening the applicator valves at orifices **27***b*. A sharp spurt of fluid is thus delivered by each of the latter orifices, which continues until the supply pressure is terminated. Upon return of the supply pressure to its low cutoff value, the valve is promptly closed, and is held closed in idle condition of the system by spring **146**. Since the valve action is very rapid and positive, an accurate spatial pattern of application is readily produced on a moving work surface, corresponding to the time pattern of pressure pulses supplied to the valve.

Auxiliary valve **142** is particularly useful when the cutoff pressure in conduit **126** may become appreciably less than atmospheric pressure, providing positive closure regardless of the strength of springs **52***b* between the shoes. Under that condition atmospheric pressure may provide sufficient force for closing the valve, and spring **146** may then be omitted. However, it is usually preferable to provide some means for holding the valve reliably in closed position during idle condition of the entire system. If the additional reliability of auxiliary valve **142** is not required, that valve structure, including valve seat **140**, may be omitted.

We claim:

1. A valve structure comprising in combination

a valve housing forming a chamber having a cylindrical wall,

a valve member movably mounted in the chamber and having a plurality of transverse bores,

a shoe freely slidable longitudinally of each bore and having a working face adapted to fit the cylindrical chamber wall in sealing relation and having a shoe passage that opens at one end through said working face,

resilient means yieldingly urging the shoe in each bore into abutting engagement with the cylindrical chamber wall,

the valve housing having an inlet passage communicating with the interior of the chamber and with the other ends of said shoe passages,

the valve housing having a plurality of outlet passages opening through the cylindrical chamber wall and being alined with openings in respective shoe faces in a first position of the valve member to open said outlet passages for flow from the inlet passage through the shoe passages, the width of each shoe working face outwardly of the shoe passage exceeding the diameter of the associated outlet passage, so as to provide a sealing overlap for said outlet passage, and said outlet passages being sealingly covered by the respective shoe faces in a second position of the valve member to close said outlet passages,

and means for selectively shifting the valve member between said first and second positions.

2. A valve structure as defined in claim **1**, and wherein

said transverse bores of the valve member are through bores substantially diametrical with respect to the cylindrical wall of the valve housing,

and said resilient means comprise a second shoe in each bore freely slidable longitudinally thereof and adapted to engage the cylindrical housing wall substantially diametrically opposite the wall engagement of the first said shoe, the housing wall being unapertured in the region engaged by each of said second shoes, and spring means yieldingly urging the shoes in each bore radially outward with essentially equal and opposite force.

3. A valve structure as defined in claim **1**, and wherein

said valve member is movable in the valve chamber axially with respect to the cylindrical chamber wall and is provided with two sealing means acting between the valve member and the chamber wall and spaced axially on opposite sides of said bores,

said inlet passage communicates with the chamber between said sealing means,

and said means for shifting the valve member comprise means for selectively supplying an operating fluid at opposite differential pressures to the chamber at its respective ends axially outward of said sealing means to shift the valve member axially between its said positions.

4. A valve structure as defined in claim **1**, and wherein

said valve member is movable in the valve chamber axially with respect to the cylindrical chamber wall and is provided with sealing means acting between the valve member and the chamber wall axially outwardly of said bores, said first position of the valve member being spaced axially outward of said second position,

said inlet passage communicates with the chamber axially inward of that sealing means,

and said means for shifting the valve member comprise means for supplying pressurized fluid to said inlet passage to drive the valve member as a piston to its outer position to open the outlet passages, and means for withdrawing pressure from said inlet passage to cause the valve member to move to its inner position to close the outlet passages.

5. A valve structure as defined in claim **2**, and wherein

the radially outer surface of the valve member adjacent the shoes is spaced from the cylindrical wall of the chamber and the space therebetween communicates freely with said inlet passage in the valve housing, whereby the frictional drag opposing rotational movement of the valve member is produced predominantly at the sliding contact of the shoes and the cylindrical wall of the chamber.

6. A valve structure as defined in claim **2**, and wherein

said resilient means comprise a compressed helical spring coaxial of each bore and exerting equal and opposite forces on the respective shoes therein.

7. A valve structure comprising in combination

a valve housing having a generally cylindrical valve chamber with a plurality of axially spaced outlet passages in the chamber wall and having an actuator chamber laterally offset from the valve chamber and communicating therewith through an opening,

means for supplying a pressurized fluid to the interiors of both said chambers,

a valve member coaxially mounted in the valve chamber for rotational oscillation between a valve opening position in which the outlet passages are accessible to said fluid and a valve closing position in which the outlet passages are isolated from said fluid,

an actuating arm mounted on the valve member and extending radially through the opening into the actuator chamber,

an actuating member engaging the arm in the actuator chamber and reciprocable in a direction transverse of the arm and of the axis of the valve chamber to cause rotary oscillation of the valve member between its said positions,

two fluid sealing means extending between the reciprocable actuating member and the valve housing on opposite sides of the opening between the said chambers, the pressurized fluid being confined be-

tween said sealing means and exerting essentially zero net force on the actuating member longitudinally of said movement thereof,

and means for driving the actuating member in its said translational movement.

8. A valve structure as defined in claim **7**, and wherein said actuator chamber is generally cylindrical with its axis transverse of the cylindrical axis of the valve chamber and laterally offset therefrom,

and the actuating member comprises a generally cylindrical body with three axially spaced peripheral channels, the central channel receiving the radially outer end of said actuating arm and the outer channels being adapted to receive flexible sealing rings that slidingly engage the cylindrical wall of the actuator chamber on axially opposite sides of said opening between the chambers.

9. A valve structure as defined in claim **7**, and wherein said actuating arm is freely rotatable in a radial bore in the valve member,

and said actuating member is freely rotatable about an axis parallel to its said reciprocation and is peripherally channeled coaxially of said rotation to receive the radially outer end of the actuating arm, whereby random rotation of the arm and of the actuating member vary the points of their mutual contact.

10. A valve structure as defined in claim **7**, and wherein the last said means comprise a drive member movable axially of the actuator chamber, and structure coupling the drive member to the actuating member externally of said sealing means.

11. A valve structure as defined in claim **7**, and wherein the last said means comprise two conduit means communicating with the actuator chamber adjacent its respective axial ends externally of said sealing means, and means for supplying pressurized fluid selectively to the conduit means to drive the actuating member as a piston in the actuator chamber.

12. A valve structure as defined in claim **4**, and wherein said inlet passage opens axially into the chamber,

and said valve member carries at its axially inner end a formation adapted to seal the inlet passage in said inner position of the valve member.

13. A valve structure as defined in claim **4**, and including

yielding means normally urging said valve member toward its said inner position.

14. A valve structure as defined in claim **4**, and wherein said chamber is apertured axially outward of said sealing means to admit ambient pressure.

15. A valve structure as defined in claim **4**, and including also second sealing means acting between the periphery

of the valve member and the chamber wall inward of said through bores and outward of said inlet passage,

the valve member having a passage communicating between said chamber inward of said second sealing means and the other ends of said shoe passages.

16. An applicator head for applying hot melt adhesive and the like to a relatively moving work surface, comprising in combination

structure forming a valve chamber having a cylindrical wall with a plurality of axially spaced delivery orifices opening radially outwardly therefrom substantially in a common direction,

means for controllably heating said structure,

a valve member movably mounted in the chamber and having a plurality of transverse bores each of which is alined with a corresponding delivery orifice in a first position of the valve member,

a shoe guided for free longitudinal movement longitudinally movable in each bore and having a centrally apertured end face adapted to sealingly engage the cylindrical wall of the valve chamber, the end face aperture of each shoe communicating with the interior of the chamber and being alined with the corresponding delivery orifice in said first position of the valve member, and the radial width of the end face outwardly of the aperture exceeding the diameter of the delivery orifice, so as to provide a sealing overlap for said delivery orifice.

means yieldingly urging the shoes toward said wall engagement,

means for supplying pressurized hot melt adhesive and the like to the interior of the chamber,

and means for selectively shifting the valve member between said first position, in which hot melt adhesive is delivered simultaneously to all said delivery orifices via the respective shoe bores, and a second position in which the end face of each shoe sealingly covers the corresponding delivery orifice to close the same.

References Cited

UNITED STATES PATENTS

1,790,845	2/1931	Schur	137—625.42 X
2,159,689	5/1939	Farrell	222—485 X
2,272,184	2/1942	Carlson	222—512 X
2,791,353	5/1957	Dorn et al.	222—485 X
2,928,380	3/1960	Kraf	137—625.48 X
2,983,280	5/1961	Maison	137—625.46 X
2,998,223	8/1961	Baxter	251—62 X
3,032,066	5/1962	Smith	251—185 X
3,212,752	10/1965	Kast	251—185 X
3,227,311	1/1966	Rowell	222—504 X

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