

[54] **FLUID DISPENSING SYSTEM**

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[58] Field of Search 118/7, 313, 315, 323, 429,
118/216; 134/94; 222/566

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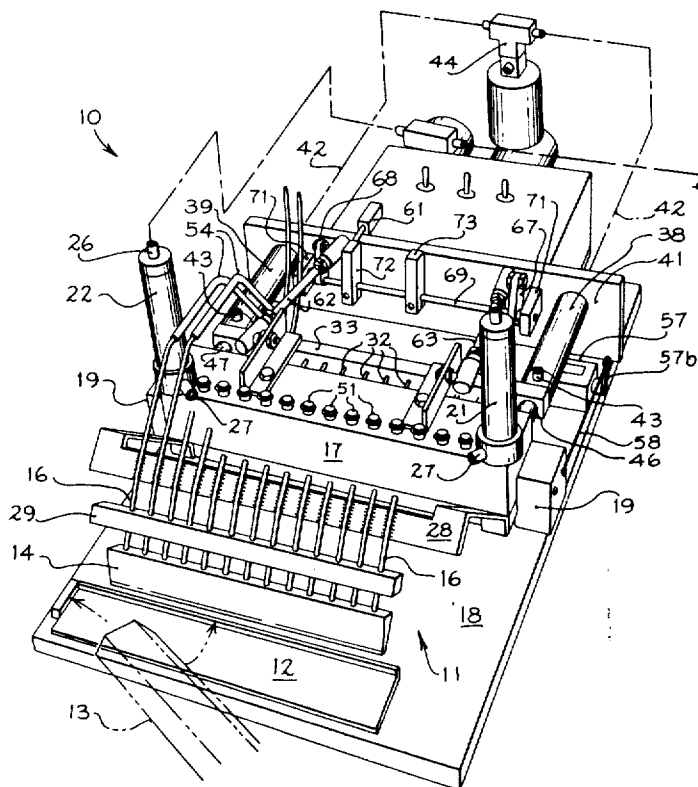
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Albritton & Herbert

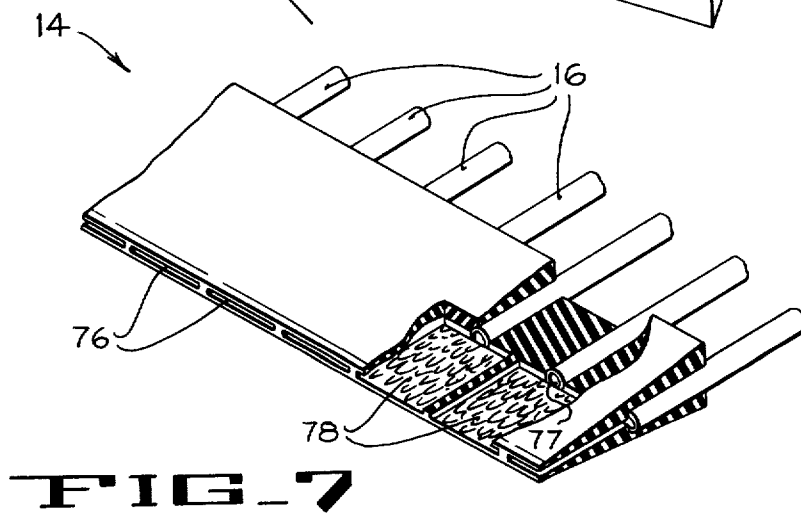
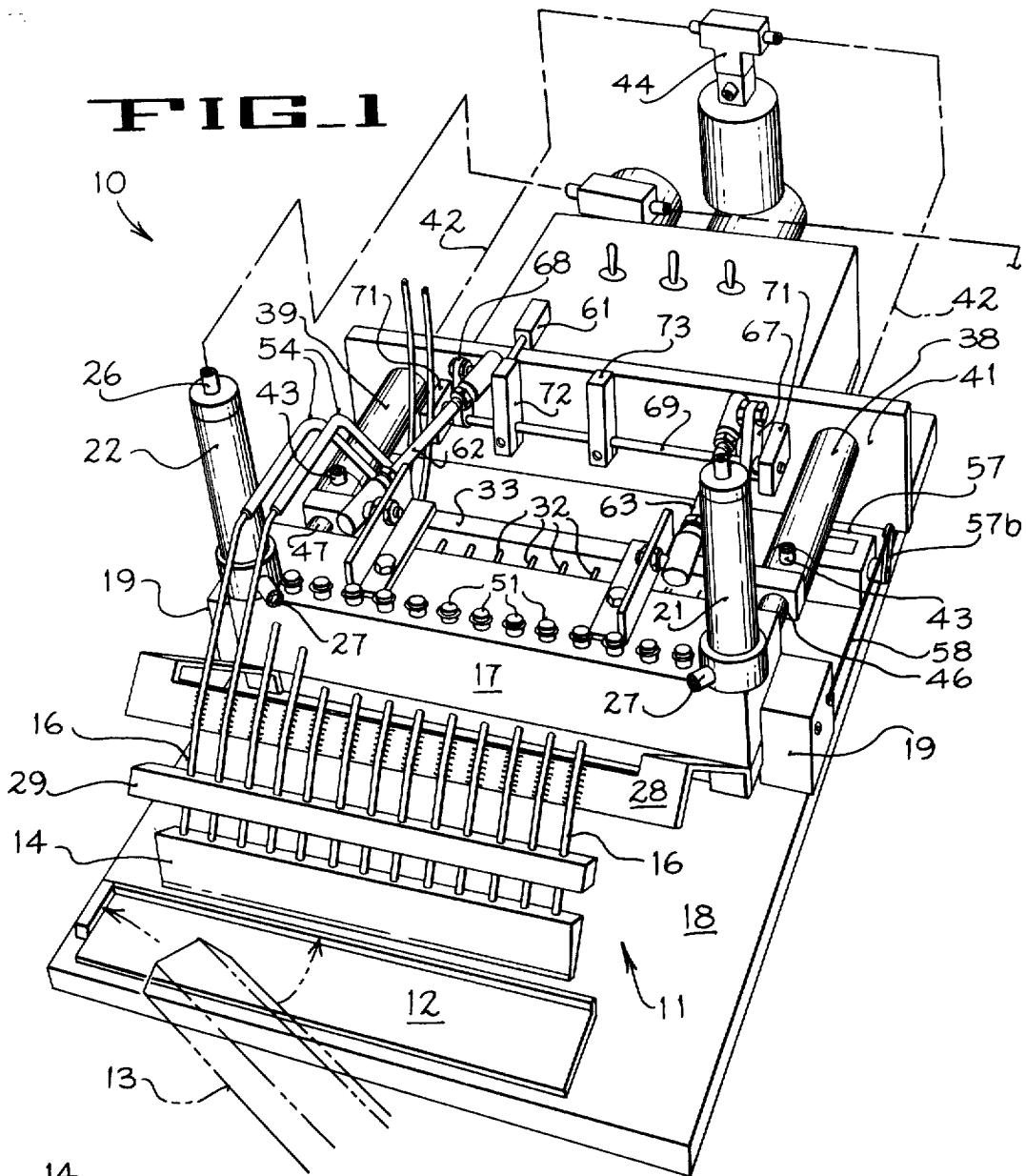
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ABSTRACT

A fluid dispensing system for discharging a predetermined quantity of fluid from a reservoir to an object to be coated, for example, includes a head assembly including a plurality of dispensing nozzles for discharging fluid material to the object to be coated or to otherwise receive the fluid. Feed lines extend from the reservoir to each nozzle and each feed line includes a positive displacement pump means and valve means disposed in the feed lines whereby the valve means are operable in one condition to couple the pump means to withdraw a predetermined volume of fluid from the reservoir as the head assembly is moved to its advanced position. The valve means is also operable in a second condition so as to discharge the predetermined volume of fluid via the nozzle and to the object receiving the fluid during a retracting movement of the head assembly.

6 Claims, 7 Drawing Figures





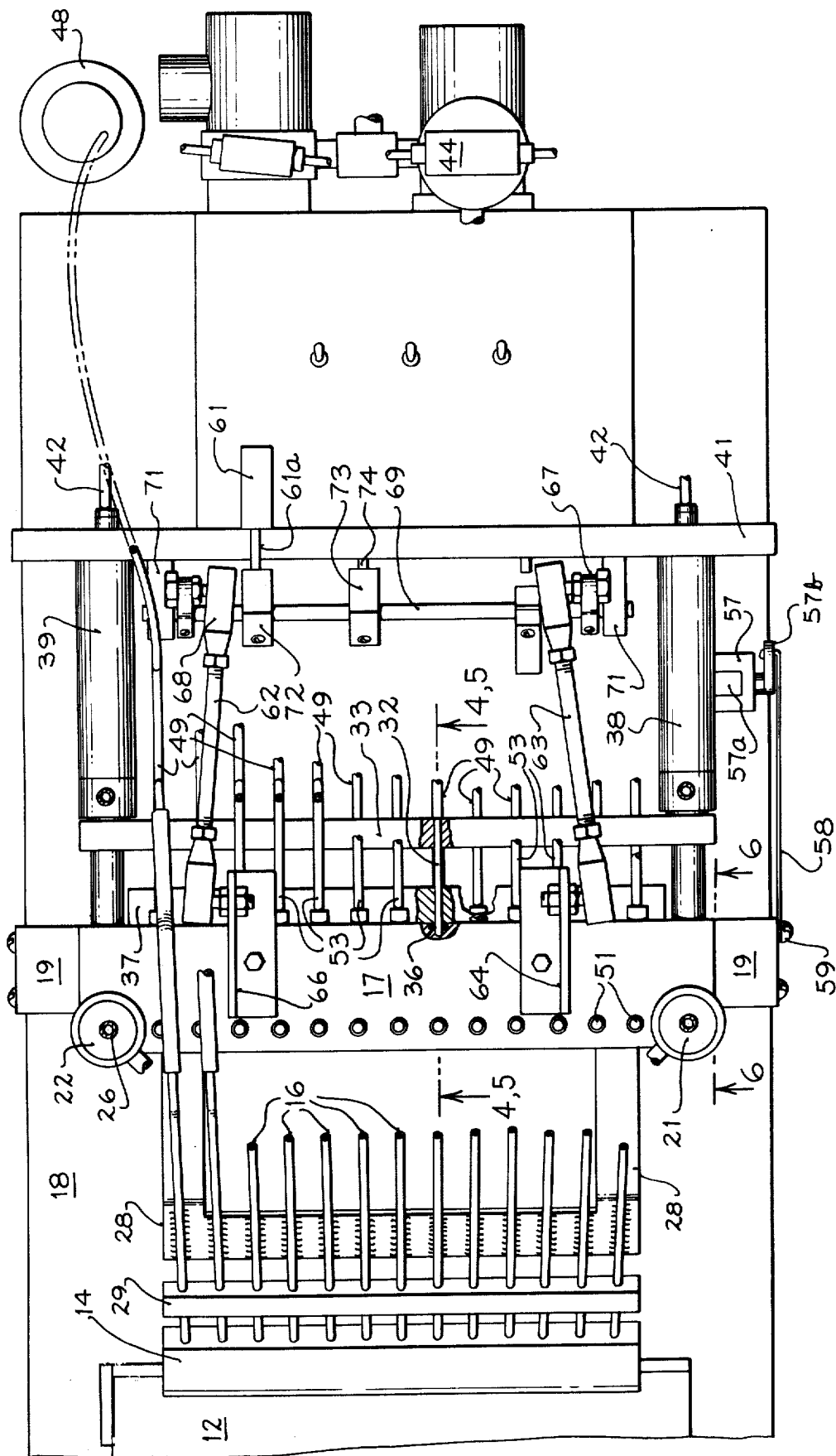


FIG-2

FIG-3

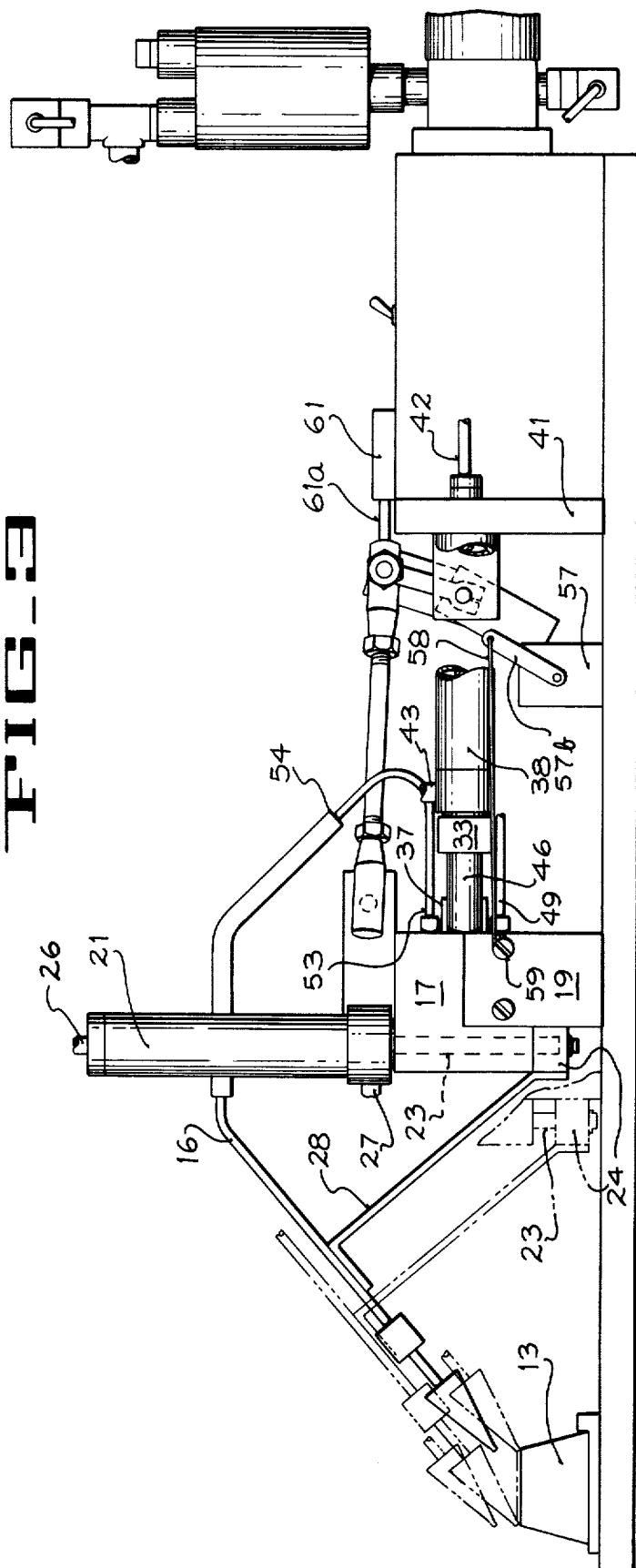


FIG-6

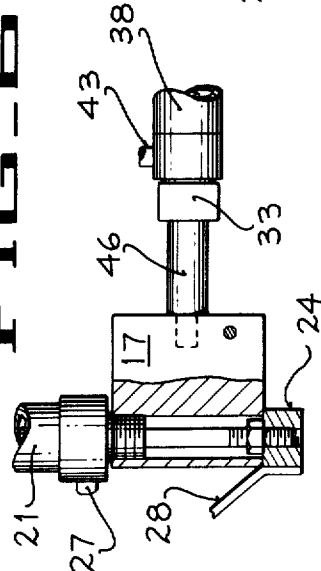


FIG-4

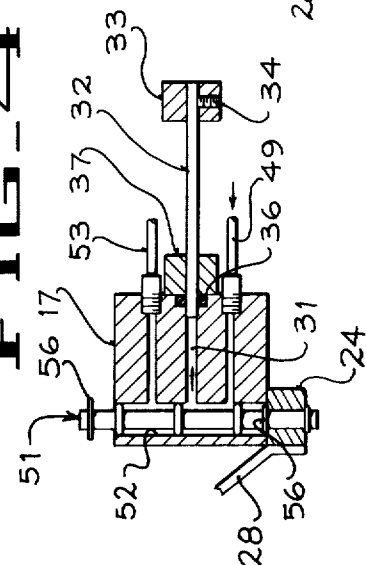
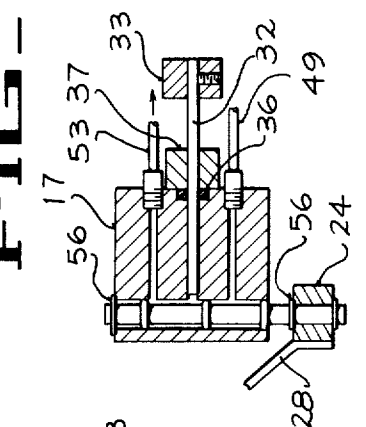


FIG-5



FLUID DISPENSING SYSTEM

BACKGROUND OF THE INVENTION

This invention pertains to fluid dispensing machines and systems and is particularly useful in applying a liquid crystal slurry to products to be coated therewith, such as thermometers of a type having a number of discrete regions each of which is to be coated by a different formulation of liquid crystal slurry whereby each coating will respond to heat and become visible at a different temperature. A suitable thermometer can be made in this manner by applying the different formulations to an acrylic, transparent product and employing a mask formed with associated numeric representations of the temperature response to be had in each given region of the object.

In the past thermometers of the type described have been manufactured using relatively inefficient apparatus whereby a long web is "striped" in parallel lines with the different formulations of liquid crystal slurry material. Ultimately, after preparation, this web is subdivided into short strips corresponding to the width of the web simply by cutting the web transversely into a number of such lengths.

Accordingly, heretofore, it has not been believed feasible or practical to apply a liquid crystal formulation directly upon the object using a dabbing or short stroke technique.

SUMMARY OF THE INVENTION AND OBJECTS

In general, there is provided a fluid dispensing system for discharging a predetermined quantity of fluid from a reservoir thereof to an object receiving the fluid comprising a head assembly including a dispensing nozzle for discharging the fluid material to the object. Means provided for imparting an advancing and retracting movement to the head assembly for dispensing the material in response thereto. A feed line extends from the reservoir to the nozzle. Positive displacement pump means and valve means are disposed in the feed line and the valve means is operable in one condition to couple the pump means to withdraw a predetermined volume of fluid from the reservoir during part of the head assembly's movement and the valve means is further operable in a second condition to discharge the volume via the nozzle to the object during another part of the movement of the head assembly. The foregoing arrangement is repeated a number of times in side-by-side relation so as to be able to coat a plurality of locations if desired. However, the basic concept resides in the original statement contained above.

According to an important aspect of the invention, a nozzle unit includes a plurality of laterally distributed discharge openings coupled to the pumping means. Each of the discharge openings is defined by side, top and bottom bounding surfaces of a compliant material and each opening is supplied with fluid from the pumping means via a flow passage formed through one end wall thereof. The compliance of the unit serves to permit all of the discharge openings to lie uniformly contiguous to the surface of the object receiving the fluid notwithstanding surface or dimensional irregularities of the object. In short, Applicant's applicator head consists of a wedge-shaped member carried on the ends of a number of feed lines for dispatching the liquid crystal slurry directly onto the object to be coated.

In general, it is an object of the present invention to provide an improved means for dispensing fluid and particularly fluid slurry of a type used in liquid crystal applications to objects for receiving such fluid.

It is a further object of the present invention to provide an improved fluid dispensing apparatus involving an improved nozzle unit.

Yet another object of the invention is to provide an improved system wherein valving of the fluid is accomplished in response to the movement of the head assembly so as to ensure that the fluid being dispensed can not be discharged from the pumping means so long as the head assembly is raised out of its dispensing position. Accordingly, the apparatus as disclosed herein as a distinct advantage of being fail-safe in regard to inadvertent loss of fluid and requires limited skill on the part of an operator to employ the equipment.

Yet another object of the invention is to provide a system wherein a precise measured amount of the relatively expensive liquid crystal slurry can be discharged and, in addition, limited by means of a simple adjustment to the bare minimum required.

The foregoing and other objects of the invention will become more evident from the following detailed description of a preferred embodiment when considered in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows in diagrammatic, perspective view with many portions broken away and removed for clarity a fluid dispensing system according to the invention;

FIG. 2 shows in plan view with portions broken away for clarity a fluid dispensing system according to the invention;

FIG. 3 shows a side elevation, diagrammatic view of FIG. 2;

FIGS. 4 and 5 show side elevation section views in enlarged detail taken along the lines 4-4, 5-5 of FIG. 2, FIG. 4 showing a control valve in its raised position and FIG. 5 showing a control valve in its lowered position;

FIG. 6 shows an enlarged detail view with portions broken away for clarity taken along the line 6-6 of FIG. 2;

FIG. 7 shows in enlarged detail a perspective view with portions broken away a dispensing nozzle as shown in FIG. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

A fluid dispensing system 10 comprises, in general, a head assembly 11, a loading platform 12 for receiving a product such as a thermometer body 13 (FIG. 3), and means for moving head assembly 11 between advanced and retracted positions as well as between raised and lowered positions so as to dispose a nozzle unit 14 to pass across and spaced above body 13, then to be lowered into engagement with body 13, then to be retracted so as to apply fluid from the tip of nozzle unit 14 unto the top surface of body 13, and then to be raised again to its starting position.

As will be described further below, the sequence of movements noted above serves to control the supply and exhaust of fluid into and out of each of a number of small cylinders associated with each of the feed lines 16.

A control block 17 is supported in spaced relation from the deck of platform 18 by means of the pair of anti-friction spacer blocks 19 mounted to each end of control block 17 and which ride along the top surface of platform 18.

Head assembly 11 includes support means now to be described for carrying the nozzle unit 14 to move with the movements of block 17 and also to be raised and lowered as now to be described.

Double-acting pistons are contained within the cylinders 21, 22 disposed to extend upwardly from the top surface of block 17. Piston rods 23 extend downwardly from the piston (not shown) contained within each of cylinders 21, 22 and pass through block 17 whereby they may become threadedly engaged (FIG. 6) to a transversely extending support bar 24.

Cylinders 21, 22 are each provided with a pair of flow passages 26, 27 and at opposite ends thereof for operating piston rod 23 between raised and lowered positions.

Support bar 24 carries a feed line support bracket 28 as well as feed lines 16 secured to bracket 28 as, for example, by means of welding. Further, a spacer bar 29 is carried on each of the feed line tubes 16 so as to maintain the spaced relation therebetween and further to provide a certain degree of rigidity to the overall head assembly 11 as it is moved between advanced and retracted and raised and lowered positions.

Control block 17 includes a series of cylindrical chambers of relatively small diameter, such as the chambers 31, or as may be hereinafter referred to as cylinders. Cylinders 31 are all closed at one end by the insertion of a rod-like piston 32 carried by a transversely extending stationary piston mounting bar 33. Bar 33 is provided with set screws 34 whereby the displacement of the inserted end of each piston 32 can be variously adjusted. Means forming a seal or bushing about each of pistons 32 comprises an O-ring 36 encircling piston 32 and retained in an annular groove formed in the rear surface of block 17 by means of the retainer bar 37. Finally, the ends of the piston mounting bar 33 are secured to the ends of cylinders 38, 39 which, in turn, are mounted to extend away from an upright wall 41 mounted upon the deck of platform 18.

Suitable flow passages 42, 43 lead into and out of cylinders 38, 39 so as to provide a double-acting piston function within each of these two cylinders as well. Accordingly, when pressure is applied to cylinder 38 via flow passage 42 from the flow divider 44, the piston rods 46, 47 serve to advance control block 17 forwardly. The foregoing action serves to withdraw each of pistons 32 from their associated cylinders 31 to a predetermined extent, thereby creating a vacuum within these cylinders 31.

Valve means, as now to be described, have been provided whereby during this advancing movement of head assembly 11, fluid from a reservoir 48 is loaded into cylinder 31 via the inlet flow passage 49 provided that head assembly 11 is in its elevated position.

It will be readily evident that, from an examination of FIGS. 1, 4 and 5, for each feed line 16, there has been provided a valve means comprised of a spool valve 51 supported to move within a valve passage 52 in following relation to the movements of a transverse support bar 24.

As arranged in FIGS. 4 and 5, when support bar 24 is in its elevated position, the spool of valve 51 serves to couple flow passage 49 to cylinder 31. On the other

hand, when support bar 24 has been lowered, the spool of valve 51 is shifted so as to couple the discharge flow passage 53 to cylinder 31 whereby retraction of control block 17 serves to cause the stationary pistons 32 to purge their respective cylinders 31 via flow passage 53 coupled to feed lines 16 by the flexible couplings 54.

Finally with respect to FIGS. 4 and 5, retainer rings 56 are carried on the ends of the spool of valve 51. These retainer rings serve to limit the displacement of each of the valve spools.

In addition to the foregoing, means have been provided for counting the number of operations of the apparatus and this is simply provided by use of a mechanical counter 57 having a window 57a in which a count will appear for each complete cycle of operation. Accordingly, it is required that the operating lever 57b swing in one direction and return before advancing a count on the counter 57. Accordingly, a wire cable 58 is coupled to the end of operating arm 57b and also to one of the screws 59 securing spacer block 19 to control block 17.

In addition to the above, various controls can be applied to operate in response to each cycle of operation and, accordingly, microswitches, such as the microswitch 61, can be operated by employing a linkage, such as the linkages 62, 63, whereby one end is fixed such as to one of the two flange elements 64, 66 bolted to move with control block 17. The other end of each of linkages 62, 63 is coupled to a rocker arm 67, 68 secured to rotate with the rotation of a rocker shaft 69. Rocker shaft 69 is supported in the journal blocks 71 and carries armature contactors 72, 73 fixed to shaft 69.

As thus arranged, as control block 17 is driven to its advanced position, the fixed ends of linkages 62, 63 are carried along with block 17 and their trailing ends serve to rotate shaft 69 by connection to rocker arms 67, 68. This action serves to move the armature contactors 72, 73 away from any microswitch armatures, such as the armature 61a or others such as armature 74 aligned with contactor 73.

Finally and with particular reference to FIG. 7, a nozzle unit 14 is carried on the ends of the feed lines 16 and is formed with a plurality of laterally distributed, rectilinear discharge openings 76. Each opening 76 is defined by side, top and bottom bounding surfaces of a compliant material. Each of the openings, in operation, becomes filled with fluid to be dispensed under pressure as such fluid is supplied via the feed lines 16 through a flow passage 77 formed through one end wall of the opening. The opening, bounded by the top, side and bottom surfaces, as noted, contains a deposit 78 of fluid to be dispensed under pressure to evenly coat body 13 to avoid any holidays or interruptions in the covering of fluid being laid down.

The compliance of the material of unit 14 is such that it permits all of the discharge openings 76 to lie uniformly contiguous to the surface of the object being coated or treated, notwithstanding surface or dimensional irregularities of the object. Accordingly, if unit 14 were rigid, it has been observed that serious limitations arise and portions of an object which are not at exactly the same level can remain uncoated. RTV-630 castable silicone rubber has been found quite satisfactory for unit 14.

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From the foregoing, it should be readily evident that there has been provided an improved system for dispensing liquid to an object in controlled amounts.

What is claimed is:

1. In a fluid dispensing system for discharging a predetermined measured quantity of fluid from a reservoir thereof to an object receiving said fluid comprising a head assembly including a dispensing nozzle for discharging said fluid material to the object, means for imparting advancing and retracting movement to said head assembly for dispensing said material, a feed line extending from said reservoir to said nozzle, positive displacement pump means and valve means disposed in said feed line, said valve means being operable in a first condition to couple said pump means to withdraw a predetermined volume of said fluid from said reservoir during part of said movement of said head assembly and operable in a second condition to discharge said volume to said nozzle during another part of said movement of said head assembly.

2. In a fluid dispensing system according to claim 1 wherein advancing movement of said head assembly while said valve means is in its said first condition serves to withdraw said predetermined volume and wherein said retracting movement of said head assembly while said valve means is in its said second condition serves to discharge said volume to said nozzle.

3. In a fluid dispensing system according to claim 1 in which said positive displacement pump means comprises a cylinder member and piston member, said members being movable relative to each other, one of said members being coupled to move with the advancing and retracting movements of said head assembly to define intake and exhaust strokes relative to said cylinder member.

4. In a fluid dispensing system according to claim 1 further comprising means for operating said head assembly between raised and lowered positions relative to said object, a portion of said valve means being coupled to said head assembly to operate said valve means between said first and second conditions, said first condition being effected in response to raising said head assembly and said second condition being effected in response to lowering said head assembly.

5. In a fluid dispensing system for discharging a predetermined quantity of fluid from a reservoir thereof to

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an object receiving said fluid comprising a head assembly including a nozzle for discharging said fluid to said object, said head assembly being movable between advanced and retracted positions, positive displacement pumping means including cylinder means of predetermined displacement, a movable cylinder block containing said cylinder means and movable with said head assembly, piston means within said cylinder means and secured in a stationary position, means for moving said piston and cylinder means relative to each other between advanced and retracted positions for respectively forming a suction and compression within the cylinder means, the last named means serving to move said head assembly and cylinder block, feed line means extending from said reservoir to said nozzle and including therein said pumping means, valve means coupled to move with head assembly and disposed in said feed line means, said valve means being operable in one condition to couple said pumping means to draw a predetermined volume of said fluid from said reservoir and in another condition to couple said pumping means to said nozzle for discharge of said volume of fluid, and means for advancing said head assembly across and spaced from the object while said valve means remains in said one condition and for retracting said head assembly across the object while said valve means remains in said second condition to dispense said volume of fluid material to said object.

6. In a fluid dispensing system according to claim 1 further in which said system comprises a plurality of feed lines and dispensing nozzles, discrete pumping means associated with each said nozzle, and individual valve means associated with each said pumping means, and wherein said plurality of nozzles is formed in a single unit, said unit comprising a plurality of laterally distributed discharge openings coupled to said pumping means, each said opening being defined by side, top and bottom bounding surfaces of a compliant material and supplied with said fluid from said pumping means via a flow passage formed through one end wall thereof, the compliance of said unit serving to permit all of said discharge openings to lie uniformly contiguous to the surface of said object notwithstanding surface or dimensional irregularities thereof.

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