Nov. 12, 1963 W. D. FULLER 3,110,425

FLUID DISPENSING APPARATUS

Filed Jan. 10, 1961 3 Sheets-Sheet 1

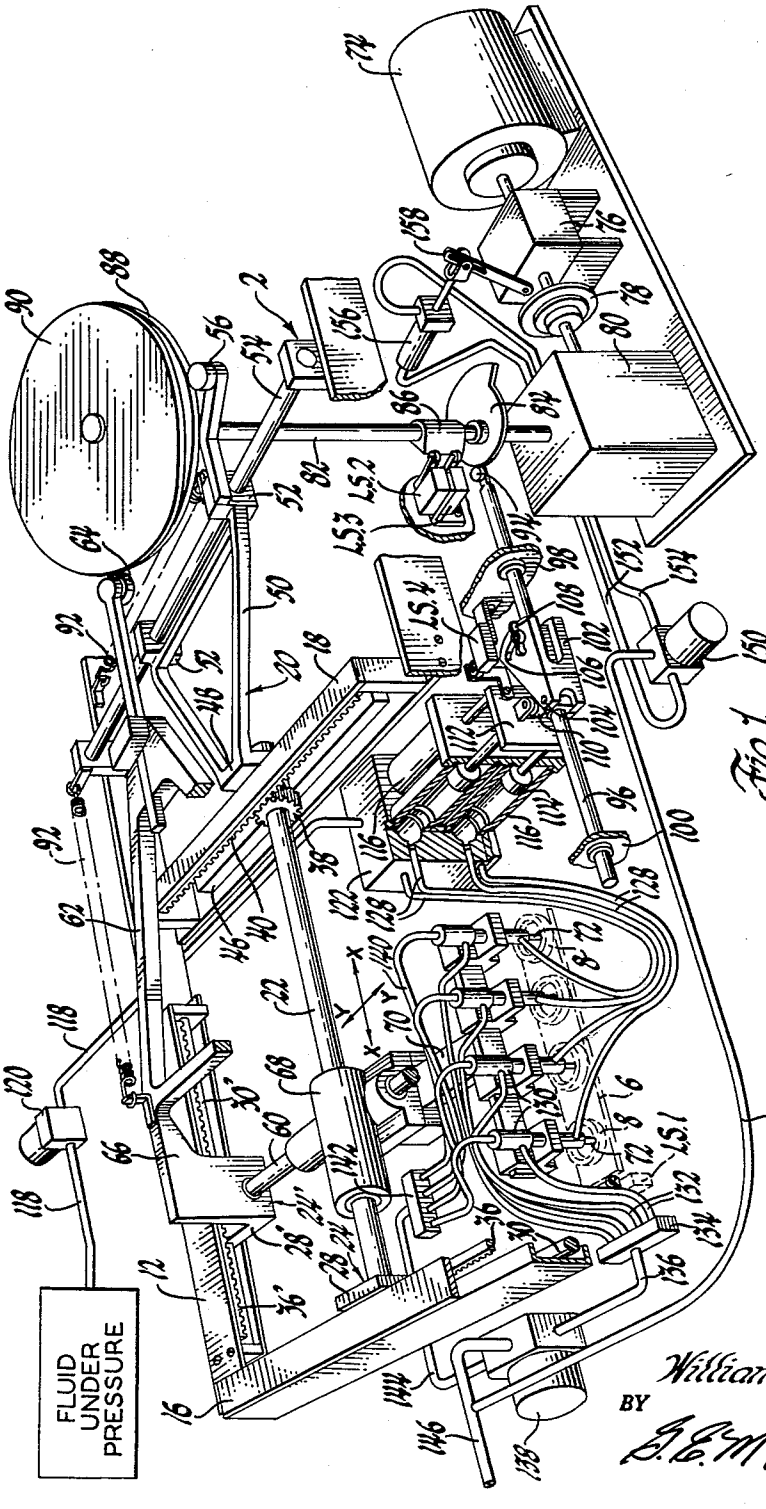


Fig. 1

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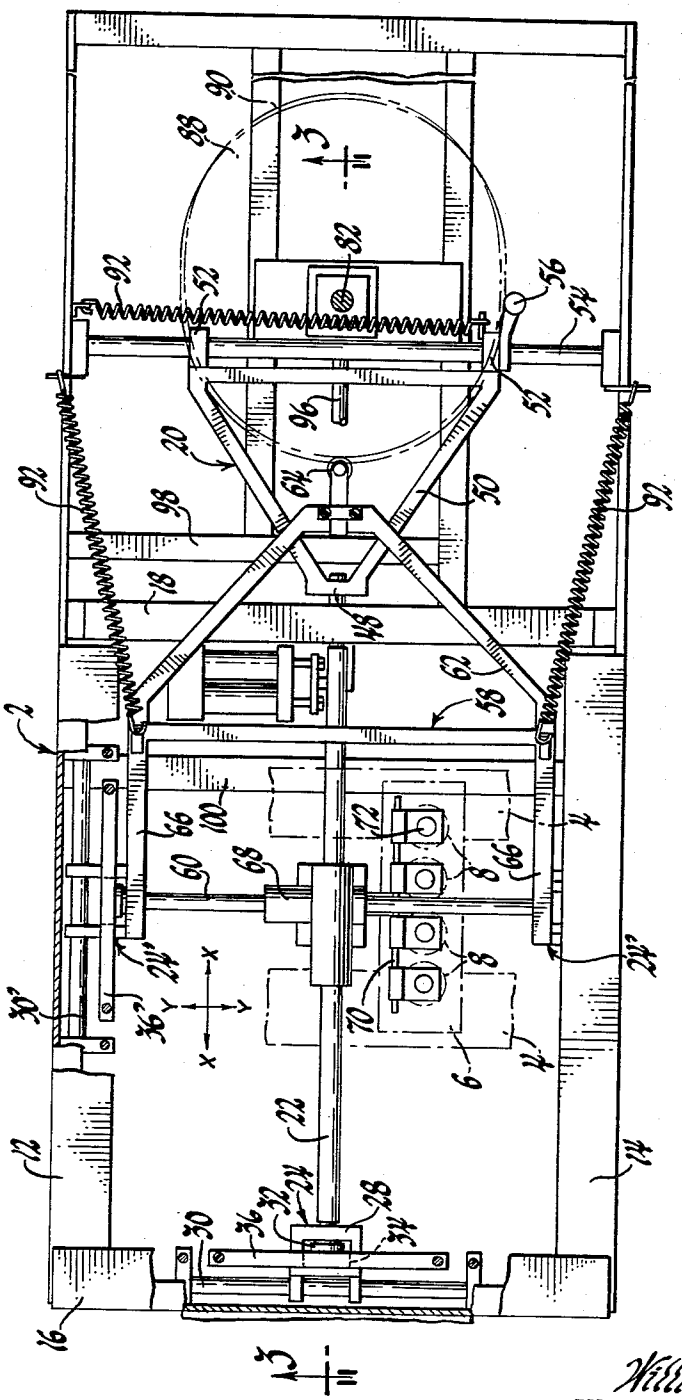


Fig. 2

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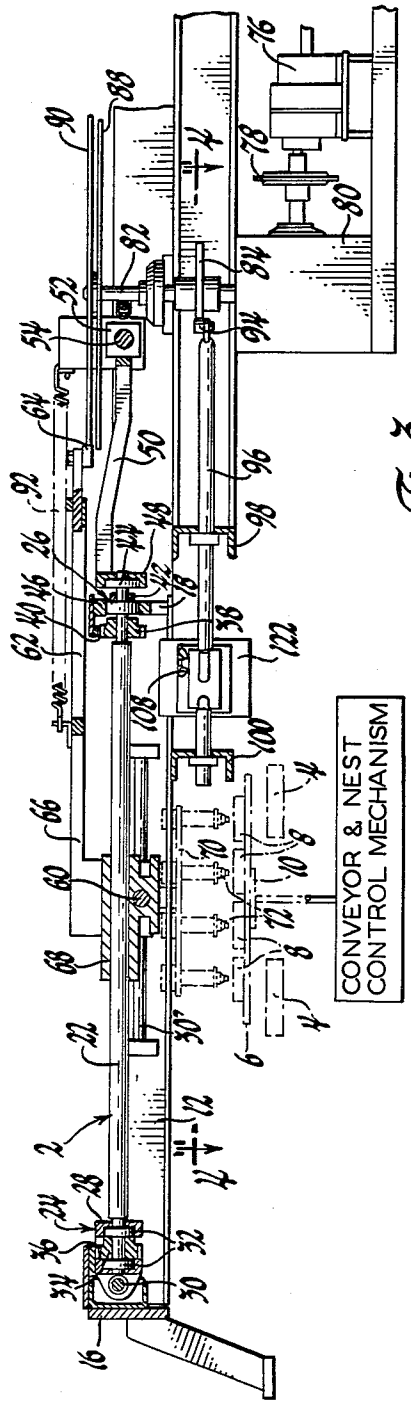


Fig. 3

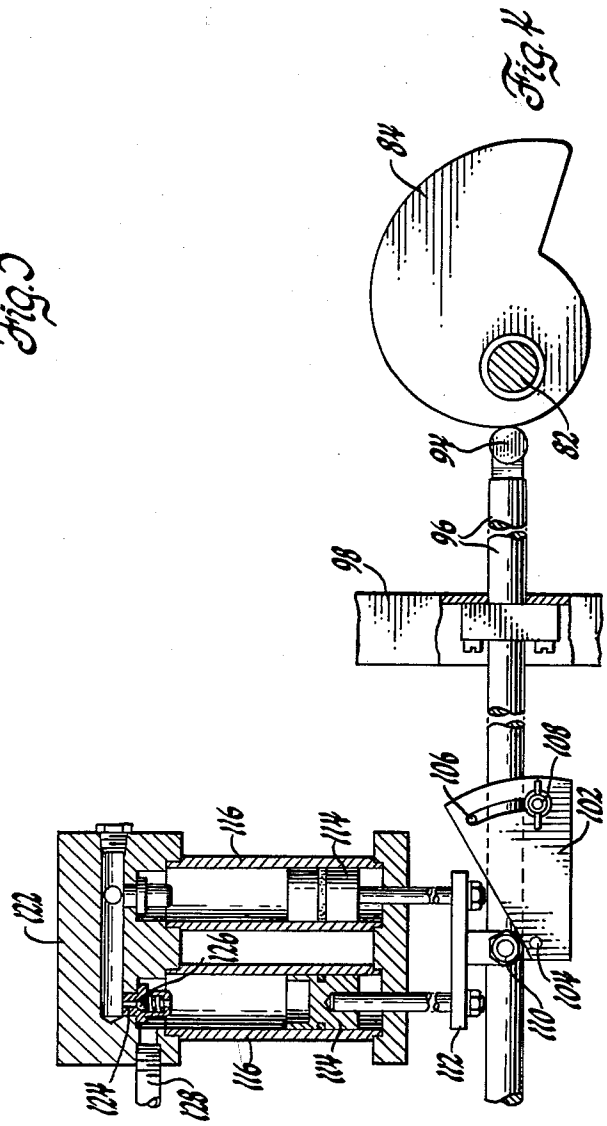


Fig. 4

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3,110,425
FLUID DISPENSING APPARATUS

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3 Claims. (Cl. 222—255)

This invention pertains to an apparatus for dispensing matter or a flowable material from a plurality of nozzles moving in predetermined identical paths and, in particular, to an apparatus for dispensing a liquid from individual nozzles into associated molds during the manufacture of gaskets for lamp lenses, bodies and other articles.

Generally speaking, the present apparatus may be described as being of the type in which a nozzle support head is subjected to at least two control movements having a predetermined relationship whereby the nozzle support head is caused to trace or travel a predetermined path, and in which a plurality of dispensing nozzles are supported on the head and respectively related to a plurality of suitable containers such as molds to provide a definite metered filling of the containers or molds as the nozzle support head travels over its path. As will appear hereinafter, the present invention may be gainfully employed in other environments, but the present apparatus has been particularly designed to solve problems encountered in manufacturing gaskets for lamp bodies and lenses.

In the interest of efficiency and economy, it is quite necessary if not absolutely essential to the mass production of gaskets of this type to utilize an apparatus including dispensing nozzles which will form such gaskets in large numbers simultaneously. Furthermore, the operation of such an apparatus must be susceptible of fine control both from the standpoint of the speed or variation of speed of movement of the apparatus or nozzles and the path of such movement. For example, and referring to the variable speed of movement of the dispensing nozzles, such speed of movement must be such as to fill the gasket mold properly; that is, to insure that the dispensing nozzles move slowly enough to completely fill wider portions of the molds while going fast enough so as not to overfill narrower portions of the molds. From the standpoint of the path of movement of the nozzles, it is equally important that the nozzles accurately trace the pattern of the molds being filled. As another point of significance, it is also important that such apparatus be relatively flexible from the standpoint of being able to manufacture varying sizes and shapes of gaskets; that is, that the apparatus may be readily converted from the manufacture of one size and/or shape of gasket to other gaskets of varying dimensions.

Therefore, it is a principal object and feature of this invention to provide an apparatus for dispensing matter or flowable material comprising a support head carrying means for dispensing the matter into a suitable container or containers, and which support head is subjected to at least two different control movements so as to trace a predetermined path.

It is yet another object and feature of this invention to provide a dispensing apparatus of the type aforementioned which may be accurately controlled both as to its speed and path of movement whereby a plurality of nozzles carried by the support head will accurately trace identical predetermined curvilinear paths along associated molds to be filled with a suitable fluid or fluid formulation in the manufacture of gaskets.

It is yet another object and feature of this invention to provide a dispensing apparatus of the type aforementioned further characterized by two carriages mounted for independent rectilinear movement relative to each other, and a nozzle support head responsive to independent movements of each of said carriages so as to follow the movements of both of said carriages in tracing the pattern of molds to be filled from a plurality of nozzles carried by the support head.

It is yet another object and feature of this invention to provide a dispensing apparatus of the type aforementioned comprising two relatively rectilinearly movable carriages each of which includes a support rod, a nozzle support head slidably mounted on each of said control rods so as to be movable in response to independent movements of said carriages, a pair of drive cams respectively associated with cam followers carried by the respective carriages so as to move the latter, a plurality of dispensing nozzles carried by the support head, and means for supplying fluid to the nozzles for dispensing into a plurality of molds beneath the nozzles, whereby the drive cams will cause the nozzle support head and hence the nozzles carried thereby to trace plural predetermined and identical paths over the molds to be filled and at a predetermined speed which may vary in the course of tracing the paths.

It is yet another object and feature of this invention to provide an apparatus of the type aforedescribed in which the drive cams are relatively easily interchangeable or replaceable so as to accommodate the manufacture of varying sizes and shapes of gaskets.

It is yet another object and feature of this invention to provide, in combination with the apparatus aforedescribed, a mechanism for dispensing predetermined quantities of fluid to the nozzles to insure that a predetermined amount of fluid is dispensed to the container or mold fed by each of the nozzles.

These and other objects of the invention are attained in an apparatus comprising a fixed rectangular support or frame, a first carriage including a first control rod having opposite ends thereof mounted on opposite sides of said support for rectilinear movement thereon, a second carriage including a second control rod having opposite ends thereof mounted on two other opposite sides of said support for rectilinear movement thereon at a right angle to the direction of movement of the first carriage and first control rod, means including first and second drive cams removably mounted on a rotatable drive spindle for moving the respective carriages along their paths simultaneously and independently of each other, a nozzle support head slidably supported on both of the control rods of said carriages whereby such head may slide on one control rod in response to rectilinear movement of the other and vice versa, a plurality of nozzles mounted in fixed relationship on the nozzle support head, and means for supplying material or a fluid to the nozzles for dispensing into a plurality of containers or molds as the nozzle support head traverses a predetermined pattern in response to operation of the drive cams. Additionally, the foregoing apparatus is equipped with a novel supply means for supplying the flowable material or fluid to a piston type pump in predetermined quantities and adjustable amounts, whereby a predetermined amount of material or fluid is supplied through the nozzles to the containers or molds on each successive cycle of the apparatus.

The foregoing features of the invention and the manner in which the aforementioned objects are attained will become apparent hereinafter as the description of the invention proceeds, and which reference is made to the drawings in which:

FIGURE 1 is a fragmentary perspective view of a preferred embodiment of the invention with certain parts broken away to illustrate certain details;

FIGURE 2 is a top plan view of the apparatus of this invention;

FIGURE 3 is a view taken on line 3—3 of FIGURE 2; and

FIGURE 4 is a view taken on line 4—4 of FIGURE 3.

As mentioned previously, the apparatus of this invention may be used in a number of environments which will be apparent to those skilled in the art. However, inasmuch as this apparatus has been designed with particular reference to the manufacture of gaskets for lamp bodies and lenses, the following description will proceed with specific reference to such a manufacturing operation. Furthermore, the inventive apparatus utilizes certain electrical, pneumatic and hydraulic systems consisting of individual components such as valves and electrical switches which are old and well known in the art and, in and of themselves, form no part of the present invention. Accordingly, in the interest of clarity and in order not to obscure the invention, these systems and components are represented schematically or diagrammatically in the drawings.

Referring now to the drawings and particularly FIGURES 2 and 3, the numeral 2 generally indicates the fluid dispensing apparatus which overlies a movable conveyor 4 on which numerous nests 6 for a plurality of molds 8 are positioned. Movement of the conveyor is controlled by the Conveyor and Nest Control Mechanism indicated diagrammatically in FIGURE 3. As will be clear to those acquainted with this art, the conveyor 4 is sequentially indexed beneath the dispensing apparatus 2 and held at rest beneath this apparatus during operation of the dispensing apparatus to fill a plurality of molds 8 carried in side-by-side relationship on the nests 6. Additionally, the Conveyor and Nest Control Mechanism includes a support head 10 which is vertically reciprocable to lift a nest and a plurality of molds upwardly from the conveyor while stationary into dispensing position beneath each of a plurality of nozzles carried by the dispensing apparatus and to lower the nest and molds back onto the conveyor after the dispensing operation and prior to indexing the conveyor. At this juncture, it may be noted that the Conveyor and Nest Control Mechanism for controlling sequential indexing movement of the conveyor and the lifting and lowering of molds from and to the conveyor as aforedescribed is conventional and known in the art. Accordingly, further description in regard to this mechanism is deemed unnecessary.

Referring now particularly to FIGURES 2 and 3, the dispensing apparatus 2 comprises a rigid fixed rectangular frame structure or support comprising the parallel longitudinally extending laterally spaced frame members 12 and 14 rigidly interconnected by the spaced parallel laterally extending frame members 16 and 18. A first movable frame member or carriage 20 includes the longitudinally extending tubular shaft 22 having bearing structures 25 and 26 at the respective ends thereof which mount the tubular shaft 22 for rotation on its axis and reciprocation or rectilinear movement along the frame members 16 and 18. The bearing structure 24 comprises a yoke or housing 28 having opposed parallel legs, the ends of which are slidably disposed on a tubular support rod 30 rigidly secured to and extending parallel to axis of frame member 16. Suitable bearings 32 are provided in the yoke or housing 28 to rotatably support one end of shaft 22 which has a pinion 34 fixed thereto and engaging rack gear 36 fixed to frame member 12 parallel to support rod 30. The bearing structure 26 includes a pinion 38 fixed to the other end of shaft 22 and engaging a rack gear 40 fixed to frame member 18. This end of shaft 22 is rotatably supported in the bearings 42 and 44. Bearing 42 supports the shaft 22 for reciprocation along rails 46 fixed to frame member 18, while the bearing 44 is disposed within the housing member 48 for a purpose to appear more fully hereinafter.

The carriage 20 also includes an A-frame 50 composed of rigidly interconnected triangularly related rod members and a pair of apertured ears 52 slidably mounted on a support rod 54 rigidly mounted on the main frame of the apparatus parallel to frame members 16 and 18. The cam follower or roller 56 is rotatably supported on a bracket carried on the A-frame 50, while the apex of the A-frame is secured to the housing member 48 enclosing bearing 44 rotatably supporting the shaft 22.

A second movable frame member or carriage is indidated at 58, and includes a tubular shaft 60 disposed at a right angle to and below shaft 22. Bearing structures 24' support the opposite ends of shaft 60 for rotation about its axis and reciprocation or rectilinear movement along the fixed frame members 12 and 14. These bearing structures are both identical to the bearing structure 24 previously described and, accordingly, primed numerals are employed in FIGURES 1 to 3 of the drawings to indicate parts corresponding to the bearing structure 24.

The second carriage 58 includes in A-frame 62 comprising rigidly interconnected triangularly related rod members in the fashion of A-frame 50. A cam roller or follower 64 is rotatably mounted on one end of a bracket mounted on the apex of the A-frame 62, while the side legs 66 thereof are formed integral with or otherwise respectively rigidly secured to the yokes or housings of the bearing structures 24'.

A nozzle support head 68 includes two tubular bores disposed at right angles to each other, and respectively slidably receiving the control rods or shafts 22 and 60.

A T-shaped bracket 70 has its base leg suitably secured to the nozzle head 68, while a plurality of nozzles 72 are adapted to be removably supported in a predetermined fixed relation along the extent of the cross member of the bracket 70. Preferably, the entire bracket 70 is adjustable relative to the nozzle head assembly, while the mounting brackets for the respective nozzles 72 are adjustable relative to each other on the cross member of the bracket 70.

A suitable motor 74 is drivingly connected through the selectively releasable and engageable clutch 76, overload coupling 78, and reduction gearing 80 to a vertically upstanding drive shaft or spindle 82. A fluid dispenser cam 84, switch cam 86, and drive cams 88 and 90 are suitably non-rotatably secured to the drive shaft 82. The drive cams 88 and 90, in particular, are connected in a suitable manner so that they may be readily removed and replaced by other cams having different configurations depending upon the path and speed of movement required of the nozzle head assembly 68. The uppermost drive cam 90 engages cam follower 64 to control the movement of the movable frame member or carriage 58 along the X axis noted in FIGURE 2 of the drawings, while the drive cam 88 engages the cam follower 56 to control movement of the other movable frame member or carriage 20 along the Y axis noted on the aforementioned figure of the drawings. Springs 92 of the type commonly used on screen doors extend between the respective A frames 50 and 62 and the rigid frame structure or support of the apparatus to continuously urge the respective cam followers 56 and 64 into engagement with the drive cams 88 and 90.

Referring particularly to FIGURES 1, 3 and 4, the dispenser cam 84 engages a cam follower 94 rotatably supported on one end of a rod 96 which is slidably supported in suitable bearings carried by fixed spaced frame members 98 and 100 of the main frame of the dispensing apparatus. A ramp type feed cam 102 is pivotally connected at 104 to the rod 96 between the frame members 98 and 100, and includes an arcuate slot 106 cooperating with a keeper 108 to adjust the angle of the feed cam surface. The ramp surfaces of the feed cam in turn engage one or more followers 110 rotatably secured to a cross head 112 which is secured to and controls the conjoint reciprocation of each piston 114 reciprocably disposed in each of the dispensing or pump cylinders 116.

The shape of the dispenser cam 84 is such that for each degree of rotation of the dispenser cam, the rod 96 is reciprocated in equal increments. Thus, adjustment of the slope of the feed cam 102 controls the volume of fluid which will be dispelled from the dispensing cylinders for one revolution of the dispenser cam 84.

Referring now particularly to FIGURES 1 and 4, the fluid to be dispensed, in this case a vinyl formulation is supplied under suitable pressure, such as from 20 to 40 p.s.i., from a suitable source through the conduit 118 and the solenoid operated control valve 120 to a manifold 122 containing one fluid inlet port 124 for each of the dispensing cylinders 116. The solenoid operated valve 120 is selectively controlled automatically in a manner to be described hereinafter. Each of the inlet ports 124 is provided with a one-way check valve 126 preventing flow of the fluid back to the manifold from the cylinders in response to pumping action of pistons 114. Each cylinder 116 includes an outlet port connected through a conduit 128 to the dispensing end of a nozzle assembly 72. In this regard, four dispensing cylinders 116 are indicated in the drawings to accommodate four dispensing nozzles; however, any number of cylinders and nozzles may be used in accordance with the number of molds. The nozzle assemblies 72 are a well known pneumatically operated type including a double-acting motor 130 at the upper end thereof which is operable under pressure to alternately open and close the nozzles to control the dispensing of the fluid supplied through conduits 128. One end of each of these motors is connected through an air line 132, manifold 134 and line 136 to a solenoid operated valve 138, while the other end of each motor is connected through a line 140, a manifold 142 and line 144 to the valve 138. Valve 138, in turn, is connected to a suitable source of air under pressure (not shown) by the conduit 146. The solenoid operated valve 138 is controlled in a manner to be described hereinafter.

The air supply line 146 is connected by a branch conduit 148 to another solenoid operated valve 150 which selectively supplies air either through the conduit 152 or the conduit 154 to acuate the double-acting air motor 156 to respectively release or engage the clutch 76 through the operating rod 158 connected to the piston rod of the air motor. The solenoid operated valve 150 and hence the clutch 76 is controlled in a manner to be described.

Prior to describing the control system for effecting sequential operation of the various valves and components of the apparatus connected thereto as aforedescribed, it should be noted that the electrical circuitry employed in this regard consists of well known components which, in and of themselves, form no part of the present invention. Accordingly, the description to follow will be directed primarily to the location and operation of the various switching constructions which initiate action or discontinue action of the various components of the apparatus, it being understood that these action-initiating elements or switches are connected through suitable conventional circuitry to the members being controlled.

Referring now to FIGURE 1 and the control system, it will be remembered that the Conveyor and Nest Control Mechanism functions to sequentially index the conveyor 4 relative to the dispensing apparatus 2, and then dwells for a predetermined time interval to permit the dispensing operation to be accomplished. More specifically, upon indexing the conveyor to its proper position beneath the dispensing nozzle assemblies 72 followed by a dwell cycle of the conveyor, the Conveyor and Nest Control Mechanism elevates a nest 6 to lift a plurality of molds 8 upwardly into dispensing position relative to the nozzle assemblies. This lifting movement and positioning of the molds causes a limit switch LS–1 to be actuated which, in turn, actuates the solenoid operated valve 150 to supply air through the conduit 154 to engage clutch 76, thereby causing the drive shaft 82 to rotate. The switch member LS–2 fixedly secured to a portion of the main frame structure of the dispensing apparatus cooperates with the switch cam 86 to selectively first open and then close each of the nozzles 72 by actuating the solenoid operated valve 138 to selectively supply air first to one end and then the other end of the motors 130 as will be obvious. Switch LS–2 is also connected to valve 120 to open supply line 118 to supply fluid to cylinders 116 upon closing the nozzles 72. The switch LS–3 located on the frame structure adjacent the switch LS–2 also cooperates with the switch cam 86, and is connected to the solenoid valve 150 so as to operate the latter to supply air through the conduit 152 to the air motor 156 to disengage the clutch 76 at the proper position in the dispensing cycle, and even though the switch LS–1 is still actuated due to the mold support or nest 6 still being elevated. As the cylinders 116 are filled and the pistons 114 are moved outwardly in response thereto, the switch LS–4 is ultimately actuated by cross head 112 to sense that the cylinders are full. This switch LS–4 is connected to the solenoid operated valve 120 to discontinue further supply of fluid therethrough and to the Conveyor and nest control Mechanism to condition the latter for the next cycle.

Reference will now be made to the operation of the apparatus of this invention, it being assumed that the apparatus is disposed with the motor 74 running, clutch 76 released, the conveyor 4 indexed and dwelling and the mold nest 6 not yet elevated. It is also assumed that, at the end of the preceding cycle, the dispensing cylinders 116 have been completely filled so as to actuate the switch LS–4, therefore conditioning the Conveyor and Nest Control Mechanism for the cycle now to be described.

Under these conditions, the Conveyor and Nest Control Mechanism then operates to elevate a nest 6 and a plurality of molds 8 into proper position relative to the nozzle assemblies 72. When the nest and molds are in position, the switch LS–1 is actuated to operate valve 150 to supply air through the conduit 154 to the air motor 156 to engage clutch 76, resulting in rotation of the drive shaft 82. The drive cams 88 and 90 then rotate and, through their cooperation with the cam followers 56 and 64, cause the respective carriages 20 and 58 and their associated tubular shafts or rods 22 and 60 to move rectilinearly on the frame structure of the apparatus and relative to each other at right angles. More specifically, the contour of each of the drive cams is such as to shift the movable frame members or carriages relative to each other in accordance with the path and speed of movement desired for the nozzle support head 68 and the nozzles carried thereby. Thus, as the drive cam 88 rotates, it acts against the follower 56 to shift the tubular rod 22 along frame members 16 and 18, thereby causing the dispenser head 68 to slide along the tubular rod 60. In similar fashion, drive cam 90 engages cam follower 64 to force the tubular shaft 60 along the frame members 12 and 14 to shift the dispenser head 68 along the tubular shaft 22. Naturally, both components of motion of dispenser head 68 may and do occur simultaneously to trace the path of the molds to be filled. As the two movable carriages shift to position the nozzle support head, the respective tubular rods or shafts 22 and 60 rotate along their axes and walk along the rack gear constructions of each of the bearings 24, 26, and 24' to prevent the assemblies from cocking. Movement of the respective carriages continues throughout 360° rotation of the drive shaft 82 and the respective drive cams 88 and 90. Of course, dispenser cam 84 also rotates with shaft 82 to reciprocate rod 96, thereby moving pistons 114 within their cylinders to pump fluid to nozzles 72.

Shortly after the drive shaft 82 is actuated as aforedescribed, the switch cam 86 actuates switch LS–2 which operates valve 138 to supply air to one end of nozzle motors 130 to open the nozzles, thereby permitting the

flow of fluid from the nozzles 72 to the molds as the nozzles are moved in their predetermined paths by the drive cams 88 and 90. After the drive cams have been rotated through approximately 340° of their movement, switch LS–2 is again actuated by a suitable lobe on the switch cam 86 to operate the valve 138 to supply air under pressure to the other ends of nozzle motors 130 to close the nozzle assemblies, thereby disrupting further flow of fluid to the molds. Actually, closing of the other nozzles occurs after the entire path of the molds has been traversed. As pointed out previously, switch LS–2 is also connected to the valve 120 so that, upon actuation of the switch as just described to close the nozzles, it also operates the valve 120 to open the supply line 118 to the dispensing cylinders 116, thereupon permitting fluid under pressure to flow into the manifold 122, pass the one way check valves 126 and into the cylinders. As fluid flows into the dispensing cylinders 116, it forces the pistons 114 outwardly and, through cooperation of the cam follower 110 and the ramp cam 102, shifts the dispenser rod 96 back toward the dispenser cam 84, the shape of the lobe on the latter permitting this movement. Shortly after the supply line 118 is opened by operation of the switch LS–2, the switch LS–3 is actuated by the switch cam 86 to operate the solenoid valve 150 to supply air through the conduit 152 to the air motor 156 to release the clutch 76 and disengage drive to the drive shaft 82. At this time, the fluid supply line 118 is still open, and the cylinders 116 continue to be filled.

Thereafter, the Conveyor and Nest Control Mechanism operates to lower nest 6 disengaging switch LS–1 and to index the conveyor 4. During the indexing operation, filling of the dispenser cylinders 116 is completed, thereby causing actuation of the switch LS–4 to operate the valve 120 and thus close fluid supply line 118. As previously mentioned, the switch LS–4 is also connected to the Conveyor and Nest Control Mechanism so as to condition the latter for a succeeding cycle upon complete filling of the dispenser cylinders. Thus, the apparatus is then in condition to repeat the cycle described above.

While but one form of the invention has been shown and described, other forms will be apparent to those skilled in the art. Therefore, the embodiment shown in the drawing is merely for illustrative purposes, and is not intended to limit the scope of the invention which is defined by the claims which follow.

I claim:

1. Apparatus for dispensing matter in a predetermined path comprising a support, first and second carriages, means mounting said carriages on said support for movement along predetermined paths and including means on said support engaging gear means on said carriages, a rotatable drive shaft, first and second drive cams on said drive shaft, first and second cam follower means mounted on said first and second carriages and respectively engaging said first and second drive cams to move said carriages, a support head connected to both of said carriages for movement in response to movement of each of said carriages, dispensing means mounted on said support head, and means for supplying matter to be dispensed to said dispensing means.

2. Apparatus for dispensing matter in a predetermined path comprising a support, first and second carriages including, respectively, first and second control rods, means mounting said carriages on said support for rectilinear movement along two angularly related axes, said last-named means including rack gears fixed to said support and engaging pinion gears respectively rotatably supporting said first and second control rods, a rotatable drive shaft, first and second drive cams removably fixed on said drive shaft, first and second cam follower means mounted on said first and second carriages and respectively engaging said first and second drive cams to move said carriages, a nozzle support head slidably supported on both of said control rods whereby said support head will slide on said first rod in response to rectilinear movement of said second rod and will slide on said second rod in response to rectilinear movement of said first rod, a plurality of nozzles fixed on said support head, and means for supplying matter to be dispensed to said nozzles.

3. Apparatus for dispensing fluid from a plurality of nozzle means movable in predetermined identical paths comprising a support, first and second carriages including, respectively, first and second control rods, means mounting said carriages on said support for rectilinear movement along perpendicular axes, said last-named means including rack gears fixed to said support and engaging pinion gears respectively rotatably supporting said first and second control rods, a rotatable drive shaft, first and second drive cams removably fixed on said drive shaft, first and second cam follower means mounted on said first and second carriages and respectively engaging said first and second drive cams to move said carriages, a nozzle support head slidably supported on both of said control rods whereby said support head will slide on said first rod in response to rectilinear movement of said second rod and will slide on said second rod in response to rectilinear movement of said first rod, nozzle means fixed on said support head, means for supplying fluid to be dispensed to said nozzle means comprising a cylinder, a piston reciprocably disposed in said cylinder, means for supplying fluid to said cylinder, conduit means connecting said cylinder to said nozzle means, a supply cam removably mounted on said drive shaft, supply cam follower means engaging said supply cam, and means including an adjustable cam connecting said supply cam follower means to said piston to reciprocate the latter with said cylinder.

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