July 14, 1953 S. T. MORELAND 2,645,171

MACHINE FOR INJECTING BACON SLABS OR THE LIKE

Filed Sept. 22, 1950 4 Sheets-Sheet 1

Fig. 3.

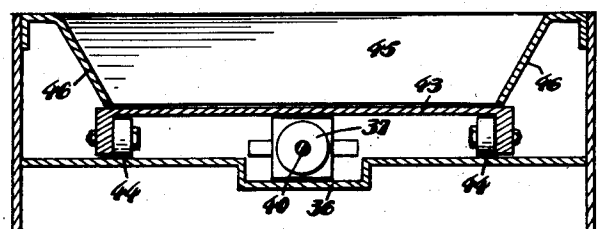


Fig. 4.

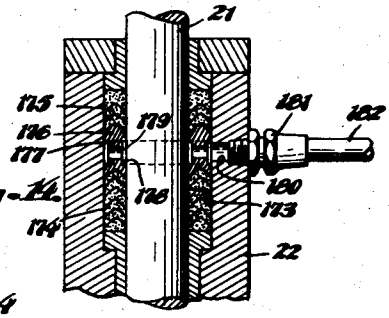


Fig. 1.

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MACHINE FOR INJECTING BACON SLABS OR THE LIKE

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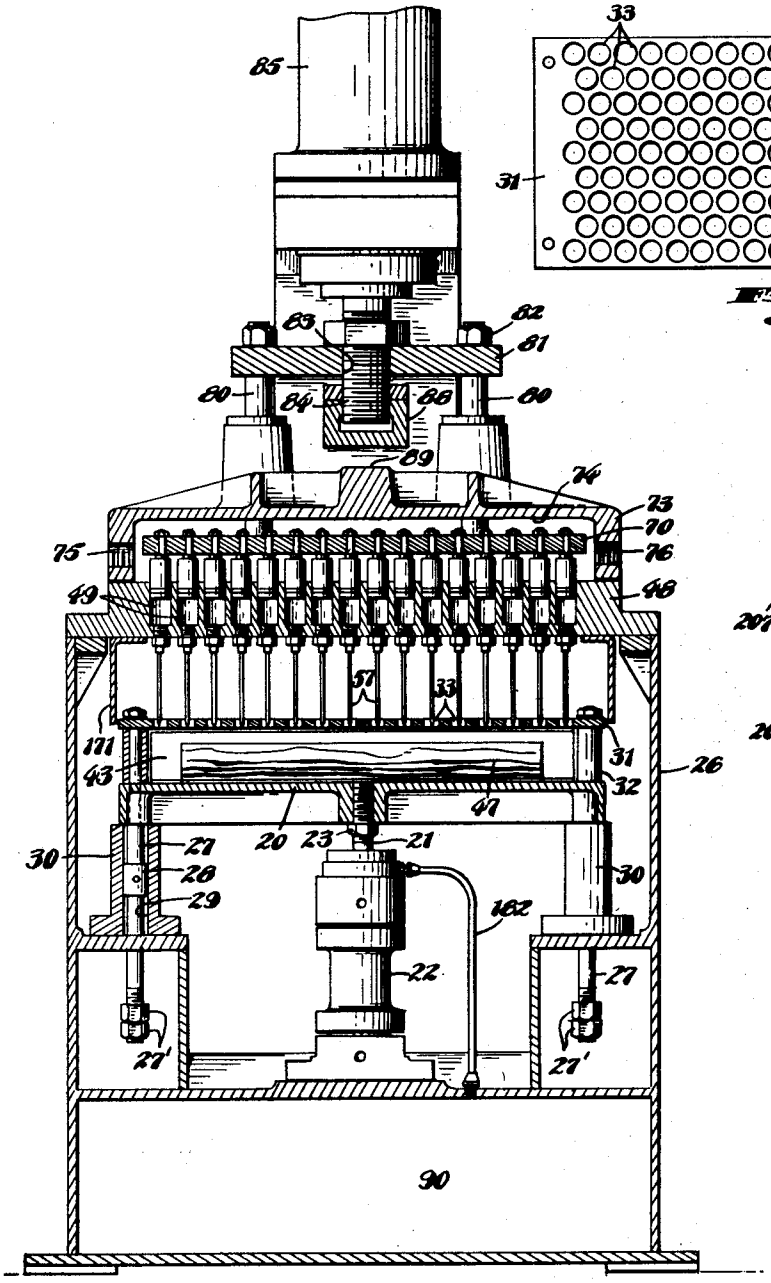


Fig. 2.

Fig. 4.

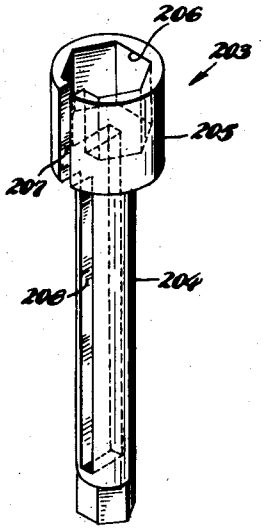


Fig. 17.

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MACHINE FOR INJECTING BACON SLABS OR THE LIKE

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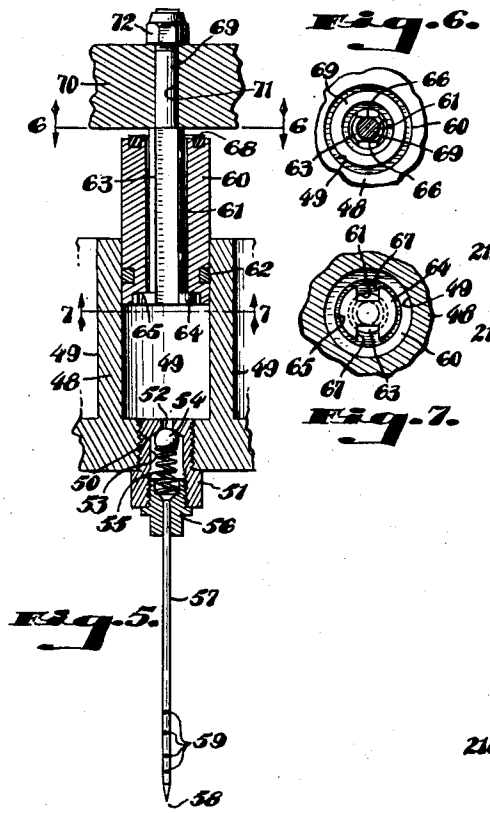


Fig. 5.

Fig. 6.

Fig. 7.

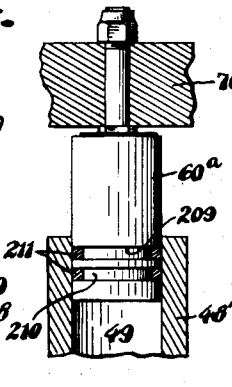


Fig. 8.

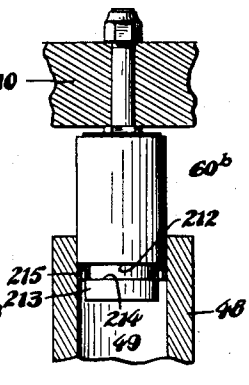


Fig. 9.

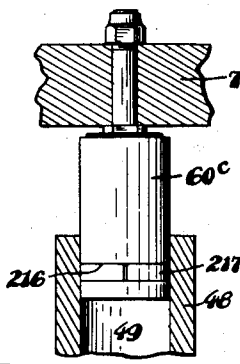


Fig. 10.

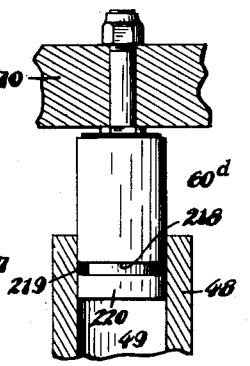


Fig. 11.

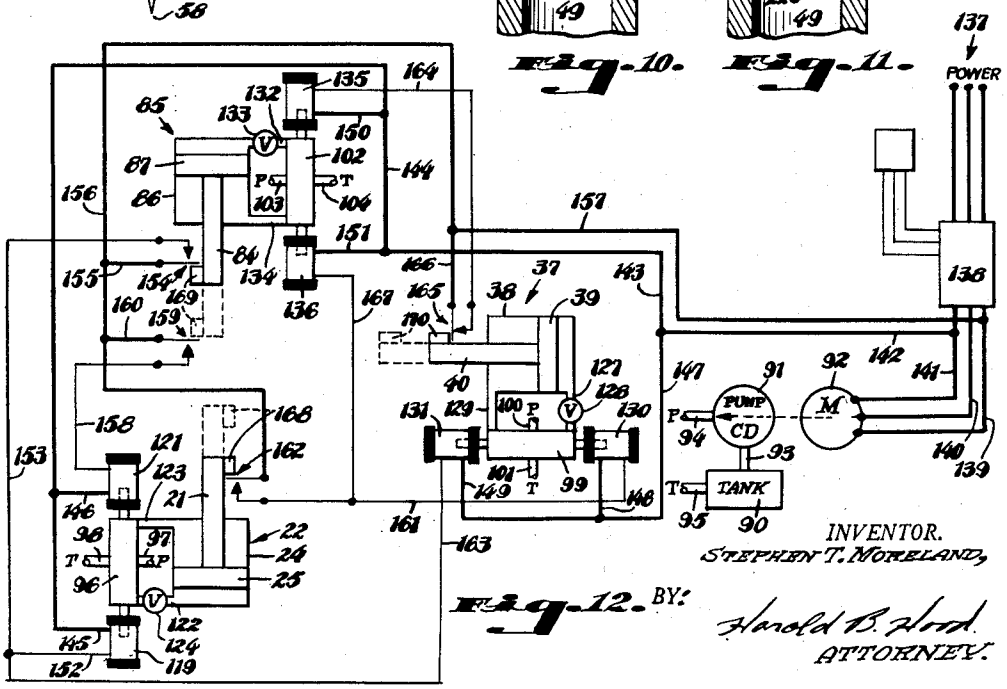


Fig. 12.

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MACHINE FOR INJECTING BACON SLABS OR THE LIKE

Filed Sept. 22, 1950 4 Sheets-Sheet 4

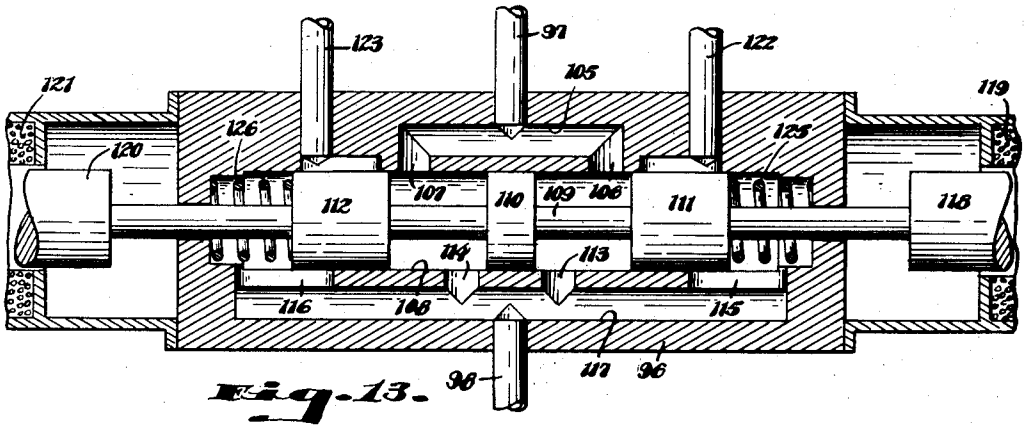


Fig-13.

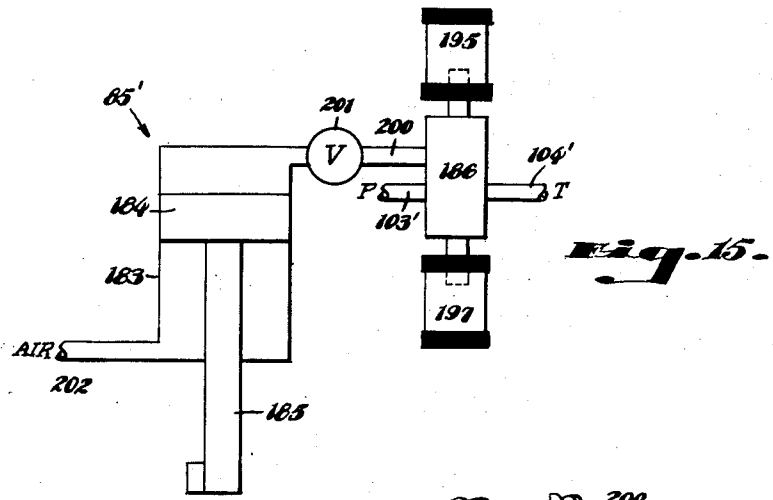


Fig-15.

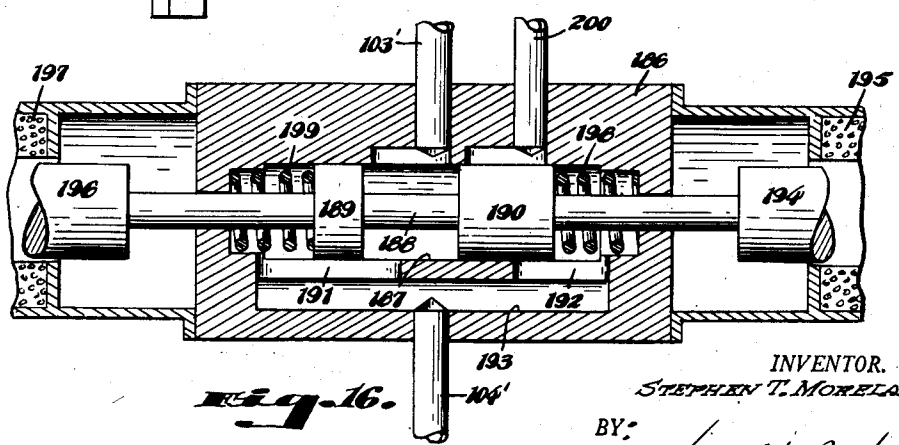


Fig-16.

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Patented July 14, 1953

2,645,171

UNITED STATES PATENT OFFICE

2,645,171

MACHINE FOR INJECTING BACON SLABS OR THE LIKE

Stephen T. Moreland, Indianapolis, Ind.

Application September 22, 1950, Serial No. 186,183

12 Claims. (Cl. 99—257)

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The present invention relates to a machine for injecting pickling solution, or any other suitable fluid, into the body of bacon slabs, or any other permeable substance. The machine has been primarily designed for injecting pickling solution into bacon slabs, and it has been so illustrated and will be so described; but the applicability of the underlying principles of the machine to other uses will be readily apparent.

The primary object of the invention is to provide a relatively simple, and fully automatic, machine for effecting substantially uniform permeation of a piece of food product with a desired fluid substance. To that end, it is a further object of the invention to provide mechanism including a multiplicity of injector needles adapted to enter the body of the product to be treated, each of said needles constituting an element of an individual syringe, and such syringes being concurrently actuated in such a fashion as to express, through each injector, the same volume of fluid, upon such concurrent actuation of the syringes.

A further object of the invention is to provide a machine of the character described through which similar objects will be automatically transported, each object being automatically treated in the same manner as it passes through the machine. A still further object of the invention is to provide, in a machine of the character under consideration, automatic control means for the various moving parts of the machine, including the syringe-actuating mechanism.

Still further objects of the invention will appear as the description proceeds.

To the accomplishment of the above and related objects, my invention may be embodied in the forms illustrated in the accompanying drawings, attention being called to the fact, however, that the drawings are illustrative only, and that change may be made in the specific constructions illustrated and described, so long as the scope of the appended claims is not violated.

Fig. 1 is a longitudinal section through one form of machine constructed in accordance with the present invention, certain elements of the assembly being more or less diagrammatically illustrated;

Fig. 2 is a transverse section through the machine;

Fig. 3 is a fragmental section taken substantially on the line 3, 3 of Fig. 1;

Fig. 4 is a plan view of a stripper plate constituting an element of the invention;

Fig. 5 is a fragmental section, upon an enlarged scale, showing the details of a single syringe assembly;

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Fig. 6 is a horizontal section taken substantially on the line 6, 6 of Fig. 5;

Fig. 7 is a similar section taken substantially on the line 7, 7 of Fig. 5;

Figs. 8, 9, 10 and 11 are fragmental sectional views showing various forms of syringe plunger and sealing ring expedients;

Fig. 12 is a wiring and fluid-flow diagram illustrating the control mechanism for the machine;

Fig. 13 is an enlarged section through one form of fluid-motor control valve which may be used in the machine of the present invention;

Fig. 14 is an enlarged fragmental section showing a novel form of packing means for a piston stem usable in one form of the present invention;

Fig. 15 is a fragmental diagrammatic view illustrating a modified form of control means;

Fig. 16 is a view similar to Fig. 13 and showing control valve means for use in the control arrangement of Fig. 15; and

Fig. 17 is a perspective view of a special wrench which may be used for seating or removing the needles of the syringe assemblies embodied in the machine.

Referring more particularly to the drawings, it will be seen that the machine disclosed herein includes a platform 20 to which is operatively connected the stem 21 of a fluid motor 22. Preferably, the stem 21 will be threadedly connected to the platform 20, whereby the position of said platform relative to said stem may be readily adjusted, and a jam nut 23 is mounted upon the stem 21 to hold the platform in adjusted position. The motor 22 may take the form suggested in Fig. 12, comprising a cylinder 24 with a piston 25 reciprocably mounted therein, one end of the cylinder being near the platform 20, the other end of the cylinder being remote therefrom and supported upon a frame 26, and the stem 21 emerging through the near end of the cylinder.

The platform 20 is guided for reciprocation in the direction of the axis of the motor 22, by a plurality of rods 27, each of which slides in one or more bushings 28 pressed into the bore 29 of a guideway 30, said guideways being suitably fixed to the frame 26. The downward limit of the stroke of the platform 20 will, of course, be defined by abutment of the platform against the upper ends of the guideways 30. The upward limit of the platform stroke is adjustably determined by the nuts 27' adjustably threaded upon the lower ends of the rods 27 which project below fixed ele-

ments of the frame 26, as is most clearly illustrated in Fig. 2.

The rods 27 also carry a stripper plate 31 fixedly spaced above the article-supporting surface of the platform 20 by means of spacer sleeves 32. The stripper plate 31 is formed with uniformly distributed perforations 33 therethrough for a purpose later to become apparent. I presently believe that, according to an optimum arrangement, the perforations 33 will be spaced from each other on 1¾ inch centers throughout substantially the whole area of the plate 31.

Transfer and loading means, indicated generally by the reference numeral 34, is suitably mounted upon the frame and comprises a table 35 which, when the platform 20 is in its fully retracted position, lies substantially flush with the article-supporting surface of said platform. A section 36 of the mechanism 34, offset below the general level of the table 35, supports a fluid motor 37 which will preferably be of the general character suggested in Fig. 12, comprising a cylinder 38 and a piston 39 reciprocably mounted therein. One end of the cylinder 38 is near the platform 20, while the other end thereof is remote from said platform, and a stem 40, connected to move with the piston 39, emerges from the cylinder 38 through the near end thereof. Upon its outer threaded end, the stem 40 carries a nut 41 which is received in a suitable socket 42 in a carriage or pusher 43, interposed between the near end of the cylinder 38 and the platform 20. It will be obvious that engagement of the nut 41 in the socket 42 provides a driving connection between the piston stem 40 and the pusher 43, and that the relation of the pusher to the stem may be readily adjusted by rotation of the nut 41. The pusher 43 is preferably hollow, as shown, to permit said pusher, upon retraction, to straddle the motor 37; and it is preferably supported upon wheels 44, as is clearly shown in Figs. 1 and 3. A supply chute 45, or conveyor, preferably defined by inwardly and downwardly inclined side walls 46, guides bacon slabs 47, or other products to be treated, toward the table 35. As will be clearly seen from an inspection of Fig. 1, the chute 45 is so related to the table 35 that, when the pusher 43 is in its projected position, an object 47 delivered by the chute 45 will fall upon the pusher 43. Now, as the pusher is retracted, the object 47 supported thereon will be restrained by the lower end of the chute 45, so that the pusher will move out of the way of that object and the object will drop to the table 35. Now, as the pusher is projected, the object 47 will be moved onto the platform 20. If the next succeeding object 47 has moved out of the chute 45 to be partially supported upon the object on the table 35, the pusher 43 will underride said following object to support the same and, if necessary, to carry it into abutment with the shield wall 172, later to be described.

Suitably supported upon the frame 26 above the platform 20 and the stripper plate 31 is a block or bed 48 in which is formed a gang of cylinders 49, upon parallel axes aligned with the direction of movement of the platform 20, and opening through the upper and lower surfaces of the block 48. The arrangement of cylinders 49 corresponds to the arrangement of perforations 33, so that each cylinder 49 is in axial alignment with a perforation 33.

As is most clearly illustrated in Fig. 5, the lower end of each cylinder 49 is reduced in area and is internally threaded as at 50 to receive a valve fitting 51 formed with a port 52 providing communication between the interior of its cylinder 49 and a chamber 53 formed within the fitting 51. Within each chamber 53 is mounted a check valve which, in the illustrated embodiment of the invention, may take the form of a ball 54 resiliently supported in sealing relation with the lower end of the port 52 by a spring 55. The spring 55, in turn, is supported by a threaded fitting 56 supporting a needle 57 which may sometimes hereinafter be referred to as a hypodermic needle. The needle 57 terminates in a sharp point 58 and is formed with a passage therethrough opening, through suitably arranged perforations 59 distributed over its shank. Preferably, but not necessarily, the tip 58 of the needle will be imperforate.

Mounted for reciprocation in each cylinder 49 is a plunger or piston 60 which is formed with an axial passage 61 therethrough. Any suitable sealing ring arrangement may be provided between the external periphery of the piston 60 and the cylinder wall, such sealing means being suggested at 62 in Fig. 5. Details of various forms of satisfactory sealing means are shown in Figs. 8 to 11 and will be described in detail hereinafter.

A stem 63 is reciprocably mounted in the passage 61, said stem being provided with an enlarged foot 64 at its lower end receivable in a pocket 65 formed in the lower end of the plunger. The stem 63 is suitably mutilated, as by diametrically opposite, longitudinally-extending grooves 66, to facilitate fluid flow therepast through the passage 61, and the foot 64 is similarly provided with notches 67 registering with the grooves 66. Obviously, while the pocket 65 is desirable to permit the leading end of the piston 60 to seat on the bottom of the cylinder, its presence is not essential.

Suitable means is provided for sealing the passage 61 against fluid flow. In the illustrated embodiment of the invention, an annular gasket 68 surrounds the upwardly-opening mouth of the passage 61 at the upper end of the piston 60. The stem 63 is provided with a reduced extension 69.

A head 70 is formed with a perforation 71 for the extension 69 of each plunger stem 63. Said extensions project beyond the head 70 and receive nuts 72 bearing against the upper surface of the head, whereby the stems 63 are constrained to move with the head 70.

As is clearly shown in Fig. 5, when the foot 64 is seated in its pocket 65, the head 70 is spaced from the gasket 68, so that the passage 61 is open for fluid flow therethrough. If, however, the head 70 is pressed against the gasket 68, it will be seen that the passage 61 will be closed against fluid flow. It will be obvious that gasket means could be carried upon the head 70 instead of upon the piston 60, or that any other suitable means might be used for providing a fluid seal around the mouth of the passage 61 when the head 70 is pressed against the upper end of the plunger 60.

A chambered cover 73 (Fig. 2) is suitably secured in place upon the block 48, cooperating with said block to define a reservoir 74 within which the head 70 is mounted. Means is provided for supplying fluid to the reservoir 74; and in the illustrated embodiment of the invention, that means comprises a treating-fluid supply port 75 and a wash-water supply port 76 formed in the cover 73. Suitable valve means (not shown) will control the supply of treating fluid and wash water to the respective ports, the valve means being

of such character as to prevent concurrent flow of treating fluid and water to the reservoir.

The cover 73 is provided (Fig. 1) with a plurality of guideways 77, each arranged upon an axis parallel with the axes of the cylinders 49, and each preferably provided with a suitable bushing 78 and a packing gland 79. A post 80 is reciprocably mounted in each guideway 77, said posts being operatively connected to the head 70, whereby the head is carried by said posts. At their upper ends, the posts are connected to an element 81, each post being provided with a reduced extension passing through an opening in the element 81 to receive a nut 82 turned down against the element 81. The element 81, in turn, is formed with a central opening 83 (Fig. 2) through which passes the piston stem 84 of a fluid motor 85, said element 81 being adjustably secured on said stem. The motor may take the form suggested in Fig. 13, comprising a cylinder 86 and a piston 87 reciprocably mounted therein, one end of the cylinder being near the platform 20 and the other end being remote therefrom, and the stem 84 emerging from the near end of the cylinder.

As is most clearly shown in Figs. 1 and 2, the stem 84 projects past the element 81 and toward the cover 73. At its end adjacent the cover 83, the stem 84 is threaded and carries an adjustable nut 88, the cover 73 being provided with an abutment surface 89 engageable by the nut 88 to limit projection of the piston stem 84. It will be obvious that, by adjustment of the nut 88, the degree of fluid-expressing movement of the pistons 60 may be adjustably limited.

It is highly desirable, for reasons which will appear as the description proceeds, that the projecting movement of each of the fluid-motor-actuating elements, and particularly of the head 70, may be closely controlled, both as to magnitude and as to rate. The adjustment means hereinabove described will control the magnitude of such movement; but the rate of such movement will, of course, be dependent upon the supply of motive fluid to each motor. While a gaseous motive fluid can, with some difficulty, be controlled to provide satisfactory control of the movement rate of the various driven elements, it is much easier to obtain such control through the use of a liquid motive fluid, and for that reason I prefer to use liquid, at least for projecting energization of each motor 22, 37 and 85. In the form of the invention illustrated in Figs. 1, 2 and 13, I have shown liquid actuation of each motor in both directions.

A liquid reservoir 90 may advantageously be built as a part of the frame 26. I have shown a pump 91 supported upon the frame of an electric motor 92 which, in turn, is supported upon the top of the reservoir 90. A pipe 93 leads from the interior of the reservoir to the intake port of the pump 91, and a supply pipe 94 leads from the pump through various branches to the several motors, while other branches lead from the motors to an exhaust pipe 95 which returns to the reservoir. A control valve 96 (Figs. 12 and 13) receives motive liquid from the pipe 94 through branch pipe 97, and returns liquid through branch pipe 98 to exhaust pipe 95. The valve 96 controls operation of the motor 22. A similar valve 99 provided with supply and exhaust branch pipes 100 and 101 controls motor 37; and a similar valve 102 provided with supply and exhaust branches 103 and 104 controls motor 85. The three valves 96, 99 and 102 are identical in construction, and therefore only valve 96 has been illustrated in detail in Fig. 13.

The supply branch 97 opens into a branched passage 105 of the casing of valve 96, the passage 105 being provided with outlets 106 and 107 opening into the cylinder 108 formed in said valve casing. A piston-type valve 109, having lands 110, 111 and 112, is mounted for reciprocation in the cylinder 108. Ports 113, 114, 115 and 116 open from said cylinder 108 into an exhaust passage 117 from which the exhaust branch 98 leads to the exhaust pipe 95.

At one end, outside the valve casing, the piston 109 carries an armature 118 for a solenoid 119; and at its opposite end, said piston carries an armature 120 for a solenoid 121. Pipes 122 and 123 lead from the cylinder 108 to opposite ends of the motor cylinder 24, as is clearly indicated in Fig. 12. An adjustable flow regulator valve 124 is preferably interposed in the pipe 122 which leads to the remote end of the cylinder 24. Springs 125 and 126, opposed to each other and mounted in opposite ends of the casing of valve 96, hold the piston 109 in its illustrated position when both solenoids 119 and 121 are deenergized.

It will be clear that, when the piston 109 is in its illustrated position, liquid is free to flow from the supply branch 97 through the passage 105, ports 106 and 107, cylinder 108, ports 113 and 114, and passage 117 to the discharge branch 98. If, however, the solenoid 119 is energized, the piston will be shifted to the right against the tendency of the spring 125. Thereby, the land 111 will open communication between the cylinder 108 and the pipe 122, the land 110 will close communication between the cylinder 108 and the exhaust passage 113, and the land 112 will close communication between the port 107 and the cylinder 108 and will open communication between the pipe 123 and the cylinder port 116. Now, liquid will flow from the supply pipe 97 through the passage 105 and port 106 to the right-hand end of the cylinder 108 and thence through the pipe 122 to the remote end of the motor cylinder 24, tending to project the piston 25 and its stem 21; while an exhaust flow path is opened from the near end of the motor cylinder 24 through the pipe 123, the left-hand end of the cylinder 108, port 116 and passage 117 to the exhaust branch 98.

Upon deenergization of the solenoid 119, the piston 109 will return to its illustrated position in which the lands 111 and 112 close the pipes 122 and 123, respectively, to hold the motor piston 25 against movement. If, now, solenoid 121 is energized, the piston 109 will be moved to the left against the tendency of the spring 126, whereby land 111 will open communication between pipe 122 and port 115 and will close port 106; land 110 will close port 114, and land 112 will open communication between port 107 and pipe 123. Now, liquid will flow from pipe 97 through passage 105, port 107, cylinder 108 and pipe 123 to the near end of motor cylinder 24, while liquid will be exhausted from the remote end of said cylinder through pipe 122, cylinder 108, port 115, passage 117 and branch exhaust pipe 98.

Similarly, pipe 127, in which is interposed regulating valve 128, leads from control valve 99 to the remote end of motor cylinder 38 and pipe 129 leads from the near end of said cylinder to the control valve 99, solenoid 130 being operable to shift the valve 99 to supply liquid to the remote end of the motor cylinder 38, and solenoid 131 being operable to shift the valve 99 to supply

fluid to the near end of the motor cylinder 38. In the same way, pipe 132, controlled by regulating valve 133, provides communication between the valve 102 and the remote end of the motor cylinder 86, while pipe 134 provides communication between the control valve 102 and the near end of said cylinder 86, solenoids 135 and 136 similarly controlling the valve 102.

A source of electrical energy is indicated at 137 in Fig. 12, wherein I have shown a three-wire system passing through a control box 138 and comprising wires 139, 140 and 141 connected to energize the motor 92. Wire 141 is connected to one side of each of solenoids 119 and 121 through wires 142, 143, 144 and branch wires 145 and 146. Said wire 141 is connected to one side of each of solenoids 130 and 131 through wires 142, 147 and branch wires 148 and 149. Wires 142, 143, 144 and branch wires 150 and 151 connect wire 141 with solenoids 135 and 136.

The other side of solenoid 119 is connected to wire 139 through wire 152, wire 153, switch 154, wire 155, wire 156 and wire 157. The other side of solenoid 121 is connected to wire 139 through wire 158, switch 159, wire 160 and wires 156 and 157. Wire 161 leads from the other side of solenoid 130 through switch 162 to wire 156. The other side of solenoid 131 is connected through wire 163 to wire 153. Wire 164 leads from the other side of solenoid 135 through switch 165 and wire 166 to wire 157; while the other side of solenoid 136 is connected by wire 167 to wire 151.

Abutment means 168, 169 and 170 are diagrammatically illustrated in Fig. 12. Abutment means 168 will move with piston stem 21; abutment means 169 will move with nut 88; and abutment means 170 will move with stem 40. The switch 162 is normally open and is positioned to be engaged and moved to closed position by abutment means 168 when the platform 20 reaches its fully retracted position. Switch 154 is normally open and is positioned to be engaged and closed by abutment 169 when stem 84 reaches its fully retracted position. Switch 159 is normally open and is positioned to be engaged by abutment means 169 when nut 88 strikes the abutment 89 on the cover 73. Desirably, the movable element of switch 159 may actually be supported upon the cover 73. Switch 165 is normally open and is adapted to be engaged and closed by abutment means 170 when stem 40 reaches its fully retracted position.

General operation

Assuming the platform 20 to be in its fully retracted position, as illustrated in Figs. 1 and 2, if the control system of Fig. 12 is energized, the motor 92 will be energized to drive the pump 91 to supply liquid under pressure through the pipe 94 to the branches 97, 100 and 103. The switch 162 will be closed, whereby solenoid 130 will be energized through a circuit leading from power wire 141 through wire 142, wire 147, wire 148, wire 161, switch 162, wire 156, and wire 157 to power wire 139. Solenoid 136 will also be energized through a circuit which may be traced from power wire 141 through wire 142, wire 143, wire 151, wire 167, wire 161, switch 162, wire 156, and wire 157 to power wire 139. Thereby, liquid under pressure will be supplied to the remote end of motor 37 and to the near end of motor 85. Pusher 43 will be projected to move a block 47 onto the platform 20. Concurrently, head 70 will be retracted or lifted. As the head moves upwardly, it will first move away from the upper ends of plungers 60, thereby opening passages 61 therethrough. The upper ends of the syringe assemblies are, of course, submerged in the pickling liquid filling the reservoir 74. As the feet 64 seat in the pockets 65, further upward movement of the head 70 will retract the plungers 60, thereby reducing the pressure in cylinders 49 (valves 54 preventing ingress of air to said cylinder through the needles 57) and pickling liquid will be drawn through the passages 61 into the cylinders 49. Since the pistons are of uniform size and will move through a uniform distance, uniform volumes of liquid will be drawn into the various cylinders.

As the stem 84 reaches its limit of retraction, the abutment means 169 will close the switch 154, thereby energizing solenoids 119 and 131. The energizing circuit for solenoid 119 is traced from power line 139 through wire 157, wire 156, branch wire 155, switch 154, wire 153, wire 152, solenoid 119, wire 145, wire 144, wire 143, and wire 142 to line wire 141. The energizing circuit for solenoid 131 is traced from line wire 139 through wire 157, wire 156, branch wire 155, switch 154, wire 153, wire 163, solenoid 131, branch wire 149, wire 147 and wire 142 to line wire 141. Thus valve 96 will be shifted to supply fluid to the remote end of motor cylinder 24, while valve 99 will be shifted to supply liquid to the near end of motor cylinder 38.

Platform 20 will thus be lifted by motor 22, carrying upwardly the piece 47 supported thereon to cause the needles 57 to penetrate said piece to a depth determined by the adjustment of the nuts 27'. Concurrently, the pusher 43 will be retracted to permit a fresh piece 47 to drop onto the table 35.

As the stem 40 reaches the limit of its retraction, its abutment means 170 will close the switch 165 to energize the solenoid 135 through a circuit to be traced from line wire 139 through wire 157, wire 166, switch 165, wire 164, solenoid 135, branch wire 150, wire 144, wire 143 and wire 142 to line wire 141. Liquid will thus be supplied to the remote end of motor cylinder 86 to move the head 70 downwardly.

Since the pieces 47 are not of absolutely uniform size and shape, some of the needles 57 may not be engaged therein. The texture, density and character of the pieces 47 may not be uniform throughout each body. It will be entirely apparent, for these and other reasons, that if a single piston were mounted, for instance, in the reservoir 74, all of the needles communicating with that reservoir, there would be a wide variance in the volumes of pickling liquid expressed through the individual needles of the gang. However, since each needle is provided with its individual syringe cylinder, since the cylinders are of uniform volume and since the individual plungers are uniformly moved, absolute uniformity of volume of liquid discharged through the respective needles will be attained.

By carefully controlling the supply of motive fluid to the motor 85, movement of the head 70 may be so controlled that pickling liquid will be quite uniformly distributed through the body of the article 47. Because of the particular structural arrangement herein disclosed, each needle 57 may be said to act individually as a brake upon liquid-expressing movement of the head 70. That is, if even one needle of the gang should be completely clogged, further downward movement of the head 70 will be stopped, provided the rupture strength of the needle exceeds the pressure exerted by the motor 85. Thus, the operator would be warned of imperfect operation of the

machine, and will be given an opportunity to shut down the machine and clean the affected needle.

This capacity of the disclosed machine is highly important and desirable in the art to which the invention pertains. The rate of injection must be so controlled that the pickling liquid will be injected into the meat as rapidly as it can be absorbed therein, but at a rate not exceeding the absorption capacity of the meat. If liquid is injected too fast, it will simply find its way up along the shank of the needle to escape from the body of the meat over the upper surface thereof. The braking effect of the pistons **60** upon the motor **85** tends to hold the injection rate within the absorption capacity of the meat.

That absorption capacity may vary between successive pieces to be treated. The denser the specimen under treatment, the slower will be the rate of absorption. In bacon, for instance, density varies widely among individual slabs, increasing as the leanness increases. Inherent in the machine, as herein disclosed, then, is a self-adjusting capacity whereby the rate of injection will be to some extent varied in accordance with variations in absorption capacty of the piece being treated.

When the nut **88** comes into contact with the abutment **89**, the abutment means **169** will close the switch **159**. Thereby, the solenoid **121** will be energized through a circuit traced from line wire **139** through wire **157**, wire **156**, branch wire **160**, switch **159**, wire **158**, solenoid **121**, branch wire **146**, wire **144**, wire **143** and wire **142** to line wire **141**. Valve **96** will thereby be shifted to retract the platform **20**; and when the platform reaches its position of full retraction, the switch **162** will be closed to reinitiate the cycle of operation just described.

A shield, indicated generally by the reference numeral **171**, surrounds the bank of syringes to retain spray which might be thrown by needles not buried in the piece **47**. Preferably, that wall **172** of the shield adjacent the feed mechanism **34** will be metal; but the other three walls of the shield may advantageously be made of transparent plastic material such as polystyrene, Lucite, or the like.

When conventional oil is used as the motive fluid for actuating the motors **22**, **37** and **85**, of course it is highly desirable to protect the food products being handled against any possible contamination by oil leaking from the motors around the piston stems. One effective means for providing such protection is illustrated in Fig. 14. As there shown, that end of the cylinder near the platform **20** is formed to provide an enlarged chamber **173** filled with packing material **174** at one end, and with packing material **175** at the other end, such packing material pressing against the stem **21** and against the peripheral wall of the chamber **173**. Between the packing sections **174** and **175**, I insert a member **176** formed to provide an external annular groove **177** and an internal annular groove **178** joined by a series of perforations **179**. The groove or channel **177** registers with a radial port **180** through the wall of the chamber **173**; and a fitting **181** is received in said port and connects with a conduit **182** leading to the reservoir **90**. Any oil which finds its way past the packing **174** along the wall of the chamber **173** will be trapped in the channel **177** and thence carried to the port **180**. Any oil which finds its way along the surface of the stem **21** will be trapped in the channel **178** and thence carried through one or more of the ports **179** to channel **177** and so through the port **180**. Each of the motors **22**, **37** and **85** may be provided with similar protective means.

As an alternative means of protecting the food product against contamination by the motive liquid, I have suggested in Figs. 15 and 16 an arrangement wherein no oil is used in the near ends of the motor cylinders. In Fig. 15, I have diagrammatically illustrated a motor **85'** to take the place of the motor **85** and comprising a cylinder **183** in which is reciprocably mounted a piston **184** carrying a stem **185** equivalent to the stem **84**. A control valve **186** is formed to provide a cylinder **187** in which is reciprocably mounted a piston valve **188** formed with spaced lands **189** and **190**. Ports **191** and **192** lead from cylinder **187** into passage **193** with which communicates branch exhaust pipe **104'**. Branch supply pipe **103'** opens into said cylinder; and the piston **188** carries at one end an armature **194** for a solenoid **195** and carries at its opposite end an armature **196** for a solenoid **197**. Springs **198** and **199** normally hold the valve in its illustrated position. A pipe **200** leads from cylinder **187** to the remote end of motor cylinder **183**, a regulating valve **201** being interposed in said pipe.

When the solenoid **195** is energized, the valve **188** will be shifted to the right, whereby pipe **200** will be placed in direct communication with supply branch **103'** through the cylinder **187**, while the port **192** will be closed by land **190** and the port **191** will be closed from communication with the supply branch **103'** by the land **189**. Thereby, liquid will be supplied to the remote end of the cylinder **183** to project the piston **184** and its stem **185**. When the solenoid **195** is deenergized, the spring **198** will return the piston **188** to its illustrated position, wherein the pipe **200** is sealed, but the supply pipe **103'** communicates with the exhaust pipe **104'** through the cylinder **187**, port **191**, and passage **193**.

When the solenoid **197** is energized, the valve will be moved to the left, whereby land **190** will close supply branch **103'**, while pipe **200** will be placed in communication with exhaust branch **104'** through cylinder **187**, port **192** and passage **193**.

Air under pressure is constantly supplied to the near end of the motor cylinder **183** through supply pipe **202**, which need not be controlled. The air pressure so supplied to the cylinder **183** will, of course, be at a value less than that of the liquid under pressure available from the pump **91**. The air pressure, however, will be sufficiently superatmospheric so that, when the remote end of the cylinder **183** is vented to the reservoir **90**, as described above, the piston **184** will be retracted by such air pressure.

In Fig. 17, I have shown a special wrench **203** for manipulating the needles **57** and their assemblies. The wrench comprises a shank **204** having an enlarged head **205** formed with a socket **206** shaped and proportioned to conform to the projecting ends of the fittings **51** and **56** or either of them. In order that it may not be necessary to dismount the platform **20** or the block **48** in order to manipulate one or more needles, the head **205** is formed with a longitudinally-extending slot **207** and the shank **204** is formed with a similar and communicating slot **208** whereby the long needle may be entered into the wrench in a radial direction before the wrench is moved

axially to engage the fitting to be manipulated in the socket **206**.

I claim as my invention:

1. In a machine of the class described, a gang of syringes, each comprising a chamber, a piston reciprocable in said chamber, and a perforated needle communicating with said chamber, a platform for supporting a product into which fluid is to be injected, motor means for producing relative movement between said platform and said needles to cause said needles to enter a product supported on said platform, motor means for subsequently moving said pistons in unison in their chambers to drive fluid out of said chambers through said needles, control means for said last-named motor means, including a switch, and means automatically actuated after said needles have entered such product, to shift said switch to initiate piston movement.

2. In a machine of the class described, a gang of cylinders, a perforated needle communicating with each cylinder, a piston reciprocable in each cylinder, means providing a valve-controlled inlet to each cylinder, a platform supported adjacent the free ends of said needles and movable toward and away therefrom in line with said needles, conveyor means adjacent said platform and including an intermittently movable element operable to feed objects successively onto said platform, means energized when said platform attains its position most remote from said needles to shift said movable element toward said platform and to retract said pistons in their cylinders to draw a uniform, measured volume of fluid into each cylinder, means energized when said pistons have been fully retracted to retract said movable element and to move said platform toward said needles to cause said needles to enter an object on said platform, means energized when said movable element has been fully retracted to advance said pistons in their cylinders to drive such measured volumes of fluid from said cylinders through said needles, and means energized upon completion of the fluid-discharging stroke of said pistons to retract said platform.

3. The machine of claim 2 including means for adjustably and uniformly limiting the length of the stroke of said pistons, thereby varying the volume of fluid so handled through each cylinder.

4. In a machine of the class described, a reservoir, a gang of cylinders opening from said reservoir, a piston reciprocably mounted in each cylinder and retractible into said reservoir, each piston being formed with a passage therethrough providing, at times, communication between said reservoir and the interior of its cylinder ahead of said piston, a head positioned in said reservoir and having a lost-motion connection with each of said pistons, and means for reciprocating said head in line with said cylinders, said head and each of said pistons being formed with cooperating surfaces establishing a fluid seal with said piston passages to close said passages when said head moves toward said cylinders, and said head moving away from said pistons to open such passages upon retraction therefrom.

5. In a machine of the class described, a reservoir, a gang of cylinders formed on parallel axes, each cylinder having a rearward end opening into said reservoir and a forward end, a perforated needle for each cylinder and opening into the forward end thereof, a piston reciprocably mounted in each cylinder, a head mounted in said reservoir for reciprocating movement therein substantially in the line of said cylinder axes, each piston having a passage therethrough opening into its cylinder ahead of said piston and having a mouth presented toward said head, means providing a lost-motion driving connection between each piston and said head, said head being provided with a sealing portion for each piston, each such portion cooperating with its piston passage mouth to seal the same during movement of said head toward the forward ends of said cylinders, but moving away from its piston to open said mouth during movement of said head away from said forward ends of said cylinders.

6. In a machine of the class described, a platform, a first fluid motor including a reciprocable piston supporting said platform to move between projected and retracted positions, a table located adjacent the retracted position of said platform, a feeder element mounted to sweep said table, a second fluid motor including a piston operatively connected to move said feeder between a retracted position in which said table is free to receive an object, and a projected position closely adjacent said platform, said feeder acting, upon movement from its retracted position to its projected position, to sweep an object supported on said table from said table onto said platform, a block mounted in line with the path of movement of said platform and near the projected position of said platform, a plurality of injectors supported on said block and projecting toward said platform to enter an object supported on said platform when said platform is projected, means providing a fluid reservoir communicating with said injectors, a third fluid motor including a piston shiftable between projected and retracted positions, means actuated by said third fluid motor upon projection of its piston to express fluid from said reservoir through said injectors, a source of fluid under pressure, a first valve means controlling flow between said source and said first fluid motor, a second valve means controlling flow between said source and said second fluid motor, a third valve means controlling flow between said source and said third fluid motor, means actuated by retraction of said first fluid motor piston to operate said second valve means to project said second fluid motor piston and to operate said third valve means to retract said third fluid motor piston, means actuated by retraction of said third fluid motor piston to operate said first valve means to project said first fluid motor piston and to operate said second valve means to retract said second fluid motor piston, means actuated by retraction of said second fluid motor piston to operate said third valve means to project said third fluid motor piston, and means actuated by projection of said third fluid motor piston to operate said first valve means to retract said first fluid motor piston.

7. In a machine of the class described, a platform mounted for reciprocation between projected and retracted positions, a first motor connected to drive said platform, means dominating said motor comprising a projecting electric circuit acting, when energized, to actuate said motor to project said platform and a retracting electric circuit acting, when energized, to actuate said motor to retract said platform, a first motor projecting switch dominating said projecting circuit, a first motor retracting switch dominating said retracting circuit, a table located adjacent the retracted position of said platform, a feeder element mounted to sweep said table, a second motor connected to drive said feeder element between a retracted position in which said table

is free to receive an object, and a projected position closely adjacent said platform, said feeder acting, upon movement from its retracted position to its projected position, to sweep an object supported on said table from said table onto said platform, means dominating said second motor comprising a projecting electric circuit acting, when energized, to actuate said second motor to project said feeder and a retracting electric circuit acting, when energized, to actuate said second motor to retract said feeder, a second motor projecting switch dominating said second motor projecting circuit, said first motor projecting switch dominating said second motor retracting circuit, a block mounted in line with the path of movement of said platform and near the projected position of said platform, a plurality of injectors supported on said block and projecting toward said platform to enter an object supported on said platform when said platform is projected, means providing a fluid reservoir communicating with said injectors, reciprocating means operatively associated with said injectors and movable between a retracted position and a projected position to express fluid from said reservoir through said injectors, a third motor connected to drive said reciprocating means, means dominating said third motor comprising a projecting electric circuit acting, when energized, to actuate said third motor to project said reciprocating means and a retracting electric circuit acting, when energized, to actuate said third motor to retract said reciprocating means, a third motor projecting switch dominating said third motor projecting circuit, said second motor projecting switch dominating said third motor retracting circuit, said switches being normally open, means moved by said first motor to close said second motor projecting switch upon retraction of said platform, means moved by said third motor to close said first motor projecting switch upon retraction of said reciprocating means, means moved by said second motor to close said third motor projecting switch upon retraction of said feeder, and means moved by said third motor to close said first motor retracting switch upon projection of said reciprocating means.

8. In a device of the class described, a platform for supporting a food product, a pusher for delivering such products serially to said platform, a bank of injectors, each including a reciprocating plunger, arranged adjacent said platform and facing the supporting surface thereof, a first reciprocating liquid-actuated motor including a cylinder, a piston mounted therein, and a stem moving with said piston and supporting said platform, said platform being interposed between said motor and said bank of injectors, a second reciprocating, liquid-actuated motor including a cylinder, a piston mounted therein, and a stem moving with said piston and operatively connected to drive said pusher, said pusher being interposed between said second motor and said platform, a third reciprocating, liquid-actuated motor including a cylinder, a piston mounted therein, and a stem moving with said piston and operatively connected to drive said injector plungers, said injectors being interposed between said third motor and said platform, a reservoir for motor-actuating liquid, means for supplying liquid from said reservoir to said motors under pressure, and packing means for each piston stem including means providing an axially-elongated chamber opening into the associated cylinders and through which said stem extends, packing material fitting each end of said chamber and engaging said stem and the chamber wall, said chamber being formed to provide an annular channel intermediate its ends and a radial port communicating with said channel, and conduit means connecting said port with said reservoir.

9. In a device of the class described, a platform for supporting a food product, a pusher for delivering such products serially to said platform, a bank of injectors, each including a reciprocating plunger, arranged adjacent said platform and facing the supporting surface thereof, a first reciprocating motor including a cylinder having one end near said platform and its other end remote therefrom, a piston mounted therein, and a stem moving with said piston and supporting said platform, said platform being interposed between said motor and said bank of injectors, a second reciprocating motor including a cylinder having one end near said platform and its other end remote therefrom, a piston mounted therein and a stem moving with said piston and operatively connected to drive said pusher, said pusher being interposed between said second motor and said platform, a third reciprocating motor including a cylinder having one end near said platform and its other end remote therefrom, a piston mounted therein, and a stem moving with said piston and operatively connected to drive said injector plungers, said injectors being interposed between said third motor and said platform, a reservoir for motor-actuating liquid, means for supplying liquid from said reservoir under pressure, valved conduit means for connecting the remote ends of said cylinders selectively with said supplying means or with said reservoir, a source of gas under pressure, and conduit means connecting the near ends of said cylinders with said gas source.

10. In a machine of the class described, a gang of syringes, each comprising a cylinder, an injector needle communicating with the forward end of each cylinder, a piston reciprocably mounted in each cylinder, said pistons and cylinders being so proportioned and arranged that, when each piston is in its forwardmost position, the rearward end of said piston remains outside the rearward end of its cylinder, each piston being formed with an axial passage therethrough, a sealing gasket surrounding the rearward end of each piston passage, a stem loosely mounted in, and completely traversing, each piston passage, means limiting rearward movement of each stem relative to its associated passage, a head operatively connected to all of said stems and movable into and out of sealing engagement with all of said gaskets, and means for reciprocating said head in a direction axial with respect to said cylinders whereby, as said head moves forward with respect to said cylinders, it closes all of said piston passages and then drives said pistons toward the forward ends of their cylinders, and as said head moves rearwardly with respect to said cylinders, it opens all of said piston passages and then retracts said pistons.

11. In a machine of the class described, a gang of syringes, each comprising a cylinder, an injector needle communicating with the forward end of each cylinder, a piston reciprocably mounted in each cylinder, said pistons and cylinders being so proportioned and arranged that, when each piston is in its forwardmost position, the rearward end of said piston remains outside the rearward end of its cylinder, each piston being formed with an axial passage therethrough, a sealing gasket surrounding the rearward end of each piston pas-

sage, a stem loosely mounted in, and completely traversing, each piston passage, a foot at the forward end of each stem having a transaxial dimension exceeding that of said passage, a head fixedly connected to all of said stems, said stems having a limited lost-motion axially relative to said pistons and said head thereby being movable into and out of sealing engagement with all of said gaskets, and means for reciprocating said head in a direction axial with respect to said cylinders whereby, as said head moves forward with respect to said cylinders, it closes all of said piston passages and then drives said pistons toward the forward ends of their cylinders, and as said head moves rearwardly with respect to said cylinders, it opens all of said piston passages and then retracts said pistons.

12. In a machine of the class described, a gang of cylinders, a perforated needle communicating with each cylinder, a piston reciprocable in each cylinder, means providing a valve-controlled inlet to each cylinder, a platform supported adjacent the free ends of said needles, means for producing relative movement of said gang and said platform toward and away from each other in line with said needles, conveyor means adjacent said platform and including an intermittently movable element operable to feed objects successively onto said platform, means energized when said platform and said gang attain maximum separation to shift said movable element toward said platform and to retract said pistons in their cylinders to draw a uniform, measured volume of fluid into each cylinder, means energized when said pistons have been fully retracted to retract said movable element and to produce relative movement of said platform and said gang toward each other to cause said needles to enter an object on said platform, means energized when said movable element has been fully retracted to advance said pistons in their cylinders to drive such measured volume of fluid from said cylinders through said needles, and means energized upon completion of the fluid-discharging stroke of said pistons to produce separation of said platform and said gang.

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