

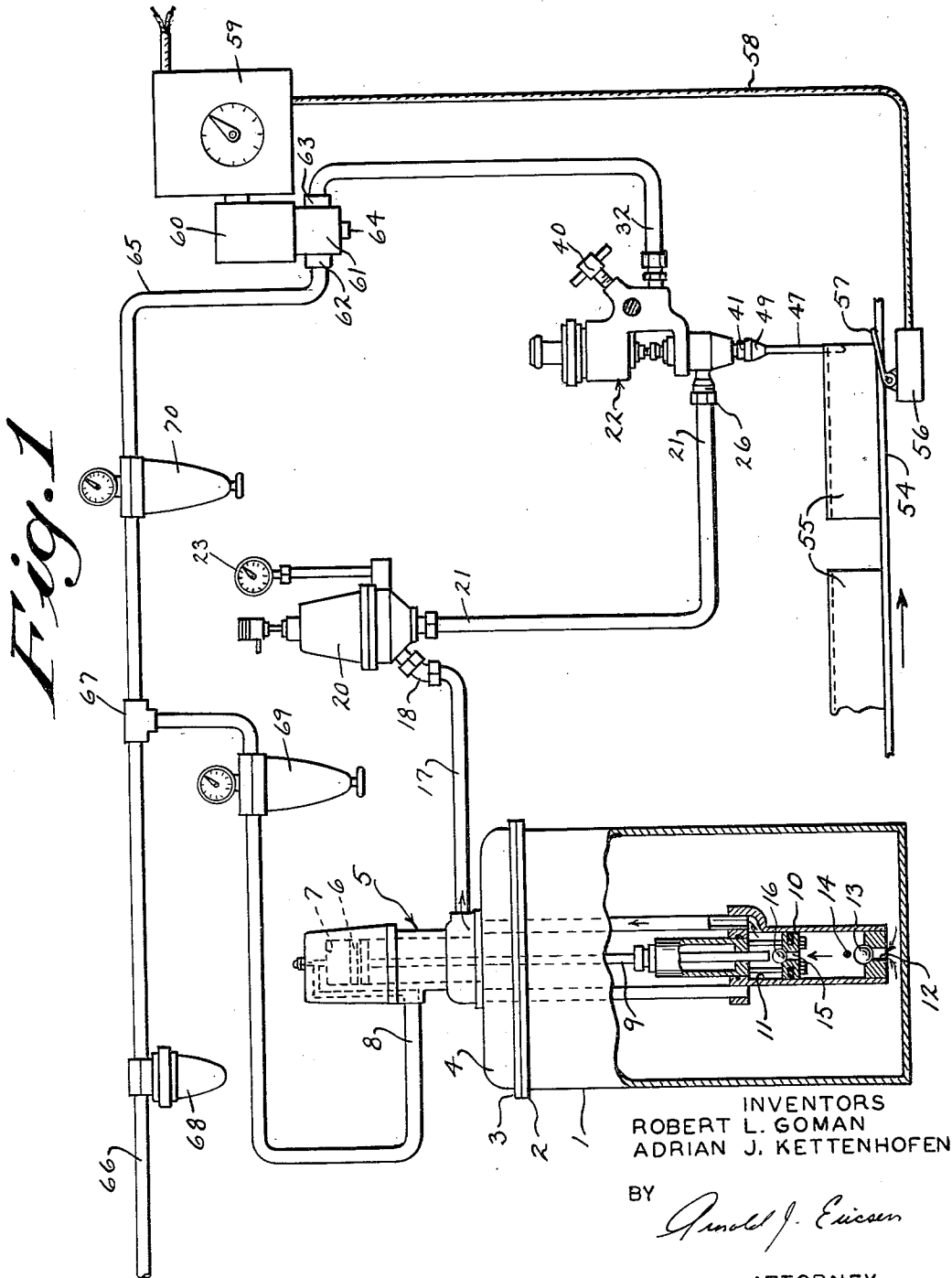
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R. L. GOMAN ETAL
FLUID DISPENSING SYSTEM

3,104,986

Filed Aug. 8, 1960

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Fig. 2

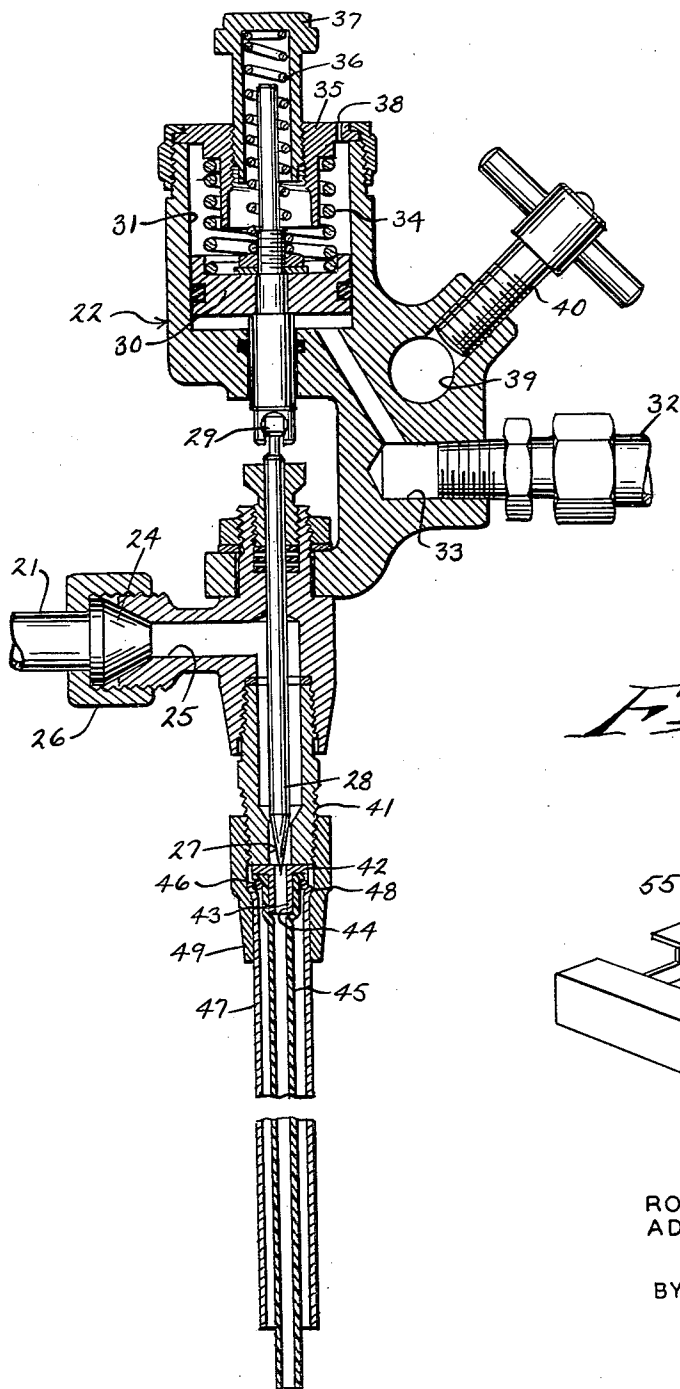


Fig. 3

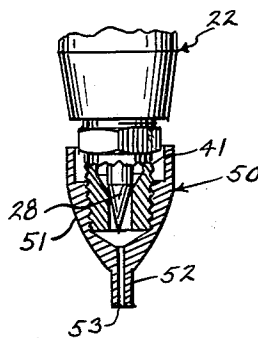
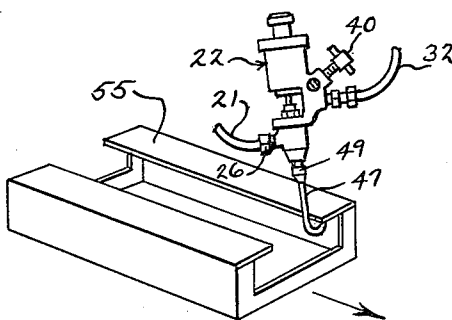


Fig. 4



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FLUID DISPENSING SYSTEM

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This invention relates to fluid dispensing systems, and it more particularly resides in a fully enclosed pressure system especially suited for the extrusion in accurately metered amounts of viscous liquids such as adhesives.

The invention is particularly adapted for use, for example, in conjunction with continuous packaging lines wherein it is necessary to apply strips of adhesive along the margins of a succession of cartons moving along a conveyor in order that covers or labels may be subsequently secured thereto. Heretofore, the application of adhesive strips in such a system has often been accomplished by means of a roller rotatable on a horizontal axis and having its lower portion disposed in an open bath of adhesive. The moving cartons in such an installation are arranged to contact the upper surface of the roller thereby causing it to rotate, with such rotation causing the adhesive to be carried from the bath to the cartons on the periphery of the roller.

Bath rollers of the type described are subject to a number of limitations in use, and have not proved satisfactory in all cases. For example, such rollers are generally capable of depositing adhesive only on the underside of a surface, and it has thus often been necessary to arrange conveyor lines to cause the cartons or other items to be turned upside-down in order to deposit adhesive on their upper surfaces. Alternatively, it has been necessary to provide one or more transfer rollers to deposit adhesive on upwardly facing surfaces. Since the rollers in either case are generally actuated only periodically as each carton passes over, the adhesive may flow downwardly about the rollers during the interim periods whereby an insufficient or excessive amount of adhesive may be deposited on the first portions of the succeeding cartons.

Further, since the baths and rollers are fully exposed to the surrounding air, the adhesive qualities of the adhesive being used may be impaired after the apparatus has been in use for a time. In order to avoid such a loss of adhesive qualities, it may be necessary to deposit only small amounts of adhesive in the baths at any one time, thus necessitating frequent refillings. This exposed arrangement also necessitates the complete dismantling and cleaning of the baths and rolls after each period of use, a time-consuming and distasteful task.

Accordingly, it is a primary object of this invention to provide a fully enclosed, pressure operated system for the dispensing of adhesives and similar fluids which overcomes the foregoing disadvantages.

It is a further object of this invention to provide such a system which is capable of periodically extruding accurately metered amounts of material in a controlled, continuous flow without pressure surges.

It is another object of this invention to provide an adhesive discharge nozzle for such a system which provides for even, controlled flow of material therethrough, and which may be adjusted to deposit the adhesive material in heretofore inaccessible areas such as the inside edges of cartons.

The foregoing are merely illustrative, however, and further objects and advantages will become apparent from the description to follow. In the description, reference is made to the accompanying drawings, forming a part hereof, in which there is shown by way of illustration and not of limitation a preferred embodiment of the invention.

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In the drawings:

FIG. 1 is a view of an adhesive dispensing system embodying the invention herein in which parts are shown broken away and in section, and other parts are represented schematically,

FIG. 2 is a view in cross section of the adhesive applicator and discharge nozzle of the system of FIG. 1,

FIG. 3 is a fragmentary view, partially in cross section, of a portion of the applicator of FIG. 2 and showing a second embodiment of a discharge nozzle, and

FIG. 4 is a view in perspective showing the adhesive applicator and discharge nozzle in use.

Referring now more specifically to FIG. 1 of the drawings, there is shown therein an enclosed adhesive dispensing system which includes an adhesive reservoir 1 adapted to be filled with adhesive (not shown) which may be in the form of a standard 55 gallon metal drum as shown herein. To allow clarity of disclosure, the adhesive to be dispensed is not shown in the drawings herein but it will be understood that the system shown is intended to be filled with a suitable adhesive. The drum 1 is provided with a flange 2 at its upper end, and a matching flange 3 of a cover 4 is attached thereto by any suitable means, the cover 4 serving to enclose the top of the drum 1. The connection between the flanges 2 and 3 is not completely airtight in order to allow adhesive to be dispensed in a manner to be hereinafter described.

A pump 5, preferably air operated, is attached to the cover 4 and extends downwardly into the drum 1. The pump 5 may be of any standard construction, and preferably includes an air motor piston 6 which is caused to reciprocate vertically within a cylinder 7 by compressed air entering the pump 5 through a pump actuating air line 8. The vertical reciprocating movement of the piston 6 is transmitted by a connecting rod 9 to a displacement piston 10 dependent from the rod 9 which piston 10 is vertically reciprocable within a chamber 11. A foot valve opening 12 is provided at the bottom of the chamber 11 and is closable by a foot valve ball stop 13 the upward, or opening, movement of which is limited by a pin 14 extending inwardly from the wall of the chamber 11. A piston valve opening 15 is provided in the piston 10 and may be closed by a piston valve ball stop 16, the opening movement of which is limited by the lower end of the connecting rod 9. An adhesive outlet line 17 is in communication with the upper end of the chamber 11 and leads outwardly of the pump 5.

In operation of the pump 5, as the piston 10 is moved upwardly in response to the upward movement of the piston 6, a partial vacuum is created under the piston 10 and the adhesive in the drum 1 enters the chamber 11 through the foot valve opening 12 in response to the atmospheric pressure within the drum 1. The foot valve ball stop 13 is free to open to allow such flow, but is limited in its opening movement by the pin 14. The pressure within the drum 1 is maintained at atmospheric level since air is allowed to enter therein between the flanges 2 and 3. During the upward stroke of the piston 10, the piston valve ball stop 15 remains in a closed position thereby maintaining the necessary vacuum. During the downward stroke of the piston 10, in response to the downward stroke of the piston 6, the ball stop 13 falls to a closed position and is held there by the pressure within the chamber 11 while the ball stop 15 is allowed to assume an open position, its upward movement being limited by the connecting rod 9. During the course of this downward stroke, the adhesive in the chamber 11, under the piston 10, is allowed to pass through the opening 15 and to the space above the piston 10. The next upward stroke of the piston 10 causes more adhesive to be drawn into the area under the piston 10 while that adhesive occupying the

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space above the piston 10 is forced upwardly through the outlet 17, the closed ball valve 16 preventing downward passage of the adhesive through the opening 15. The air pressure needed to operate the pump 5 will depend upon the viscosity of the fluid being dispensed and the pressure desired in the outlet line 17. In the system shown herein, which is designed for dispensing an adhesive having a viscosity of 2800-3400 centipoise at 70 degrees F., such as the water dispersion adhesive manufactured by Swift & Co. as type Z3917, it has been found desirable to provide approximately 50 p.s.i. pressure in the actuating line 8 in order to provide for a pressure of 140 p.s.i. in the adhesive outlet line 17.

Although the pneumatically operated displacement pump 5 shown herein has proven satisfactory in use, it will be understood that any of a number of other standard pumps may be used without departure from the invention. Therefore, a number of the specific details of construction of the pump 5 have neither been shown nor described herein, it only being necessary to provide adequate pump means to force adhesive through the outlet line 17 from the drum 1 at a desired pressure.

Although the pump 5 is arranged to force adhesive through the line 17 at a desired pressure of 140 p.s.i., it will be obvious that pressure surges due to the reciprocating action of the pump 5 will cause this pressure to deviate. Therefore, the outlet line 17 is connected, by a fitting 18, to a diaphragm type fluid pressure regulator 20 of a standard construction. It is the function of the pressure regulator 20 to even out the pressure surges in the line 17 whereby adhesive will flow at a constant pressure through a line 21 serving as an adhesive inlet to an adhesive applicator 22. A gauge 23 serves as a means whereby the operation of the regulator 20 may be checked. In order to insure an even flow through the line 21, it is desirable to set the regulator 20 for an output pressure less than that available from the line 17. Therefore, in the embodiment shown, the regulator 20 is arranged to provide an output pressure of approximately 100 p.s.i. in the line 21. Since the regulator 20 may be of any of a number of constructions well known in the art, the specific structural details thereof have not been shown nor described herein.

As stated above, the line 21 serves as an adhesive inlet to the applicator 22 and, referring to FIG. 2, it can be seen that the line 21 is provided with a conical fitting 24 which is held against an inlet opening 25 by means of a nut 26. Adhesive from the line 21 flows through the inlet opening 25 and downwardly through a valve or discharge opening 27. A needle valve 28 serves to meter the flow of adhesive through the opening 27 and is connected by a releasable joint 29 to a pneumatically actuated piston 30 operating within a chamber 31. Due to the releasable joint 29, the adhesive carrying elements of the applicator 22 may be entirely disconnected for cleaning. A control air line 32 is connected to an air inlet 33 of the applicator 22, and the inlet 33 extends angularly and upwardly to enter the chamber 31 at the bottom thereof. A piston spring 34 operates between the piston 30 and a threaded cap 35 to urge the piston 30 downwardly as seen in FIG. 2. A control spring 36 operates between the piston 30 and an adjustment knob 37 threadedly engaged to the cap 35 against the bias of the spring 36. The cap 35 extends downwardly into the chamber 31 to serve as a limit to the upward motion of the piston 30. The knob 37 may be turned into or out of the chamber 31 to provide a fine adjustment of the spring force exerted on the piston 30. The piston 30 and its associated elements serve as a control means for the valve 28. When compressed air from the line 32 enters the applicator 22 through the inlet 33, the piston 30 is forced upwardly against the springs 34 and 36, the air trapped above the piston being let out through an outlet port 38. This motion is transmitted, through the joint 29, to the

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metering valve 28 which is thereby raised from the discharge opening 27 to allow the passage of adhesive there-through. When the flow of air through the line 32 is cut off, the springs 34 and 36 are freed to force the piston 30 downwardly thereby closing the valve 28 and stopping the flow of adhesive.

The applicator 22 is further provided with a cylindrical aperture 39 and a set screw 40 by means of which it may be mounted to be positioned with respect to a conveyor line.

Referring again to FIG. 2, it can be seen that the terminal end of the applicator 22 is threaded as at 41. An adapter 32 provided with a narrowed neck portion 43 is positioned adjacent to the valve opening 27 and has an opening 44 therethrough. A flexible tube 45, preferably formed of polyethylene, is disposed at one end about the neck portion 43 and extends downwardly therefrom. An O-ring 46 is positioned about the tube 45 near the base of the adapter 42, and a guard tube 47, preferably formed of a relatively soft material such as copper, is disposed about the tube 45 and is provided with an outwardly turned flange 48 in contact with the O-ring 46. A shouldered nut 49 is threadedly engaged with the threads 41 and serves to hold the adapter 42, tube 45, O-ring 46, and tube 47 in clamping engagement with the applicator 22. The adapter opening 44 and tube 45 together constitute a discharge conduit for the applicator 22, and should be of substantially equal internal cross section to allow for a smooth flow of adhesive therethrough. The copper guard tube 47 may be bent as in FIG. 4 whereby the tube 45 will be held in a position to discharge adhesive in any desired area. The tube 45 preferably fits loosely within the tube 47 to prevent constrictions caused by such bending which may cause an uneven flow.

A shorter, non-flexible discharge nozzle 50 is shown in the embodiment of FIG. 3 and has a roughly conical body portion 51 threadedly engaged with the threads 41 and a narrowed downwardly extending neck portion 52 having a cylindrical discharge orifice 53. The discharge nozzle 50 may be more suitable for some continuous runs where it is only necessary to deposit adhesive on upwardly facing surfaces.

Referring again to FIG. 1, it can be seen that the applicator 22 is positioned immediately above a conveyor belt 54 moving in the direction of the arrow as seen in FIG. 1 and on which is carried a series of objects such as cartons 55. A precision switch 56, or other suitable sensing device such as a photoelectric cell, is preferably positioned immediately below the conveyor 54 and includes an upwardly extending actuating arm 57 which is engageable by each carton 55 as it passes thereover. The switch 56 is connected by a cable 58 to a timer 59 which may be of any suitable standard construction. The timer 59 is connected in circuit with a solenoid 60 which is in turn connected to an air valve 61 having an inlet 62, an outlet 63 and a vent 64. The control air line 32 is connected to the outlet 63 of the valve 61, and a control air supply line 65 is connected to the inlet 62.

A main air supply line 66 is connected to a source of compressed air (not shown) and serves to supply air to the pump actuating line 8 and control air supply line 65 through a T connection 67. An extractor 68, of standard construction, may be connected in line with the main air line 66 and functions in the normal manner to trap water vapor contained in the compressed air. A pump air line regulator 69 is connected in line with the line 8 and serves to maintain the pressure necessary to operate the pump 5, 50 p.s.i. in the embodiment shown. A control air supply line pressure regulator 70 is connected in line with the line 65 and serves to regulate the pressure therein. In the embodiment of the invention shown the control air line is designed to operate with a pressure of approximately 75 p.s.i.

In operation, adhesive is forced from the drum 1

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through the regulator 20 and to the applicator inlet 24 by the pump 5 above described. The adhesive is, however, prevented from flowing through the applicator opening 27 by the valve 28 which is normally held in a closed position by the springs 34 and 36. When a carton 55, traveling along the conveyor 54, reaches the position shown in FIG. 1 wherein the switch actuating arm 57 is depressed, the switch 56 is actuated thereby actuating the timer 59. The timer 59 in turn completes a circuit through the solenoid 60 which thereby causes opening of the valve 61, allowing compressed air to pass from the line 65 through the inlet 62 and out the outlet 63 to the control air line 32. The action of the air on the piston 30 causes the valve 28 to be raised as described, thereby allowing adhesive to flow through the opening 27 and the tube 45 to be deposited on the carton 55. The timer 59 is arranged to interrupt the current to the solenoid 60 at a predetermined time after actuation of the timer 59, and this time is equal to that required for the carton 55 to pass under the applicator 22 as determined by the speed of the conveyor 54 and the length of the carton 55. When the timer 59 reaches its shutoff point, the solenoid 60 is deactivated and the valve 61 is closed thus cutting off the supply of compressed air through the line 32. The piston 30 is then free to be forced downwardly by the springs 34 and 36, the entrapped air being let out through the vent 64. By virtue of this action, the valve 28 is moved downwardly into a closed position thus cutting off the flow of adhesive. When the succeeding carton 55 strikes the actuating arm 57, the entire cycle is repeated.

In some applications, it may be desirable to substitute another sensing device, such as a photoelectric cell, for the switch 56. In such cases, it may be possible to dispense with the timer 59.

Thus it can be seen that there is provided herein a fully enclosed, pressure-actuated system with means included therein for insuring an even continuous flow of adhesive without pressure surges, and with control means included therein for causing the adhesive to be accurately metered in predetermined amounts in response to a timing circuit. Due to its enclosed construction, the system need not be shut down and cleaned after each period of use and, indeed, the tube 45 is maintained filled at all times by capillary action, whereby it is unnecessary even to cap the tube 45 at the end of such periods. As seen in FIG. 4, the discharge nozzle is flexible and enables the adhesive to be deposited on heretofore inaccessible portions of the cartons.

Although the system shown is especially suitable for depositing adhesive on a succession of cartons moving along a conveyor, it will be obvious that the system might easily be adapted for a number of other uses or for use with other materials. Therefore, although a preferred embodiment of the invention has been shown and described herein, it is desired that it be understood that the invention is not to be limited to the specific form and arrangement of parts shown except insofar as such limitations are contained in the following claims.

We claim:

1. In an enclosed adhesive dispensing system the combination comprising: an enclosed adhesive reservoir having an outlet line for discharging adhesive from the reservoir under pressure; an air activated pump attached to said reservoir and connected to said outlet line for moving adhesive into said outlet line under pressure; an adhesive applicator having a discharge opening with a metering valve, a control means for said metering valve, and an adhesive receiving inlet leading to said discharge opening; an inlet line leading to said adhesive receiving inlet; a pressure regulator interposed between and joining said outlet line and said inlet line which regulator admits adhesive to the inlet line at a sustained pressure reduced from peak pressures within said outlet line; a control air

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line connected to said control means for said metering valve; a solenoid operated valve leading to and adapted for opening and closing said control air line; a timer for feeding operating signals to said solenoid operated valve; an article position sensing device connected to said timer; and a main air supply line for said pump and said solenoid operated valve.

2. In an enclosed adhesive dispensing system the combination comprising: an enclosed adhesive reservoir having an outlet line for discharging adhesive from the reservoir under pressure; an air activated pump attached to said reservoir and connected to said outlet line for moving adhesive into said outlet line under pressure; an adhesive applicator having an elongated flexible discharge conduit of substantially constant internal cross section with a metering valve, a control means for said metering valve, and an adhesive receiving inlet leading to said conduit; an inlet line leading to said adhesive receiving inlet; a pressure regulator interposed between and joining said outlet line and said inlet line which regulator admits adhesive to the inlet line at a sustained pressure reduced from peak pressures within said outlet line; a control air line connected to said control means for said metering valve; a solenoid operated valve leading to and adapted for opening and closing said control air line; a timer for feeding operating signals to said solenoid operated valve; an article position sensing device connected to said timer; and a main air supply line for said pump and said solenoid operated valve, said main air supply line including air pressure regulating means for maintaining desired pressure therein.

3. In an adhesive applicator including a discharge opening with a metering valve, a control means for the metering valve, and an adhesive receiving inlet leading to the discharge opening, the combination therewith of: an adapter adjacent said discharge opening and having an opening therethrough in communication with said discharge opening; an elongated flexible adhesive discharge tube disposed at one end about said adapter; a flexible guard tube that is only slightly shorter than the adhesive discharge tube and is loosely disposed about said adhesive discharge tube with one of its ends located at the adapter, said guard tube being deformable to a set position to direct said adhesive discharge tube in a selected direction, the said discharge opening, adapter opening, and adhesive discharge tube being of substantially equal internal cross section; and means to hold said adapter, adhesive discharge tube and guard tube in clamping engagement against said adhesive applicator.

4. In an adhesive applicator including a threaded terminal portion having a discharge opening therethrough, a metering valve, a control means for the metering valve, and an adhesive receiving inlet leading to the discharge opening, the combination therewith of: an adapter having a base abutting the terminal portion of the applicator at the discharge opening and a narrowed neck portion extending outwardly therefrom, said adapter having an opening therethrough in communication with said discharge opening; an elongated flexible adhesive discharge tube tightly disposed at one end about the neck portion of said adapter; a flexible guard tube having a flared end abutting the base of the adapter, said guard tube being loosely disposed about said adhesive discharge tube and being only slightly shorter than said adhesive discharge tube, said guard tube being deformable to a set position to direct said adhesive discharge tube in a selected direction, the said adapter opening and adhesive discharge tube being of substantially equal internal cross section; and threaded means engageable with the terminal portion of the adapter, said threaded means having a shoulder engageable with the flared end of the guard tube to hold the guard tube and adapter in clamping engagement against the terminal portion of the applicator.

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