Feb. 20, 1951 J. P. LISSIMORE 2,542,282

LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

Filed May 10, 1947 8 Sheets-Sheet 1

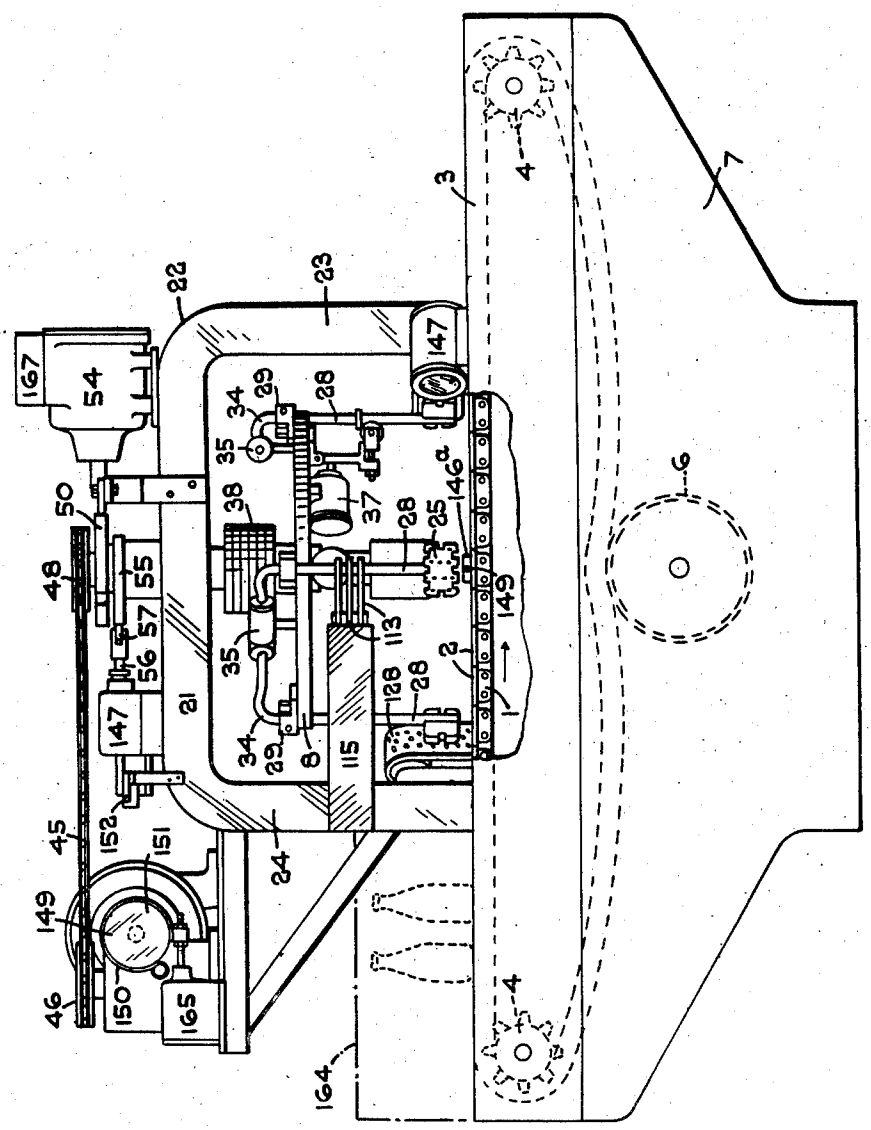


FIG. I.

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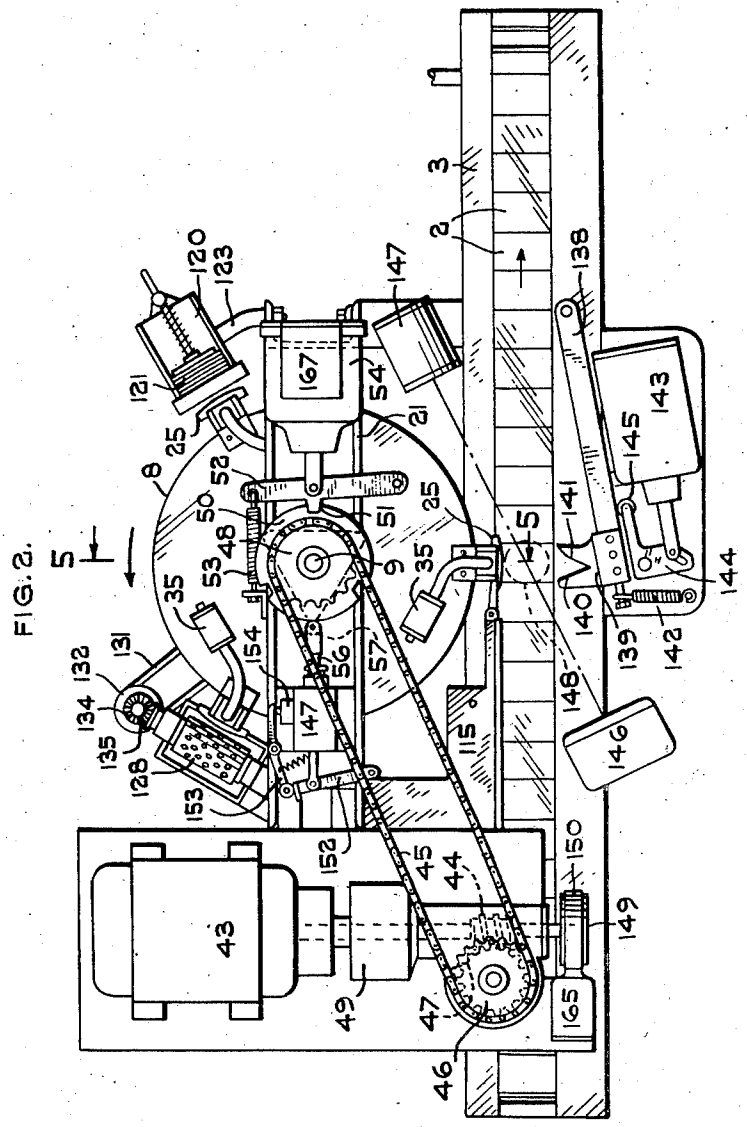


FIG. 2.

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LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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FIG.3.

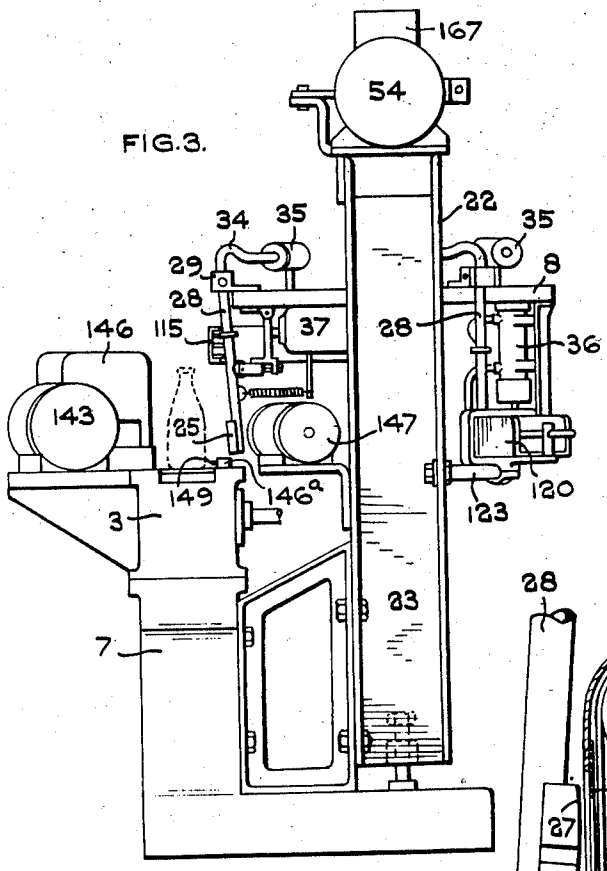


FIG.4

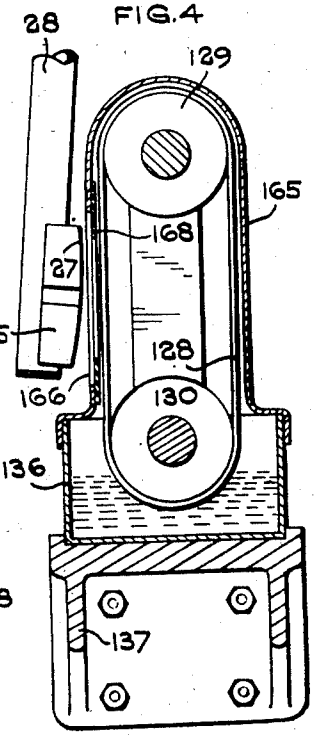
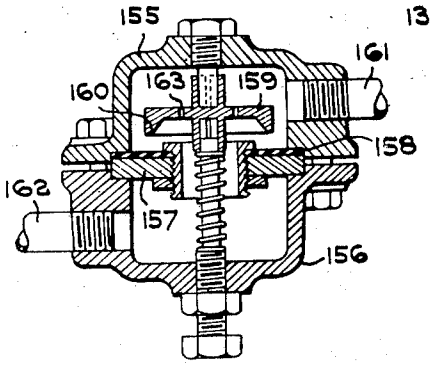


FIG.13.



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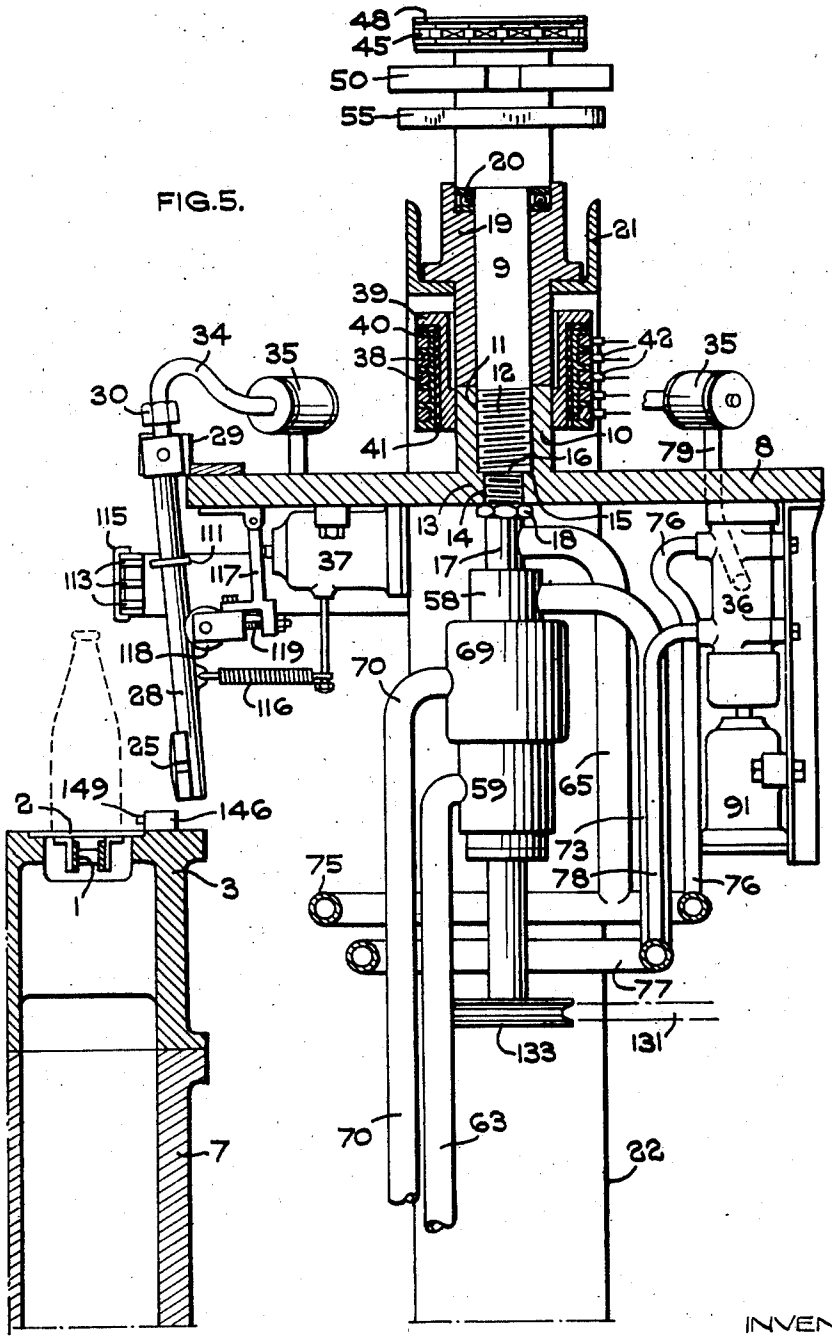
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LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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FIG.5.



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LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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FIG. 9.

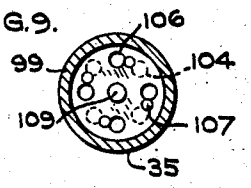


FIG. 8.

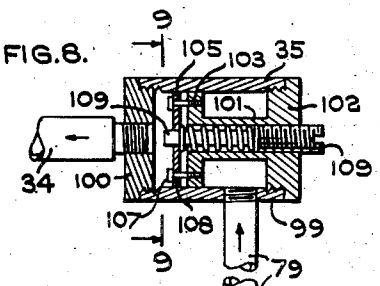


FIG. 6.

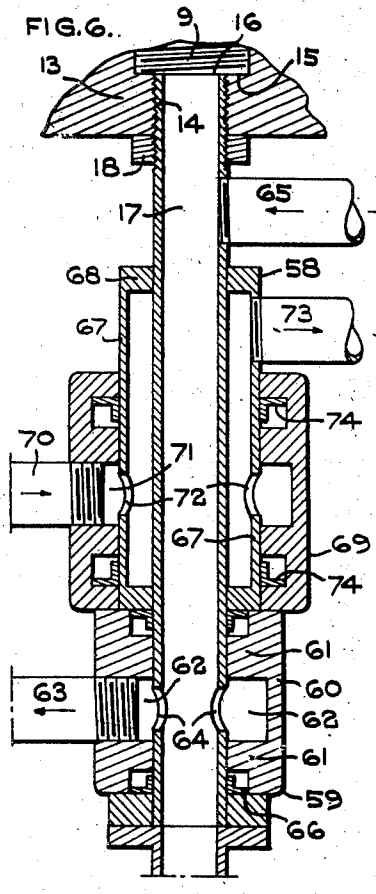


FIG. 7.

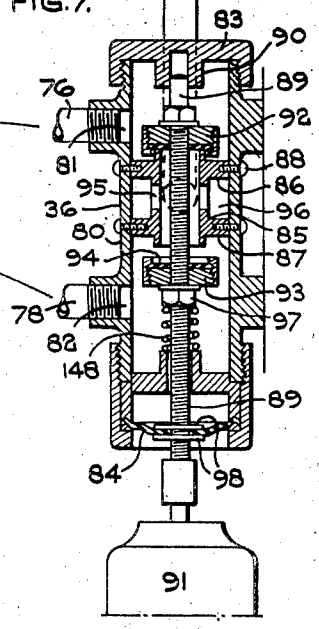
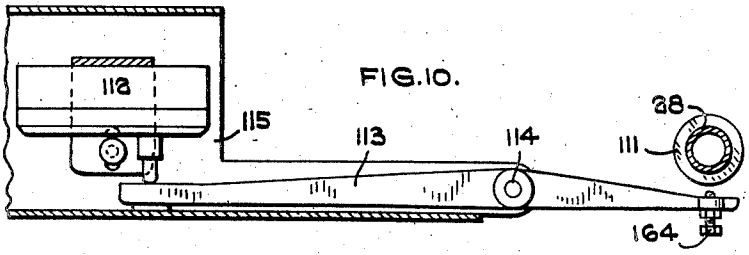


FIG. 10.



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LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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FIG. 11.

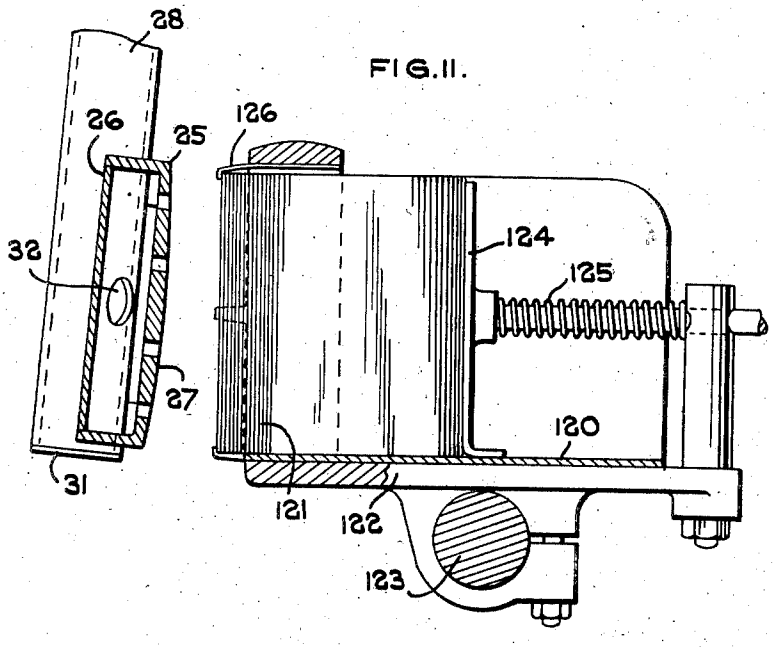
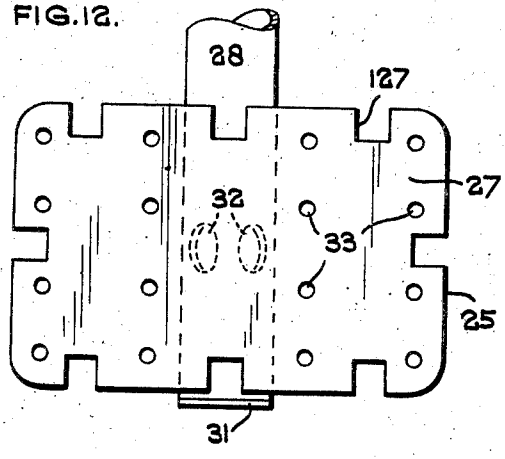


FIG. 12.



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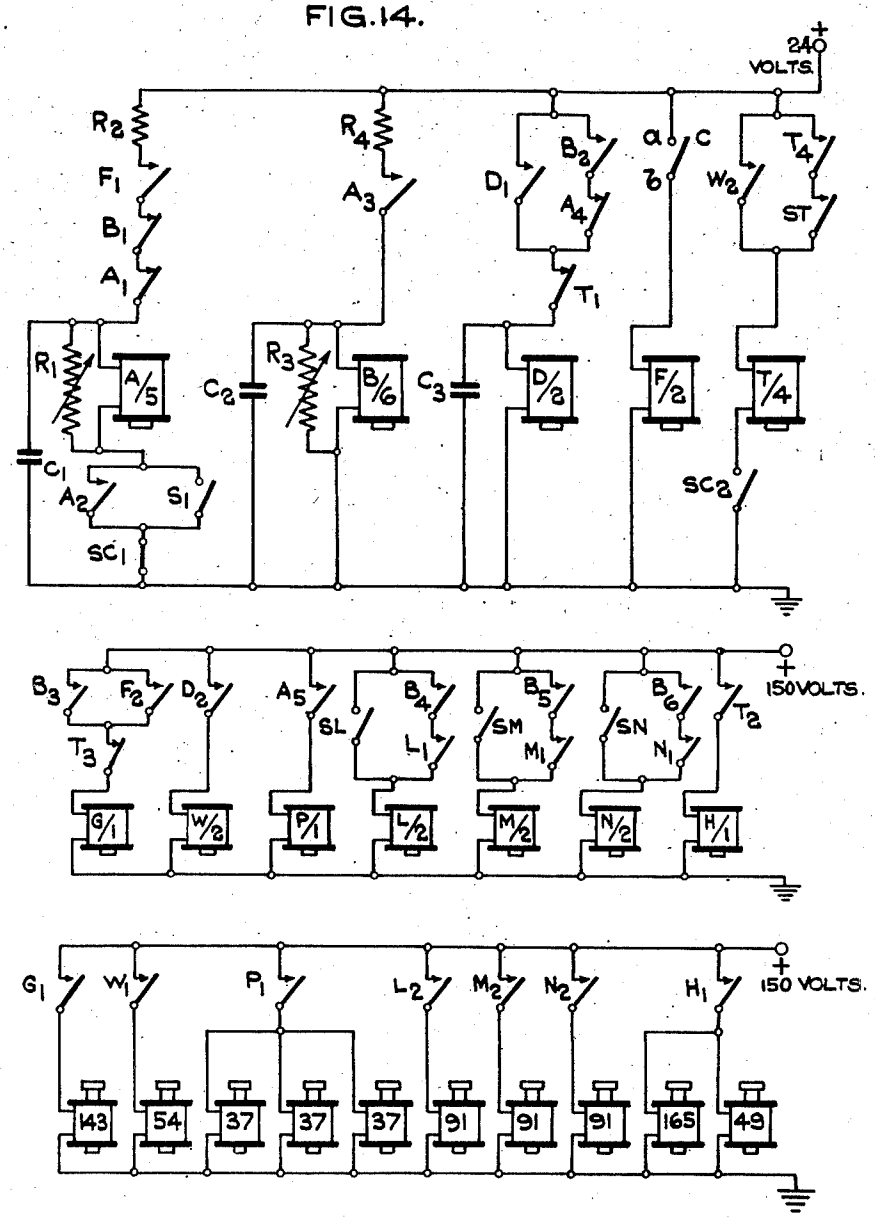
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Feb. 20, 1951 J. P. LISSIMORE 2,542,282

LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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FIG. 14.



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LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

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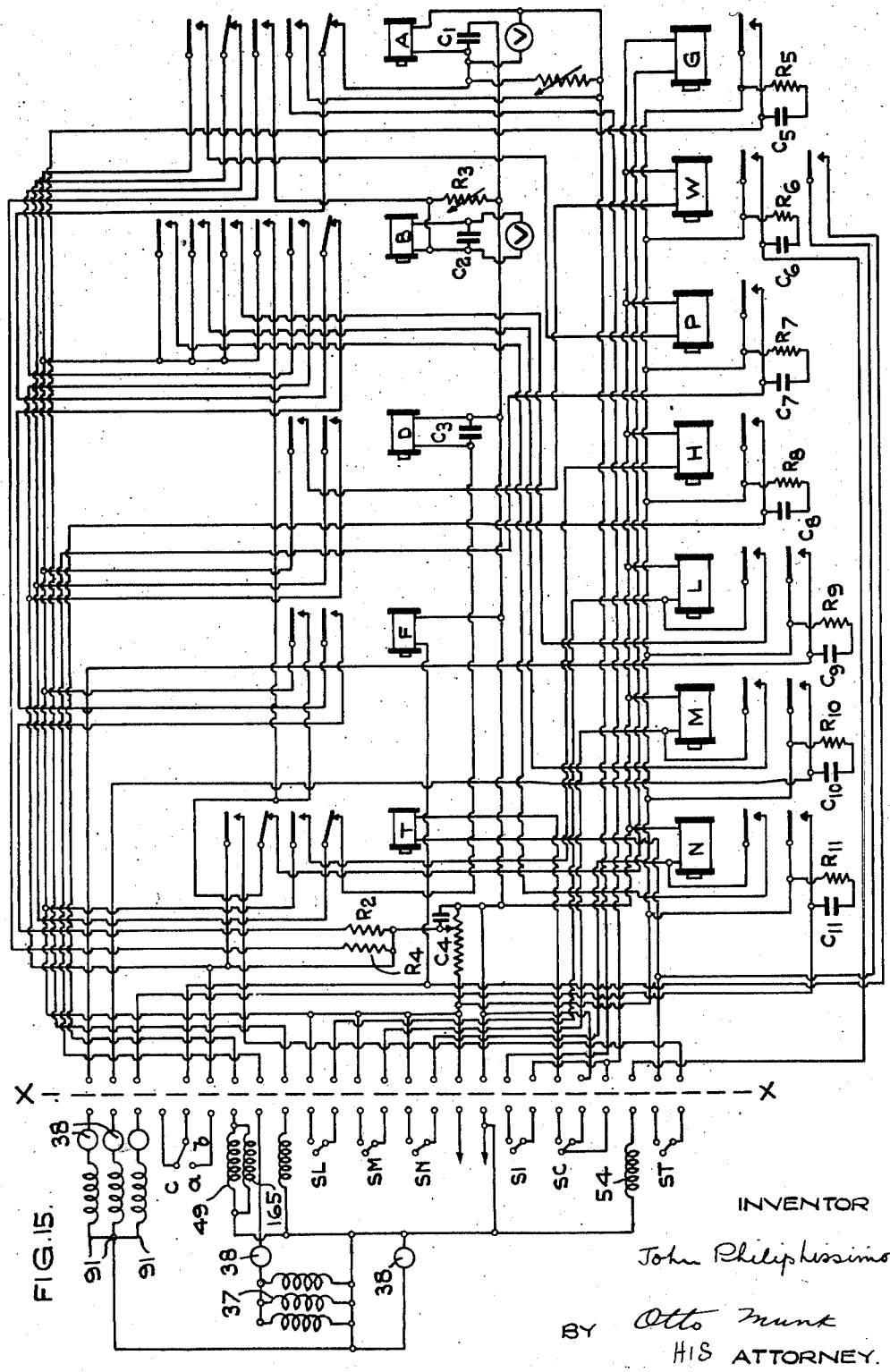


FIG. 15.

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Patented Feb. 20, 1951

2,542,282

UNITED STATES PATENT OFFICE

2,542,282

LABELING MACHINE WITH PNEUMATIC LABEL TRANSFER AND APPLYING MEANS

John Philip Lissimore, Dudley, England

Application May 10, 1947, Serial No. 747,224
In Great Britain March 16, 1946

Section 1, Public Law 690, August 8, 1946
Patent expires March 16, 1966

15 Claims. (Cl. 216—55)

1

This invention relates to apparatus for labelling articles.

One object of the present invention is to obtain automatic operation of the apparatus in accordance with the supply of articles fed thereto while so far as possible reducing the number of parts of the apparatus which are necessarily maintained in a continuously moving state during temporary period of idleness e. g. in the intervals between groups of or individual articles fed to the apparatus, thereby economising in driving power and minimising wear in the apparatus so as to increase its life and reliability.

A further object of the invention is to obviate the need for an attendant or special mechanism to time the feed of articles for labelling, or to space them at exact intervals apart on a feed device, or to place them in special feed compartments or carriers, in accordance with this object the apparatus being capable of unsynchronised operation with respect to other apparatus for the pre-treatment of the articles.

A further object is to enable such unsynchronised or spasmodic operation to take place irrespective of substantial variations in the shape or size of articles to be labelled.

The invention has for a further object to increase the range of variation in size and shape of articles upon which a pneumatic labelling apparatus may be used to affix labels without the necessity of stopping the apparatus for adjustment or for substituting replacement parts.

A further object is in a pneumatic labelling apparatus to reduce to a very small value the loss of suction occasioned by the application of suction to a transfer member prior to engagement of a label thereby while maintaining full suction when the label is positioned on the transfer member.

A further object is to provide a novel form of adhesive applying device in a pneumatic labelling apparatus so constructed as to avoid the risk of stripping of a label from a transfer member upon which the label is held by suction during the adhesive coating operation.

Further objects and advantages of my invention will be pointed out or will be apparent from the following description of preferred embodiments of my invention illustrated in the accompanying drawings wherein:

Figure 1 is a view in front elevation of a machine for labelling bottles constructed in accordance with the present invention.

Figure 2 is a plan view of the same machine.

Figure 3 is a view in end elevation viewed from the right hand end of the machine as shown in Figure 1.

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Figure 4 is a sectional elevational view of the adhesive applying apparatus.

Figure 5 is a sectional end elevational view of the machine along the line 5—5 of Figure 2 viewed from the right hand end of the machine.

Figure 6 is a sectional elevational view of the header boxes from which suction and pressure supplies are conveyed to transfer members.

Figure 7 is a sectional elevational view of a three way valve connecting a transfer member to the suction or pressure sections of the header box.

Figure 8 is a sectional elevational view of a limiter valve.

Figure 9 is a sectional view of a limiter valve along the line 9—9 of Figure 8.

Figure 10 is a fragmentary view showing in plan the mechanism whereby micro-switches are operated to cause suction or pressure to be supplied to the transfer members.

Figure 11 is a sectional view in elevation of the magazine for labels.

Figure 12 is a view in front elevation of a picker box.

Figure 13 is a sectional elevational view of a limiter valve showing an alternative construction.

Figure 14 is a circuit diagram showing the interconnections between the various controlling relays and operating solenoid.

Figure 15 is a wiring diagram.

In the construction illustrated the machine is for labelling bottles by a substantially continuous process in which paper labels are coated with adhesive and affixed to the sides of the bottles, the apparatus consists of the following four principal parts:

A. A conveyor for conveying the bottles through the apparatus.

B. A head mounted for rotary movement and carrying the transfer members, conveniently three in number, which are adapted to receive the labels and apply the same coated with adhesive to the bottle.

C. Apparatus for applying the labels to the transfer members for coating the same with adhesive and for retaining the bottle in the labelling position.

D. An electrical system for controlling the operation of the apparatus, which system is actuated from a photo-electric cell.

The construction and operation of these four sections of the apparatus will now be described.

Apparatus A

The conveyor 1 is of any conventional type and comprises, for example, a number of spaced slats 2 which are continuously driven horizontally in a straight line and which carry the bottles in turn up to and from the actual labelling apparatus, the conveyor passing over a supporting platform 3 which carries also the other parts of the apparatus.

The conveyor passes around two sprocket wheels 4 at either end of the platform 3, one of which is a driving sprocket.

The lower part of the conveyor is supported by a free running wheel or roller 6 mounted on a lower supporting frame 7 which supports the platform 3.

The platform 3 and conveyor 1 are detachable from the lower supporting frame 7 so that different sizes and types of platform and conveyor may be used with the same machine to suit different types of work.

Apparatus B

This apparatus comprises a head 8 of substantially circular form mounted for rotation about a vertical axis and positioned at a higher level than and to one side of the moving belt or platform of the conveyor. The head 8, which is preferably constructed of aluminium or light alloy, is supported upon a shaft 9. The head has a centre boss 10 which has an opening 11 threaded internally to engage an external screwthread 12 on the supporting shaft. The lower part 13 of the boss 10 has an internally threaded opening 14 of smaller diameter and the internal shoulder 15 thus formed abuts against the end 16 of the supporting shaft. A hollow shaft 17 forming an extension of the supporting shaft 9 is screwed into the opening 14 in the lower part 13 of the boss 10 and secured by a nut 18.

The head and its supporting shaft are disposed to the rear of the conveyor and the shaft is itself supported in a single journal bearing 19 and by a single thrust bearing in the form of a ball bearing 20.

These bearings are carried by the upper member 21 of an inverted U-shaped frame 22 of channel section disposed to the rear of the conveyor with the arms 23 and 24 of the U and upper centre portion of the U all in a plane approximately parallel to the line of travel of the conveyor.

Depending from the head at positions spaced equally around it are three transfer members in the form of relatively shallow hollow metal boxes 25, one of the larger faces 26 of each box being flat and directed towards the axis of rotation of the head, and the opposite face 27 being curved to the spherical convex configuration and outwardly directed.

Each box is supported from the lower end of a dependent pipe 28 which serves both as a support for the box and to convey suction or pressure to the interior thereof. The upper end of each pipe is pivoted between arms 29 of a bracket secured at or near the outer edge of the head so that each transfer member can move radially with respect to the axis of rotation of the head. Each transfer member is balanced about its pivotal axis by a combined union nut and balance weight 30.

Each box is conveniently formed as a hollow box-like casting having an opening in the face 26 thereof in which is secured by brazing or welding the end of the pipe 28 so that the pipe can communicate with the interior of the box. The end of the pipe 28 may be closed by a plate 31 and that part of the pipe which is inside the box is provided with one or more holes 32 through which air may be expelled into the box or withdrawn from the box. The spherical convex face of the box 27 is provided with a large number of spaced holes 33 of small diameter which extend through the outwardly directed wall of the box and communicate with the interior thereof.

To the upper end of each pipe 28 is connected a flexible tube 34, each tube 34 being connected via a limiter valve 35 to an electrically operated three-way valve 36 to which is connected also suction and air pressure sources so that suction or air pressure can be applied alternatively to each transfer member, thus causing air to be drawn in through or expelled from the small holes 33.

Conveniently, a suitable blower, not shown in the drawings, is provided having a capacity, for example, of 20 cubic feet per minute capable of giving a suction pressure of 10 inches of mercury and a compression pressure of 5 pounds per square inch above atmosphere.

For moving each of the transfer members radially outwards, the head 8 carries on its underside three correspondingly spaced solenoids 37.

For conveying the electrical supply to operate these solenoids, the head is provided with a set of slip rings 38 supported by a sleeve 39 secured to the boss 10 of the head. Individual slip rings are insulated from one another by a carrier 40 of insulating material having circumferential grooves in which individual slip rings are located, the carrier being concentric with the sleeve 39 and spaced therefrom by a bush 41, of insulating material. Passageways extending axially down the bush may be provided so that electrical connecting wires can pass along them for connection to the interior part of the slip rings 38. Stationary brushes 42 bear upon the slip rings for the purpose of conveying the electrical supply thereto. Five slip rings are provided, one of which is common to all circuits, another of each conveys the electrical supply for operating simultaneously each of the three solenoids 37 for displacing each of the transfer members radially outwards and the other three of which carry electrical supplies for operating solenoids associated with the three-way valves 36.

For rotating the head 8 and the transfer members carried thereon, an electric motor 43 is provided. The motor drives the head through the worm gearing 44 and a sprocket chain 45 passing around two sprocket wheels, one 46 keyed on a common shaft with the worm wheel 47 and the other 48 keyed on to the shaft 9 which drives the head. A magnetic clutch 49 is interposed between the driving motor 43 and the worm gearing 44 so that the drive from the motor may be connected to and disconnected from the head as desired. Further, keyed to the shaft 9 and located immediately below the sprocket 48 is a disc 50. The disc has radial slots 51 cut in its periphery spaced angularly around the periphery at 120° intervals. The disc 50 and hence the head 8 may be located in one of three angularly spaced positions by the co-operation of a pawl 52 which is mounted to be engageable in any one of the slots 51. The pawl 52 is pivoted at one end and connected at the other end to the spring 53

which tends to press the pawl against the rim of the disc 50 so that it engages with one of the slots 51 when this is opposite the pawl. The pawl can be withdrawn from engagement with a slot so that it is clear of the rim of the disc 50 by means of a solenoid 54.

In moving between its two operative positions the pawl actuates a micro-switch 167 having two pairs of contacts, the purpose of the switch will be later described.

Owing to the comparatively high moment of inertia of the rotatable head a device is provided for sliding the retardation of the head when a slot 51 is just approaching the pawl 52 and is about to become engaged therewith. The said device takes the form of a triangu'ar shaped cam 55 keyed to the shaft 9 upon whose triangular cam surface bears a plunger 56 spring loaded to move in an inward radial direction and in connection with the piston of a dashpot 147 so that its outward radial motion is opposed. The triangular cam is so positioned that the spring loaded plunger 56 bears upon the corners of the triangular cam when the pawl 52 is in engagement with slots 51. The corners of the triangular cam are rounded somewhat and the spring loaded plunger 56 may be provided with a roller 57 which bears upon the cam surface.

In order to assist further the retarding of the head, a magnetically operated brake 149 is provided comprising a contractable band 150 which, when the brake is operated, engages the outer periphery of a drum 151.

The other end of the plunger 56 is connected to a lever 152, the end of which engages a further lever 153 for operating a micro-switch 154 for controlling the engagement and disengagement of the magnetic clutch and the magnetic brake.

Conveniently the pressure and suction supplies to the three-way valve 36 may be connected from the blower to header boxes 58 and 59. The lower header box 59 which conveys suction consists of a cylindrical member 60 having axially spaced inwardly directed flanges 61, the interior surfaces of which closely engage the hollow shaft 17. Between the two flanges 61 the member 60 is enclosed in an annular space 62 which is connected to the suction source by means of a pipe 63 screwed into an opening in the wall of the member 60 communicating with the annular space 62. At a position opposite the said annular space the hollow shaft 17 is provided with two holes 64 so that the interior of the shaft is in connection with the suction source and a further pipe 65 in communication with the interior of the hollow shaft 17 is connected to the hollow shaft 17 at a position above both header boxes. The member 60 and the pipe 63 are stationary and the hollow shaft 17 rotates with the head 8. Effective sealing between shaft 17 and the stationary member 60 is provided by suitable seals 66.

The upper header box 58 comprises a hollow cylindrical member 67 having inwardly directed flanges 68 which engages the external surface of the hollow shaft 17, and the whole member 67 rotates with the hollow shaft 17. Around the member 67 is provided another cylindrical member 69 similar in construction to the cylindrical member 60 of the lower header box and performing a similar function with respect to the member 67 as the member 60 performs with respect to the hollow shaft 17. A pipe 70 conveying air under pressure communicates with an enclosed annular space 71 in the member 69 and thence through two holes 72 in the wall of the member 67 with the interior of the member 67. A further pipe 73 positioned above the member 69 communicates with the interior of the member 69. The pipe 73 and the member 67 rotate with the head 8 and the member 69 and the pipe 70 are stationary. Effective sealing between rotating members and the stationary members is provided by packing pieces 74 similar to those already described.

The pipe 65 conveying suction is connected to a ring pipe 75 disposed beneath the header boxes and concentric with the axis of the shaft 9. From this ring pipe 75 connection with the three-way valves 36 may be made by pipes such as that shown at 76. The pipe 73 conveying pressure is connected to a similar ring pipe 77 which is in turn connected to the three-way valves 36 by pipes such as that shown at 78.

Between each transfer member and the suction and pressure source is included a three-way valve 36. There are two inlet connections to each said valve and these are joined to pipes 76 conveying suction and 78 conveying pressure. The outlet connection from the valve is to pipe 79 which, depending upon the position of the valve, conveys either suction or pressure via the limiter valve 35 to the transfer members.

The three-way valve 36 comprises an outer hollow cylindrical body 80 having axially spaced inlet openings 81 and 82 to which the pipes 76 and 78 respectively are connected. The member 80 is closed at one end by a cap 83 and at the other end by a flexible diaphragm 84. Disposed inside the member 80 and concentric therewith is the further hollow cylindrical member 85 open at both ends. The member 85 has a pair of axially spaced outwardly directed circular flanges 86 and 87 which engage the inner surface of the member 80 closely so as to prevent the leakage of air between the said flanges and the said surface and are secured to the member 80 by soldering thereto and by screws 88. Concentric with the axis of the cylindrical members 80 and 85 is a rod 89 slidable axially in a bearing 90 in the cap 83 at one end and extending at the other end through the flexible diaphragm 84, this last said end being in operative connection with a solenoid 91. The rod 89 carries two piston-like members 92 and 93 spaced along the rod 89, one of which, 92, in one position of the rod closes one open end of the member 85 and the other of which 93 in another position of the rod closes the other open end of the member 85. Both piston members 92 and 93 are of smaller diameter than the internal diameter of the member 80 so that air can pass freely around them from one side to the other but of larger diameter than the internal diameter of the member 85 so that they can seal the open ends thereof completely. For effective sealing of the ends of the member 85 each of the piston-like members 92 and 93 may include rings 94 of soft material such as leather, rubber or suitable material disposed to engage the ends of the member 85.

In one position of the rod 89 as shown in Figure 7 the piston-like member 92 seals the end of the member 85 thus shutting off all connection between the pipe 76 and the interior of the member 85. The piston-like member 93 however, is, in this position, clear of the other end of the member 85, the interior of which is thus in communication with the pipe 78 and air under pressure is conveyed thereto. In another position of the rod 89, not shown, the piston-like member 92 may be clear of the end of the member 85 and the piston-like member 93 may close the

other end, the rod being retained in this position by the action of a spring 148. In this case the interior of the member 85 is connection with pipe 76 and is subject to suction. The position of the rod 89 is controlled by the solenoid 91 which ensures that it is positioned in one of the two positions described.

In order to convey suction or air pressure from the interior of the member 85 to the outlet pipe 79, holes 95 are provided extending through the wall of the member 85 intermediate the flanges 86 and 87 and the pipe 79 is connected to the member 80 so as to communicate with the annular space 96.

The rod 89 is threaded and the piston-like members 92 and 93 are likewise provided with internal threads for engagement with that of the rod so that their axial positions may be carefully adjusted for efficient operation of the valve. They are secured in position by lock nuts 97. Sealing between the rod 89 and the diaphragm 84 is effected by two washer-like members 98 which clamp the diaphragm 84 between them.

The spring 148 is sufficiently strong to operate the valve and cause it to move into the suction supplying position against the weight of the rod and armature of the solenoid 91 and against the excess pressure on the interior of the diaphragm 84 and the washers 98 but is not so strong as to be incapable of subsequent compression by the action of the solenoid 91 when the valve is moved to the pressure supplying position.

As previously mentioned a limiter valve 35 is provided between each three-way valve 36 and its associated transfer member in order to reduce loss of suction at times when the transfer member is connected to the source of suction but no label is in engagement therewith. In one form the limiter valve comprises a hollow cylindrical body 99 having an inlet opening or port into which the pipe 79 is connected so as to communicate with the interior. One end of the limiter valve is connected to a second pipe 34 connected at the other end of the transfer member. The pipe 34 is connected through an outlet opening or port in the end cap 100 of the limiter valve. The limiter valve includes another member 101 of bobbin-like form having two outwardly directed axially spaced circular flanges 102 and 103. The first of these flanges 102 is threaded round its external periphery and closes the other end of the member 99 which is provided with an internal thread for engagement therewith. The second flange 103 is of external diameter equal to the internal diameter of the member 99 and is disposed inside the member 99 in a piston-like manner forming a partition in the body 99. The pipe 79 communicates with the annular space enclosed between the two flanges 103 and 102. The flange 103 is provided with a number of axial holes 104 extending through it, and a disc-like member or valve head 105 provided with similar holes 106 is disposed against the side of the flange 103 remote from the flange 102. The disc-like member can slide axially so that it is either against the face of the flange 103 or spaced therefrom by a small distance; it is guided for this motion by pins 107 extending through suitable axial holes 108 in the disc and secured in the flange 103, and by a central pin 109. The disc is spring loaded by a light spring 110 retained on the pin 109 so that the disc is normally spaced from the flange 103. The holes 106 in the disc are disposed so that they are out of register with the similar holes 104 in the flange 103.

When suction is applied to the pipe 79 and no label impedes the inward flow of air through the holes 33 in the transfer members, a considerable current of air flows into the limiter valve through the pipe 34. Since the holes 104 and 106 are not in register the air has to take a tortuous path through the disc 105 and the flange 103 before reaching the pipe 79. Under such conditions there is a considerable thrust acting on the outer surface of the disc 105 and this is moved axially thereby against the action of the spring 110 so that the holes 104 in the flange 103 are sealed. The pipe 79 is therefore only in such communication with the atmosphere as is occasioned by leakage between the flange 103 and the disc 105, and loss of suction is prevented or reduced.

The sealing action of the disc 105 is maintained only through the inward flow of air through the pipe 34 and thus when a transfer member has a label engaged on its surface the flow of air is in any case reduced and insufficient for the limiter valve to come into operation. Thus the limiter valve has little or no effect in reducing the suction available at the transfer members for retaining labels thereon. Even when the limiter valve is in action there is sufficient leakage through it to cause a small intake of air through the small holes 33 in the pickers so that when a transfer member is adjacent or in contact with a label the suction is sufficient to attract the label on to the transfer member.

An alternative construction of limiter valve is shown in Figure 13; this comprises a hollow cylindrical body formed in two parts 155 and 156 supporting a concentric annular partition 157, the upper surface of this seating is provided with an annular partition ring 158 of rubber or other suitable material on to which may be drawn by an action similar to that already described a movable disc or valve head 159 having a downwardly directed peripheral flange 160 for contact with the seating ring and connection is made to the limiter valve by pipes 161 leading to the three-way valve and a pipe 162 leading to the transfer member associated with the limiter valve, one or more small holes 163 are provided in the disc 159 in order to ensure a sufficient degree of leakage through the valve when in its closed position to enable the transfer members to extract a label from the magazine, the limiter valve is preferably mounted so that its axis is vertical or approximately so to avoid any tendency towards sticking.

The pipe 28 supporting each transfer member carries a collar 111 for actuating one of three vertically spaced micro-switches 112 Figure 10, through one of three vertically spaced levers 113 pivoted on a common pivot 114 to a member 115 secured to the U-shaped frame member 24. The collars of each transfer member are disposed at different levels so that each transfer member operates a different one of the three levers 113 and hence a different micro-switch 112 for a purpose to be later described. Adjusting screws 164 are provided on the end of each lever 113 to enable the position at which the transfer members operate their associated micro-switch to be adjusted to obtain the best results in operation.

The transfer member and its supporting pipe 28 is normally retained in a retracted position by a spring 116. The operating solenoid 37 for

displacing the transfer members outwardly acts upon the pipe 28 through a dependent lever arm 117 carrying a roller 118, the position of which is adjusted by a screw and nut 119.

Apparatus C

One part of this apparatus comprises a magazine for labels illustrated in Figure 11. The magazine comprises a box-like container 120 for the labels 121, open at the top and at each end and supported upon a bracket 122 clamped upon a rod 123 extending from the frame of the machine.

The labels 121 are packed in the box and a pressure plate 124 spring loaded by a spring 125 bears against one end of the pack and tends to expel the labels from one of the open ends of the box. The labels are prevented from expulsion by small hook-like members 126 which retain the pack but which will permit a single label to be withdrawn from the pack after it is curled slightly and urged out of the box.

The magazine is disposed so that the outermost label retained by the hooks 126 is presented to the convex face of a transfer member.

When the transfer member is moved outwardly through the action of solenoid 37, its face 27 is brought into contact with the said outermost label which, by reason of the suction applied at that time to the interior of the transfer member, is curled slightly into engagement with the face 27 and withdrawn from the magazine when the transfer member is retracted. The peripheral edges of each transfer member have recesses 127 at positions corresponding with the hooks 126 to permit the convex face of each transfer member to be engaged closely with the outermost label when the transfer member is opposite to the magazine and when it is moved outwardly in relation to the head.

Another part of this apparatus comprises a device for applying adhesive to labels which are engaged on and carried by the transfer members. This device is illustrated in Figure 4 and comprises a flexible endless perforated band or belt 128 which passes round two pulleys 129 and 130 rotating about axes which are parallel and spaced vertically one above the other. The upper pulley 129 is driven from the lower part of the shaft 9 by means of a belt 131 and pulleys 132 and 133, the latter being keyed to the shaft 9 and the former driving one 134 of a pair of bevel gears, the other 135 of which is mounted on a common shaft with a pulley 129. The band 128 thus travels round the pulleys or is stationary in synchronism with the movements of the head 8.

The lower of the two pulleys 130 is partly immersed in a trough 136 containing a suitable adhesive, so that the outwardly directed surface of the band 128 becomes coated therewith. The trough 136 is supported upon a bracket 137, itself secured to one of the frame members of the machine.

The adhesive applying device is disposed so that the surface of the band 128 which is coated with adehsive is engaged by a label carried on a transfer member when this is moved outwardly through the action of its operating solenoid 37.

A casing 165 is provided and this extends around the band 128 except for a suitably positioned opening 166 through which the transfer member and its associated label move to engage the band, the casing thus prevents the inadvertent distribution of adhesive to the moving parts of the machine. A flexibly mounted window serves to restrict the area of application of adhesive to a selected portion of the label surface.

A further part of apparatus C is a bottle arresting and barrier mechanism for the purpose of arresting and positioning a bottle on the conveyor preparatory to the operations in which a label is applied thereto.

This mechanism comprises a lever arm 138 pivoted at one end on a vertical axis and carrying at the other end a bottle arresting and barrier member 139 having a V-shaped notch, the inwardly directed edges of which engage the bottle. One edge 140 may have a straight edge and the other edge 141 may be curved outwardly towards the open end of the V or the notch may have two straight edges, the outer one of which diverges from the edge 140 at a greater angle than the inner one so that the V-shaped notch is thereby adapted conveniently to engage the sides of bottles of varying diameters, and secure the same accurately in the labelling position, with their axes lying always in the same plane perpendicular to the conveyor track.

The lever arm 138 and the bottle arresting and barrier member 139 are normally clear of the conveyor 1 and disposed on that side of it which is remote from the head 8 and the pickers and is spring loaded to be retained in this position by a spring 142. The lever arm 138 and the bottle arresting and barrier member 139 are operated for arresting bottles through the action of the solenoid 143 and the bell crank lever 144. The roller 145 of the bell crank lever bears against one side of the lever arm 138 and causes this to be deflected about its pivoted end so that the bottle arresting and barrier member 139 swings over the conveyor and engages a bottle between the surfaces of the V-shaped notch and a retaining block or abutment member 146 located on the other side of the conveyor, to prevent continued feed of remaining unlabelled articles to the labelling position.

The bottle arresting and barrier mechanism, the adhesive applying apparatus, and the magazine for the labels are spaced angularly round the head at 120° intervals so that while one of the transfer members is applying a label to a bottle arrested by the bottle gripping mechanism, another of the transfer members is withdrawing a fresh label from the magazine and another of the transfer members already carrying a label has this coated with adhesive by the adhesive applying apparatus.

The operations of arresting a bottle, displacing the transfer members radially outwards, applying labels to a bottle and withdrawing a label from the magazine are all controlled by electrical means and the intermittent rotation of the head 8 and the repetition of the cycle of operations is likewise similarly controlled.

Apparatus D

Before describing the arrangement and operation of the electrical system it will be convenient to describe first of all the sequence of operations of the apparatus as set forth above.

Bottles for labelling are placed upon the conveyor 1 at or near the left hand end thereof as specified by reference to Figure 1. The bottles are conveyed by the conveyor travelling from left to right until one bottle interrupts the light beam directed from lamp 146 on to the photoelectric cell 147. This interruption of light causes

the photo-electric cell to actuate the bottle arresting and barrier mechanism which arrests and positions the bottle in the position as shown at 148. The side of the bottle remote from the arresting and barrier member 139 thus presses against the block 146 and against a micro-switch operating plunger 149 projecting therefrom, and closes the associated micro-switch contacts.

The head 8 will be either in such a position that the pawl 52 is engaged with a slot 51 with the result that a transfer member carrying an adhesive coated label by suction is opposite the arrested and positioned bottle and the other two transfer members opposite the magazine and the adhesive applying apparatus respectively, or will be moving and will automatically assume such position by engagement of the pawl 52 in the next approaching slot 51.

When the head is in the position described, the closing of the said micro-switch contacts causes the three transfer members through energising of operating solenoids 37 to be moved radially outwards pivoting about their pivotal mountings in brackets 29. so that one transfer member box approaches the arrested and positioned bottle, another transfer member box carrying a label by suction approaches the endless band 128 of the adhesive applying device bringing the label into contact therewith, and the other transfer member box approaches and is brought into contact with the outermost label of the magazine.

The outward motion of that transfer member box opposite the arrested and positioned bottle causes the collar 111 on the supporting pipe 28 to actuate one of the three lever arms 113 thus closing the contacts of one of the three micro-switches 112.

The closing of the last said contacts causes the three-way valve 36 associated with the transfer member which is opposite the arrested and positioned bottle to cut off the suction connection to it and supply the transfer member with air under pressure. The adhesive coated label retained thereon is thus blown radially outwards from the transfer member box and engages around and adheres to the surface of the bottle.

After a short time interval the solenoids 37 are de-energised and the transfer members return under the influence of springs 116 to the retracted position, the three-way valve supplying air under pressure to the transfer member which has just performed a labelling operation returning after a further short interval to its previous condition wherein it re-connects the transfer member to the suction source.

Concurrently with the retraction of the pickers the pawl 52 is withdrawn by its solenoid 54 from the slot 51 in which it is engaged so that the head is then free to rotate. The arresting and barrier mechanism solenoid is also de-energised and the labelled bottle released so that it is conveyed away by the conveyor.

After a further short interval the magnetic clutch 49 is engaged, the brake released, and the head is driven from the motor 43.

The head now rotates until the pawl, which after a small rotational movement of the head, has been released by the solenoid 54 so as to bear by spring pressure against the rim of the disc 50, engages in the next slot, the brake being applied and the magnetic clutch 49 being disengaged just prior to the said next slot reaching the pawl engaging the position so that the head which then rotates under its own momentum is retarded and brought almost to rest before the slot is so engaged. Another bottle is brought by the conveyor to a position in register with the labelling station and the cycle of operations is repeated.

For determining the sequence of operations and the relative timing of each operation in a complete cycle the actuation of the solenoids referred to in the previous description is controlled by a number of electrical relays having operating coils and contacts appropriately interconnected.

The relays are housed in a casing 164 which may be located on the machine in any suitable position, for instance, secured to the frame member 24 with its base level with the conveyor 1. With reference to Figure 15 the relays A, B, D, F, T, G, W, P, H, L, M, N, and those components associated with them on the same side of the broken line X—X are included within the casing 164 while those components on the other side of the broken line are distributed on the machine in positions already described.

For explanatory purposes the electrical connections to the relays and the various operating solenoids are shown in Figure 14 in a circuit diagram of the type usually termed schematic, with the contacts operated by a relay removed on the circuit diagram from the vicinity of the operating coil of the relay and placed conveniently near that relay operating coil or operating solenoid on which the said contacts are effective. Each relay operating coil has a characteristic reference letter, for convenience followed by a figure indicating the number of pairs of contacts operated by the relay coil, and the contacts thus operated are designated by the characteristic letter of their associated relay followed by a distinguishing number.

The relay system can be regarded broadly as comprising five primary relays A, B, D, F, and T whose function is to control the sequence and timing of operations and seven secondary relays G, W, P, L, M, N, H whose function is to energise or de-energise the various operating solenoids.

The mode of operation can readily be understood by tracing the sequence of relay operation in a complete cycle of operations of the machine.

The initial position of the relays will be assumed to be that shown in Figure 14 that is the position adopted when the head is stationary, the pawl 52 is engaged in one of the slots 51 and a bottle is approaching the labelling station.

When the bottle reaches such a position that it interrupts the light beam between the lamp 146 and the photo-electric cell 147 contacts *a* and *c* on the photo-electric cell are closed and relay F is operated. Contacts F2 are made, relay G is operated closing contacts G1 and the solenoid 143 is actuated thus causing the bottle to be arrested and positioned at the labelling station.

Simultaneously, with the operation of relay F contacts F1 are closed and condenser C1 becomes charged to the voltage of the supply.

As the bottle is arrested and positioned it depresses plunger 149 and the associated micro-switch contacts S1 are made. Relay A is thus connected across condenser C1, operated, contacts A1 and A4 open, and contacts A2, A3 and A5 close. The opening of contacts A1 thus disconnects the relay A and condenser C1 from the supply, the relay continuing to be retained in the operated position by the discharge of condenser C1, through its operating coil.

Contacts A2 being closed ensure continued connection of relay A across condenser C1 independently of contacts S1 and thus independently

of any slight movement of the bottle during later operations.

The closing of contacts A5 operates relay P thus actuating the transfer member deflecting solenoids 37 and causing the transfer members to be moved radially outwards. In such outward travel the collar 111 on that transfer member supporting pipe 28 associated with the transfer member opposite the arrested and positioned bottle actuates one of the micro-switches 112 through one of the levers 113 thus closing one pair of micro-switch contacts SL, SM or SN. (Say for example SL.) Relay L is thus operated closing contacts L2 and actuating one of the three-way valves G1 causing the transfer member to be supplied with air under pressure and directing the label on to the bottle.

Simultaneously with the closing of contacts A5, contacts A3 are closed operating relay B. Contacts B1 are opened and contacts B2, B3, B4, B5 and B6 are closed. Contacts B3 closed across contacts F2 and make the action of the arresting and barrier member independent thereof.

Contacts B4, B5, B6, when thus closed, render the continued actuation of one of the three-way valves solenoid 91 independent of micro-switch contacts SL, SM, SN by virtue of the closing of one of the pairs of contacts L1, M1 or N1 (in the case L1 through the operation of relay L as already described). The purpose is to ensure that the transfer member opposite the bottle shall continue to be supplied with air even after, later in the cycle of operations, it return to its retracted position, there being thus no tendency for it to suck the label from the bottle.

The labelling operation having been completed the subsequent operations of pawl retraction, head rotation and arresting and barrier member release are effected in the following manner.

As previously described contacts A4 are open and contacts B2 are closed. When, however, the voltage across condenser C1 falls to a certain value relay A returns to its non-operated position and contacts A1 and A4 close, A2, A3, A5 open.

Reclosing of contacts A4 operates relay D, closing contacts D1 which serve to render the continued operation of relay D independent of the condition of contacts A4 and B2, and closing contacts D2 thus operating relay W and closing contacts W1 to actuate the pawl retraction solenoid 54, thereby closing contacts SC2 and opening contacts SC1 of a micro-switch operated by the pawl.

The opening of contacts A5 de-energises relay P and the transfer members return to the retracted position.

The operation of relay W also closes contacts W2 thus relay T operates when contacts SC2 close as previously described. Contacts T1 and T3 open and contacts T2 and T4 close.

The closing of contacts T2 operates relay H thus making contacts H1 energising the solenoid 165 of the magnetic brake and releasing the brake and likewise energising the magnetic clutch 49 causing the head 8 to be rotated. After a small sector of rotation the contacts ST of micro-switch 145 are closed and since contacts T4 are already closed contacts T4 and ST in series render the retention of relay T in its operated position independent of contacts W2.

The breaking of contacts T3 causes the gripper to release the bottle so that it moves along under the action of the conveyor, clears the photo-electric cell light beam and contacts *a* and *c*, opens de-energising relay F and breaking contacts F1 and F2.

The breaking of contacts T1 causes eventual de-energisation of relay D (on discharge of condenser C3 with resultant return of relay W to its non-operated condition breaking of contacts W1 and W2 and release of the pawl so that it bears against the edge of the then rotating disc 50.

Since contact A3 has been opened by the de-energisation of relay A as previously described, relay B is no longer connected to the supply and after an interval of time returns to its non-operated position, this interval depending upon the discharge rate of condenser C2. Contacts B1 thus close and contacts B2, B3, B4, B5 and B6 open.

Contacts B4, B5 and 6 being open, the picker previously supplied with air under pressure is reconnected to the suction source by the reversion of the associated three-way valve to its initial position (in this case through the de-energisation of relay L).

When the head rotates to such a position that the micro-switch contacts ST are again opened, relay T is de-energised and contacts T1 and T3 close and contacts T2 and T4 open, the opening of T2 being at once effective in disengaging the magnetic clutch and applying the magnetic brake to retard the head in readiness for engagement of the next approaching slot 51 by the pawl 52. When this event occurs the machine and relays are again in their initial position for the start of a fresh cycle of operations.

The rate of feed of bottles by the conveyor is arranged to be such that during each cycle relay T has returned to its non-operated condition before a fresh bottle actuates the photo-electric cell. Contact T3 is thus closed and the bottle will, even if the pawl is not yet in the slot, be arrested and positioned at the labelling station by reason of the operation of relay G through closed contacts T3 and F2 when the photo-electric cell light beam is interrupted. This represents a possible variation on the sequence of events just described, but is not a variation affecting the correct operation of the apparatus.

The micro-switches are of the snap action type. The values of condensers C1, C2 and C3 and resistances R1, R2, R3 and R4 are chosen to give the desired time between operation and return of relays A, B and D to their non-operated positions after disconnection from the electrical supply line.

Condensers C5 to C11 and resistances R5 to R11 are for reducing sparking at the contacts across which they are connected and may have any suitable values for this purpose.

I claim:

1. Apparatus for labelling articles, comprising in combination, a transfer member provided with a label engaging face having at least one opening, an adhesive applying device, a magazine for containing labels, means for moving the transfer member between the magazine, the adhesive applying device and a labelling station, a device for supplying selectively pneumatic suction through said opening to retain a label in said face or pressure through said opening to project a label away from said face onto an article, control means operatively associated with the last said device adapted to determine the nature of the supply furnished (that is suction or pressure) in accordance with the position of the transfer member, a conveyor for conveying articles in succession

to the labelling station; and means responsive to the passage whilst on the conveyor of each article to initiate automatically a single cycle of operations of the apparatus, said responsive means including a device having a field of article detection extending across the whole width of the conveyor whereby said responsive means is operable by each of said articles irrespective of substantial variations in the lateral position occupied thereby on the conveyor.

2. In an apparatus for labelling articles, the combination of a conveyer for conveying articles to a labelling station said conveyer being adapted to be driven continuously and having an article supporting face engaging frictionally with the articles to provide tractive effort therefor, with an article arresting and barrier member adapted to move laterally across the conveyer at the labelling station from an inoperative to an operative position, said member having a notched forward end for engaging the sides of the leading article and a barrier face extending in the operative position of said member laterally across the conveyer in advance of the portion thereof in register with said labelling station, so as to bar the passage of remaining unlabelled articles to the labelling station, electrically controlled means operatively associated with said member for moving same between its inoperative and operative positions, article responsive means comprising a photo-electric cell positioned in the path of a controlling ray therefor which intersects the path of articles, electrical conductor means connected between said photo-electric cell and said electrically controlled means for conveying controlling electrical impulses to the latter for initiating a single cycle of operations of the apparatus including preliminary actuation of said arresting and barrier member, and an abutment member positioned at the labelling station opposite said notched end and having means thereon adapted to actuate electrical switch contacts in response to movement of an article guided by said notched end against said means, said switch contacts being connected in an electrical circuit including electrical means adapted to control continued performance of operations in a single cycle of operations of the machine.

3. In an apparatus for labelling articles, the combination of a conveyer for conveying articles to a labelling station said conveyer adapted to be driven continuously and having an article supporting face engaging frictionally with the articles to provide tractive effort therefor, with an article arresting and barrier member, electrically controlled means operatively associated with said member for moving same laterally across the conveyer at the labelling station from an inoperative to an operative position, article responsive means comprising a photo-electric cell positioned in the path of a controlling ray therefor which intersects the path of articles, and electrical conductor means connected between said photo-electric cell and said electrically controlled means for conveying controlling electrical impulses to the latter for initiating actuation of said arresting and barrier member.

4. In an apparatus for labelling articles, the combination of a conveyer for conveying articles to a labelling station, said conveyer adapted to be driven continuously and having an article supporting face engaging frictionally with the articles to provide tractive effort therefor, with an article arresting and barrier member adapted to move laterally across the conveyer at the labelling station from an inoperative to an operative position, said member having a notched forward end for engaging the sides of the leading article and a barrier face extending, in the operative position of said member, laterally across the conveyer in advance of the portion thereof in register with said labelling station, so as to bar the feed of remaining unlabelled articles to the labelling station, and article responsive means adapted to initiate a single cycle of operations of the apparatus including actuation of said arresting and barrier member.

5. In an apparatus for labelling articles, the combination of a conveyer for conveying articles to a labelling station, said conveyer adapted to be driven continuously and having an article supporting face engaging frictionally with the articles to provide tractive effort therefor, with an article arresting and barrier member adapted to move laterally across the conveyer at the labelling station from an inoperative to an operative position, said member having means to engage and locate the leading article at the labelling station and means to bar the passage of remaining unlabelled articles to the labelling station, and responsive means adapted to initiate a single cycle of operations of the apparatus including actuation of said arresting and barrier member.

6. In an apparatus for labelling articles, the combination of a conveyer for conveying articles to a labelling station said conveyer being adapted to be driven continuously and having an article supporting face engaging frictionally with the articles to provide tractive effort therefor, with means for arresting each article in succession at the labelling station and for preventing the delivery of further articles thereto while the arrested article is in position thereat, and responsive means adapted to initiate a single cycle of operations of the apparatus including actuation of said arresting and preventing means.

7. In apparatus for labelling articles in combination a supporting structure a plurality of transfer members supported therefrom for rotation around a common axis each transfer member being provided with a label engaging face having at least one opening, an adhesive-applying device, a magazine for containing labels, means for moving the transfer member between the magazine, the adhesive applying device and a labelling station, a device for selectively supplying pneumatic suction through said opening to retain a label on said face, or pneumatic pressure to project a label away from said face onto an article at the labelling station, said transfer members being spaced apart at equal angular intervals around said axis of rotation, means yieldable to the resistance offered to the outward movement of the transfer member at the labelling station by an article thereat, for moving said transfer member outwardly from said axis of rotation.

8. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, a rotary head, a plurality of transfer members supported therefrom by means of pivotally mounted and dependent hollow arms adapted to convey the required suction and pressure to their associated transfer members, the pivotal mounting axis of each arm being sub-

stantially tangential to a pitch circle centered on the axis of rotation of the head, said transfer members being spaced apart at equal angular intervals around said axis of rotation, means yieldable to resistance offered to outward movement the transfer members by an article at the labelling station, by a label pack in the magazine, and by the adhesive applying device respectively for moving the arms outwardly from said axis of rotation when the transfer members are registered respectively with the magazine, the adhesive applying device and the labelling station and control means adapted to be operated by the outward movement of the arm at the labelling station to change the nature of the supply furnished to the associated transfer member from suction to pressure.

9. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, a rotary head, a plurality of transfer members supported therefrom by means of arms, the pivotal mounting axis of each arm being substantially tangential to a pitch circle centered on the axis of rotation of the head, said transfer members being spaced apart at equal angular intervals around said axis of rotation, means yieldable to resistance offered to outward movement the transfer members by an article at the labelling station, by a label pack in the magazine, and by the adhesive-applying device respectively for moving the arms outwardly from said axis of rotation, when the transfer members are registered respectively with the magazine, the adhesive applying device and the labelling station, and control means adapted to be operated by the outward movement of the arms at the labelling station to change the nature of the supply furnished to the associated transfer member from suction to pressure.

10. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, a rotary head, a plurality of transfer members supported therefrom, said transfer members being spaced apart at equal angular intervals around said axis of rotation, means yieldable to resistance offered to outward movement of the transfer members by an article at the labelling station, by a label pack in the magazine and by the adhesive applying device respectively for moving said transfer members outwardly from said axis of rotation when the transfer members are registered respectively with the magazine, the adhesive applying device and the labelling station, and control means adapted to be operated by the outward movement of the transfer member at the labelling station to change the nature of the supply furnished to said transfer member from suction to pressure.

11. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, a rotary head, a plurality of transfer members, supported therefrom said transfer members being spaced apart at equal angular intervals around said axis of rotation, and means yieldable to resistance offered to outward movement of the transfer members by an article at the labelling station, by a label pack in the magazine and by the adhesive applying device respectively for moving said transfer members outwardly from said axis of rotation when the transfer members are registered respectively with the magazine, the adhesive applying device and the labelling station.

12. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, a supporting structure, a plurality of transfer members rotatably mounted thereon, said transfer members being spaced apart at equal angular intervals around said axis of rotation, and means yieldable to the resistance offered to the outward movement of the transfer member at the labelling station by an article thereat, for moving said transfer member outwardly from said axis of rotation.

13. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the tranefer members, a rotary head, a plurality of transfer members supported therefrom, said transfer members being spaced apart at equal angular intervals around said axis of rotation, means yieldable to resistance offered to outward movement of the transfer members by an article at the labelling station, by a label pack in the magazine and by the adhesive applying device respectively for moving said transfer members outwardly from said axis of rotation when the transfer members are registered respectively with the magazine, the adhesive applying device and the labelling station, control means adapted to be operated by the outward movement of the transfer members at the labelling station and the magazine respectively to change the nature of the supply furnished to said transfer members from suction to pressure and vice versa, a suction reservoir common to all said transfer members, and, operatively connected between said reservoir and the transfer members limiter valves for restricting the loss of suction from said reservoir when suction is applied to a transfer member and no label is retained thereon.

14. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, an adhesive ap-

plying device comprising a belt supporting structure, a perforated flexible endless belt carried thereby having a portion positioned within a container for adhesive and a face portion adapted for engagement with a label carried on a transfer member positioned in register with said belt, and means for driving said belt intermittently.

15. In an apparatus for labelling articles wherein labels are extracted from a magazine with the aid of pneumatic suction applied through transfer members, moved by the latter to an adhesive applying device for coating the labels with adhesive, and moved subsequently to a labelling station at which they are delivered onto articles by means of pneumatic pressure applied through the transfer members, an adhesive applying device comprising a belt supporting structure, an endless travelling belt carried thereby a portion of which is positioned within a container for adhesive, and a face portion adapted for engagement with a label carried on a transfer member positioned in register with said belt, and means for driving said belt intermittently, the belt being characterised in that it has passageways for the admission of atmospheric air to the face of a

label during engagement of a belt face portion therewith.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
586,561	Mosher	July 20, 1897
676,244	Sherman	June 11, 1901
1,007,080	Evans	Oct. 31, 1911
1,072,403	Bender	Sept. 2, 1913
1,429,095	Peters et al.	Sept. 12, 1922
2,024,042	Jance	Dec. 10, 1935
2,109,505	Rue et al.	Mar. 1, 1938
2,163,274	Dixon	June 20, 1939
2,171,130	Merrifield	Aug. 29, 1939
2,179,144	Buttner	Nov. 7, 1939
2,214,096	Weiss	Sept. 10, 1940
2,384,241	Elsner	Sept. 9, 1945
2,391,694	Everett	Dec. 25, 1945
2,483,458	Fischer et al.	Oct. 4, 1949