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Jones et al.

[11] **3,904,466**

[45] **Sept. 9, 1975**

[54] **LABELLING MACHINES**

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[73] Assignee: **Decca Limited,** London, England

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[52] **U.S. Cl.** **156/216;** 156/221; 156/320; 156/364; 156/483; 156/489; 156/497; 156/499; 156/567; 156/571; 156/DIG. 4; 156/DIG. 27; 156/DIG. 31; 156/DIG. 40

[51] **Int. Cl.²**..... **B65C 1/06;** B65C 9/06; B65C 9/14

[58] **Field of Search** ..... 156/212, 227, 363, 364, 156/475, 483, 484, 489, 499, 497, 556, 566, 567, 571, 216, 221, 320, DIG. 4, DIG. 27, DIG. 31, DIG. 40

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[57] **ABSTRACT**

A labelling machine suitable for labelling slab-like objects such as magnetic tape cartridges, comprising at least one holder which is cyclically movable between at least three operating stations in turn, so as to pick up an adhesive label from a stack by suction at a first operating station, the adhesive on the label being activated at a second operating station and then applied to the narrow face of a slab-like object which is held adjacent the first holder at a third operating station by a second holder. The second holder is movable between a first position in which slab like objects are fed into it by a feeding mechanism, and a second position in which an activated label can be applied to the narrow face of a slab-like object within the second holder. After a label has been applied to a slab-like object, the object is ejected from the second holder through a resilient gate so that the sides of the gate press the label over two opposite broad faces of the object.

11 Claims, 9 Drawing Figures

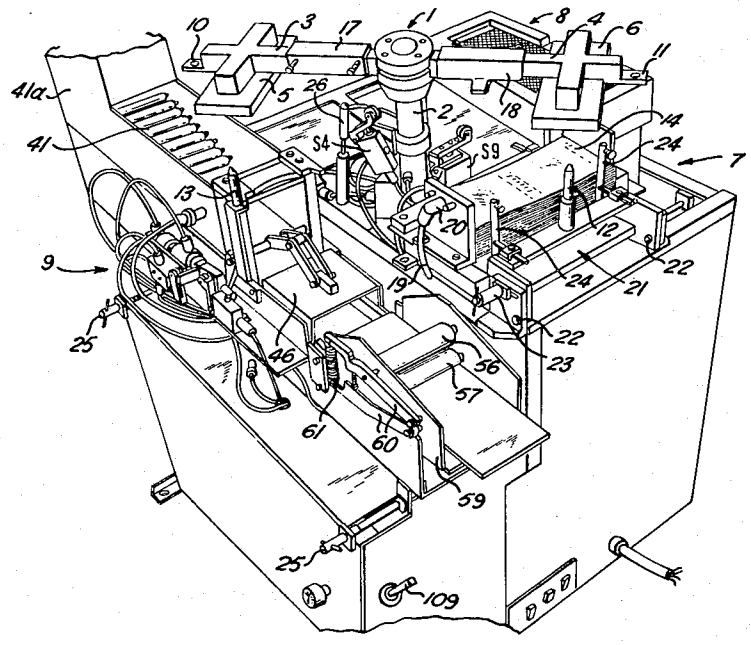


FIG. 1

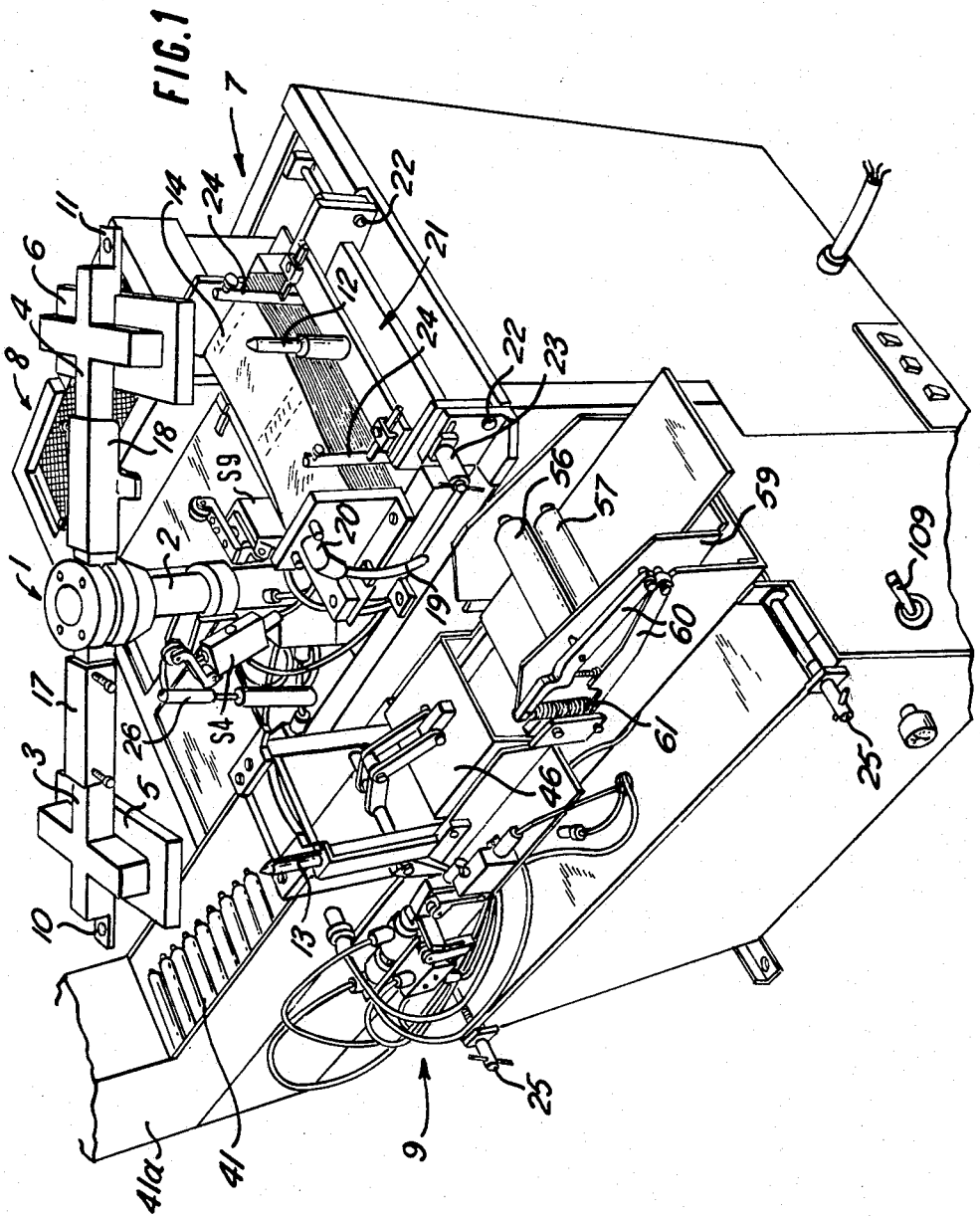

7
14
24
22
11
6
4
21
12
8
24
22
23
18
S6
56
57
59
2
20
109
1
19
60
17
26
S4
61
3
5
46
25
10
13
25
9
41a
41

FIG. 2

FIG. 8

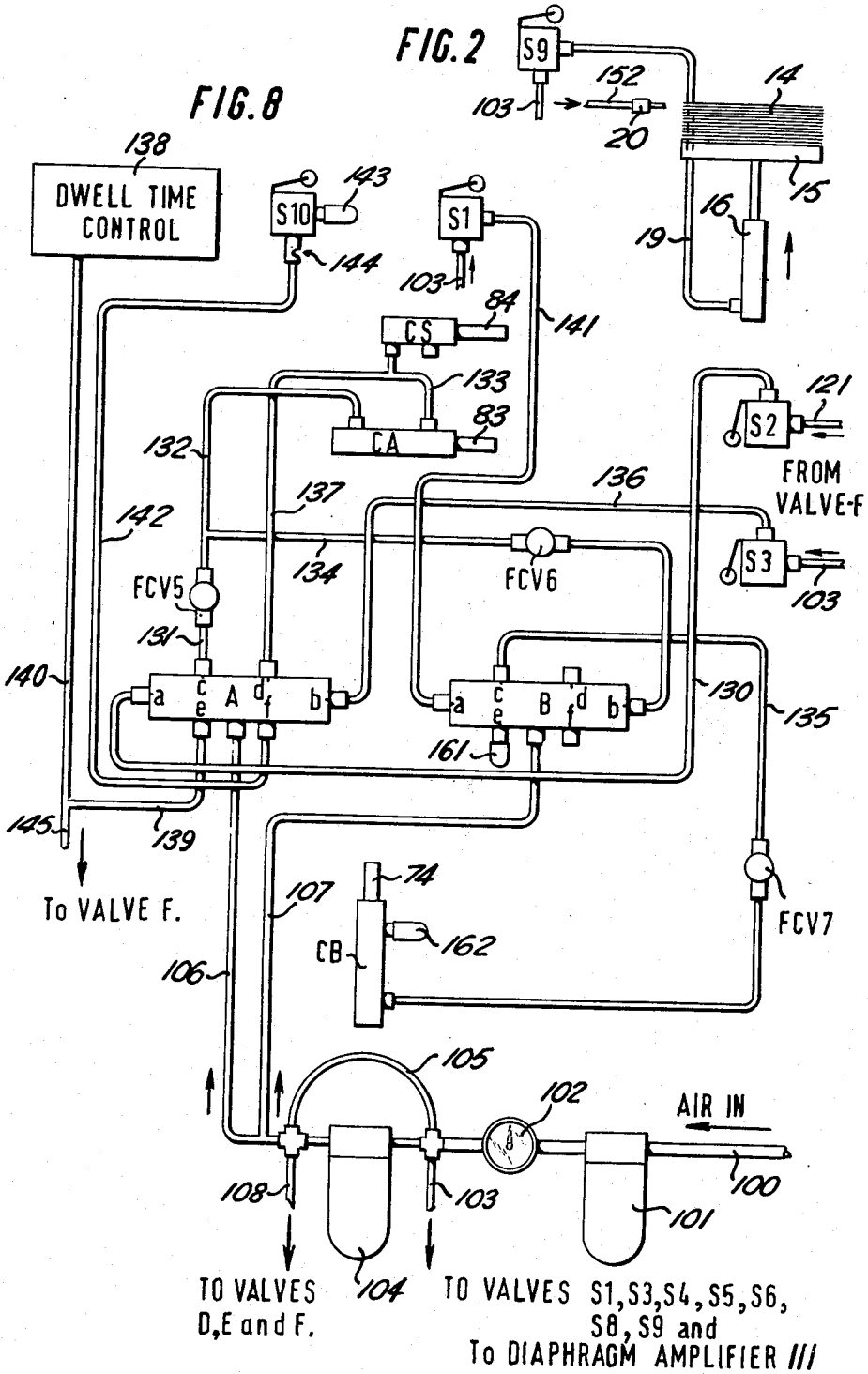

DWELL TIME CONTROL
138
S10
143
144
S1
103
S9
152
20
14
15
16
19
84
CS
141
133
83
CA
132
121
S2
FROM VALVE-F
136
137
142
134
FCV5
FCV6
S3
103
131
140
a c e A d f b
a c e B d f b
130
135
161
145
139
To VALVE F.
107
74
CB
162
FCV7
106
105
102
AIR IN
100
101
108
103
104
TO VALVES D,E and F.
TO VALVES S1,S3,S4,S5,S6, S8,S9 and To DIAPHRAGM AMPLIFIER III

FIG. 3

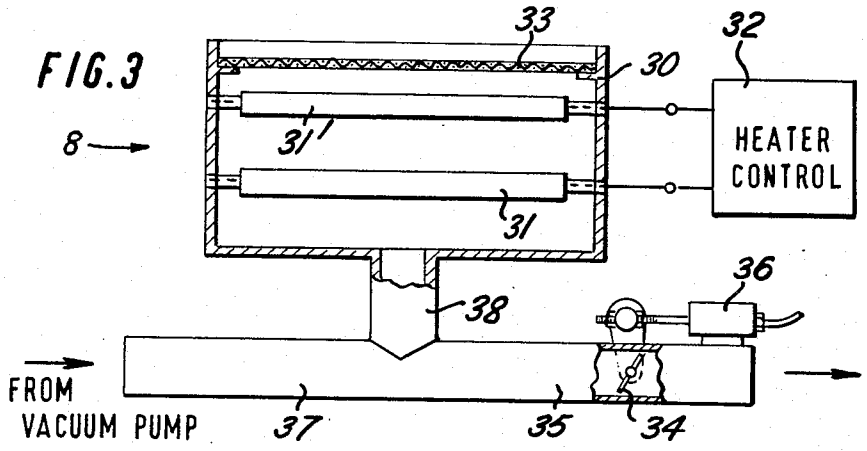


FIG. 6

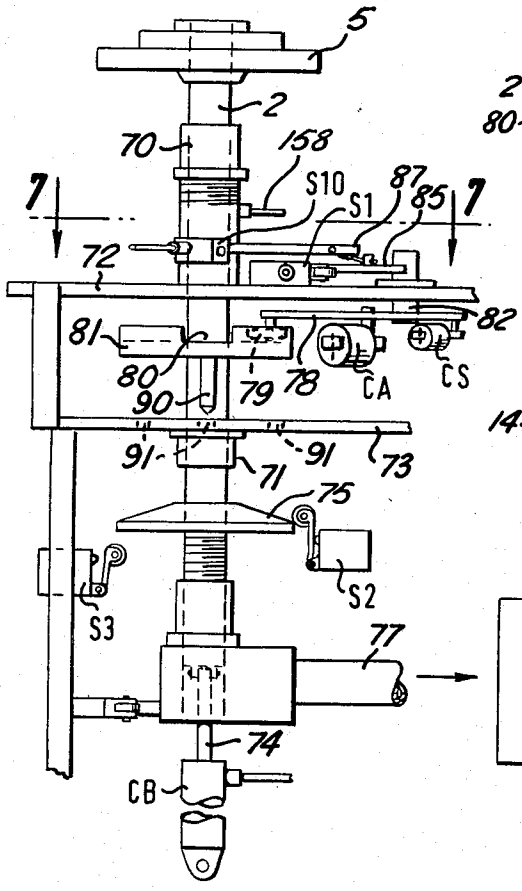


FIG. 7

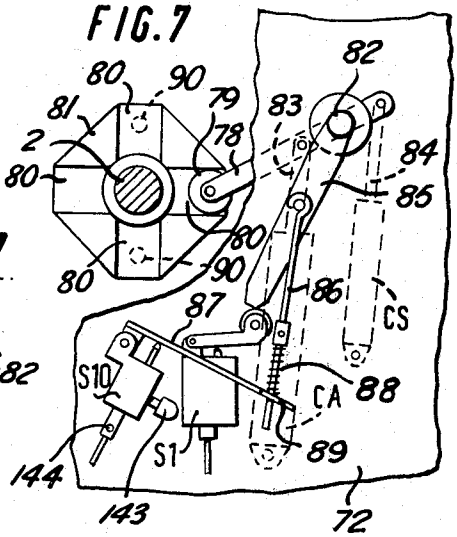


FIG. 4

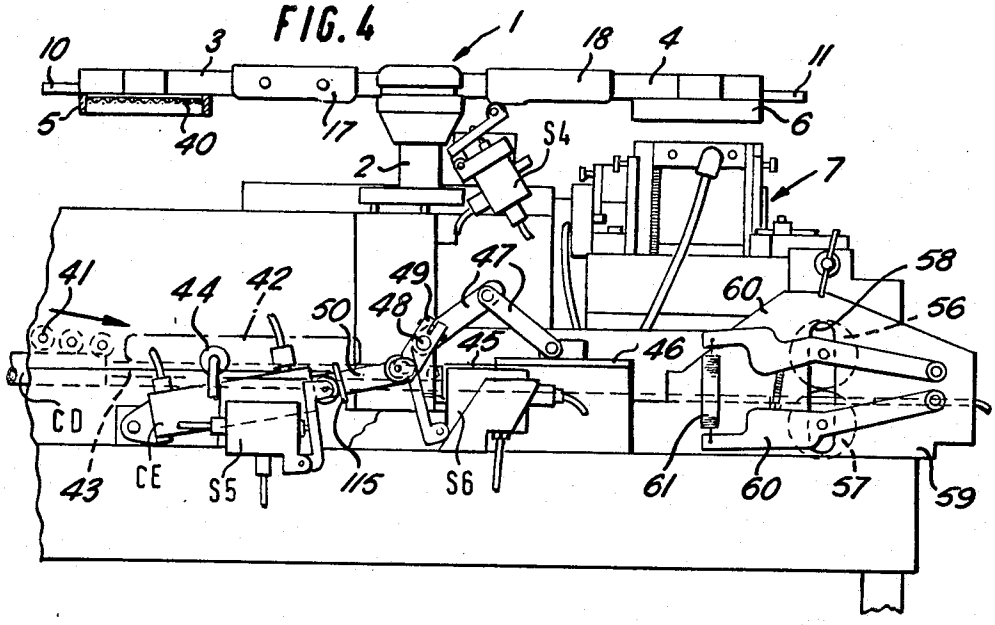
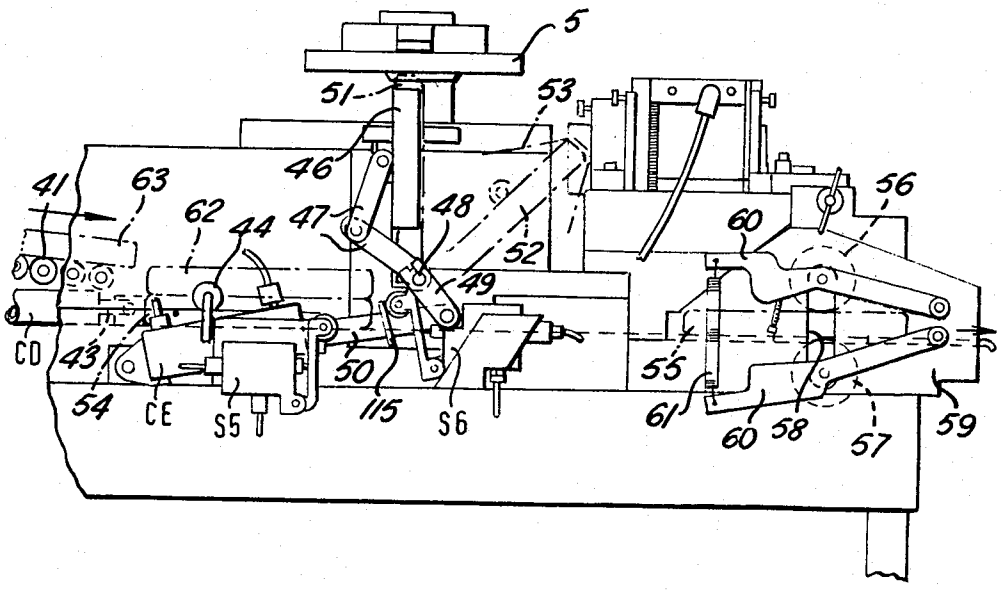

10
3
1
18
4
11
5
40
17
6
S4
2
7
41
44
42
49
47
58
60
56
50
48
45
46
CD
43
CE
S5
115
S6
61
60
57
59

FIG. 5


5
51
53
46
41
63
62
44
47
48
56
60
52
49
CD
43
50
55
54
CE
S5
115
S6
61
60
58
57
59

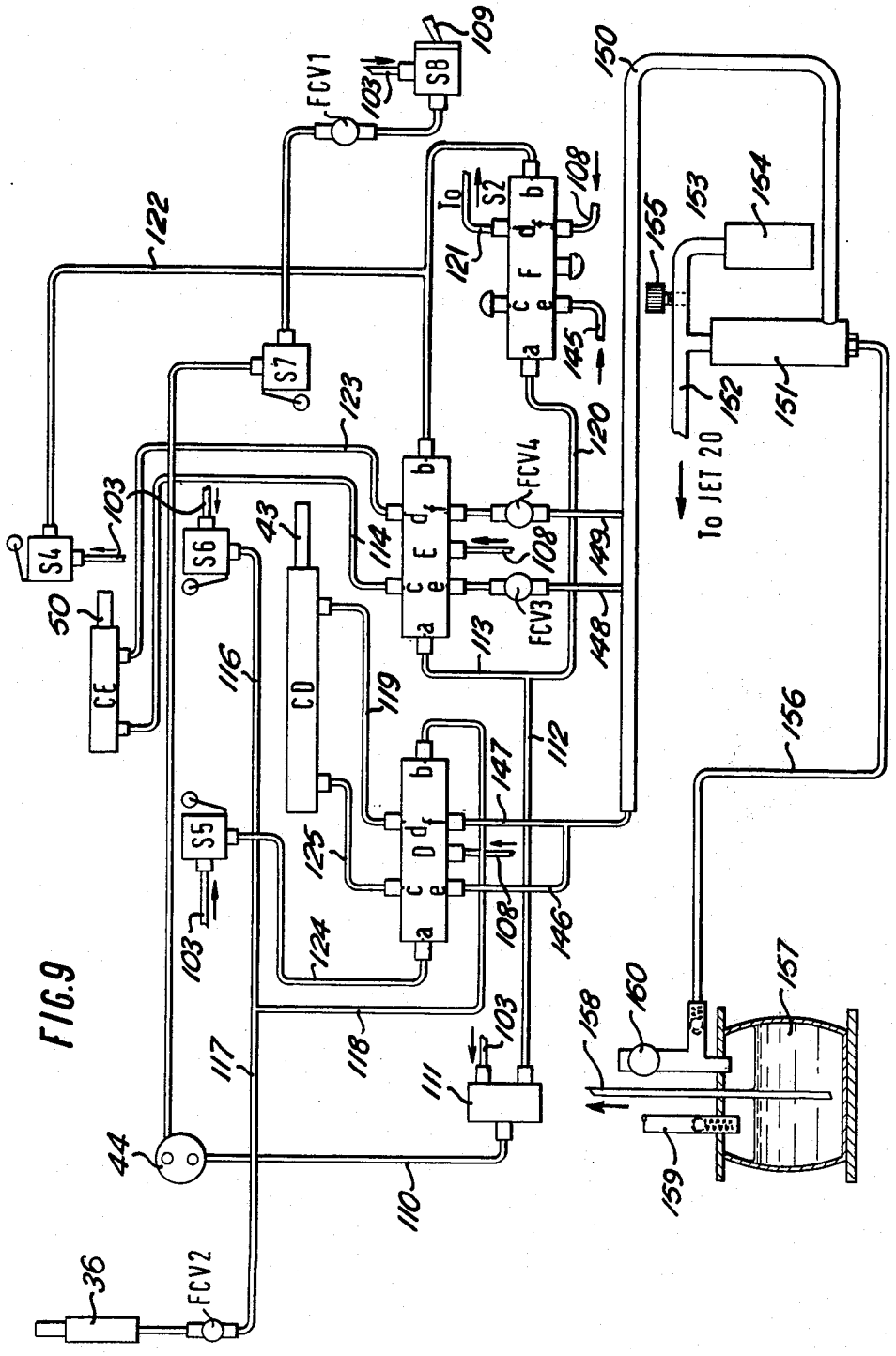

FCV1
S8
109
103
150
122
S2
108
121
153
154
155
S7
123
145
120
152
151
To JET 20
S4
103
S6
43
114
FCV4
108
149
50
CE
116
CD
119
FCV3
148
113
156
112
147
S5
125
103
124
108
146
158
160
157
117
118
111
103
159
44
110
36
FCV2

FIG. 9

LABELLING MACHINES

This invention relates to labelling machines for applying adhesive labels to slab-like objects, for example magnetic tape containers such as cartridges.

Machines for the application of an adhesive label to the broad face only of each of a succession of objects are well known. The present invention concerns a machine by which a single label can be applied to an object so that it extends from one broad face round an end or narrow face to a second broad face opposite the first.

According to the present invention, there is provided a labelling machine comprising at least one cyclically movable first holder; means for cyclically moving the first holder in steps between at least three operating stations in turn, a first of the operating stations having means for supporting adhesive labels in a stack; means for causing a label from the stack to be picked up by suction by the first holder; a second operating station having means for activating adhesive on the label; and a third station comprising a feeding mechanism and a pivoted second holder movable between a first position wherein the second holder can receive slab-like objects one at a time from the feeding mechanism, and a second position wherein a narrow face of a slab-like object contained within the second holder is adjacent an adhesive side of the label in the first holder, means for relatively moving the first holder and the second holder when the second holder is in its first position to cause the label in the first holder to adhere to the narrow face of the object in the second holder, and a resilient gate, the feeding mechanism including means for ejecting an object from the second holder through the gate so that the sides of the gate press the label over two opposite broad faces of the object.

In a preferred embodiment of the invention, the or each first holder is carried by a rotatable arm, the means for cyclically moving the first holder being arranged to rotate the arm in steps so as to bring the first holder adjacent each operating station in turn.

The means for relatively moving the first and second holders may comprise means for moving the first holder and arm bodily along the axis of rotation of the arm.

Preferably, the resilient gate comprises a pair of resiliently mounted rollers.

In the preferred embodiment of the invention, the means for activating adhesive on the label comprises a heater having a radiant heating element, means being provided to direct a blast of air past the heating element towards the adhesive side of the label held by the first holder when the first holder is at the second station. The heater may also include a second radiant heating element arranged for fine temperature control.

Preferably, also, a sensor is provided at the third station for sensing the presence of an object at the input of the feeding mechanism so as to initiate a labelling cycle.

In order that the operation of the machine is automatic, pneumatic circuitry is provided to automatically control the movement of the first holder and the operation of each operating station.

According to another aspect of the invention, there is provided a method of labelling slab-like objects comprising the steps of moving a first holder to a first station to pick up a label from a stack by means of suction, moving the first holder and label to a second station, activating adhesive to one side of the label, moving the first holder and activated label to a third station, allowing the label to adhere to the narrow face of a slab-like object held adjacent the label at the third station, and returning the first holder to the first station to pick up another label, the slab-like object with the label attached being ejected from the third station through a resilient gate which causes the label to adhere to two opposite broad faces of the object.

Preferably, the first holder is cyclically moved in a circular path from one station to another, and is lowered at each station before each operation and raised after each operation before being moved to the next station.

The object may be fed into a second holder, the second holder then being pivoted from a first position wherein it receives the object to a second position wherein the narrow face of the object is adjacent the first holder as it reaches the third station in order that the label may be allowed to adhere to the narrow face of the object, the second holder containing the object and attached label being returned to its first position so as to receive another cartridge as the labelled cartridge is ejected through the resilient gate. The adhesive on the label is preferably activated by heating at the second station.

Reference will hereinafter be made to the accompanying drawings which illustrate one embodiment of the invention, and of which:

FIG. 1 is a perspective view of a cartridge labelling machine, having a label feed station, a heater station, and a cartridge labelling station;

FIG. 2 shows diagrammatically the label feed station of the cartridge labelling machine of FIG. 1;

FIG. 3 shows diagrammatically the heater station of the cartridge labelling machine of FIG. 1;

FIGS. 4 and 5 show diagrammatic elevational views of the cartridge labelling station of the cartridge labelling machine of FIG. 1, in various stages of operation;

FIG. 6 is a diagrammatic elevational view of part of the cartridge labelling machine of FIG. 1;

FIG. 7 is a diagrammatic view of the part of the cartridge labelling machine shown in FIG. 6, taken along the line 7—7; and

FIGS. 8 and 9 show diagrammatically the pneumatic circuit for controlling the cartridge labelling machine.

Referring to FIG. 1, a cartridge labelling machine is provided with a rotor assembly 1, which has a hollow vertical rotatable shaft 2 with hollow arms 3 and 4 fixed to its upper end in order to form a tee piece. The outer end of each of the arms 3 and 4, is provided with a label holder 5 and 6 respectively. The rotor assembly is arranged to be intermittently rotated through 90° in an anti-clockwise direction as seen in FIG. 1, in order that each holder 5 and 6 is cyclically traversed through four operating stations, namely a label feed station 7, a heater station 8, a "rest" station and a cartridge labelling station 9. The arms 3 and 4 are provided at their outer ends with a lug 10 or 11 respectively, the lugs being each provided with an aligning hole which, when the rotor is in the correct position, accommodates an aligning rod 12 or 13 located at the label feed station 7 and the cartridge labelling station 9 respectively, to ensure correct positioning of the rotor assembly before each operation as hereinafter described. The alignment of the mechanism at the cartridge feed station with re-

spect to the rotor assembly may be adjusted by means of screws **25**, that of the mechanism at the label feed station by other adjusting screws (not shown).

Although the rotor assembly shown is provided with two arms **3** and **4** each having a holder **5** or **6** respectively, any number of arms may be used, the number determining the arrangement of the various stations and the angle through which the rotor assembly moves during each period of rotation.

After each 90° rotation, the rotor assembly is lowered by about one inch, preferably dropping under its own weight. Thus the holder **5**, for example is lowered when located above the label feed **7** station so as to pick up a label by means of suction applied through the hollow shaft **2** and arm **3**, and then raised. The rotor assembly then rotates through 90° and lowers the holder **5** containing the label over the heater station **8** to activate the adhesive on the label, as hereinafter described and is raised again. After a second 90° movement, the holder **5** and activated label are lowered in the "rest" station **9**, which is opposite the label feed station **7**, and are raised again to execute a third 90° rotation so as to be located at the cartridge feed station **10**, which is opposite the heater station **8**. The holder **5** is lowered to bring the activated label into contact with the narrow end of a cartridge which is held narrow end uppermost in this station as hereinafter described. The label is released by vacuum induced in the arm **3** being relieved as flap **17** on arm **3** is raised on contact with a peg **26** at the cartridge feed station. The label sticks to the cartridge and the empty holder **5** is raised and rotated through a fourth 90° movement to return to the label feed station for another cycle to begin. The holder **6**, being diametrically opposite the holder **5**, executes the same cycle but lags 180° behind the holder **5**. A flap **18** similar to flap **17** is provided on arm **4** for easy release of a label at station **9**.

The label feed station, shown also in FIG. **2**, comprises apparatus arranged to support a stack of labels **14** on a movable platform **15** which may be raised or lowered by means of pneumatic cylinder **16** which is controlled by a switch **S9** via a line **19**. When the rotor assembly reaches the label feed station, in order to pick up a label it is lowered until the holder **5** or **6** contacts the top of the stack. As each label is removed from the top of the stack during the operation of the machine, the distance through which the rotor must be lowered increases gradually until the arm whose holder is at this station contacts and closes switch **S9**, causing the piston of cylinder **16** to raise the platform **15**. Since the switch **S9** is only closed briefly as the arm is lowered, the time during which the piston of the cylinder **16** extends is also brief, with a result that platform **15** is only raised by a short distance each time. This short distance ensures that the top label of the stack is maintained in a substantially constant horizontal location adjacent air jet **20**, which is arranged at one side of the stack **14**. The action of the air jet **20** separates the top label of the stack from the remainder in order that the top label may be easily picked up by one of the holders **5** or **6** by suction, without disturbing the rest of the stack.

In order to insert a stack of labels into the label feed station, a label guide assembly **21** is rotated from the position shown in FIG. **1** about horizontal pivots **22**, after a label access catch **23** has been released. The apparatus may be provided with a ratchet which, unless released, prevents the platform from moving downwardly. When a new stack of labels is to be placed in the apparatus, the ratchet is released to allow the platform **15** to be pushed downwardly and the new stack inserted on the top of the platform. Once the ratchet is re-engaged, and the pneumatic circuit connected, the cylinder **16** ensures that the stack is raised so that the top label is located in the correct horizontal plane. The stack is restrained by series of guide rods **24**.

Referring to FIG. **3** which shows the heater station in greater detail, a heater box **30** contains a coarse control heater element **31** and a fine control heater element **31** arranged one above the other as shown, the control of the heater elements being performed by heater control circuitry **32** which preferably includes a thyristor arrangement (not shown) for the control of heater element **31**. A grid **33** is located in the heater box **30** above the heater elements. When a butterfly valve **34** located in an exhaust pipe **35** is open, the opening and closing of the valve **34** being controlled by the retraction or extension respectively of the piston of a cylinder **36**, air from a vacuum pump (not shown in this Figure) is drawn through a pipe **37** and through the exhaust pipe **35** and released to atmosphere. When the valve is open, air is also drawn down through a pipe **38** through the heater box **30**. When the butterfly valve **34** is closed, the exhaust pipe **35** is therefore obstructed, and the air coming into pipe **37** passes upwardly through pipe **38** and upwardly through the heater box. The valve is closed when a label held by one of the holders **5** or **6** is lowered over the heater box so that the label adhesive can be activated by hot air passing upwardly through the heater box, this air having been heated twice since it is first drawn down through the box when the valve is open and thereafter, once the valve is closed, passes back up through the heater box and past the heater elements a second time.

Referring to FIG. **4**, in which the holder **5** is shown in section, it can be seen that the holder **5** is an inverted shallow tray having a grid **40** within it for holding a label by suction applied through the shaft **2** and the arm **3**. The holder **6** is similarly formed.

Cartridges entering the cartridge labelling station which is shown in FIGS. **4** and **5**, first pass down an inclined plane over a series of freely rotatable rollers **41**. The cartridges may be placed at the top of the incline manually, or may be gravity fed by placing them inside a hopper **41a** (see FIG. **1**). Once a cartridge reaches the bottom of the incline, it takes up the position **42** (shown in FIG. **4**) on top of the piston **43** of a pneumatic cylinder CD. Once there, its presence is sensed by a sensor **44** which is arranged as a central orifice, surrounded by a series of air jets (not shown); in thise case three air jets are used, from three ports at angular spacings of 120°. The presence of the cartridge in the position **42** produces a back pressure in the central orifice which is sensed and initiates a labelling cycle as hereinafter described. When the piston **43** of cylinder CD is retracted, the cartridge falls down in front of the piston and, on subsequent extension of the piston **43** which acts as a slider, is pushed to the right as seen in FIG. **4**, to take up the position **45** within a cartridge holder **46**. The holder **46** is pivotable between the horizontal position seen in FIG. **4** and the vertical position seen in FIG. **5** by means of rods **47** about a horizontal pivot **48**. Movement of the holder between the horizontal and vertical positions is effected by means of a link **49** which is actuated by a piston **50** of a pneumatic cyl-

inder CE, the holder being raised to the vertical position as the piston **50** is extended.

Once the holder is in the vertical position as seen in FIG. **5**, the cartridge takes up the position **51** in order that a label may be deposited on its narrow end face which now is uppermost, by the holder **5** for example. Once the label is attached to the narrow end face of the cartridge, the piston **50** of cylinder CE is retracted so that the cartridge passes through the position **52** bearing a label **53** and returns to the horizontal position **45.**

Once the horizontal position **45** has been reached by the cartridge, the extension of piston **43** of the cylinder CD to push another cartridge **54** into the holder **46** causes the labelled cartridge to be pushed out of the holder **46** and to pass through the position **55** as it is passed between two horizontal rollers **56** and **57.** The axles about which the rollers can rotate are arranged to be movable within a slot **58** in a plate **59,** the axles being connected to two pivotal arms **60** which are biased towards each other by a spring **61.** The passage of a cartridge between the rollers forces them apart, the tension in the spring **61** producing a sufficient return force to make the label stick on the two broad faces of the cartridge as it passes between them. The cartridge then passes out of the machine and is either collected manually or may be taken for packaging on a conveyor.

The feed of the cartridges is continuous, as seen in FIG. **5**, where the cartridge in position **54** is ready to be pushed by the piston **43** into the holder **46,** a following cartridge in a position **62** resting on top of the cartridge in position **54** being ready to drop down on to the upper side of the extended piston **43** in order that its presence may be sensed by the sensor **44** as previously described. Following cartridges such as that shown in the position **63,** are located on the rollers **41** and take up each position as it is vacated.

The cartridge feed mechanism is arranged so that the arrival of the holder **5** at **6** at the cartridge feed station coincides with the arrival of the holder **46** in the vertical position shown in FIG. **5,** in order that when the holder **5** or **6** drops, an activated label may be attached to the narrow end face of a cartridge held vertically in the holder **46.** As the rotor assembly is subsequently raised and rotated towards the label feed station, the holder **46** is pivoted towards its horizontal position shown in FIG. **4,** arriving there at the same time as the rotor assembly arrives at the label feed station.

Referring to FIGS. **6** and **7,** which show the rotor assembly as seen from the fourth "rest" station opposite the label feed station, the shaft **2** is rotatable within bushes **70** and **71** carried by horizontal plates **72** and **73** respectively. The shaft **2** is arranged to drop under its own weight to lower the rotor assembly through a short distance, preferably about **1** inch, when the assembly is correctly positioned at each station. Thus the lower end of the shaft is connected to the piston **74** of a pneumatic cylinder CB which is operable to raise the shaft again as hereinafter described. The position of the shaft, i.e. whether it is in the "up" position or in a "down" position, is sensed by means of switches S2 and S3 respectively, these switches being arranged to be closed by means of the upper and lower sides respectively of a flange **75** which is mounted on the lower part of the shaft **2.** The switches S2 and S3 are used to control parts of the pneumatic circuit for the machine, as hereinafter described. Suction is applied to the holders **5** and **6** of the respective arms **3** and **4** of the rotor assembly by means of a vacuum pump **76** via a line **77** connected to the bottom of the shaft **2.** The exhaust of the vacuum pump is connected to line **36** (see FIG. **3**) as hereinbefore described.

The shaft is intermittently rotated by means of a swinging lever **78** carrying at one end a roller **79** which is arranged to operate within slots **80** of a modified Geneva star **81** which is mounted on the shaft **2.** The lever **78** is pivoted at a point **82** to the plate **72.** The pistons **83** and **84** of two pneumatic cylinders CA and CS respectively are pivoted to the lever **78** on opposite sides of the pivot point **82.** These pneumatic cylinders CA and CS operate in opposition to each other so that when piston **83** of cylinder CA is extended, thus rotating the lever in a clockwise direction, away from the position shown in FIG. **7** through an angle of less than 90°, the piston **84** of cylinder CS is caused to retract so as to produce rapid deceleration of piston **83** at the end of the stroke of piston **83,** as hereinafter described. The roller **79** which bears on one side of the slot **80** in which it rests causes the shaft **2** to rotate. The roller **79** is able to execute an arcuate path about pivot point **82** since it is able to move radially with respect to the shaft **2** within the relevant slot **80.** Once the shaft has been rotated through 90° and drops as previously described, the cylinders CA and CS cause the lever **78** to be pivoted in an anticlockwise direction so as to return to the position shown to engage the next slot **80** when the shaft is raised once more.

The action of the two cylinders CA and CS is controlled in a manner hereinafter described to ensure fast and smooth acceleration and deceleration of the rotor assembly by means of a switch **S1,** which is closed as the lever **78** is caused to rotate in an anti-clockwise direction to the position shown in FIG. **7,** and a second switch **S10** which is closed when the anticlockwise rotation of the lever **78** is complete. A second lever **85** also pivoted to the point **82** and rotatable with the lever **78** is arranged to close the switch **S1** as the lever **78** rotates in anti-clockwise direction. A rod **86** attached to the lever **85** at a point along its length is arranged to close the switch **S10** when the anti-clockwise rotation of the levers **78** and **85** is complete by means of pivoted arm **87.** The rod **86** is provided with a compression spring **88** and passes through a slot **89** within the arm **87** in such a way that, as the lever **85** rotates anticlockwise, the rod **86** moves to the right within slot **89,** until it encounters the right hand extremity of slot **89** as seen in FIG. **7.** The pressure of the spring **88** causes the arm **87** to rotate in a clockwise direction as seen in FIG. **7** thus closing switch **S10.**

As previously described, the shaft **2** drops under its own weight after each 90° movement once the lever **78** has completed its anticlockwise swing and is about to fly back to rotate the shaft again. As the shaft drops, and consequently the Geneva star **81** also, two rods **90** on the underside of the Geneva star engage in two of four locating holes **91,** each associated with one station, in the plate **73.** The diameter of the holes **91** is greater than that of the rods **90** so that only a coarse alignment of the assembly is achieved. The fine alignment is performed by one of the lugs **10** or **11** slidably engaging a respective one of the rods **12** or **13** (see FIG. **1**) as previously described. Therefore, if for example due to wear of the moving parts, the shaft rotated through an angle of only approximately 90°, the course alignment would ensure that the lugs **10** and **11** were

able to fit over the top of one of the rods 12 and 13 which are rounded off so as to slide over the rod and accurately align the rotor assembly.

When the machine is in an inoperative condition, i.e. the air supply to the pneumatic circuitry is disconnected, and the vacuum pump is switched off, the rotor assembly is located above the label feed and "rest" stations in its "down" position. Once the stack of labels is loaded into the label feed mechanism and the air supply connected, the rotor assembly rises to its "up" position but does not rotate. At least two cartridges are fed into the cartridge feed mechanism and as the first is sensed by the sensor 44 (FIG. 1) the rotor assembly is rotated through 90° and dropped to bring the holder 5, for example, over the heater station.

Meanwhile, the piston 43 of cylinder CE retracts, allowing the sensed first cartridge to fall into position 54, and the empty cartridge holder is raised to the vertical position (FIG. 5). The rotor assembly is then raised, rotated through 90° and dropped again to bring the holder 6 over the top label of the label stack which by this time has risen under the influence of cylinder 16 (FIG. 2) to the corect horizontal plane so as to pick up the top label, the vacuum pump having been switched on. The rotor assembly is then raised. During this second rotation, the holder 46 is lowered to its horizontal position and the sensed first cartridge is pushed inside it into position 45 (FIG. 4).

The second cartridge which by now is in position 42, the piston 43 of cylinder CD having retracted, is sensed by the sensor, causing further rotation of the rotor assembly to bring the holder 5 over the cartridge feed mechanism as the holder 46 is pivoted to raise the first cartridge to the vertical position 51 (FIG. 5). The rotor assembly then drops to allow the adhesive of the label held by holder 6 to be activated at the heater station. The rotor assembly is then raised and rotated a fourth time in order to bring the holder 5 into the label feed station, as the holder 46 lowers the first cartridge which is unlabelled to the horizontal.

At the end of this second cycle of 180° rotation, the holder 6 carrying an activated label is in the "rest" station. If a third cartridge follows the second, a third cycle of 180° movement is commenced. After the first 90° movement of the rotor, the holder 6 carrying an activated label is brought into registration with the second cartridge which has been pushed by the piston 43 into the holder 46 and raised by the holder 46 to the vertical position 51 (FIG. 5). The label is thus attached to the second cartridge which is ejected from the machine after the third cycle. Each cartridge after the first is labelled as it passes the machine, the first being required to start off a "run."

It will be apparent that the sensing of a cartridge in position 42 produces a total rotation of the rotor assembly of 180°, i.e. two cartridges must be sensed in turn at the input of the cartridge feed station for the rotor assembly to complete one revolution. The sensing of one cartridge results in the labelling of the cartridge preceding it in the "run." It is to be noted that since after the cartridge of a "run" has been labelled, one holder 5 or 6 of the rotor assembly still holds an activated label whilst the last cartridge which is in position 45 (FIG. 4) is unlabelled, so that if desired, the first cartridge, otherwise unlabelled, could be fed into the machine at the end of a "run" and thus the last cartridge labelled.

Referring to FIGS. 8 and 9, air enters the pneumatic circuit in line 100 and passes through a filter 101 and a regulator 102 in which it is regulated to 80 lbs. per sq. inch. A part of the regulated air is then passed via line 103 to valve switches S1, S3, S4, S5, S6, S8 and S9 and to a diagram amplifier 111. A second part of the flow of regulated air is passed through a lubricator 104 since lubricated air is required for the working of control valves in the pneumatic circuit and for the cylinders which they operate. To reduce the demand on the lubricator, which includes a 9 inch feed cylinder (not shown), the remainder of the regulated air flow is taken round a bypass loop 105 which is connected across the lubricator. Lubricated air is then fed to a control valve A via line 106, to a control valve B via line 107 and to control valves D, E and F via line 108.

FIG. 9 shows the pneumatic circuit required for operating the cartridge feed mechanism at the cartridge labelling station. When the machine is inoperative, the piston 43 of cylinder CD, which is the cartridge feed cylinder, is extended, and the piston 50 of cylinder CE, the cylinder which rotates the cartridge holder is retracted i.e. the cartridge holder is in the horizontal position (see FIG. 4). When an on/off switch 109 is operated to close the valve switch S8, unlubricated an at a pressure of 80 pounds per square inch is fed through a flow control valve FCV1 to a valve switch S7 which has been closed by the extended piston 43 of cylinder CD. The air is then passed by the closed switch S7 to the sensor 44, and, when a cartridge is in position 42 (see FIG. 4) the back pressure sensed by the sensor 44 is transmitted via line 110 to the diaphragm amplifier 111, is amplified and fed via lines 112 and 113 to port a of the control valve E. Port C of the control valve E then opens, sending pressurized air along line 114 to the cylinder CE causing the piston 50 to be extended, and raising the cartridge holder to the vertical position as seen in FIG. 5.

When piston 50 is fully extended, a flange 115 (see FIGS. 4 and 5) on the piston closes the valve switch S6. Air is then applied by the switch S6 via lines 116 and 117 and via a flow control valve FCV2 to the cylinder 36 which controls the butterfly valve 34 (see FIG. 3) as previously described. When air is applied to the cylinder 36 its piston extends causing the butterfly valve 34 to close the exhaust pipe 35. At the same time air is fed through lines 116 and 118 to pilot b of the control valve D, port d of control valve D then opens to feed air via line 119 to the cylinder CD, retracting the piston 43 whilst opening switch S7 and cutting off the air supply to the sensor. The catridge waiting in position 42 (see FIG. 5) then falls into position 54 when the piston 43 is fully retracted. The cartridge feed mechanism is now in a position where a label can be applied to a cartridge in the vertically located cartridge holder as hereinbefore described.

At the same time as the diaphragm amplifier feeds the amplified back pressure via lines 112 and 113 to pilot a of control valve E, it feeds air via lines 112 and 120 to pilot a of control valve F, producing a "rotor start" signal to be transmitted to valve S2 from port d of control F via line 121, thus initiating a 90° rotation of the rotor assembly as hereinafter described. Thus the rotor assembly is rotated to position the holder 5 or 6 over the cartridge feed station as the cartridge holder 46 is raised to the vertical position.

Once a label has been applied to the cartridge within the holder, and the rotor is again rotating towards the label feed station, the valve switch S4 (see FIG. 1) is closed by the respective arm 3 and 4 of the rotor. The closing of the switch S4 causes air to be fed via line 122 to pilot b of control valve E, opening port d of control valve E to supply air via line 123 to the cylinder CE. This retracts piston 50 allowing switch S6 to open, and lowering the cartridge holder to the horizontal position. Once the holder is horizontal and the retraction of piston 50 is complete, the flange 115 (see FIGS. 4 and 5) closes the switch S5 applying air pressure via line 124 to pilot a of control valve D. Port c of control valve D then opens applying air pressure via line 125 to cylinder CD causing piston 43 to be extended whilst closing switch S7 again and restarting the cycle. The extension of piston 43 pushes the cartridge in position 54 (see FIG. 5) into the holder, which results in the labelled cartridge within the holder being ejected between the rollers 56 and 57 as previously described.

FIG. 8 shows the pneumatic circuit which controls the rotation of the rotor assembly. In the inoperative condition, of the machine, the rotor is orientated so that one of the holders 5 or 6 is located above the label feed mechanism, the rotor being in the "up" position. (see FIG. 4), so that the valve switch S2 is closed as previously described. When the "rotor start" signal is received via line 121 from port c of control valve F in the cartridge feed circuit of FIG. 9, pressure is applied via line 130 to pilot a of control valve A. Port c of control valve A then feeds a signal through line 131, a flow control valve FCV5 and line 132 to cylinder CA causing the piston 83 to be extended thus turning the rotor through 90° as hereinbefore described. At the same time a signal is applied through line 134 and flow control valve FCV6 to pilot b of control valve B to reset control valve B. This causes the lift cylinder CB to be exhausted through line 135, flow control valve FCV7 an port c of control valve B.

When the b 90° rotation of the rotor is complete, the shaft of the rotor drops through a short distance, preferably about 1 inch, to deposit a label held by one of the holders 5 or 6 on to the cartridge held in the cartridge holder which at this point is in the vertical position, and to activate the adhesive on the label held by the other holder 5 or 6 which is at this point located above the heater box. The dropping of the shaft 2 closes the switch S3, which applies a signal via line 136 to pilot b of control valve A which resets control valve A. The cylinder CA is exhausted to atmosphere via lines 132 and 131, ports c and d of control valve A, and thence via lines 139 and 140 to a "dwell time" control 138. The time taken for the piston 83 of cylinder CA to retract is governed by the "dwell time" control 138. When the retraction of piston 83 is completed, switch S1 is closed as hereinbefore described, causing pressure to be applied via line 141 to pilot a of control valve B, causing pressure to be applied via line 135 and flow control valve FCV7 to lift cylinder CB thus extending piston 74, and raising the rotor assembly. Once the shaft on the rotor assembly is fully raised, switch S2 is again closed and the cycle is repeated for the second 90° swing, since the closure of switch S2 sends a signal via line 130 to control valve A for the second 90° swing to commence. During the second 90° swing, S4 is closed by arm 3 or 4, sending a signal to port b of valves E and F via line 122. Valve F then cuts off the air supply to S2 and opens line 145 to atmosphere via ports e and c, thus by passing the "dwell time" control 138, and reducing the time taken for exhausting cylinder CA during the second 90° swing.

In order that the acceleration and deceleration of the rotational movement of the rotor caused by piston 83 of cylinder CA is fast and smooth, the cylinders CA and CS are arranged so that they work in opposition as previously described. Thus as the piston 83 of cylinder CA is extended and approaches the end of its stroke, the piston 84 of cylinder CS is forced to retract. This causes air to be exhausted from cylinder CS via line 133, a part of this flow passing into cylinder CA to smooth down the extension of piston 83. The remainder of the flow from cylinder CS is passed through line 137 to port d of the control valve A, through the valve to port f of control valve A, and via line 142, to the switch S10 which has a muffler valve 143. In addition the switch S10 is provided with a small orifice 144 at its input through which air can be exhausted. During the initial accelerating period i.e. the initial extension of piston 83, the switch S10 is closed allowing air to be exhausted through the muffler valve 143. Thus the pressure in line 133 is relatively low, allowing fast acceleration of piston 83. However as the piston 83 reaches the end of its extension, and the rotor approaches the end of its 90° swing, the switch S10 is opened, as previously described, cutting the muffler valve 143 out of the circuit and leaving only the small orifice 144 as an exhaust port for the air. This raises the pressure in line 133 and thus slows down the rate at which the piston 83 may extend, decelerating the rotation of the rotor by effectively cushioning the swing of the lever 78 (see FIG. 7) and allowing the rotor to drop without the lever 78 over-shooting. Adjustment of muffler valve 143 and orifice 144 allows for variations in the rate of acceleration and deceleration of the rotor assembly.

Exhaust air taken from ports e and f of both control valves D and E (see FIG. 9) via lines 146, 147, 148 and 149 respectively is coupled in a common line 150 and passed through a second filter 151 to remove any trace of lubricant. Air free from lubricant is taken from the top of the filter 151 and fed via line 152 to the air jet 20 which separates the top label from the rest of the stack in the label feed mechanism (see FIG. 2). A restricted parallel output is allowed to pass to atmosphere through line 153 and a silencer 154. The amount of air which is allowed to pass into the silencer is controlled by a valve 155 which is located in line 153. Lubricated exhaust air is taken from the bottom of the filter 151 and passed via line 156 into an oil reservoir 157 so as to pump oil up pipe 158 (see also FIG. 6) in order to lubricate the rotor mechanism. Oil is able to return to the oil reservoir via a return pipe 159. The pressure of the air in line 156 is monitored by a safety valve 160 which is located at the entrance of line 156 into the reservoir.

The operation of the machine may be varied in several aspects by the adjustment of the flow control valves and muffler valves provided. In particular, the provision of flow control valves FCV4 and FCV3 in exhaust lines 149 and 148 respectively of control valve E enable the rate of raising and lowering of the cartridge holder respectively, to be adjusted.

The point in the cycle at which the rotor assembly drops is controlled by suitable adjustment of flow con-

trol valves FCV5 and FCV6, the rate at which it drops being controlled by a muffler valve **161** on the lift cylinder CB, and the rate at which it is raised being controlled by the flow control valve FCV7 and a muffler valve **162** on port e of control valve B.

We claim:

1. A method of labelling slab-like objects, which have a narrow face and two opposite broad faces adjacent thereto, comprising the steps of:

moving a first holder to a first operating station to pick up a label having inactivated adhesive on one side thereof from a stack by means of suction;

moving the first holder and the label which is held thereby to a second operating station;

activating the adhesive on the one side of the label while the first holder and label are at the second operating station;

moving the first holder and activated label which is held thereby to a third operation station;

feeding a slab-like object to be labelled in a direction parallel to said opposite broad faces thereof into a second holder at the third operating station when the second holder is in a first position;

pivoting the second holder and the object to be labelled contained therein about a relatively fixed pivot point through a predetermined angle from said first position into a second position in which the said narrow face of the object to be labelled is adjacent the activated side of the label contained in the first holder when the first holder reaches the third operation station;

causing the label to adhere to the said narrow face of a slab-like object to be held by the second holder adjacent the label in the first holder at the third operating station by relative movement between the first and second holders;

returning the first holder to the first operating station to pick up another label; and,

pivoting the second holder and the slab-like object which is contained within the second holder and has the label attached to said narrow face thereof back to the first position so as to receive another object to be labelled as the labelled object is ejected from the second holder through a resilient gate which causes the ends of the label to adhere to the said two opposite broad faces of the object which are adjacent the said narrow face.

2. A method as claimed in claim **1**, wherein the first holder is cyclically moved in a circular path from one operating station to another and is lowered at each station before each operation and raised after each operation before being moved to the next station.

3. A method as claimed in claim **1** wherein the adhesive on the label is activated by heating the label at the second station.

4. A labelling machine for use in labelling slab-like objects, which have a narrow face and two opposite broad faces adjacent thereto, comprising:

a first holder including means for holding an adhesive label by suction;

at least three operating stations;

means for cyclically moving the first holder in steps past said three operating stations in turn;

the first of said three operating stations having means for supporting a stack of adhesive labels which have inactivated adhesive on one side thereof and which are picked up by suction one at a time by the first holder when the first holder is at the first operating station;

the second of said three operating stations having means for activating the adhesive on the one side of a label held by suction in the first holder when the first holder is at said second operating station;

the third of said three operating stations including means for presenting the narrow face of the slab-like object to be labelled to an adhesively activated label in the first holder when the first holder reaches the third operating station;

said presenting means comprising a feeding mechanism and a second holder which is pivotable through a predetermined angle about a relatively fixed pivot point between a first position in which the slab-like objects to be labelled are fed, one at a time, in a direction parallel to said opposite broad faces thereof into the second holder by the feeding mechanism, and a second position in which the said narrow face of the object to be labelled held therein is presented to the adhesively activated label held in the first holder when the first holder reaches the third operating station, and means for pivoting said second holder and said object contained therein about said fixed pivot point between said first and second positions;

means for causing the activated label to adhere to the said narrow face of the object presented thereto at the third operating station;

said last means comprising means for moving the first holder and the second holder relatively towards one another when the first holder is at said third operating station and the second holder is in said second position so as to cause the activated label held by the first holder to adhere to said narrow face of the object in the second holder;

a resilient gate; and,

said feeding mechanism being arranged to eject an object having a label attached to the narrow face thereof from the second holder, when said second holder returns to its first position through said predetermined angle, through said resilient gate to cause the ends of the label to adhere to the said two opposite broad faces adjacent the said narrow face of said object.

5. A labelling machine as claimed in claim **4** wherein:

the first holder is carried at one end of an arm which is rotatable in steps about an axis at right angles to the length of the arm; and,

said means for relatively moving the first and second holders comprises means for moving the first holder and the arm together along said axis.

6. A labelling machine as claimed in claim **4**, wherein:

at least two first holders are provided, each carried at one end of a respective arm,

each of said arms being mounted at the other end thereof on a common shaft for rotation therewith in a manner so that the first holders lie in a common plane orientated at right angles to the axis of the shaft;

said means for cyclically moving the first holder including means for rotating the shaft about its axis in steps to bring each first holder to each operating station in turn, and,

said means for relatively moving the first and second holders comprising means for moving said first

holders, said arms and said shaft together along the axis of said shaft.

7. A labelling machine as claimed in claim **4,** wherein the resilient grade comprises a pair of parallel resiliently mounted rollers.

8. A labelling machine as claimed in claim **4,** wherein the means for activating adhesive on the one side of a label comprises heater means including a radiant heating element and means for directing a blast of air past the heater means towards said one side of a label in the first holder when the first holder is at said second operating station.

9. A labelling machine as claimed in claim **8,** wherein said heater means includes a second radiant heating element arranged for fine temperature control.

10. A labelling machine as claimed in claim **4,** wherein a sensor is provided at the third operating station for sensing the presence of a slab-like object at the input of the feeding mechanism so as to initate a labelling cycle.

11. A labelling machine as claimed in claim **4,** wherein pneumatic circuitry is provided to control automatically the movement of the first holder and the operation of each operating station.

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