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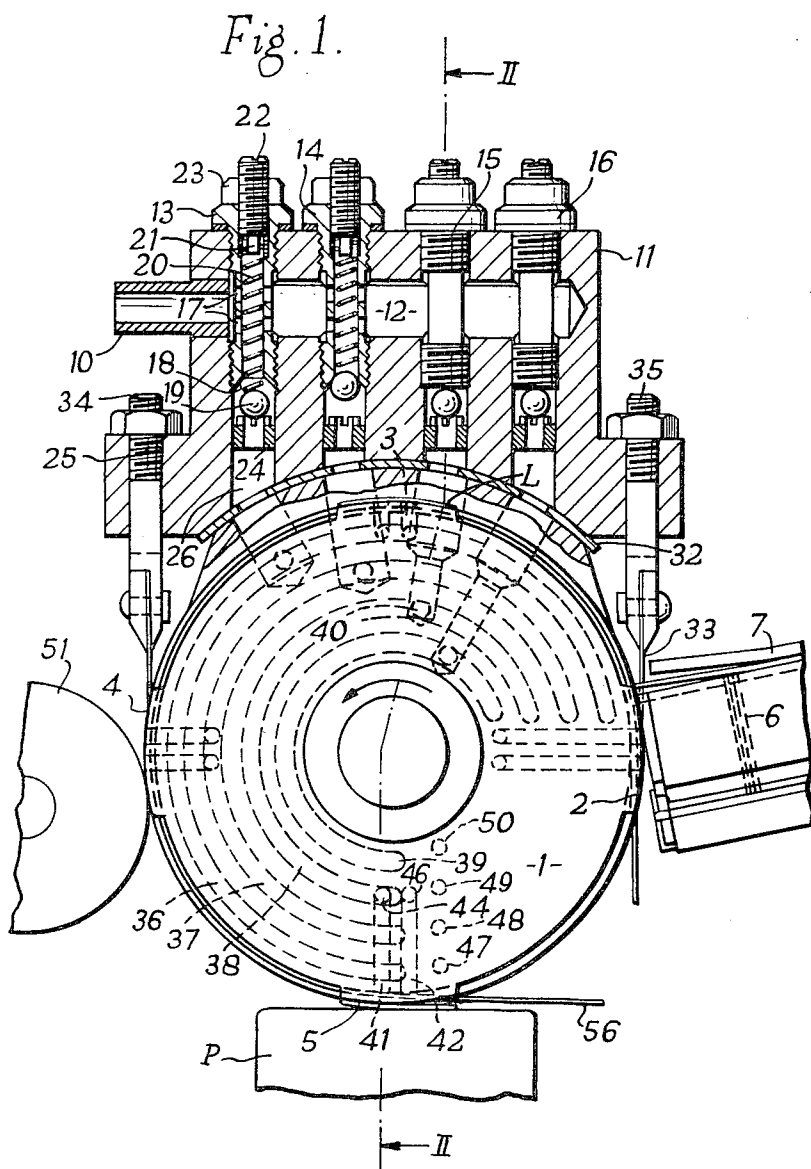
F. SOUTHCOTT

3,222,059

SUCTION APPARATUS

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2 Sheets-Sheet 1



INVENTOR

INVENTOR
Frederick Southcott

BY

BY
Watson, H. Grindle & Watson

ATTORNEY

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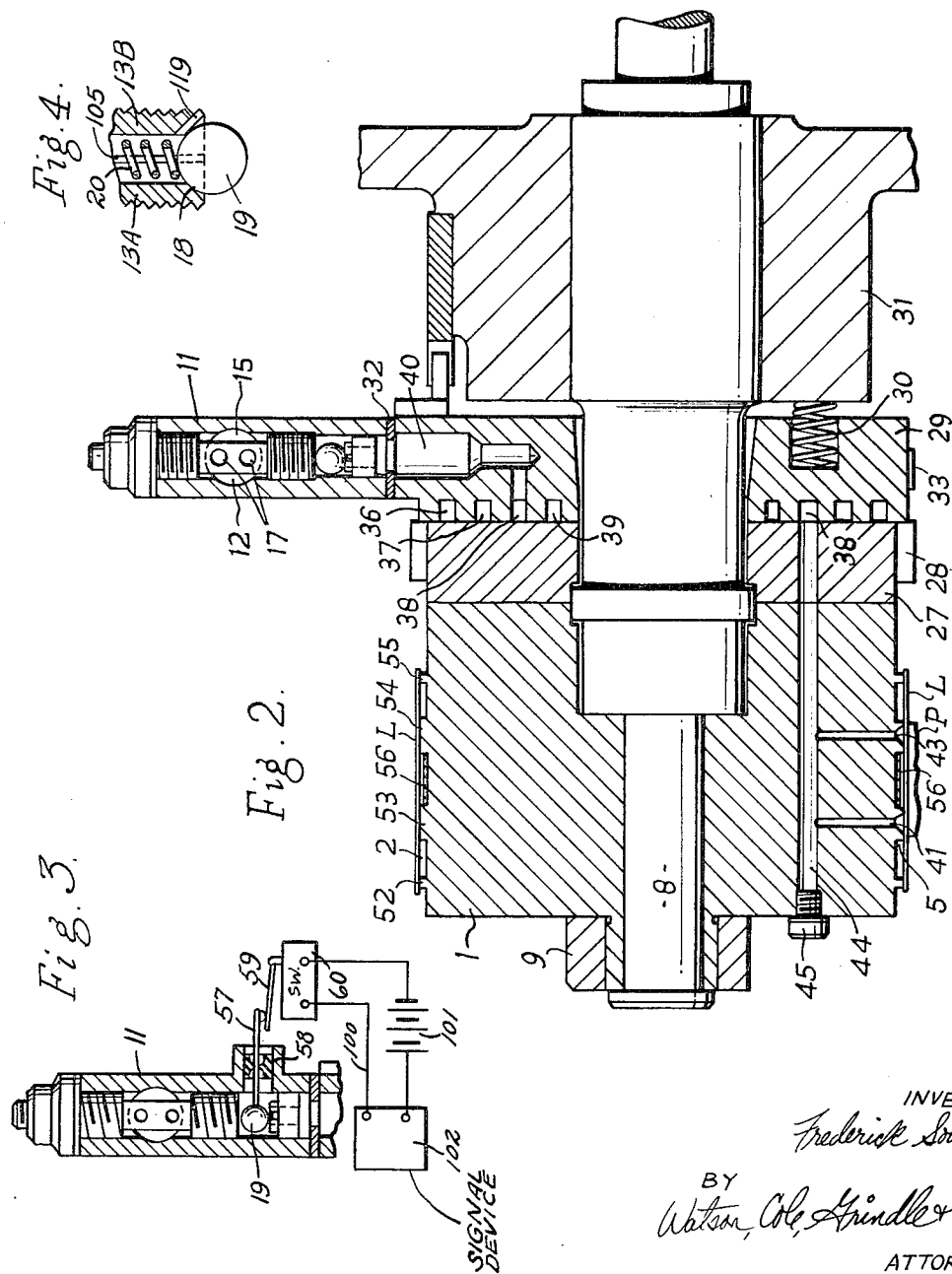
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SUCTION APPARATUS

Frederick Southcott, London, England, assignor to The Molins Organisation Limited, London, England, a corporation of Great Britain

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7 Claims. (Cl. 271-28)

This invention concerns improvements in or relating to suction apparatus for transferring articles (e.g. labels) from one position to another.

In apparatus of this type use is frequently made of applying suction through openings at a series of suction stations on a conveying surface, to each of which one of the articles adheres suctionally. This arrangement is suitable for feeding printed paper labels from a stack of such to the tops of packets of cigarettes and has been disclosed in copending United States application Serial No. 144,774, now United States Patent No. 3,151,014. In such an arrangement, if an article to be fed is missing, then the openings to which it should have been suctionally held remain open to atmosphere and this results in the possibility of atmospheric pressure being transmitted to the openings at other suction stations, thereby causing the risk that articles which should have been suctionally held may become disengaged from the conveying surface. In the present invention means are provided to substantially cut off suction from an opening at a suction station from which an article is missing.

According to the present invention there is provided suction apparatus for transferring articles (e.g. paper labels) from one position to another, comprising transfer means having a series of openings at suction stations at each of which an article can be suctionally held to the transfer means, a source of suction, and valve means associated individually with each of the said suction stations through which the said openings can communicate with the said source of suction, each of the said valve means being adapted to substantially close responsively to the flow of air through an opening at its associated suction station to the source of suction. Preferably, each of the said valve means is adapted to be substantially closed while it is in communication with atmosphere through an opening at its associated suction station, and to open when it ceases to be in such communication with atmosphere.

Each of the valve means may comprise a valve seat, a ball, and a spring arranged so that the spring can hold the ball away from the valve seat when the air pressure is substantially equal at either side of the valve seat, and so that air pressure can hold the ball in the valve seat against the action of the spring, thereby substantially closing the valve, when air flow through an opening at the suction station associated with the valve means causes an increased air pressure on that side of the valve seat remote from the suction source. The ball and valve seat in each of the valve means is preferably adapted to permit a small air leak through the valve seat when the ball is in the valve seat and the valve is substantially closed, so that the air pressure on either side of the valve seat can substantially equalise and the ball can be moved away from the valve seat by the spring to open the valve when the valve means ceases to be in communication with atmosphere.

Substantial closing of any one of the valve means may be arranged to cause a signal. For example, movement of the ball into the valve seat of the valve means mentioned above may be arranged to cause a signal. For example, movement of the ball into and away from the valve seat may close and open an electrical circuit adapted to cause a signal.

The said transfer means may comprise a drum having a series of peripheral suction stations provided with suction ports which can communicate, through channels in the drum, and through the said valve means, with the said source of suction, the apparatus comprising means to rotate the drum about its axis.

Apparatus in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is an end view, partly in section, of suction transfer apparatus.

FIGURE 2 is a section along the line II-II of FIGURE 1.

FIGURE 3 is a sectional view of part of a suction valve, and showing in purely diagrammatic form an electrical circuit energized by the movement of the valve member.

FIGURE 4 is a fragmentary sectional view of the lower portion of the valve body illustrating a modified form of the invention.

In the apparatus shown in FIGURE 1, transfer means comprising a drum 1 having four suction stations 2, 3, 4 and 5 of slightly greater diameter than that of the rest of the drum, removes labels L from a stack 6 in an inclined magazine 7, which oscillates as disclosed in copending United States Application Serial No. 144,774, now United States Patent No. 3,151,014. The drum 1 rotates in the direction shown by the arrow in FIGURE 1 and is driven by a shaft 8 (FIGURE 2) through grub screws, which are not shown, in a collar 9. Each of the suction stations is connected individually to a source of suction as will now be described.

A pipe 10 communicates with the source of suction, which is not shown, and the pipe is screwed into a quadruple valve body 11 in which it communicates with a manifold 12. Four valve sleeves 13, 14, 15 and 16 are screwed into the valve body 11, each of the sleeves having two holes 17 drilled through so that the inside of the sleeves is in communication with the manifold 12. Each valve sleeve comprises a valve, all four of which are identical. One will be described. On the lower end of the valve sleeve 13 is a seat 18 which can be substantially closed by a ball 19. The seat 18 and ball 19 are adapted to permit a small air leak through the valve seat when the ball is in the valve seat for a purpose to be described later. One way of providing the small air leak is to cut a bleed groove or slot in the conical valve seat as suggested at 119 in FIGURE 4. The ball 19 is normally held away from the seat 18 by a spring 20, the tension in which is controlled by a stop 21 fixed to the end of an adjusting screw 22 held in position by a lock nut 23. Downward movement of the ball 19 is limited by a ring 24 the top of which is slotted at 25 to allow the passage of air from below the ball to above the ball when it is seated on the ring 24. The ring 24 is located in a passage 26 within the valve body 11.

Referring now to FIGURE 2 it can be seen that the valve body 11 is separate from the drum 1. To the right of the drum 1 as seen when looking at FIGURE 2 is a gear 27 having teeth 28 driving other mechanism unconnected with the apparatus of the present invention. The drum 1 and the gear 27 are secured together, both being driven by the shaft 8. To the right of the gear 27 is an air chamber member 29 through which the shaft 8 passes, this member 29 not being rotatable with the shaft. The left hand face of the member 29 is held in close contact with the right hand face of the gear 27 by means of three springs one of which, 30, is shown in FIGURE 2, the springs being held in compression between the member 29 and a part 31 of the fixed casting of the apparatus.

The valve body 11 is separated from the member 29 by a seal 32 and is attached to it by means of a strap 33,

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the ends of which are secured to screws 34 and 35 fixed by means of nuts to projections from the valve body 11 (FIGURE 1). In the left hand face of the member 29 (as viewed in FIGURE 2) there are four grooves 36, 37, 38 and 39 each extending circumferentially approximately 270° around a circle. Each of the grooves communicates with one of the valves by means of a passage through the member 29. Thus in FIGURES 1 and 2 it will be seen that the groove 38 communicates through a passage 40 with the valve of which 15 is the valve sleeve, the seal 32 being drilled in the appropriate places to permit communication.

Each of the four suction stations 2, 3, 4 and 5 comprises four suction port openings. In the case of the suction station 5, two ports 41 and 42 can be seen in FIGURE 1 while in FIGURE 2 a third port 43 can be seen in addition to the port 41. The ports 41 and 43 communicate with a channel 44 drilled through both the drum and the gear 27, the outer end being plugged at 45 and the inner end communicating with the groove 38. Similarly the port 42 and the fourth, but not shown, port of the suction station 5 communicates with a channel 46 which in its turn also communicates with the groove 38.

The left hand face (as viewed in FIGURE 2) of the member 29 is provided with four holes 47, 48, 49 and 50 (see FIGURE 1) each communicating with the atmosphere and the centre lines of which are respectively of the same radius as the grooves 36, 37, 38 and 39.

A gum wheel 51 running in a gum bath which is not shown applies gum to a label L held to the suction station in the position indicated by 4 in FIGURE 1. The gum wheel 51 has a ribbed periphery so as to apply lines of gum to each label L. The suction stations 2, 3, 4 and 5 comprise raised circumferential rings as at 52, 53, 54 and 55 in FIGURE 2 and the ribbed portions of the gum wheel 51 are so spaced as to apply gum streams to the label in positions that avoid the rings 52, 53, 54 and 55. Between the rings 53 and 54, a stripping tape 56 running as shown in FIGURE 1 helps to strip a label L which is applied to a packet P at the position of the suction station 5 in FIGURE 1 from the hold of the suction ports 41, 42 and 43.

The operation of the apparatus will now be described. The magazine 7 is arranged to oscillate so that its free end is moving in the same general direction as a suction station when the latter is picking up a label. As the drum 1 rotates the suction stations move past the magazine 7 in turn, the suction station indicated by 2 being shown in FIGURE 1 moving into the position where its suction ports communicate with the groove 39, and thus, via the valve in the sleeve 16, with the suction source.

The normal position of the valves contained within the sleeves 13, 14, 15 and 16 is open, i.e. as in the case of the sleeve 13 in FIGURE 1, the ball 19 is held against the ring 24 by the action of the spring 20. This open condition remains true as long as the air pressure on both sides of the valve seat is substantially equal, equalization of pressure being rapidly achieved by means of the slots 25 in the top of the ring 24. Thus as soon as the suction source is put into direct communication with the ports of a suction station, as at 2 in FIGURE 1, suction is immediately applied to the ends of ports and an article such as a label L covering the ports will be immediately held suctionally. The detaching of a label from the stack 6 in the magazine 7 is facilitated by the movement of the latter in the same general direction as the movement of the periphery of the drum. When each label reaches the position of the suction station 4 in FIGURE 1, gum is applied to it by the gum roller 51 so that on reaching the position of the suction station 5 in FIGURE 1, the gum on the label adheres to the top of a packet P. At this latter position the stripping tape 56 moves away tangentially from the periphery of the drum 1, thereby helping to strip the label from the holding action of the suction. At the same time the openings at the inner ends

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of the channels 46 and 44 start to move away from communication with the groove 38, thereby cutting off suction from the ports 41, 42, 43 and the fourth port (not shown). As each opening moves into line with the hole 49 atmospheric pressure is admitted to the ports and any final adhesive tendency between the ports and a label is removed.

If a suction station moves past the end of the magazine 7 without picking up a label, air will be sucked in through the ports as soon as they are in direct communication with the suction source. The action of the air passing through the opening of a ring, as in the case of the valve in the sleeve 14 in FIGURE 1, lifts the ball against the action of the spring and substantially closes the valve. The valve then remains substantially closed while it is in communication with atmosphere through the ports at its associated suction station, on account of the increased air pressure on that side of the valve seat remote from the suction source, thereby preventing the breaking of the suction at those other suction stations to which labels have adhered. When a station without a label, as in the case of that indicated by the reference 4 in FIGURE 1, has passed beyond the position of the station 5 in FIGURE 1, so that its associated groove, and hence its associated valve means, ceases to be in communication with atmosphere, the small air leak as at 119 through the valve seat, previously referred to, permits the air pressure on either side of the valve seat to substantially equalise so that the spring can move the ball away from the valve seat to re-open the valve. Suction can then be applied through the ports at the suction station as the latter again passes the magazine 7 to receive a label.

FIGURE 3 is a section through part of a suction valve similar to those previously described, showing one example of means by which movement of the ball 19 can be used to cause a signal when the valve substantially closes. The ball 19 has connected thereto an arm 57 which passes through the centre of the rubber bush 58 housed in an opening in the wall of the valve body 11. The bush 58 seals the opening and serves as a pivot for the lever 57. The lever 57 engages with a switch lever 59 forming part of a switch 60, so that when the ball 19 rises from its position shown in FIGURE 3 into the valve seat to substantially close the valve, the lever 57 moves the switch lever 59 to close the switch 60, and when the ball 19 moves away from its valve seat to open the valve, the lever 57 moves to allow the switch 60 to open.

The switch 60 is included in any suitable electrical circuit so that closing of the switch causes a signal. Such a provision may include, for example, the electrical circuit 100 which includes a source of current 101 and a signal generating means 102.

The valves 13, 14, 15 and 16 in the apparatus shown in FIGURES 1 and 2 may all be of the form described above with reference to FIGURE 3, so that when any one of the valves substantially closes a signal is caused, indicating a missing label on the transfer drum. Such a signal such as generated at 102 may be utilised in any desired manner, for example, to actuate mechanism to prevent a packet being presented to the suction station from which a label is missing, or, alternatively, to eject the packet to which no label has been applied at a later stage. As a further example, the signal may be used to operate a warning system.

It will be appreciated that closing of a valve can be used to cause a signal by known other means than that described above with reference to FIGURE 3. For example, the valve seat could be in the form of two metal parts, such as suggested at 13A and 13B in FIGURE 4, separated by insulating material, shown at 105, the two parts forming terminals in an electrical circuit and the ball 19 being of metal so that when it is in the valve seat it bridges the two parts, thus providing an electrical connection and closing the circuit, which may of course be the same circuit indicated at 100 in FIGURE 3.

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What I claim as my invention and desire to secure by Letters Patent is:

1. Suction apparatus for transferring articles serially from a first position to a second position, comprising a rotatable drum having a series of openings at a plurality of suction stations at each of which one of said articles can be suctionally held to the drum, a common source of suction, conduit means by which each suction station can communicate with said source and individual valve means in said conduit between each suction station and said source, each valve means comprising a seat and a valve member, said valve member being biased away from said seat to open the valve to free passage of air, and an air-leak passageway between said valve member and said seat affording restricted passage of air when the valve is closed.

2. Suction apparatus as claimed in claim 1 wherein a relatively weak spring holds the valve member away from the seat, the spring yielding to the force exerted on the valve member by the difference in pressure between atmosphere and said source.

3. Suction apparatus as claimed in claim 2 in which means are provided for successively cutting off communication between said source and each suction station while each said suction station is at said second position.

4. Suction apparatus as claimed in claim 3 in which further means are provided at said second position for

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opening each said suction station to atmosphere so that said article held thereto is released.

5. The apparatus as set forth in claim 1 in which there are provided a signal and means operable by the closing of any one of said valve means to actuate said signal.

6. The apparatus as set forth in claim 5 in which means are provided connecting said signal actuating means to said valve member itself.

7. The apparatus as set forth in claim 6 in which said signal actuating means is electrical and is disposed in an electric circuit, and said connecting means includes an element in said electric circuit carried by said valve member and adapted to close the circuit when said valve member is seated and to break said circuit when said valve member is disposed away from its seat.

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EARL M. BERGERT, *Primary Examiner.*