Sept. 13, 1960 H. E. STOVER 2,952,104

METHOD AND MEANS FOR REMOTE CAP FEEDING

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Fig. 1.

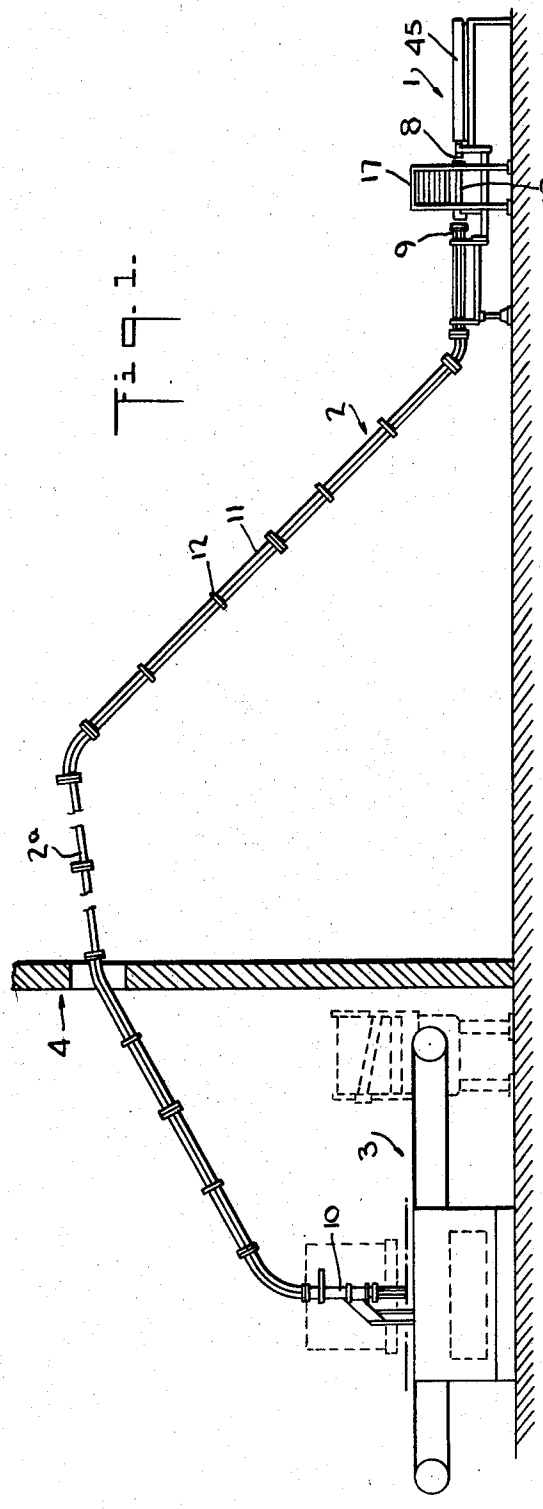


Fig. 3.

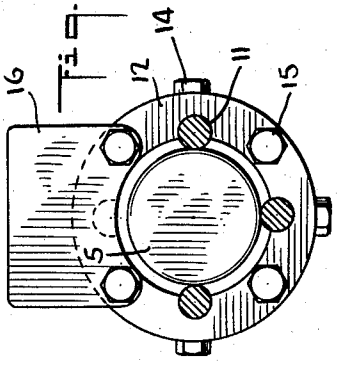
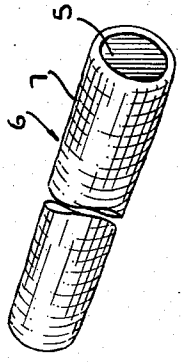


Fig. 1a.



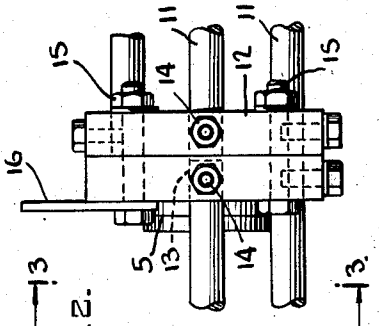


Fig. 2.

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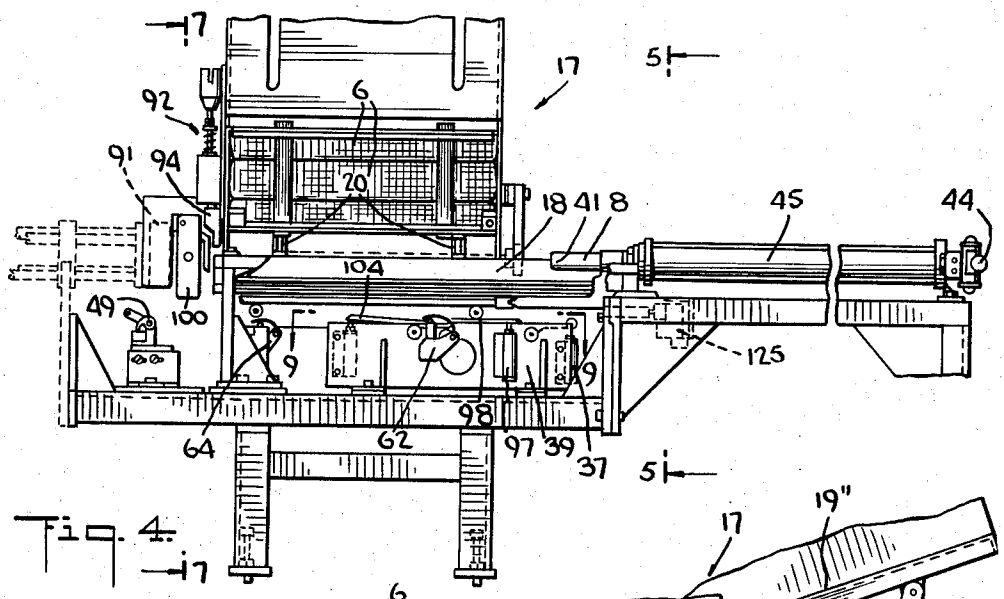


Fig. 4.

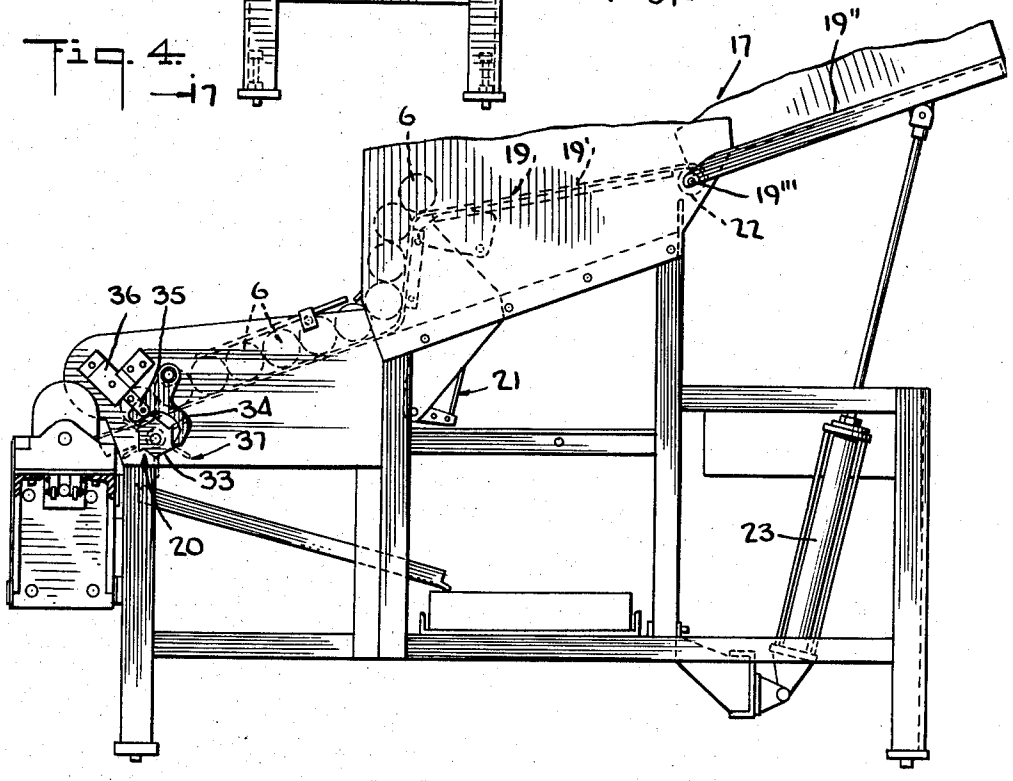


Fig. 5.

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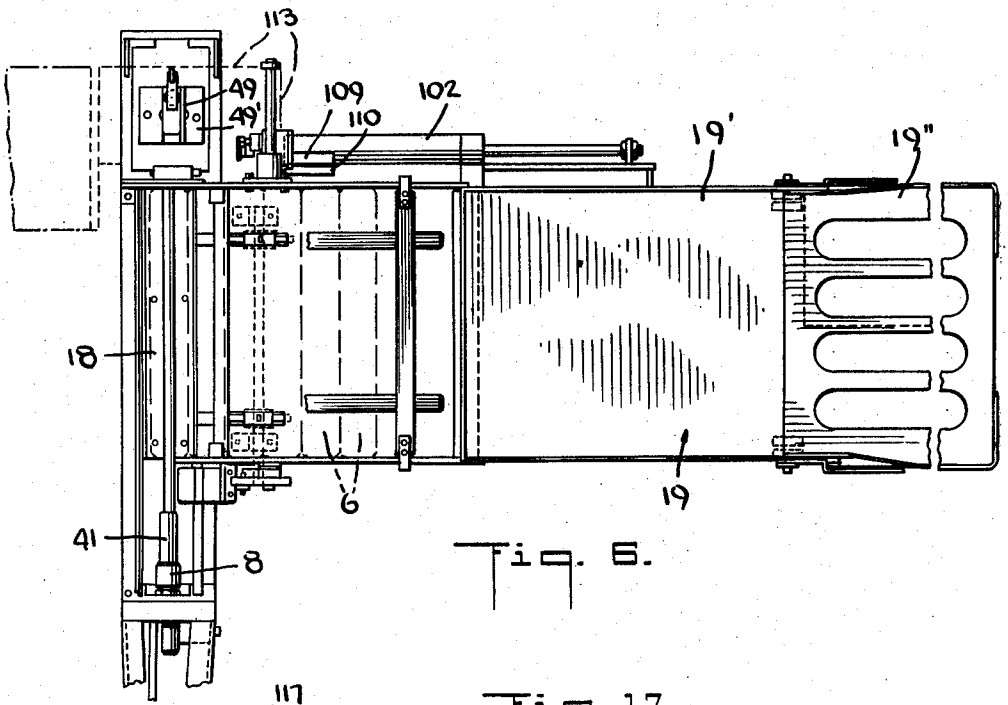
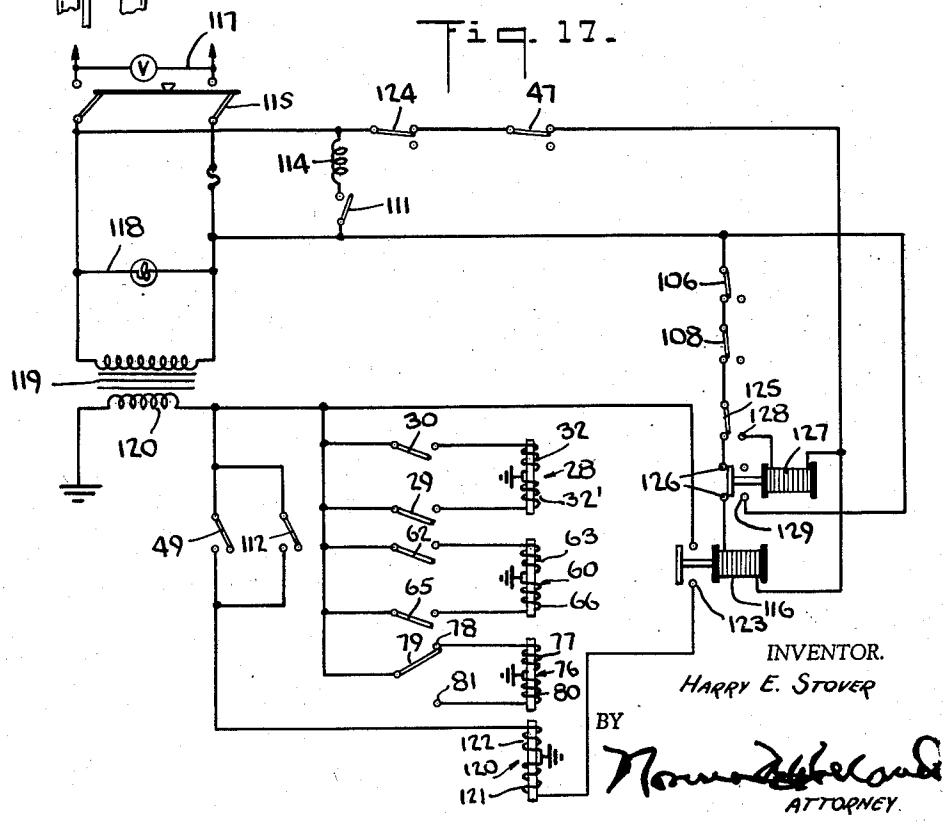


Fig. 6.

Fig. 17.



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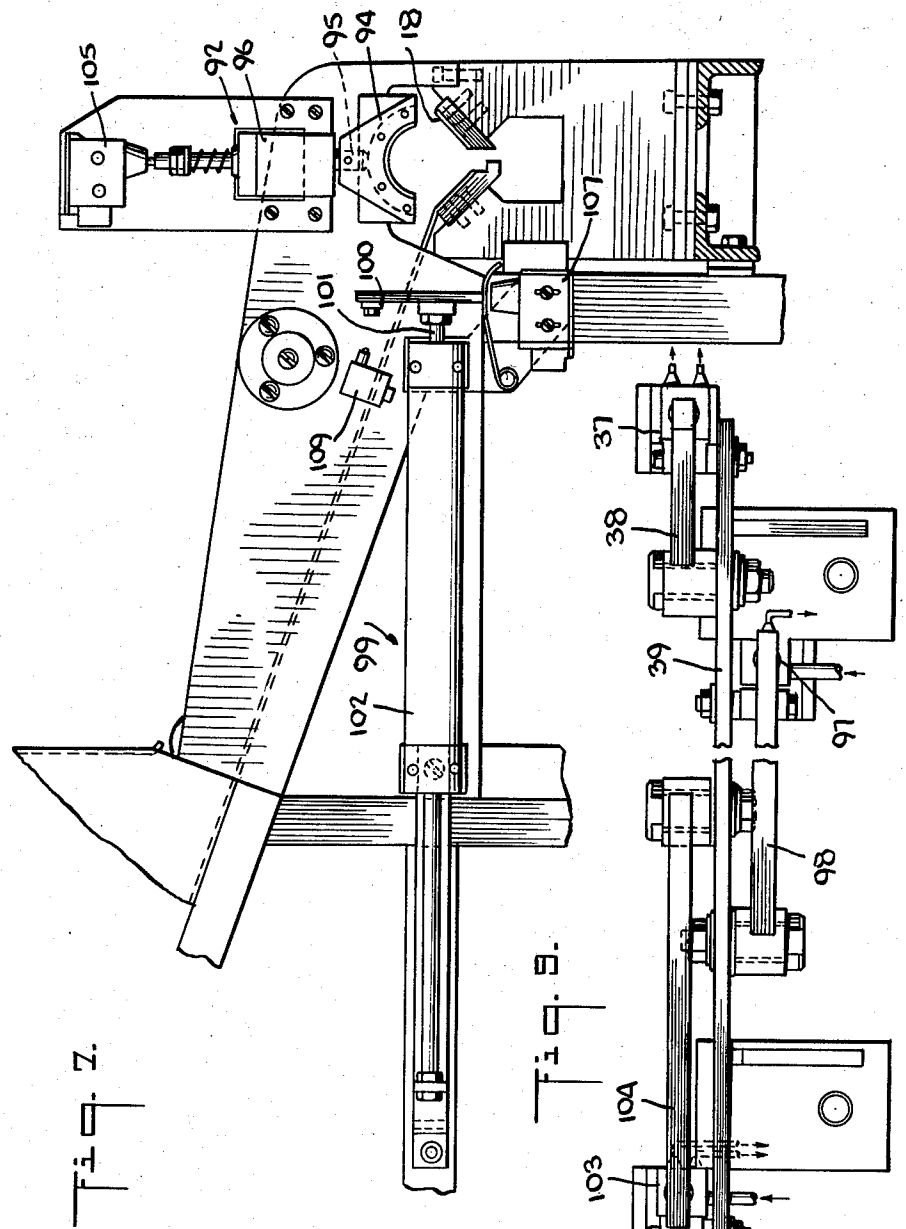


Fig. 7.

Fig. 8.

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Fig. 8.

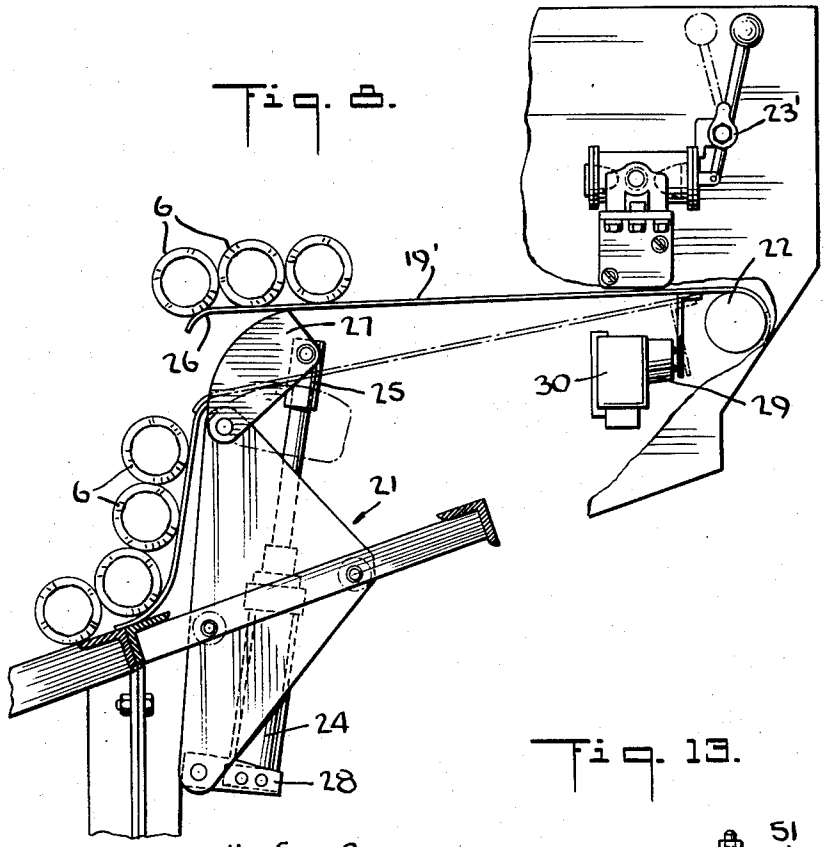
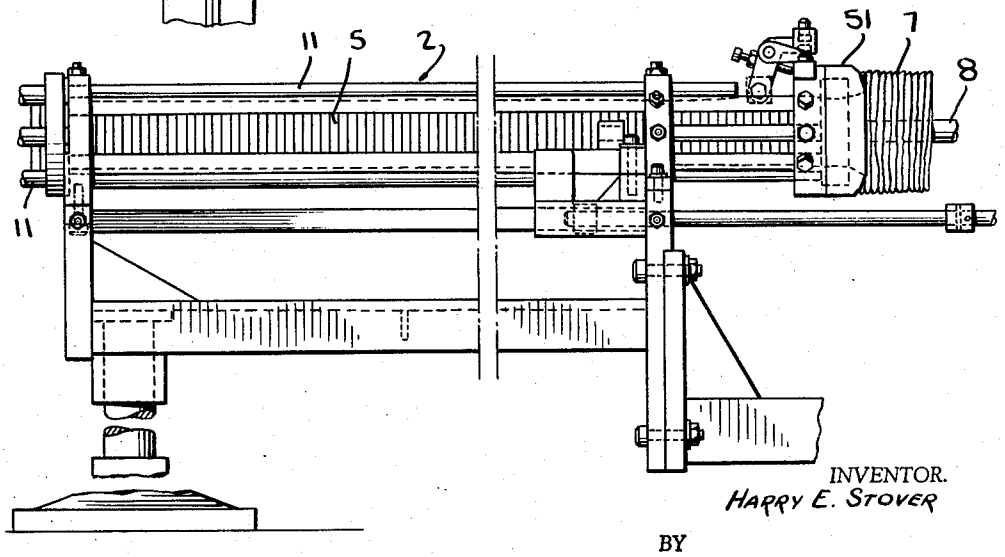


Fig. 13.



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Fig. 12.

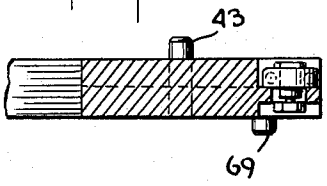
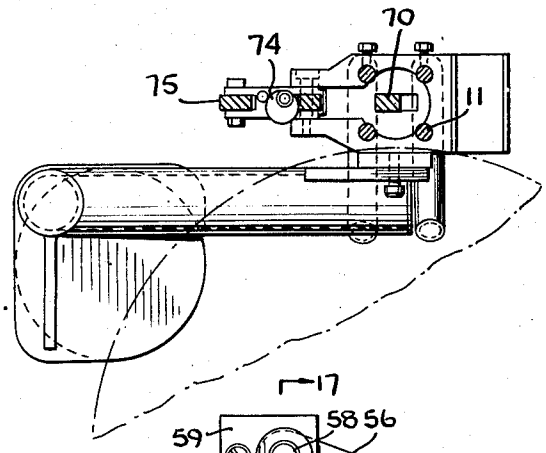


Fig. 15.



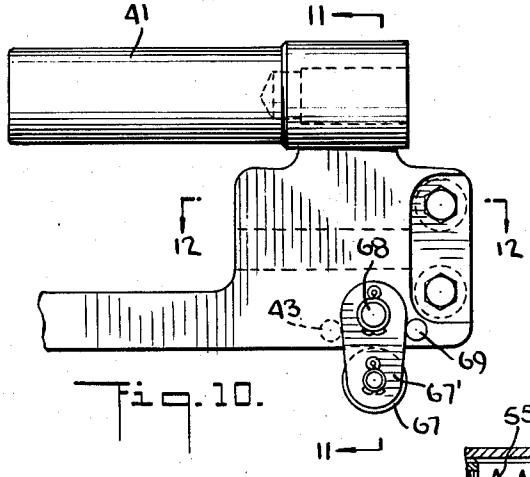


Fig. 10.

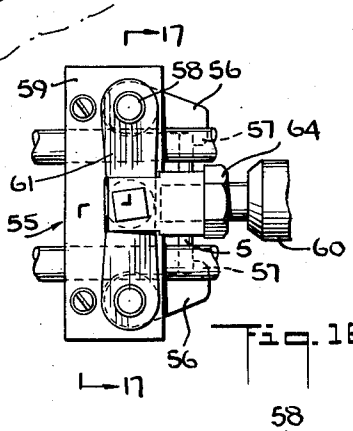


Fig. 16.

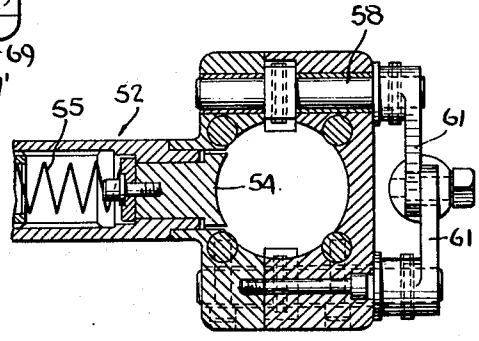


Fig. 17.

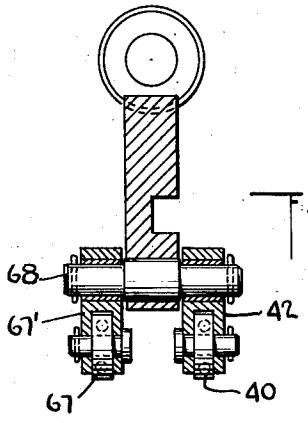


Fig. 11.

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METHOD AND MEANS FOR REMOTE CAP FEEDING

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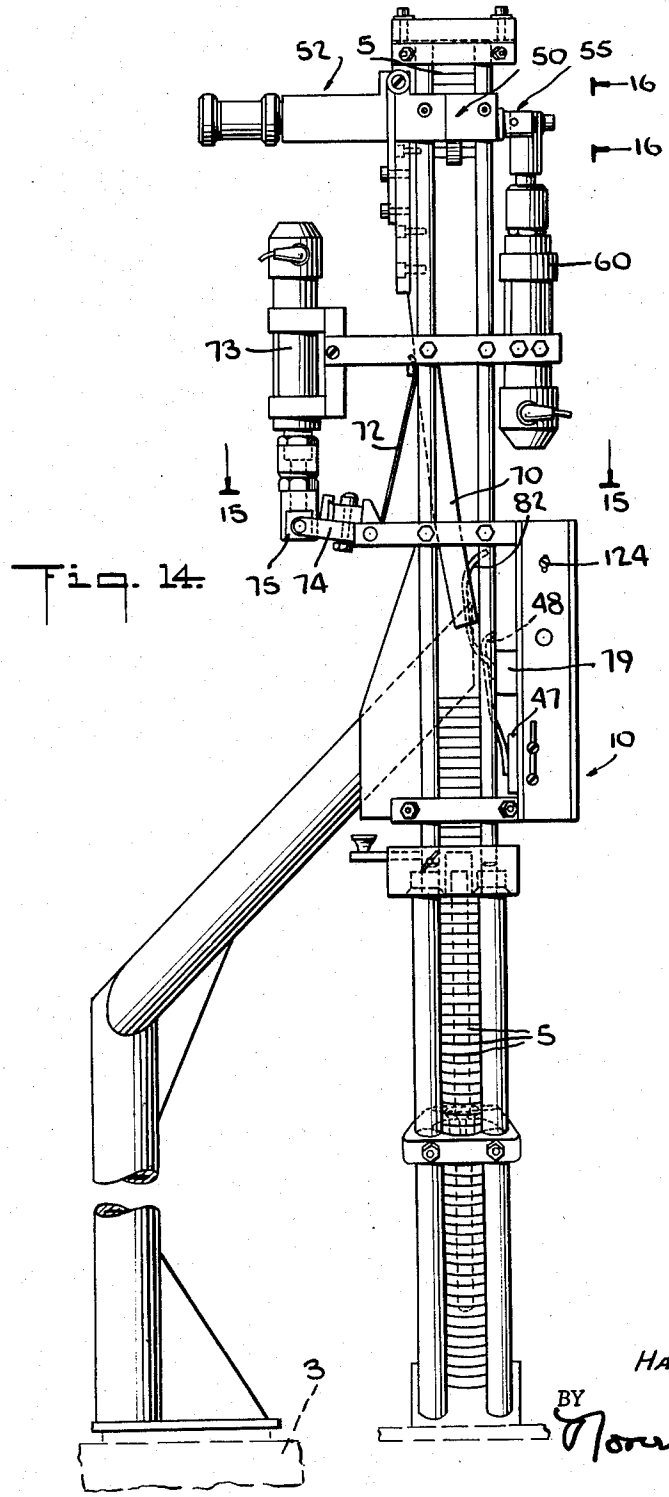


Fig. 14.

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United States Patent Office 2,952,104
Patented Sept. 13, 1960

2,952,104

METHOD AND MEANS FOR REMOTE CAP FEEDING

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Filed Feb. 4, 1958, Ser. No. 713,256

20 Claims. (Cl. 53—3)

The present invention relates to a device and method for feeding closure caps to a sealing machine and more particularly to a method and an automatic remote cap feed adapted to supply closures to the sealing machine at a rate controlled by the speed of operation of the sealing machine.

In the presently used methods of operation for sealing machines, closures for the containers being sealed are supplied from suitable hoppers or cap feed chutes located at or near the sealing machine. When the cap supply means is thus located in the area of the sealing machine, an operator must be available at this point to maintain the proper supply of closures in the feeding means, and the closures fed to the machine must be brought to the sealing machine by a suitable truck or other conveyance. The present invention eliminates the need for the cap feeding operator and for the cap supply in the area of the packing machine by providing a remote cap feed which may be located in a position remote from the sealing machine; for example, in a centralized closure supply room. This improves the sanitary conditions and frees space at the sealing location itself as it reduces the number of operating personnel which work at this location and it eliminates the need for the trucking of closure caps to this point.

The centralized cap feeding room may contain as many remote cap feeding machines as is necessary to supply sealing machines at the various different packing locations. By centralizing the cap feeding operation in this manner, the storage space for the caps may be centralized and it is possible for a single operator to supervise the supply of closures to several sealing machines at several widely spaced locations.

Accordingly, an object of the present invention is to provide an improved cap feeding device and method.

Another object of the present invention is to provide an automatic cap feeding machine and method adapted for remote operation.

Another object of the present invention is to provide an improved means for supplying closure caps to a sealing machine from a remote location.

Another object of the present invention is to provide a fully automatic remote cap feeding device.

Another object of the present invention is to provide an automatic remote cap feeding means, several of which may be supervised by a single operator.

Another object of the present invention is to provide an automatic remote cap feeding machine with improved safety features.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been

chosen for purposes of illustration and description and is shown in the accompanying drawings, forming a part of the specification, wherein:

Fig. 1 is a side elevational view showing the remote cap feed of the present invention connected to a sealing machine;

Fig. 1*a* is a perspective view of a package of caps for use with the remote cap feed;

Fig. 2 is an enlarged fragmentary detailed view of the cap chute;

Fig. 3 is a sectional view of the cap chute taken along line **3—3** of Fig. 2;

Fig. 4 is a front elevational view of the automatic cap feeder of the remote cap feed of Fig. 1;

Fig. 5 is a sectional view of the automatic cap feeder taken along line **5—5** of Fig. 4;

Fig. 6 is a top plan view of the automatic cap feeder illustrated in Figs. 4 and 5;

Fig. 7 is a sectional view of the automatic cap feeder taken along line **7—7** of Fig. 4;

Fig. 8 is an enlarged side elevational view of the bin portion of the automatic cap feeder of Fig. 4;

Fig. 9 is an enlarged detailed top plan view of the automatic cap feeder air control switches;

Fig. 10 is an enlarged detailed view of the contact head of the pusher rod;

Fig. 11 is a sectional view of the pusher head taken along line **11—11** of Fig. 10;

Fig. 12 is a view of the pusher head taken along line **12—12** of Fig. 10;

Fig. 13 is an enlarged front elevational view of the intake end of the cap chute;

Fig. 14 is a side elevational view of the delivery end of the cap chute;

Fig. 15 is a sectional view of the delivery end of the cap chute taken along line **15—15** of Fig. 14;

Fig. 16 is a sectional view of the delivery end of the cap chute taken along line **16—16** of Fig. 14;

Fig. 17 is a sectional view of the delivery end of the cap chute taken along line **17—17** of Fig. 16; and

Fig. 18 is a schematic diagram of the electrical control system for the remote cap feed.

GENERAL DESCRIPTION

The remote cap feed will first be described generally with particular reference to Fig. 1. The remote cap feed has an automatic cap feeder **1** which is located at a convenient closure storage point and which is connected by an elongated cap chute **2** to a sealing machine **3** located in a packing room **4**. Caps **5**, preferably packed in packages **6** by tubular wrappers **7** (Fig. 1*a*), are fed into the automatic cap feeder **1** by the operator. The automatic cap feeder **1** includes a pusher rod **8** which pushes a package **6** of the caps **5** into the intake end **9** of the chute **2** in each cycle of its operation. The chute **2** is initially filled with a continuous line of the caps **5**, and thereafter the entry of a package **6** of the caps **5** into the intake end **9** forces a corresponding number of caps **5** into the delivery end **10** of cap chute **2**. The operation of the pusher rod **8** is controlled by a sensing means at the delivery end of the chute as will be more fully described below.

As seen in Figs. 1–3, the cap chute **2** comprises parallel rods **11** attached in spaced position by connector rings **12** so that they accommodate closure caps **5**. The vertical and inclined portions of the cap chute **2** have four rods **11** which completely surround the closure caps **5**, as seen in the left-hand side of Fig. 2, to prevent spillage of the caps from these portions of the cap chute. The generally horizontal portions of the cap chute, such as portion **2***a*, preferably have an open portion provided by the elimina-

tion of one of the top enclosing rods **11**. This allows access to the cap chute **2** at this point and also provides a safety feature inasmuch as a jamming of the cap chute in advance of this open portion will merely cause the caps **5** in the chute to spill outwardly from the chute **2** in the event that the pusher rod **8** continues to operate. The cap chute **2** is conveniently formed in suitable sections which are interconnected by the fastening of the ends **13** of the rods **11** in connector rings **12** with suitable bolts **14** and by thereafter fastening the two connector rings **12** together with fasteners **15**. The cap chutes are attached to suitable supports by hangers **16**.

Automatic cap feeder

As briefly described above, the automatic cap feeder **1** automatically and periodically pushes a stack or package of caps **5** into the cap chute **2** to provide a continuous supply of caps at the sealing machine **3**. The operation of the automatic cap feed and its pusher rod **8** will now be described in detail.

As illustrated in Figs. 5 and 8, a bin **17** is provided adjacent to the pusher rod into which the operator loads the cap containing packages **6** and which itself intermittently feeds the packages **6** to a trough **18** adjacent to the pusher rod **8** through the cooperation of the inclined bottom surface **19** of the bin **5**, the cooperating star wheel **20**, and agitator means **21**. The purpose of the agitator means **21** is to insure a constant feeding of the cap packages **6** to the trough **18**. The details of the agitator are illustrated in Fig. 8. A portion **19'** of the bin bottom is hingedly connected at shaft **22** so that it may rotate about the shaft **22** between the raised and lowered positions shown in Fig. 8. An air motor **24** has its reciprocating arm **25** operatively connected to the outer end **26** of the bottom plate **19'** through the intermediation of the hinged cam member **27**. A continuous reciprocating motion of the motor arm **25** is provided by connecting the electrically operated control valve **28** of the air motor **24** to microswitches **29** and **30**. Microswitch **30** is connected through the solenoid portion **32** of the air motor control valve **28** (Fig. 18) so that microswitch **30** is closed when the bottom **19'** is in its lowermost position. The closing of the switch **30** moves the control valve **28** of the air motor **24** to its upward position so that the plunger **25** raises the bottom **19'** to its uppermost position. When its uppermost position is reached, it opens the microswitch **30** and simultaneously closes the microswitch **29**. This energizes the other half **31** of the control coil, causing the air motor armature **25** to move downwardly and thereby returning the bottom **19'** to its lowered position. The above operation continues as long as the air motor **24** and micro switches **29** and **30** are connected to their sources of air and electricity, respectively. The upper end **19''** of the bin bottom is preferably hingedly connected at **19'''** so that it may be lowered to facilitate loading and may thereafter be raised to facilitate the downward feeding of cap packages. An air motor or other hydraulic means **23** operated by controls **23'** (Fig. 8) is used to adjust the bottom portion **19''**.

The trough **18** is provided at the lower end of the bin **17** to receive a package **6** prior to the operation of the pusher rod **8**. In order to cause the entrance of the packages **6** into the trough **18** at the proper time when the pusher rod **8** has reached its withdrawn position as seen in Fig. 4, a star wheel **20** is mounted across the lower end of the bin **17** which has projecting fins **31**. The lowermost package **6** in the bin **17** is held in the pocket intermediate the fins **31** until the star wheel **20** is rotated by its control means to rotate the next pocket to the surface of the bin **17**. In order to synchronize the entry of the package **6** into the trough **18** with the motion of the pusher rod **8**, the star wheel **20** is controlled by a ratchet **33**. As illustrated in Fig. 5, the pawl **34** is pivotally connected to arm **35** of air motor **36**. The air motor **36** is connected to the air control valve **37** which alternately supplies compressed air to opposite sides of the air motor piston under the control of the contact arm **38** which is pivotally mounted on the control plate **39**. When the pusher rod **8** is being returned to its withdrawn position as seen in Fig. 4 after having delivered a group of caps from the trough **18** to the cap chute **2**, the roller **40** on the end portion **41** of the pusher arm **8** (Figs. 10 and 11) engages the contact arm **38**, thereby temporarily forcing it downwardly and operating the valve **37**. On the downward stroke of contact arm **38**, the air motor **35** is moved in one direction, permitting a partial revolution of the star wheel **20**, and as the roller **40** clears the contact arm **38**, it returns to its normal upward position, thereby causing the valve **37** to return the air motor **35** and pawl **32** to their original positions. The air motor **36** is thus caused to reciprocate in opposite directions, permitting the weight of the packages **6** in the star wheel **20** to rotate the star wheel **20** a distance corresponding to one ratchet tooth so that the next trough between the star wheel blades **31** engages the next lowermost bag in the hopper **5** and so that the bag previously held in the star wheel **20** rolls into the trough **18** preparatory to the next movement of the plunger **8**. In order to prevent movement of the star wheel **20** during inward motion of the pusher rod **8**, the roller **40** is mounted on a pivot arm **42** which swings clear of the valve contact arm on the inward stroke of pusher rod **8** but which is held downwardly on the outward stroke by pin **43**.

The operation of the pusher rod **8** will now be explained. The reciprocating pusher rod **8** is part of the air motor **45** which is mounted on a suitable support means at the right-hand end of the trough **18** and which is positioned so that the end **41** of the pusher rod **8** engages the center of a package **6** of caps **5** in the trough **18**. Air motor **45** is supplied with air at the desired pressure by an inlet **44** and has a control valve operated by suitable electric solenoids to move the pusher rod in opposite directions. The movement of the pusher rod **8** against the caps **7** and the resulting movement of the caps **7** into the intake end **9** of the cap chute **2**, as is illustrated in Fig. 13, is initiated by a pusher rod control switch **47** which is mounted at the delivery end **10** of the cap chute **2**, as is illustrated in Fig. 14. When the supply of caps in the delivery end **10** of the cap chute **2** reaches the level shown in Fig. 14, the contact arm **48** of the switch **47** springs outwardly within the cap chute, thereby closing the switch **47**. Switch **47** is connected to the control solenoid of the air motor **45**, and when it is closed, the control solenoid of the air motor **45** moves to its pushing position, causing the pusher rod **8** to move from its withdrawn position, as seen in Fig. 4, to its fully extended position adjacent to the intake end **9** of the cap chute **2** as illustrated in Fig. 13. When the pusher rod **8** reaches its fully extended position, its end **41** (Fig. 10) engages a pusher rod return microswitch **49**. Switch **49** moves the pusher arm control solenoid in the opposite direction, causing the pusher rod **8** to be withdrawn to the position illustrated in Fig. 4. The operation of the switches **47** and **49** will be described more fully below in connection with a description of the schematic diagram of the control circuit illustrated in Fig. 18.

As described above, the withdrawal of the pusher rod **8** operates the ratchet **33** to rotate the star wheel **20** so that another package **6** of closures rolls into the trough **18** as the pusher rod **8** reaches its fully withdrawn position as seen in Fig. 4. Pusher rod **8** will remain in its withdrawn position until the sealing machine lowers the stack of caps at the delivery end **10** of the cap chute **2** to the point illustrated in Fig. 14, when the switch **47** will once again operate the pusher rod air motor **45**.

Cap chute brake

In order to provide for the intermittent operation of the pusher rod control switch **47** to cause additional

packages of caps 5 to be pushed into the cap chute 2, it is necessary for the delivery end 10 of the cap chute 2 to be emptied adjacent to the pusher rod control switch 47 as the closures 5 are used by the sealing machine 3. This is accomplished by providing a brake means 50 in the cap chute 2 at a fixed distance above the pusher rod control switch 47. As the sealing machine 3 continues to operate and to withdraw closures 5 from the delivery end 10 of the chute 2, the height of the stacked closures in the cap chute 2 gradually decreases as the brake means 50 prevents passage of the closures 5 into the delivery end of the chute 10. The stack of the closures 5 in the delivery end 10 of chute 2 will eventually be lowered to the point illustrated in Fig. 14, at which time the sensing arm 48 on the pusher rod control switch 47 will swing inwardly of the cap chute closing the switch 47 and thereby initiating the operation of the pusher rod 8. The space in the cap chute 2 between the uppermost closure 5 and the brake means 50 when the switch 47 operates is made slightly greater than the length of the cap packages 6 to permit the re-entry of caps 5 into this space due to the operation of the pusher rod 8. When the pusher rod 8 operates to force another package of closures 5 into the chute 2, it is necessary for the closure caps 5 adjacent to the brake means 50 to be forced past the brake means 50. One satisfactory type of brake means which will prevent the passage of the closures 5 due to the force of gravity but which will permit the passage of the closures under the additional force of the pusher rod 8 comprises a pressure brake such as is indicated at 52 in Figs. 14 and 17. The pressure brake 52 comprises a slidably mounted stop 54 which is resiliently held in a normal projecting position within the cap chute 2 by means of the spring 55. When the caps 5 are resting against the stop 54, the stop 54 engages the lowermost cap 5 and prevents its passage downwardly of the cap chute. The additional force on the closure caps 5 as the pusher rod 8 moves additional caps into chute 2 forces the stop 54 outwardly of the cap chute, allowing the closures 5 to pass through the brake means 50. The resiliently mounted stop means 54 provides an adequate braking means in many cases; however, in the preferred embodiment illustrated herein, an additional electrically controlled locking brake 55 is provided in which a pair of gripping members 56 having closure engaging lips 57 (Fig. 16) is provided in cap chute 2 to positively engage the lower closure 5 during the braking period. As seen in Figs. 16 and 17, the gripping members 56 are pivotally mounted on shafts 58 on a support member 59 and the shafts themselves are connected to an air motor 60 through the intermediation of arms 61. At the beginning of the chute loading cycle of the pusher rod 8, the roller 67 on the pusher rod 8 closes a switch 62 energizing section 63 (Fig. 18) of the air motor 60 solenoid and lowering the air motor arm 64 and thereby swinging the gripping members 56 clear of the closure caps 5 in the cap chute 2, allowing them to pass the braking means 50. When the pusher rod 8 reaches its fully extending position adjacent to the intake end 9 of the cap chute 2, the switch 65 is closed by roller 67, causing the energizing of section 66 of the air motor 60 solenoid, raising the air motor arm 64, and thereby swinging the gripping members 56 inwardly of the cap chute 2 to prevent the further passage of caps 5 past the braking means 50. The switches 62 and 65 which open and close locking brake 55 are engaged by roller 67 on the pusher rod 8. The roller 67 only actuates the switches on the pushing or outward stroke as the roller 67 swings upwardly about its pivoted mounting 68 on the return stroke. Pin 69 holds the roller 67 in its downward position on the pushing stroke. Thus, it is seen that caps 5 are allowed to pass the brake means 50 only during the loading operation as a package of closures 5 is forced into the chute 2. Thereafter, the use of the closures 5 by the sealing machine 3 gradually creates an empty space in the cap chute 2 between the switch 47 and the brake 50. When this space reaches the predetermined length which allows the switch arm 48 of the switch 47 to swing inwardly of the cap chute, another loading cycle is started which includes the opening of the brake means 50 as described above.

Contour brake

In order to partially arrest the downward motion of the closures 5 and to provide a smooth entry of the closures 5 into the space beneath the braking means 50 during a chute loading cycle, a resiliently mounted contour brake 70 is pivotally mounted on the cap chute as seen in Figs. 14 and 15. Contour brake 70 has a pivotal mounting at 71 and it is resiliently held within the cap chute 2 by a flexible spring member 72 fastened at one end of the contour brake 70 and connected at its opposite end to a pressure regulating air motor 73 through linkage 74. When the contour brake is in its inward or braking position as seen in Fig. 14, the arm 75 of air motor 73 has been moved upwardly causing a clockwise rotation of the attached link 74 and the spring member 72, thereby causing an inward or counterclockwise rotation of the contour brake 70 into the cap chute 2. The air motor arm 75 is controlled by control solenoid 76 which has one section 77 connected to contact 78 of switch 79 and its other section 80 connected to contact 81. When the level of caps 5 in the cap chute reaches a point just above that shown in Fig. 14, arm 82 of switch 79 moves inwardly closing contact 78 and energizing solenoid section 77 raising air motor arm 75 and moving contour brake 70 to its braking position. Thus, the arm 82 of the contour brake switch 79 is positioned to operate prior to the operation of the pusher rod switch 47 to insure that the contour brake 70 is in its braking position before the pusher rod 8 is activated to move caps past the braking means 50. After the supply of caps 5 begins to build up in the cap chute adjacent the contour brake switch 79, the switch arm 82 will be forced outwardly, closing switch contacts 81 and energizing solenoid portion 80, causing the arm 75 of the contour brake air motor 73 to be lowered, thereby rotating the contour brake 70 outwardly of the cap chute to prevent its interfering with the normal passage of caps 5 downwardly to the sealing machine.

Gripping jaw and kicker

In order to insure the removal of the tubular wrapper 7 from the package 6 as the caps 5 are moved into the intake end 9 of the cap chute 2, a resilient mouth such as a rubber ring 91 having an inside diameter slightly greater than the diameter of the caps 5 is mounted on the end of the cap chute 2 as illustrated in Fig. 13. In addition to the ring 91, a gripping means 92 is provided at the right (Fig. 4) of the ring 91. The gripping means 92 is shown in detail in Fig. 7 and it comprises a movable gripping jaw 94 mounted for vertical motion on the arm 95 of an air motor 96. The air motor 96 moves the gripping jaw 94 from a position in contact with the tubular wrapper 7 of package 6 during the feeding action of the pusher rod 8 where it assists in the stripping off of the tubular wrapper 7 to a raised position clear of the tubular wrapper 7 at other times. The operation of the air motor 96 is controlled by an air control valve 97 which is mounted beneath the trough 18 in such a position that it is operated by the pusher rod 8 during its cap pushing action. The control valve 97 is engaged by a rotatably mounted contact arm 98 as seen in Figs. 4 and 9. Contact arm 98 normally is held in its upward position by the control valve. However, when the pusher rod 8 moves against a stack 6 in the trough 18, the arm 98 is moved downwardly by the roller 67 (Fig. 10) on the end of the pusher rod 8. As seen in Figs. 10 and 12, the roller 67 is pivotally mounted on a support arm 67' so that the arm 67' is held in its vertical actuating

position on the inward or pushing stroke of the pusher arm 8 by pin 69, thereby activating the control valve 97 to lower the gripping jaw 94. On the outward or return stroke of the pusher rod 8, however, the mounting arm 67' is free to rotate in a clockwise direction (Fig. 10) so that the control valve is not actuated and the gripping jaw 94 returns to its raised position.

When the tubular wrapper 7 has been removed from the closures 5 and the pusher rod 8 is returning to its withdrawn position, a kicker means 99 removes the stripped wrapper from the automatic cap feed in the following manner. The kicker 99, as illustrated in Fig. 7, comprises a kicker plate 100 which is mounted on the end of arm 101 of an air motor 102. When the air motor 102 is energized, arm 101 moves the kicker plate 100 outwardly against the removed wrapper 7, thereby thrusting it into a suitable disposal chute. The outward and inward motion of the kicker 99 are controlled by an air control valve 103 mounted beneath the pusher rod 8 and operated thereby. A pivotally mounted contact arm 104 engages the control valve 103. Contact arm 104 is engaged by the roller 40 on the end 41 of the pusher rod 8. Roller 40, as seen in Figs. 10 and 12, is mounted to engage the contact arm 104 only during the withdrawal action of the pusher rod 8. Thus, as the roller 40 is moved from left to right (Fig. 4) on the return stroke of the pusher rod 8, it depresses the control arm 104, thereby causing a temporary outward movement of the kicker air motor and its attached kicker plate for the period that the roller 40 is passing over the contact arm 104.

Safety devices

Safety means are provided on the gripping means 92 to prevent movement of the pusher rod 8 through the first portion of a cycle unless the gripping jaw 94 is in its raised position to prevent a premature gripping of the cap package 6. This safety means comprises a microswitch 105 mounted above the gripping jaw air motor 96 (Fig. 7). The switch 105 has a set of contacts 106 which are connected in series with the pusher rod control circuit, and the switch 105 is adjusted so that the contacts 106 are closed when the gripping jaws are in their raised position allowing the pusher rod 8 to initiate its normal movement as long as the gripping jaw 94 is in its raised position clear of the cap package 6. A safety means is also provided on the kicker 99 to prevent the initiation of the movement of the pusher rod 8 except when the kicker 99 is in its withdrawn position. This safety means comprises a microswitch 107 whose contacts 108 are also connected in series in the pusher rod control circuit. The switch 107 is positioned so that its contacts 108 are closed when the kicker is in its withdrawn position, allowing normal operation of the pusher rod when the kicker 99 is in this position but preventing the initiation of an inward movement of the pusher rod 8 in the event the kicker 99 is in its outward position in the path of the cap package 6.

Additional safety means are also provided to prevent the operation of the pusher rod 8 when protective covers are removed from the automatic feeder device. Thus, for example, microswitches 109 and 110 are mounted on the sides of the bin 17, and the contacts 111 and 112, respectively, on these microswitches are set to open when the cover 113 is lifted or rotated to expose the ends of the trough 18 and the input end of the cap chute 2. The contacts 111 of switch 109 are connected in series with an air valve solenoid 114 in a main air supply control valve. Open of the cover 113 closes the contacts 111 thereby energizing the solenoid 114 so that the air suuply to the cap feeder is shut off, stopping its operation. Contacts 112 (Fig. 18) of switch 110 are connected in a pusher rod reversing circuit in parallel with the regular reversing switch 49 so that the pusher rod 8 is reveresd towards its withdrawn position in the event the cover 113 is opened with whatever air remains in the system after the air valve operated by the safety switch 109 has been closed and also when the air is again turned on.

The electrical control circuit

The electrical control circuit is illustrated in Fig. 18. A switch 115 connects the circuit with a conventional voltage source 117 and a pilot light 118 is connected across the input to indicate the closing of switch 115. As described above, four of the air motors, i.e. the hopper agitator air motor 23, the cap brake motor 60, the contour brake air 73, and the pusher rod air motor 45, are all controlled by electric solenoids each having a double winding. One winding is energized to move the control valve and the air motor arm in one direction, and the other winding is energized to move the control valve and the air motor arm in the opposite direction. The control valves remain in the position to which they are moved by one solenoid until the other solenoid is energized. The solenoids are powered as seen in Fig. 18 by the secondary 120 of control transformer 119. The operation of the switches which control the air motor solenoids for the hopper agitator, the cap chute brake, and the contour brake have been described in detail above. In each case the switches which control these motors are connected between the secondary 120 of the control transformer 119 and the air motor solenoids as shown.

The air motor 45 has its control solenoid 120 similarly connected to the secondary of transformer 119; however, the section 121 which is energized to move pusher rod 8 against the package of caps and to move the caps into chute 2 is energized by a pusher rod control relay 116 which itself is controlled by a separate circuit connected across the switch 115. The circuit which operates the control relay 116 to close its contacts 123 includes a toggle switch 124 and the pusher rod switch 47 both located at the delivery end of the chute 2, the contacts 106 and 108 of the gripper jaw safety and the kicker safety, the pusher rod forward switch 125, and contacts 126 of a holding relay 127. The pusher rod forward switch 125 is mounted at the end of the air motor 45 where its contacts are closed by the pusher rod 8 when the rod 8 is in its fully withdrawn position. This circuit for control relay 116 operates in the following manner. Prior to the commencement of an operating cycle of pusher rod 8, the pusher rod 8 is in its fully withdrawn position as seen in Fig. 4 and the gripper jaw 94 and the kicker 99 are both in their withdrawn positions. The gripping jaw safety contacts 106, the kicker safety contact 108, and the pusher rod forward switch 125 will all be in their closed position and contacts 126 on the holding relay will be closed with the holding relay in its unenergized condition as seen in Fig. 18. The operator of the sealing machine will then close the toggle switch 124. If there is a gap in the supply of closure caps adjacent the pusher rod control switch 47 at the delivery end 10 of the cap chute, the switch 47 will be closed. This connects the pusher rod control relay 116 across the voltage source 117 thereby closing its contacts 123 so that the section 121 of the air motor solenoid 120 is energized causing the air motor 45 to move the pusher rod 8 outwardly against a package of caps in the trough 18. As soon as the pusher rod 8 moves outwardly, the pusher rod forward switch 125 moves to contact 128, thereby opening the pusher rod control relay. This simultaneously energizes the holding relay 127 as its contacts 129 are closed and the holding relay 127 will remain with contacts 126 open until the presence of caps in the delivery end of the cap chute 2 opens the pusher rod control switch 47. The holding relay 127 prevents continuous operation of the pusher rod 8 when no caps are being delivered to open the pusher rod control switch 47. Meanwhile, pusher rod 8 continues to move outwardly until its outer end 41 contacts the pusher rod return switch 49. When switch 49 is closed by the pusher rod 8, the other side 122 of the air motor control

solenoid 120 is energized causing the air motor 45 to return the pusher rod 8 to its withdrawn position. The pusher rod 8 will remain in this withdrawn position until sufficient caps are used by the sealing machine to form another gap in the delivery end of the cap chute 2 adjacent to the pusher rod control switch 47, at which time it will be reclosed to repeat the above cycle.

Operation

The operation of the remote cap feed which has been described in detail above will now be summarized with particular reference to the schematic diagram of the remote cap feed electrical control circuit as illustrated in Fig. 18.

In loading the bin 17 with a suitable supply of cap packages 6, the outer end of the bin including the bottom section 19'' is lowered to a suitable height by the use of hydraulic controls 23'. When the loading has been completed, the bottom section 19'' is raised to provide a sufficient incline for effective gravity feeding of the cap packages 6 toward trough 18. As long as air is supplied to the remote cap feed and the main electrical switch 115 remains closed, the automatic bin agitator 21 will operate. The air motor 24 of the agitator will move its arm 25 in the direction in which it was moving when the remote cap feed was turned off. When the section of the bin bottom 19' which is connected to the agitator 21 reaches its extreme downward or upward position, the direction of movement of the air motor arm 25 will automatically be reversed by the closing of either switch 29 or switch 30 as described more fully above. Thereafter, the agitator 21 will continue to operate, causing the cap packages 6 to move downwardly in bin 17 under the combined force of the agitator action and the pull of gravity towards the trough loading star wheel 20.

When there is a gap in the pile of caps 5 in the delivery end 10 of the cap chute 2, the pusher rod control switch 47 will be closed as will also normally be the stripping jaw safety switch contact 106, the kicker safety switch contact 108, the pusher rod forward switch 125, and hold relay 127 contacts 126. The pusher rod control relay 116 will therefore be connected across the voltage source 117 as soon as the main switch 115 and the control toggle switch 124 are closed to start the remote cap feed. The closing of the pusher rod control relay 116 connects the secondary 120 of the control transformer 119 across the loading section 121 of the pusher air motor solenoid 120. The pusher rod 8 is now moved towards the intake end 9 of the cap chute 2 by air motor 45 thereby moving a cap package 6 into the intake end of cap chute 2 from the trough 18. When the pusher rod 8 reaches its fully extended position with its end 41 adjacent to the cap chute 2, it contacts the pusher rod return switch 49. The closing of the switch 49 energizes the return section 122 of the pusher rod air motor solenoid 120 causing the air motor 45 to be reversed in direction and causing the pusher rod 8 to be returned to its withdrawn position.

Pusher rod 8 will remain stationary in its withdrawn position until the sealing machine 3 utilizes sufficient closures to close the pusher rod control switch 47 at the delivery end 10 of the cap chute. If the cap chute 2 has not been filled with closures, the pusher rod control switch 47 will remain closed with the result that the holding relay 127 remains in its open position with its contacts 126 open. Another cycle of the pusher rod 8 may be initiated when the circuit is in this position by opening and reclosing the control toggle switch 124 which causes the contacts 126 of the holding relay 127 to be reclosed. As the pusher rod 8 is moved towards the delivery end of the cap chute 2, the gripping jaw 94 is lowered against the tubular wrapper 7 on the package of caps 6 as the air control valve 97 of the gripping jaw air motor 96 is actuated by the roller 67 on the pusher rod 8. On the return stroke of the pusher rod 8, the air control valve 103 is actuated by roller 40 on the pusher rod 8, thereby actuating the kicker air motor 102 so that the kicker plate 100 ejects the removed cap wrapper 7 from the automatic cap feed. Just before the pusher rod 8 reaches its fully withdrawn position, roller 40 also contacts the operating valve 37 for the air motor 35 causing the pawl 34 to rock and allowing the star wheel 20 to rotate a distance corresponding to one ratchet tooth so that a fresh package 6 of caps is allowed to roll into the trough 18 preparatory to the next cap feeding cycle of the pusher rod 8.

During the initial cap feeding movement of the pusher rod 8, the gripping members 56 of the brake means 50 at the delivery end 10 of cap chute 2 are opened to allow the caps 5 in cap chute 2 to pass the brake means 50. The gripping members 56 of the brake means 50 are opened by the operation of their interconnected air motor 60 which is controlled by the contact of roller 67 on the pusher rod 8 against the brake opening switch 62. When the pusher rod 8 reaches its fully extended position, its roller 67 closes the switch 65, returning the brake air motor 60 to its original position with the gripping members 56 of the brake means 50 rotated back to their cap braking position. Since the brake means 50 prevents the passage of closures 5 behind it in cap chute 2 downwardly to the sealing machine 3, the gradual use of the closures 5 between the brake 50 and the sealing machine 3 will form a gap in the closure chute 2 adjacent to the pusher rod control switch 47 so that it will be closed when a gap is formed in cap chute 2 whose length corresponds generally to the length of a package of closures 6. The closing of the pusher rod control switch 47 when this occurs will automatically start the above-described loading cycle, causing a package of caps 5 to be moved into the intake end 9 of the cap chute 2 and a corresponding number of caps to be moved past the brake means 50 into the gap at the delivery end 10 of the cap chute 2.

It will be seen that the present invention provides an improved remote cap feeding device particularly adapted for use with sealing machinery so that it may supply caps thereto from a centralized and remote cap feeding position. By using the remote cap feed of this invention, the area in the immediate neighborhood of the sealing machine may be kept free of closure supplying and feeding operations and this area may therefore be made more sanitary and less cluttered. The method and device described above may be used to supply several sealing machines from a single remotely located cap feeding station and the operation of several remote cap feeding devices may be supervised by a single operator as the device disclosed is relatively simple, efficient, safe, and rugged and as the cap storing bin associated with each remote cap feeding machine is capable of storing and handling a relatively large supply of closures.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. A remote cap feed for a sealing machine comprising the combination of an elongated cap chute, means to store a plurality of stacks of caps adjacent to one end of said cap chute, means to feed a stack of caps successively from said storage means into one end of said cap chute, sensing means positioned at the opposite end of said cap chute and connected to the second said means to operate it to feed caps into said cap chute when said cap chute is partially emptied of caps adjacent said sensing means by the sealing machine, and braking means at the opposite end of said cap chute in advance of said sensing means and adapted to prevent the passage of caps thereby to the sealing machine until caps are forced past

the braking means by the operation of said means to feed a stack of caps into said one end of said cap chute.

2. The remote cap feed as claimed in claim 1 in which said brake means comprises a pressure brake having a resiliently mounted stop removably projecting into said cap chute.

3. The remote cap feed as claimed in claim 1 in which said brake means comprises a motor actuated stop means movably mounted and operatively connected to the motor for movement between a first braking position within said cap chute and a second position clear of said chute, and switch means connected to said motor and positioned to be engaged by said cap feeding means to move said stop means to its second position as caps are fed into said cap chute.

4. The remote cap feed as claimed in claim 1 which further comprises a second brake means intermediate said first named braking means and the opposite end of said chute, said second brake means comprising a resiliently mounted cap retarding means adapted to engage caps in said cap chute and to slow their movement towards said opposite end thereof.

5. The remote cap feed as claimed in claim 4 in which said second brake means further comprises a motor means operatively connected to said cap retarding means, and a switch means in said cap chute connected to said motor means whereby said motor moves said retarding means clear of said cap chute when said cap chute is filled with closures adjacent to said sensing means.

6. A remote cap feed for a sealing machine comprising the combination of an elongated cap chute, an automatic cap feeder positioned at one end of said cap chute comprising a pusher to push a plurality of caps successively into said one end of said cap chute, braking means in said cap chute spaced from its opposite end adapted to resist the passage of caps through said chute to the sealing machine, sensing means positioned on said cap chute intermediate the opposite end and said braking means and connected to the automatic cap feeder to control the operation of the pusher means whereby caps are fed into the first end of said cap chute when the sealing machine utilizes enough closure to form a gap of predetermined length in the caps adjacent said sensing means, and means to temporarily open said braking means during the feeding of caps into said chute by said pusher whereby the gap in the cap chute is refilled.

7. The remote cap feed as claimed in claim 6 in which said pusher comprises a reciprocally mounted pusher rod operatively connected to a reversible motor, said motor having its reversing control connected to said sensing means whereby said pusher rod is moved towards said chute when said gap of predtermined length is sensed thereby, and said reversing means also connected to a switch means adjacent to said one end of said cap chute and adapted to be actuated by said pusher rod when said pusher rod is moved thereagainst whereby said motor is reversed to move said pusher rod away from said cap chute.

8. The remote cap feed as claimed in claim 7 in which said reversible motor comprises an air motor, and said reversing control comprises an electrically operated air control valve.

9. A remote cap feed for an automatic sealing machine comprising the combination of an elongated cap chute having one end connected to the sealing machine cap feeding mechanism, an automatic cap feeder positioned at the other end of said cap chute comprising a pusher to push a plurality of caps successively into said other end of said cap chute, braking means in said cap chute spaced from the sealing machine end and adapted to resist the passage of caps through said chute, sensing means positioned on said cap chute intermediate the sealing machine and said braking means and connected to the automatic cap feeder to control the operation of the pusher means whereby caps are fed into the other end of said cap chute when there is a gap of predetermined length in the caps between the sealing machine and said braking means, and means to temporarily open said braking means during the feeding of caps into said chute by said pusher whereby the gap in the cap chute is refilled.

10. The remote cap feed as claimed in claim 9 which further comprises a bin adapted to contain stacks of caps arranged in discrete packages, said bin adapted to feed the packages to a trough positioned intermediate the said one end of the cap chute and the pusher, and a trough feeder means intermediate said trough and said bin adapted to feed one package to said trough for each feeding action of the pusher means.

11. The remote cap feed as claimed in claim 10 in which said bin has its bottom inclined toward said trough, and said trough feeder comprises a gravity operated star wheel having a ratchet control means operatively connected to said pusher means whereby the rotation of the star wheel is synchronized with the movement of the pusher means.

12. The remote cap feed as claimed in claim 10 which comprises a stripping means at said one end of said cap chute adapted to strip a cover from each package as said pusher means moves the caps into said chute, and a kicker means adjacent thereto and adapted to eject the stripped cover from said trough.

13. The remote cap feed as claimed in claim 10 in which said bin has a sloping bottom adapted to roll packages towards said trough, and said bottom has a movably mounted portion connected to a reciprocable drive means, means to reciprocate said drive means whereby said movably mounted portion is agitated to facilitate the motion of the packages towards the trough.

14. The remote cap feed as claimed in claim 10 which further comprises a gripping jaw movably mounted and positioned to engage the package surface adjacent to the said one end of the cap chute, a rubber-like ring member mounted on the said one end of the cap chute having an inside diameter slightly greater than the cap diameter, and said ring and said gripping jaw cooperating to strip a wrapper from the package of caps as the caps are pushed into the cap chute from said trough by said pusher means.

15. The remote cap feed as claimed in claim 14 which further comprises a safety switch positioned adjacent to said gripping jaw and having its contacts connected in the pusher means control circuit, said safety switch positioned to be closed only when said gripping jaw is out of engagement with a package whereby the pusher means is operative only at this position of the gripping jaw.

16. The remote cap feed as claimed in claim 13 in which said reciprocable drive means comprises a reversible air motor having an electrically controlled reversing valve, and said reciprocating means comprises a pair of switches connected to said valve and positioned to be alternately closed by said movably mounted portion of said bottom to reverse said valve and said air motor.

17. The remote cap feed as claimed in claim 12 and which further comprises a safety switch positioned adjacent to said kicker means and having its contacts connected in the pusher means control circuit, said safety switch position to be closed only when said kicker means is withdrawn from the stripping means whereby the pusher means is operative only at this position of the kicker means.

18. A remote cap feed comprising the combination of an elongated cap chute, an automatic cap feeder positioned at one end of said cap chute comprising a pusher to push a plurality of caps successively into said one end of said cap chute, braking means in said cap chute spaced from its opposite end adapted to resist the passage of caps through said chute, sensing means positioned on said cap chute intermediate the opposite end and said braking means and connected to the automatic cap feeder to control the operation of the pusher means whereby caps

are fed into the first end of said cap chute when there is a gap of predetermined length in the caps adjacent said sensing means, means to temporarily open said braking means during the feeding of caps into said chute by said pusher whereby the gap in the cap chute is refilled, and holding means adapted to inactivate the pusher means when the gap remains unfilled after the movement of said pusher towards said cap chute.

19. The remote cap feed as claimed in claim 18 in which said holding means comprises a holding relay.

20. A method of automatically feeding closure caps to a sealing machine from a remote position which comprises wrapping a plurality of caps in wrappers in stacked relationship to form packages of caps, thereafter removing the wrapper from a stack of caps and feeding the caps successively from the remote position to the sealing machine in a line in series relationship, blocking the passage of the caps to the sealing machine at a point adjacent

thereto, feeding the caps on the sealing machine side of the block to the sealing machine sensing the formation of a gap of a length corresponding to a package length in the stacked caps between the blocking point and the sealing machine as the caps are used by the sealing machine, and thereupon feeding another package of caps into the line of caps at the remote position while simultaneously removing its wrapping, and temporarily unblocking the caps to allow the resultant movement of the line of caps to refill the said gap.

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