Feb. 11, 1969 J. H. SHERRILL 3,426,503

CIGARETTE PACKAGING APPARATUS

Filed Aug. 23, 1965

Sheet 1 of 7

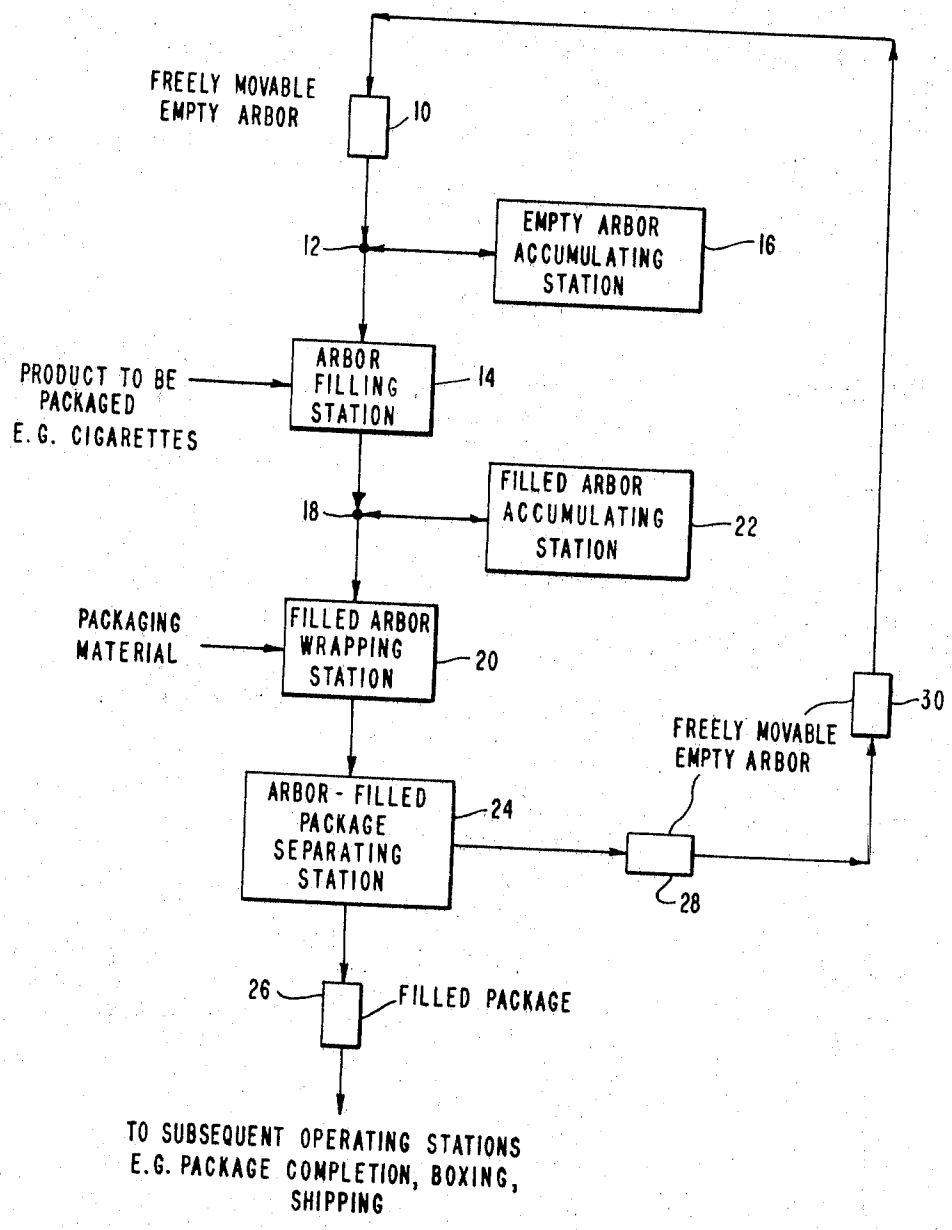

FIG. 1.

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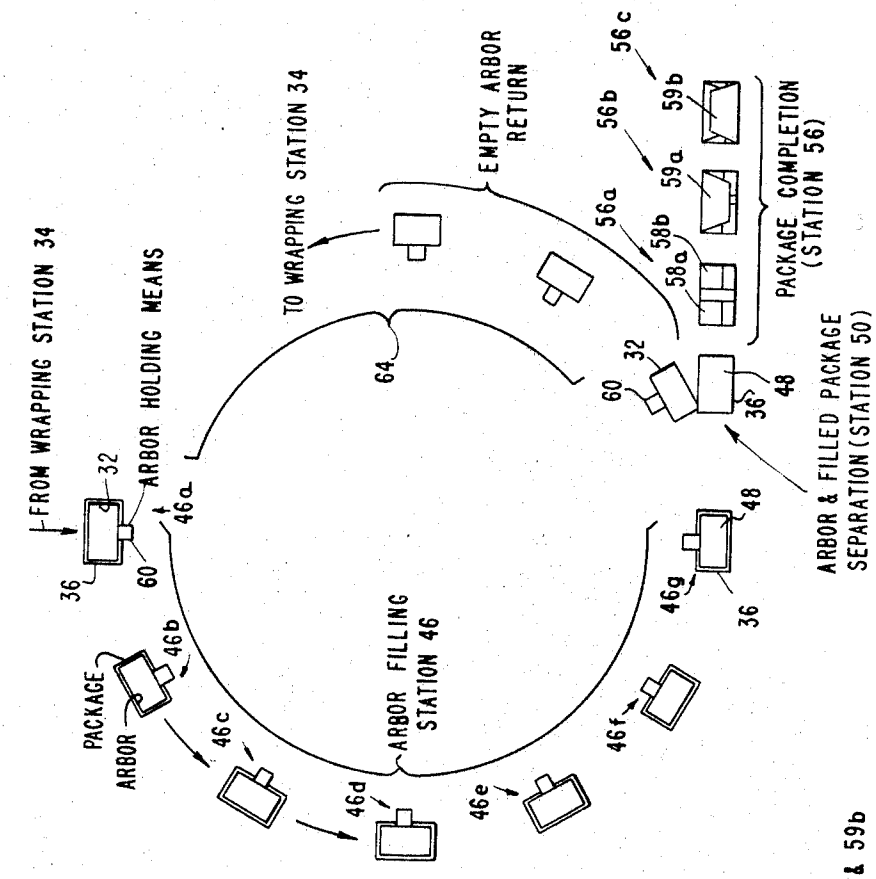


FIG. 3.

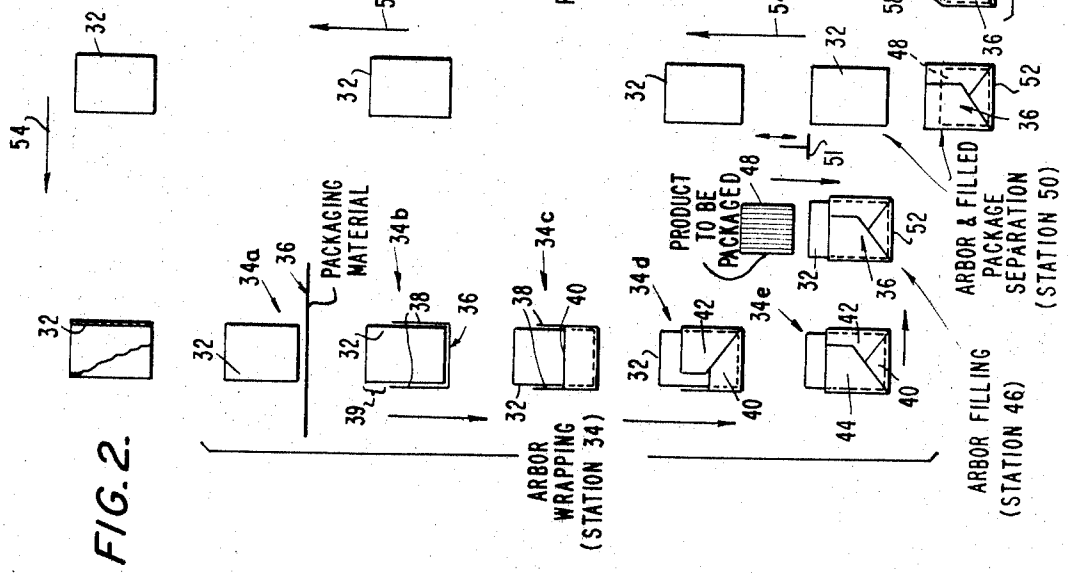


FIG. 2.

FIG. 4.

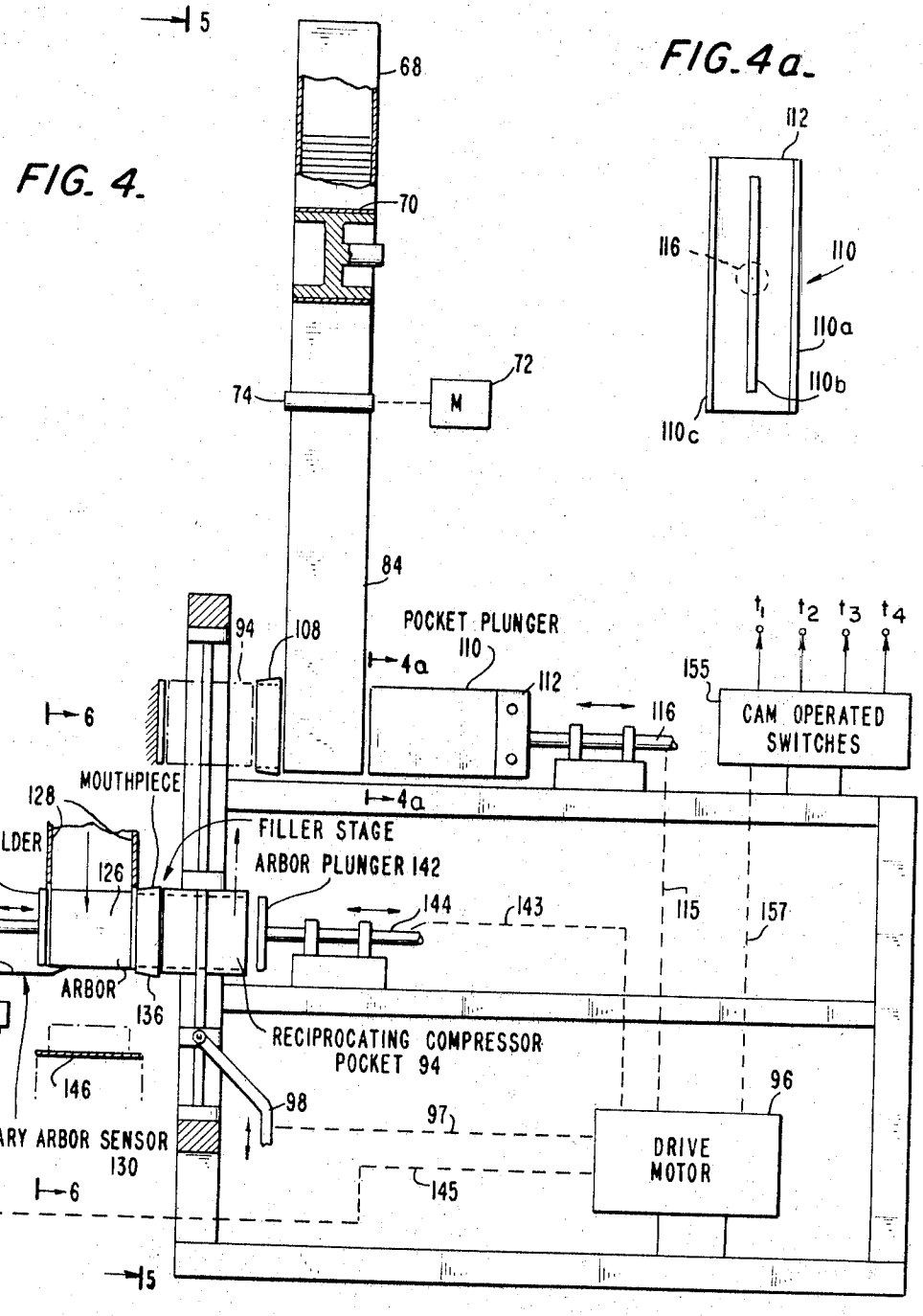
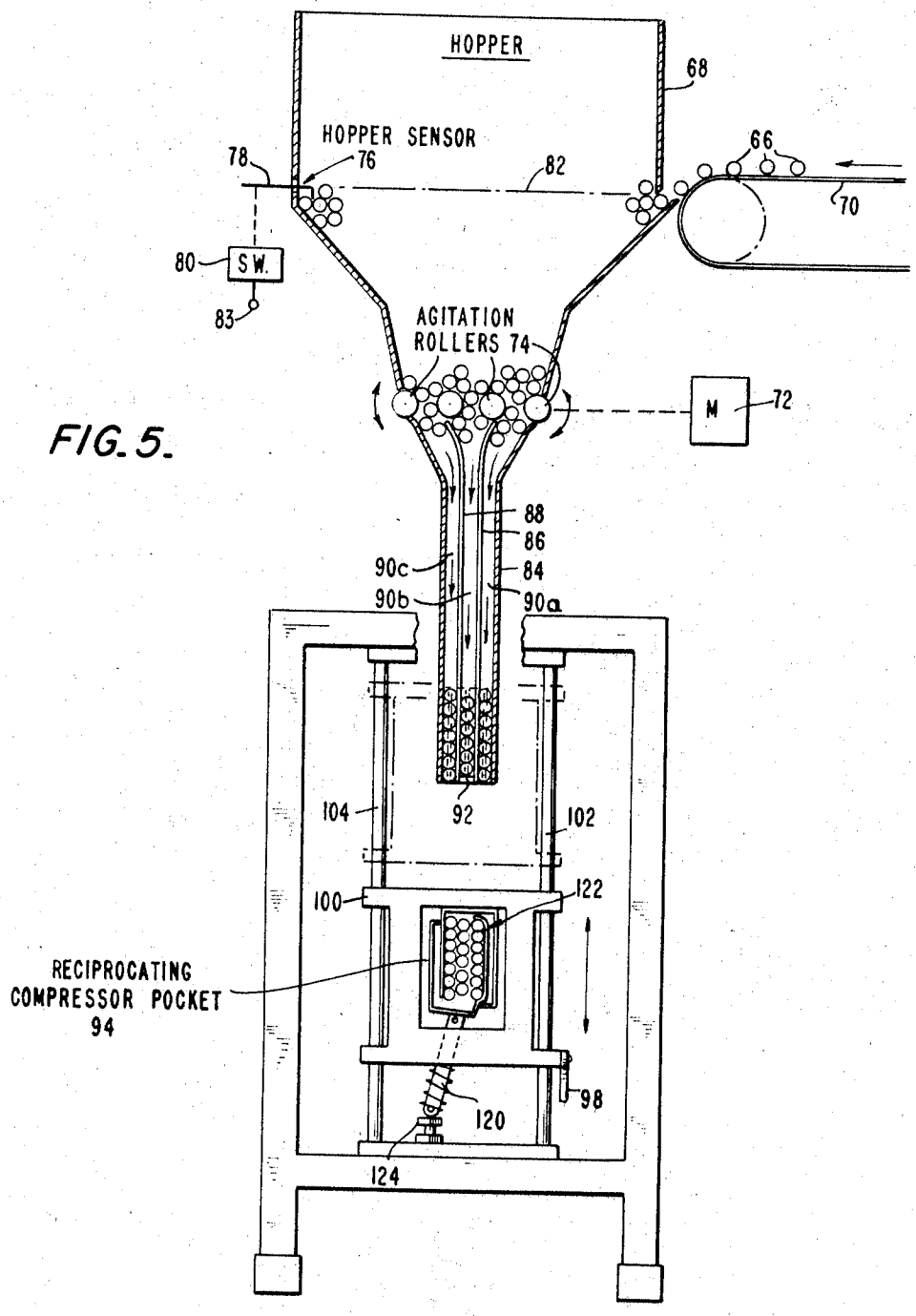

5
68
70
72
74
M
84
94
108
POCKET PLUNGER
110
4a
112
116
6
MOUTHPIECE
128
ARBOR HOLDER
138
126
FILLER STAGE
ARBOR PLUNGER 142
147
144
143
132
ARBOR
136
S
134
146
RECIPROCATING COMPRESSOR POCKET 94
98
97
PRIMARY ARBOR SENSOR 130
145
DRIVE MOTOR
96
115
157
155
CAM OPERATED SWITCHES
t1 t2 t3 t4

FIG. 4a.

112
116
110
110a
110b
110c

FIG. 5.


HOPPER
68
HOPPER SENSOR
76
78
82
66
70
80
SW.
83
AGITATION ROLLERS 74
M
72
88
86
90c
84
90b
90a
92
104
102
100
122
RECIPROCATING COMPRESSOR POCKET 94
98
120
124

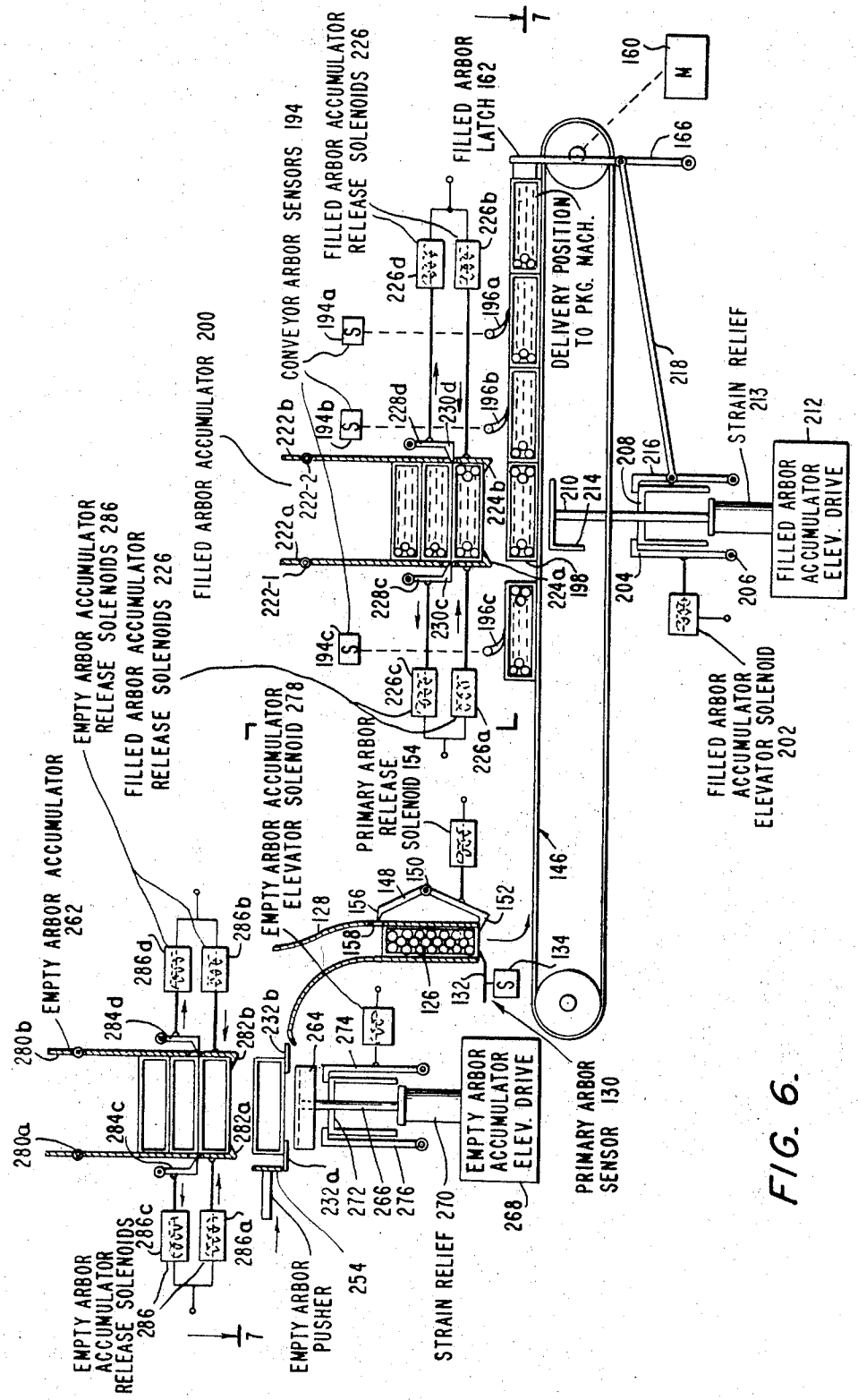

EMPTY ARBOR ACCUMULATOR 262
EMPTY ARBOR ACCUMULATOR RELEASE SOLENOIDS 286
FILLED ARBOR ACCUMULATOR RELEASE SOLENOIDS 226
FILLED ARBOR ACCUMULATOR 200
CONVEYOR ARBOR SENSORS 194
FILLED ARBOR ACCUMULATOR RELEASE SOLENOIDS 226
FILLED ARBOR LATCH 162
DELIVERY POSITION TO PKG. MACH.
STRAIN RELIEF 213
FILLED ARBOR ACCUMULATOR ELEV. DRIVE
FILLED ARBOR ACCUMULATOR ELEVATOR SOLENOID 202
EMPTY ARBOR ACCUMULATOR ELEVATOR SOLENOID 278
PRIMARY ARBOR RELEASE SOLENOID 154
EMPTY ARBOR ACCUMULATOR ELEV. DRIVE
PRIMARY ARBOR SENSOR 130
EMPTY ARBOR PUSHER
STRAIN RELIEF 270
EMPTY ARBOR ACCUMULATOR RELEASE SOLENOIDS 286

FIG. 6.

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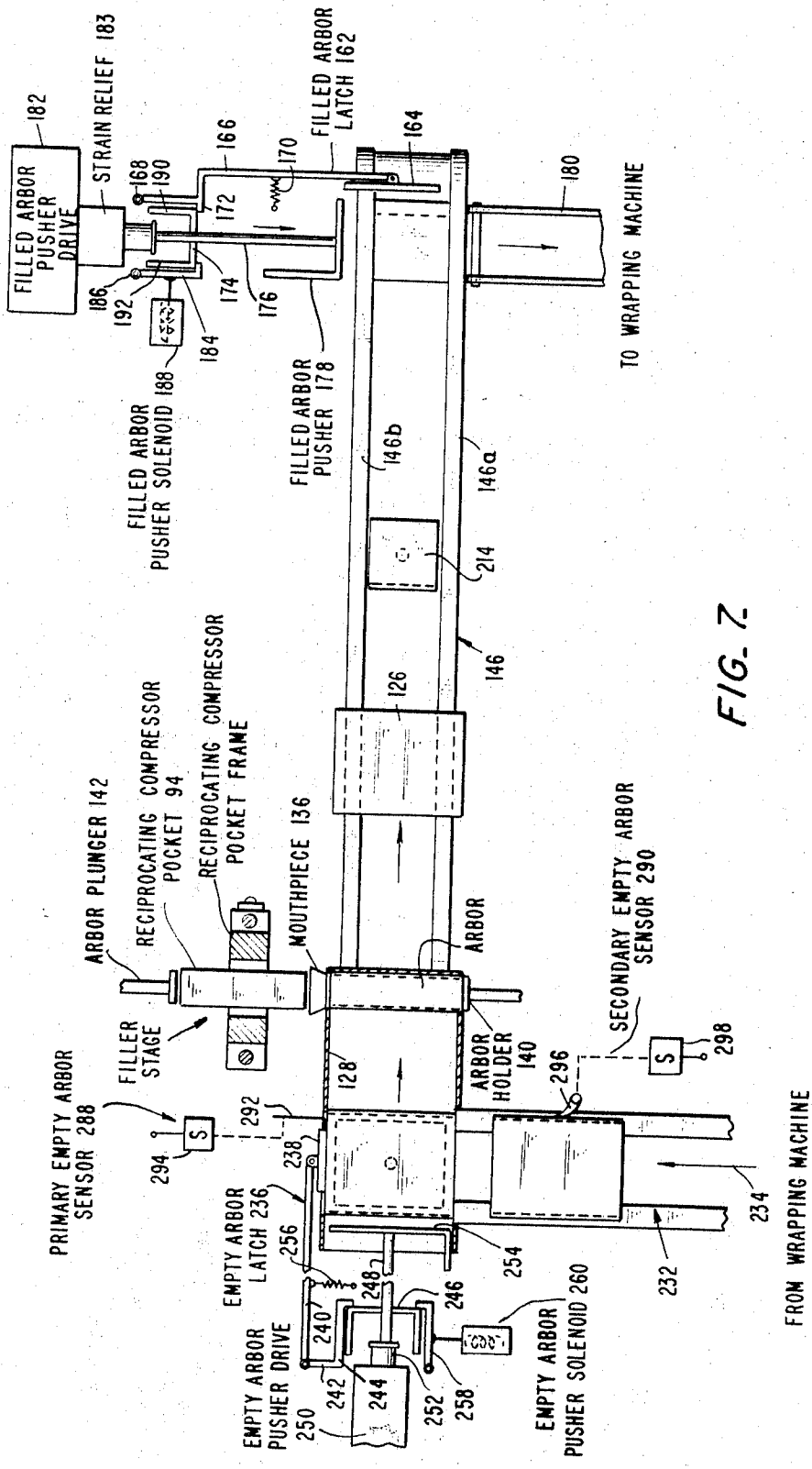

FIG. 7

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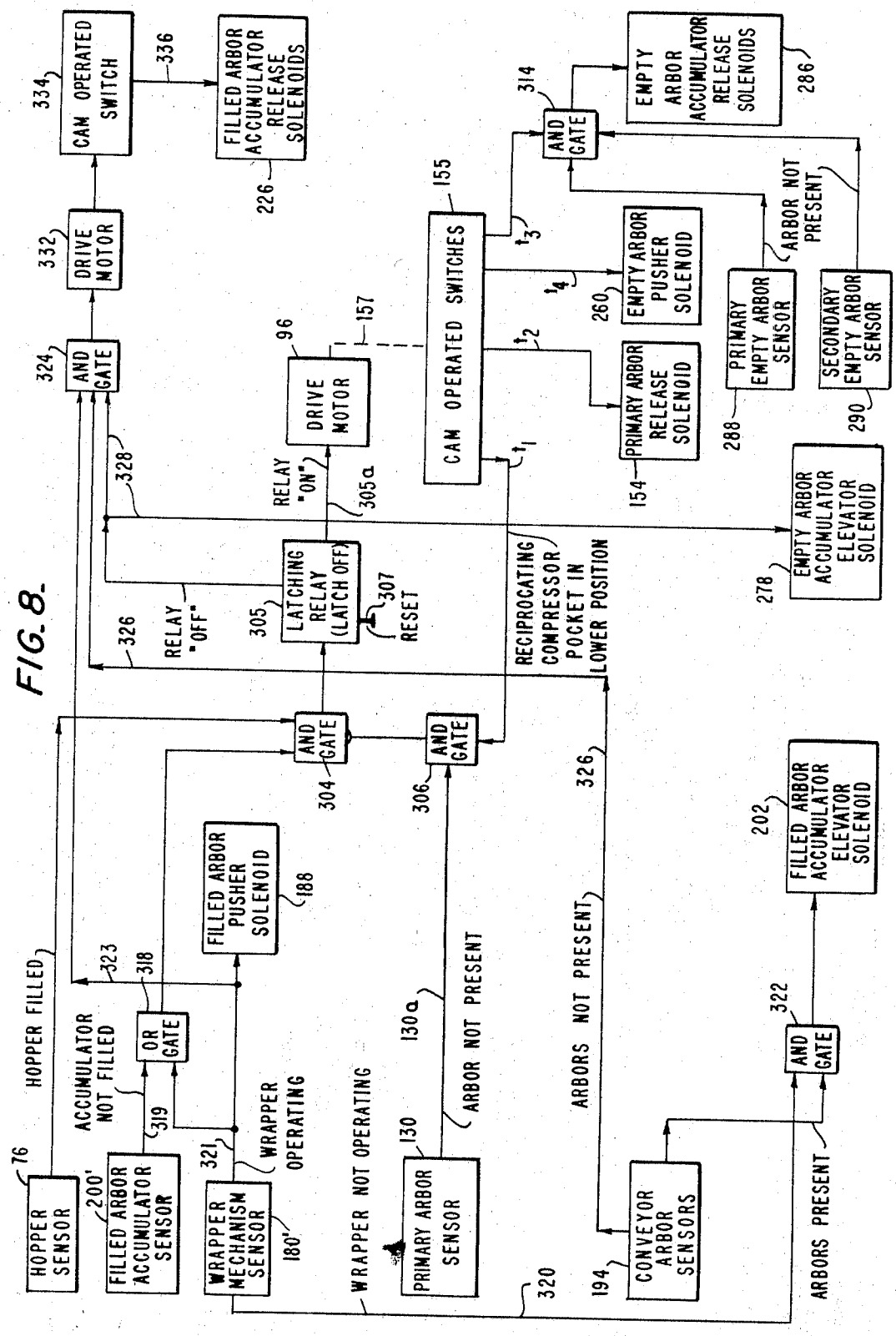

FIG. 8.

United States Patent Office 3,426,503
Patented Feb. 11, 1969

3,426,503

CIGARETTE PACKAGING APPARATUS

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Filed Aug. 23, 1965, Ser. No. 481,632
U.S. Cl. 53—124 14 Claims
Int. Cl. B65b 19/04, 19/12, 5/00

ABSTRACT OF THE DISCLOSURE

A cigarette packaging system employing freely movable arbors which may be conveyed from point to point and selectively accumulated or directed to operating stations in which different operations are performed such as filling and wrapping. The arbors are hollow, rectangular in section, and adapted to hold a number of cigarettes equal to the number in a conventional package of cigarettes. The accumulating system stores arbors when they cannot be supplied to operating stations and supplies arbors when the opertaing stations are in need of arbors.

This invention relates to the packaging of a product. It has particular application to the packaging of cigarettes.

The current conventional process for manufacturing packaged cigarettes includes a making machine which forms the individual cigarettes and delivers them on a belt commonly termed a catcher belt. From the catcher belt, the cigarettes are loaded, either by machine or by hand, into a portable receptacle, commonly called a tray, holding several thousand cigarettes. After a tray is filled at the making machine, the tray is transported, either on a conveyor or by a truck, to a packing machine. There the cigarettes are counted into groups of a predetermined number (usually twenty), and then packed.

In a typical packing machine, the cigarettes from the tray are fed into a hopper, from which groups (usually twenty to a group) are counted and arranged in the relative positions they will have in the finished package. Each counted group is then compressed laterally and forced endwise into a hollow arbor, open at both ends, and flared outwardly at the receiving end so as to guide the entering cigarettes. The arbor has internal lateral dimensions slightly smaller than those of a finished package of cigarettes, and external lateral dimensions about the same as a finished package. The arbor is, however, somewhat longer than a finished package.

After the arbor is filled, an inner wrapper is formed around the discharge end of the arbor, closing that end. A cup, or label-carrying paper wrapper, open at one end, is then wrapped over the inner wrapper. The cigarettes are then pushed out of the arbor through the closed end, carrying the inner wrapper and the cup with them. Since the cigarettes have been tightly compressed in the arbor, they expand as they leave the arbor, filling the inner wrapper. The open end of the inner wrapper is then closed. Usually, the inner wrapper is of foil laminated with paper. A sealing strip is applied transversely across the open end of the cup.

The packages from the packing machine are then transferred to a wrapping machine, where they are enclosed in an outer wrapper, usually of transparent plastic material, e.g., cellophane.

Cigarette-making machines commonly in use produce cigarettes at a rate equal to about half the rate at which a packing machine can pack them. Consequently, it is usual to employ about twice as many making machines as packing machines. The rate of output of the packing machines is limited by the slowest operation performed

in them, which is the counting and arbor filling operation.

In accordance with the present invention, that operation is removed as a limiting factor on the speed of the packing machines, so that one packing machine may take care of the output of more than two making machines.

In the past, the hollow arbors for containing the cigarettes during the packing operation have been fastened to a conveyor mechanism, such as a rotary drum. As a result, the arbors are conveyed to and from fixed locations and are not susceptible of being selectively conveyed to alternate positions. Hence if there is a failure in the packing machine, the entire packing operation, including the transfer of cigarettes to and from the machine, is brought to a halt because the conveying operations cannot be changed to compensate for the failure. In the present invention, the arbors are not fastened to a conveyor mechanism, and advantageously they do not have flared ends. Flared guides are employed at arbor-filling points only. The absence of flared ends as well as attachment to a conveyor mechanism renders the arbors suitable for being conveyor to alternate locations for accumulation in the event of machine failure, e.g., and generally facilitates a speeding of the packing operation.

Accordingly, it is an object of the present invention to provide improved packaging apparatus and methods.

Another object of the invention is to provide packaging apparatus and methods which permit the selective conveying of arbors for packaging a product to alternate locations.

Another object of the invention is to employ a freely movable arbor in the packaging of a product.

A further object of this invention is to employ a freely movable arbor whtch may be stacked with other arbors for accumulation.

These and other objects are achieved in the present invention by employing a freely movable arbor, i.e., a releasably securable arbor, for the packaging of a product. The term "freely movable arbor" as well as the term "releasably securable arbor" as used herein is intended to designate a hollow container which is not fixedly attached to any mechanism but which is freely movable in the sense that it may be transferred from one location to another and, in particular, may be transferred to any one of several alternate locations. An arbor is regarded as freely movable or releasably securable even though it is held in place on a conveyor, for example, by some form of mechanical or magnetic retainer. The term means that at one or more points the arbor is unrestrained so that it may be transferred from one conveying means to another, for example.

By providing such a freely movable arbor, a product to be packaged can be placed within the arbor, at an arbor-filling unit which may be, e.g., at a product-making machine, and then the arbor can be conveyed to a wrapper-forming machine in which a wrapper is wrapped about the arbor and the product therein. Thereafter the wrapper and the product together may be disassociated from the arbor, and the wrapper may then be completed so as to completely enclose the product. The empty arbor is then returned to the arbor-filling unit to be filled again with the product to be packaged. Such a system lends itself to the providing of alternate operating stations, such as accumulating stations wherein either empty or filled arbors are accumulated. As an example, with the freely movable arbor, if a wrapper-forming machine is operating at too slow a rate to accommodate steadily all articles to be wrapped from the product-making machine, arbors filled with the product to be packaged may be accumulated

to be supplied at a later time to the same or to another wrapper-forming machine.

In the packaging of cigarettes, a typical sequence might be first to fill empty arbors with cigarettes and then to wrap the filled arbors with an inner wrapper. The conveying system may include accumulating stations for accumulating empty arbors as well as arbors filled with cigarettes but unwrapped with the packaging material. In this fashion, shutdowns in the arbor-filling station or the wrapper-forming station can be tolerated without causing a complete cessation of the overall process.

In accordance with an alternative embodiment of the invention, empty arbors first may be wrapped with a packaging material and then filled with a product to be packaged. This sequence has particular application to the packaging of finely divided material, for example, soap flakes. Again, the system may include accumulating stations to accumulate empty arbors and arbors filled with product.

In the present invention, as directed to the packaging of cigarettes, trays of cigarettes may be carried to a packing machine as has been done in the past, and the cigarettes may then be placed in the freely movable arbors, or one or more cigarette-making machines may supply cigarettes directly from the catcher belts thereof into a hopper for conventional counting into the conventional lots of twenty cigarettes each to be then transferred to the freely movable arbors. It is particularly advantageous to transfer cigarettes directly from cigarette-making machines into the freely movable arbors since the risk of deformation and damage by handling, transportation and storage is greatly lessened because the arbors provide a holder for the cigarettes to prevent damage. The cigarette-filled arbors may be transported by conveyor belt or any other means to one or more locations where it is desirable to locate the packing and wrapping machines as well as accumulators. With this arrangement, making machines and packing and wrapping machines may be handled in a group, and the shutting down of one or more machines will not adversely affect the operation since the arbors may be shunted to and from different machines to accommodate different combinations of operative machines.

The invention will be more completely understood by reference to the following detailed description of representative embodiments thereof, which is to be read in conjunction with the appended drawings, in which:

FIG. 1 is a diagram in block form illustrating a representative packaging system incorporating freely movable arbors in accordance with the present invention;

FIG. 2 is a diagram illustrating a typical sequence of packaging operations in accordance with the present invention;

FIG. 3 is a diagram illustrating one type of arbor filling and subsequent arbor-filled package separating operations suitable for the packaging operations shown in FIG. 2;

FIG. 4 is a view of an arbor-filling station in a system for the packaging of cigarettes in accordance with the present invention;

FIG. 4*a* shows a pocket plunger forming a portion of the apparatus of FIG. 4, and is a view taken along the line **4***a*—**4***a* in FIG. 4 looking in the direction of the arrows;

FIG. 5 is a view of a portion of the arbor-filling station of FIG. 4, taken along the line **5**—**5** of FIG. 4 and looking in the direction of the arrows, showing a mechanism for transferring loose cigarettes to a reciprocating compressor pocket;

FIG. 6 is a view of the system shown in FIG. 4, taken along the line **6**—**6** of FIG. 4 and looking in the direction of the arrows, showing unfilled and filled arbor accumulating stations as well as mechanisms for conveying arbors from one operating station to another;

FIG. 7 is a view of the system shown in FIG. 6, looking downwardly from the line **7**—**7** in that figure; and

FIG. 8 is a block diagram of a representative control system for controlling the various mechanisms shown in the system of FIGS. 4–7.

FIG. 1

Referring now to FIG. 1, there is shown, in block diagram form, a system for the packing of a product and incorporating a plurality of freely movable arbors. As pointed out before, a "freely movable arbor" is an arbor unattached to its conveying means during selected portions of the travel of the arbor through the system so that it may be advantageously conveyed from station to station and, in particular, conveyed to alternate stations. The system shown in FIG. 1 is in the form of a closed loop and is particularly adapted for the packaging of cigarettes. The loop is shown to commence with a freely movable, empty arbor **10** which is conveyed by any suitable conveying means to a junction **12**. From the junction **12** the arbor is normally conveyed to an arbor-filling station **14**, to which is supplied the product to be packaged, for example, cigarettes. In the event that the arbor filling station **14** is non-operative or cannot receive an empty arbor from the junction **12** for whatever reason, the empty arbor and subsequent empty arbors are conveyed from the junction **12** to an empty arbor accumulating station **16** wherein the empty arbors are stored. The empty arbor accumulating station **16** is controlled so that, in the event that the arbor filling station **14** can receive empty arbors to be filled with the product to be packaged but no empty arbors are available at the junction **12**, then empty arbors are provided by the accumulating station **16** to the junction to be conveyed to the filling station **14**.

At the filling station **14**, each arbor is filled with the product to be packaged and then is conveyed to a junction **18** from which the filled arbors are normally conveyed to a filled arbor wrapping station **20**, to which is supplied a packaging material. In the event that the wrapping station **20** is inoperative or cannot receive product-filled arbors for whatever reason, then the arbors are conveyed from the junction **18** to a filled arbor accumulating station **22**. The station **22** is similar to the station **16** in that it accumulates arbors, in this case product-filled arbors, as long as the wrapping station **20** is unable to receive arbors to be wrapped. The accumulating station **22** is controlled so that it may selectively supply product-filled arbors to the junction **18** to be conveyed to the wrapping station **20** in the event that the wrapping station is able to receive arbors for wrapping and none are being supplied from the arbor filling station **14**.

At the filled arbor wrapping station **20**, the packaging material supplied to the station is wrapped about each arbor supplied to the station, the arbor serving as a form for the wrapping of the product. The station **20** may receive arbors for wrapping from one or more filling stations, such as the station **14**, or one or more accumulating stations, such as the station **22**. The wrapped arbors pass from the wrapping station **20** to an arbor-filled package separating station **24** in which the arbor is separated from the packaging material and the product enclosed therein. This is typically accomplished by a pusher mechanism (a representative form of which is shown in FIG. 2 and explained below) which is applied against the product inside the arbor and which passes through the arbor, in the case of a hollow arbor open at both ends, to push the product and the packaging material away from the arbor. From the separating station **24**, each product-filled package (designated as **26**) is conveyed to subsequent operating stations, for example, for package completion, boxing and shipping. The empty arbors are conveyed from the station **24**, as shown at **28** and **30**, back to the junction **12** from which they are either conveyed to the accumulating station **16** or to the filling station **14** as described above.

In the system of FIG. 1, two accumulating stations **16** and **22** have been shown, for the purpose of storing empty and product-filled arbors, respectively. It should be noted that additional accumulating stations (not shown) may be employed, for example, to store arbors from the wrapping station **20** in the event that they cannot be supplied directly to the separating station **24**. It should be further noted that the sequence of operations in the system of FIG. 1 is particularly adapted to a product such as cigarettes which will frictionally retain itself within an arbor when tightly packed therein. With such a product, the arbors may be first filled and then wrapped. In the case of a loose product which will not be retained in a hollow arbor open at both ends, then the packaging sequence would be first to wrap the empty arbors with the packaging material and then to fill the wrapped arbors with the product to be packaged. This latter packaging sequence is shown in FIG. 2.

FIGS. 2 AND 3

Referring to FIG. 2, an empty arbor **32** is shown just prior to being conveyed to arbor wrapping station **34**. The arbor **32** typically is a hollow container, rectangular in section and open at both its ends. The arbor may be of different shape, of course. The empty arbor is conveyed to the wrapping station **34**, the first substation of which is designated **34***a*. At the substation **34***a*, packaging material **36** such as paper is positioned adjacent to one end of the arbor **32**. At the next substation **34***b*, the packaging material **36** is folded as at **38** against the side faces of the arbor **32**. The arbor may be held by any convenient holding means during this and previous and subsequent operations. Typically the arbor is longer than the package to be completed, so that a space **39** is available on the arbor to which the holding means (a representative form of which is shown in FIG. 3) may be affixed without interfering with the completion of the package. The arbor is then conveyed to the next substation **34***c* wherein tucks are completed in the packaging material, as at **40** against the end faces of the arbor **32**. At the next substation **34***d*, end folds as shown at **42** are formed against the end faces of the arbor over the end tucks **40**. At the final substation **34***e*, end folds **44** are completed over the end tucks **40** and the end folds **42**.

The hollow arbor, one end of which is enclosed by the packaging material **36**, is then conveyed to arbor-filling station **46**. At this station, the product to be packaged, designated **48** and constituting a loose product such as powdered soap flakes or a compact product such as a piece of soap, is positioned within the hollow arbor **32**. From the station **46**, the arbor is conveyed to a separating station **50** wherein the arbor **32** is separated from the packaging material **36** containing the product **48** therein. Typically, the separation is completed by a pusher mechanism **51** which pushes the product **48** completely through the hollow arbor **32**. As the product **48** is pushed through the arbor **32** it bears against closed end **52** of the packaging material so that the packaging material and the contained product **48** are pushed together off the arbor. From the station **50**, the empty arbor **32** is conveyed as shown by arrows **54** back to the station **34** to be wrapped with the packaging material **36**. The package **36** containing the product **48** is conveyed from the station **50** to package completion station **56**. At the first substation **56***a*, end tucks designated **58***a* and **58***b* are taken in the packaging material, leaving flaps **59***a* and **59***b*. At the substation **56***b*, the end fold **59***a* is completed, and at the final substation **56***c*, end fold **59***b* is completed over the end tucks **58** to complete the package which is then conveyed away for further handling.

Referring to FIG. 3, there is shown in diagrammatic form one representative technique for receiving wrapped arbors as in FIG. 2 from the wrapping station **34** and filling the arbors with the product to be packaged. The arbor filling station is designated **46** as in FIG. 2 and comprises a series of seven substations **46***a*–**46***g* disposed in a semicircle. For its circular course, the arbor **32** may be held by any convenient holding means **60**. It will be noted from FIG. 2 that the packaging material **36** does not extend completely about the side and end faces of the arbor **32**, thereby leaving an accessible portion of the arbor designated **39** in FIG. 2 (see substation **34***b*). This portion of the arbor is free to have affixed thereto the arbor holding means **60** which, in the case of an arbor of steel, for example, may be a magnetic holder. Of course any form of mechanical holding means will suffice. The arbor holding means affixed to the arbor **32** then conveys the arbor through the station **46** wherein the arbor is filled. For this purpose, the arbor holding means **60** may be attached to the periphery of a continuously rotating wheel, for example, so that arbors are conveyed from the station **46** to the separating station **50**. As explained in connection with FIG. 2, the arbor **32** is separated from the wrapper **36** containing the product **48** at the station **50**. This is typically accomplished by a pusher such as that designated **51** in FIG. 2. The empty arbor **32**, still held by the arbor holding means **60**, is conveyed along a circular course to be returned to the wrapping station **34**. Following separation at the station **50**, the empty arbor may be disengaged from the arbor holding means **60** at any position along its circular path within the region designated **64**. The package **36** with the product **48** is completed at the package completion station **56**. As described above in connection with FIG. 2, at the substation **56***a*, end tucks **58***a* and **58***b* are made. At the substation **56***b*, one end fold **59***a* is made over the end tucks **58**. The final end fold **59***b* overlying the fold **59***a* and the tucks **58** is made at the substation **56***c*. From this station, the completed package is conveyed away for further handling.

In the arrangements shown in FIGS. 2 and 3, the wrapping operations and the product filling operations are all completed by conventional apparatus which has not been shown to simplify the explanation of the invention. Further, the accumulation of unfilled, filled and package-wrapped arbors as described above has not been shown in these figures.

FIGS. 4–8

The details of a system in accordance with the invention showing the filling of arbors with a product to be packaged and the accumulation both of unfilled and filled arbors are shown in FIGS. 4–8. The specific system set forth is directed to the packaging of cigarettes, but of course this is simply representative.

Arbor filling

Referring to FIGS. 4 and 5, and particularly to FIG. 5, cigarettes **66** from a cigarette-making machine (not shown) are conveyed to a hopper **68** on a catcher belt **70**. The belt **70** is driven by a motor (not shown) typically controlled by the cigarette-making machine to supply cigarettes to the hopper as they are made. Within the hopper, the cigarettes are slowly agitated by rollers **74** typically driven by motor **72**. The agitation is for the purpose of keeping the cigarettes moving downwardly and preventing "bridging." The hopper **68** includes a hopper sensor **76** which may be formed from a feeler **78** coupled to a switch **80**, for example. When cigarettes in the hopper attain the level shown by line **82**, the feeler **78** is moved to actuate the switch **80**. For example, the switch **80** may be a normally open switch which is closed upon actuation by the feeler **78** to supply potential from a voltage source (not shown) to output terminal **83**. The hopper sensor **76** is typically connected to the cigarette-making machine to cause the machine to stop making cigarettes when the hopper **68** is sufficiently filled with cigarettes to actuate the switch **80**. Thus the cigarette-making machine only makes cigarettes

whenever the cigarette level in the hopper **68** is beneath the level of line **82**.

The lower portion of the hopper **68** is formed with an extension **84** containing vanes **86** and **88** therein. These vanes divide the extension **84** into three compartments **90***a*, **90***b* and **90***c*. These three compartments provide three discrete rows of cigarettes as shown in the figure. The number of rows of cigarettes is arbitrary; the number of rows is the same as the number of rows in a completed package of cigarettes. The middle compartment **90***b* is provided with a projection **92** at the bottom thereof to displace all cigarettes in that row slightly upwardly with respect to the cigarettes in the outside compartments **90***a* and **90***c*. This displacement is for the ultimate transfer of seven cigarettes from each of the two outside compartments **90***a* and **90***c* and only six cigarettes from the middle compartment **90***b*, to provide for a transfer of twenty cigarettes altogether, the customary number in a package of cigarettes. Again, this is an arbitrary expedient.

As shown in FIGS. 4 and 5, the cigarettes in the bottom of the hopper extension **84** are adapted to be transferred to a vertically reciprocating compressor pocket **94**. This compressor pocket is reciprocated by a drive motor **96** coupled to the pocket **94** by linkage **97** and **98**. The compressor pocket **94** is typically mounted in a frame **100** which is guided vertically by guide rods **102** and **104**. When the compressor pocket **94** is in an upper position shown in dashed lines in FIG. 4, it is positioned adjacent a tapered mouthpiece **108** which guides the cigarettes from the hopper extension **84** into the pocket **94**. The cigarettes are driven into the pocket **94** by a pocket plunger **110** shown in detail in FIG. 4*a*. The pocket plunger is formed with three vanes **110***a*, **110***b* and **110***c* extending outwardly from a plate **112**. The vanes **110***a*, *b* and *c* are adapted to pass respectively through the compartments **90***a*, *b* and *c* in the hopper extension **84** so as to push the cigarettes out of the hopper extension and through the mouthpiece **108** ino the compressor pocket **94**. The vane **110***b* is shorter than the vanes **110***a* and **110***c* (by about one half the diameter of a cigarette on the top and on the bottom of the vane) so as to clear the projection **92** in the hopper extension and to engage only six cigarettes as compared with seven cigarettes as engaged by each of the vanes **110***a* and **110***c*. The pocket plunger **110** is driven by drive motor **96** coupled to the plunger plate **112** by linkage **115** and **116**.

After the cigarettes have been transferred by the pocket plunger **110** to the compressor pocket **94**, the compressor pocket is lowered by the drive motor **96** to a lower position as shown in full lines in FIG. 4. In this position, a link **120** (FIG. 5) attached to vane structure **122** which comprises the compressor pocket is actuated by striking a contact member **124**. The vane structure of the compressor pocket is actuated to compress the cigarettes within the pocket so that they may be more easily transferred from the pocket to an empty arbor **126** shown in FIG. 4.

As shown in FIG. 4, the empty arbor **126** is positioned within an arbor chute **128**. The arbor when in this position actuates a primary arbor sensor **130** formed from a feeler **132** that actuates a switch **134**. The empty arbor is retained against a mouthpiece **136** by an arbor holder **138** that is moved to bear against the arbor. Cigarettes within the compressor pocket **94** are pushed out of the pocket and through the mouthpiece **136** into the empty arbor **126** by an arbor plunger **142** that is operated by the drive motor **96** through linkage **143** and **144**. The plunger **142** is reciprocated when the reciprocating compressor pocket **94** is in its lower position shown.

After the arbor **126** has been filled with cigarettes, the arbor holder **138**, driven by drive motor **96** through linkage **145** and **147**, moves away from the cigarette-filled arbor **126** to permit the arbor to be dropped from the arbor chute **128** onto a conveyor **146**. The mechanism for dropping the arbor is shown in FIG. 6 and comprises a bell-crank lever **148** pivoted about an axis **150**. The lever **148** is normally in the position shown in FIG. 6 in which its lower end **152** extends partially across the lower opening of the arbor chute **128** to retain the arbor **126** within the chute. The lever is coupled to a primary arbor release solenoid **154** which, when energized, pivots the lever so that its lower end **152** is withdrawn permitting the cigarette-filled arbor **126** to fall onto the conveyor **146**. When the link is so pivoted, its upper end **156** passes into the chute **128** through an opening **158** so as to prevent any arbors above that just dropped from also dropping onto the conveyor **146**.

At about the same time that the cigarette-filled arbor **126** is being dropped from the chute **128** onto the conveyor **146**, the drive motor **96** causes the compressor pocket **94** to be moved to its upper position again to receive cigarettes from the hopper extension **84** and to go through another cycle of operation to transfer cigarettes from the pocket to another empty arbor supplied to the chute **128**. The movements of the compressor pocket **94**, the pocket plunger **110**, the arbor plunger **142**, and the arbor holder **138** are all timed together by conventional cam mechanisms (not shown) in the drive motor **96** so that they occur in proper sequence. The primary arbor sensor **130** controls the operation of the drive motor **96** through a control circuit shown in FIG. 8 so that the drive motor is halted, preventing the arbor plunger **142** and the arbor holder **138** from being actuated unless an empty arbor is in the bottom of the chute **128**. For the purpose of control, the drive motor **96** operates cam operated switches **155** coupled to the motor by linkage **157**, so that a series of pulse signals is generated once during each machine cycle at terminals t_1 through t_4. The pulse signals are employed in the circuit of FIG. 8. One of the pulse signals (at the terminal t_2) is employed to energize the primary arbor release solenoid **154**.

Filled arbor transfer to wrapper

The conveyor **146** is driven by a motor **160** and conveys the arbor filled with cigarettes, which is tipped over onto one of its wide sides as it strikes the moving conveyor, to the right with respect to FIGS. 6 and 7. Referring to FIG. 7, it will be noted that the conveyor **146**, advantageously formed from spaced belts **146***a* and **146***b*, conveys the arbor **126** to the right until the arbor strikes a filled arbor latch **162**. This latch is formed from a plate **164** positioned at least partially across the conveyor **146** and which is coupled to an arm **166** that pivots about an axis **168**. The arm is lightly biased by a spring **170** so that a projection **172** on the arm bears against a crosspiece **174** attached to a pusher rod **176**. The pusher rod **176** is terminated by a filled arbor pusher **178** which is an L-shaped plate that serves to push the cigarette-filled arbor **126** from the conveyor **146** onto a conveyor **180** that leads to a wrapping machine (not shown). The pusher **178** is driven by a filled arbor pusher drive **182** which may be a constantly reciprocating drive that operates against the rod **176** through a strain relief **183**. In other words, if the rod **176** is prevented from moving outwardly by the projection **172** bearing against the crosspiece **174**, movement of the reciprocating drive **182** will be taken up in the strain relief. The crosspiece **174** is also retained against outward movement by a latch **184** pivoted about an axis **186** and operated by a filled arbor pusher solenoid **188**. The solenoid **188** is adapted to be energized to pull the latch **184** away from the crosspiece **174** when the wrapping machine is in operation. Consequently, when an arbor **126** filled with cigarettes strikes the latch plate **164** at the end of the conveyor **146**, pivoting the arm **166** and swinging the projection **172** away from the crosspiece **174**, the rod **176** is free to move outwardly as driven by the pusher drive **182** to push the

cigarette-filled arbor onto the conveyor **180**. It should be noted that the crosspiece **174** is provided with extensions **190** and **192** which bear against the projection **172** and latch **184** respectively so as to retain the projection and the latch outwardly while the pusher **178** is reciprocating.

Filled arbor accumulation

Provision is made to store cigarette-filled arbors in the event that the wrapping machine is out of operation. Assume that the wrapping machine is inoperative and that the filled arbor pusher solenoid **188** is not energized so that it assumes the position shown in FIG. 7 preventing movement of the pusher **178** outwardly and preventing the transfer of cigarette-filled arbors to the conveyor **180**. As a result, cigarette-filled arbors accumulate on the conveyor **146** until they fill the conveyor to the extent shown in FIG. 6. In this condition, a plurality of conveyor arbor sensors **194**, e.g., switches **194***a*, **194***b* and **194***c* actuated by feelers **196***a*, **196***b* and **196***c* detect the accumulation of arbors on the conveyor. When all the sensors have been actuated, indicating the presence of a cigarette-filled arbor designated **198** under a filled arbor accumulator **200**, a filled arbor accumulator elevator solenoid **202** is energized. The solenoid is coupled to a latch **204** pivoted about an axis **206**. The latch in the position shown in FIG. 6 bears against a crosspiece **208** forming a portion of a rod **210** that is driven by a filled arbor accumulator elevator drive **212**. The drive **212** may be coupled to the rod **210** through a strain relief **213** so that the drive may continuously reciprocate even though the latch **204** prevents upward movement of the rod **210**. The rod **210** is terminated in an L-shaped plate **214** which is shown in FIG. 7 as being capable of passing between the conveyor belts **146***a* and **146***b*. The crosspiece **208** on the rod **210** is also retained against upward movement by a latch **216** connected by an arm **218** to the arm **166** connected to the filled arbor latch **162**. When the latch **162** is pivoted by an arbor in position to be transferred to the conveyor **180**, the arm **218** is also moved pivoting the latch **216** away from the crosspiece **208**. Hence when all the conveyor arbor sensors **194** have been actuated indicating the presence of the arbor **198** under the accumulator **200**, thereby energizing the solenoid **202** and pivoting the other latch **204**, the elevator drive **212** moves the rod **210** upwardly. Upward movement of this rod causes the plate **214** to push the cigarette-filled arbor **198** upwardly into the accumulator **200**.

In this connection it should be noted that the accumulator walls are formed with two side plates **222***a* and **222***b* respectively formed with lower projections **224***a* and **224***b*. The side plates **222** are spring biased to the positions shown in FIG. 6. When the plate **214** pushes the arbor **198** upwardly so that it bears against the projections **224**, the plates **222** pivot about ares **222–1** and **222–2**, causing the projections **24** to move outwardly and permitting the cigarette-filled arbor to enter the accumulator. Once the arbor has passed beyond the projections **224**, each of the plates **222** pivots about its axis so that the projections once again retain the arbors within the accumulator.

The elevator solenoid **202** is controlled by the circuit of FIG. 8 so that if the wrapping machine is operating, then the solenoid will not be energized, thereby preventing cigarette-filled arbors from being pushed into the accumulator **200**, even though there may be a backup of arbors along the conveyor **146** as shown in FIG. 6. This action is provided inasmuch as the wrapping machine normally is able to accommodate cigarette-filled arbors as fast as they are dropped onto the conveyor from the chute **128**.

Provision is made to drop cigarette-filled arbors stored in the accumulator **200** onto the conveyor **146** to be transferred to the conveyor **180** to the wrapping machine. Typically, three conditions should be satisfied before arbors are dispensed from the accumulator **200**, namely, the wrapping machine must be operating, the conveyor arbor sensors **194** must not be actuated, thereby indicating that the conveyor **146** is empty of arbors except for possibly an arbor in the delivery position about to be transferred to the conveyor **180**, and the mechanism of FIGS. 4 and 5 must be non-operative so that no cigarette-filled arbors are being supplied from the chute **128**. If these conditions are met, filled arbor accumulator release solenoids **226** are energized periodically to drop cigarette-filled arbors one at a time from the accumulator **200** onto the conveyor **146**. Solenoids **226***a*, **226***b* are coupled to side plates **222***a*, **222***b*, respectively, and when energized cause the projections **224***a*, **224***b* at the bottoms of the plates to move outwardly so as to permit the lowest cigarette-filled arbor in accumulator **200** to drop onto the conveyor **146**. Concurrently, solenoids **226***c*, **226***d* are energized which are coupled respectively to pivotable arms **228***c*, **228***d*. When these latter two solenoids are energized, the arms **228** are pivoted so that end projections **230***c* and **230***d* project inwardly into the accumulator **200** and hold in place the cigarette-filled arbors above the arbor that is being dropped onto the conveyor, preventing these upper arbors from passing downwardly onto the conveyor. When the solenoids **226** are de-energized, the projections **224** move inwardly and retain the arbors in the accumulator **200** while the projections **230** are moved outwardly. Thus arbors are supplied one at a time to the conveyor **146** from the accumulator **200**.

Arbor wrapping

It will be noted, then, that cigarette-filled arbors are supplied to the wrapping machine via the conveyor **180** either directly from the arbor-filling mechanism of FIGS. 4 and 5, which fills empty arbors with cigarettes, or from cigarette-filled arbors supplied from the filled arbor accumulator **200** of FIG. 6. The wrapping machine may be any of a number of well known wrapping machines to wrap the arbors and may operate in a fashion as shown diagrammatically in FIG. 2, for example.

Empty arbor return

Following the wrapping of the arbors and the separation of the arbors from the packages filled with the material to be packaged, as shown in FIG. 2, for example, empty arbors are returned to the mechanism of FIGS. 4 and 5 again to be filled with material to be packaged. The return mechanism is shown in FIG. 7 and comprises a conveyor **232** from the wrapping machine. Empty arbors are conveyed in the direction of arrow **234** and strike empty arbor latch **236** positioned at the end of the conveyor **232**. The latch **236** is formed with a strike plate **238** which is contacted by an empty arbor and which is connected by arms **240** and **242** to a latch **244**. The latch **244** bears against a crosspiece **246** mounted on rod **248** driven by empty arbor pusher drive **250**. The drive **250** is typically connected to the rod **248** through a strain relief **252** so that the drive may be constantly reciprocating even though the rod **248** is restrained from movement. The rod **248** is terminated in an L-shaped plate **254** which serves to push each empty arbor at the end of the conveyor **232** into the chute **128** to be dropped down into position to receive cigarettes from the reciprocating compressor pocket **94**. The arm **240** of the empty arbor latch mechanism **236** is lightly spring biased by a spring **256** so that, in the absence of an empty arbor at the end of the conveyor **232**, the latch **244** prevents the pusher **254** from moving outwardly. The empty arbor pusher **254** is also restrained from outward movement by another latch **258** controlled by an empty arbor pusher solenoid **260**. Typically, the solenoid **260** is energized once each machine cycle following the release of a cigarette-filled arbor from the chute **128**. Thus if the arbor filling mechanism of FIGS. 4 and 5 is operating, and following the release of a

cigarette-filled arbor from the chute **128**, solenoid **260** is energized permitting the pusher plate **254** to move outwardly in the event that an empty arbor is in position at the end of the conveyor **232**.

Empty arbor accumulation

Provision is made to store empty arbors from the conveyor **232** in an empty arbor accumulator **262** shown in FIG. 6 in the event that the arbor filling mechanism of FIGS. 4 and 5 is inoperative, so that empty arbors will not then be pushed into the chute **128**. As shown in FIG. 6, the conveyor **232** is formed from a pair of belts **232***a* and **232***b* spaced apart to permit an L-shaped elevator plate **264** to pass upwardly between them. The elevator plate **264** is attached to a rod **266** driven by an empty arbor accumulator elevator drive **268** through a strain relief **270**. Thus the drive **268** may be constantly reciprocating, even though the rod **266** is restrained from movement. The rod **266** has a crosspiece **272** thereon which bears against latches **274** and **276**. The latch **276** is coupled to the latch **244** of FIG. 7, so that when an empty arbor reaches the end of the conveyor **232** the latch **276** is released. The remaining latch **274** is controlled by an empty arbor accumulator elevator solenoid **278** which is only energized in the event that the arbor filling mechanism of FIGS. 4 and 5 is inoperative. If this is the case, then, each time an empty arbor reaches the end of the conveyor **232** the elevator plate **264** will be released so as to move upwardly, pushing the empty arbor into the accumulator **262**. The rod **266** then moves downwardly to be latched against upward movement until another arbor reaches the end of the conveyor **232**.

The accumulator **262** is formed in the same fashion as the accumulator **200** for storing filled arbors. Namely, the accumulator **262** is formed with side plates **280***a*, **280***b* which include lower projections **282***a*, **282***b* that project toward each other. A pair of latches **284***c*, **284***d* are also included which may project through the side pieces **280** of the accumulator but which are normally biased outwardly as shown in FIG. 6. When an empty arbor is pushed upwardly by the elevator plate **264**, it bears against the projections **282***a*, **282***b* so that the plates **280** pivot outwardly against a biasing spring (not shown) which normally retains them inwardly. As soon as the empty arbor is pushed above the projections, the projections move inwardly by the pivoting of the plates **280** to retain the arbor and all those arbors thereabove within the accumulator.

The system is arranged to provide for the selective releasing of empty arbors from the empty arbor accumulator **262** in the event that the arbor filling mechanism of FIGS. 4 and 5 is operative, but no empty arbors are being received via the conveyor **232**. To this end, the side pieces **280** and the latches **284** are controlled by empty arbor accumulator release solenoids **286**. Specifically, solenoids **286***a*, **286***b* control the plates **280***a*, **280***b* and, when energized, pivot the plates to move the projections **282***a*, **282***b* outwardly to release an empty arbor from the accumulator **262** onto the conveyor **232**. At the same time, solenoids **286***c*, **286***d* which control the latches **284***c*, **284***d* are energized to pivot the latches inwardly so as to prevent further empty arbors from dropping down onto the conveyor. Thereafter the solenoids are deenergized, and the projections **282** and latches **284** return to the positions shown in FIG. 6 ready for the release of another empty arbor onto the conveyor.

As shown in FIG. 7, there are included a primary empty arbor sensor **288** and a secondary empty arbor sensor **290**. The sensor **288** is formed from a feeler **292** positioned at the end of the conveyor **232** and which is actuated by an empty arbor in position at the end of the conveyor. This feeler is connected to a switch **294**. The secondary empty arbor sensor **290** includes a feeler **296** which actuates a switch **298**. The primary and secondary empty arbor sensors **288** and **290** are employed to control the empty arbor accumulator release solenoids **286**. In particular, the solenoids will not be energized to release an empty arbor from the accumulator **262** as long as either one of the sensors **288** and **290** detects an empty arbor on the conveyor.

Control system

FIG. 8 is a block diagram of a control system for regulating the sequence of operation of the various mechanisms shown in FIGS. 4–7. Referring to FIG. 8, the cam operated switches **155** of FIG. 4 are actuated by the drive motor **96** that moves the reciprocating compressor pocket **94**, the pocket plunger **110**, the arbor plunger **142** and the arbor holder **138**. The drive motor **96** is controlled by an AND gate **304** through a latching relay **305**. The switches **155** include four output conductors designated t_1–t_4 to which are supplied periodic signals. Each conductor receives a signal once during a machine cycle, and the subscripts designate the time in a cycle during which the signal is received. In other words, the signals in a cycle occur in the order t_1, t_2, t_3 and t_4.

The conductor t_1 is connected to an AND gate **306** and is energized when the reciprocating pocket **94** (FIG. 4) is in its lower position, ready to transfer cigarettes to an arbor adjacent to the mouthpiece **136**. The other input to the gate is received from the primary arbor sensor **130**. If no arbor is present in the chute **128** (FIG. 4) in position to receive cigarettes from the reciprocating pocket **94**, output conductor **130***a* is energized, enabling the gate **306** and applying a signal to an inhibit input of AND gate **304**, removing the output signal from that gate. This shuts off the latching relay **305**, de-energizing output conductor **305***a* to stop the drive motor **96**. The latching relay will remain in the off position until reset by actuation of a reset lever **307**. In the off state of the latching relay **305** when the drive motor **96** is de-energized, further operation of the mechanisms controlled by the motor are prevented.

If an arbor is present in the chute **128** in position to receive cigarettes from the pocket **94**, no signal is present on the conductor **130***a* from the sensor **130**, the AND gate **306** remains disabled, and the gate **304** is not inhibited, thereby leaving the latching relay **305** energized in turn to energize the drive motor **96**. Following the transfer of cigarettes by the arbor plunger **142** to the empty arbor, a signal is generated on conductor t_2 which is connected to the primary arbor release solenoid **154** (FIG. 6) which releases the cigarette-filled arbor onto the conveyor **146**.

A signal is next generated on the conductor t_3 which is connected to AND gate **314**. This gate also has applied thereto signals from the primary and secondary empty arbor sensors **288** and **290** (FIG. 7). These sensors generate signals which are applied to the gate **314** in the event that no empty arbors are sensed by the sensors. If this is the case, the AND gate **314** will be energized applying a signal to the empty arbor accumulator release solenoids **286** (FIG. 6) to release an empty arbor from the accumulator **262** onto the conveyor **232** in position to be pushed into the chute **128**. If, however, either of the arbor sensors **288** and **290** senses an arbor already in position on the conveyor, the AND gate **314** will not be energized and no empty arbor will be released from the empty arbor accumulator **262**.

Next, conductor t_4 is energized to actuate the empty arbor pusher solenoid **260** (FIG. 7). This action releases the empty arbor pusher rod **248** if an empty arbor is in position at the end of conveyor **232** (releasing latch **244**), so that an empty arbor is pushed into position in the chute **128** to receive cigarettes from the compressor pocket **94**.

It should be noted that the AND gate **304** which energizes the drive motor **96** through the latching relay **305** requires enabling signals from the hopper sensor **76** (FIG. 5) and an OR gate **318**. This OR gate receives

signals from filled arbor accumulator sensor **200'** which may include a switch (not shown) associated with the accumulator **200** of FIG. 6 and actuated when the accumulator is not completely filled with arbors to provide a signal on conductor **319**. The OR gate **318** is also connected to wrapper mechanism sensor **180'** which may include a switch (not shown) associated with the conveyor **180** of FIG. 7, for example, and which generates a signal on conductor **321** only when the wrapper mechanism or conveyor is operative. Hence the AND gate **304** is energized to cause the drive motor **96** to be energized only if the hopper sensor **76** senses a predetermined minimum level of cigarettes in the hopper **68** and either the filled arbor accumulator **200** is not completely filled with cigarette-filled arbors or the wrapper mechanism is operating. If these conditions are not fulfilled, the AND gate **304** will be de-energized, and the latching relay **305** will be in its off condition.

The wrapper mechanism sensor **180'** is also connected by a conductor **320** to an AND gate **322**. This conductor is energized if the wrapper mechanism is not operating. Also connected to the AND gate **322** are the conveyor arbor sensors **194** which sense an accumulation of arbors on the conveyor **146** as described above in connection with FIG. 6 When the wrapper is inoperative and an accumulation of arbors on the conveyor **146** is sensed, the AND gate **322** is energized, energizing the elevator solenoid **202** (FIG. 6) to transfer cigarette-filled arbors from the conveyor **146** into the accumulator **200**.

When the wrapper mechanism is operating, a signal is generated by the sensor **180'** which energizes via the conductor **321** the filled arbor pusher solenoid **188** (FIG. 7). The energized solenoid permits the arbor pusher **178** to operate whenever the latch **162** is actuated by an arbor in position to be pushed onto the conveyor **180**. The signal from the sensor **180'** is also applied by conductor **323** to AND gate **324**. This gate also receives a signal via conductor **326** from conveyor arbor sensors **194**. The conductor **326** is energized if none of the sensors is actuated by an arbor on the conveyor **146**. A third input to the AND gate **324** is derived from conductor **328** which is energized when latching relay **305** is in its off state. Hence if the wrapper mechanism is operating, there are not arbors on the conveyor **146**, and the arbor filling mechanism of FIGS. 4 and 5 is not operating to supply cigarette-filled arbors to the conveyor **146**, the AND gate **324** is energized to energize a drive motor **332** which continuously drives a cam operated switch **334**. This switch generates a timed signal periodically on an output conductor **336**. The timed signal energizes the filled arbor accumulator release solenoids **226** as described above in connection with FIG. 6 to release cigarette-filled arbors from accumulator **200** onto the conveyor **146** for delivery to the wrapping machine. At this same time, namely, while the arbor filling mechanism of FIGS. 4 and 5 is non-operative, the signal on the conductor **328** energizes the empty arbor accumulator elevator solenoid **278** (FIG. 6) to cause empty arbors received from the conveyor **232** to be stored in the empty arbor accumulator **262**. This action continues until the latching relay is reset by actuation of the reset lever **307**.

SUMMARY

There has been described an invention for the packaging of a product incorporating freely movable arbors. Such arbors, filled or unfilled with product and partially wrapped or unwrapped, may be selectively conveyed to alternate locations to provide for storage to aid in the packaging process. The invention has been disclosed in connection with representative embodiments which should not be taken to limit the invention. The invention is defined by the following claims.

What is claimed is:

1. In apparatus for packaging a product, the combination of a plurality of releasably securable hollow arbors comprising tubes of rectangular section and each comprising four connected walls to hold a product without danger of damage to the product and to permit storage of the arbors one against another, a plurality of operating stations, one of said operating stations comprising means for filling the arbors with a product to be packaged, another of said stations comprising means for wrapping a packaging wrapper about each of said arbors, yet another of said stations including means for disassociating said packaging wrapper containing said product from each of said arbors, conveyor means for conveying said arbors sequentially through said stations, and accumulating means selectively operable to divert filled and unfilled arbors from their normal sequential movement through said operating stations to be stored one against another in said accumulating means.

2. In apparatus for packaging a product, the combination of a plurality of releasably securable hollow arbors comprising tubes of rectangular section and each comprising four connected walls to hold a product without danger of damage to the product and to permit storage of the arbors one against another, a plurality of operating stations, one of said operating stations comprising means for filling the arbors with a product to be packaged, another of said stations comprising means for wrapping a packaging wrapper about each of said arbors, yet another of said stations including means for disassociating said packaging wrapper containing said product from each of said arbors, still another of said stations including means for completing the wrapping of the packaging wrapper about the product for each of the wrappers disassociated from the arbors so as to completely enclose said product, conveyor means for conveying said arbors sequentially through said stations, and accumulating means selectively operable to divert filled and unfilled arbors from their normal sequential movement through said operating stations to be stored one against another in said accumulating means.

3. In apparatus for packaging a product, the combination of a plurality of releasably securable hollow unfilled arbors comprising tubes of rectangular section and each comprising four connected walls to hold a product without danger of damage to the product and to permit storage of the arbors one against another, a first operating station including means for filling the unfilled arbors with the product to be packaged, a first accumulator for accumulating unfilled arbors one against another, first conveyor means for selectively conveying unfilled arbors to one of said first operating station and said first accumulator, a second operating station including means for wrapping a packaging wrapper about each of said arbors filled with said product, a second accumulator for accumulating arbors filled with said product and one against another, and second conveyor means for selectively conveying arbors filled with said product from said first operating station to one of said second operating station and said second accumulator.

4. In apparatus for packaging a product, the combination of a plurality of freely movable unfilled arbors, a first operating station including means for filling the unfilled arbors with the product to be packaged, a first accumulator for accumulating unfilled arbors, first conveyor means for selectively conveying unfilled arbors to one of said first operating station and said first accumulator, a second operating station including means for wrapping a packaging wrapper about each of said arbors filled with said product, a second accumulator for accumulating arbors filled with said product, and second conveyor means for selectively conveying arbors filled with said product from said first operating station to one of said second operating station and said second accumulator, including first control means controlling said first conveyor means so that said first conveyor means conveys unfilled arbors to said first operating station when

said first operating station is operative and at least one of the following two conditions is met:

(a) said second accumulator is not completely filled with arbors;

(b) said second operating station is operative to wrap packaging wrappers about said arbors;

said first conveyor means otherwise conveying unfilled arbors to said first accumulator.

5. In apparatus for packaging a product, the combination of a plurality of freely movable unfilled arbors; a first operating station including means for filling the unfilled arbors with the product to be packaged; a first accumulator for accumulating unfilled arbors; a second operating station including means for wrapping a packaging wrapper about each of said arbors filled with said product; a second accumulator for accumulating arbors filled with said product; first conveyor means for conveying unfilled arbors to said first operating station when said first operating station is operative and at least one of the following two conditions is met:

(a) said second accumulator is not completely filled with arbors,

(b) said second operating station is operative to wrap packaging wrappers about said arbors;

said first conveyor means otherwise conveying unfilled arbors to said first accumulator; said first conveyor means including means responsive to an absence of unfilled arbors being conveyed to said first operating station to selectively release unfilled arbors from said first accumulator to be conveyed to said first operating station when said first operating station is operative, second conveyor means for conveying arbors filled with said product from said first operating station to said second operating station when said second operating station is operative and to said second accumulator when said second operating station is inoperative; said second conveyor means including means for releasing arbors accumulated in said second accumulator to be supplied to said second operating station when product-filled arbors are not supplied from said first operating station and said second operating station is operative.

6. In apparatus for packaging a product, the combination of a plurality of freely movable unfilled arbors; a first operating station including means for filling the unfilled arbors with the product to be packaged; a first accumulator for accumulating unfilled arbors; a second operating station including means for wrapping a packaging wrapper about each of said arbors filled with said product; a second accumulator for accumulating arbors filled with said product; first conveyor means for conveying unfilled arbors to said first operating station when said first operating station is operative and at least one of the following two conditions is met:

(a) said second accumulator is not completely filled with arbors;

(b) said second operating station is operative to wrap packaging wrappers about said arbors;

said first conveyor means otherwise conveying unfilled arbors to said first accumulator; said first conveyor means including means responsive to an absence of unfilled arbors being conveyed to said first operating station to selectively release unfilled arbors from said first accumulator to be conveyed to said first operating station when said first operating station is operative; second conveyor means for conveying arbors filled with said product from said first operating station to said second operating station when said second operating station is operative and to said second accumulator when said second operating station is inoperative; said second conveyor means including means for releasing arbors accumulated in said second accumulator to be supplied to said second operating station when product-filled arbors are not supplied from said first operating station and said second operating station is operative; a third operating station for disassociating packaging wrappers containing said product from the corresponding arbors, said third operating station including means for applying the arbors disassociated from the packaging wrappers to said first conveyor means; third conveyor means for conveying wrapped and product-filled arbors from said second operating station to said third operating station, a fourth operating station for completing the wrapping of the packaging wrapper about the product for each of the product-filled wrappers from the third operating station so as to completely enclose said product, and fourth conveyor means for conveying product-filled wrappers from said third operating station to said fourth operating station for package completion.

7. In apparatus for packaging cigarettes, the combination of a plurality of releasably securable, hollow arbors each comprising a tube formed of connected walls and each open at both ends thereof to hold a group of cigarettes therein equal in number to those in a package to be formed and held in place by friction between cigarettes and between cigarettes and arbor walls without danger of damage to the cigarettes, an operating station including means for repeatedly compressing laterally groups of cigarettes each equal in number to those in a package to be formed and filling each of the arbors with a group of cigarettes so compressed by moving them longitudinally through one of said open arbor ends, following which operation the cigarettes in said group expand to engage the arbor walls, and conveyor means for conveying said arbors to and from said operating station.

8. In apparatus for packaging cigarettes, the combination of a plurality of releasably securable, hollow arbors each comprising a tube formed of connected walls and each of which is open at an end thereof to hold a group of cigarettes therein equal in number to those in a package to be formed and held in place by friction between cigarettes and between cigarettes and arbor walls without danger of damage to the cigarettes, a plurality of operating stations, one of said operating stations including means for repeatedly compressing laterally groups of cigarettes each equal in number to those in a package to be formed and filling each of the arbors with a group of cigarettes so compressed by moving them longitudinally through said open arbor end, following which operation the cigarettes in said group expand to engage the arbor walls, another of said stations including means for wrapping a packaging wrapper about each of the arbors, and conveyor means for conveying said arbors to and from said operating stations.

9. In apparatus for packaging cigarettes, the combination of a plurality of releasably securable, hollow arbors each comprising a tube formed of four connected walls and each of which is open at an end thereof and rectangular in section to hold cigarettes therein in place by friction between cigarettes and between cigarettes and arbor walls without danger of damage to the cigarettes and to permit storage of the arbors one against another, a plurality of operating stations, one of said operating stations comprising an arbor filling station for filling each of the arbors with cigarettes to be packaged through said open arbor end, another of said stations comprising an arbor wrapping station for wrapping a packaging wrapper about each of said arbors, conveying means for conveying said arbors to and from said operating stations, and accumulating means selectively operable to divert arbors from their normal movement through said operating stations to be stored one against another in said accumulating means.

10. Apparatus as recited in claim 9, wherein said conveyor means first conveys unfilled arbors to said arbor filling station and thereafter conveys cigarette-filled arbors to said arbor wrapping station.

11. Apparatus as recited in claim 10, wherein said accumulating means comprises first and second accumulating stations, said first accumulating station serving to selectively receive unfilled arbors normally conveyed by said conveyor means to said arbor filling station, said second accumulating station serving to selectively receive

cigarette-filled arbors normally conveyed by said conconveyor means to said arbor wrapping means.

12. Apparatus as recited in claim **11**, wherein said first accumulating station includes means responsive to an absence of unfilled arbors being supplied to said arbor filling station for supplying unfilled arbors to said conveyor means to be conveyed to said arbor filling station.

13. Apparatus as recited in claim **11**, wherein said second accumulating station includes means responsive to an absence of cigarette-filled arbors being conveyed to said arbor wrapping station for supplying cigarette-filled arbors to said conveyor means to be conveyed to said arbor wrapping station.

14. In cigarette-making and packaging apparatus, the combination of a cigarette-making machine including catcher belt means for discharging cigarettes, a plurality of releasably securable arbors each comprising a tube formed of connected walls and each for containing a plurality of cigarettes equal in number to those in a package to be formed, the cigarettes being held in place in an arbor by friction between cigarettes and between

cigarettes and arbor walls, and arbor filling means located adjacent to said catcher belt means for taking cigarettes directly from said catcher belt means and placing them in said releasably securable arbors.

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