Sept. 9, 1958 J. H. SHERRILL 2,851,146

APPARATUS FOR DISTRIBUTING CARTONS OR THE LIKE

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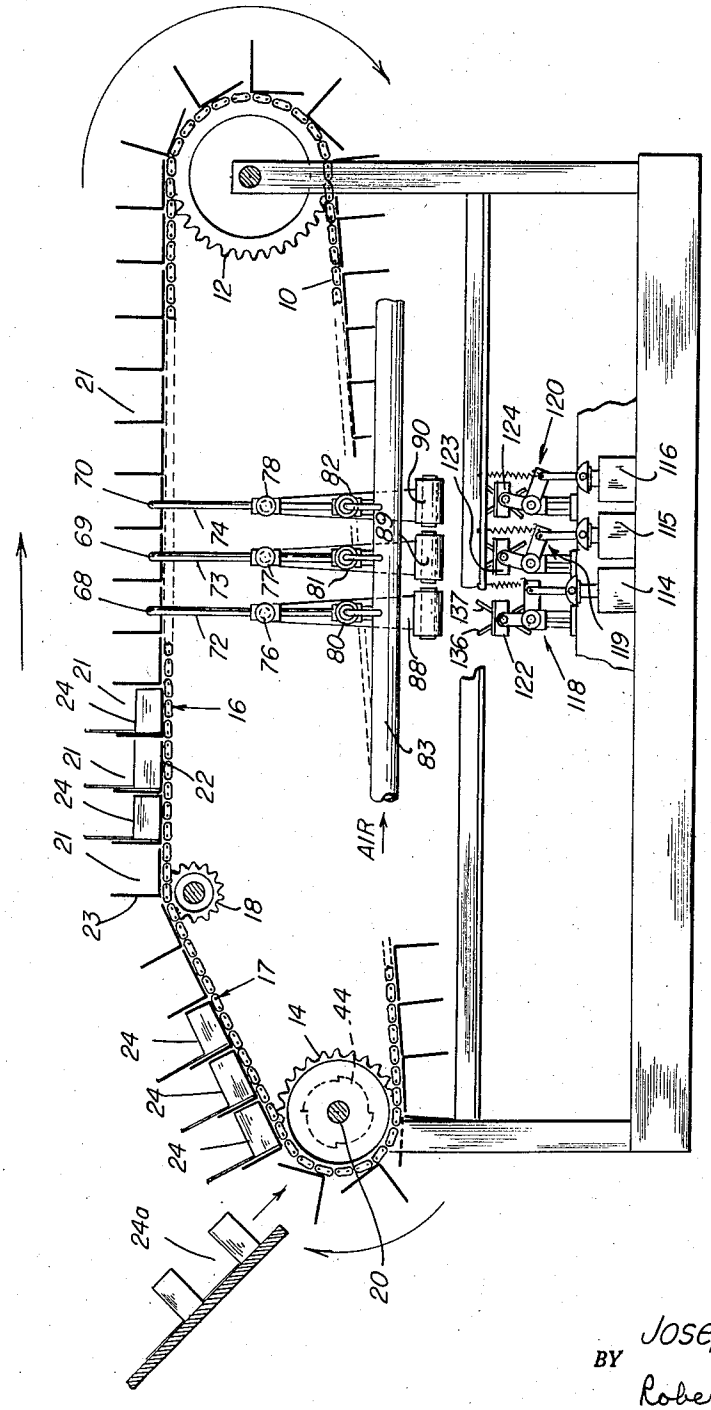


FIG. 1

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APPARATUS FOR DISTRIBUTING CARTONS OR THE LIKE

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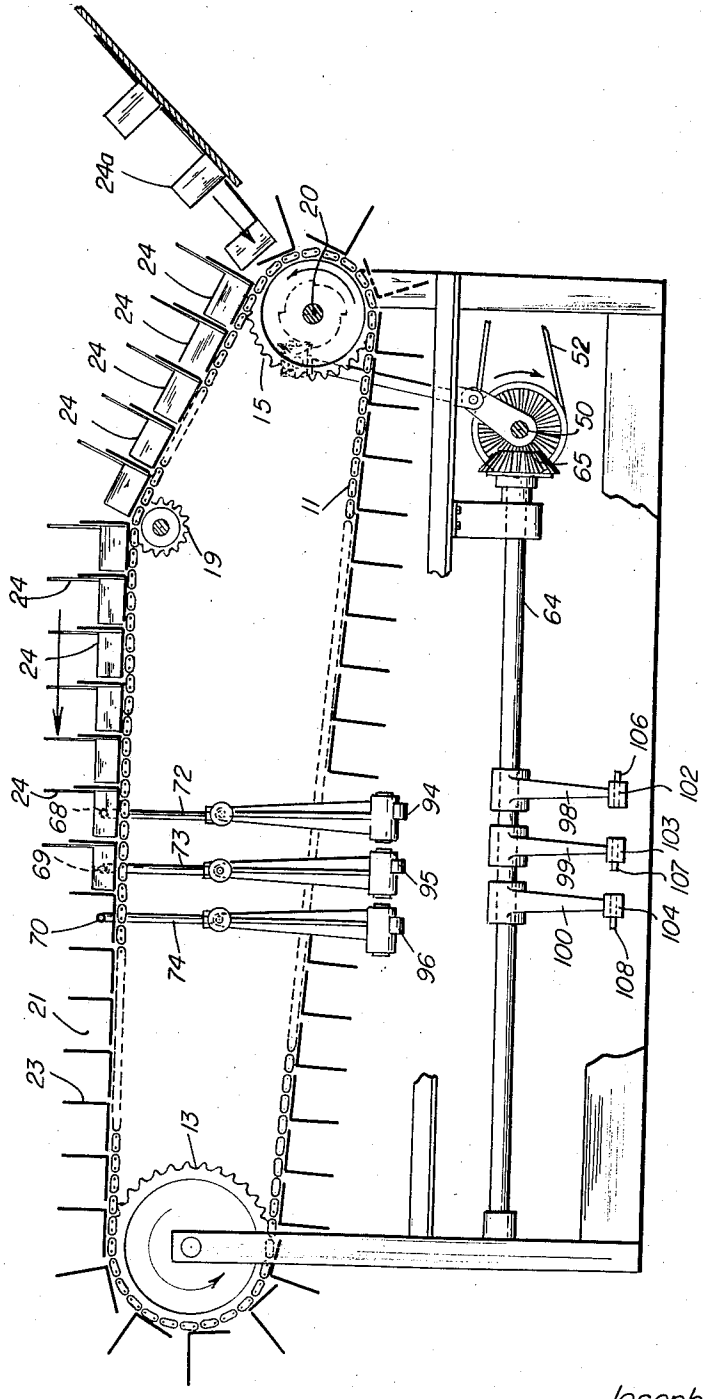


FIG. 2

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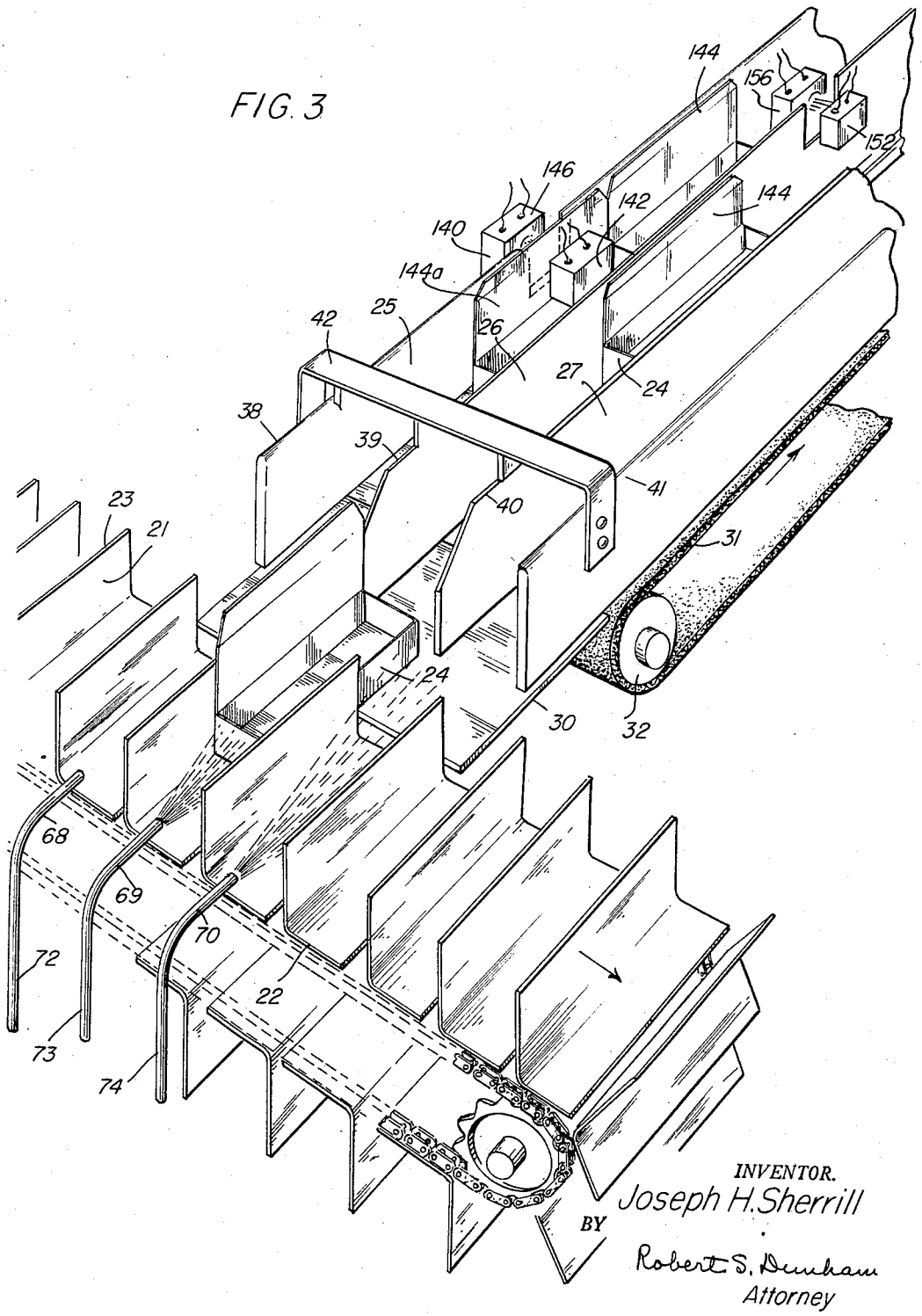
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APPARATUS FOR DISTRIBUTING CARTONS OR THE LIKE

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FIG. 3



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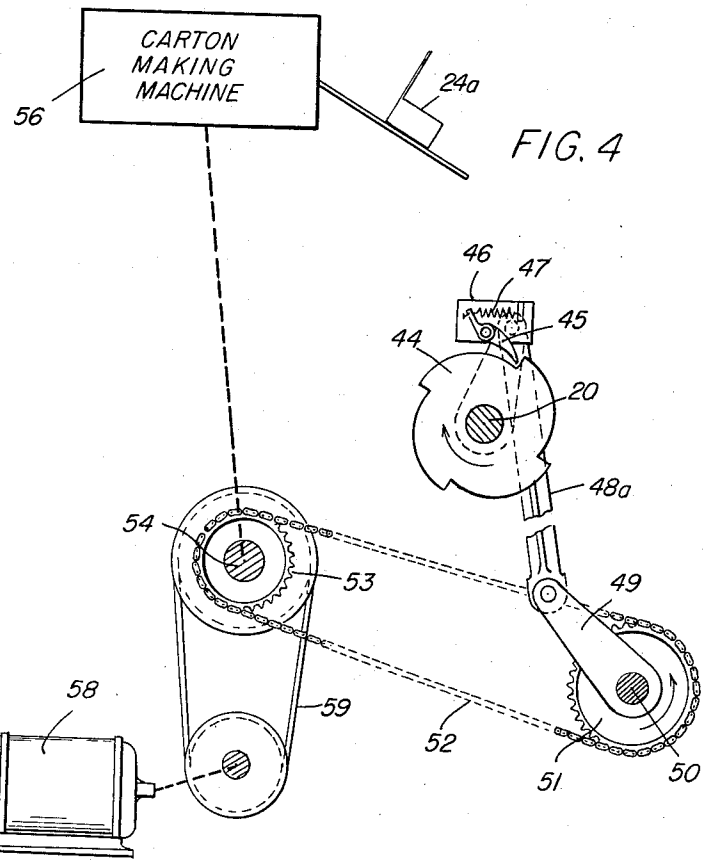


FIG. 4

FIG. 9

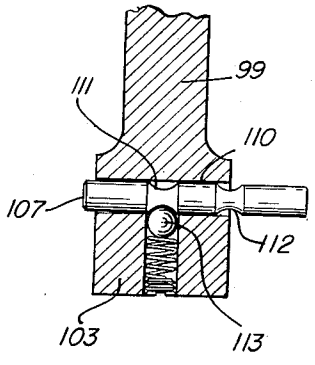
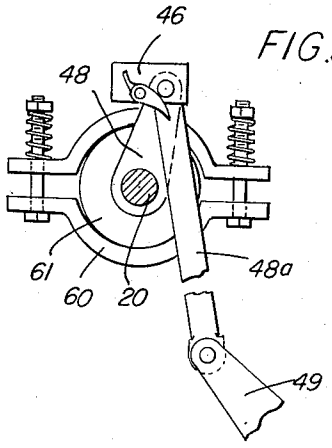


FIG. 5



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FIG. 6

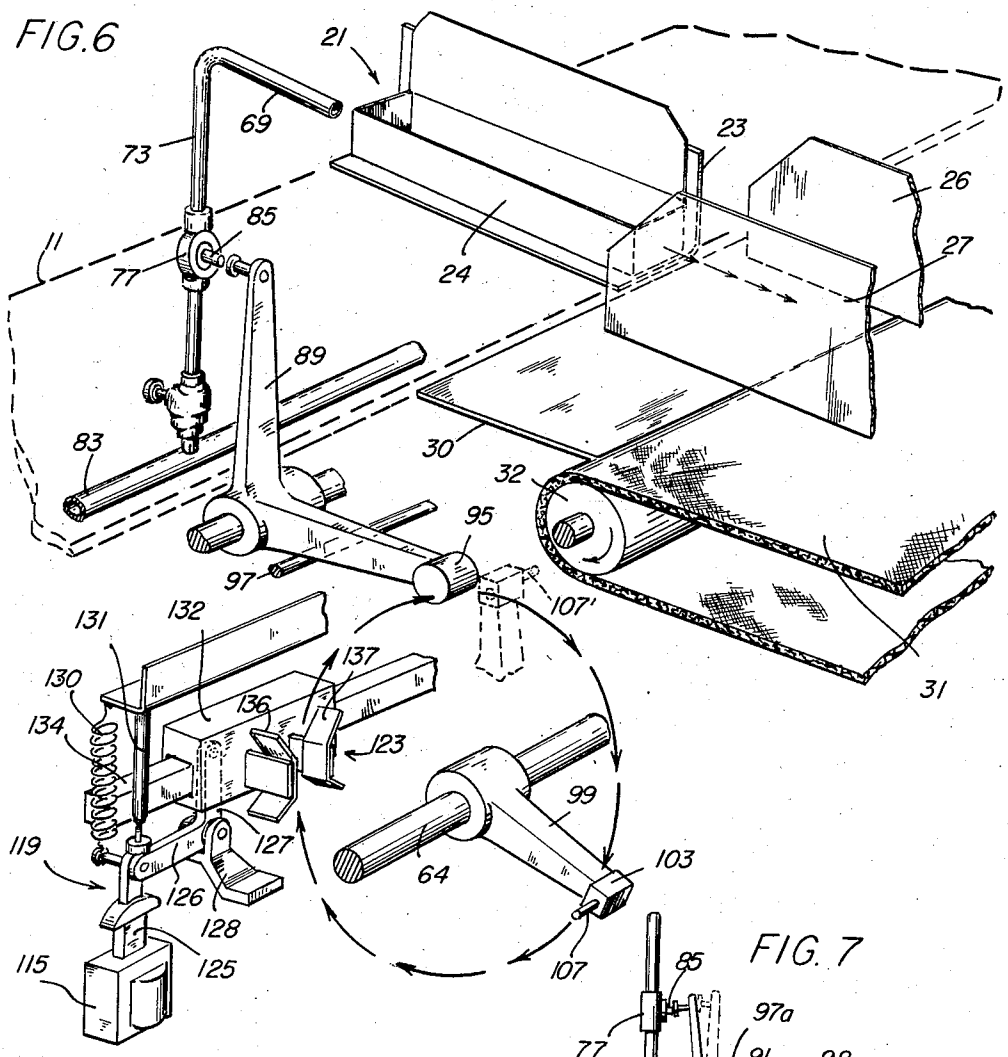


FIG. 7

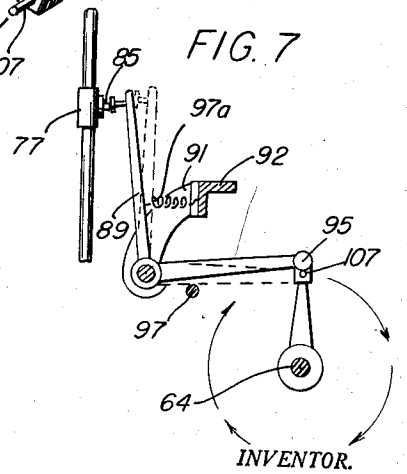
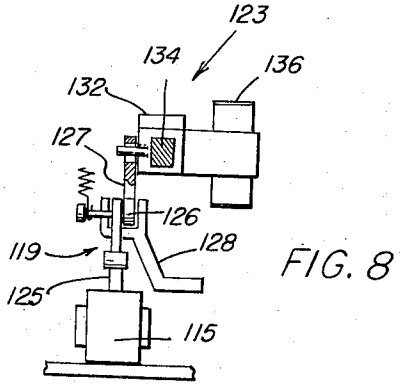


FIG. 8



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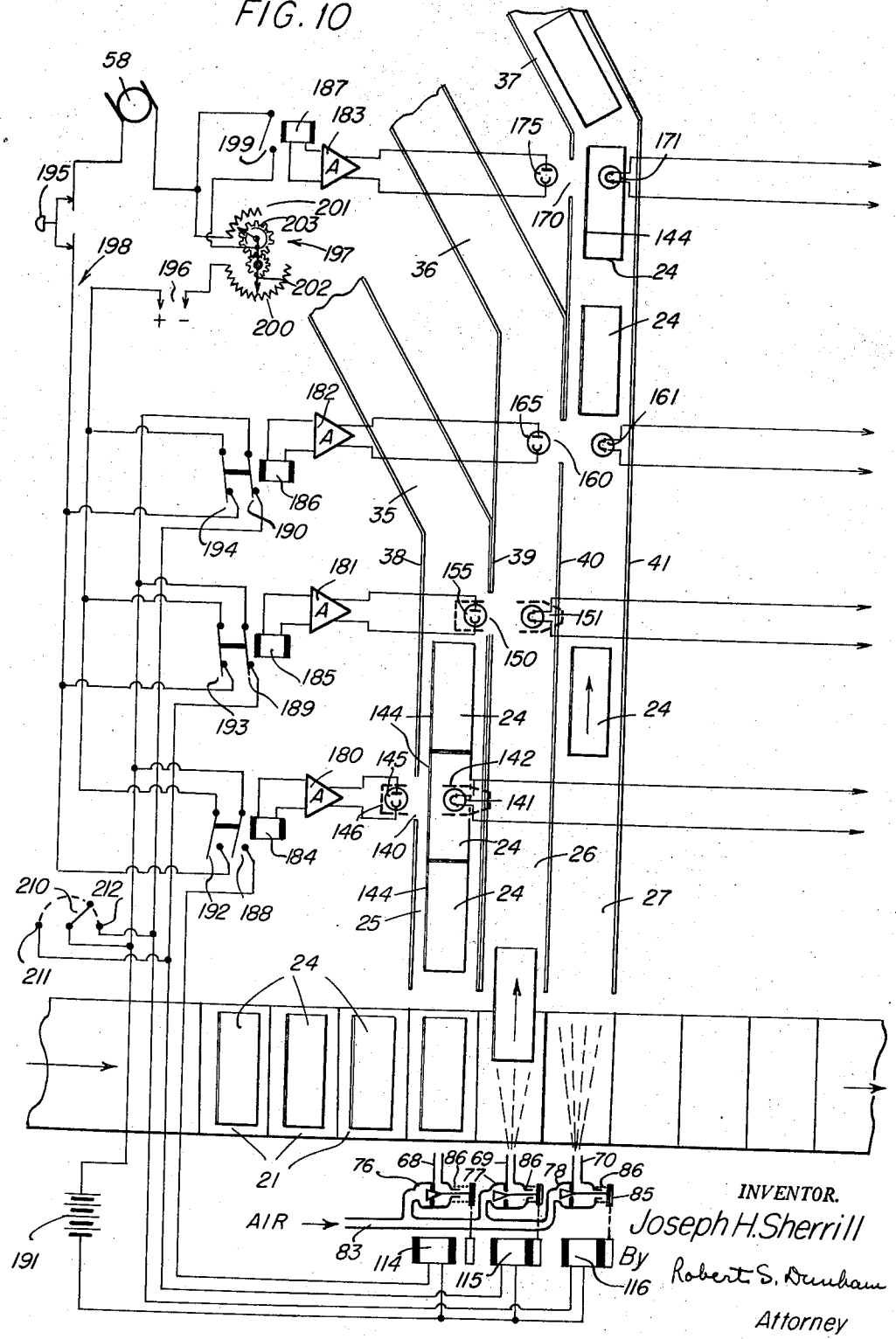
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APPARATUS FOR DISTRIBUTING CARTONS OR THE LIKE

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6 Sheets-Sheet 6

FIG. 10



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United States Patent Office

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APPARATUS FOR DISTRIBUTING CARTONS OR THE LIKE

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Application November 10, 1955, Serial No. 546,066

12 Claims. (Cl. 198—31)

This invention relates to the distribution of articles from a passing line or series of them, into a plurality of paths each intended to receive and advance such articles in succession, the distribution being effected in accordance with a desired selection, such as the requirements of the respective paths as to the supply of articles therein. In a more particular sense, the invention is directed to apparatus for distributing light articles such as cartons or the like, and specifically empty cartons that are designed to be packed with cigarette packages, so that from a substantially continuous supply the cartons may be selectively delivered into and along a plurality of paths or channels, leading, for example, to stations for loading them with packages.

An important object of the invention is to provide new and efficient apparatus of the character described, especially in the form of an essentially automatic machine which will direct cartons or the like from a passing succession thereof into one or another of a plurality of paths, where the cartons are to be successively advanced, the distribution being such as to be governed by the requirements in or at the end of each path for supply of cartons.

A further object is to afford improved carton distributing apparatus whereby from a single source of carton supply, such articles may be automatically directed into and along one or another of several paths, in an effective and reliable manner, without damage to the cartons and with rapidity appropriate for relatively high speed operation of associated apparatus, e. g. such as involved in feeding cartons to the distributor or in the utilization of the distributed cartons.

Other objects are to provide reliable and automatic apparatus of the character described, including novel arrangements for sensing the condition of the paths of distribution with respect to the presence or absence of cartons therein and novel and improved means for controlling distribution operations in accordance with detected conditions, as well as new and unusually effective devices for deflecting or advancing the articles into the distribution paths.

To these and other ends, the apparatus comprises means for advancing successive articles, e. g. cartons, along a predetermined course, means providing a plurality of distribution paths or channels at appropriate localities or stations along the first-mentioned means, and devices for advancing or projecting the cartons into the distribution paths, each of which includes means to effectuate advance of the articles, e. g. to a remote locality of use. Specifically effective further features of the invention reside in means in the several paths of distribution for detecting conditions as to the presence of cartons therein, the detected presence or absence of cartons being utilized, by appropriate control instrumentalities, to operate selectably one or another of the deflecting or projecting devices, e. g. so that the distribution is effected automatically in accordance with the need or demand for the articles in the respective channels.

The improved apparatus in its presently preferred forms also includes rapid-acting means such as air jets for displacing the cartons from their original course into the several paths of distribution, and electrically controlled means for activating or leaving inactive the several jet means, in response to signals from the carton detectors, which advantageously comprise photoelectric devices located at a more or less remote point in the separate channels. Although other uses of the apparatus are contemplated, particularly in equivalent situations, the machine is particularly suited for incorporation in the packing and packaging section of a cigarette manufacturing plant, where the entire output of a single carton-making machine is fed to the present distributor and the latter is then effective to direct the cartons to a plurality of separate stations where they are automatically or otherwise loaded with cigarette packages. In such circumstances the present apparatus affords an equable supply of cartons to all of the packing stations, being in effect automatically responsive to the needs of the several stations and self-compensating for variations of or differences among the rates at which they utilize the cartons.

By way of illustration, a presently preferred embodiment of the invention is shown in the accompanying drawings, wherein:

Fig. 1 is a side elevation of the main distributing section of the machine, shown in simplified form and with a number of parts or details broken away;

Fig. 2 is a similar, simplified elevational view of the opposite side of the main machine section;

Fig. 3 is a fragmentary perspective view of the top part of the machine and of the associated distribution paths, with various parts or sections broken away;

Fig. 4 is a fragmentary detail showing certain driving means for the machine of Fig. 1, with associated structures in diagrammatic form;

Fig. 5 is another detail in vertical section, spaced rearwardly from Fig. 4, of the same driving means;

Fig. 6 is a fragmentary perspective view showing the train of instrumentalities providing electro-mechanical control of deflecting means in the machine;

Fig. 7 is a fragmentary vertical section showing certain of the parts of Fig. 6 in a different relation;

Fig. 8 is a detail, partly in vertical section, of an electromagnetic device of Fig. 6;

Fig. 9 is a fragmentary sectional view of the end of a cam arm shown in Figs. 6 and 7; and

Fig. 10 is a schematic plan view of the top of the machine and the distribution paths or channels, together with a simplified wiring diagram of the electrical control arrangements.

The machine illustrated in the drawings is particularly designed to receive successive empty cartons, of the type conventionally used for enclosing a group of cigarette packages, and for distributing the cartons along a plurality of channels to different localities where the cartons are to be loaded. More specifically, the cartons are of the presently conventional elongated type, and are delivered in an open condition, with the opening uppermost, and with the closure flap in an upstanding position. They are distributed into channels in an endwise or longitudinal direction so as to reach their ultimate destination in endwise abutting lines.

For clarity, the drawings are greatly simplified, omitting much supporting structure, and minor mechanical details inconsequential to a disclosure of the principles and basic construction of the invention.

Referring to Figs. 1, 2, 3 and 10, the distributor comprises a chain conveyor constituted by a pair of endless chains **10, 11** running in parallel over pairs of sprockets **12, 13** and **14, 15** at respective ends of a horizontal elongated course, the upper path of the chains following a truly horizontal path over a considerable distance at **16,**

and also having an entrance path of upward slope in the direction of chain travel at 17, the chains being guided at the locality of direction change in the upper path by appropriate idler sprockets 18, 19. The sprockets 14, 15 are mounted on a common shaft 20 for drive of the conveyor chains as explained below.

The conveyor system advanced by the chains is arranged to constitute a succession of transverse pockets generally designated 21, each adapted to receive a single carton and each consisting of an angular metal structure 22 having essentially an L-shape in cross-section with the upright portion 23 of the L disposed at the rear of the pocket with respect to the direction of conveyor travel indicated by the arrows. Cartons 24 are received on the conveyor, conveniently at its sloping section 17, as from a carton-making machine of conventional construction, not shown. The associated carton or box machine may be driven in synchronism with the conveyor so that cartons are deposited in successive pockets of the conveyor in suitably timed relation, as indicated generally by the arriving carton 24*a* in Fig. 1.

As shown in Figs. 3 and 10, the machine is intended to deflect cartons at the rear side, from the chain conveyor into one or another of a plurality of channels, each carton being thus discharged endwise for longitudinal travel along the selected channel. In the apparatus illustrated there are shown three such channels generally designated 25, 26 and 27, corresponding respectively to three successive pockets of the chain conveyor, e. g. during the momentary interruptions of its travel, which is intermittent in character as explained below. It will be understood that other numbers of channels may be employed, with similar sequential or correlated control; three channels are shown because three loading stations have been found suitable for efficient utilization of the output of a conventional carton machine. The channels extend horizontally at the level of the floors of the pockets in the horizontal chain course 16, generally at a region near the center of such course, and disposed at the side of the machine which is shown in Fig. 2, opposite to the side illustrated in Fig. 1.

The channels have a floor which includes a short entrance apron 30, of smooth, polished metal or the like, and conveyor belt means extending from the entrance apron as far as desired for transport of articles in the channels. Thus in Fig. 3 there is shown a single conveyor belt 31 having a width to extend under the three channels and carried by suitable rollers such as the roller 32, with appropriate driving means (not shown) for continuously moving the upper web of the conveyor loop in a direction away from the distributing section. If desired, separate conveyor belts may be provided for each channel; indeed the length of the channels may be such as to require a tandem arrangement of belts, especially where channels may branch off to successive localities of use as indicated at 35, 36 and 37 in Fig. 10. In all cases, the general function is to provide a continuously moving floor in each channel, throughout its horizontal length. The channel configuration for the successive paths 25, 26 and 27 is completed by upright, elongated partitions 38, 39, 40 and 41, carried with their bottom edges just above the apron 30 and the belt system 31, by suitable overhead support means at successive localities, one such support means being represented by the bridge 42 in Fig. 3.

The conveyor chains 10, 11 are intermittently advanced, so as to have suitable, successive periods of dwell with each pocket stopping first at channel 25, then at channel 26 and thereafter at channel 27 for selective discharge of the carton 24 in such pocket into one or another of the channels, as explained above. This intermittent drive is effected by a ratchet wheel 44 on the shaft 20 of the rear-end sprockets 14, 15. As shown in Figs. 4 and 5 the ratchet wheel is engaged by a pawl 45 carried on a block 46 and urged toward the ratchet by a tension spring 47, the block 46 being pivotally carried on an arm 48 which is free to turn about the shaft 20. A connecting arm 48 also extends downwardly from the block 46 and is pivoted to a crank arm 49 which is mounted on the main distributor drive shaft 50. The shaft 50 is driven by a sprocket 51, chain 52 and a further sprocket 53 on a countershaft 54, the last-mentioned shaft being also arranged to drive the carton-making machine indicated at 56 in Fig. 4. Suitable power for turning the shaft 54 is obtained, for example, from a motor 58 through an appropriate belt system indicated at 59.

In order to prevent coasting or overrunning of the shaft 20, and thus to insure desired arrest of the chain conveyor with the pockets in precise registration relative to the channels 25, 26 and 27, a spring-pressed brake or drag 60 is provided to engage frictionally a suitable brake drum 61 on the shaft 20, as seen in Fig. 5. The machine also includes (Fig. 2) a cam shaft 64 extending perpendicularly to the drive shaft 50 and rotated by the latter through bevel gears 65. The arrangement of the pawl and ratchet 45, 44 and the bevel gears 65 (the latter preferably having a 1:1 ratio) is conveniently such that for each advance of the conveyor chain by a distance of one pocket 21, the shaft 64 makes one revolution; the shaft 64, nevertheless, rotates continuously so that each revolution actually occupies the time of a single conveyor step plus the time of dwell between steps.

The apparatus includes means for projecting the cartons 24 in a selected manner from the pockets 21 into one or more of the channels 25, 26 and 27. While other types of carton-displacing devices can be employed and likewise other modes of control, the illustrated machine very advantageously comprises pneumatic means for ejecting cartons from the pockets, under an electromechanical control, which is adapted to respond to desired signals, for example from the distribution channels. As shown, there are provided, at the stations occupied by the angular supports 22 when they are in registration with the distribution channels, a plurality of nozzles 68, 69, 70 each respectively disposed to direct a jet or pulse of air against the end of the body portion of a carton 24 resting in the corresponding conveyor pocket, for blowing the carton into the adjacent channel while the conveyor has its period of dwell.

The nozzles have corresponding supply pipes 72, 73, 74 which extend downwardly at the side of the machine shown in Fig. 1, through spring-action control valves 76, 77, 78 and regulating and shut-off valves 80, 81, 82 to a common pipe 83 which is connected to an appropriate source of air or other gas under pressure, not shown.

Each of the valves 76, 77, and 78, for example, as illustrated relative to the valve 77 in Fig. 6, may comprise a device of known character, normally closed and having an operating pin or stud 85, which may be depressed against suitable spring means (e. g. as indicated at 86 in the diagrammatic view of Fig. 10) to open the line and thus allow corresponding discharge of a jet of air from the connected nozzle, e. g. the nozzle 69. The pin 85 of each valve is adapted to be engaged by a corresponding projection at the upper end of one of three bell crank levers 88, 89, 90, the lever 89 being specifically shown as arranged for engagement with the pin of the valve 77 in Fig. 6. The bell crank levers are each pivoted on a horizontal axis by individual supporting means 91 carried by a horizontal beam 92 (Fig. 7), there being one such lever for each of the valve and nozzle assemblies.

The horizontal arms of the bell crank levers respectively carry follower block 94, 95, 96, it being understood that the weight of the horizontal arm and block in each case (or as supplemented, if desired, by a tension spring 97*a*, Fig. 7) is such as to maintain the bell crank in the position shown in Fig. 6, e. g. against a suitable stop 97

and with the upper arm disengaged from the corresponding valve pin 85. Thus the normal position of these parts is with the valve closed so that no air is projected against the cartons in the conveyor pockets.

Mounted on the shaft 64, to revolve therewith, are three cam arms 98, 99, 100, each terminating in a corresponding block 102, 103, 104. The blocks are respectively provided with horizontally slidable pins 106, 107, 108 which are arranged to project selectably on one side or other of the corresponding block. For example, as representatively shown in Fig. 9, which illustrates the block 103 on the arm 99 in section radial with respect to the shaft 64, the pin 107 seats with a close sliding fit in a transverse hole 110. The pin has a pair of longitudinally spaced peripheral grooves 111, 112, each adapted to be engaged by suitable impermanent locking means such as a spring-pressed ball 113 in the body of the block 103.

In Fig. 9 the pin 107 is shown projecting substantially from the righthand side of the block 103 and essentially not at all from the left hand side, the lefthand groove 111 being engaged by the ball 113. Upon pushing the righthand end of the pin toward the left the groove 111 can be made to ride past the ball and the pin can be brought to a second position with the groove 112 seating the ball. In such second position the pin projects from the lefthand side if the block 103 and substantially not at all from the righthand side. Identical arrangement is provided for the pins 106 and 108 in the blocks 102, 104.

The relative dispositions of the bell cranks 88, 89 and 90 and the arms 98, 99, 100 on the shaft 64 are such that if one of the cam pins project to the left (as seen in Figs. 2 and 6) rotation of the corresponding arm will bring such pin against the underside of the follower block (94, 95 and 96) and rock the crank arm upward, causing the upright arm of the crank to engage the corresponding valve pin 85 and open the air line to the related nozzle (Fig. 7). When a pin in one or the other of the blocks 102, 103, 104 is displaced in the other direction (i. e. projecting from the right as seen in Figs. 2 and 6) the block (102, 103 or 104) of the rotating arm can move freely past the corresponding bell crank follower, without engaging the latter and thus without opening the associated air valve (Fig. 6).

The arms 98, 99, 100 rotate continuously and in unison, passing the bell crank followers simultaneously. One or more of the latter will be rocked to open the corresponding air valve only if the cam pin is in the lefthand position (as seen in Fig. 2). In consequence the mechanical system is conditioned to actuate the air valves once for each revolution of the shaft 64, the passage of the arms past the bell cranks being timed with the commencement of the conveyor dwell, but actual selection of one or more valves for opening depends on the condition of the corresponding cam pins.

For positioning the pins, electromagnetic means are provided, respectively constituting the electromagnets 114, 115, 116 with their armature assemblies generally designated 118, 119, 120 and pin guides actuated thereby, 122, 123, 124 (Fig. 1). Details of these electromagnetic controls which are identical with each other, may best be seen from the illustration of the electromagnet 115 and its associated parts in Figs. 6 and 8. The armature assembly 119 comprises a core-type armature 125 adapted to be drawn down into the electromagnet 115 when the latter is energized, and a bell crank comprising a horizontal arm 126 linked to the armature 125, and a vertical arm 127, the crank being pivotally supported by an appropriate bracket 128. A tension spring 130 keeps the crank arm 126 (and thus the magnet armature 125) in a normally elevated position, against an adjustable stop 131, such position corresponding to deenergization of the magnet.

The upper arm 127 of the bell crank is pivoted to a block assembly 132 which constitutes part of the pin guide 123. The block assembly 132 is arranged to slide horizontally on a rectangular bar 134, appropriate clearance (e. g. a vertical slot in the arm 127) for the pivotal connection of the pin being provided so that as the armature is rocked from its normally deenergized position of Figs. 6 and 8 to an energized position such as shown in Fig. 1, the block 132 is shifted laterally, e. g. to the left in Fig. 6. Projecting from the block 132 alongside the path of the block 103 of the cam arm 99, are a pair of guide plate assemblies 136, 137, including central vertical portions horizontally spaced by a distance equal to or very slightly greater than the length of the pin 107, and outwardly flaring wings above and below. The arrangement of these members 136, 137 is such that as the arm 99 brings the block 103 between them, the pin 107 is positioned in accordance with their location.

Thus if the magnet is deenergized and the block 132 is in its righthand position (Fig. 6), the action of the guides 136, 137 will be such that as the block 103 swings upwardly through the guides, the pin 107 will project to the right of the block 103, as seen in dotted lines at 107' in Fig. 6. If such has been the position of the pin before the block 103 swept between the members 136, 137, there is no shift of the pin, but if the pin has been projecting from the lefthand side (as shown in the solid line indication 107 in Fig. 6), the guides, particularly the lefthand guide 136, will cause it to snap to its other position. Likewise, if the magnet 115 is energized and the block 132 is located in its leftward station, the guides will cause the pin to project from the lefthand side of the block 103, i. e. in position for operation of the bell crank 89 and opening of the air valve 77, as shown in Fig. 7. Hence the electromagnets 102, 103, 104 are arranged to control the positioning of the pins 106, 107, 108 and thereby to control, at the succeeding time in the cycle, the operation or non-operation of the air valves for the carton ejector nozzles. In the machine illustrated, for example, each valve is opened when its corresponding electromagnet has been energized and vice versa.

It will now be seen (referring to Figs. 3 and 10) that as the empty cartons 24 are successively brought into position opposite the channels 25, 26 and 27, a carton will be blown into one or another of the channels, depending on the operation or non-operation of the corresponding air valve 76, 77, 78 at such time. Of course, since each pocket progresses from one channel to the next in the intermittent movement of the chain conveyor, the carton occupying such pocket will be ejected only at the first station for which air ejection is effected by opening of the corresponding valve.

In the complete apparatus illustrated, and although other signaling means may be employed for controlling the electromagnets in any desired sequence or mode of selection, the preferred manner of control is in accordance with the requirements of the several channels for carton supply. To that end means are provided in each channel for detecting the presence or absence of a line of cartons backed-up and therefore only slowly progressing to the ultimate point of delivery, and for correspondingly controlling the related electromagnet to interrupt further carton projection into such channel or to continue carton projection as needed.

While other sensing means may be used, photoelectric devices are particularly satisfactory, being arranged to detect the presence or absence of passing carton flaps or covers. Such means are illustrated in Figs. 3 and 10, it being understood that the lengths of the channels and likewise the longitudinal spacing or positioning of the photoelectric means have been greatly abbreviated for convenience of illustration; ordinarily the detecting devices are to be located at greater, successive distances along the channels and the channels themselves may extend for relatively greater distances to ultimate delivery points as by the branches 35, 36, and 37.

For convenience, the channels are arranged in order

of length, channel **25** being the shortest (i. e. leading to the nearest delivery point) and channel **27** the longest; it will be understood that in other situations the lengths of the channels may have other relationships or may be equal, e. g. where they may branch to package loading stations equally remote from the distributor. Where the channels are of unequal length (in order) as shown in Fig. 8, the successive detecting instrumentalities are at correspondingly more remote distances from the distributing machine, in order to afford equalized back-up of the lines of cartons from their stations of use.

Thus at an appropriate locality the wall **38** of the channel **25** has an opening **140** through which a beam of light is projected from a lamp **141** in a housing **142** that is suspended in the channel above the carton bodies and that is spaced from the wall **38** by a distance conveniently permitting the passage of upstanding carton flaps **144**. On the other side of the opening **140** a photoelectric cell **145**, in a housing **146**, is adapted to be impinged by the beam from the lamp **141**. If a carton flap **144** is interposed in the light beam (as at **144***a*, Fig. 3), illumination of the photo cell **145** is interrupted, whereas if no carton and thus no flap is in position, the beam reaches the photo cell. A similar aperture **150** in the wall **39** of the channel **26**, and a like lamp **151** and photo cell **155** are arranged in identical fashion, being enclosed in suitable housings **152** and **156**. The illumination of the photo cell is again controlled by the presence or absence of a passing carton flap.

Through a like opening **160** in the wall **40** of channel **27**, a similar lamp **161** illuminates a photo cell **165**, these elements being again arranged (with corresponding housings, not shown in Fig. 10) for control of illumination by passing carton flaps. For supplemental control functions as described below, the third channel **27** may include another photoelectric device spaced considerably beyond the arrangement **161—165** in the direction of carton travel, e. g. comprising another opening **170**, lamp **171** and photocell **175**, again for detecting the presence or absence of passing cartons by their upstanding flaps.

The several photo cells **145**, **155**, **165** and **175** are connected to appropriate amplifiers designated **180**, **181**, **182** and **183**, respectively arranged for energization or deenergization of corresponding relays **184**, **185**, **186** and **187** in accordance with the presence or absence of light on the associated photo cell. Thus when the channels are loaded with cartons at the photo cell locality, the relays are deenergized, but when the cartons are absent in one case or another the corresponding relay is energized. Each of the relays **184**, **185**, **186** has a pair of normally open contacts **188**, **189**, **190**, respectively connected for controlling the circuits, from a common source of current **191**, to the electromagnets **114**, **115** and **116**. In consequence, when one of the relays is energized its corresponding contacts close and the related magnet is similarly energized.

The relays **184**, **185** and **186** also include supplemental contacts **192**, **193** and **194** respectively arranged to be closed upon relay energization, these contacts being connected in parallel for control of the main driving motor **58**. While in practice more complex and sensitive control circuits for the motor will be employed as known in the motor control art, the drawing illustrates a simple energizing circuit, e. g. for a D. C. type of motor **58**, having an on-off switch **195**, a source of current **196** and a speed control means **197**, the relay contacts being connected in parallel across points **198** in this circuit. It will be seen that if all channels **25**, **26**, and **27** are loaded with cartons at the localities of the photo cells **145**, **155** and **165**, all of the contacts **192**, **193**, **194** will be open, so that drive of the motor **58** is interrupted, shutting down the carton-making machine and the distributor with its chain conveyor. Under such circumstances no cartons are distributed in the channels until there is a demand for cartons in at least one of them, closing its corresponding relay contacts.

A convenient, cooperating adjunct in the illustrated system is a special speed control for the motor, actuated from the third channel **27**. Specifically, the relay **187**, under control of the photo cell **175**, has a pair of contacts **199**, which are closed only when the relay is energized and which are arranged upon closure to effect a predetermined increase of the motor speed and thus an increase in the rate of operation of the carton machine and the distributor.

Although with preferred, conventional types of motor control adapted for utilization of a reference voltage transmitted to the control circuit and affording speed variation in accordance with change in the reference voltage, a special relay-controlled adjustment of the reference voltage would ordinarily be used, the drawing illustrates for implicity of explanation a rheostat assembly **197** intended to control motor speed in inverse relation to the amount of resistance included in the motor energizing circuit. For instance the device **197** may include a pair of resistors **200**, **201** having their arms **202**, **203** geared to operate in unison but with different proportional amounts of resistance variation, from zero to a maximum in each segment. The contacts **199** are connected between one of these arms, conveniently the arm **203** related to the lesser part of the total resistance, and the central connection of the two resistors. Hence when the contacts **199** are closed the resistance is reduced by a proportion which is constant over at least a considerable range of adjustment of the device **197**, i. e. so as to increase the motor speed by a predetermined percentage. As explained, the preferred system in practice employs a reference voltage set up in a suitable potentiometer (not shown) but controlled by the relay contacts **199** in similar fashion to the control of device **197**, this voltage being utilized for control of the motor circuit in a conventional way.

The effect of the motor control system under the photo cell **175** is to speed up the entire operation of carton making and distributing, should the third channel **27**, which is the last to receive cartons, be so depleted that there are no cartons at the location of this photo cell. Under such circumstances speed-up of the motor is effected until abundant supply of cartons is reestablished in the vicinity of the cell **175**. The relay **187** is then deenergized and the motor speed returns to its normal value. The normal speed may, of course, be adjusted as desired by manual operation of conventional means, e. g. as shown in very rudimentary form at **197**.

It will be understood that the several amplifiers **180** to **183** inclusive may include time delay means (not shown) of conventional sort (e. g. a resistance-condenser circuit, or mechanical dashpot means for the relay) such that when the corresponding relay has been energized, its deenergization will not occur until after a period of time sufficient to permit backing up of, say, two or three cartons in the channel at the side nearest the distributing machine. In this fashion, too rapid fluctuation of the control is avoided, yet when the cartons are only passing at considerably spaced intervals, the relay and electromagnet will remain energized, affording proper response to the actual need for continuing carton supply in the channel. There may be likewise in each of the amplifiers a similar but relatively short time delay (as by like suitable means, not shown) in the energization of the relay upon illumination of the photo cell, e. g. to prevent the relay from operating by light from the crack between closely abutting cartons as the latter may be passing slowly, in backed-up condition, down the channel.

Although the general operation of the apparatus will be largely self-explanatory from the foregoing, it may be summarized briefly. Empty cartons **24**, with their flaps upstanding, are disposed in succesisve pockets **21** of the

chain conveyor, at the lefthand end of the latter as seen in Fig. 1. With the pockets 21 so filled, and the flaps abutting the rear walls 23 of the pockets, the conveyor advances stepwise, bringing the pockets in succession past the entrances to the channels 25, 26, 27, with a dwell of the conveyor as the pockets thus successively come in registration with the channels. The cam arms 98, 99 and 100 continue to rotate, beneath the distributing assembly, for positioning of the pins 106, 107 and 108 in accordance with the energized or deenergized condition of the magnets 114, 115 and 116.

In each instance where the magnet is energized, the pin is maintained in or shifted to such position as to rock the corresponding bell crank 88, 89 or 90 and open the corresponding air valve 76, 77 or 78. Since the instant of passage of the ends of the cam arms relative to the follower blocks 94, 95, 96 of the bell cranks is timed to occur just at the beginning of the dwell period of the conveyor chain (the latter being in turn governed by that part of the cycle of rotation of the crank 49, Fig. 4, wherein the crank is not pulling the pawl 45 downwardly), the cartons are at rest when the nozzles 68, 69, 70 are conditioned to discharge jets or puffs of air against the ends of the carton bodies.

To the extent that one or more valves are opened, corresponding jets of air are discharged for a brief interval, and if a carton is disposed in the corresponding pocket 21 of the conveyor, it is thereby projected endwise out of the pocket, across the apron 30 and into the corresponding one of the channels 25, 26 and 27, i.e. upon the conveyor belt 31. The carton then travels along the channel as indicated above, until it reaches and backs up the line of cartons that may already exist in the channel, and that may be waiting (or moving by slower progress) for use at the remote end.

The control of distribution is effected by the demand of the several channels. Thus if in channel 25 the row of cartons is backed up to a point where the opening 140 is blocked by a carton flap 144, the relay 184 is deenergized and likewise magnet 114, as actually shown in Fig. 10. Accordingly when a carton is brought in a position of registration with this channel, i. e. in a pocket 21 of the conveyor, there is no air projected from the nozzle 68 and the carton remains in the pocket. If at the same time the cartons in channels 26 and 27, for example, are not backed up to a point where they block the light to photo cells 155, 165, both of the relays 185, 186 will be energized and both of the magnets 115 and 116 will likewise be actuated (Fig. 10). Hence both jets will blow during the period of conveyor dwell, but of course, if by reason of previous carton discharge into channel 25 or 26, there is no carton in registration with channel 27, the only actual carton displaced will be that which had advanced to the locality of channel 26, it being understood that in this instance the distribution to channel 25 had been cut off.

As soon as channel 25 is filled, and assuming channel 25 remains filled, all cartons will be projected into channel 27, the relays 184 and 185 remaining deenergized. If the supply of cartons in channel 27 falls so low that photo cell 175 is exposed, the relay 187 is energized to effect an increase in speed of the driving motor by a predetermined percentage, say 8 to 10%. The higher rate of carton advance and distribution is followed until cartons are backed up past the cell 175 in channel 27, whereupon the relay 187 is deenergized and the speed returns to normal.

In practice it is found that the normal operating speed should be one which for the most part keeps the channel 27 filled back of the photo cell 175, yet not quite so far as the photo cell 165. Under such circumstances the air discharges for deflecting cartons into channels 25 and 26 go on and off at various, generally irregular times, in accordance with demands in these channels, while the excess cartons are constantly or almost constantly directed into channel 27. Of course if all channels become loaded back to their magnet-controlling photo cells, the motor contacts 192, 193, 194 will all be open, interrupting drive of the machine until there is need for more cartons in at least one of the channels.

In this fashion automatic delivery of cartons into the several paths of distribution is afforded in a rapid and effective manner, under control by the actual demand of the paths for carton supply.

If desired, there may also be included a supplemental switch 210 which has an intermediate open position and alternate closed positions through the contacts 211, 212 respectively connected to effect continuing energization of the electromagnets 115, 116, the arm of the switch being connected to the side of the current source 191 opposite to the side extending to the electromagnets. If this switch is closed through contact 212, the air nozzle 70 fires every time the shaft 83 revolves, and channel 27 takes all cartons not taken by channels 25 and 26. Of course if cartons become backed up in all channels, the absence of light on photo cell 165 (as well as the others) will open the circuit of motor 58, but the machine tends to coast through a few more steps of advance of the conveyor pockets 21. Thus the effect of switch 210 will be to project the corresponding few cartons into channel 27, instead of allowing them to be carried past. When the carton-utilizing operation at the remote end of channel 27 is shut down, the switch 210 can be shifted (automatically, if desired) to contact 211, thus making channel 26 the one which takes all cartons not required by channel 25, including the few cartons brought up after a deenergization of the motor 58.

It is to be understood that the invention is not limited to the specific structures herein shown and described, but may be embodied in other ways without departure from its spirit.

I claim:

1. Apparatus for distributing a succession of articles into a plurality of paths, comprising means for advancing the articles in succession past a plurality of distributing localities, means extending separately from the respective localities for removal of articles in succession along correspondingly different paths, fluid jet means separately disposed at each of the distributing localities for respectively effecting displacement of articles from the first-mentioned means into the corresponding removal means, photoelectric means in the separate paths of the removal means for detecting the condition of each path with respect to the presence of articles therein, and control means including electromagnetic means controlled by said photoelectric means, for controlling the operation of the jet means to effectuate distribution of the articles into the several paths in accordance with the demand for articles in each, said control means including means controlled by the electromagnetic means and timed with the advancing means for operating the jet means only at times when the advancing means is in position for location of articles at the aforesaid localities.

2. Apparatus for distributing a succession of elongated cartons into a plurality of paths, comprising means including a conveyor having transverse single carton-receiving pockets for advancing the cartons in sidewise succession past a plurality of distributing localities, channel means extending separately from the respective localities for conveying cartons endwise in succession along correspondingly different channels, air jet means separately disposed at each of the distributing localities at the opposite side of the conveyor from the channels, and each operable to direct an air jet against the end of a carton, for respectively propelling cartons from the first-mentioned means into the corresponding channel, means in the separate channels along which the cartons are carried by said conveying means for detecting the condition of each channel with respect to the presence of cartons therein, and means controlled by said detect-

ing means for controlling the operation of the air jet means to effectuate distribution of the cartons into the several paths in accordance with the demand for cartons in each, said jet operation controlling means including means timed with the advancing means for operating the jet means to propel cartons into the channels only at times when the conveyor is positioned for registration of its pockets with the channels of the channel means.

3. Apparatus for distributing a succession of elongated cartons into a plurality of paths, comprising means including a conveyor having transverse single carton-receiving pockets for advancing the cartons in sidewise succession past a plurality of distributing localities, channel means extending separately from the respective localities for conveying cartons endwise in succession along correspondingly different channels, said advancing means including intermittent driving means for alternating advance and dwell of the conveyor to arrest the conveyor intermittently with pockets thereof in registration with the said channels during the periods of dwell, air jet means separately disposed at each of the distributing localities at the opposite side of the conveyor from the channels, and each operable to direct an air jet against the end of a carton, for respectively propelling cartons from the first-mentioned means into the corresponding channel, and means timed with the advancing means for operating the air jet means only during the periods of dwell of the conveyor, to distribute the cartons into the several channels.

4. In article distributing apparatus, in combination, means for advancing successive articles to a distributing locality, means providing a path for removal of articles from said locality, ejecting means at said locality for effecting displacement of articles into said path, photoelectric means at a region of the path for continuously detecting and signaling the presence of articles there, and means including signal-retaining means electrically controlled by the detecting means and means controlled by said signal-retaining means and timed with the advancing means, for controlling the ejecting means to displace articles into the path only when articles are absent at said region and only at times when the advancing means is in position for location of an article at the aforesaid locality.

5. In article distributing apparatus, in combination, means for intermittently advancing successive articles to a distributing locality, including means providing a dwell of each advancing article at said locality intermediate successive movements of the advancing means, means providing a path for removal of articles from said locality, means at said locality for effecting displacement of articles into said path and including a control device therefor, a signal-responsive control means spaced from said control device, a control element settable in positions respectively, for operation and non-operation of said control device, said signal-responsive means being adapted to set said control element in accordance with received signals, and means for continuously rotating said control element past said signal-responsive means and said control device in succession and in timed relation with the advancing means, for effecting operation of the displacing means during the period of dwell in accordance with a predetermined signal received by the signal-responsive means.

6. In article distributing apparatus, in combination, means for advancing successive articles to a distributing locality, means providing a path for removal of articles from said locality, fluid jet means at said locality for displacing an article into said path, valve means for controlling fluid supply to said device, having an operating element shiftable to open the valve means, a rotatable member adapted to rotate past said element and having a device shiftable between a position for engaging the element to open the valve means and a position for passing the element without displacing it, means for rotating the member in timed relation with the advancing means, and controllable means in the path of rotation of said member, for selectively disposing the device in one or the other of its said positions.

7. Apparatus as described in claim 6, wherein the shiftable device comprises a pin movable to project from one side or the other of the element and means for impermanently holding the pin in each position of projection, said operating element being disposed in the path of the pin in one position of projection, said controllable means comprising a pair of guide means bordering the path of the element so that the pin travels between them, and electromagnetic means for shifting the guide means from one pin-locating position to another pin-locating position.

8. In article distributing apparatus, in combination, pocketed conveyor means for advancing the pockets thereof past a plurality of distributing localities, each pocket being adapted to hold an article, a plurality of means respectively disposed at said localities to provide corresponding paths for removal of articles from the conveeyor means, said plurality of removal path means being disposed along said conveyor means to be in registration with an equal plurality of the pockets of the conveyor means simultaneously, said conveyor means including intermittent drive means therefor, to provide successive periods of dwell of the conveyor means with pockets in registration with the removal path means, a plurality of means at said localities respectively, for effecting displacement of articles into the removal path means, means in the path means for detecting the presence and absence of articles at predetermined regions of the paths, and means controlled by said detecting means for selectively controlling said displacement means to provide selectable distribution of articles from successive pockets into one or another of the removal path means in accordance with the demand for articles in the paths, said controlling means including means timed with the conveyor means for operating the displacement means only during periods of dwell of said conveyor means.

9. In article distributing apparatus, in combination, pocketed conveyor means for advancing the pockets thereof past a plurality of distributing localities, each pocket being adapted to hold an article, a plurality of means respectively disposed at said localities to provide corresponding paths for removal of articles from the conveyor means, said plurality of removal path means being disposed along said conveyor means to be in registration with an equal plurality of the pockets of the conveyor means simultaneously, said conveyor means including intermittent drive means therefor, to provide successive periods of dwell of the conveyor means with pockets in registration with the removal path means, a plurality of fluid jet means at said localities along the conveyor means, respectively corresponding to and opposite the removal path means, for ejecting articles from the pockets into the removal path means, means in the several removal path means for detecting the condition of each with respect to the presence of articles therein, and means controlled by said detecting means and timed with the intermittent drive means for effecting operation of the jet means during successive periods of dwell of the conveyor means, selectively to effectuate distribution of articles into the paths in accordance with the demand for articles in each.

10. Apparatus as defined in claim 9, which includes supplemental article detecting means in the last removal path means along the conveyor means, at a more remote region of said path than the first detecting means, and means controlled by said supplemental means for controlling the intermittent drive means to increase the rate of advance of the conveyor means in response to absence of articles at said more remote region.

11. Apparatus for distributing a succession of articles into a plurality of paths, comprising means for advancing the articles in succession past a plurality of distribut-

ing localities, said advancing means including intermittent operating means therefor to provide successive cycles of article advance and intervening periods of dwell with articles arrested respectively adjacent the distributing localities, means extending separately from the respective localities for removal of articles in succession along correspondingly different paths, fluid jet means separately disposed at each of the distributing localities for respectively effecting displacement of articles from the first-mentioned means into the corresponding removal means, each of said jet means being operable to direct a fluid jet against an article to propel it into the adjacent removal means, and means timed with the intermittent operating means for operating the jet means only during said periods of dwell of the articles, to distribute the articles into the several removal means.

12. Apparatus for distributing a succession of articles into a plurality of paths, comprising means for advancing the articles in succession past a plurality of distributing localities, said advancing means including intermittent operating means therefor to provide successive cycles of article advance and intervening periods of dwell with articles arrested respectively adjacent the distributing localities, means extending separately from the respective localities for removal of articles in succession along correspondingly different paths, displacing means separately disposed at each of the distributing localities for respectively propelling articles from the first-mentioned means into the corresponding removal means, means located in each of the paths of the removal means and responsive to the absence of an article at a predetermined region of each path, for detecting the condition of each path with respect to the presence of articles therein, and means controlled by said detecting means for controlling the operation of the displacing means to effectuate distribution of the articles into the several paths in accordance with the demand for articles in each, said last-mentioned means including means timed with the intermittent operating means for operating the displacing means only during the aforesaid periods of dwell of the articles.

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