MECHANISM FOR CARRYING ARTICLES THROUGH A TREATING ZONE WITH A VARIABLE DELIVERY AND DISCHARGE RATE

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This invention relates to a mechanism for carrying articles through a treating period or zone in accordance with a variable delivery and discharge rate; for example, when loaves of bread are discharged from an oven they are cooled before they are sliced and wrapped. Automatic and mechanical handling of the bread has long been desired, but it has been difficult to provide a conveyor mechanism which can be synchronized with the rate of oven discharge and also with operation of the bread-slicing and wrapping machines. This difficulty is readily apparent when it is considered that the oven must be in continuous operation, otherwise the bread will be overbaked or burned. Thus the oven cannot be stopped on failure or lag in operation of the slicing and wrapping machines.

It is, therefore, the principal object of the present invention to provide a conveyor mechanism for the handling of bread between the oven and the slicing and wrapping machines which includes a plurality of independent trays adapted to be loaded and automatically moved through the cooling zone in accordance with the discharged rate of bread from the oven and to provide for holdover of the bread on the conveyor in case the slicing and wrapping machines are not operating to take care of the oven discharge.

It is also an object of the invention to provide a continuous conveyor which automatically accommodates empty trays and has them available for reception of the bread as it is discharged from the oven.

Automatic movement of the bread through a cooling zone is also desirable because the conveyor and cooling space may be located just below the ceiling level to leave ample floor space for other bakery operations. It is, therefore, a further object of the invention to provide an elevating mechanism for guiding the loaves of bread from the oven to the conveyor of the cooling zone and to provide a lowering mechanism for returning the empty trays to a position for receiving loaves of bread discharged from the oven.

Further objects of the invention are to provide a conveying mechanism having a relatively long travel within a limited space by providing a plurality of superimposed conveyor runs and transfer mechanisms for automatically transferring loaded trays from the end of one run to the next run and so on to the point of discharge; to provide automatic safety controls for the transfer mechanism; to provide automatic discharge of cool bread to one or more or all of several bread slicing and slicing machines; to provide a continuous conveyor with ample storage capacity so as to avoid being held up by bread; and to provide a smoothly operating conveyor mechanism wherein the trays are controlled to avoid rough handling that might result in cripples.

Other objects of the invention are to provide a simple and positive transfer of the trays from one pair of tracks to another; to provide for stopping a following tray while the preceding tray is being transferred; to provide a transfer mechanism that is of smooth action and does not jar the bread carried in the trays; to provide a structure which provides for fully loading all of the trays regardless of the number of loaves baked per unit of time, to provide ample storage capacity so as to avoid taking bread out of the cooler unless required in the wrapping machines, and to provide a cooler of compact construction for use in small bakeries.

In accomplishing these and other objects of the invention, as hereinafter pointed out, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawings wherein:

Fig. 1 is a diagrammatic view of a continuous conveyor mechanism constructed in accordance with the present invention.

Fig. 2 is a diagrammatic view of safety switches and electrical controls for controlling emptying of the trays of cool bread and selectively discharging the bread to one or more slicing and wrapping machines.

Figs. 3, 3A, 3B, and 3C are side-elevational views of the different portions of the conveyor mechanism along the length thereof.

Figs. 4 and 4A are a side-elevational view of the lower and upper portions respectively of the elevator by which trays of bread are lifted from loading position to the entrance of the cooling zone. The figures also include the lowering device by which the empty trays are carried from the lower run of the conveyor mechanism to a position for transfer to the tray-lifting conveyor at the loading station.

Fig. 5 is an enlarged fragmentary sectional view particularly illustrating the transfer mechanism whereby a tray is transferred from an upper run to a lower run of the conveyor mechanism.

Fig. 6 is a shortened end view showing one of the trays being carried by the elevator, the direction of the view being indicated by the arrows and the line 6-6, Fig. 4.

Fig. 7 is a similar view of the portion of the tray-lowering device, the direction of the view being indicated by the arrows and the line 7-7, Fig. 4.

Fig. 8 is an enlarged fragmentary view particularly illustrating one of the tray carriers on the lowering conveyor.

Fig. 9 is a fragmentary section on the line 9-9, Fig. 5.

Fig. 10 is a fragmentary transverse section on the line 10-10 of Fig. 5.

Fig. 11 is a transverse fragmentary section on line 11-11, Fig. 12.

Fig. 12 is a side-elevational view of the tray-transfer conveyors and the safety control mechanisms therefor.

Fig. 13 is a perspective view of one of the trays.

Fig. 14 is a fragmentary longitudinal section through a tray carried by an upper run and an end of a tray on the next lower run.

Fig. 15 is a section on the line 15-15, Fig. 14.

Fig. 16 is a diagrammatic view of the wiring and switches for controlling the transfer mechanisms.

Fig. 17 is a detailed section showing the motor drive for one of the conveyor runs.

Fig. 18 is a detailed fragmentary perspective view showing discharge of the bread from the trays.

Referring now in detail to the drawings:

1 designates a tray-conveying mechanism constructed in accordance with the present invention for moving loaves of bread through a cooler that is located in a position to receive loaves discharged from an oven by way of a pan-emptying machine and a conveyor belt 2, the oven and pan-emptying machines not being illustrated since they specifically form no part of the present invention.
The mechanism 1 includes spaced side frames 3 and 4. The side frames 3 and 4 are composed of vertical members such as I-beams 5 connected along their inner sides by pairs of longitudinally extending angle members 6, 7, 8, 9 and 10 arranged with the pairs in vertically spaced, superimposed relation at the respective sides of the frames and also extending on the sides of the frame below the lower pairs of angles 6'-7' are similar angles 8'-9', and lower angles 9 between which are shorter angles 10'-10'' which are terminated short of the left-hand end of the frames, Fig. 1, to accommodate unloading stations including offtake belts 11 and 12. The lowermost angles 8' extend to the left-hand end of the machine to carry the trays to a lowering conveyor 13 later described. The upper angles 6 extend to an elevator 14 also to be later described. All of the angles have flanges 15 thereof extending inwardly and the other flanges 16 vertically for attachment to the I-beams 5 by means of inwardly extending brackets 17, as shown in Fig. 11. The I-beam members 5 are connected across their lower ends by transverse I-beams 18 which may be suspended from the ceiling of a building in which the apparatus is installed to avoid supporting columns which occupy floor space. The inner sides of the frames are closed at ends thereof by sheet metal walls 19, and, if desired, the entire sides may be similarly closed to provide a chamber or treating zone which in the illustrated instance is a cooling zone 19.

The left-hand end (Fig. 3) of the side frames has I-beams 20 extending below the suspended I-beams 18. The lower ends of the I-beams 20 are connected with horizontal I-beams 21 that support vertical I-beam members 22 which carry the elevator 14 that lifts trays from a loading station 23 which may be at floor level to an inlet opening 24 at the upper end portion of the treating chamber 19.

The I-beam members 20 have forwardly extending brackets 20' that carry the immediately adjacent transverse beam 28 as shown in Fig. 3. The opposite or right-hand ends of the side frames also have vertical columns 25 that carry brackets 26 to support the endmost transverse I-beam 18 at that end of the machine, as shown in Fig. 3C. The flanges 16 of the longitudinal angle members 6, etc. project above the brackets 17 to form tracks or rails 27 and 28 extending longitudinally of the treating chamber for support of the trays, as later described.

The upper angles 6 terminate short of the angles 7 to permit passage of a tray carrier at the end of the upper track to deposit the trays on the track of the angles 7. Likewise the angles 7 at the opposite ends terminate short of the angles 6. The same is also true of the other angles at the tray discharge ends thereof.

The inwarrowly extending horizontal flanges 8 of the longitudinal angle members mount longitudinal rails 29 and 30 for supporting roller chains as now to be described for moving the trays along the tracks of the angles. A pair of endless chains 31 operate over sprockets 32 and 33 near the respective ends of the machine and which are carried on transverse shafts 34 and 35. The chains have upper runs 40 movable along the rails of the angles 6 and lower runs 41 that are carried on rails of intermediate angles 42.

Similar pairs of chains 43 and 44 are associated with the angles 6' and 6'' so that the runs therefore extend along the tracks by the angles at the respective sides of the cooling chamber. The sprockets and shafts which mount and actuate the respective chains are located short of the terminals of the angles to accommodate tray-transfer mechanism, "A" to "I", later to be described and to prevent transfer of the trays without interference of the shafts, etc., of the main conveyor chains.

Therefore, relatively shorter conveyor chains are provided at the respective sides of the chamber at the terminal ends of the tracks. The first of these chains 45, are carried on sprockets 46-46' that are mounted on stub shafts 47-48. The stub shafts 48 at the respective sides of the machine are driven by chains 49 from the shafts 34. Likewise, travel of the trays is continued at the opposite ends of the angles by chains 50 which are also located at each of the sides of the cooling chamber and are mounted on stub shafts 53-54 projecting inwardly from the side frames. The chains 50 are driven from the shaft 35 by connecting chains 55. In this way the shafts 34-35 may extend across the entire width of the machine to keep the driving lugs 56 on the chains in exact lateral alignment so that the trays are carried parallel along the entire length of the tracks. The feeder chains 59' at the left-hand end of the cooling chamber operate over sprockets 57-58 on stub shafts 59 similar to the chains 44 but the chains are driven in reverse direction with respect to the drive of the chains 50 at the opposite end because the upper runs are used to move the trays to the left-hand end of the cooling chamber (Fig. 1). The reverse drive is effected by intermeshing gears 60-61 located respectively on the ends of the shaft 34 and on stub shafts 62 that project inwardly from the side frames. The gears 61 are connected with sprockets 63 that 8', and, in driving relation with respect to the sprockets 58, the sprockets 64 being driven by chains 65.

Chains similar to the chains 50 are provided between the angles 6'-7' and 6'-7'' as designated 66-67 respectively. Chains 68-69, similar to the chains 50, are provided between the angles 7'-6' and 7'' and angles 8 that provide tracks for carrying the trays to the unloading station above the offtake belts 11 and 12, which lead to separate slicing and wrapping machines not shown. The tracks 8 continue beyond the unloading station and terminate in substantial registry with the angles 6' to carry the unladen trays to storage racks comprising a shaft 9-10 and 8'. The angles 9-10 are of shorter length in that they fill in the space between that end of the cooler and the belts 11 and 12. The lower angles 8', however, extend to the left hand end of the machine (Fig. 1) to carry the empty trays to the tray lowering conveyor 13.

The trays deposited on the tracks of the angles 8 are pushed forwardly therealong by the chains 69 so that filled trays are always in position to continue travel to the unloading stations when a tray is advanced by rubber forwarding wheels 74 onto the chains 75 that carry the trays across the unloading stations where the empty trays are picked up by conveyor chains 76 that continue movement of the empty trays to the opposite end of the angles 8 with the aid of side chains 77 corresponding with the side chains 66 and 67 previously described. The trays are moved along the angles 9 by the lugs on the lower runs of the chains 77 and are moved to the ends thereof with one tray pushing the other so as to provide storage of the empty trays. The angles 10 provide tracks for reversing movement of the trays under action of chains 78 which operate over sprockets 79 and 80 that are carried on transverse shafts 81 similar to the main chains previously described. The empty trays are continued along the tracks of the lower angles 8' by side chains 82 having the upper runs 83 extending along the track of the angles. The chains 82 are driven from the chains 78 by chain and gear connections similar to the chain and gear connections previously described. The trays are passed to the terminal ends of the tracks of the angles 10 by feed chains 84 similar to the feed chains 59 previously described.

The shafts 35 of the main chains are driven by chains 85 operating over sprockets 86 on outer ends of the shafts 35 and over sprockets 87 which are fixed to countershafts 88 journaled in slide blocks 89 that are adjustable to tension the chains by a screw mechanism indicated at 90, Fig. 3C. The shafts 88 carry sprockets
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5 6 that are driven by chains 92 operated by sprockets 93 on the power shafts 94 of gear reduction units 95, the gear reduction units being driven by electric motors 96 which are carried on platforms 97 mounted on one of the side frames as best shown in Fig. 17. The motors 96 thus provide a continuous drive for the chains thus far described so that the chains operate continuously to move and advance the trays along the tracks. The terminal end of the tracks is provided with stops 98 to detrain the trays preparatory to their engagement by the transfer mechanism. As the trays are transferred from the end of an upper track to the start of the next lower track.

The legs on the respective conveyor chains mentioned comprise paws 99 that are pivoted on projecting ends 100 of certain of the link pins 101 forming a part of the respective chains, the paws having terminal portions 102 that engage projecting ends 103 of the next adjacent pins that connect the chain links. The paws 100 are supported in position to normally engage an upper transverse pin 104 or a lower transverse pin 105 that are carried by brackets 106 at each corner of the trays. The paws 100 are supported in position with the terminal portions 102 in engagement with the projecting pin by spring 107 which connect with the paws with a projecting end of a forward link pin 108 as shown in Fig. 15. The paws 100 have forward faces 109 for engaging the pins 104 or 105 as the case may be, depending on the track on which the tray is moving and then spring 107 and the chains associated therewith. The paws have rounded rear edges 110 which form cam surfaces to permit riding of the pins thereover when the springs 107 yield under a holding pressure that is applied to the respective trays as when preceding trays are stopped for various reasons as later described. Movement of the paws is limited on the links by studs 111 that project from the chain link through arcuate slots 112 of the respective paws.

The trays are best illustrated in Figs. 13 to 15 inclusive and include a rectangular frame 113 having transverse members 114 and 115 connected at the ends by relatively shorter longitudinal end members 116 and 117. The end members 116 and 117 carry intermediate transverse members 118 to attach a series of rods 119 that form the bottoms of the trays and which have the forward ends thereof turned upwardly to form fingers 120 for preventing leaves of bread from sliding off the trays. The fingers 120 are carried by a series of the trays and are in position to be engaged by the legs or paws 99 on the chains. Carried by the tray frames are shafts 121 having ends 122 projecting from the side faces of the end members 116—117 of the trays to provide trunnions 122 for mounting rollers 123. The rollers have grooved peripheries 124 which engage the lower tracks 125 mounted in driving relation therewith and operating over the sprockets is an endless chain 139 that when the lower chain is driven, the upper chain is also driven in the same direction and at the same relative speed. The lower chain is driven by a sprocket 140 that operates over a sprocket 141 in fixed relation with the sprocket 131'. The chain 140 is in turn driven by a sprocket 142 which is mounted on a driving shaft 143 having a sprocket 144 mounted thereon exteriorly of one of the side plates and which is actuated by a chain 145 driven by a sprocket 146 on the driving shaft of a gear reduction unit 147. The unit 147 is mounted on a bracket 148 on the side plates of the machine and is actuated by a motor 149.

Fixed to the chains 126 and 127 are carriers 150, each including a bar 151 attached to the chain links by ears 152 and 153 of the carriers. The tray carrier also includes a transverse member 154 provided with vertical sides 155, a vertical end 156 and an inclined end 157. The carriers thus described are adapted to be gyrated by the chains so that the transverse members thereof move upwardly under the projecting hubs 158 of the trays to lift the trays while the ears 152 and 153 are at the vertical ends 155 of the carriers of the vertical faces 158 of the carriers for lifting the trays from a track and over the stop at the end thereof as the ears move across the horizontal runs 130 and 134. The trays are thus carried upwardly and away from the ends of the tracks a sufficient amount to clear the stop and then the trays are lowered as the ears move around the peripheral of the sprockets 137 and 131', through the incline portions of the run 130' and 134'. The carriers are tilted during the later movement so that the tray is slightly tilted to set the foremost wheels upon the next lower track. However the carriers continue to move downwardly with the inclined runs of the belt until the rear wheels engage the track. Then, as the carrier continues to move away from the trays, the trays are moved along the lower track into a position to be engaged by lugs on the runs of the main chains associated with that track. The chain links, when they come in engagement with the pins on the ends of the tray, push the trays along to the opposite end of that track until the trays reach the end thereof and are in position to be engaged by a transfer mechanism at that end of the track. The transfer mechanisms are operated only when a tray is in position to be transferred to the next track and in the event a tray has not passed out of position on the next lower track. This is effected by switches controlling operation of the electric motors 149 (as illustrated in the diagram in Fig. 16). The electric motors 149 are supplied with current from service wires 150—151—152 through branch wires 153—154—155 that connect with a motor 149 through a switch 156 that is actuated by an electromagnet 157 to close circuit through the branch conductors 153—154—155 which supply current to the motor 149, it being understood that there is a like circuit for every one of the transfer mechanisms. Mounted at the terminal end of each track at both sides of the machine are normally open switches 159—159 that are in position to be engaged by a tray when a tray reaches the stops at the terminal end of the track (see Fig. 4A). The switches 159—159 are in the circuit including a conductor 160 that connects the switches 159—159 with switch 161 in series with the solenoid winding 157 which has its terminal connected with the branch conductor 153. The solenoid switch 156 also includes a holding section 162 that closes circuit between the conductor 160 and a conductor 163 that connects the stopping switch 164 in series with the conductor 160. With this arrangement the switches 159—159 initially close the circuit to the electromagnet 157 to effect closure of the solenoid switch and start operation of the motor 149 and the holding section of the switch then maintains the solenoid winding in circuit through the conductor 163 until the trans-
ferred tray has reached a position on the next lower track and opened a stop switch 164 to break the holding circuit to the electromagnet 157 whereupon a spring 165 becomes effective in opening the solenoid switch. The switch 164, as above stated, is normally closed and is actuated by a movable bar 166 that is carried at one end by a link 167 and at the other by an actuating arm 160 for the switch 164 (see Fig. 4A). Therefore, if a tray previously transferred is stopped in a position engaging the bar 166, the switch 164 is opened and it is impossible to close the circuit to the motor 149 until the tray, depressing the bar 166, has passed on along the track. Then the transfer mechanism guides the tray into a position to acti-

In order that both slicing and wrapping machines may be simultaneously supplied with loaves of bread, means is provided for discharging the loaves of bread from every other tray onto the conveyor 11 and the loaves of bread on the intermediate trays onto the conveyor 12. Should one of the slicing and wrapping machines be out of service for any reason, provision is made for discharging all of the loaves of bread on the conveyor supplying the other slicing and wrapping machine. When the slicing and wrapping machine is again started the loaves of bread may again be divided between the two machines. This is effected by providing a movable stop bar 207 (Figs. 2 and 3A) in the path of the loaves of bread to cause them to be detained while the tray is still moving forward. The tray on moving out from under the bread leaves no support for the bread and passes over a chute 208 to the first discharge conveyor 11 (see Fig. 18). On advance of the next tray, means is provided for raising the movable bar 207 out of the path of the bread thereon so that the loaves remain on the tray until contacted by a fixed bar 209 (Figs. 2 and 3A) which causes the loaves to be displaced from that tray and they drop upon a chute 210 onto the discharge conveyor 12. Thus with the movable bar in motion the bread is de-

When the slicing and wrapping machine served by the belt 11 is taken out of operation, the movable bar is caused to raise on passage of each tray so that the bread passes the movable bar and is discharged by the fixed bar down the chute 210 to supply the machine which remains in service. If the machine served by the discharge conveyor 12 is out of service then the movable bar remains down and the wheels onto which the bread is discharged down the chute 208 onto the conveyor 11. The actuating these controls is illustrated diagrammatically in Fig. 2.

Also operating in timed relation with the chains 75 is a disk 213 (Fig. 2) that is driven by a chain and sprocket connection 214 from the conveyor chains 75. The disk 213 includes a lug 215 that operates a switch 215 that closes circuits through an electric relay 2 and 3A) which pulls the latch 204 out of position for permitting the next tray to pass. For example, a tray is
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9 released upon each contact of the lug 213' with the actuating arm of the switch 215. When the tray is passed onto the belt 75 a part of the tray contacts a switch 217 that closes circuit to the electromagnet 216 so as to bring the fastened simultaneously the elements of the lug 220. A switch 221 which also closes circuit with the electromagnet mechanism 216 for releasing the latch 204 (Figs. 2 and 3A). The movable bar 207 is raised upon closing of the switch 219 and lowered by a switch 222 (Figs. 2 and 3A) in position to be operated after a tray has passed the bar 207. Switches 223 and 224 (Fig. 12) are also provided in series in the path of the empty trays to stop operation of the latch 204 when the empty tray storage space is filled. Current is supplied to the respective electromagnet mechanisms 216 and 218 and the various switches in circuit therewith from a transformer 225. Also included in the low voltage circuit including conductors 226 and 227. One terminal of each of the switches 215, 219 and 221 is supplied with current through a branch conductor 228 that is connected with the conductor 226. The switches 217 and 222 are connected with the conductor 226 by branch conductors 229 and 230 respectively.

In order to selectively control discharge of the bread to the bread slicing machines in the manner above described, manual switches 231 and 232 (Fig. 2) are provided preferably at the site of the slicing and wrapping machines. The switches 231 and 232 include pairs of contacts 233 and 234 for the switch 231 and 235 and 236 for the switch 232. The contacts 234 are connected in circuit with the switch 222 and the electromagnet mechanism 218 by conductors 237 and 238. The contacts 233 of the switch 231 are connected with the switch 215 through a conductor 239 and with the electromagnet mechanism 216 through a conductor 240. The contacts 236 are connected with the switch 219 and with the electromagnet mechanism 218 through conductors 241 and 242. The contacts 235 of the switch 232 are connected with the switch 219 by a conductor 243. The circuit is completed through the electromagnet mechanisms 216 and 218 by the conductor 237 by branch conductors 245 and 246 respectively. The switch 223 which is actuated by the empty trays is in series with the conductor 227 to open circuit to all of the switch mechanisms just described so that when the empty tray space is filled the various mechanisms cannot be operated to release additional trays until the empty trays have cleared sufficiently to allow for passage of additional trays into the storage space. It is obvious that the switch 223 will operate on the passage of each empty tray and to avoid interference thereof unless the switch has been operated by a stopped tray as when the storage space is filled the switch 224 is connected in parallel or in bypass relation with the switch 223 by means of a conductor 247. Therefore, both switches 223 and 224 must be open before the control circuits are opened.

Assuming that the apparatus constructed as described is in operation with all the various motors and switches connected with a suitable current source, and further assuming that loaves of bread are being supplied to the conveyor 2 with the length of the loaves arranged transversely thereof and in consecutive side to side relation, when the foremost empty tray on the off take tracks 199 has moved into position adjacent the conveyor 2 to contact with 200. The switch 200 is closed to the operation of the pusher mechanism 201 which pushes the loaves of bread endwise onto the tray waiting to receive them, as shown in Fig. 4 of the drawings. When the pusher mechanism reaches the limit of its stroke the switch 202 is closed to energize the motor 177 (Fig. 3) which actuates the elevator 14 and empty pan lowering conveyor 13. As a carrier 173 moves under the sprockets 169 the sockets 175 and 176 thereof enter into position for engaging the projecting portions 130 and 131 of the chains to engage the projecting portions 125 at the ends of that tray. The carrier then moves upwardly from the sprockets 169 a part thereof engages the switch 203 (Fig. 4) to stop operation of the motor 177 (Fig. 3). Upon removal of the first tray from the tracks 199, the following tray moves into position for closing the switch 204, which again sets the pusher mechanism into operation to push another row of loaves of bread from the conveyor 2 onto that tray. It is to be understood that the conveyor 2 is automatically stopped when the bread has been advanced in sufficient quantity to fill a tray, and after the bread is pushed therefrom the conveyor is started to carry another supply of loaves into position for filling a tray.

The operations thus far described are intermittent but progressive so that trays of bread are being carried to the top of the elevator for admission into the cooling chamber. When the tray carriers move above the upper sprocket 170 and start to descend on the opposite side, the trays are lowered onto the tracks of the upper angles 6 with the grooved peripheries 124 of the wheels 123 engaging the flanges 16 of the angles 6. The carriers continue their movement leaving the tray deposited on the angles 6 so that the tray is engaged by the lugs 56 on the chains 45 which move the tray along the tracks onto and onto the portion thereof where they are picked up by the lugs on the main chains 31. The chains 31 advance the trays to the discharge end of the angle 6 and onto the conveyor 59 which moves the first of the trays into position to be engaged by the transfer mechanism "A" so that the tray is lowered onto the flanges 123 of the next lower angle 7. The tray is continued along the tracks 7 and transferred to the tracks 6' and so on until the tray reaches the tracks of the angles 8, it being understood that the one tray is followed by additional filled trays so that trays of bread are continuously moved through the cooling chamber in a zigzag path from the top of the chamber to the lower portion thereof where the loaves of bread are discharged from the trays to the conveyors 11 and 12 leading to the slicing and wrapping machines.

Should for any reason trays be stopped on any one of the tracks as, for example, when the tracks are full to the point where one tray is pushing the other and the foremost tray is stopped, the paws 56 yield against action of the springs 107 and ride under the lugs 184 or 105 as the case may be (Fig. 15). The various conveyor mechanisms continue to operate to move the trays that are free to advance. Transfer of the trays is effected when a tray reaches the end of a track and moves into position to be engaged by the tray carriers 150 of the transfer mechanisms. When a tray reaches the end of the track it engages the switches 158 and 159 to close circuit through the conductor 160, solenoid winding of the switch 156 and conductor 157 to close contacts of the switch 156 for energizing the motor 149 which operates the transfer mechanism.

When the motor is energized the chains 126 and 127 of the transfer mechanism start operation in an anti clockwise direction (60). The motor 150 moves the tray carriers 150 upwardly from the vertical run 130 and 131 of the chains to engage the projecting portions 125 at the ends of that tray. The tray will then be lifted from the tracks so as to clear the stops 95. As the carrier is moved along the horizontal runs 130 and 134 of the chains, the tray is moved into position so that the rear edge clears the end of the track and the carriers move bodily to the inclined runs 130' and 134' the wheels of the tray are deposited on the next lower track so that the lugs 56 on the chains associated therewith start movement of the
tray in reverse direction along said next lower tracks to the discharge end where the tray is again transferred by the transfer mechanism "B" in the same manner as just described. When a tray engages the wheels 74 the wheels move the tray into position where it is engaged by the lugs on the next conveyor.

Assuming that the bread from every other tray is to be moved onto the conveyor 11 and the bread from the intermediate tray onto the conveyor 12, both manual switches 231 and 232 are closed. When the tray is moved onto the conveyor 75 it engages the switch 217 to bring the latch 284 into position for stopping the following tray. Since the cam disk 213 is driven in timed relation with movement of the lugs 207 on the conveyor 75, the switches 221 and 219 are closed. Current then passes through the conductor 228, conductor 241, conductor 242, electromagnet mechanism 218 and conductor 246 to raise the bar 207 and permit passing of the loaves on the tray thereunder to a position where they are engaged by the fixed bar 209. As the tray continues its advancement by the conveyor 75 the bread is detained by the fixed bar but the tray moves thereunder so that the loaves of bread are pushed off the rear of the tray and slide down the chute 210 onto the conveyor belt 12 (see Fig. 2). Similarly, tray 235 is kept closed by the switch 235 so that current flows by way of the conductors 228, 243, switch contacts 235, conductors 240 to the electromagnet mechanism 216 and conductors 245 to cause the latch 204 to release the following tray which, on engaging the switch 217, causes the latch mechanism 216 to move the pawl 294 into position for detaining the next following tray. The tray, which has been released, is then advanced by the conveyor 75 but by this time the switches 221 and 219 have opened so that no current flows to the electromagnet mechanism 218. The bar 207 therefore remains in its lowered position for detaining the loaves of bread, the bar having been depressed as the previous tray closed the switch 222 to effect energization of the electromagnet 218 for returning the bar 207 to its lower position. The loaves of bread are then detained by the bar 207 while the tray moves therefrom. The bread drops down the chute 230 to the conveyor 11. By this time the lug 213' has closed the switch 215 to release the following tray. The lug 220 then moves into position so as to effect raising of the bar 207. The fixed bar 209 is then the effective bar so that the loaves of bread are discharged onto the chute 12. Thus loaves of bread are supplied alternately to both slicing and wrapping machines.

Assuming that the slicing and wrapping machine served by the conveyor 12 is taken out of service, the manual switch 231 is opened so that the electromagnet mechanism 218 operated thereby does not raise the bar 207. Therefore the bread on every tray drops onto the chute leading to the conveyor 11. Likewise, if the slicing and wrapping machine served by the conveyor 11 is taken out of service the switch 231 is opened and the switch 232 closed. Therefore, closure of the switch 215 by the lug 213' of the cam disk 213 has no effect on the latch 204 but the switches 221 and 219 are effective in releasing the trays and raising the movable bar 207 so that all of the bread passes the bar 207 and is detained by the fixed bar 209 to be discharged onto the chute 12.

Should the empty tray storage space be full of trays as, for example, in case the supply of bread has stopped to the conveyor 2. When this happens, the foremost tray moving into position adjacent the conveyor 2 has closed the switch 205 and the elevator is stopped by the tray closing the switch 200 to actuate the pusher 201. The pusher will open up until there is no bread to be pushed onto the waiting tray and against the fingers 120 thereof, the switch 292 will not close therefore the elevator remains stopped and the empty trays may accumulate to completely fill the storage space to the point where switches 223 and 224 are effective in opening the circuit which releases the latch 204 so that the latch 204 cannot operate but will remain in position to detain the filled trays. The filled trays are thus delayed and backed up along the various trays until the empty trays will not clear the switches 223 and 224. During this time trays will be stopped on the respective tracks, with one tray stopping the following tray. When the stopped trays collect on the tracks in edge to edge contact thereby increasing the storage capacity. Thus the tracks automatically become storage space for the filled trays. It is obvious that the lower tracks likewise provide storage for the empty trays and that the trays are always in position at the delivery end of the track formed by the angles 8'. When an empty tray reaches the end of the angles 8' it is transferred by the transfer mechanism "G" to the tracks 9 and from the track 9 to the track 10 by the transfer mechanism "H," and from the track 10 to the tracks 8 by the transfer mechanism "I." When an empty tray reaches the end of the tracks 8', the tray is thus lifted and the tray hangs from the carriers 197 as it is carried over the sprockets 192 and downwardly between descending runs 195 of the chains, as shown in Fig. 4. When the carrier passes the idle sprockets 196 and moves downwardly towards the sprockets 199, the tray hangs in position so that the lower edge thereof engages the cam tracks 199 (Fig. 4). Continued movement of the forward portion of the tray carries the tray into horizontal position so that the front portion engages the tracks 199 while the rear portion slides off the cam into engagement with the tracks 199.

It is thus obvious that I have provided a conveyor mechanism for handling of bread between the oven and the slicing and wrapping machines which includes a plurality of independent trays adapted to be loaded and automatically moved through the cooling zone in accordance with discharge rate of bread from the oven and to provide holder of the bread on the conveyor mechanisms in case the slicing and wrapping machines are not operating to take care of the oven discharge.

It is also obvious that the slicing and wrapping machines may continue to operate on the supply of bread that is capable of being supplied by the present improved automatic conveyor. Also the bread may be delivered to all or any of a plurality of slicing machines as cases may demand making the apparatus extremely flexible to the output as well as to a widely variable input.

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

1. An apparatus for carrying articles through a treating zone from a receiving station to a discharging station including a plurality of trays for containing said articles, means moving the trays in successive order through the treating zone from the receiving station to the discharge station, means in the path of the trays for discharging the articles at the discharge station, and means for receiving empty trays from the discharge station and for returning the empty trays to the receiving station for retrieval through the treating zone including means for storing the empty trays in idle position when trays are being moved from said discharge means to said returning means.

2. A conveyor mechanism including, a plurality of superimposed pairs of tracks, trays having wheels adapted for free rolling support on the tracks, means for moving the trays along said tracks, tray-transfer means at terminals of the tracks to transfer the trays from one pair of tracks to a lower pair of tracks, said tray-transfer means including a tray carrier, means for moving the carrier downwardly for rolling support of the tray on the pair of tracks in the lower pair of tracks, said connections being arranged to tilt the carrier when the carrier is in position to roll by gravity onto said next lower pair of tracks, and means responsive to the presence of stored trays on said tracks for controlling operation of the transfer means, and said
moving means being releasable from the trays with the trays free and floating upon said moving means to provide storage of the trays on the tracks while other trays are being advanced on the tracks.

An apparatus for carrying said articles through a treating zone including a plurality of trays for containing said articles, means for moving the trays in successive order through the treating zone from a receiving station to a discharge station, means for discharging the articles at the discharge station, means for storing the trays containing said articles intermediate the receiving and discharge stations to compensate for any variation in discharge and receiving rate of said articles, and means for returning the trays to the receiving station for retrieval through the treating zone including means for storing the empty trays.

An apparatus for carrying articles through a treating zone including a plurality of trays for containing said articles, means for moving the trays in successive order through the treating zone from a receiving station to a discharge station, means spaced along the tray-moving means for engaging the trays and moving the trays in spaced relation, said tray-engaging means being releasable responsive to pressure-resisting advance of the trays and reengageable with a forward tray upon release of said pressure, and means in the path of the trays for discharging the articles from the trays, means for storing the empty trays, and means for returning the empty trays to the receiving station.

5. An apparatus for carrying articles through the treating zone including trays for containing said articles, means for moving the trays progressively in consecutive order in a zig-zag path through the treating zone from a receiving position to a discharging position, means spaced apart and having upper and lower runs, tracks extending along said runs, a tray having opposite ends supported on the tracks, means on the chains and adapted to engage a part at the respective ends of the tray to move the tray from one end of the tracks to the other, tray-transfer means at the respective ends of the tracks, means for actuating the transfer means to transfer the tray from one track to the other for return movement in the opposite direction whereby the tray is moved in alternate directions from the upper track to the lower of said tracks, and means for stopping succeeding trays while the transfer means is in motion, said engaging means on the chains being releasable from the trays when the trays are stopped by said stopping means.

6. A conveyor mechanism including a plurality of superimposed chains arranged in pairs with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, trays having opposite ends supported on the tracks, means on the chains and adapted to engage a part at opposite ends of the trays to move the trays from one end of the tracks to the other, tray-transfer means at the respective ends of the tracks, means for actuating the transfer means to transfer the trays to the next lower tracks for movement in the opposite direction whereby the trays are moved in alternate directions from the upper pair of tracks to the lower pair of tracks, said tray-transfer means including a tray carrier in tray-receiving position, upper and lower endless chains at the respective ends of the tray carrier, motor actuated means for actuating said last named chains, and means connecting the chains with the carrier for movement of the carrier by chains onto position with the next lower pair of tracks and said connections being arranged to tilt the carrier when the carrier is in position relative to said lower pair of tracks for rolling movement of a tray onto said tracks.

10. A conveyor mechanism including a plurality of superimposed pairs of chains with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, trays having rolling support on the tracks, means on the chains and adapted to engage a part at opposite ends of the trays to move the trays from one end of the tracks to the other, tray-transfer means at terminals of the respective tracks to transfer the trays to the next lower tracks for movement in the opposite direction whereby the trays are moved in alternate directions from the upper pair of tracks to the lower pair of tracks, said tray-transfer means including a tray carrier in tray-receiving position, upper and lower endless chains at the respective ends of the tray carrier, motor actuated means for actuating said last named chains, and means connecting the chains with the carrier for movement of the carrier by chains onto position with the next lower pair of tracks and said connections being arranged to tilt the carrier when the carrier is in position relative to said lower pair of tracks for rolling movement of a tray onto said tracks, and means responsive to operation of said chains of the transfer means for detaching a following tray during transfer of a preceding tray.

11. A conveyor mechanism including a plurality of superimposed pairs of chains with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, trays having rolling support on the tracks, means on the chains and adapted to engage a part at opposite ends of the trays to move the trays from one end of the tracks to the other, said engaging means on the chains being releasable from the trays when the trays are stopped by said stopping means, and means for stopping the transfer means upon presence of an interfering tray on the lower track.
alternate directions from the upper pair of tracks to the lower pair of tracks, said tray-transfer means including a tray carrier, said tray receiving position at said terminal, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to-tracking contact with the next lower pair of tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll by gravity onto said next lower pair of tracks.

13. A conveyor mechanism including, a plurality of superimposed pairs of tracks, a tray having wheels adapted for rolling support on the tracks, means for moving the tray along said tracks, tray-transfer means at terminals of the tracks to transfer the tray from one pair of tracks to a lower pair of tracks, said tray-transfer means including a tray carrier in tray-receiving position at said terminal, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to-tracking contact with the next lower pair of tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll by gravity onto said next lower pair of tracks.

14. A conveyor mechanism including, a plurality of superimposed pairs of tracks with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, a tray having wheels supported on the tracks, means on the chains and adapted to engage a part at the respective ends of the tray to move the tray from one end of the tracks to the other, tray-transfer means at the terminals of the respective tracks to transfer the tray to the next lower tracks for movement in the opposite direction whereby the tray is moved in alternate directions from the upper pair of tracks to the lower pair of tracks, said tray-transfer means including a tray carrier in tray-receiving position at said terminal, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to tracking contact with the next lower pair of tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll by gravity onto said next lower pair of tracks.

15. A conveyor mechanism including, a plurality of superimposed pairs of tracks with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, a tray having wheels supported on the tracks, means on the chains and adapted to engage a part at the respective ends of the tray to move the tray from one end of the tracks to the other, tray-transfer means at the terminals of the respective tracks to transfer the tray to the next lower tracks for movement in the opposite direction whereby the trays are moved in alternate directions from the upper track to the lower track of said tracks, said tray-transfer means including a tray carrier in tray receiving position at the end of a pair of the tracks, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to tracking contact with the next lower tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll onto said next lower tracks.

16. A conveyor mechanism including a plurality of superimposed pairs of tracks with the chains in each pair spaced apart and having upper and lower runs, tracks extending along said runs, a tray having wheels supported on the tracks, means on the chains and adapted to engage a part at the respective ends of the tracks to move the tray from one end of the tracks to the other, tray-transfer means at the respective ends of the tracks to transfer the tray from one track to the other, tray-transfer means at the respective ends of the tracks to transfer the tray from one track to the other for return movement in the opposite direction whereby the trays are moved in alternate directions from the upper track to the lower track of said tracks, said tray-transfer means including a tray carrier in tray receiving position at said terminal, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to tracking contact with the next lower tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll onto said next lower tracks, driving means for said chains, means operable through pressure of a tray to effect operation of the driving means to effect transfer of the tray by said carrier, and means for holding a succeeding tray from moving into said transfer position while a tray is being transferred.

17. An apparatus for carrying bread from a baking oven through a cooler to a bread wrapper wherein the baking oven and bread wrapper have differentially variable capacities, said apparatus including, a plurality of trays, superimposed horizontal tracks in the cooler for supporting the trays in successive order, means for moving the trays progressively along the tracks, tray-transfer means connecting the end of one track with a start of a next lower track for transferring the foremost tray on an upper track to the next lower track, means for carrying bread from the oven, means for loading the bread on the trays for movement through the cooler, means between one of the tracks and the next lower track for discharging bread from the trays, a conveyor in receiving relation with the discharge means for carrying the bread to the bread wrapper, means for conveying empty trays from the lowermost track to the bread loading means, means responsive to the presence of an empty tray stopped at said bread discharge means for stopping movement of the following loaded tray to progressively stop the loaded trays as they reach the stopped trays, means responsive to presence of a stopped tray at the receiving end of each track for controlling operation of the corresponding tray transfer means, means at the discharge end of each track and connected with the transfer means for stopping the trays during operation of the respective tray transfer means, and latch means on the tray moving means for engaging and normally moving the trays in spaced relation along the respective tracks and releasable from engagement with the trays when a tray engaged thereby reaches a stopped tray to compensate for differentially variable capacities between baking oven and bread wrapper.

18. An apparatus for carrying bread from a baking oven through a cooler to a bread wrapper wherein the baking oven and bread wrapper have differentially variable capacities, said apparatus including, a plurality of trays, conveyor means for carrying the baked bread from the oven, means for loading the bread onto the tracks, trays in the cooler for supporting the trays in successive order, means for moving the trays progressively along the tracks, tray-transfer means at the respective ends of the tracks to transfer the tray from one track to the other, tray-transfer means at the respective ends of the tracks to transfer the tray from one track to the other for return movement in the opposite direction whereby the trays are moved in alternate directions from the upper track to the lower track of said tracks, said tray-transfer means including a tray carrier in tray receiving position at the end of a pair of the tracks, upper and lower endless chains at the respective ends of the carrier, and means connecting the chains with the carrier for movement of the carrier along with chains downwardly to tracking contact with the next lower tracks and said connections being arranged to tilt the carrier when the carrier is in position to roll onto said next lower tracks.
gressively along the tracks, means for discharging bread from the trays as the trays are moved through said discharge means, a conveyor in receiving relation with the discharge means for carrying the bread to the bread wrapper, means for conveying empty trays to the loading station responsive to the presence of an empty tray stopped at said bread discharge means for stopping movement of the following loaded tray to progressively stop the loaded trays as they reach the stopped tray, and latch means on said tray moving means for engaging and normally moving the trays in spaced relation along the tracks and releasable from engagement with the trays when a tray engaged thereby reaches a stopped tray to compensate for differentially variable capacities between baking oven and bread wrapper.

19. An apparatus for carrying bread from a baking oven through a cooler to a bread wrapper wherein the baking oven and bread wrapper have differentially variable capacities, said apparatus including, a conveyor for carrying the baked bread from the oven to the cooler, a plurality of trays, superimposed horizontal tracks in the cooler for supporting the trays in successive order, means for moving the trays progressively along the tracks, tray transfer means connecting the end of one track with a start of a next lower track for transferring the foremost tray on an upper track to the next lower track, means between one of the tracks and the next lower track for discharging bread from the trays as the trays are moved through said discharge means, a conveyor in receiving relation with the discharge means for carrying the bread to the bread wrapper, a tray elevator between the first named conveyor and the uppermost tracks, means for conveying empty trays from the lowermost track to the elevator, means for pushing bread from the said first named conveyor and loading an empty tray at the delivery end of the said last named conveyor means, means for operating the elevator to carry the loaded tray to the receiving end of the uppermost track, means responsive to presence of an empty tray for actuating the pusher, means on the pusher to effect starting of the elevator when the bread is deposited on the empty tray, means actuated by a following empty tray for stopping the elevator operating means when in position to effect actuation of the pusher and to stop the following trays that have passed the bread discharge means, means responsive to the presence of an empty tray stopped at said bread discharge means for stopping movement of the following loaded tray to progressively stop the loaded trays as they reach the stopped trays, means responsive to presence of a stopped tray at the receiving end of each track for controlling operation of the corresponding tray transfer means, means at the discharge end of each track and connected with the transfer means for stopping the trays during operation of the respective tray transfer means, and latch means on the tray moving means for engaging and normally moving the trays in spaced relation along the uppermost tracks and releasable from engagement with the trays when a tray engaged thereby reaches a stopped tray to compensate for differentially variable capacities between baking oven and bread wrapper.

20. An apparatus for carrying articles from a receiving station through a treating zone to a discharge station, including a plurality of individual trays adapted for containing articles of bread, means for moving the trays progressively in consecutive order along said guide means through the treating zone from a receiving position to a discharging position, tray-engaging means, and means movable supporting the tray-engaging means in spaced apart relation on the tray-moving means for engaging and moving the trays in spaced relation along said guide means, said tray-engaging means being movable to release the trays responsive to a holding pressure on the leading edge of the trays to bunch the trays in edge to edge relation on said guide means, and said engaging means being reengageable with the foremost trays to reestablish said spacing of the trays along said guide means when the pressure is relieved.

21. An apparatus for carrying loaves of bread through a treating zone including trays for containing said loaves of bread, guide means for forming a zigzag path for the trays in the treating zone, means for moving the trays progressively in consecutive order along said guide means through the treating zone from a receiving position to a discharging position, tray-engaging means, and means movable supporting the tray-engaging means in spaced apart relation on the tray-moving means for engaging and moving the trays in spaced relation along said guide means, said tray-engaging means being movable to release the trays responsive to a holding pressure on the leading edge of the trays to bunch the trays in edge to edge relation on said guide means, and said engaging means being reengageable with the foremost trays to reestablish said spacing of the trays along said guide means when the pressure is relieved.

22. An apparatus for carrying loaves of bread from a receiving station through a treating zone to a discharge station, including a plurality of individual trays adapted for containing loaves of bread, means for moving the loaves of bread into the trays, means for carrying the trays in spaced apart relation to the receiving station, guide means extending through the treating zone for supporting the trays, means for moving the trays in consecutive order along the guide means for carrying the loaves of bread through the treating zone from the receiving station to the discharge station, tray pickup means on said moving means at spaced points thereon substantially corresponding to the rate of delivery of the trays by said carrying means, said trays having a part adapted to be engaged by a pickup means as each tray is delivered at the receiving station to maintain normally the spaced apart relation of said trays along said paths, said tray moving means including transfer means at the ends of the paths to transfer the trays from one path to the next, and means for stopping the trays on said paths when a tray is being transferred by the transfer means.

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