United States Patent

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[33] **Germany**
[31] **H 62241**

[54] **APPARATUS FOR TRANSPORTING RECEPTACLES FOR CIGARETTES OR THE LIKE**
22 Claims, 20 Drawing Figs.

[52] **U.S. Cl.** **214/89,** 198/20, 198/177
[51] **Int. Cl.** **B65g 17/16**
[50] **Field of Search** ..... 214/89, 730, 16.42, 313, 1 RCM; 198/20, 118, 177, 38

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ABSTRACT: A load-unload unit which transfers cages for cigarette trays between carriages traveling with the chain of an overhead conveyor and tray-receiving and tray-discharging stations in a cigarette-producing or cigarette-packing machine. The unit comprises an upright column which may be moved along the ground and supports a vertically reciprocable lifter for a rotator which can move a carrier for cages about the axis of the column. The carrier has a fork or plate which can support one cage at a time, and the entire carrier or its fork is turnable or tiltable about a horizontal axis. A parallel mechanism is provided to maintain the fork in a desired position of inclination during rotation of the carrier about the horizontal and/or vertical axis.

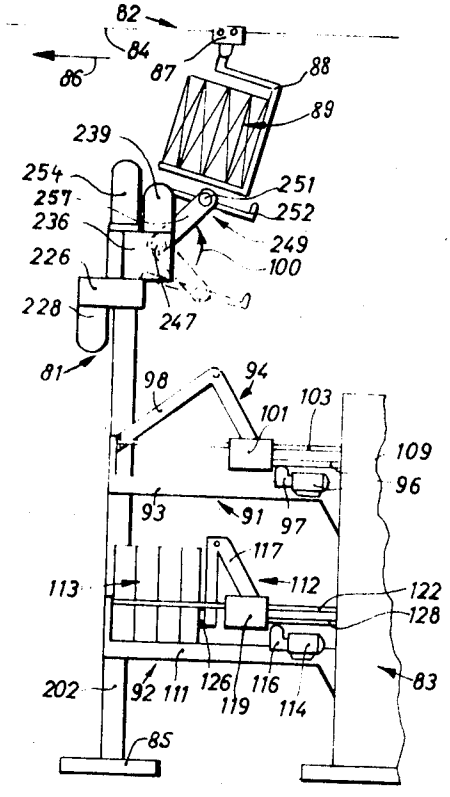


Fig.1

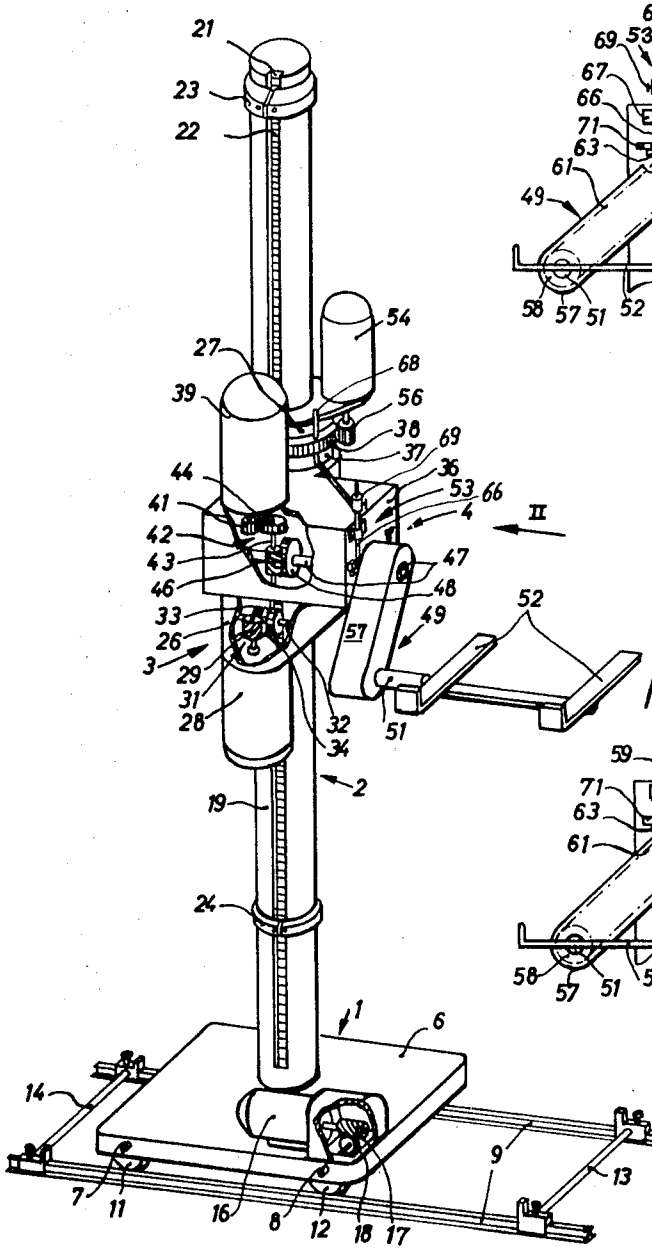


Fig.2

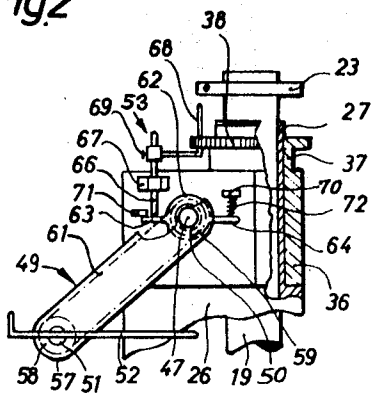
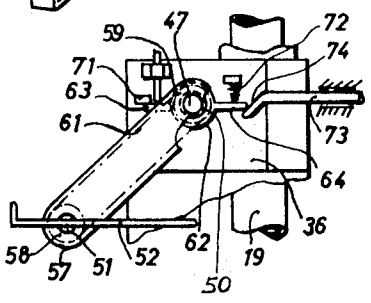


Fig.3



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Fig4a

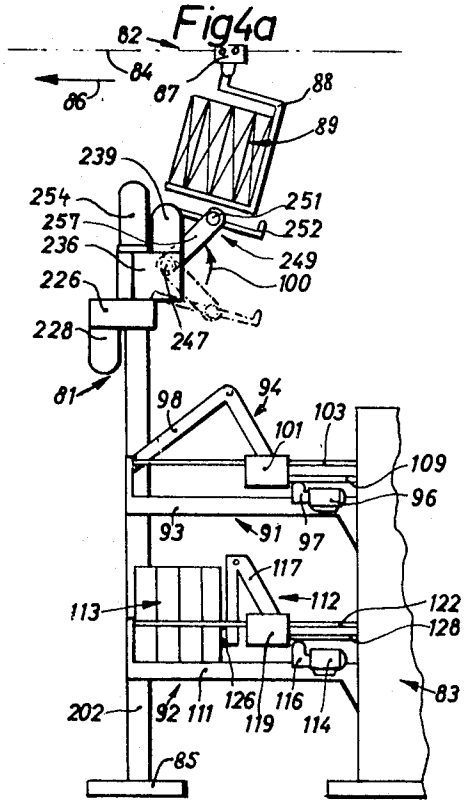


Fig5a

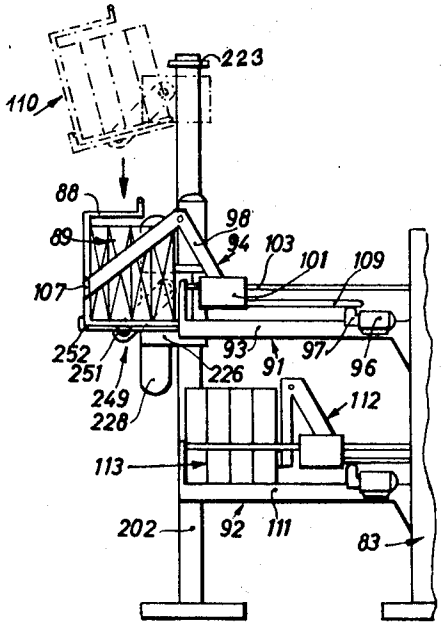


Fig4b

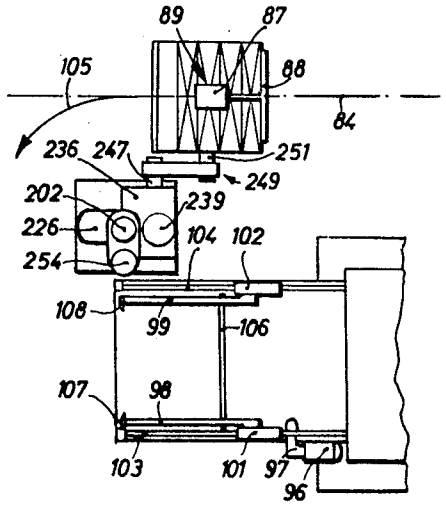
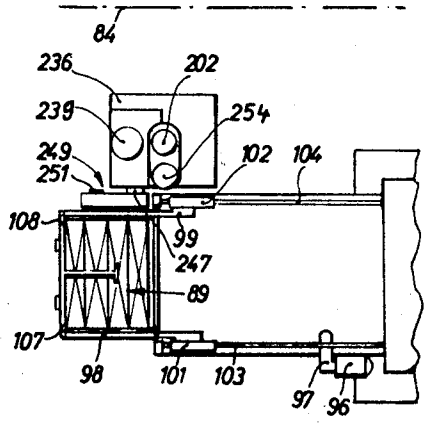


Fig5b



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Fig6a

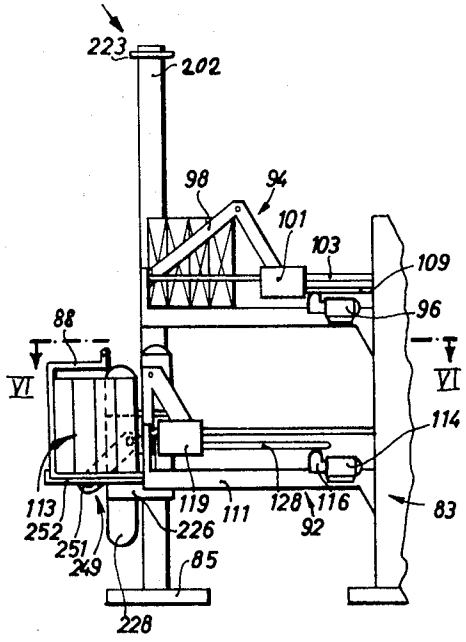


Fig7a

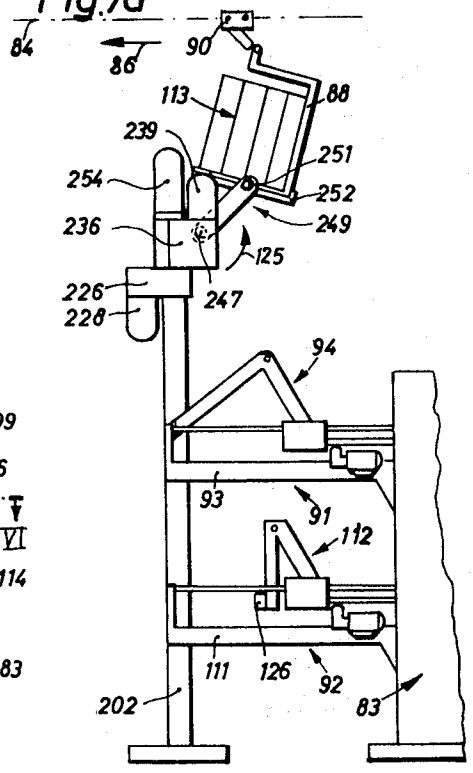


Fig6b

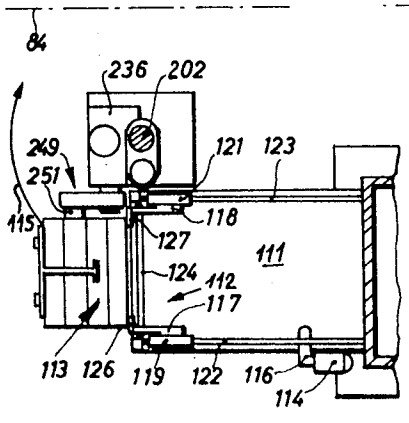
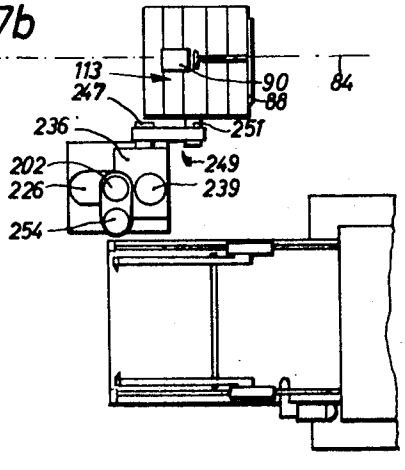


Fig7b



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Fig.8

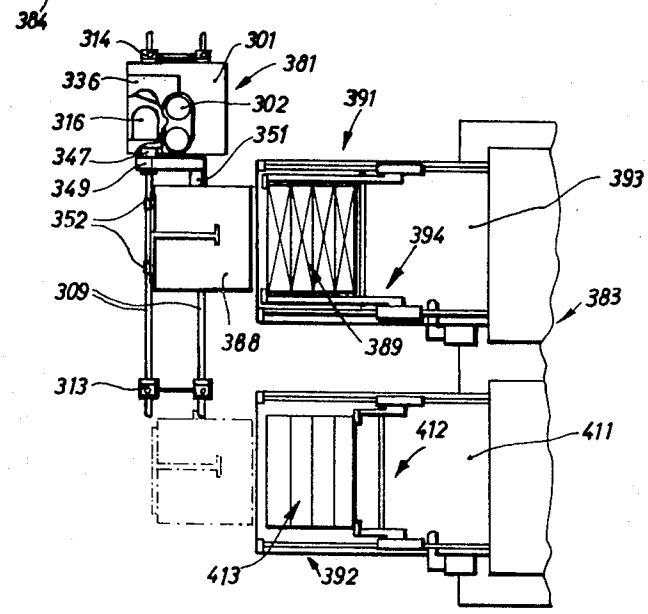


Fig.9

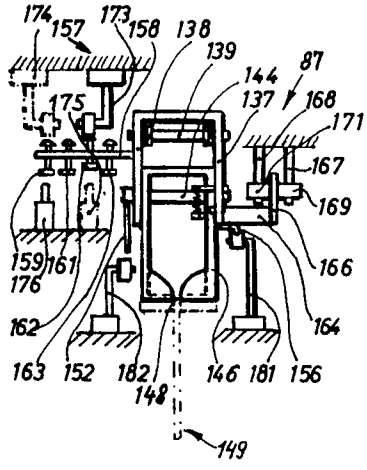
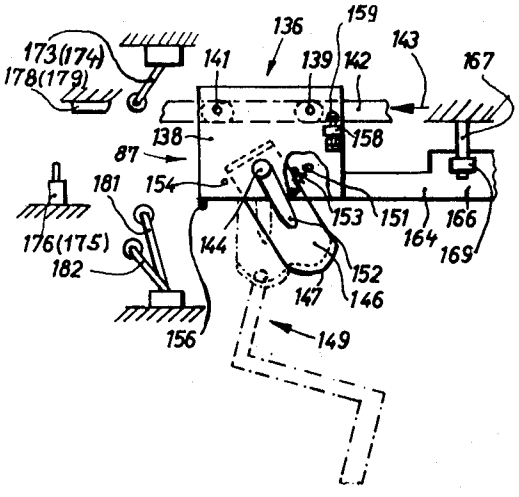


Fig.10



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Fig.11

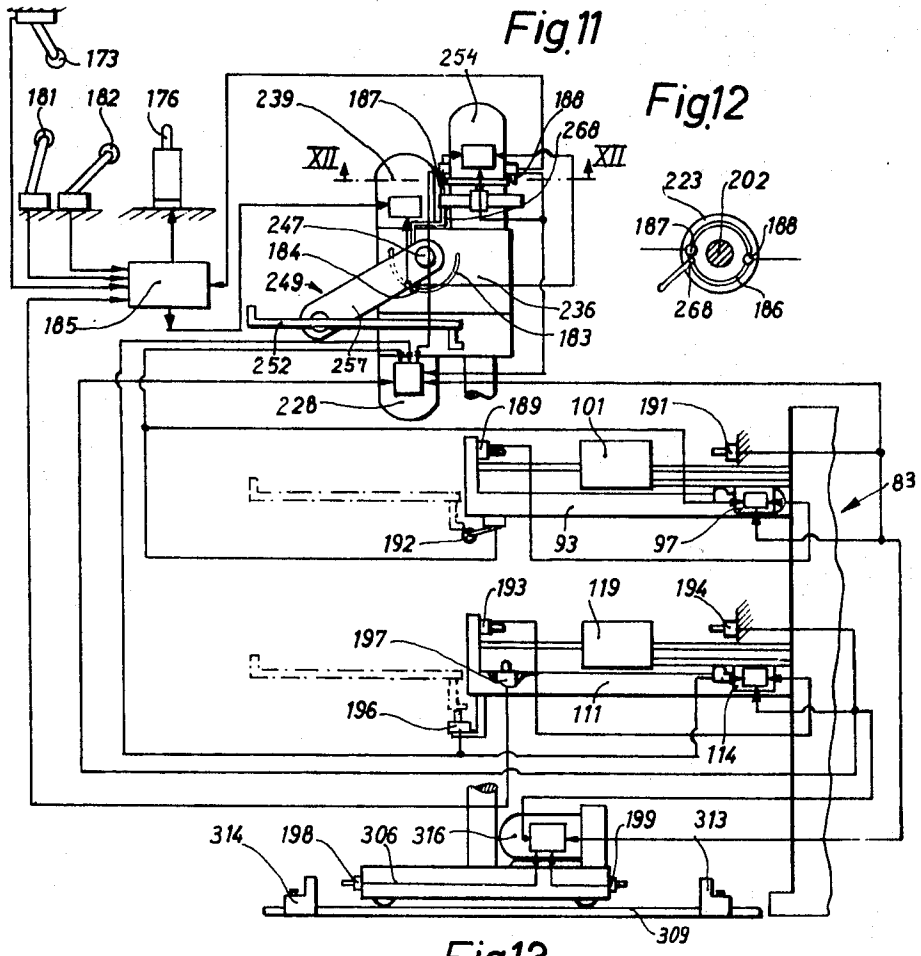
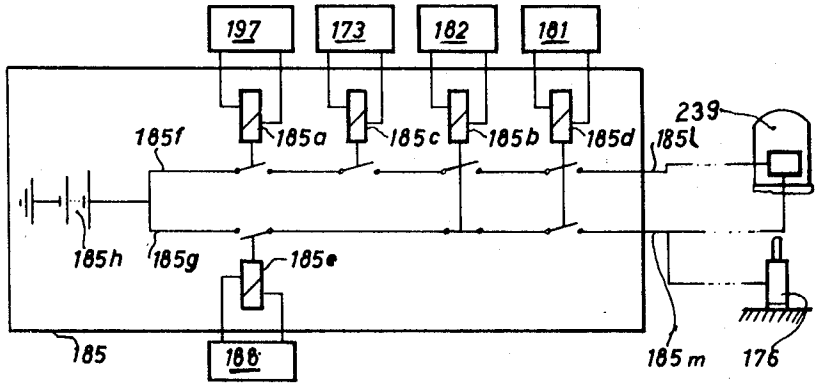


Fig.12

Fig.13



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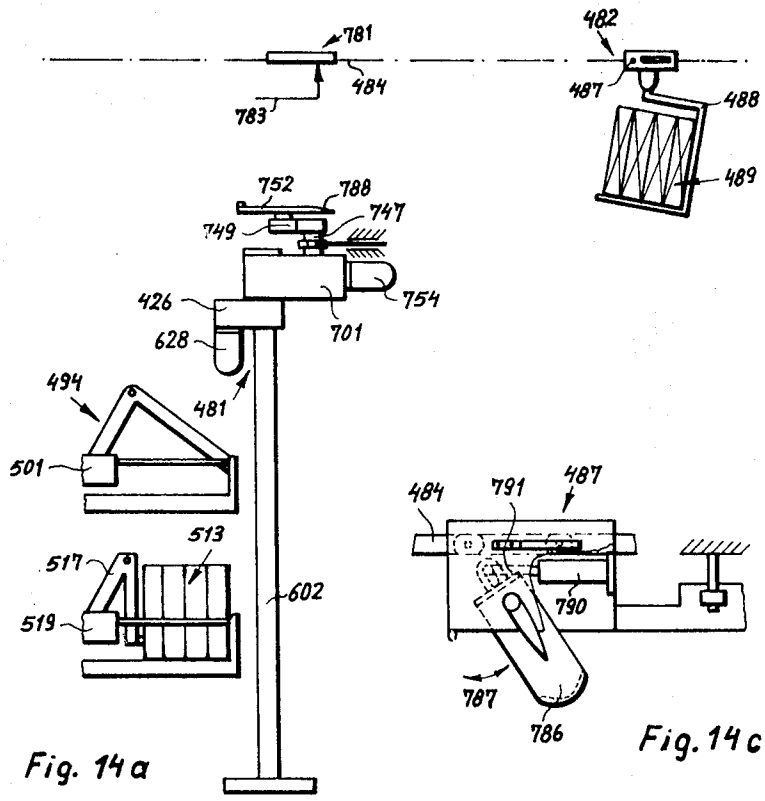


Fig. 14a

Fig. 14c

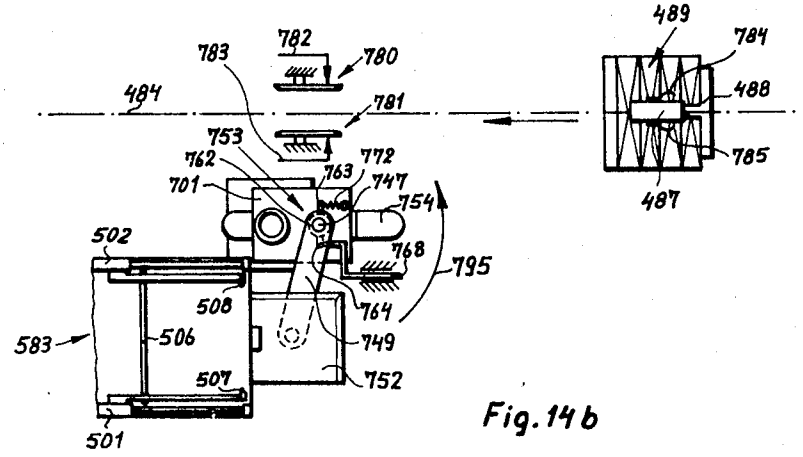


Fig. 14b

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APPARATUS FOR TRANSPORTING RECEPTACLES FOR CIGARETTES OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for transporting receptacles, particularly for transporting chargers or trays for cigarettes, cigars, cigarillos, filter rods, filter rod sections or like rod-shaped commodities. More particularly, the invention relates to improvements in apparatus of the type wherein an endless conveyor transports individual trays or cages for one or more trays along an endless path and past one or more cigarette producing and one or more cigarette-consuming machines each of which receives one type of trays and discharges another type of trays. Thus, a producing machine receives empty trays and discharges filled trays whereas a consuming machine e.g., a cigarette-packing machine) receives filled or loaded trays and discharges empty trays.

A serious drawback of presently known apparatus which are employed for transportation of empty and filled trays between consuming and producing machines is that the so-called load-unload units which transfer trays between the carriages of an endless conveyor and one or more consuming or producing machines occupy too much room, that the controls which initiate automatic transfer of trays between the conveyor and a machine when such machine requires fresh trays or must discharge trays occupy too much space and are overly complicated, as well as that the transfer of trays between the conveyor and a machine takes up too much time. Furthermore, known apparatus are not sufficiently versatile, i.e., they cannot be used for transportation of different types of trays.

SUMMARY OF THE INVENTION

It is an object of my invention to provide an apparatus wherein the transfer unit which transports trays or other types of receptacles between a conveyor and a consuming or producing machine occupies little room, wherein the transfer unit can move receptacles from the conveyor to a machine or vice versa, wherein the transfer unit can transfer receptacles within short intervals of time, and wherein such transfer unit can automatically maintain the receptacles in an optimum position for attachment to the conveyor or for introduction into a machine.

Another object of the invention is to provide a novel control system which can effect automatic transfer of receptacles between a conveyor and one or more consuming or producing machines.

A further object of the invention is to provide an apparatus which can manipulate different types of receptacles, either singly or in groups of two or more.

An additional object of the invention is to provide a novel transfer unit or load-unload unit which can be used in an apparatus of the just outlined character.

Still another object of the invention is to provide a transfer unit which can simultaneously manipulate different types of receptacles, for example, larger receptacles which accommodate one or more smaller receptacles.

A concomitant object of the invention is to provide a unit which can transfer individual receptacles or groups of receptacles between a conveyor and a machine wherein the stations which respectively receive and discharge receptacles are located at the same level, at different levels, close to each other, at a substantial distance from each other and/or in any other position which is best suited for the particular type of machine.

The improved apparatus comprises a transporting conveyor (preferably an endless overhead conveyor) having travelling carriages arranged to support detachable receptacles for travel along a predetermined path, at least one receptacle receiving station and at least one receptacle-discharging station adjacent to such path, and a transfer unit for transferring receptacles between the carriages of the conveyor and at least one of the stations. The transfer unit comprises carrier means having a portion arranged to support receptacles during transfer between the one station and the carriages, means for moving the carrier means along an arcuate path, and means for changing the orientation of the supporting portion of the carrier means.

The arcuate path may be an endless circular path which is located in a horizontal or in a vertical plane. The means for changing the orientation may include means for tilting that portion of the carrier means which supports a receptacle. Furthermore, the transfer unit is preferably provided with a parallel mechanism for maintaining the receptacle-supporting portion of the carrier means in a predetermined position of inclination during movement of carrier means along the arcuate path.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a perspective view of a transfer unit which can be utilized in an apparatus embodying one form of my invention;

FIG. **2** is a side elevational view of a portion of the transfer unit as seen in the direction of arrow II in FIG. **1**, the carrier means of the transfer unit being shown in the upper end position;

FIG. **3** is a similar side elevational view of a portion of a modified transfer unit;

FIG. **4***a* is a fragmentary side elevational view of an apparatus which utilizes a transfer unit similar to the one shown in FIG. **1**, the carrier means of the transfer unit being shown in a position in which it is about to receive a group of loaded trays from a carriage of an endless overhead conveyor;

FIG. **4***b* is a top plan view of the structure shown in FIG. **4***a*;

FIG. **5***a* is a side elevational view similar to that shown in FIG. **4***a* but illustrating the carrier means of the transfer unit in a position in which the group of trays carried thereby is about to be transferred into a consuming machine of the apparatus;

FIG. **5***b* is a top plan view of the structure shown in FIG. **5***a*;

FIG. **6***a* is a side elevational view of the structure shown in FIG. **4***a* or **5***a* but showing the carrier means of the transfer unit in a position it assumes during reception of a group of empty trays from the consuming machine;

FIG. **6***b* is a horizontal sectional view as seen in the direction of arrows from the line VI—VI of FIG. **6***a*;

FIG. **7***a* is a side elevational view of the structure shown in FIG. **4***a*, **5***a* or **6***a* but showing the carrier means of the transfer unit in a position it assumes during attachment of a cage containing a group of empty trays to a travelling carriage of the conveyor;

FIG. **7***b* is a top plan view of the structure shown in FIG. **7***a*;

FIG. **8** is a fragmentary top plan view of a different apparatus which embodies a modified consuming machine;

FIG. **9** is an end elevational view of a carriage;

FIG. **10** is a side elevational view of the carriage shown in FIG. **9**;

FIG. **11** is a diagrammatic view of the control circuit in the apparatus of FIGS. **4***a* to **7***b*;

FIG. **12** is a fragmentary horizontal sectional view as seen in the direction of arrows from the line XII—XII of FIG. **11**; FIG. **13** illustrates the details of an electrical control unit in the circuit of FIG. **11**;

FIG. **14***a* is a fragmentary side elevational view of a further apparatus wherein the carrier means of the transfer unit is rotatable about a vertical axis which is parallel to the axis of the upright support of the transfer unit;

FIG. **14***b* is a top plan view of the structure shown in FIG. **14***a*; and

FIG. **14***c* is an enlarged side elevational view of a carriage in the conveyor of the apparatus shown in FIGS. **14***a* and **14***b*.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 to 3, there is shown a load-unload unit (hereinafter called transfer unit for short) which is employed to transfer larger receptacles or cages for groups of smaller receptacles in the form of cigarette chargers or trays between travelling carriages which form part of an endless overhead conveyor and the tray-receiving and tray-discharging stations of a cigarette making or cigarette-consuming machine. The transfer unit comprises a lower portion 1 which constitutes a wheel-mounted dolly, an upright column or support 2, a first transporting assembly or lifter 3 which can move a load including one or more receptacles up or down along the column 2, and a second transporting assembly or rotator 4 which can move a load about the vertical axis of the column.

The lower portion 1 comprises a baseplate 6 provided with two parallel axles 7, 8 for wheels or rollers 11, 12. These wheels can travel along two parallel floor-mounted guide rails 9. Longitudinally adjustable stop blocks 13 and 14 are provided on the rails 9 to limit the extent of movement of the baseplate 6 along the rails. The drive for moving the lower portion 1 along the rails 9 comprises a reversible electric motor 16 whose output shaft carries a worm 17 meshing with a worm wheel 18 on the axle 8. It is clear that the transmission including the worm 17 and worm wheel 18 can be replaced by a different transmission, for example, by two bevel gears.

The column 2 comprises an upright tube 19 provided with a longitudinally extending groove 21 for a chain 22 which is fixed in the tube. Two vertically adjustable annular stops 23 and 24 are affixed to the tube 19 at levels above and below the assemblies 3 and 4. The lifter 3 comprises a gearbox 26 which is movable up and down along the column 2 and contains a sleevelike bearing 27 which surrounds the tube 19 (see FIG. 2). The drive of the lifter 3 includes a reversible electric motor 28 which is mounted at the underside of the gearbox 26 and whose output shaft carries a worm 29. This worm forms part of a transmission 31 which is accommodated in the gearbox 26 and further includes a worm wheel 33 mounted on a horizontal shaft 32 as well as a sprocket wheel 34 which is rigid with the shaft 32 and cooperates with the chain 22 in the groove 21 of the tube 19. The side surfaces in the groove 21 guide the sprocket wheel 34 when the motor 28 drives the shaft 32. The chain 22 and sprocket wheel 34 can be replaced by a rack and pinion.

The rotator 4 comprises a gearbox 36 which is rotatable on the bearing 27 of the lifter 3 and comprises an upwardly extending tubular portion 37 having a ring gear 38. The gearbox 36 moves up and down with the gearbox 26 of the lifter 3. The drive of the rotator 4 includes a reversible electric motor 39 mounted on top of the gearbox 36 and having an output shaft provided with a spur gear 41 meshing with a spur gear 44 on a vertical shaft 43. The shaft 43 carries a worm 46 meshing with a worm wheel 48 on a horizontal shaft 47. The parts 41 and 43 to 48 together form a transmission 42 which can rotate a carrier 49 having a hollow arm or housing 57 affixed to that end portion of the shaft 47 which extends outwardly from the gearbox 36. The carrier 49 further includes a horizontal shaft 51 and a receptacle-supporting portion or fork 52 affixed to the shaft 51. The shaft 51 is parallel to the shaft 47. The rotator 4 constitutes a means for moving the fork 52 of the carrier 49 along an arcuate path which is located in a vertical plane. This arcuate path is a circumferentially complete circular path.

A third transporting assembly or turning means includes a reversible electric motor 54 whose output shaft extends downwardly and carries a gear 56 meshing with the ring gear 38. The motor 54 moves with the gearbox 26 up and down along the tube 19 but does not rotate thereabout. The motors 16, 28, 39 and 54 are braking motors.

The aforementioned housing or arm 57 of the carrier 49 serves as a bearing for one end of the shaft 51 which is provided with a sprocket wheel 58 (FIGS. 2 and 3). A hollow shaft 50 which is journaled in the arm 57 surrounds the shaft 47 and carries a second sprocket wheel 59. The diameters of sprocket wheels 58, 59 are identical and these sprocket wheels are coupled by an endless chain 61. The parts 50, 51, 57, 59, 61 together form a parallel mechanism which normally maintains the fork 52 in a predetermined position of inclination irrespective of the angular position of the arm 57 with reference to the shaft 47.

The gearbox 36 supports an angle adjusting or orientation changing device 53 which includes a disk 62 fixed to the hollow shaft 50 in the space between the gearbox 36 and hollow arm 57. The disk has two radial projections or fingers 63, 64 which are located diametrically opposite each other. The adjusting device 53 further includes a shifter pin 66 which is reciprocable in a guide 67 affixed to the gearbox 36. The pin 66 is adjustably coupled with an L-shaped actuator or trip 68 which extends upwardly through a bore in the gear 38. The coupling between the pin 66 and trip 68 includes a clamp 69. The gearbox 36 supports a stop 71 and a retainer 70 for a helical spring 72.

The spring 72 biases the finger 64 to urge the finger 63 against the stop 71.

FIG. 3 further shows an auxiliary orientation changing device in the form of a reciprocable horizontal plunger 73 which has a cam face 74 adapted to engage the finger 64 and to turn the disk 62 in a counterclockwise direction so as to move the finger 63 away from the stop 71 and to thus stress the spring 72. The plunger 73 forms part of a control system and is located at a tray-receiving station which will be described later.

FIGS. 4*a* to 7*b* illustrate certain details of an apparatus which serves to transport empty and loaded smaller receptacles in the form of cigarette chargers or trays 89, 113 between one or more producing machines or makers and one or more consuming machines. For example, the apparatus may be used to transport empty trays 113 and loaded or filled trays 89 between one or more cigarette making machines and one or more packing machines. This apparatus includes two or more transfer units or load-unlaod units 81 which are substantially identical with the transfer unit of FIG. 1. The transfer unit 81 shown in FIG. 4*a* receives filled or loaded chargers or trays 89 from an endless overhead transporting conveyor 82 and supplies such trays to a consuming machine 83. The transfer unit 81 also serves as a means for returning empty trays 113 from the consuming machine 83 to the transporting conveyor 82. The numerals employed to identify parts of the transfer unit 81 are the same as those employed in FIGS. 1 to 3 but each thereof is raised by 200. For example, the numeral 202 denotes the column or support, the numeral 226 denotes the gearbox of the lifter, and so forth. The sole difference between the two units is that the lower portion of the transfer unit 81 consists of a pedestal 85 which is fixedly secured to the floor. It is clear, however, that the pedestal 85 can be replaced by the lower portion 1 of FIG. 1; all that is necessary is to move the stop blocks 13, 14 of FIG. 1 so close to each other that the base plate 6 is immobilized therebetween.

The overhead transporting conveyor 82 comprises an endless travelling chain 84 which carries longitudinally spaced carriages or runners 87 and 90 for detachable larger receptacles here shown as cages or gondolas 88 each adapted to contain a desired number of smaller receptacles or trays. In the illustrated embodiment, a loaded cage 88 accommodates four empty or loaded trays 89. Empty trays 113 are denoted by rectangular boxes and loaded trays 89 are denoted by rectangular boxes with two diagonal lines extending between the four corners. As shown in FIG. 4*a*, the cage 88 accommodates four loaded or filled trays 89. The cage 90 of FIG. 7*a* accommodates four empty trays 113. The chain 84 travels in the direction indicated by arrow 86.

The consuming machine 83 is mounted at a level below and adjacent to the endless path defined by the overhead transporting conveyor 82 and comprises two superimposed stations 91, 92. The upper station 91 receives groups of loaded trays 89 and the lower station 92 discharges groups of empty trays 113. The directions in which the trays 89, 113 are respectively fed into and evacuated from the stations 91, 92 of the consuming machine 83 are parallel with that indicated by arrow 86.

The upper or receiving station 91 accommodates a receiving platform 94 and a tray advancing mechanism 94 which can move loaded trays 89 from the carrier 249 of the transfer unit 81 into the interior of the consuming machine 83. The advancing mechanism 94 comprises a reversible electric motor 96 which drives a gear transmission 97 and two linkages 98, 99 which are mounted on holders 101, 102. These holders are reciprocable along guide rods 103, 104 and the linkages 98, 99 are connected to each other by a transversely extending coupling rod 106. The free ends of linkages 98, 99 are provided with motion transmitting portions or claws 107, 108 which resemble hooks and are biased by suitable springs. The holder 101 is rigid with a toothed rack 109 which meshes with a pinion on the output shaft of the transmission 97.

The lower or discharging station 92 of the consuming machine 83 accommodates a horizontal platform 111 and an advancing mechanism 112 which serves to deliver groups of empty trays 113 into a cage 88 on the fork 252 of the transfer unit 81. The advancing mechanism 112 includes a reversible electric motor 114 which drives a gear transmission 116. Two linkages 117, 118, (FIG. 6*b*) of the advancing mechanism 112 are respectively mounted on holders 119, 121 which are reciprocable along horizontal guide rods 122, 123 on the platform 111. A coupling rod 124 connects the linkages 117, 118 with each other and the free ends of these linkages are respectively provided with motion transmitting portions or claws 126, 127 which are biased by suitable springs, not shown. The holder 119 is rigid with a toothed rack 128 (FIG. 4*a* or 6*a*) which meshes with a pinion on the output shaft of the transmission 116.

FIG. 8 illustrates a transfer unit 381 which is substantially identical with the transfer unit of FIG. 1. The numerals employed to denote parts of the transfer unit 381 are similar to those used in FIGS. 1 to 3 but each such numeral is raised by 300. This transfer unit 381 cooperates with a modified consuming machine 383 wherein the two stations 391, 392 are disposed at the same horizontal level. The parts of the consuming machine 383 are denoted by numerals which are similar to those used in FIGS. 4*a*–7*a* but each such numeral is also raised by 300. For example, the numeral 412 denotes the advancing mechanism for empty trays 413 at the discharging station 392 and the numeral 393 denotes the platform for filled trays 389 at the receiving station 391. The lower portion 301 of the transfer unit 381 is movable along two guide rails 309 between stop blocks 313, 314 so that it can move its carrier 349 into registry with the platforms 393, 411 at the stations 391 and 392. The endless chain 384 of the overhead transporting conveyor is provided with longitudinally spaced carriages or runners (not shown) which can receive cages 388 with empty trays 413 from the carrier 349 or deliver cages with loaded trays 389 to the carrier 349.

The position of the receiving station 391 with reference to the chain 384 is the same as that of the receiving station 91 with reference to the chain 84. The distance between the column 302 and the outer ends of platforms 393, 411 at the stations 391, 392 is somewhat greater than that between the column 202 and platforms 93, 111 because the transfer unit 381 should have room to travel along the rails 309 into registry with the platforms 393 and 411.

FIGS. 9 and 10 illustrate the details of a carriage or runner 87 which is identical with the carriages 87 and 90 of FIGS. 4*a* to 7*b*. This carriage comprises an inverted U-shaped frame member or bracket 136 having sidewalls 137, 138 which are coupled to the links of an endless chain 142 (corresponding to the chain 84) by pins 139, 141. The chain 142 is driven and advances in the direction indicated by arrow 143. The sidewalls 137, 138 of the frame member 136 carry the ends of a horizontal pintle 144 for a swingable suspending element or hook 146 having a trough-shaped lower end portion or bottom 147. The upper part of the hook 146 extends into the space between the sidewalls 137, 138 and its bottom 147 is provided with a slot 148 whose width increases upwardly toward the pintle 144. The plane of the slot 148 is parallel to the direction which is indicated by arrow 143. Each cage 88 has an upwardly extending arm 149 (indicated by phantom lines) and the upper end of each arm 149 has an enlarged head or boss which cannot pass through the slot 148. However, that portion of the arm 149 which is directly below the head can pass through this slot. The hook 146 is connected with a helical spring 151 which is mounted on the sidewall 137 and tends to bias the hook in a counterclockwise direction, as viewed in FIG. 10. One end portion of the pintle 144 extends beyond the sidewall 138 of the frame member 136 and is rigid with a cage indicator 152 which is parallel to the hook 146. The sidewall 137 carries two abutments 153, 154 which limit the extent of angular displacement of the hook 146 about the axis of the pintle 144. The sidewall 137 further carries an index 156 which is adjacent to the bottom face of the frame member 136. The sidewall 138 carries an indicator assembly 157 which can indicate, among other things, the brand or type of cigarettes in the trays travelling with the carriage 87. This indicator assembly 157 includes a bar 158 which extends from the sidewall 138 and carries four markers 159, 161, 162, 163. The marker 159 indicates whether or not the cage suspended on the carriage 87 is empty (i.e., whether or not the cage accommodates any trays) and the markers 161–163 can indicate three different brands or types of cigarettes. Each of the markers 159, 161–163 is movable with reference to the bar 158 between two end positions and each of these markers then tends to remain in its end position.

The sidewall 137 of the frame member 136 further comprises a projection 164 supporting a guide strip 166 which extends rearwardly and beyond the frame member 136 (see FIG. 10). The guide strip 166 is parallel to and is spaced from the sidewall 137.

The frame of the consuming machine which is to receive filled trays from the chain 142 by way of the transfer unit of the present invention supports two fixed bolts 167, 168 which are adjacent to one side of the chain 142 and extend vertically downwardly (see FIG. 9). These bolts respectively carry guide rolls 169, 171 which are separated from each other by a gap whose width approximates the thickness of the guide strip 166. The positioning of guide rolls 169, 171 on the consuming machine and the mounting of the strip 166 on the carrier 87 are such that, when the frame member 136 travels along the consuming machine, the strip 166 advances through the gap between the guide rolls 169, 171 during the entire interval required for transfer of trays between the overhead conveyor and the consuming machine.

A brand detector or scanner 173 is mounted in the path of one of the markers 161–163. It is assumed that the consuming machine requires cigarettes of the brand denoted by the marker 162 and, therefore, the brand detector 173 extends into the path of the marker 162. The marker 162 can engage the brand detector 173 only when it assumes its upper end position (shown in FIG. 9). The frame of a producing machine or maker carries a carriage detector or scanner 174 (indicated in FIG. 9 by phantom lines) which extends into the path of the marker 159 and is actuated when the marker 159 assumes the upper end position (in FIG. 9, the marker 159 is shown in its lower end position). The detector 174 detects carriages which transport empty trays because a producing machine must receive empty trays and discharges filled trays which are then transported by the endless conveyor on to one of more consuming machines.

Electromagnets 175, 176 are mounted behind the detectors 173, 174 in the path of movement of the markers 159, 162 to move such markers to the upper end positions when warranted during travel of the carriage past a consuming or producing machine. Stationary restoring cams 178, 179 are respectively disposed in the path of movement of markers 162, 159 behind the detectors 173, 174 to move the corresponding markers to their lower end positions. It is clear that the electromagnet 175 and restoring cam 179 are adjacent to a producing machine.

FIGS. 9 and 10 further show a hook detector 181 and a cage detector 182.

FIGS. 11 and 12 illustrate the electric programming and control circuit of an apparatus which includes the transfer unit of FIGS. 4*a*–7*b*, the consuming machine 83 of FIGS. 4*a* to 7*b* and an overhead conveyor having an endless chain for carriages 87 of the type shown in FIGS. 9 and 10. These FIGS. merely show those parts of the apparatus which are necessary for full understanding of the operation. The transfer unit of FIG. 11 differs from the transfer unit 81 of FIGS. 4*a*–7*b* merely in that the pedestal 85 is replaced by the lower portion 301 of FIG. 8. The baseplate 306 of the transfer unit shown in FIG. 11 is reciprocable along rails 309 between the stop blocks 313, 314 in response to operation of the motor 316. The upper end position of the carrier 249 is determined by the upper annular stop 223 (FIG. 12) on the column 202.

The detectors 181, 182 form part of a control unit 185 which is connected with the electromagnet 176 for the markers 162. The gearbox 236 of the rotator is provided with an arcuate groove 183 which is concentric with the shaft 247 and serves to accommodate a circumferentially adjustable limit switch 184. The annular stop 223 is provided with a concentric groove 186 for two adjustable limit switches 187, 188. Two further limit switches 189, 191 are mounted on the platform 93 of the consuming machine 83 at the opposite sides of the holder 101 for the linkage 98. Limit switches 193, 194 are mounted on the discharging platform 111 of the machine 83 at the opposite sides of the holder 119 for the linkages 117. A limit switch 192 is mounted at the front end of the platform 93 to be actuated by the fork 252 of the carrier 249. The front end of the lower platform 111 carries a limit switch 196 and this platform further carries a limit switch 197 installed in the path of movement of empty trays. Two limit switches 198, 199 are mounted at the opposite ends of the base plate 306 to be respectively actuated by stop blocks 314, 313. The conductors which connect the switches with the control unit 185 and with the motors of the transfer unit and consuming machine 83 are shown but not specifically identified in FIG. 11.

The details of the control unit 185 are shown in FIG. 13. This control unit includes a first relay 185*a* whose winding is connected with the limit switch 197, and a second relay 185*b* whose winding is connected with the cage detector 182, a third relay 185*c* whose winding is connected with the brand detector 173, a fourth relay 185*d* whose winding is connected with the hook detector 181, and a fifth relay 185*e* whose winding is connected with the limit switch 188. One working contact of each of the relays 185*a*–185*d* is connected in a conductor 185*f*. Another working contact of the relay 185*d*, a working contact of the relay 185*e* and an idle contact of the relay 185*b* are connected with a second conductor 185*g*. The conductors 185*f*, 185*g* are connected to a source 185*h* of control potential and their terminals 185*l*, 185*m* are connected with the motor 339. The terminal 185*m* is further connected with the electromagnet 176.

The operation of the apparatus is as follows:

The start of a working cycle is shown in FIGS. 4*a* and 4*b*. The fork 252 of the carrier 249 is held in a position in which it is ready to take over a cage 88 with four loaded trays 89. The cage 88 is still suspended on the carriage 87 of the conveyor 82. The foremost of the four empty trays 113 actuates the limit switch 197 (FIG. 11) on the platform 111 of the consuming machine 83 whereby the switch 197 energizes the relay 185*a* (FIG. 13) and the latter closes its working contact in the conductor 185*f*. The carriage 87 supports a cage 88 which contains four loaded trays 89; therefore, its marker 162 is in the upper end position (FIG. 9) and engages the detectors 173 of the machine 83 whereby the detector 173 energizes the relay 185*c* and the latter closes its working contact in the conductor 185*f* (FIG. 13). The cage 88 of the carriage 87 engages the detector 182 which energizes the relay 185*b* and causes this relay to close its working contact in the conductor 185*f* of FIG. 13. Finally, the hook 146 of the carriage 87 engages the detector 181 and the latter energizes the relay 185*d* in the control unit 185 of FIG. 13 so that the four working contacts in the conductor 185*f* are closed. This completes the circuit of the motor 239 of the rotator in the transfer unit 81 of FIG. 4*a* and the motor 239 causes the hollow arm 257 of the carrier 249 to turn in a circular path about the axis of the shaft 247 (see the arrow 100 in FIG. 4*a*). The inclination of the fork 252 remains unchanged due to the action of parallel mechanism in the arm 257 (refer to parts 50, 51, 57, 59, 61 in FIGS. 2 and 3) so that the fork 252 engages the cage 88 from below and lifts the arm 149 (FIGS. 9 and 10) out of the hook 146 of the carriage 87. The carrier 249 continues to rotate in a vertical plane in the direction indicated by arrow 100 through the intermediate position shown in FIG. 4*a* by phantom lines whereby the arm 257 actuates the limit switch 184 (FIG. 11) on the gearbox 236 and the limit switch 184 arrests the motor 239. At the same time, the limit switch 184 completes the circuit of the motor 254 which rotates the fork 252 and the cage 88 with loaded trays 89 in the direction indicated by arrow 105 (FIG. 4*b*). When the carrier 249 reaches the phantom-line position 110 of FIG. 5*a*, the trip 268 actuates the limit switch 188 on the upper annular stop 223 whereby the switch 188 arrests the motor 254 and starts the motor 228 of the lifter so that the gearbox 226 moves downwardly along the column 202 and entrains the gearbox 236. When the carrier 249 reaches the solid-line position of FIG. 5*a*, it registers with the upper station 91 of the consuming machine 83. Before, the carrier 249 begins to move downwardly, the upper end of the trip 268 bears against the upper annular stop 223 and causes the shifter pin (see the shifter pin 66 in FIG. 2 or 3) to bear against the finger 63 so that the spring 72 is stressed and the finger 63 remains spaced from the stop 71. However, when the carrier 249 of FIG. 4*a* begins to move downwardly toward the solid-line position of FIG. 5*a*, the trip 268 moves away from the stop 223 and allows the spring 72 to return the finger 63 into abutment with the stop 71. This changes the orientation of the fork 252 by moving it to a horizontal position (see FIG. 5*a*) so that the bottom surfaces of the four loaded trays 89 are located in a horizontal plane and can be readily transferred onto the platform 93 at the receiving station 91. The fork 252 then actuates the limit switch 192 (FIG. 11) which arrests the motor 228 of the lifter and starts the motor 96 for the transmission 97. The latter's pinion moves the rack 109 in a direction to the left, as viewed in FIG. 5*a* whereby the advancing mechanism 94 moves its claws 107, 108 to the positions shown in FIG. 5*b* in which these claws engage the left-hand side face of the outermost loaded tray 89 in the cage 88 which is supported by the fork 252 of the carrier 249. The claws 107, 108 are biased so that they can yield during movement in a direction to the left, as viewed in FIG. 5*a*, but they are free to engage the leftmost tray 89 when moved to the outer end positions. The holder 101 then actuates the limit switch 189 (see FIG. 11) which reverses the motor 96 so that the claws 107, 108 of the linkages 98, 99 travel in a direction to the right and transfer the four loaded trays 89 onto the platform 93. The cage 88 is now empty and remains on the carrier 249. When the holder 101 of the advancing mechanism 94 reaches its right-hand end position, it actuates the limit switch 191 (FIG. 11) which arrests the motor 96 and starts the motor 228 in a sense to move the carrier 249 downwardly into registry with the discharging station 92 (see FIG. 6*a*). The fork 252 actuates the limit switch 196 (FIG. 11) which arrests the motor 228 and starts the motor 114 of the advancing mechanism 112 on the platform 111. The claws 126, 127 of the linkages 117, 118 push four empty trays 113 into the empty cage 88 on the carrier 249. Such movement of claws 126, 127 is completed when the holder 119 actuates the limit switch 193 (FIG. 11) which reverses the motor 114 whereby the linkages 117, 118 return to their initial positions. The claws 126, 127 are biased by springs and can yield during retraction to the positions shown in FIG. 7*a*. The holder 119 then actuates the limit switch 194 (FIG. 11) which arrests the motor 114 and starts the motor 228 in a sense to move the carrier 249 upwardly toward the conveyor 82. The carrier 249 raises the cage 88 with four empty trays 113 therein. When the carrier 249 returns to the phantom-line position 110 of FIG. 5*a*, the trip

268 engages the annular stop 223 and causes the shifter pin 66 (FIG. 2 or 3) to move the finger 63 away from the stop 71 so that the fork 252 changes its orientation and returns to the inclined position shown in FIG. 4*a* which is best suited to couple the arm 149 to the hook 146 of an empty carriage 90 (FIG. 7*a*). When the carrier 249 returns to the upper end position, the trip 268 actuates the limit switch 187 (FIG. 12) which arrests the motor 228 and starts the motor 254 which begins to turn the carrier in the direction indicated by arrow 115 (FIG. 6*b*). The carrier 249 ceases to turn when it reaches the phantom-line position of FIG. 4*a* because the trip 268 then engages the limit switch 188 (FIG. 12) which arrests the motor 254 and energizes the relay 185*e* (FIG. 13). The relay 185*e* closes its working contact in the conductor 185*g*. When an empty carriage 90 approaches the transfer unit 81, see FIG. 7*a*, the index 156 on the carriage 90 engages the detector 181 but not the detector 182 because the hook 146 of the empty carriage 90 is held by spring 151 so that it assumes the position shown in FIG. 10. The detector 181 energizes the relay 185*d* (FIG. 13) which closes its working contact in the conductor 185*g* to complete the circuit of the electromagnet 176 (the relay 185*e* is already energized and maintains its working contact in closed position). The relay 185*d* also completes the circuit of the motor 239 so that this motor rotates the carrier 249 in the direction indicated by arrow 125 (FIG. 7*a*) whereby the carrier 249 lifts the cage 88 with empty trays 113 and couples the arm 149 of the cage 88 to the hook 146 of the carriage 90. The weight of the cage 88 with four empty trays 113 therein overcomes the bias of the spring 151 and causes the hook 146 to move to the broken line position of FIG. 9. This moves the cage indicator 152 to operative position so that it can actuate a detector 182 in a producing machine, i.e., in a machine which receives empty trays 113 and delivers loaded trays 89. The energized electromagnet 176 moves its armature upwardly and the armature pushes the marker 159 of the carriage 90 to the upper end position.

The stop 71 (FIGS. 2 and 3) is normally positioned in such a way that it can arrest the associated finger 63 in an angular position in which the fork 52 is held in a horizontal plane or in a plane which is parallel to the planes of platforms at the two stations of the consuming machine. However, it might become necessary to maintain the fork 52 in a different position of inclination. This can be brought about by the plunger 73 of FIG. 3. The plunger 73 is shiftable by an electromagnet (not shown) in response to closing of the limit switch 196 on the lower platform 111 of the machine 83 shown in FIG. 11 whereby the cam face 74 of the plunger 73 changes the inclination of the fork 52 by engaging with and turning the finger 64 of the disk 62 which is rigid with the shaft 51. Thus, the orientation of the fork 52 can be changed by the device 53 and/or by the plunger 73.

The operation of the apparatus which embodies the transfer unit 381 of FIG. 8 is practically identical with that of the just described apparatus with the sole important exception that, when the carrier 349 completes the delivery of loaded trays 389 to the receiving station 391 of the consuming machine 383, the column 302 is caused to advance along the rails 309 in response to starting of the motor 316 so as to move the carrier 349 and the empty cage 388 thereon into registry with the platform 411 at the discharging station 392. The cage 388 then assumes the phantom-line position shown in the lower part of FIG. 8. When the four empty trays 413 are transferred into the cage 388, the motor 316 moves the carrier 349 back to the position shown in FIG. 8. The movements of the baseplate 306 of the transfer unit 381 along the rails 309 are initiated by the limit switches shown in FIG. 11. The limit switch 191 starts the motor 316 in a sense to move the baseplate 306 toward the stop block 313. The limit switch 199 is then actuated in response to engagement with the block 313 and arrests the motor 316. If the stations 391, 392 are not at the same level, the time required to move the cage 388 from the solid-line to the phantom-line position of FIG. 8 is less than the time required to move the carrier 349 from the level of the station 391 to the level of the station 392. Otherwise, the control circuit can employ suitable time-lag relays or the like for the motor 328. When the transfer of empty trays 413 into the cage 388 is completed (advancing mechanism 412 of FIG. 8), the limit switch 193 (FIG. 11) starts the motor 316 in a sense to move the baseplate 306 toward the stop block 314. The latter actuates the switch 198 which arrests the motor 316. The carrier 349 is then ready to lift the cage 388 with empty trays 413 and to suspend such cage on the next empty carriage of the chain 384.

FIGS. 14*a* to 14*c* show parts of a further apparatus wherein the shaft 747 of the transfer unit 481 is rotatable about a vertical axis. The receptacle-supporting portion 752 of the carrier 749 is located in a horizontal plane. All such parts of the transfer unit 481 which are similar to those of the unit shown in FIG. 1 are denoted by numerals similar to those shown in FIGS. 1 to 3. A motor 754 drives a transmission in a gearbox 701. The transmission includes the vertical shaft 747 which extends upwardly beyond the gearbox 701 and supports the carrier 749. The portion 752 of the carrier 749 can support cages 488 for loaded trays 489 or for empty trays 513. In this embodiment of my invention, the portion 752 resembles a plate. The arm of the carrier 749 contains a parallel mechanism for the plate 752; this parallel mechanism is similar to the one shown in FIGS. 2 and 3. An angle adjusting or orienting device 753 for the plate 752 of the carrier 749 comprises a disk 762 (FIG. 14*b*) with two projections or fingers 763, 764 located diametrically opposite each other. The finger 763 is connected with a spring 772 and the finger 764 can be turned by a trip 768 against the opposition of spring 772. The purpose of the device 753 is to change the orientation of the portion 752 in the event that the stations of the consuming machine 583 are not parallel to the direction of travel of the chain 484 which forms part of an overhead conveyor 482 and supports carriages 487 for cages 488.

Bus bars 780, 781 are provided at the transfer station where the unit 481 receives and delivers trays, and these bus bars are connected with power lines 782, 783.

FIG. 14*c* shows certain details of a carriage 487 which resembles the carriage 87 of FIGS. 9 and 10. The spring 151 of FIG. 10 is replaced by an electromagnet 790 whose winding is connected with resilient contacts 784, 785 (FIG. 14*b*). The movable armature of the electromagnet 790 is connected with an actuating rod 791 which can oscillate the hook 786 of the carriage 487 in directions indicated by double-headed arrow 787.

The operation of the apparatus shown in FIGS. 14*a* to 14*c* differs from the operation of previously described apparatus in the following respects: When a cage 488 with loaded trays 489 reaches the transfer station, a detector (not shown) starts the motor 754 so that the plate 752 turns in a circular path located in a horizontal plane in the direction indicated by arrow 795 (FIG. 14*b*). The plate 752 is thus moved to a position below the cage 488 whose hook 786 extends vertically downwardly. The cage 488 is lifted by the plate 752, such lifting being due in part to the provision of a cam face 788 which is shown on the plate 752 in FIG. 14*a*. The plate 752 takes over the cage 488 whereby the latter tilts forwardly so that its bottom moves into a horizontal plane and rests fully on top face on the plate 752. The elastic contacts 784, 785 engage the bus bars 780, 781 and energize the electromagnet 790 so that the armature of the electromagnet moves the bar 791 which moves the hook 786 to the inclined position shown in FIG. 14*c*. This completes the disengagement of the cage 488 from the carriage 487 and the hook 786 remains in the inclined position during travel past the cage on the plate 752.

The carrier 749 then turns about the axis of the shaft 747 and returns to the illustrated angular position. This starts the motor 628 of the lifter which moves the carrier 749 downwardly along the column 602. The delivery of loaded trays 489 to the receiving station of a consuming machine 583 and the transfer of empty trays into the cage 488 take place in the same way as described before. The motor 628 then moves

the carrier **749** upwardly and delivers the cage **488** with empty trays to an oncoming empty carriage on the chain **484**. The hook of the empty carriage returns to vertical position in response to deenergization of the respective electromagnet **790** while the contacts **784, 785** of such electromagnet move beyond bus bars **780, 781**. This enables the hook to properly support the carriage **488** with four empty trays therein.

The consuming machine **583** is similar to the machine **83** of FIGS. **4***a* to **7***b*. FIGS. **14***a* and **14***b* merely show the advancing mechanism **494**, holders **501, 502** and **519**, linkage **517**, claws **507, 508**, and coupling rod **506**.

The main difference between the transfer unit **481** and the previously described transfer units is that the carrier **749** can travel in an arcuate path which is located in a horizontal plane, i.e. that the shaft **747** is vertical. The orientation of the plate **752** is changed by the device **753**.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of my contribution to the art.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. In an apparatus for transporting receptacles for cigarettes or like commodities, a combination comprising conveyor means having travelling carriages arranged to support detachable receptacles for travel along a predetermined path; at least one receptacle-receiving station and at least one receptacle-discharging station adjacent to said predetermined path; and a transfer unit for transferring receptacles between at least one of said stations and said carriages, comprising carrier means having a portion arranged to support receptacles during transfer between said one station and said carriages, means for moving said carrier means along an arcuate path, and means for changing the orientation of said portion of said carrier means.

2. A combination as defined in claim **1**, wherein said arcuate path is a closed path.

3. A combination as defined in claim **1**, wherein said arcuate path is disposed in a predetermined single plane.

4. A combination as defined in claim **3**, wherein said arcuate path is a circular path.

5. A combination as defined in claim **3**, wherein said predetermined plane is substantially vertical.

6. A combination as defined in claim **3**, wherein said predetermined plane is substantially horizontal.

7. A combination as defined in claim **1**, wherein said means for changing the orientation of said portion of said carrier means includes means for tilting said portion.

8, A combination as defined in claim **1**, wherein said transfer unit further comprises a parallel mechanism for maintaining said portion of said carrier means in a predetermined position of inclination during movement of said carrier means along said arcuate path.

9. A combination as defined in claim **1**, wherein said transfer unit further comprises lifter means for moving said carrier means up and down along a substantially vertical path.

10. A combination as defined in claim **1**, wherein said means for moving said carrier means along said arcuate path comprises rotator means for rotating said carrier means about a substantially vertical axis.

11. A combination as defined in claim **1**, wherein said transfer means further comprises a support for said carrier unit and drive means for moving said support back and forth along a horizontal path.

12. A combination as defined in claim **1**, wherein each of said receptacles is dimensioned to accommodate at least one smaller receptacle.

13. A combination as defined in claim **1**, wherein each of said carriages comprises means for indicating the presence and absence of receptacles thereon as well as the type of commodities in such receptacles.

14. A combination as defined in claim **1**, wherein said one station is provided with detector means and each of said carriages is provided with an index which can engage said detector means to thus indicate the approach of a carriage into the range of said transfer means.

15. A combination as defined in claim **1**, wherein each of said carriages is provided with a marker means for indicating the absence of a receptacle thereon.

16. A combination as defined in claim **1**, wherein each of said carriages comprises means for indicating the type of commodities in the respective receptacles.

17. In as apparatus for transporting commodities, particularly for transporting receptacles for cigarettes or the like, a combination comprising an endless transporting overhead conveyor having travelling portions for transport of commodities along a predetermined path; at least one commodity-receiving station adjacent to said path; at least one commodity-discharging station adjacent to said path; and a power-operated transfer unit for transferring commodities between said travelling portions of said conveyor and at least one of said stations, comprising a substantially upright support, a rotator directly carried by said support, said rotator including carrier means rotatable with reference to said support and arranged to transfer commodities between said travelling portions of said conveyor and said one station, means for rotating said carrier means with reference to said support, and a lifter arranged to move said rotator with said carrier up and down along said support.

18. A combination as defined in claim **17**, wherein said carrier means comprises a portion for support of commodities and means for holding such portion of said carrier means in a predetermined position of inclination while the carrier means moves relative to said support.

19. A combination as defined in claim **18**, wherein said means for holding comprises a parallel mechanism.

20. A combination as defined in claim **17**, further comprising means for rotating said carrier means about the axis of said support.

21. A combination as defined in claim **17**, further comprising means for moving said support back and forth along a substantially horizontal path.

22. A combination as defined in claim **17**, wherein said carrier means comprises a portion for support of commodities and further comprising means for changing the orientation of said portion of said carrier means including means for rotating said portion of said carrier means about a substantially horizontal axis.