United States Patent [19]

Kruse et al.

[11] **3,721,340**

[45] **March 20, 1973**

[54] **METHOD AND APPARATUS FOR TRANSPORTING CIGARETTE PACKS OR THE LIKE**

[75] Inventors: **Friedel Kruse**, Hamburg; **Gunter Wahle**, Reinbeck; **Otto Erdmann**, Hamburg; **Willy Rudszinat**, Dassendorf, all of Germany

[73] Assignee: **Hanni-Werk Korber & Co. KG**, Hamburg, Germany

[22] Filed: **Nov. 12, 1970**

[21] Appl. No.: **88,723**

[30] **Foreign Application Priority Data**

Nov. 22, 1969 Germany.....P 19 58 738.3

[52] **U.S. Cl.**.....**209/74 R**, 198/31 AA, 198/209

[51] **Int. Cl.**.....**B07c 5/342**

[58] **Field of Search**.....209/73, 74; 198/31 AA, 209

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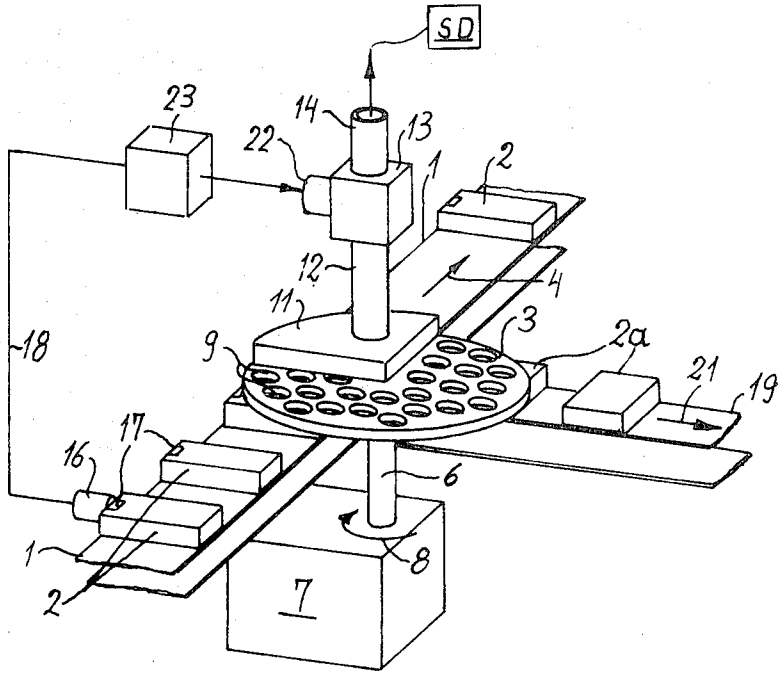
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Primary Examiner—Allen N. Knowles
Attorney—Michael S. Striker

[57] **ABSTRACT**

Cigarette packs are transported by the upper stretch of a first belt to move into the range of a pneumatic overhead conveyor which transfers some or all of the packs onto one or more additional belts. The pneumatic conveyor has an apertured disk which is driven at a constant speed and rotates at a level above the first belt so that a portion of the disk overlaps the path of oncoming packs. The disk rotates below one or more suction chambers at least one of which is normally disconnected from and can be connected to a suction generating device when a selected pack reaches the disk whereby the disk cooperates with the suction chamber to lift the selected pack off the first belt and to transfer it onto another belt. The selection is made by a circuit employing a detector which is adjacent to the first belt and serves to produce signals in response to detection of defective packs or in response to detection of each pack whereby a timer circuit energizes the solenoid of a valve which controls the evacuation of air from a suction chamber above the revolving disk to effect the transfer of each second or third, etc. pack onto a second belt and the transfer of all other packs onto a third belt.

20 Claims, 2 Drawing Figures



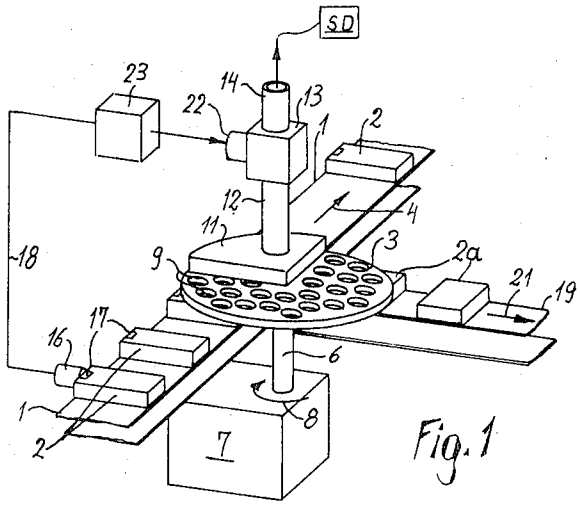


Fig. 1

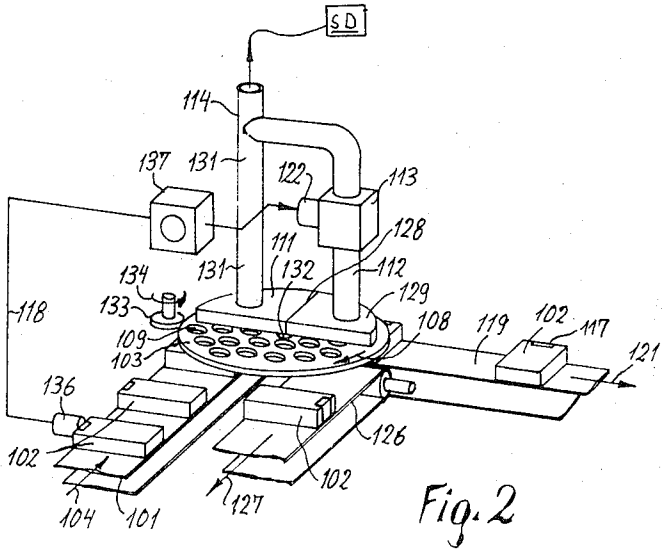


Fig. 2

INVENTORS
FRIEDEL KRUSE
GUNTER WAHLE
OTTO ERDMANN
WILLY RUDSZINAT
BY Richard I. Stein
ATTORNEY

METHOD AND APPARATUS FOR TRANSPORTING CIGARETTE PACKS OR THE LIKE

BACKGROUND OF THE INVENTION

The present invention relates to a method and apparatus for transporting cigarettes, cigars, cigarillos, cheroots, packs of cigarettes or other rod-shaped tobacco-containing articles and/or other commodities. More particularly, the invention relates to improvements in a method and apparatus for transporting cigarette packs or like commodities which are supplied to the apparatus in the form of one or more rows or streams.

It is already known to expel from a row or file of cigarette packs those packs which are defective, contaminated or must be transported to a testing station. As a rule, such apparatus comprise pushers or plungers which expel selected packs from the stream and can introduce a spare pack to take the place of the expelled pack. U.S. Pat. No. 3,040,862 discloses a packing machine wherein a pusher is normally blocked by the armature of an electromagnet and is permitted to move across the path of a row of cigarette packs in order to expel a selected pack (e.g., a defective pack) from such path. A drawback of such machines is that the pusher can be used only when the machine operates intermittently so as to expel a defective pack during an interval between two successive movements. This will be readily understood since the pusher must be withdrawn upon completion of a working stroke so as to enable the stream of packs to advance along its path.

SUMMARY OF THE INVENTION

An object of the invention is to provide a novel and improved method of transporting cigarette packs, unconfined tobacco-containing articles or analogous commodities irrespective of whether the commodities are transported stepwise or continuously and regardless of whether the neighboring commodities are located at the same distance or at different distances from each other.

Another object of the invention is to provide a novel and improved method of converting a single series or stream of commodities into a plurality of streams or vice versa.

A further object of the invention is to provide a novel method of segregating defective or uncompleted commodities from a series of commodities wherein the defective or uncompleted commodities are in random distribution with satisfactory commodities.

An additional object of the invention is to provide a novel method of withdrawing from a series or stream of travelling commodities a selected number of commodities as desired intervals for the purpose of spot-testing or the like without interfering with the transport of remaining commodities in the desired direction.

Still another object of the invention is to provide a method according to which the commodities are treated gently to avoid smudging, permanent deformation, tearing and/or other defects.

A further object of the invention is to provide a transporting apparatus which can be readily adjusted or converted for transport of a variety of commodities, which can be used to segregate travelling defective commodities from travelling satisfactory commodities, to divide a single series or stream of travelling commodities into a plurality of streams or vice versa, to withdraw from a stream of commodities a selected number of commodities at selected intervals for the purpose of visual inspection or automatic testing, or to simply change the direction of travel of a series of commodities.

Another object of the invention is to provide an apparatus which occupies little room, which can be used with advantage with presently known and existing processing machines for tobacco and tobacco-containing products, and which comprises a small number of relatively simple and compact parts.

An ancillary object of the invention is to provide a transporting apparatus which can feed the output of a single producing machine to a plurality of processing machines.

One feature of the present invention resides in the provision of a method of transporting packs of tobacco-containing articles, unpacked tobacco-containing articles or analogous commodities. The method comprises the steps of conveying a series (for example, a single file or row) of commodities along a first path located in a first plane, preferably in a substantially horizontal plane, pneumatically lifting at least some commodities of the series into an endless second path located in a second plane which is preferably at least substantially parallel to the first plane and conveying the thus lifted commodities along at least a portion of the second path, and the additional step of transferring commodities from the second path into at least one further path. The second path is preferably a circular path, and the additional step may comprise transferring commodities from the second path into two or more further paths wherein the commodities can be conveyed to discrete processing stations. For example, one of the further paths can lead defective or unfinished commodities to a receptacle or to that machine which furnishes commodities to the first path, and another further path can lead commodities to a processing machine, such as a carton filling or pack-binding machine.

The method preferably further comprises the steps of scanning the commodities of the series in the first path, producing signals in response to detection of selected commodities of the series (namely, of each commodity which passes the scanning or detecting station, of each *n*-th commodity, or of each defective commodity), and utilizing at least some of the signals to initiate pneumatic lifting of selected commodities from the first path. The pneumatic lifting step preferably comprises lifting the commodities by the application of suction, and the signals can be utilized to control the application of suction.

The scanning step may involve simple counting of commodities in the series of commodities which are conveyed along the first path and utilizing the signals which are produced in response to detection of each second or third, etc. commodity to pneumatically lift one or more commodities which follow the second or third, etc. commodity.

The commodities of the series which advances along the first path may include two or more classes of commodities, for example, satisfactory and defective commodities, and the scanning step may comprise detecting the defective or satisfactory commodities and pneumatically lifting the thus detected commodities into the second path.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved transporting 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 diagrammatic perspective view of a transporting apparatus for cigarette packs which embodies one form of the invention; and

FIG. 2 is a diagrammatic perspective view of a modified apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The apparatus of FIG. 1 comprises a first conveyor having an endless belt 1 whose upper stretch transports a series of cigarette packs 2*a* and/or 2 along a straight path which is located in a horizontal or nearly horizontal plane. For example, the belt 1 can transport cigarette packs from a packing or wrapping machine which forms and fills the packs and provides each filled and closed pack with a tax label or stamp 17. A pneumatic overhead conveyor operates in a second horizontal plane which is located above the plane of the upper stretch of the belt 1 and serves to lift certain packs off the belt 1 and to transport such packs along a portion (about one fourth) of an endless circular path prior to transfer of the thus lifted and conveyed packs to a receiving conveyor here shown as including an endless belt 19. For example, the belt 1 can transport toward the lifting station two classes of packs, namely, satisfactory packs 2 each of which is provided with a properly applied tax label 17 and defective or uncompleted packs 2*a* which are not provided with tax labels. The belt 19 can transport the packs 2*a* back to the packing machine which supplies packs to the belt 1, to a receptacle, to other collecting means for defective or uncompleted packs, or to another destination.

The upper stretch of the belt 1 transports satisfactory packs 2 past and beyond the lifting station, for example, to a pack-binding or carton filling machine, not shown. Such satisfactory packs travel sideways in the direction indicated by an arrow 4. The arrow 21 indicates the direction of sidewise travel of packs 2*a* along the path defined by the upper stretch of the belt 19.

The pneumatic conveyor comprises a stationary suction chamber 11 and a rotary disk-shaped air-permeable conveying element 3 which is located directly below and moves along the open underside of the suction chamber. The openings of the disk 3 are shown at 9; this disk is driven in a clockwise direction (arrow 8) by a transmission 7 having a vertical or nearly vertical output shaft 6.

The suction chamber 11 can be connected to the intake of a suction generating device SD by a first conduit 12, a solenoid-operated valve 13, and a second conduit 14. The valve 13 forms part of a selector unit or control unit which further includes a detector 16, conductor means 18 for transmission of signals from the detector, and a time-delay relay 23 which delays the transmission of signals from the detector 18 to the solenoid 22 of the valve 13. The detector 16 is preferably a photosensitive detector of known design, for example, one having a light source which directs a beam of light against successive packs 2, 2*a* of the series on the upper stretch of the belt 1 and a receiver which produces a signal whenever the light beam is reflected on a tax label 17 or whenever no such reflection of the light beam occurs. The detector 16 is preferably of the color-sensitive type. The detector 16 scans the path which is defined by the upper stretch of the belt 1 and transmits to the time-delay relay 23 an electric signal whenever it detects the absence of a tax label 17 on the adjacent packs 2*a*. The relay 23 energizes the solenoid 22 with such a delay that the valve 13 opens and connects the chamber 11 with the suction generating device SD when the respective pack 2*a* moves into the range of the pneumatic conveyor.

The operation:

The packing machine discharges a succession of packs 2 and 2*a* in random distribution whereby such packs travel with the upper stretch of the belt 1 as indicated by the arrow 4. The selector unit is on so that the detector 16 scans the packs for the presence or absence of tax labels 17 and produces an electric signal whenever it detects a pack 2a which does not carry a label. Such signal is transmitted to the relay 23 by way of the conductor means 18 and is delayed for an interval of time which is necessary to transport the detected pack 2*a* from the scanning station to the lifting station (below the suction chamber 11). The relay 23 then energizes the solenoid 22 which opens the valve 13 to connect the chamber 11 with the suction generating device SD. The output shaft 6 of the transmission 7 drives the disk 3 at a constant speed, preferably at a speed corresponding to that of the upper stretch of the belt 1. As the pack 2*a* moves below the open underside of the suction chamber 11, it is attracted by suction against the underside of the revolving disk 3 and is transported along an arc of about 90 degrees prior to being deposited onto the upper stretch of the belt 19. It will be seen that the open underside of the chamber 11 extends along that portion of the endless second path in which the packs 2a are transported from the belt 1 to the belt 19. The energization of solenoid 22 is of short duration, namely, just long enough to insure that the chamber 11 remains connected with the suction generating device SD for a period of time which suffices to transfer the detected pack 2*a* onto the belt 19 but too short to enable the pneumatic conveyor to lift and transport the next-following satisfactory pack 2. Of course, the nature of signals which are produced by the detector 16 can be such that the solenoid 22 remains energized without any interruptions if the detector 16 detects two or more successive packs 2*a*.

As mentioned above, the belt 19 can return the packs 2*a* to the machine which supplies packs 2, 2*a* to the belt 1 or to another destination. The satisfactory packs 2 are free to advance past and beyond the suction chamber 11 and reach a pack-binding or a carton filling machine, not shown.

In the embodiment which is shown in FIG. 1, the suction chamber 11 extends along an arc of about 90° because the paths defined by the upper stretches of the belts are substantially normal to each other. It is clear

that the vertical planes for the conveyors which include the belts 1, 19 can make an obtuse angle as well as that the belt 19 can be replaced by a receptacle, a chute or other means for accepting the packs 2*a* from the pneumatic conveyor. It is also clear that the suction chamber can overlap a portion of the upper stretch of the belt 19 so that the packs 2*a* are positively held by suction until they reach a position above the belt 19. In FIG. 1, the dimensions of the suction chamber 11 are such that a pack 2*a* which is lifted off the belt 1 is entrained and accelerated to the extent necessary to cause it to land on the upper stretch of the belt 19.

The path which is defined by the disk 3 of the pneumatic conveyor is preferably parallel to the path along which the packs 2 and 2*a* are transported by the belt 1. However, the two paths need not be disposed in two planes which are exactly parallel to each other. For example, the plane of the disk 3 can be inclined with reference to the plane of the upper stretch of the belt 1 in such a way that the lifted commodities 2*a* cover a distance which exceeds the vertical distance that a commodity must cover after it is released by the disk 3 to descend onto the upper stretch of the belt 119.

FIG. 2 illustrates a modified transporting apparatus wherein all such parts which are identical with or clearly analogous to the corresponding parts of the apparatus shown in FIG. 1 are denoted by similar reference characters plus 100. In this embodiment of the invention, the pneumatic overhead conveyor includes a disk-shaped conveying element 103 (having openings 109) and two suction chambers 111, 129 which are separated from each other by a partition 128. Furthermore, the pneumatic conveyor serves to lift all packs 102 off the endless belt 101 of the first conveyor and thereupon segregates the packs into two groups or streams one of which is delivered onto the upper stretch of the belt 119 and the other of which is delivered onto the upper stretch of an endless belt 126 forming part of a second conveyor of the receiving means for packs. The selector unit or control unit of the second apparatus comprises a timer circuit 137 which replaces the time-delay relay 23 and performs the additional function of selecting those packs 102 which are to be transferred onto the upper stretch of the belt 126. Such packs are thereupon advanced in the direction indicated by an arrow 127.

The upper stretch of the belt 101 transports a series of cigarette packs 102 in the direction indicated by the arrow 104. Such packs are scanned by a photosensitive detector 136 which is connected to the timer circuit 137 by conductor means 118. The packs 102 are lifted off the belt 101 by the disk 103 in cooperation with the suction chamber 111 are are normally deposited on the upper stretch of the belt 119 to be transported in the direction indicated by the arrow 121, for example, to a pack-binding or carton filling machine, not shown. Certain packs 102 are transported by the disk 103 in cooperation with the suction chambers 111, 129 to be deposited on the upper stretch of the belt 126 and to be transported in the direction indicated by the arrow 127, for example, to a testing device (not shown) which serves to examine the packs for the presence or absence of tax labels 117 or for the presence or absence of defects. The detector 136 simply serves to produce a signal in response to detection of each pack 102 which is transported by the belt 101, and such signals are stored in and counted by the timer circuit 137. The latter then energizes the solenoid 122 of the valve 113 which is installed between the conduits 112, 114. The conduit 112 is connected to the suction chamber 129 and the conduit 114 is connected with the suction generating device SD. The suction chamber 111 is permanently connected with the suction generating device SD by way of the conduit 114 and a further conduit 131. The arrangement can be such that the timer circuit 137 energizes the solenoid 122 to open the valve 113 and to connect the chamber 129 with the device SD in response to detection of each second or third or fourth or tenth, etc. pack 102. The solenoid 122 thereupon remains energized for an interval of time which suffices to transfer a single pack 102 or two or more packs onto the belt 126 for transport to the testing device. Thus, the apparatus of FIG. 2 can be used for spot-checking of a series of commodities and for withdrawing from the normal path (including the paths defined by the belts 101, 119 and that portion of the pneumatic conveyor which includes the disk 103 and suction chamber 111) at least one commodity after a predetermined number of commodities (namely, one or more) has been permitted to advance along the normal path. The withdrawn commodities are transferred onto the belt 126. The suction chambers 111, 129 are stationary and the disk 103 is rotatable on a vertical stub shaft 132. The drive means for the disk 103 comprises a pinion 133 whose teeth mate with teeth (not shown) provided on the periphery of the disk 103. The pinion 133 is driven in a counterclockwise direction by the output shaft 134 of a transmission or motor, not shown. The disk 103 rotates in a clockwise direction (arrow 108) at a constant speed.

The timer circuit 137 is preferably adjustable so that the person in charge can select the number of packs 102 which are to be transferred onto the belt 119 before a pack is caused to be transferred onto the belt 126 and/or that the person in charge can select the number of packs 102 which are to be transferred onto the belt 126 after the transport of *n* packs onto the belt 119 (*n* is a whole number including 1). It can be said that the timer circuit 137 serves to select the sequence in which the packs 102 are being transferred onto the belts 119 and 126.

The operation of the apparatus shown in FIG. 2 is as follows:

The belt 101 receives a series of packs 102 from a packing machine (not shown) and transports the series along a path (arrow 104) which is located in a substantially horizontal plane below the plane of the rotating disk 103. Each pack 102 advances along the detector 136 which transmits to the timer circuit 137 an electric signal by way of the conductor means 118 whenever it detects a pack 102. The circuit 137 maintains the solenoid 122 in deenergized condition while a certain number (one or more) of the packs 102 moves into the range of the suction chamber 111 which is permanently connected with the suction generating device SD whereby the disk 103 lifts such packs off the upper stretch of the belt 101 and deposits them on the upper stretch of the belt 119 for transport along a third path (arrow 121) to a pack-binding or carton filling machine. The suction chamber 129 cannot interfere

with the deposition of packs **102** onto the belt **119** as long as the valve **113** remains closed. However, when the circuit **137** receives from the detector **136** a preselected number of signals, its output signal energizes the solenoid **122** which opens the valve **113** with a requisite delay so that a predetermined pack **102** is caused to adhere to the underside of the disk **103** while the latter moves the thus attracted pack along the suction chambers **111** and **129**. This causes the pack to land on the upper stretch of the belt **126** and to be transported (arrow **127**) to the testing device for spot checking. As stated before, the circuit **137** can be designed to cause each second pack **102** to move onto the belt **126** or to cause *m* packs **102** to move onto the belt **126** after the transport of *n* packs onto the belt **119** (*m* or *n* is a whole number including 1). It is normally sufficient for spot checking to transfer each tenth pack **102** from the belt **101** onto the belt **126** and to transfer all of the remaining packs onto the belt **119** for further processing without testing.

In the embodiment of FIG. **2**, the path defined by the belt **119** is substantially normal to the path defined by the belt **101** and substantially normal to the path defined by the belt **126**. It is clear that the mutual inclination of such paths can be varied at will, depending on the availability of space and on the mounting of the packing, testing, pack-binding and/or carton filling means. The packs which are transported onto the belt **119** travel along one-fourth of the endless path defined by the disk **103** and the packs which are transported onto the belt **126** travel along about one-half of such endless path. If the timer circuit **137** is set to cause the transfer of each tenth pack **102** onto the belt **126**, the period during which the solenoid **122** is energized is just long enough to insure that a single pack adheres to the underside of the disk **103** while the latter covers an angle of about 180° so that the pack lands on the belt **126**.

The timer circuit **127** will be set to energize the solenoid **122** in response to detection of each second pack **102** if the single series or row of packs on the belt **101** is to be divided into two streams or rows of packs one of which travels in the direction indicated by the arrow **121** and the other of which travels in the direction indicated by the arrow **127**. Such setting of the timer circuit **137** is desirable when the output of a single packing machine which delivers packs **102** to the belt **101** is to be processed by two carton filling or pack-binding machines which can be installed close to or at a desired distance from each other. The exact details of construction of the timer circuit **137** form no part of the present invention.

The improved transporting apparatus is susceptible of many additional modifications without departing from the spirit of our invention. For example, the detector **16** or **136** can be designed to scan the packs **2**, **102** or analogous commodities (such as discrete cigarettes, cigarillos, cigars or cheroots) for the presence or absence of spots, holes in wrappers, unsatisfactory fillers or filter plugs and/or other defects. The transporting apparatus can be used to divide a single stream of rod-shaped tobacco-containing articles into a plurality of streams. It is also within the purview of the invention to use the apparatus for converting several discrete streams of commodities into a single stream.

An important advantage of the transporting apparatus is that it can classify commodities without any damage to their components and that its operation is not dependent on the rate at which the commodities are delivered into the range of the pneumatic conveyor. Thus, the apparatus can be used in connection with machines which discharge commodities at a regular rate or at different intervals. Also, the apparatus can change the direction of commodities to a desired extent and in a small area, regardless of whether it serves to merely change the direction of travel of a single stream of commodities or to divide a single stream into several streams. The apparatus comprises a small number of simple parts and is readily convertible for the transport of different types of commodities as well as for spot checking, simple changing of direction, or dividing into several streams each of which can travel in a different direction.

The photoelectric detector **16** or **136** can be replaced with a mechanical scanning device, a pneumatic scanner which transmits pneumatic signals to a transducer, an electromagnetic scanner or another detector.

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 our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

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

1. A method of transporting packs of tobacco-containing articles or analogous commodities, comprising the steps of conveying a series of commodities along a first path located in a first plane; scanning the commodities of said series in said first path; producing signals in response to detection of selected commodities in said series; pneumatically lifting the selected commodities of said series in response to said signals into a second path located in a second plane which is at least substantially parallel to said first plane and conveying the thus lifted commodities along at least a portion of said second path; and the additional step of transferring commodities from said second path into at least one further path.

2. A method as defined in claim **1**, wherein said second path is a substantially circular path.

3. A method as defined in claim **1**, wherein said additional step comprises transferring commodities from said second path into a plurality of further paths, and further comprising the step of conveying the commodities along each of said further paths to discrete processing stations.

4. A method as defined in claim **1**, wherein said step of pneumatically lifting said selected commodities comprises lifting the commodities by the application of suction and wherein said signals are utilized to control the application of suction.

5. A method as defined in claim **1**, wherein said scanning step comprises counting the commodities of said series and wherein the commodities which are to be lifted into said second path are selected in accordance with a predetermined schedule.

6. A method as defined in claim 1, wherein the commodities of said series include at least two classes of commodities and said scanning step comprises detecting one of said classes of commodities.

7. A method as defined in claim 1, wherein said step of conveying the lifted commodities includes continuously moving such commodities along said portion of said second path.

8. A method as defined in claim 1, wherein said further path is at least substantially parallel to said first path.

9. Apparatus for classifying packs of tobacco-containing articles or analogous commodities, comprising a first conveyor for conveying a series of commodities along a first path located in a first plane; a pneumatic overhead conveyor operative to lift at least some commodities from said first path and to transport the thus lifted commodities along at least a portion of a second path located in a plane which is disposed above and is at least substantially parallel to said first plane, said penumatic conveyor comprising an air-permeable rotary conveying element and at least one suction chamber adjacent to said conveying element; and receiving means for accepting commodities from said pneumatic conveyor.

10. Apparatus as defined in claim 9, wherein said receiving means comprises at least one additional conveyor arranged to transport commodities along at least one further path.

11. Apparatus as defined in claim 9, wherein said element has a first side facing said first plane and a second side, said suction chamber having an open side facing said second side and extending along said portion of said second path.

12. Apparatus as defined in claim 11, wherein said conveying element is a rotary apertured disk.

13. Apparatus as defined in claim 9, wherein said first conveyor comprises an endless belt.

14. Apparatus as defined in claim 9, wherein said receiving means comprises at least one further conveyor having an endless belt for reception of commodities from said pneumatic conveyor.

15. Apparatus as defined in claim 9, further comprising selector means for selecting those commodities which are lifted by said pneumatic conveyor, said selector means comprising detector means for scanning the commodities of said series.

16. Apparatus as defined in claim 15, wherein said detector means comprises means for producing signals in response to detection of at least some commodities of said series.

17. Apparatus as defined in claim 16, wherein said selector means further comprises means for operating said pneumatic conveyor in response to at least some of said signals.

18. Apparatus as defined in claim 9, wherein said pneumatic conveyor comprises means for changing the direction of travel of commodities between said first path and said receiving means.

19. Apparatus as defined in claim 9, further comprising means for continuously rotating said conveying element.

20. Apparatus for transporting packs of tobacco-containing articles or analogous commodities, comprising a first conveyor for conveying a series of commodities along a first path located in a first plane; a pneumatic overhead conveyor operative to lift commodities from said first path and to transport the thus lifted commodities along at least a portion of an endless second path located in a plane which is disposed above and is at least substantially parallel to said first plane; receiving means for accepting commodities from said pneumatic conveyor; and selector means for selecting those commodities which are lifted by said pneumatic conveyor, said selector means comprising detector means for scanning the commodities of said series and having means for producing a signal in response to detection of each commodity of said series, and counter means for operating said pneumatic conveyor in response to reception of a predetermined number of signals from said detector means.

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