

Description

This invention relates to a vacuum single filer apparatus for, and a method for, the transport of articles in a wide mass at an upstream location into single file at a downstream location.

Various prior apparatus have been devised for bringing containers which are in a bulk or multiple row arrangement into single row alignment. However, these have inherently had certain disadvantages. Apparatus have been provided wherein multiple rows of containers are moved downstream in a conveyor belt and diagonal deflectors extend inwardly from both sides to funnel the containers into single file arrangement at the downstream end. Such an apparatus is illustrated in U.S.-1,990,549. All these apparatus have an inherent disadvantage in that the containers tend to bridge across the space between the deflectors and can create a jam resulting in the discontinuance of the flow of containers in a single file alignment at the downstream end. Also, such apparatus will only operate satisfactorily at relatively slow speeds, such as under 500 containers per minute.

Roller type conveyor apparatus have been provided for conveying multiple rows of containers which are brought into single file by a deflector which extends downstream and diagonally across the conveyor to one side thereof ultimately to bring the containers into single file alignment. Again, such apparatus must be operated at relatively low speeds. Examples of such devices are shown in U.S.-A-2 468 290 and U.S.-A-2 690 251.

A vacuum belt apparatus is illustrated in U.S.-A-3 352 404 which serves to bring bottles which are dropped down onto the conveyor thereof into longitudinal alignment. This apparatus, however, is not used for bringing multiple rows of containers into single file.

A high speed vertical single filer is described in EP-A-117633 or U.S. Patent published December 31, 1985 under No. 4 561 806. This device is very efficient and effective for bringing multiple rows of containers into single file at high speed such as 3,500 containers per minute or more. Opposite side walls converge and acceleration jets are provided which coact to bring containers into single file alignment as they move from the upstream end to the downstream end. However, one disadvantage is that a relatively long longitudinal path is required in order to accomplish the single filing. Because of the physical constraints presented in some plants, there is not sufficient distance between adjacent stations so that containers can be brought into single file utilizing this vertical single filer. Furthermore, it cannot be used with containers having high frictional surfaces, such as bright containers. Otherwise, jamming will occur at the point of the equilateral triangle formed by the converging containers because of opposite containers rotation.

A single filer apparatus is also disclosed in EP-A-175 292 which is prior art only in the sense specified in Article 54(3) and (4). In this apparatus,

the articles remain substantially in contact with each other throughout the alignment process and each article in the initial wide mass has to be forced between two other articles to take up its position in the single file.

In accordance with this invention, the apparatus as set forth above (see EP-A-117633) is characterized by means for arranging said mass into discrete rows or articles which rows are inclined to the transportation direction of said apparatus with an article at an outside end of each row longitudinally aligned with a single file downstream location, means for longitudinally separating and moving the discrete rows of articles from said upstream location towards said downstream location, vacuum means for holding the outside article in fixed position relative to the moving means as it is moved from said upstream location to said downstream location; and means for moving the other articles in each row into alignment behind the outside article as the articles are moved from said upstream location to said downstream location.

Also in accordance with the invention, the method as set forth above (see EP-A-117633) is characterized by the steps of arranging the mass of articles into discrete rows of articles which are inclined to the direction between the upstream location and the downstream location; successively separating the inclined rows of articles; moving the separated rows of articles downstream from the upstream location; moving the other articles in each row into alignment with an outside article thereof as the row is moved from the upstream location to the downstream location; and holding the outside article in fixed lateral position by means of vacuum as the other articles are moved into alignment therewith.

The single filer may include a foraminous belt having a reach with a center line, extending from an upstream location to a downstream location and having first and second side edges. Means may be provided for moving the foraminous belt from the upstream location to the downstream location. Means may also be provided for supplying articles to the belt at the upstream location in a wide mass. A vacuum plenum preferably extends below the reach of the belt and has an upper wall with openings therein to draw vacuum in the plenum and a guide may extend above the belt at an angle thereto from a point adjacent the first side of the belt at the upstream location to a point spaced from the second side of the belt a distance slightly greater than the diameter of the article to form a single file discharge for the articles at the downstream location along an axis parallel to the center line. Means may be provided which draw a higher vacuum through the belt along the axis passing through the single file discharge to hold the articles aligned with the discharge in position to pass therethrough. The openings in the plenum wall are preferably longitudinal slots which vary in width depending on the amount of vacuum to be drawn and correspond in lateral arrangement with rows of per-

forations or holes in the foraminous belt. At the upstream end, a dead plate is preferably provided having a diagonal downstream edge with slots therein for drawing a vacuum on the aligned rows of articles over the dead plate to hold them in alignment in diagonal rows. They are moved in this alignment downstream by the mass of articles behind them. As the rows of articles move onto the foraminous belt, the belt separates them into discrete rows wherein the articles in each row can be moved laterally so as to be brought into longitudinal alignment along the center line.

A most important preferred feature is an infeed vacuum belt which moves the mass of articles onto the vacuum dead plate when handling articles with high friction surfaces. The articles then have to be in a tight equilateral triangle on this infeed vacuum belt and rotation cannot occur or articles will bridge across the dead plate and jam. The infeed vacuum belt holds the articles firmly in place and will not allow the two outside articles to start to rotate which would normally occur because of friction contact with the two outside guide rails.

Slots are preferably provided in the leading edge of the dead plate through which vacuum is drawn to hold firmly the articles in diagonal rows until they are pushed off the vacuum dead plate onto the vacuum belt. If it were not for the slots in the vacuum dead plate the air being pulled into the vacuum belt would draft the articles off the dead plate by the Coanda Effect and the articles would feed onto the vacuum belt in a random helter-skelter fashion which would totally disrupt the single filing process.

It can be seen that this apparatus in accordance with the preferred embodiment, is simple in construction yet is highly efficient in operation and provides means for aligning a mass of containers into single file at high speed and over a short distance relative to that required in previously proposed apparatus.

A vacuum single filer in accordance with the present invention will handle articles such as freshly washed, highly-etched aluminium containers which have an extremely high coefficient of friction since opposing rotation cannot occur.

Articles of the same diameter do not require adjustment of the single filer for different heights, which is the case of all present and previously proposed mechanical or air single filers which are handling articles having a high coefficient of friction.

A vertical single filer embodying the present invention will now be described, by way of example, with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is a perspective view of a vacuum single filer in accordance with the present invention;

Figure 2 is a fragmentary, side elevation of the apparatus of Figure 1, with the containers omitted for clarity of illustration;

Figure 3 is a top plan view of the apparatus of Figure 1, showing further details thereof;

Figure 4 is fragmentary plan view, to an enlarged scale, of a dead plate showing the position of the containers as they move thereacross onto a perforate belt of the apparatus;

Figure 5 is vertical fragmentary section, to an enlarged scale, taken on line 5-5 of Figure 3, showing the arrangement of the drive belts at the dead plate area;

Figure 6 is a vertical section, taken on line 6-6 of Figure 3, showing details of vacuum plenums forming parts of the apparatus;

Figure 7 is a top plan view, similar to Figure 3, but omitting the belt and rails to show the arrangement of vacuum slots and locations of various plenums;

Figure 8A is a fragmentary, top plan view at the downstream end of the single filer showing a downed container as it is being drafted away from the other containers; and

Figure 8B is a fragmentary, top plan view similar to Figure 8A, but showing the drafted container as it is discharged from the apparatus.

In accordance with this invention, a vacuum single filer is provided wherein a mass of articles, such as containers 10 can be brought into single file alignment at very high speeds. By way of a general description, the apparatus includes a vacuum plenum table 11 having an endless transfer belt 12 which extends around an upstream idler roller 13 and a downstream drive roller 14 for conveying containers from the upstream location to the downstream location to bring them from a multi-row alignment into a single file, as more fully described below. The downstream end of belt 12 passes around a lower downstream roller (not shown) which is journaled in bearings 15. Belt 12 extends along the bottom of table 11 to a lower upstream roller (not shown), which is journaled in bearings 16, and back to roller 13. Conveniently, roller 13 is mounted on shaft 17 which is journaled in bearings, such as bearing 18. Similarly, roller 14 is mounted on shaft 19 which is journaled in bearing 20. Table 11 has spaced side walls 21 and 22 which are interconnected by an upstream end wall 24 and a downstream end wall 26. Within this table are several plenums which are individually controlled and are described more fully below. Over the top of the table and the plenums is a plenum top wall or slotted board 28 through which air is drawn by the vacuum from the various plenums. Conveniently, endless belt 12 has a plurality of rows of perforations or holes 30 which are aligned with selective slots in board 28 to facilitate the single file alignment of the containers, all as discussed below.

Advantageously, containers 10 are supplied onto a dead plate 32 by suitable infeed vacuum conveyor means, such as conveyor belt 33, having perforations 34, best seen in Figure 4, which extends over drive roller 35. The drive roller 35 is mounted on shaft 36 journaled in bearing 37. The vacuum is drawn through vacuum plenum 38 mounted below belt 33. The containers are supplied from vacuum conveyor

belt 33 to dead plate 32 between a pairs of spaced side rails 39 and 40. The pairs of rails can be inclined towards one another over the portion thereof above belt 33 to bring the containers into tight contiguous rows of three or more which are nested together in their normal equilateral triangular configuration forming rows of three or more containers each at an angle of 30° to a line perpendicular to the direction of movement, all as best seen in Figures 1 and 3. The vacuum drawn through conveyor belt 33 serves to lock the containers in the tight equilateral configuration so that they remain indexed or aligned so that each row of containers has exactly the same alignment and will be discharged from the dead plate in exactly the same orientation with respect to each other.

As seen in Figures 3 and 4, dead plate 32 has a leading edge 42 which is at a corresponding 30° angle and has a plurality of parallel longitudinal slots 44 extending inwardly from the leading edge and which correspond in positioning with the rows of openings 30 in belt 12. As a vacuum is drawn in the plenum below openings 30, the row of containers which is adjacent the leading edge of dead plate 32 above slots 44 will be firmly held on the edge of the plate and remains there until they are pushed off the dead plate by adjacent rows of containers being moved forwardly by vacuum belt 33. This ensures that the containers are uniformly arranged in diagonal rows of three or more as they leave the dead plate and move onto belt 12. The spacing between adjacent diagonal rows of containers will be determined by the speed relation between belt 12 and belt 33 and can be adjusted as required to bring the containers into a continuous single row file. The faster the speed of belt 12 relative to the speed of belt 33, the greater the spacing between diagonal rows of containers.

Referring now to Figure 7, it can be seen that plenum top wall 28 includes a plurality of longitudinal slots which vary in length and width and are utilized to draw a vacuum on the bottom of the respective containers and to provide for variations in the vacuum due to the different vacuum chambers or plenum chambers over which the slots pass. An upstream vacuum chamber 46 is provided adjacent to and below dead plate 32. A large main vacuum chamber 48 is adjacent to and substantially downstream of vacuum chamber 46 and includes most of the area under top wall 28. Within main vacuum chamber 48 is a small intermediate vacuum chamber 50 and adjacent the downstream end of main vacuum chamber 48 is another small downstream vacuum chamber 52.

The vacuum chambers are encompassed by longitudinal side walls 54 and 56 which are interconnected by angular upstream end wall 58, which is parallel to the downstream edge of dead plate 32, and lateral downstream end wall 60.

Vacuum chamber 46 is defined further by a lateral side wall 62 which extends inwardly from outer side wall 54 and joins longitudinal wall 64

which is perpendicular thereto and extends upstream until it joins a short lateral side wall 66 which joins another longitudinal side wall 68 that extends upstream until it connects with a lateral portion 70 of diagonal side wall 58.

Plenum chamber 50 includes a lateral upstream wall 72 which extends inwardly from outer side wall 54 and connects to longitudinal wall 74 which in turn is connected to lateral downstream wall 76. Downstream plenum chamber 52 has an upstream lateral wall 78 which extends inwardly and connects to a longitudinal wall 79 which in turn connects to end wall 60.

Each of the above-described plenum chambers communicates with a lower, master vacuum, plenum 80 having vacuum drawn therein through duct 81 as seen in Figures 2 and 6 connected to a blower (not shown); plenum 80 extends under all of the other plenums and is bounded by the side walls 54 and 56 and the end walls 58 and 60. A top wall 82 separates lower chamber 80 from the other plenum chambers. The vacuum in main plenum chamber 48 is controlled by means of valve 83 between main chamber 48 and lower chamber 80, which is operated through control rod 84 connected to handle 86 (fig. 7). The upstream plenum chamber 46 has a valve 88, for communication with lower plenum chamber 80, operated through a control rod 90 connected to handle 92. Likewise, plenum chamber 50 has the vacuum controlled between it and chamber 80 by means of valve 94 connected through arm 96 to handle 98. Similarly, vacuum plenum 52 has the vacuum controlled between it and chamber 80 through valve 100 which is connected by means of arm 102 to handle 104.

A deflector 106 extends in a direction inclined to the length direction across a portion of belt 12 from an upstream end to a downstream end and serves to move the containers from their multi-row alignment into a single file across the vacuum belt, as will be discussed in more detail below. Conveniently, deflector 106 is supported by a plurality of adjustable brackets 108 which permit adjustment of the angle of deflection of the cans so that the deflector 106 may be straight or curved, as desired and as conditions dictate. The upstream end is located to be engaged by the innermost container of each inclined row. The downstream end is located to bring the containers into final single file alignment in cooperation with varying amounts of vacuum drawn on the respective containers of each inclined row.

A very long and relatively wide slot 110 extends from under a slot 44 of dead plate 32 downstream to a point wherein the containers are nearly in single file whereupon it necks down to a narrower slot 112 which extends downstream through the single file zone. As can be seen, the containers which are aligned with slot 110 at dead plate 32 remain aligned with this slot and continuing slot 112 through the single file zone at the downstream end.

Adjacent slot 110 is an equally wide, but much shorter slot 114 whose upstream end also begins

under one of slots 44 of dead plate 32, but extends downstream to a point closely adjacent the wall 62 between upstream plenum chamber 46 and main plenum chamber 48. The downstream end of slot 114 terminates in a narrower slot 116 which extends downstream through the single file zone. Similarly, another relatively short but wide slot 118 has an upstream end extending from beneath a slot 55 in dead plate 32 to a downstream location adjacent wall 62 and merges with a narrower slot 120 extending downstream to a position under deflector 106. Another wide but even shorter slot 122 extends from a position under another slot 44 in deadplate 32 downstream to a point adjacent lateral plenum wall 66 whereupon it merges with narrow slot 124 extending to a point under deflector 106. Finally, another short wide slot 126 extends from under another slot 44 in deadplate 32 downstream to a point adjacent lateral plenum wall 66 whereupon it merges with narrow slot 128 extending to a point under deflector 106. It will be understood that the lateral spacing of all of the previously described slots is less than one container diameter so that during the lateral movement, each container will be over at least one slot for holding it against the belt.

Each of the plenum chambers can be connected to a source of vacuum, such as an exhaust fan (not shown) which communicates to the various chambers by means of suitable ducts (not shown). For example, plenum chamber 46 is connected to the vacuum source through a valve 88 through which the flow of air can be adjusted, as by handle 92. A high vacuum is pulled through upstream plenum chamber 46 and therefore through slots 110, 114, 118, 122 and 126. Conveniently, each of these slots extends under slots 44 of dead plate 32, as previously described, and therefore firmly holds the leading row of containers so they are in precise angular alignment. They remain in that position until pushed forwardly by the mass of containers being advanced thereacross by belt 33. The high vacuum in this area stabilizes the containers so that they do not fall over as they move from the dead plate onto the belt and are brought up to the speed of the belt. However, after the containers leave the dead plate and are advanced by endless belt 12, the innermost container will cross plenum wall 66 and then will be above narrower slots 124 and 128 which are extensions of wider slots 122 and 126, respectively, so that this container is subjected to less vacuum force as it advances with belt 12. On the other hand, the outer containers will be under wide slots 110, 114 and 118 during this initial downstream movement. Thus, as the innermost container engages deflector 106 it will tend to be dragged to the rear of the other two containers. The containers will then be over the main plenum chamber 48.

As the containers move past lateral wall 62, which separates plenum chambers 46 and 48, the slots 114 and 118 are reduced in width and merge with narrow slots 116 and 120, as previously

described. Thus, the vacuum drawn on the center container is reduced, but since the outer container is still above wide slot 110, a substantial vacuum is still drawn thereon. As the containers move further downstream, the outside container moves over plenum chamber 50 whereupon narrow slot 116 increases in width to become a wide slot 130 thereby applying further vacuum on the outside container. This is necessary because by the time the containers reach this position the center container comes into engagement with deflector 106 and begins to be dragged rearwardly with respect to the outside container. Thus, it is important in this apparatus to hold the outside container in its aligned position with respect to the single file discharge against any frictional or lateral forces applied to it by the movement of the center container.

As the containers are carried downstream past plenum chamber 50 and back over plenum chamber 48, the two inside containers are now almost in single file but displaced inwardly and rearwardly from the outside container which continues along its original path. Slot 130 necks down to a narrow slot 132 which continues through the single file zone.

As containers continue further downstream, deflector 106 continues to push the inner containers outwardly so that they ultimately become aligned with the outside container. As the downstream end is approached, the wide slot 110 which is under the outside containers narrows down to a narrow slot 112 because at this point the inner containers are nearly aligned with the outer container and the additional vacuum force is no longer required. By reducing the size of the slots, the power requirements for the apparatus are also reduced very substantially. It will be understood that the vacuum force applied by the narrower slots, previously described, is of a low enough force that the deflector 106 can move or slide the cans laterally across the belt as the belt advances the containers, whereas the vacuum force under the wide slots is sufficient to substantially lock the container thereover in a fixed position relative to belt 12 as the other cans are moved laterally by the deflector 106. When the containers come into single file arrangement, they are parallel with guide 134 and are held in alignment by that guide and an opposite parallel guide 136, as best seen in Figures 1 and 3.

Adjacent the single file area, and spaced laterally outwardly from the path of the cans is a wide longitudinal drafting slot 138 of limited length. The purpose of this slot is to draft a downed container 10' away from the single file path and over the edge of vacuum plenum table 11 to a suitable receptacle (not shown) so that the container does not continue along the single file path with the properly oriented containers. The vacuum drawn through slot 138 will cause a downed container to be drawn toward the slot and because of the momentum of the container it will continue rolling across the slot and off the edge of the table into the receptacle. Con-

veniently, guide 136 (Fig. 1) comprises a single rail spaced above the belt a sufficient distance to allow a downed container 10' to roll thereunder.

From the foregoing, the advantages of the preferred embodiment of this invention are readily apparent. A vacuum single filing apparatus has been provided which will bring vertical containers into single file at very high speeds wherein inclined rows of three or more containers are sequentially discharged onto the vacuum conveyor belt with the outside container being held in fixed position by vacuum while a deflector moves the inner containers gradually into alignment behind the outside container ultimately bringing the containers into single file. Furthermore, this can be accomplished over a relatively short distance as compared to other single filers presently available. Another important advantage is that the single filer can be used to single file highly etched aluminium containers of any height which have surfaces with a high coefficient of friction.

The invention has been illustrated and described in conjunction with a preferred single filing apparatus wherein the containers are supported and conveyed by a belt under the containers. However, it should be understood that the single filing apparatus could be above the containers whereupon they are lifted and conveyed by means of the vacuum from the upstream position, wherein they are in mass, to the downstream single file zone in accordance with the teaching of U.S. Patent Application Serial No. 533,225 (issued under 4 561 806 on December 31, 1985).

Although the articles have been described as being empty cylindrical containers, they can be of any cross-sectional geometry, such as oval or rectangular. The sidewalls do not have to be straight, but can be contoured. The containers can be either full or empty and can be of any height. The container weight is merely a friction of the degree of vacuum that is pulled at the vacuum transfer belt to get the container up to speed without tipping over.

The term "vacuum" as used herein does not necessarily mean what is conventionally known as a "high vacuum". The term merely means a sub-atmospheric pressure at a level adequate to support or control an article.

Claims

1. A vacuum single filer apparatus for the transport of articles (10) in a wide mass at an upstream location into single file at a downstream location, said apparatus being characterized by means (39, 40, 44) for arranging said mass into discrete rows of articles which rows are inclined to the transportation direction of said apparatus with an article at an outside end of each row longitudinally aligned with a single file downstream location, means for longitudinally separating and moving the discrete rows of articles from said upstream location toward said downstream location, vacuum means (50) for holding the outside article in fixed position relative to the moving

means as it is moved from said upstream location to said single file downstream location; and means (106) for moving the other articles (10) in each row into alignment behind the outside article as the articles are moved from said upstream location to said downstream location.

2. Apparatus according to claim 1 characterized in that said means for moving the discrete rows of articles comprises a foraminous belt (12) having a reach with an article-conveying face, a vacuum face and a centreline, said reach extending from the upstream location to the downstream location and having an inside edge and an outside edge, that said vacuum means comprises plenum means (48, 50) on the vacuum face of said reach of said belt, said plenum means having a wall adjacent said reach with parallel longitudinal slots (120, 124) therein whereby to draw a vacuum through said belt, that said means (106) for moving the other articles comprises a deflector (106) extending from said article conveying side of said belt (12) at an angle thereto from a point adjacent said inside edge of said belt at said upstream location to a point spaced from said outside edge of said belt a distance slightly greater than the diameter or largest diameter of the articles (10) to form a single file discharge for the articles at said downstream location along an axis parallel to said centreline and in that means (50) are provided for a higher vacuum through said belt along said axis passing through said single file discharge to hold the outside article in each row aligned with said single file discharge and means (48) providing a lesser vacuum through said belt to other articles so that they can be slid across said belt by said deflector (106) to bring them into single file alignment along said parallel axis behind the outside article at said single file discharge.

3. Apparatus as claimed in claim 2, characterized by belt moving means (14, 19, 20) operative to move said belt (12) at sufficient speed to separate longitudinally said rows of articles along said belt so that each succeeding row of articles can be brought into alignment with the preceding articles without interference therewith.

4. Apparatus as claimed in claim 2 or claim 3, characterized in that one of said longitudinal plenum wall slots (110) is located along said axis and is wider than said other slots so as to serve as said higher vacuum providing means.

5. Apparatus as claimed in claim 2, claim 3 or claim 4, characterized in that said plenum wall (28) extends laterally beyond said outside edge of said belt and has a slot (138) parallel to and spaced from said outside belt edge to draft tipped articles (101) off said belt.

6. Apparatus as claimed in any one of claims 2 to 5, characterized in that said means for arranging said mass into discrete rows of articles comprises a dead plate (32) at said upstream location extending across said article conveying face of said reach of said belt (12) and having a leading inclined edge serving to align said articles in said inclined rows as they move on to said belt (12).

7. Apparatus as claimed in claim 6, characterized

veniently, guide 136 (Fig. 1) comprises a single rail spaced above the belt a sufficient distance to allow downed container 10' to roll thereunder.

From the foregoing, the advantages of the preferred embodiment of this invention are readily apparent. A vacuum single filing apparatus has been provided which will bring vertical containers into single file at very high speeds wherein inclined rows of three or more containers are sequentially discharged onto the vacuum conveyor belt with the outside container being held in fixed position by vacuum while a deflector moves the inner containers gradually into alignment behind the outside container ultimately bringing the containers into single file. Furthermore, this can be accomplished over a relatively short distance as compared to other single filers presently available. Another important advantage is that the single filer can be used to single file highly etched aluminium containers of any height which have surfaces with a high coefficient of friction.

The invention has been illustrated and described in conjunction with a preferred single filing apparatus wherein the containers are supported and conveyed by a belt under the containers. However, it should be understood that the single filing apparatus could be above the containers whereupon they are lifted and conveyed by means of the vacuum from the upstream position, wherein they are in mass, to the downstream single file zone in accordance with the teaching of U.S. Patent Application Serial No. 533,225 (issued under 4 561 806 on December 31, 1985).

Although the articles have been described as being empty cylindrical containers, they can be of any cross-sectional geometry, such as oval or rectangular. The sidewalls do not have to be straight, but can be contoured. The containers can be either full or empty and can be of any height. The container weight is merely a friction of the degree of vacuum that is pulled at the vacuum transfer belt to get the container up to speed without tipping over.

The term "vacuum" as used herein does not necessarily mean what is conventionally known as a "high vacuum". The term merely means a sub-atmospheric pressure at a level adequate to support or control an article.

Claims

1. A vacuum single filer apparatus for the transport of articles (10) in a wide mass at an upstream location into single file at a downstream location, said apparatus being characterized by means (39, 40, 44) for arranging said mass into discrete rows of articles which rows are inclined to the transportation direction of said apparatus with an article at an outside end of each row longitudinally aligned with a single file downstream location, means for longitudinally separating and moving the discrete rows of articles from said upstream location toward said downstream location, vacuum means (50) for holding the outside article in fixed position relative to the moving

means as it is moved from said upstream location to said single file downstream location; and means (106) for moving the other articles (10) in each row into alignment behind the outside article as the articles are moved from said upstream location to said downstream location.

2. Apparatus according to claim 1 characterized in that said means for moving the discrete rows of articles comprises a foraminous belt (12) having a reach with an article-conveying face, a vacuum face and a centreline, said reach extending from the upstream location to the downstream location and having an inside edge and an outside edge, that said vacuum means comprises plenum means (48, 50) on the vacuum face of said reach of said belt, said plenum means having a wall adjacent said reach with parallel longitudinal slots (120, 124) therein whereby to draw a vacuum through said belt, that said means (106) for moving the other articles comprises a deflector (106) extending from said article conveying side of said belt (12) at an angle thereto from a point adjacent said inside edge of said belt at said upstream location to a point spaced from said outside edge of said belt a distance slightly greater than the diameter or largest diameter of the articles (10) to form a single file discharge for the articles at said downstream location along an axis parallel to said centreline and in that means (50) are provided for a higher vacuum through said belt along said axis passing through said single file discharge to hold the outside article in each row aligned with said single file discharge and means (48) providing a lesser vacuum through said belt to other articles so that they can be slid across said belt by said deflector (106) to bring them into single file alignment along said parallel axis behind the outside article at said single file discharge.

3. Apparatus as claimed in claim 2, characterized by belt moving means (14, 19, 20) operative to move said belt (12) at sufficient speed to separate longitudinally said rows of articles along said belt so that each succeeding row of articles can be brought into alignment with the preceding articles without interference therewith.

4. Apparatus as claimed in claim 2 or claim 3, characterized in that one of said longitudinal plenum wall slots (110) is located along said axis and is wider than said other slots so as to serve as said higher vacuum providing means.

5. Apparatus as claimed in claim 2, claim 3 or claim 4, characterized in that said plenum wall (28) extends laterally beyond said outside edge of said belt and has a slot (138) parallel to and spaced from said outside belt edge to draft tipped articles (101) off said belt.

6. Apparatus as claimed in any one of claims 2 to 5, characterized in that said means for arranging said mass into discrete rows of articles comprises a dead plate (32) at said upstream location extending across said article conveying face of said reach of said belt (12) and having a leading inclined edge serving to align said articles in said inclined rows as they move on to said belt (12).

7. Apparatus as claimed in claim 6, characterized



in that said means for arranging said mass into discrete rows of articles comprises a perforate infeed belt (33) for supplying said articles to said dead plate (32) guide means (39, 40) for containing said mass of articles into an equilateral triangular configuration, and means (38) for drawing a vacuum through said infeed belt (33) to hold said articles in fixed relation to each other and against frictional forces applied by said guide means on said articles.

8. Apparatus, as claimed in any one of claims 2 to 7, characterized in that said vacuum plenum means (48, 50) comprises a plurality of plenum chambers adjacent said vacuum face of said belt reach (12) to draw varying amounts of vacuum along the length of said reach so as selectively to control the movement of the articles laterally across the belt.

9. Apparatus as claimed in claim 6, characterized in that the plenum slots (120, 124) have at least a relatively wide portion at the upstream end adjacent said dead plate (32) and a relatively narrower downstream portion (112, 132).

10. Apparatus as claimed in claim 9, characterized in that said dead plate (32) has a plurality of slots (44) aligned with an overlapping the upstream ends of said longitudinal plenum slots (120, 124).

11. Apparatus, as claimed in claim 10 characterized in that said vacuum plenum means includes an upstream plenum chamber (46) for drawing a vacuum through said dead plate slots (44) and at least a portion of the wide upstream portion of said longitudinal plenum slots, and a main plenum chamber (48) for drawing a vacuum through at least a large portion of the remainder of said plenum slots along their respective lengths.

12. Apparatus as claimed in claim 11, characterized in that said vacuum plenum means further includes an intermediate plenum chamber (50) within said main plenum chamber to draw a higher vacuum on articles moving along said axis to hold them in fixed position relatively to said belt as adjacent containers of any given row are slid laterally across said belt (12) into alignment along said axis by said deflector (106).

13. Apparatus as claimed in claim 5, characterized in that said vacuum plenum means further includes a downstream plenum chamber (52) at said single file discharge communicating with said parallel slot (138) to draft tipped articles (10') off said belt.

14. Apparatus as claimed in claim 2, characterized in that said longitudinal plenum slots include a first slot (128) adjacent said inside edge of said belt (12) having a wide upstream portion extending to a first, short, distance downstream and terminating downstream in a narrow portion extending to said deflector (106), a second slot (124) adjacent said first slot and spaced toward said outside edge of said belt having a wide upstream portion extending said first short distance downstream and terminating, downstream in a narrow portion extending to said deflector, a

third slot (120) adjacent said second slot (124) and spaced toward said outside edge of said belt having a wide upstream portion extending a second distance downstream which is greater than said first distance and terminating in a narrow portion extending downstream to said deflector (106), a fourth slot (116) adjacent said third slot and spaced toward said outside edge of said belt having a wide upstream portion extending said second distance downstream and terminating in a narrow portion extending downstream toward said deflector, and a fifth slot (110) adjacent said fourth slot and spaced toward said outside edge of said belt having a wide upstream portion extending a third distance downstream which is substantially greater than said second distance and terminating in a narrow portion (112) extending downstream through said downstream location.

15. Apparatus as claimed in claim 14, characterized in that said fourth slot (116) further includes alternate wide and narrow portions downstream to said deflector (106).

16. Apparatus as claimed in any one of claims 2 to 15, characterized by a pair of spaced rails (39, 40) which converge at said upstream location to hold the articles in said contiguous alignment.

17. A method of conveying a wide mass of articles at an upstream location into single file at a downstream location, characterized by the steps of arranging the mass of articles into discrete rows of articles which are inclined to the direction between the upstream location and the downstream location; successively separating the inclined rows of articles; moving the separated rows of articles downstream from the upstream location; moving the other articles in each row into alignment with an outside article thereof as the row is moved from the upstream location to the downstream location; and holding the outside article in fixed lateral position by means of vacuum as the other articles are moved into alignment therewith.

18. A method as claimed in claim 17, characterized in that the rows of articles are progressively moved into single file configuration.

Patentansprüche

1. Unterdruck-Aufreihvorrichtung für den Transport von an einer Zulaufstation in einer ausgebreiteten Menge vorliegenden Gegenständen (10) unter Bildung einer einzelnen Reihe derselben zu einer Ablaufstation, gekennzeichnet durch Einrichtungen (39, 40, 44) zum Ordnen der Menge der Gegenstände zu in bezug auf die Transportrichtung der Vorrichtung geneigt angeordneten Reihen von Gegenständen, so daß jeweils ein Gegenstand an einem äußeren Ende jeder Reihe in Längsrichtung auf eine Einzelreihen-Ablaufstation ausgerichtet ist, durch eine Einrichtung zum Trennen der einzelnen Reihen in Längsrichtung voneinander und zum Bewegen der einzelnen Reihen von Gegenständen von der Zulaufstation in Richtung auf die Ablaufstation,



durch eine Saugeinrichtung (50) zum Halten des jeweils äußeren Gegenstands in einer festen Position relativ zu der die Reihen bewegendes Einrichtung während der Bewegung von der Zulaufstation zur Einzelreihen-Ablaufstation, und durch eine Einrichtung (106) zum Bewegen der anderen Gegenstände (10) in jeder Reihe in Ausrichtung auf den jeweils äußeren Gegenstand während der Bewegung der Gegenstände von der Zulaufstation zur Ablaufstation.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Einrichtung zum Bewegen der einzelnen Reihen von Gegenständen ein gelochtes Band (12) aufweist, welches ein Trum mit einer Förderseite für die Gegenstände, eine Unterdruckseite und einer Mittellinie hat, wobei sich das Trum von der Zulaufstation zur Ablaufstation erstreckt und einen inneren und einen äußeren Rand aufweist, daß die Saugeinrichtung eine an der Unterdruckseite des Trums des Bands angeordnete Unterdruckkammer (48, 50) aufweist, welche in einer dem Trum zugewandten Wand mit sich parallel in Längsrichtung erstreckenden Schlitzen (120, 124) zum Ausüben einer Saugwirkung durch das Band hindurch aufweist, daß die Einrichtung (106) zum Bewegen der anderen Gegenstände eine Führung (106) aufweist, welche sich an der Förderseite des Bands (12) von einer an der Zulaufstation nahe dem inneren Rand des Bands liegenden Stelle in einem Winkel zu einer Stelle erstreckt, welche zum äußeren Rand des Bands einen Abstand aufweist, welcher etwas größer ist als der Durchmesser oder der größte Durchmesser der Gegenstände (10), so daß an der Ablaufstation ein Auslaß für die Einzelreihe der Gegenstände gebildet ist, dessen Achse parallel zu der Mittellinie verläuft, und daß eine Einrichtung (50) zum Erzeugen einer stärkeren Saugwirkung durch das Band hindurch entlang der Achse des Auslasses für die Einzelreihe zum Festhalten des äußeren Gegenstands in jeder Reihe in Ausrichtung auf den Auslaß für die Einzelreihe sowie eine Einrichtung (48) zum Erzeugen einer auf die anderen Gegenstände einwirkenden schwächeren Saugkraft durch das Band hindurch vorgesehen ist, so daß die anderen Gegenstände von der Führung quer zum Band verschoben werden können, um sie am Auslaß für die Einzelreihe in Einzelreihenausrichtung entlang der parallelen Achse mit dem jeweiligen äußeren Gegenstand zu bringen.

3. Vorrichtung nach Anspruch 2, gekennzeichnet durch einen Bandantrieb (14, 19, 20) zum Bewegen des Bands (12) mit einer zum Trennen der einzelnen Reihen von Gegenständen voneinander in Längsrichtung des Bands ausreichenden Geschwindigkeit, so daß sich die Gegenstände jeder Reihe in Ausrichtung auf die vorausgegangenen Gegenstände bringen lassen, ohne von diesen gestört zu werden.

4. Vorrichtung nach Anspruch 2 oder 3, dadurch gekennzeichnet, daß einer (110) der in Längsrichtung der einen Wand der Unterdruckkammer ausgebildeten Schlitze sich entlang der genannten Achse erstreckt und breiter ist als die anderen

Schlitze, so daß er als die Einrichtung zum Erzeugen der stärkeren Saugkraft wirksam ist.

5. Vorrichtung nach Anspruch 2, 3 oder 4, dadurch gekennzeichnet, daß die Wand (28) der Unterdruckkammer sich seitlich über den äußeren Rand des Bands hinaus erstreckt und einen im Abstand vom äußeren Rand des Bands parallel zu diesem verlaufenden Schlitz (138) zum Abziehen von umgefallenen Gegenständen (101) vom Band aufweist.

6. Vorrichtung nach einem der Ansprüche 2 bis 5, dadurch gekennzeichnet, daß die Einrichtung zum Ordnen der Menge der Gegenstände zu einzelnen Reihen von Gegenständen eine sich an der Zulaufstation quer über die Förderseite des Trums des Bands erstreckende Stellplatte (32) aufweist, welche einen schräg verlaufenden vorderen Rand zum Ausrichten der Gegenstände in den schräg geneigten Reihen bei ihrer Aufgabe auf das Band (12) hat.

7. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Einrichtung zum Ordnen der Gegenstände zu einzelnen Reihen von Gegenständen ein gelochtes Zufuhrband (33) zum Aufgeben der Gegenstände auf die Stellplatte (32), Führungseinrichtungen (39, 40) zum Zusammenhalten der Menge der Gegenstände in einer gleichseitigen Dreiecksform und eine Einrichtung (38) zum Erzeugen einer Saugkraft durch das Zufuhrband (33) hindurch aufweist, so daß die Gegenstände in fester Stellung relativ zueinander gehalten und gegen von den Führungseinrichtungen auf sie ausgeübte Reibungskräfte gesichert sind.

8. Vorrichtung nach einem der Ansprüche 2 bis 7, dadurch gekennzeichnet, daß die Unterdruckkammer (48, 50) in mehrere Unterdruckkammern an der Saugseite des Trums des Bands (12) unterteilt ist, so daß über die Länge des Trums unterschiedliche Saugkräfte erzeugbar sind, um die Querbewegung der Gegenstände über das Band wahlweise zu beeinflussen.

9. Vorrichtung nach Anspruch 6, dadurch gekennzeichnet, daß die Schlitze (120, 124) der Unterdruckkammer wenigstens einen relativ breiten Abschnitt am zulaufseitigen Ende nahe der Stellplatte (32) und einen relativ schmälere ablaufseitigen Abschnitt (112, 132) aufweisen.

10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß die Stellplatte (32) eine Anzahl von Schlitzen (44) aufweist, welche auf die Längsschlitze (120, 124) der Unterdruckkammer ausgerichtet sind und deren zulaufseitige Enden überlappen.

11. Vorrichtung nach Anspruch 10, dadurch gekennzeichnet, daß die Unterdruckkammer eine zulaufseitige Unterdruckkammer (46) zum Erzeugen einer Saugkraft durch die Schlitze (44) der Stellplatte und wenigstens ein Stück des breiteren Abschnitts der Längsschlitze der Unterdruckkammer hindurch und eine Haupt-Unterdruckkammer (48) zum Erzeugen einer Saugkraft durch wenigstens einen großen Teil der verbleibenden Abschnitte der Schlitze der Unterdruckkammer über die jeweilige Länge derselben aufweist.



12. Vorrichtung nach Anspruch 11, dadurch gekennzeichnet, daß die Unterdruckkammer eine innerhalb der Haupt-Unterdruckkammer angeordnete innere Unterdruckkammer (50) aufweist, welche eine erhöhte Saugkraft auf sich entlang der Achse bewegende Gegenstände ausübt, um diese in fester Position relativ zu dem Band zu halten, während benachbarte Behälter einer jeweiligen Reihe durch die Führung (106) quer über das Band (12) in Ausrichtung verschoben werden.

13. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß die Unterdruckkammer ferner eine ablaufseitige Unterdruckkammer (52) an dem Einzelreihen-Auslaß aufweist, welche zum Abziehen von umgefallenen Gegenständen (10') von dem Band mit dem parallelen Schlitz (138) strömungsverbunden ist.

14. Vorrichtung nach Anspruch 2, dadurch gekennzeichnet, daß zu den sich in Längsrichtung erstreckenden Schlitzen der Unterdruckkammer ein zunächst dem inneren Rand des Bands (12) verlaufender erster Schlitz (128) gehört, welcher einen sich über eine erste, kurze Länge in Laufrichtung erstreckenden, breiten zulaufseitigen Abschnitt aufweist und ablaufseitig in einem zu der Führung (106) verlaufenden schmalen Abschnitt ausläuft, ein dem ersten Schlitz benachbarter und in Richtung auf den äußeren Rand des Bands von diesem beabstandeter zweiter Schlitz (124) welcher einen sich über die kurze erste Länge in Ablaufrichtung erstreckenden breiten zulaufseitigen Abschnitt hat und ablaufseitig in einem zu der Führung verlaufenden schmalen Abschnitt ausläuft, ein dem zweiten Schlitz benachbarter und in Richtung auf den äußeren Rand des Bands von diesem beabstandeter dritter Schlitz (120), welcher einen sich über eine zweite Länge, welche größer ist als die erste Länge, ablaufseitig erstreckenden breiten zulaufseitigen Abschnitt aufweist und ablaufseitig in einem zu der Führung (106) verlaufenden schmalen Abschnitt ausläuft, ein dem dritten Schlitz benachbarter und in Richtung auf den äußeren Rand des Bands von diesem beabstandeter vierter Schlitz (116), welcher einen sich ablaufseitig über die zweite Länge erstreckenden breiten zulaufseitigen Abschnitt aufweist und ablaufseitig in einem zu der Führung verlaufenden schmalen Abschnitt ausläuft, und ferner ein dem vierten Schlitz benachbarter und in Richtung auf den äußeren Rand des Bands von diesem beabstandeter fünfter Schlitz (110), welcher einen sich über eine dritte Länge, welche beträchtlich größer ist als die zweite Länge, in Ablaufrichtung erstreckenden breiten zulaufseitigen Abschnitt aufweist und ablaufseitig in einem durch die Ablaufstation hindurch verlaufenden schmalen Abschnitt (112) ausläuft.

15. Vorrichtung nach Anspruch 14, dadurch gekennzeichnet, daß der vierte Schlitz (116) in Ablaufrichtung auf die Führung (106) zu einander abwechselnde breite und schmale Abschnitte aufweist.

16. Vorrichtung nach einem der Ansprüche 2

bis 15, gekennzeichnet durch ein Paar konvergierend an der Zulaufstation angeordnete Schienen (39, 40) zum Zusammenhalten der Gegenstände in gegenseitiger Berührung.

17. Verfahren von in einer ausgebreiteten Menge an einer Zulaufstation vorliegenden Gegenständen zu einer Ablaufstation unter Bildung einer einzelnen Reihe der Gegenstände, dadurch gekennzeichnet, daß man die Menge der Gegenstände zu einzelnen Reihen von Gegenständen ordnet, welche schräg zu der Richtung von der Zulaufstation zur Ablaufstation verlaufen, daß man die schräg verlaufenden Reihen aufeinanderfolgend voneinander trennt, daß man die voneinander getrennten Reihen von der Zulaufstation in Ablaufrichtung fortbewegt, daß man die anderen Gegenstände jeder Reihe während der Fortbewegung derselben von der Zulaufstation zur Ablaufstation mit einem äußeren Gegenstand der Reihe in Ausrichtung bewegt und daß man den äußeren Gegenstand durch Unterdruck in einer seitlich fixierten Stellung festhält, während die anderen Gegenstände in Ausrichtung mit ihm gebracht werden.

18. Verfahren nach Anspruch 17, dadurch gekennzeichnet, daß die Reihen von Gegenständen fortschreitend zu einer durchgehenden Einzelreihe geordnet werden.

Revendications

1. Appareil à vide de mise en une seule file pour le transport d'objets (10) se trouvant en une large masse à un emplacement amont pour les amener en une seule file à un emplacement aval, cet appareil étant caractérisé en ce qu'il comprend des moyens (39, 40, 44) permettant d'amener cette masse en rangées distinctes d'objets, rangées qui sont inclinées par rapport à la direction de transport de l'appareil, un objet se trouvant à l'extrémité extérieure de chaque rangée étant en alignement longitudinal avec l'emplacement aval à file unique, des moyens pour séparer longitudinalement et déplacer les rangées distinctes d'objets depuis l'emplacement amont susdit vers l'emplacement aval, un dispositif à vide (50) permettant de maintenir l'objet extérieur en position fixe par rapport aux moyens de déplacement tandis qu'il se déplace depuis l'emplacement amont vers l'emplacement aval à file unique, et un dispositif (106) pour le déplacement des autres objets (10) de chaque rangée pour les amener en alignement à l'arrière de l'objet extérieur, au fur et à mesure que les objets sont déplacés depuis l'emplacement amont vers l'emplacement aval.

2. Appareil suivant la revendication 1, caractérisé en ce que les moyens prévus pour déplacer les rangées distinctes d'objets comprennent une courroie perforée (12) dont une volée comporte une face de transfert d'objets, une face à vide et un axe de symétrie, cette volée s'étendant depuis l'emplacement amont vers l'emplacement aval et comportant un bord intérieur et un bord extérieur, le dispositif à vide comprend des moyens à vide (48, 50) prévus suivant la face à vide de la volée



susdite de la courroie, ces moyens à vide comportant une paroi voisine de la volée et présentant les fentes longitudinales parallèles (120, 124) de manière à créer un vide à travers cette courroie, le dispositif (106) prévu pour déplacer les autres objets comprend un déflecteur (106) s'étendant depuis le côté de transfert d'objets de la courroie (12) suivant un angle déterminé par rapport à celle-ci, depuis un point voisin du bord intérieur susdit de la courroie à l'emplacement amont vers un point espacé du bord extérieur de cette courroie d'une distance légèrement supérieure au diamètre ou au plus grand diamètre des objets (10) pour former une décharge en une seule file des objets à l'emplacement aval le long d'un axe parallèle à l'axe de symétrie, et le dispositif (50) est prévu pour assurer un vide plus élevé à travers la courroie le long de l'axe passant par la décharge à file unique en vue de maintenir l'objet extérieur de chaque rangée en alignement avec cette décharge en file unique, un dispositif (48) assurant un vide moins élevé à travers la courroie susdite pour les autres objets de manière que ceux-ci puissent être amenés à glisser en travers de la courroie par le déflecteur susdit (106) afin de les amener en alignement en file unique le long de l'axe parallèle susdit, à l'arrière de l'objet extérieur à l'endroit de la décharge en une seule file.

3. Appareil suivant la revendication 2, caractérisé par des moyens (14, 19, 20) de déplacement de la courroie (12), capables de déplacer celle-ci à une vitesse suffisante pour séparer longitudinalement les rangées susdites d'objets le long de cette courroie afin que chaque rangée successive d'objets puisse être amenée en alignement avec les objets précédents sans interférence entre eux.

4. Appareil suivant la revendication 2 ou 3, caractérisé en ce que l'une (110) des fentes de paroi à vide longitudinales est localisée le long de l'axe susdit et est plus large que les autres fentes de manière à servir de moyen assurant un vide plus élevé.

5. Appareil suivant la revendication 2, la revendication 3 ou la revendication 4, caractérisé en ce que la paroi à vide (28) s'étend latéralement au-delà du bord extérieur de la courroie et présente une fente (138) parallèle au bord extérieur de la courroie et espacée de ce bord, cette fente étant destinée à attirer les articles tombés (10') à l'écart de cette courroie.

6. Appareil suivant l'une quelconque des revendications 2 à 5, caractérisé en ce que les moyens prévus pour agencer la masse susdite d'objets en rangées distinctes comprend un plateau immobile (32) à l'emplacement amont, s'étendant en travers de la face de transfert d'objets de la volée susdite de la courroie (12) et présentant un bord menant incliné servant à aligner les objets susdits en rangées inclinées au fur et à mesure qu'ils se déplacent pour arriver sur la courroie (12).

7. Appareil suivant la revendication 6, caractérisé en ce que les moyens prévus pour agencer la masse susdite en rangées distinctes d'objets comprend une courroie d'alimentation perforée

(33) destinée à amener les objets au plateau immobile (32), des moyens de guidage (39, 40) destinés à contenir la masse susdite d'objets suivant une configuration triangulaire équilatérale, et un dispositif (38) permettant d'appliquer un vide à travers la courroie d'alimentation (33) afin de maintenir les objets susdits en position fixe les uns par rapport aux autres et à l'encontre des forces de friction appliquées par les moyens de guidage susdits sur les objets précités.

8. Appareil suivant l'une quelconque des revendications 2 à 7, caractérisé en ce que les moyens à chambre à vide (48, 50) comprennent une série de chambres à vide adjacentes à la face à vide de la volée de la courroie (12) pour appliquer des grandeurs variables de vide suivant la longueur de la volée susdite afin de régler sélectivement le déplacement des objets latéralement en travers de la courroie.

9. Appareil suivant la revendication 6, caractérisé en ce que les fentes à vide (120, 124) comportent au moins une portion relativement large à l'extrémité amont, au voisinage du plateau immobile (32) et une portion aval relativement plus étroite (112, 132).

10. Appareil suivant la revendication 9, caractérisé en ce que le plateau immobile (32) présente une série de fentes (44) alignées de manière à chevaucher les extrémités amont des fentes de chambre longitudinales susdites (120, 124).

11. Appareil suivant la revendication 10, caractérisé en ce que les moyens à chambre à vide comprennent une chambre à vide amont (46) permettant d'appliquer un vide à travers les fentes (44) du plateau immobile et au moins une partie de la portion amont large des fentes de chambre longitudinales, et une chambre à vide principale (48) permettant d'appliquer un vide à travers au moins une partie large du reste des fentes à vide suivant leur longueur respective.

12. Appareil suivant la revendication 11, caractérisé en ce que les moyens à chambre à vide comprennent en outre une chambre à vide intermédiaire (50) à l'intérieur de la chambre à vide principale susdite pour créer un vide plus important sur les objets se déplaçant le long de l'axe susdit afin de les maintenir en position fixe par rapport à la courroie au fur et à mesure que les récipients adjacents d'une rangée donnée quelconque sont amenés à glisser latéralement en travers de la courroie (12) pour être amenés en alignement le long de l'axe susdit par le déflecteur (106).

13. Appareil suivant la revendication 5, caractérisé en ce que les moyens à chambre à vide comprennent en outre une chambre à vide aval (52) à l'endroit de la décharge susdite en file unique, cette chambre communiquant avec la fente parallèle (138) destinée à attirer les objets tombés (10') à l'écart de la courroie.

14. Appareil suivant la revendication 2, caractérisé en ce que les fentes à vide longitudinales comprennent une première fente (128) adjacente au bord intérieur de la courroie (12) et comportant une portion amont large s'étendant sur une pre-



mière distance courte se situant en aval et se terminant en aval par une portion étroite s'étendant vers le déflecteur (106), une seconde fente (124) adjacente à la première fente et espacée vers le bord extérieur de la courroie, cette fente présentant une portion amont large s'étendant suivant la première distance courte susdite vers l'aval et se terminant en aval par une portion étroite s'étendant jusqu'au déflecteur, une troisième fente (120) adjacente à la seconde fente (124) et espacée vers le bord extérieur de la courroie, en ayant une portion amont large s'étendant sur une seconde distance vers l'aval, qui est supérieure à la première distance susdite, et se terminant par une portion étroite s'étendant vers l'aval jusqu'au déflecteur (106), une quatrième fente (114) adjacente à la troisième fente et espacée vers le bord extérieur de la courroie, en comportant une portion amont large s'étendant suivant la seconde distance susdite vers l'aval et se terminant par une portion étroite s'étendant vers l'aval jusqu'au déflecteur, et une cinquième fente (110) adjacente à la quatrième fente et espacée vers le bord extérieur de la courroie, en ayant une portion amont large s'étendant sur une troisième distance vers l'aval, qui est sensiblement supérieure à la seconde distance susdite et se terminant par une portion étroite (112) s'étendant vers l'aval à travers l'emplacement aval susdit.

15. Appareil suivant la revendication 14,

caractérisé en ce que la quatrième fente (114) comprend en outre des portions large et étroite alternées en direction du déflecteur (106).

16. Appareil suivant l'une quelconque des revendications 2 à 15, caractérisé en ce qu'il comprend une paire de rails espacés (39, 40) qui convergent à l'emplacement amont pour maintenir les objets suivant l'alignement contigu précité.

17. Procédé pour transférer une large masse d'objets se trouvant à un emplacement amont pour les amener en une seule file à un emplacement aval, caractérisé en ce qu'il comprend les phases suivantes: l'agencement de la masse d'objets en rangées distinctes d'objets qui sont inclinées par rapport à la direction allant de l'emplacement amont à l'emplacement aval, la séparation en succession des rangées inclinées d'objets, le déplacement des rangées séparées d'objets vers l'aval depuis l'emplacement amont, le déplacement des autres objets de chaque rangée en alignement avec un objet extérieur au fur et à mesure que la rangée est déplacée depuis l'emplacement amont vers l'emplacement aval, et le maintien de l'objet extérieur dans une position latérale fixe grâce à un vide au fur et à mesure que les autres objets sont déplacés pour être amenés en alignement avec lui.

18. Procédé suivant la revendication 17, caractérisé en ce que les rangées d'objets sont progressivement déplacées pour être amenées suivant une configuration en une seule file.

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