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(54) **APPARATUS FOR FILLING A CAVITY, FILLING STATION AND METHOD OF FILLING A CAVITY**

VORRICHTUNG ZUM FÜLLEN EINES HOHLRAUMS, FÜLLSTATION UND VERFAHREN ZUM
FÜLLEN EINES HOHLRAUMS

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Description

[0001] This invention relates to apparatus for filling a cavity, a filling station and method of filling a cavity, in particular apparatus for filling under gravity from a hopper, a storage device for articles, the storage device having a form of a columnar cavity between opposed side walls, with a mass flow of mutually parallel (or substantially mutually parallel) rod-shaped articles descending from the hopper.

[0002] The apparatus is useful for filling a cavity with rod-shaped articles that are cigarette rods or cigarette filter rods or other tobacco products (such as cigars or cigarillos).

[0003] The tobacco industry presents specific challenges for handling a mass flow of articles. Cigarette rods and filter rods are physically delicate and fragile, but are handled in enormous numbers, when manufacturing packs of cigarettes. To handle a mass flow of cigarette rods from a cigarette maker to a cigarette packer, it is conventional to employ a so-called "tray" for temporary storage of cigarette rods and filter rods. Such a tray is known with only one chamber for storing the rods (i.e. with one columnar cavity), but trays are also known with a plurality of chambers, typically arranged as a single row of columnar cavities, each of which is defined by a pair of opposed side walls, each such side wall defining a thin partition between two adjacent columnar cavities in the row. The present invention has particular application to the filling of such trays but is also used for the filling of single chamber trays. In the further part of the description the name "storage device" can be replaced with the name "tray" respectfully single chamber tray or multicavity tray. The term "product" can be replaced with the term "article" or "rod-shaped article".

[0004] There is a long history of proposals for filling trays with cigarette rods or filter rods, in a way that will enable to achieve close-packing of the rods, with a minimum of free space and voids between adjacent rods. The closer the rods can be packed, in perfect symmetry, the less likely it is that one or other of the rods will suffer physical damage in the tray. Besides, perfect close packing of the rods will make maximum use of the storage capacity of any one tray.

[0005] Over the years, there have been numerous proposals for filling such trays with cigarette rods or filter rods. Such proposals include those of US Patent 2919529, DE-A-1066118, GB-A-2062567, DE-A-3103836, US-A-4489534, German A publications numbers 3708791, 3809689, 3819384 and 19829735. Also of interest are EP-A-920815 and EP-A-1955604.

[0006] Many of the prior proposals involve gradual downward movement of a tray, relative to a supply station, as the supply station delivers rods into the columnar cavities of the tray. In this way, the distance that an individual rod falls, when advancing out of the supply station and into the cavity of the tray, is reduced to a minimum. Once the tray has descended far enough that its columnar cavities are full, the supply of rods to those cavities can be terminated temporarily, to enable the full tray to be taken away and a fresh empty tray to be advanced into a position where its floor is immediately adjacent below the supply station, ready for the supply to be resumed and that fresh tray to be lowered gradually, during the filling process.

[0007] US 3 320 717 A discloses an apparatus for filling under gravity from a hopper, a storage device for articles that has the form of a columnar cavity between opposed side walls, with a mass flow of mutually parallel rod-shaped articles descending from the hopper, the apparatus comprising a cavity-filling device for filling the cavity that alternates in use between a closed configuration that blocks a downward flow of the said articles through the device and an open configuration that allows flow of the articles through the device.

[0008] It is an object of the present invention to achieve improvements in filling of trays with objects such as cigarette rods or filter rods.

Summary of the invention

[0009] The present invention provides apparatus for filling under gravity from a hopper, a storage device for articles that has the form of an columnar cavity between opposed side walls, with a mass flow of mutually parallel rod-shaped articles descending from the hopper, characterised by a cavity-filling device that alternates in use between a closed configuration that blocks a downward flow of the said articles through the device and an open configuration that allows flow of the articles through the device, the device being movable in translation, in alternate upward and downward strokes within the cavity, being in the closed configuration on the downward stroke and in the open configuration on the upward stroke.

[0010] The present invention provides also apparatus, wherein the cavity-filling device comprises a first set of mutually parallel co-planar elongate bars. The bars of the first set being spaced apart at regular intervals widely enough to permit the articles to slide between the bars. Further apparatus comprises a second set of mutually parallel co-planar bars. The bars of the second set being spaced apart at regular intervals such that, in the closed configuration, at least one bar of the second set obstructs each gap between the bars of the first set through which articles flow when the device is in its open configuration.

[0011] According to the invention the bars of the first set have a rectangular cross-section and are mounted for rotary motion while the bars of the second set have a circular cross-section.

[0012] According to the invention alternation between the said open and closed configuration is accomplished by a linear relative movement of the first bar and second bar sets in translation, transverse to the upward and downward direction.

[0013] According to the invention the bars of the first set are rotatably mounted on a support and the bars of the second set are mounted on a horizontally moveable beam arranged below of the bars of the first set.

[0014] The apparatus according to the invention is arranged for filling a storage device which is a tray that has a plurality of side walls that defines a single row of said columnar cavities, the apparatus being adapted to fill simultaneously a plurality of the columnar cavities in the row.

[0015] According to the invention in the apparatus including said hopper wherein the cavity-filling device prior to its downward stroke serves in its closed configuration as a shutter that closes an outlet in the base of the hopper.

[0016] According to the invention the apparatus includes means to actuate the cavity-filling device in dependence upon the fill state of the storage device beneath the cavity-filling device.

[0017] According to the invention the apparatus includes means to move the cavity-filling device upwards at a steady speed and downwards at a steady speed.

[0018] According to the invention there is provided a filling station for filling a succession of empty storage devices with mutually parallel rod-shaped articles, comprising a hopper, a filling apparatus according to the invention and a transport device for advancing a succession of the empty storage devices to a filling position beneath the filling apparatus and then advancing the storage devices, when full, out of the filling position.

[0019] According to the invention there is provided a method for filling succession of storage devices under gravity from a hopper, with a mass flow of mutually parallel rod-shaped articles, each storage device having the form of a columnar cavity between opposed side walls, the method comprising the steps of:

arranging a cavity-filling device under the hopper, the device is in a closed configuration that blocks a downward flow of the said articles through the device;

placing an empty storage device under the cavity-filling device;

moving the cavity-filling device downward as far as a base wall of the storage device;

shifting the device from the closed configuration to an open configuration that allows flow of the articles through the device;

moving the device upwards close to a top of the storage device;

shifting the device from the open configuration to the closed configuration; and

replacing the filled storage device with another empty storage device.

[0020] According to the invention the method, wherein the cavity-filling device comprises a first set of mutually parallel co-planar elongate bars, the bars of the first set being spaced apart at regular intervals widely enough to permit the articles to slide between the bars, and a second set of mutually parallel co-planar bars, the bars of the second set being spaced apart at regular intervals thereby providing such that at least one bar of the second set obstructs each gap between the bars of the first set when shifting the device from the open configuration to the closed configuration, and wherein the shifting step comprises shifting the bars of the second set laterally with respect to the first set of bars and the tray.

[0021] According to the invention the method further comprises the step of:

performing a rotary motion of the bars of the first set and/or the bars of the second set during upward and/or downward movement.

[0022] According to the invention the method further comprises the step of:

moving the cavity-filling device upwards and downwards at a constant speed.

[0023] According to the invention the method is used to fill simultaneously a plurality of the columnar cavities of a multi-compartment tray.

[0024] With the method and apparatus of the present invention, one can visualise any one or more of the following enhancements of performance:

1. A closer approach to perfectly close packing in the arrangement of product items within the cavity of the storage device filled with those items.
2. A greater level of confidence that the filling process will not do physical damage to any one of the articles.
3. A potential to increase the rate of filling of storage cavities.
- 5 4. A potential to reduce the physical size of the filling station.
5. Greater reliability of filling, leading to a reduced amount of "downtime" at the filling station.
6. A higher level of confidence that there will be no "spillage" of product items, released from a hopper but failing to be captured in the intended storage cavity.

10 **[0025]** Turning to the specifics of the cavity-filling device, Applicant envisages a first set of mutually parallel co-planar elongate bars, the bars of the first set being spaced apart at regular intervals widely enough to permit the articles to slide between the bars. Then there is a second set of mutually parallel co-planar bars, the bars of the second set being spaced
 15 apart at regular intervals such that there is at least one bar of the second set available to obstruct each gap between two adjacent bars of the first set. In operation, the second set of bars would occlude the gaps between the bars of the first set, during the downstroke, so that the first and second bar sets together support the rod articles just above the bar
 20 sets in the hopper, the downstroke of the cavity-filling device permitting a mass flow of parallel product articles to flow down, under gravity, into the cavity in which the cavity-filling device is descending. Then, when the cavity is full and the cavity-filling device is at the floor of the full cavity, the bars of the second set will move laterally so that each takes up a position more or less below one of the bars of the first set, thereby no longer occluding the gaps between the bars of
 25 the first set and allowing the product items to pass downwardly between the bars of the first set. In this configuration, the cavity-filling device is then raised gently through the full height of the full cavity, with all the rods in the cavity passing one by one through one or other gap between one or other pair of adjacent bars of the first set of bars (and the second set of bars) of the cavity-filling device, until the upwardly rising cavity-filling device reaches the top of the cavity. At this point, the cavity-filling device is once more up at the level of the base of the hopper, and a reverse movement of the
 bars of the second set, into the starting configuration where they occlude the gaps between the bars of the first set, will bring the cavity-filling device back to a configuration in which it functions as a shutter at the base of the hopper. At this point, the full tray can be removed and a fresh empty tray brought into position beneath the cavity-filling device, ready for a repeat of the tray filling operation.

30 **[0026]** It will be appreciated that, with the present invention, there need be no relative movement, during the cavity-filling process, between the hopper and the storage device. Instead, what is envisaged is an absence of such relative movement, during filling, between the hopper and the storage device, the requisite movement to achieve gentle filling being accomplished instead by the downward and upward stroke of the inventive cavity-filling device. This cavity-filling device, in preferred embodiments, functions not only as a shutter in the floor of the hopper, but also as a device for lowering product articles from the hopper to the floor of the cavity of the storage device, with virtually no unmanaged
 35 free fall under gravity apart from any residual "settling" of articles below the filling device, into their desired symmetrical close-packed arrangement in the storage cavity. Not only that, but the upward stroke of the cavity-filling device, through the bed of product items filling the cavity, has the potential to ease the product items into the desired close-packed arrangement, and minimise the number of unwanted "voids" and free space between the articles in the cavity below the filling device.

40 **[0027]** It will also be appreciated by skilled readers that the cavity-filling device can be the only subassembly that moves during the filling of the storage device. One can envisage that the space requirements needed for the reciprocating cavity-filling device might be relatively modest. Further, one can envisage a simplified mechanical construction of the filling station, and rapid exchange of a cavity-filling device that is in need of maintenance or repair, with very little downtime in the filling station as such.

45 **[0028]** Applicant has found it advantageous to select for the bars of the first set a cross-section which is generally rectangular (although the four perpendicular corners of the cross-section will be rounded to some extent, as appropriate to minimise physical damage to the articles being handled). Applicant has also found it effective to arrange for these bars of the first set, with non-circular cross-section, to be mounted all for simultaneous oscillatory rotatory motion about a relatively small angle. This assists the smoothness of throughflow of the product articles past the bars of the first set
 50 during the upstroke of the cavity-filling device. Furthermore, the gentle impulse given to the rod-shaped articles during the oscillatory motion can be just enough to assist the rods into a disposition closer to the ideal symmetrical close packed arrangement below the cavity-filling device.

[0029] However, a range of other cross-sections are contemplated. Circular cross-sections with a grooved or ridged surface might assist an oscillatory movement of the bars to jiggle the rod-shaped articles into a close-packed array. Non-circular cross-sections with a greater number of faces than four might work as well, or better, than 4-sided bars. While oscillatory rotatory movement is presently preferred, other forms of movement of the bars of the first set, such as small amplitude vibration about their median positions in the bar array, might be equally or more effective to assist through
 55 flow of rod articles and their close packing beneath the filling device. Specifically, we envisage small amplitude oscillation,

up and down, in the bars of the first set, as a way to defeat any incipient tendency of the rods to "bridge" between and above any particular adjacent pair of bars of the first set.

[0030] Conversely, the bars of the second set advantageously have a circular cross-section. They are not well-placed on the upstroke to assist the rod articles into a close packed disposition. Giving them a smooth circular cross-section is one design option. Another is to give them a trapezium cross-section with a pair of parallel faces serving as horizontally arranged upper and lower major surfaces. Conveniently, the bars of the second set are not required to rotate at all during the downstroke or the upstroke, but only to move, in the intervals between the upward and downward strokes, laterally relative to the bars of the first set. This is conveniently accomplished by mounting all the bars of the second set on a common beam that is arranged to move horizontally and laterally below the bars of the first set, between the open and closed configurations of the cavity-filling device.

[0031] Although the summary of the invention up to now has been in terms of a cavity-filling device, it will be appreciated that another aspect of the present invention resides in a method for filling a succession of columnar cavities, and a further aspect of the invention resides in a filling station that includes a cavity-filling device as described above.

Brief description of the drawings

[0032] For a better understanding of the present invention, and to show more clearly how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

- Fig. 1 is an isometric view of a first embodiment of filling station that includes a cavity-filling device according to the present invention, the filling station being in a first disposition, ready to receive an empty single compartment tray;
- Fig. 2 is a view of a second embodiment of filling station, in a second disposition, that includes a multi-compartment tray ready to be filled;
- Fig. 3 shows the station of Fig. 2, in a third disposition, with the tray part-filled;
- Fig. 4 shows the station of Figs. 2 and 3, in a fourth disposition, with the tray now full;
- Fig. 5 shows the station of Figs. 2 to 4, with the cavity-filling device undergoing its upstroke, through the full columns of the tray;
- Fig. 6 is a schematic section through one cavity of the tray of Fig. 2, showing the cavity-filling device serving as a shutter at the base of a hopper;
- Fig. 7 is a section like Fig. 6, but through the filling device at the point shown in Fig. 3;
- Fig. 8 is a section like Figs. 6 and 7, showing the filling device at the end of its downstroke, corresponding to the Fig. 4 disposition of the filling station;
- Fig. 9 is a section like that of Figs. 6, 7 and 8 but showing the filling device about to commence its upstroke from the floor of the cavity, with each circular bar of the second set now in a disposition immediately below a rectangular bar of the first set of bars of the filling device;
- Fig. 10 is a section like that of Figs. 6 to 9, but with the filling device part of the way through its upstroke;
- Fig. 11 is a section like that of Figs. 6 to 10, showing the filling device having reached the top of its upstroke, but not yet serving as a shutter;
- Fig. 12 is a section like that of Figs. 6 to 11, with the filling device at the same vertical height as in Fig. 11 but with the circular cross-section rods of the second set of rods occluding each gap between the rods of the first set so that the filling device is once more functioning as a shutter at the base of the hopper.
- Figs. 13, 14 and 15 are scrap sections of the upper part of the cavity being filled, each showing a different alternative cross-section for the bars of the cavity-filling device;
- Figs. 16 and 17 are isometric views like those of Figs. 1 and 2, each showing a different infeed/output architecture for the trays being filled at the filling station;
- Fig. 18 shows a single cavity tray in front elevation, with a cavity-filling device above, and temporary dividing walls within the tray cavity at the filling station; and
- Fig. 19 shows part of the length of a cavity-filling device, in isometric view.

Detailed description of preferred embodiments

[0033] The filling station 1 in Fig. 1 exhibits an input zone in which empty trays 2 are presented for filling on the station. Each tray has a back wall 3 and parallel side walls 5 and 6 with a cavity in-between. Full trays are carried along on an input conveyor 7 to a filling region 8 of the filling station. The tray of Fig. 1 exhibits just a single cavity. Each tray has a base surface 4 that spans between the opposed side walls 5 and 6 of its single full width cavity. Empty trays are carried along on an input conveyor 7 to a filling region 8 of the filling station. A hopper 9 for rod-shaped articles such as cigarette

rods or cigarette filter rods is fed from an input conveyor 11 and another input conveyor 7 brings empty trays to the filling station in which a filling device 12 is carried on vertical guides 13 so that it can perform an upstroke and a downstroke relative to the hopper 9. Fig. 1 shows a full tray 14 on the output conveyor 10, after having been lowered away from the filling region 8. The single tray 15 shown with base surface 4, at present in the filling region 8, has to be filled and then

5 lowered to the output conveyor 10, clear of the filling region, to leave the space there free for the next empty tray to be brought into the filling region by the input conveyor 7. Full trays are carried away on an output conveyor 10 from a filling region 8 of the filling station.

[0034] Moving on to Fig. 2, we see a succession of multi-compartment trays, with the next empty tray 16 having been conveyed into the filling region 8. In this drawing, tray 16 exhibits a single row of eight cavities, but operation of the present filling device is well-adapted equally for filling trays with a different number of columnar cavities. Fig. 2 shows an additional conveyor 18 below the filling station and useful for conveying improperly filled trays out of the filling station in a direction opposite to the direction, along conveyor 10, which properly filled trays take.

[0035] Readers will find it helpful, in the following description, to compare each isometric view with the corresponding sectional view, as the process proceeds. See also Fig. 19. We begin with Fig. 2 and Fig. 6. In each of the sectional views Figs. 6 to 15, we show (for the sake of clarity) the bars in only one columnar cavity and only the single next adjacent bar in the adjacent columnar cavity each side of the illustrated cavity. The drawings are not to scale.

[0036] The filling device 12 is embodied in a first set of square section bars 52 cantilevered from the main beam of the filling device 12. For more detail, see Fig. 19 below. In Fig. 6, we see a single columnar cavity 54 between opposed sidewalls 56 and 58, the cavity 54 being just one of the eight cavities visible in Fig. 2. Fig. 6 shows four square section bars 52. With eight columnar cavities, that would make a full set of $4 \times 8 = 32$ bars in the first set of bars of the filling device. Readers will appreciate that there may be more or less than 32 bars in the first set, depending on the relative dimensions of the product articles and the number of columnar cavities, and the width of each such cavity.

[0037] Co-linear with the walls 56 and 58, and above them, are depending stationary stub walls 56A and 58A carried by the hopper and extending downwardly from the base of the hopper 9.

[0038] The gaps between members of the set of square bars 52 are wide enough to permit throughflow of product items 60, except when the bars 62 of the second set of bars of the filling device are arranged to occlude the gaps between adjacent square bars 52. It can readily be seen in the section of Fig. 6 that when the circular section bars 62 are each arranged to occupy a position halfway between the two square bars of the first set immediately above, that will be enough to prevent product items 60 from advancing through the gaps between the bars of the first set. In this way, the first and second sets of bars and the stub walls 56A, 58A together function as a shutter to prevent any downward flow of product items out of the hopper 9 into the cavity 54.

[0039] Having described what is to be seen in drawing Figs. 2 and 6, it will be a relatively simple task for readers to follow the cycle of movement of the filling device through the successive stages shown in sections Fig. 7 through to Fig. 12.

[0040] Taking first Fig. 7, with isometric view Fig. 3, we see that the filling device has descended in the cavity 54 to a level B part of the way down the depth of the cavity 54. There has been no relative movement of the bars of the first and second sets of the filling device. A mass flow of product rods from the hopper 9 passes under gravity into the top of the column 54 and it can be seen from the schematic representation in Fig. 7 that the rods above the filling device 12 are not perfectly close packed. The filling device is descending slowly. The tray 14 and the hopper 9 are not moving relative to each other at all and, if the descent of the filling device 12 is gentle enough, there should be no damage to any of the product rods descending under gravity into the columnar cavity 54.

[0041] Moving on to Fig. 8 and Fig. 4, we see the filling device 12 at level C, corresponding to the bottom of its downstroke, with the circular section bars 62 unable to descend any further, because they are up against the base surface 4 of the columnar cavity. Note that each of the bars 62 has unobstructed free space either side of it, so is free to move laterally relative to the upper set of square bars 62. For the time being, however, the bars 62 continue to block any downward flow of product rods past the square bars 62.

[0042] The position changes in Fig. 9, however, with lateral movement of the round bars 62, each into a position vertically below a corresponding square bar 52. Suddenly, there is no longer any impediment to downward flow of product rods through the gaps between the square bars 52. We see in Fig. 9 that the three rods 64, 66 and 68 that in Fig. 8 were located level with the square bars 52 have now been able to fall between the gaps, freely under gravity, until they come to rest on the floor surface 4 of the columnar cavity. Attention is also directed to the product rod items 70 and 72 directly above the product rod 62 lying on the base of the storage cavity 54. Each of the rods 70 and 72 rests against the other one, and also against one of the square bars between which the product rod 64 has past downwardly. One can envisage that the two product rods 70 and 72 could stay indefinitely in a "bridged" position above the square bars of the filling device.

[0043] Moving on to Fig. 10, however, we see the filling device 12 at level D, some distance above the base of the cavity 54. Furthermore, we see three close packed rows of product rods below level D. We do not see in the drawings the oscillatory rotatory movement of the square bars 52, as the filling device 12 ascends through the bed of product rods in the storage cavity 54, but we can imagine that oscillation, and how it might frustrate any incipient bridging tendency and thereby assist the downward flow of product rods through the gaps between the bars 52, and how it might further

assist those product rods emerging downwardly from the gaps between the square bars 52 in taking up a close packed disposition as shown below level D in Fig. 10.

[0044] The filling device continues to rise through the bed of product rods, until it reaches the disposition shown in Fig. 11, at the top of the storage cavity, at level E, which is the same as level A in Fig. 6. In Fig. 11, however, the circular section rods 62 have not yet moved back across to the starting disposition shown in Fig. 6, where they occlude the gaps between square bars 52 to prevent further downward flow of product rods from the hopper 9. This disposition is shown in Fig. 12, which corresponds to that of Fig. 6 except that, in Fig. 12, the full tray below the tray filler has not yet been taken away and replaced by an empty tray such as we see in Fig. 6.

[0045] Not shown in the drawings, for reasons of clarity, are the various sensors, control devices and actuators that monitor and control the filling process. Specifically, an array of fullness sensors (known per se) can be arranged just below the cavity-filling device to ensure that each single cavity has been properly filled. In the event of improper filling of one or more cavities, the tray can be discharged from the filling station along conveyor 18 instead of conveyor 10.

[0046] Drawing Figs. 11 and 12 suggest to the viewer that the effect of the filling device is to deliver in the columnar cavity 54 an arrangement of product rods that is perfectly close packed. The Applicant does not make the claim that his filling device will always deliver perfect close packing of rods. It is merely suggested that the filling device which is the subject of this patent application offers some potential to deliver improvements in the degree of close packing that is achievable in the conventional trays used for temporary storage of cigarette rods and other tobacco products in the present day tobacco industry.

[0047] Moving on, we turn now to drawing Figures 13 to 15. Each is a scrap of a section corresponding to Fig. 6 and each shows a different shape of the cross-section of each bar 62 of the second set of bars. Thus, the bars in Fig. 13 have opposed flat parallel upper and lower faces and, linking them, one face that is orthogonal to both of the upper and lower faces and one that is somewhat inclined to the other face linking the upper and lower surfaces. Such a shape might be advantageous when the inclined face is the leading face when the second set of bars translates from the open to the closed configuration at the top of the columnar cavity, gently urging downwardly into the cavity any rod-shaped article that must be pushed aside before the cavity-filling device can reach its closed configuration.

[0048] As to Fig. 14, here we see both faces linking the upper and lower faces of the quadrilateral cross-section of the rods 62 being inclined to these faces at other than 90°, and symmetrical to each other. Such arrangement of rods 62 facilitates widening of the through channel in the region of the second set of rods. In this way, the bars can gently urge rod articles downwards both when the bars move into the closed configuration and when they move into the open configuration.

[0049] As to Fig. 15, we see bars 62 of a rectangular cross-section, but wider than they are thick. Where height constraints are severe, this shape might be advantageous, allowing minimisation of the height difference between the base of the hopper and the base of the tray being filled.

[0050] Moving on to Fig. 16, here we see an "In Line" filling station in which empty trays advance in direction P into filling station Q, before advancing further along a tray conveyor as shown by arrow R.

[0051] In contrast, Fig. 17 shows a similar infeed along arrow P into filling station Q, but an output in a direction S perpendicular to infeed conveyor P. Skilled readers will understand that various dispositions of infeed and output are possible, the arrangement being chosen being the one that meets best the customer's available accommodation for the filling station.

[0052] In Fig. 18, we see a single cavity tray in a filling station with a cavity-filling device with gaps between the bars 52 of the upper set of bars. Between two adjacent bars such as 82 and 84, there is no member of the set of lower bars 62, the gap instead being filled by one of a temporary dummy wall 82. The reader will appreciate that selective removal of lower bars 62, and replacement by dummy walls 80, can provide at the filling station as many or as few temporary columnar cavities within the volume of the tray as the operator of the process pleases. In passing, the reader will appreciate from Fig. 18 how it is that the filling device with a single set of upper bars 52 of uniform spacing can be modified (by selective removal of lower bars 62) to suit trays with different numbers of columnar cavities.

[0053] After the tray has been filled, the dummy walls in the filling station can be withdrawn from the full tray. One possibility is to withdraw them upwardly, through the open top of the full tray. Another possibility is to withdraw them laterally, away from the back wall of the full tray. Whatever architecture is selected will be the one that is fitting to the available space for the tray filling station. The dummy wall placement in the tray and removal from it, before and after the tray is filled, can naturally be integrated with movements of the cavity-filling device, and automated.

[0054] Turning to Fig. 19, we see a portion of the length of a cavity-filling device with an upper set of bars 52 and a lower set of bars 62. The upper set of bars is cantilevered from a beam 90 and the lower set from its own beam 92. Not shown are drive and suspension means whereby the lower beam 92 can be moved in translation, relative to the upper beam 90, between the open and the closed configurations of the device. Also not shown (but realisable nevertheless by those skilled in the art) are the means whereby the bars can be oscillated or vibrated as desired. Figs. 1 to 5 show where the beams 90,92 are installed in the device 12 to function within the filling station.

[0055] The drawings show only a few embodiments, and only schematically. The skilled reader will understand from

the disclosure how to put the invention into effect, over the scope of the claims which follow. The reader will also understand the details of the tobacco equipment industry, and therefore how to transform the schematic disclosures above into practical engineering solutions for integration into a fully-functioning commercial scale production line.

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Claims

1. Apparatus for filling under gravity from a hopper (9), a storage device (2, 14, 15, 16) for articles that has the form of a columnar cavity (54) between opposed side walls (5, 6, 56, 58), with a mass flow of mutually parallel rod-shaped articles (60) descending from the hopper (9), comprising a cavity-filling device (12) for filling the cavity (2, 14, 15, 54) that alternates in use between a closed configuration that blocks a downward flow of the said articles through the cavity-filling device (12) and an open configuration that allows flow of the articles through the cavity-filling device (12),
and **characterized in that:**
- the cavity-filling device (12) being movable in translation, in alternate upward and downward strokes within the cavity (2, 14, 15, 54), being in the closed configuration on the downward stroke and in the open configuration on the upward stroke.
2. The apparatus according to Claim 1, wherein the cavity-filling device (12) comprises a first set of mutually parallel co-planar elongate bars (52), the bars (52) of the first set being spaced apart at regular intervals widely enough to permit the rod-shaped articles (60) to slide between the bars (52), and a second set of mutually parallel co-planar bars (62), the bars (62) of the second set being spaced apart at regular intervals such that, in the closed configuration, at least one bar (62) of the second set obstructs each gap between the bars (52) of the first set through which articles flow when the cavity-filling device (12) is in its open configuration.
3. The apparatus according to Claim 2, wherein the bars (52) of the first set have a rectangular cross-section and are mounted for rotary motion.
4. The apparatus according to Claim 2, wherein the bars (62) of the second set have a circular cross-section.
5. The apparatus according to Claim 2, 3 or 4, wherein alternation between the said open and closed configuration is accomplished by a relative movement of the first bar (52) and second bar (62) sets in translation, transverse to the upward and downward direction.
6. The apparatus according to Claim 5, wherein the bars (52) of the first set are rotatably mounted on a support (90) and the bars (62) of the second set are mounted on a horizontally moveable beam (92) arranged below of the bars (52) of the first set.
7. The apparatus according to any one of the preceding claims for filling a storage device which is a tray (16) that has a plurality of side walls (56, 58, 80) that defines a single row of said columnar cavities (54), the apparatus being adapted to fill simultaneously a plurality of the columnar cavities (54) in the row.
8. The apparatus according to any of Claims 1 to 5 and including said hopper (9) and wherein the cavity-filling device (12) prior to its downward stroke serves in its closed configuration as a shutter that closes an outlet in the base of the hopper (9).
9. The apparatus according any one of the preceding claims and including means to actuate the cavity-filling device (12) in dependence upon the fill state of the storage device (2, 14, 15, 16) beneath the cavity-filling device (12).
10. The apparatus according to any one of the preceding claims, and including means to move the cavity-filling device (12) upwards at a steady speed and downwards at a steady speed.
11. A filling station (1) for filling a succession of empty storage devices (2, 15, 16) with mutually parallel rod-shaped articles (60), the filling station (1) comprising a hopper (9), a filling apparatus according to any one of Claims 1 to 10 and a transport device for advancing a succession of the empty storage devices (2, 15, 16) to a filling position beneath the filling apparatus and then advancing the filled storage devices (14), out of the filling position.

12. A method for filling succession of storage devices (2, 15, 16) under gravity from a hopper (9), with a mass flow of mutually parallel rod-shaped articles, each storage device (2, 14, 15, 16) having the form of a columnar cavity between opposed side walls (5, 6), the method comprises the steps of:

5 arranging a cavity-filling device (12) under the hopper (9), the cavity-filling device (12) is in a closed configuration that blocks a downward flow of the said articles through the cavity-filling device (12);
 placing an empty storage device (2, 16) under the cavity-filling device (12);
characterised in that
 it further comprises the steps of:
 10 moving the cavity-filling device (12) downward as far as a base wall of the storage device (2, 16);
 shifting the cavity-filling device (12) from the closed configuration to an open configuration that allows flow of the articles through the cavity-filling device (12);
 moving the cavity-filling device (12) upwards close to a top of the storage device (2, 16);
 shifting the cavity-filling device (12) from the open configuration to the closed configuration; and
 15 replacing the filled storage device (2, 16) with another empty storage device (2, 16).

13. The method according to Claim 12, wherein the cavity-filling device (12) comprises a first set of mutually parallel co-planar elongate bars (52), the bars (52) of the first set being spaced apart at regular intervals widely enough to permit the rod-shaped articles (60) to slide between the bars (52), and a second set of mutually parallel co-planar bars (62), the bars (62) of the second set being spaced apart at regular intervals thereby providing such that at least one bar (62) of the second set obstructs each gap between the bars (52) of the first set when shifting the cavity-filling device (12) from the open configuration to the closed configuration, and wherein the shifting step comprises shifting the bars (62) of the second set laterally with respect to the bars (52) of the first set of bars and the storage device.

14. The method according to Claim 13, further comprising the step of:

performing a rotary motion of the bars (52) of the first set and/or the bars (62) of the second set during upward and/or downward movement.

15. The method according to any of Claims 12 to 14, further comprising the step of: moving the cavity-filling device (12) upwards and downwards at a constant speed.

16. The method according to any one of Claims 12 to 15, wherein the method is used to fill simultaneously a plurality of the columnar cavities (54) of a multi-compartment storage device (16).

Patentansprüche

1. Vorrichtung zum Befüllen einer Speichervorrichtung (2, 14, 15, 16) für Gegenstände, die die Form eines säulenförmigen Hohlraums (54) zwischen einander gegenüberliegenden Wänden (5, 6, 56, 58) aufweist, aus einem Trichter unter Nutzung der Schwerkraft mit einem Massenstrom aus zueinander parallelen, stabförmigen Gegenständen (60), die aus dem Trichter (9) herab fallen, eine Hohlraumbefüllungsvorrichtung (12) zum Befüllen des Hohlraums (2, 14, 15, 54) umfassend, die im Gebrauch zwischen einer geschlossenen Konfiguration, die einen abwärts gerichteten Strom der Gegenstände durch die Hohlraumbefüllungsvorrichtung (12) blockiert, und einer offenen Konfiguration wechselt, die den Strom der Gegenstände durch die Hohlraumbefüllungsvorrichtung (12) zulässt, und die **dadurch gekennzeichnet ist, dass:**

die Hohlraumbefüllungsvorrichtung (12) in abwechselnden Auf- und Abwärtshüben innerhalb des Hohlraums (2, 14, 15, 54) translatierend bewegbar ist, wobei sie im Abwärtshub die geschlossene Konfiguration aufweist und im Aufwärtshub die offene Konfiguration aufweist.

2. Vorrichtung nach Anspruch 1, wobei die Hohlraumbefüllungsvorrichtung (12) umfasst:

einen ersten Satz aus zueinander parallelen, koplanaren, länglichen Stangen (52), wobei die Stangen (52) des ersten Satzes mit regelmäßigen Abständen, die breit genug sind, damit die stabförmigen Gegenstände (60) zwischen die Stangen (52) gleiten können, voneinander beabstandet sind, und einen zweiten Satz aus zueinander parallelen, koplanaren Stangen (62), wobei die Stangen (62) des zweiten Satzes mit regelmäßigen

Abständen voneinander beabstandet sind, so dass in der geschlossenen Konfiguration mindestens eine Stange (62) des zweiten Satzes jede Lücke zwischen den Stangen (52) des ersten Satzes blockiert, durch die die Gegenstände strömen, wenn die Hohlraumbefüllungsvorrichtung (12) ihre offene Konfiguration aufweist.

- 5 **3.** Vorrichtung nach Anspruch 2, wobei die Stangen (52) des ersten Satzes einen rechteckigen Querschnitt aufweisen und für eine rotierende Bewegung montiert sind.
- 4.** Vorrichtung nach Anspruch 2, wobei die Stangen (62) des zweiten Satzes einen kreisförmigen Querschnitt aufweisen.
- 10 **5.** Vorrichtung nach Anspruch 2, 3 oder 4, wobei der Wechsel zwischen der offenen und der geschlossenen Konfiguration durch eine relative Translationsbewegung der Sätze aus den ersten Stangen (52) und den zweiten Stangen (62) quer zur Auf- und Abwärtsrichtung geschieht.
- 15 **6.** Vorrichtung nach Anspruch 5, wobei die Stangen (52) des ersten Satzes rotierbar an einem Lager (90) montiert sind und die Stangen (62) des zweiten Satzes an einem horizontal bewegbaren Träger (92) montiert sind, der unterhalb der Stangen (52) des ersten Satzes angeordnet ist.
- 20 **7.** Vorrichtung nach einem der vorangehenden Ansprüche zum Befüllen einer Speichervorrichtung, bei der es sich um einen Einsatz (16) handelt, der eine Mehrzahl von Seitenwänden (56, 58, 80) aufweist, die eine einzelne Reihe der säulenförmigen Hohlräume (54) definiert, wobei die Vorrichtung dafür ausgelegt ist, gleichzeitig eine Mehrzahl der säulenförmigen Hohlräume (54) in der Reihe zu befüllen.
- 25 **8.** Vorrichtung nach einem der Ansprüche 1 bis 5, die den Trichter (9) aufweist, und wobei die Hohlraumbefüllungsvorrichtung (12) vor ihrem Abwärtshub in ihrer geschlossenen Konfiguration als Verschluss dient, der einen Auslass in der Basis des Trichters (9) verschließt.
- 30 **9.** Vorrichtung nach einem der vorangehenden Ansprüche, ferner aufweisend eine Einrichtung unterhalb der Hohlraumbefüllungsvorrichtung (12) zum Betätigen der Hohlraumbefüllungsvorrichtung (12) abhängig vom Füllstand der Speichervorrichtung (2, 14, 15, 16).
- 35 **10.** Vorrichtung nach einem der vorangehenden Ansprüche, ferner aufweisend eine Einrichtung zum Bewegen der Hohlraumbefüllungsvorrichtung (12) aufwärts mit einer konstanten Geschwindigkeit und abwärts mit einer konstanten Geschwindigkeit.
- 40 **11.** Füllstation (1) zum Befüllen einer Abfolge von leeren Speichervorrichtungen (2, 15, 16) mit zueinander parallelen, stabförmigen Gegenständen (60), wobei die Füllstation (1) umfasst:

einen Trichter (9), eine Befüllungsvorrichtung nach einem der Ansprüche 1 bis 10 und eine Transportvorrichtung zum Befördern einer Abfolge von leeren Speichervorrichtungen (2, 15, 16) in eine Befüllungsposition unterhalb der Befüllungsvorrichtung und dann Befördern der gefüllten Speichervorrichtungen (14) aus der Befüllungsposition.
- 45 **12.** Verfahren zum Befüllen einer Abfolge von Speichervorrichtungen (2, 15, 16) unter Nutzung der Schwerkraft aus einem Trichter (9) mit einem Massenstrom aus zueinander parallelen, stabförmigen Gegenständen, wobei jede Speichervorrichtung (2, 14, 15, 16) die Form eines säulenförmigen Hohlraums zwischen einander gegenüberliegenden Seitenwänden (5, 6) aufweist, wobei das Verfahren die folgenden Schritte umfasst:

Anordnen einer Hohlraumbefüllungsvorrichtung (12) unter dem Trichter (9), wobei die Hohlraumbefüllungsvorrichtung (12) eine geschlossene Konfiguration aufweist, die einen Abwärtsstrom der Gegenstände durch die Hohlraumbefüllungsvorrichtung (12) blockiert;
Platzieren einer leeren Speichervorrichtung (2, 16) unter der Hohlraumbefüllungsvorrichtung (12);
dadurch gekennzeichnet, dass
es ferner die folgenden Schritte umfasst:
Bewegen der Hohlraumbefüllungsvorrichtung (12) abwärts bis zu einer Basiswand der Speichervorrichtung (2, 16);
Verstellen der Hohlraumbefüllungsvorrichtung (12) aus der geschlossenen Konfiguration in eine offene Konfiguration, die einen Strom der Gegenstände durch die Hohlraumbefüllungsvorrichtung (12) zulässt;
Bewegen der Hohlraumbefüllungsvorrichtung (12) aufwärts bis nahe an die Oberseite der Speichervorrichtung

(2, 16);

Verstellen der Hohlraumbefüllungsvorrichtung (12) aus der offenen Konfiguration in die geschlossene Konfiguration; und

Ersetzen der gefüllten Speichervorrichtung (2, 16) durch eine andere, leere Speichervorrichtung (2, 16).

13. Verfahren nach Anspruch 12, wobei die Hohlraumbefüllungsvorrichtung (12) umfasst:

einen ersten Satz aus zueinander parallelen, koplanaren, länglichen Stangen (52), wobei die Stangen (52) des ersten Satzes mit regelmäßigen Abständen, die breit genug sind, damit die stabförmigen Gegenstände (60) zwischen die Stangen (52) gleiten können, voneinander beabstandet sind, und einen zweiten Satz aus zueinander parallelen,

koplanaren Stangen (62), wobei die Stangen (62) des zweiten Satzes mit regelmäßigen Abständen voneinander beabstandet sind, so dass mindestens eine Stange (62) des zweiten Satzes jede Lücke zwischen den Stangen (52) des ersten Satzes blockiert, wenn die Hohlraumbefüllungsvorrichtung (12) aus der offenen Konfiguration in die geschlossene Konfiguration verstellt wird, und wobei der Verstellungsschritt das Verstellen der Stangen (62) des zweiten Satzes lateral in Bezug auf die Stangen (52) des ersten Satzes von Stangen und die Speichervorrichtung umfasst.

14. Verfahren nach Anspruch 13, ferner den folgenden Schritt umfassend:

Durchführen einer rotierenden Bewegung der Stangen (52) des ersten Satzes und/oder der Stangen (62) des zweiten Satzes während der Aufwärts- und/oder Abwärtsbewegung.

15. Verfahren nach einem der Ansprüche 12 bis 14, ferner den folgenden Schritt umfassend:

Aufwärts- und Abwärtsbewegen der Hohlraumbefüllungsvorrichtung (12) mit einer konstanten Geschwindigkeit.

16. Verfahren nach einem der Ansprüche 12 bis 15, wobei das Verfahren verwendet wird, um gleichzeitig eine Mehrzahl der säulenförmigen Hohlräume (54) einer Mehrkammern-Speichervorrichtung (16) zu befüllen.

Revendications

1. Appareil pour le remplissage par gravité, à partir d'une trémie (9), d'un dispositif de stockage (2, 14, 15, 16) pour articles qui a la forme d'une cavité en colonnes (54) entre des parois latérales opposées (5, 6, 56, 58), avec un débit massique d'articles en forme de tige parallèles entre eux (60) descendant de la trémie (9), comprenant un dispositif de remplissage de cavité (12) pour le remplissage de la cavité (2, 14, 15, 54) qui alterne, en cours d'utilisation, entre une configuration fermée qui bloque un écoulement vers le bas desdits articles à travers le dispositif de remplissage de cavité (12) et une configuration ouverte qui permet l'écoulement des articles à travers le dispositif de remplissage de cavité (12),
et caractérisé en ce que :

le dispositif de remplissage de cavité (12) est mobile en translation, dans des courses alternées vers le haut et vers le bas au sein de la cavité (2, 14, 15, 54), se trouvant dans la configuration fermée sur la course vers le bas et dans la configuration ouverte sur la course vers le haut.

2. Appareil selon la revendication 1, dans lequel le dispositif de remplissage de cavité (12) comprend un premier ensemble de barres allongées coplanaires parallèles entre elles (52), les barres (52) du premier ensemble étant espacées à des intervalles réguliers de façon suffisamment large pour permettre aux articles en forme de tige (60) de glisser entre les barres (52) et un deuxième ensemble de barres coplanaires parallèles entre elles (62), les barres (62) du deuxième ensemble étant espacées à des intervalles réguliers de telle sorte que, dans la configuration fermée, au moins une barre (62) du deuxième ensemble bouche chaque écartement entre les barres (52) du premier ensemble à travers lequel les articles s'écoulent lorsque le dispositif de remplissage de cavité (12) se trouve dans sa configuration ouverte.

3. Appareil selon la revendication 2, dans lequel les barres (52) du premier ensemble possèdent une coupe transversale rectangulaire et sont montées pour un mouvement rotatif.

4. Appareil selon la revendication 2, dans lequel les barres (62) du deuxième ensemble possèdent une coupe transversale circulaire.
- 5 5. Appareil selon la revendication 2, 3 ou 4, dans lequel une alternance entre lesdites configurations ouverte et fermée est accomplie par un mouvement relatif des barres (52) du premier ensemble et des barres du deuxième (62) ensemble en translation, transversalement à la direction montante et descendante.
6. Appareil selon la revendication 5, dans lequel les barres (52) du premier ensemble sont montées rotatives sur un support (90) et les barres (62) du deuxième ensemble sont montées sur une poutre mobile horizontalement (92) 10 disposée sous les barres (52) du premier ensemble.
7. Appareil selon l'une quelconque des revendications précédentes, destiné au remplissage d'un dispositif de stockage qui est un plateau (16) qui possède une pluralité de parois latérales (56, 58, 80) qui définit une rangée unique desdites cavités en colonnes (54), l'appareil étant conçu pour remplir simultanément une pluralité des cavités en colonnes (54) dans la rangée. 15
8. Appareil selon l'une quelconque des revendications 1 à 5 et incluant ladite trémie (9) et dans lequel le dispositif de remplissage de cavité (12) avant sa course vers le bas sert, dans sa configuration fermée, d'obturateur qui ferme une sortie dans la base de la trémie (9). 20
9. Appareil selon l'une quelconque des revendications précédentes et incluant un moyen pour actionner le dispositif de remplissage de cavité (12) en fonction de l'état de remplissage du dispositif de stockage (2, 14, 15, 16) en dessous du dispositif de remplissage de cavité (12).
- 25 10. Appareil selon l'une quelconque des revendications précédentes et incluant un moyen pour déplacer le dispositif de remplissage de cavité (12) vers le haut à une vitesse constante et vers le bas à une vitesse constante.
11. Poste de remplissage (1) pour remplir une succession de dispositifs de stockage vides (2, 15, 16) avec des articles en forme de tige parallèles entre eux (60), le poste de remplissage (1) comprenant une trémie (9), un appareil de remplissage selon l'une quelconque des revendications 1 à 10 et un dispositif de transport pour faire avancer une 30 succession des dispositifs de stockage vides (2, 15, 16) à une position de remplissage en dessous de l'appareil de remplissage, puis faire avancer les dispositifs de stockage remplis (14) hors de la position de remplissage.
12. Procédé de remplissage d'une succession de dispositifs de stockage (2, 15, 16) par gravité, à partir d'une trémie (9), avec un débit massique d'articles en forme de tige, parallèles entre eux, chaque dispositif de stockage (2, 14, 15, 16) ayant la forme d'une cavité en colonne entre des parois latérales opposées (5, 6), le procédé comprend les étapes consistant à : 35
 - disposer un dispositif de remplissage de cavité (12) sous la trémie (9), le dispositif de remplissage de cavité (12) étant dans une configuration fermée qui bloque un écoulement vers le bas desdits articles à travers le dispositif de remplissage de cavité (12) ;
 - mettre en place un dispositif de stockage vide (2, 16) sous le dispositif de remplissage de cavité (12) ;
 - caractérisé en ce que**
 - il comprend en outre les étapes consistant à : 45
 - déplacer le dispositif de remplissage de cavité (12) vers le bas jusqu'à une paroi de base du dispositif de stockage (2, 16) ;
 - faire passer le dispositif de remplissage de cavité (12) de la configuration fermée à une configuration ouverte qui permet un écoulement des articles à travers le dispositif de remplissage de cavité (12) ;
 - déplacer le dispositif de remplissage de cavité (12) vers le haut près d'un sommet du dispositif de stockage (2, 16) ;
 - faire passer le dispositif de remplissage de cavité (12) de la configuration ouverte à la configuration fermée ; et
 - remplacer le dispositif de stockage rempli (2, 16) par un autre dispositif de stockage vide (2, 16).
13. Procédé selon la revendication 12, dans lequel le dispositif de remplissage de cavité (12) comprend un premier 50 ensemble de barres allongées coplanaires parallèles entre elles (52), les barres (52) du premier ensemble étant espacées à des intervalles réguliers de façon suffisamment large pour permettre aux articles en forme de tige (60) de glisser entre les barres (52) et un deuxième ensemble de barres coplanaires parallèles entre elles (62), les barres (62) du deuxième ensemble étant espacées à des intervalles réguliers, assurant ainsi que l'au moins une barre (62)

du deuxième ensemble bouche chaque écartement entre les barres (52) du premier ensemble lorsque l'on fait passer le dispositif de remplissage de cavité (12) de la configuration ouverte à la configuration fermée et dans lequel l'étape de passage comprend le déplacement des barres (62) du deuxième ensemble latéralement par rapport aux barres (52) du premier ensemble de barres et au dispositif de stockage.

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14. Procédé selon la revendication 13, comprenant en outre l'étape consistant à :

exécuter un mouvement rotatif des barres (52) du premier ensemble et/ou des barres (62) du deuxième ensemble durant le mouvement vers le haut et/ou vers le bas.

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15. Procédé selon l'une quelconque des revendications 12 à 14, comprenant en outre l'étape consistant à : déplacer le dispositif de remplissage de cavité (12) vers le haut et vers le bas à une vitesse constante.

16. Procédé selon l'une quelconque des revendications 12 à 15, où le procédé est utilisé pour remplir simultanément une pluralité de cavités en colonnes (54) d'un dispositif de stockage à compartiments multiples (16).

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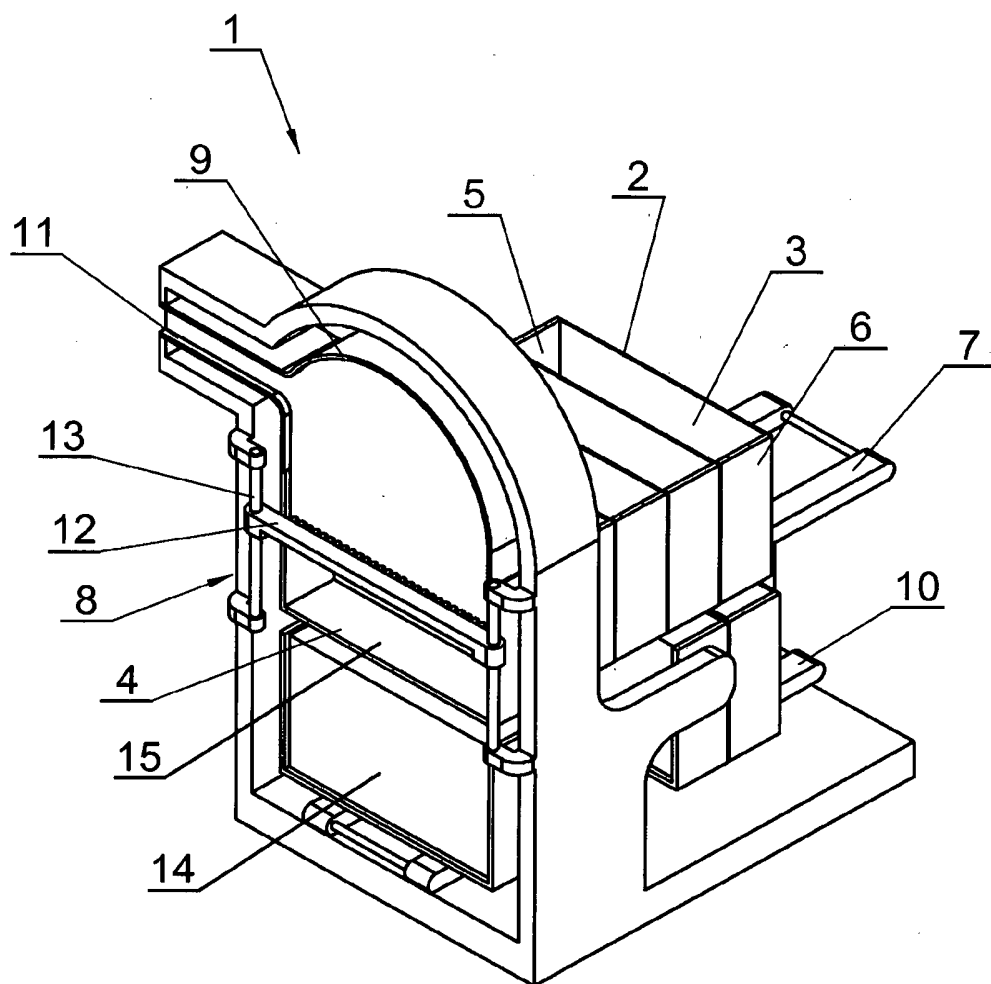


Fig. 1

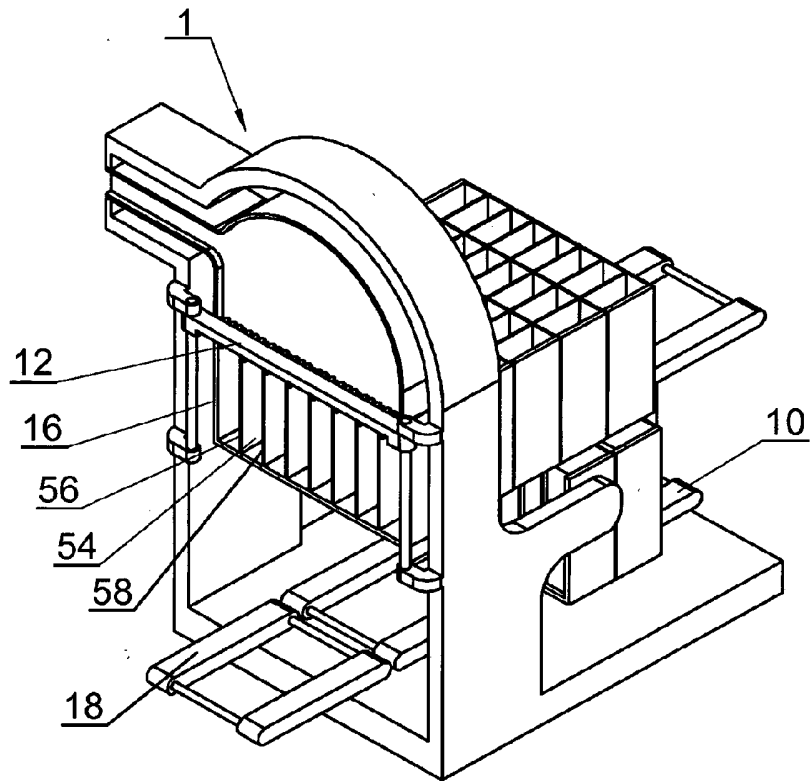


Fig. 2

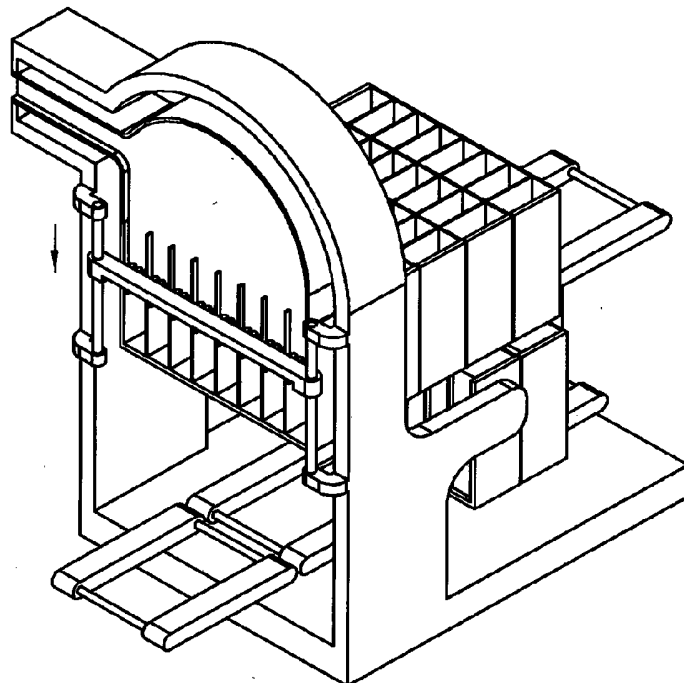


Fig. 3

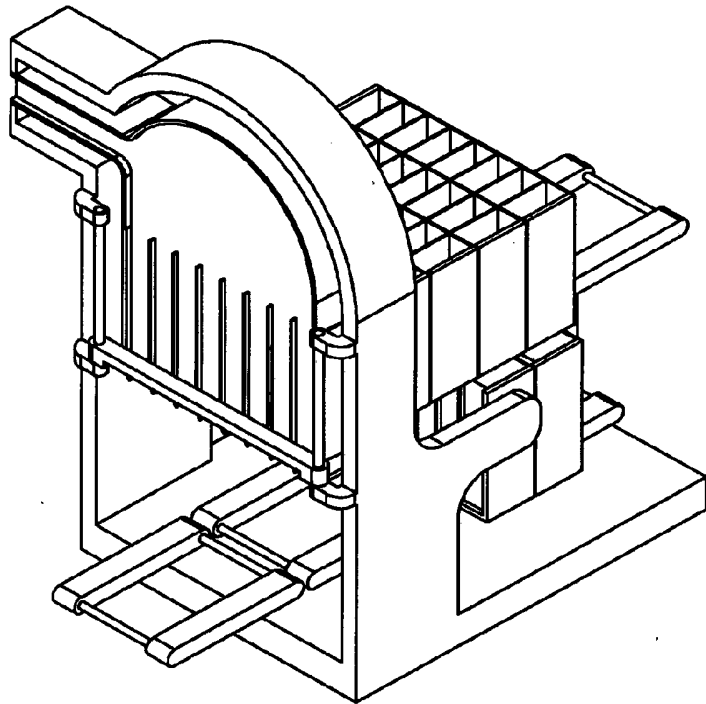


Fig. 4

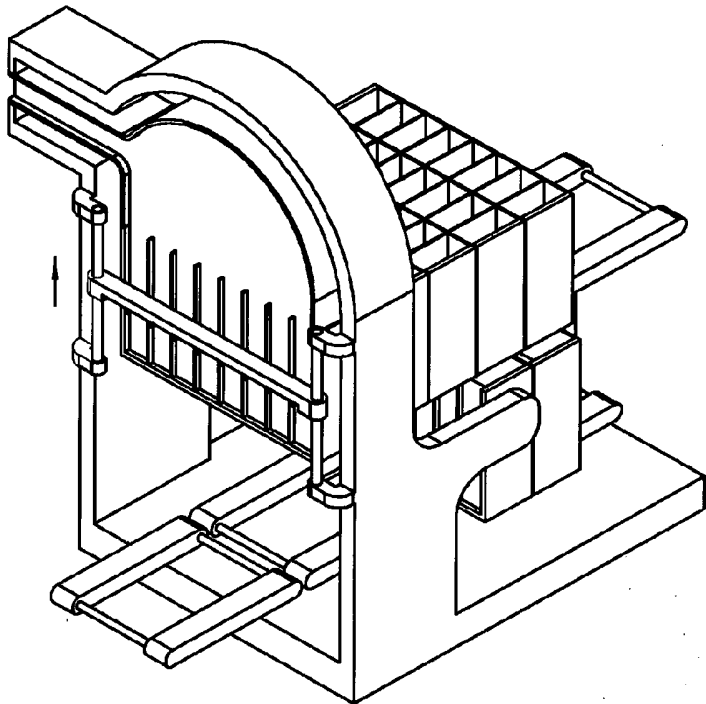


Fig. 5

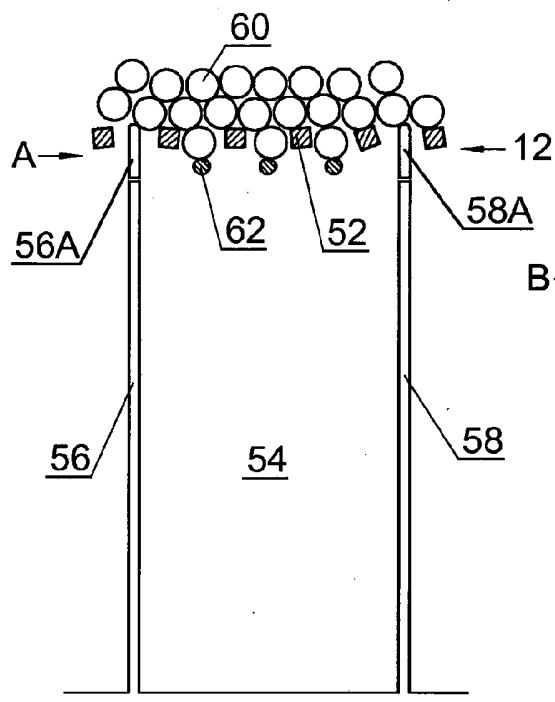


Fig. 6

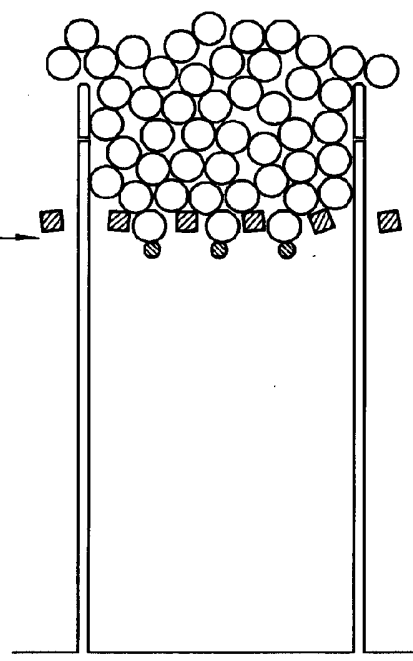


Fig. 7

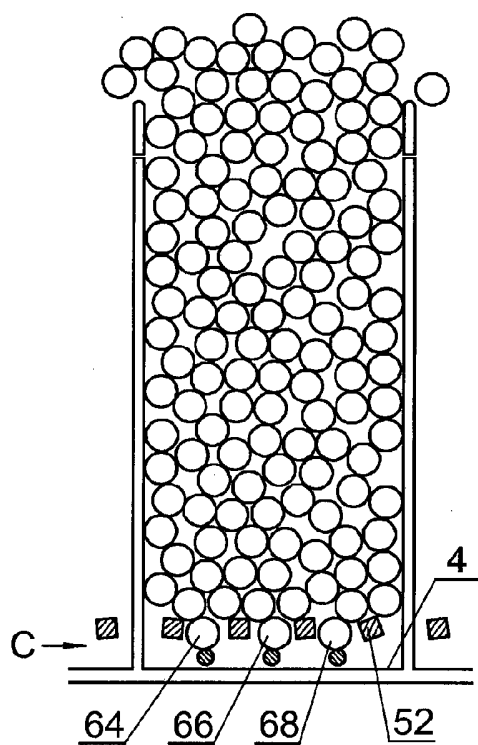


Fig. 8

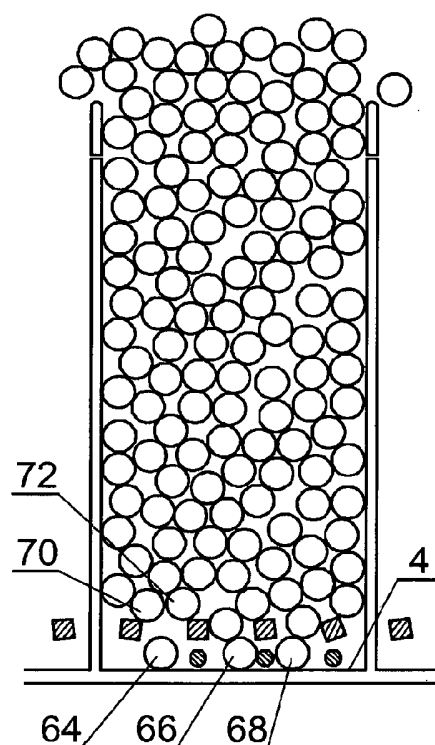


Fig. 9

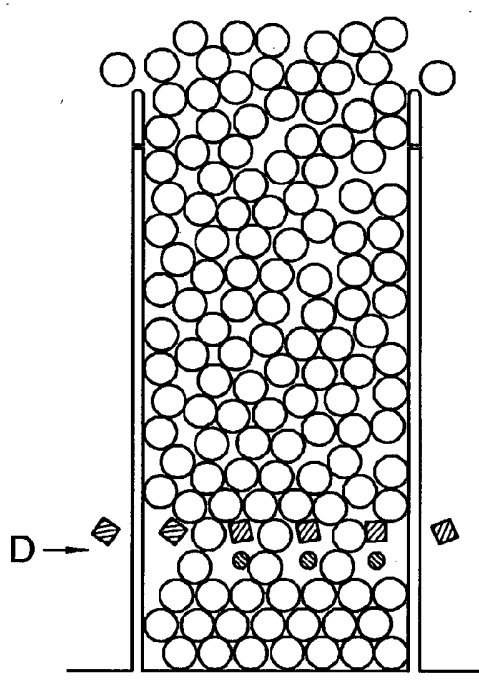


Fig. 10

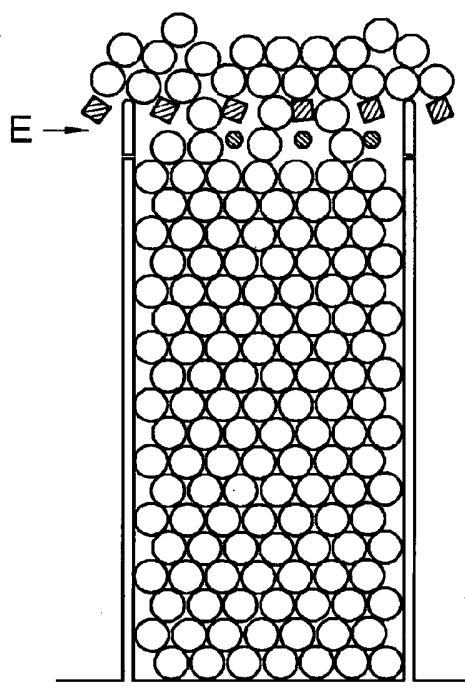


Fig. 11

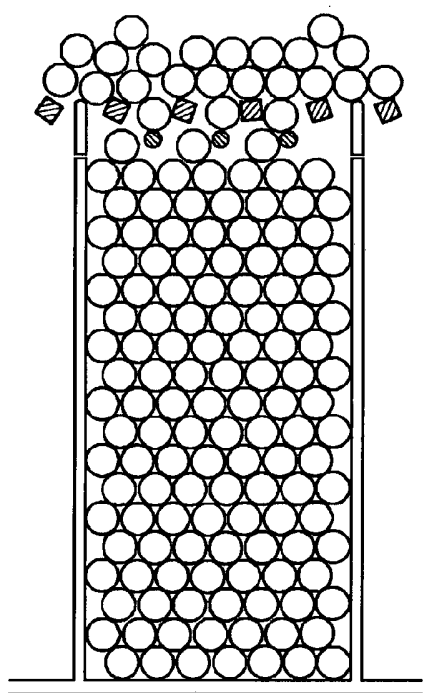


Fig. 12

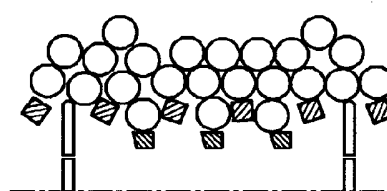


Fig. 13

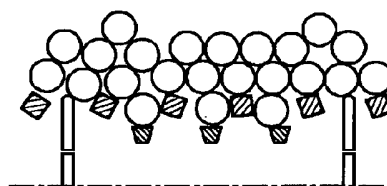


Fig. 14

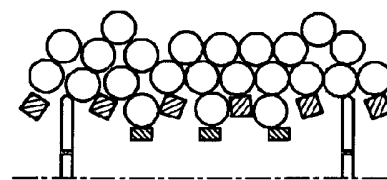


Fig. 15

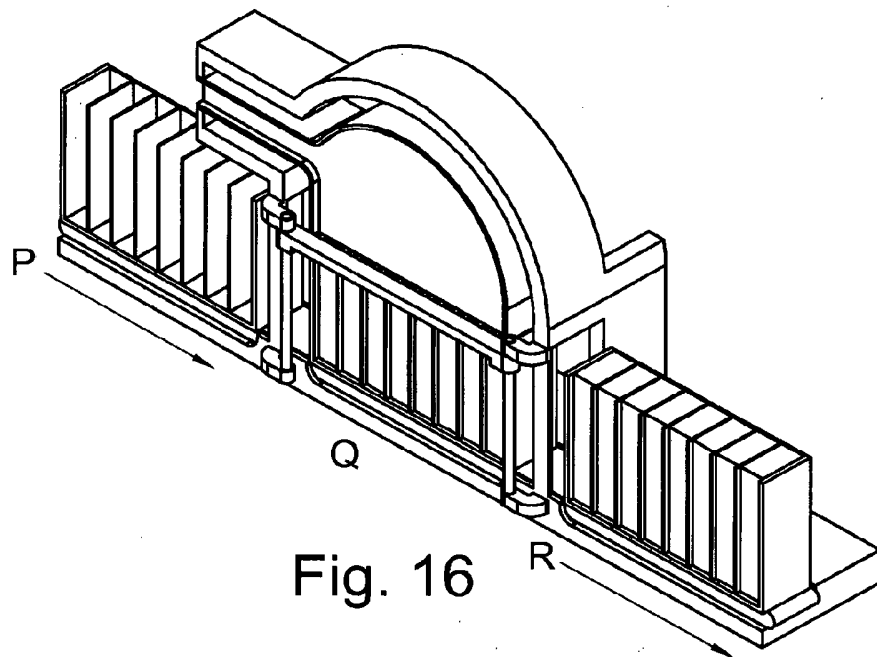


Fig. 16

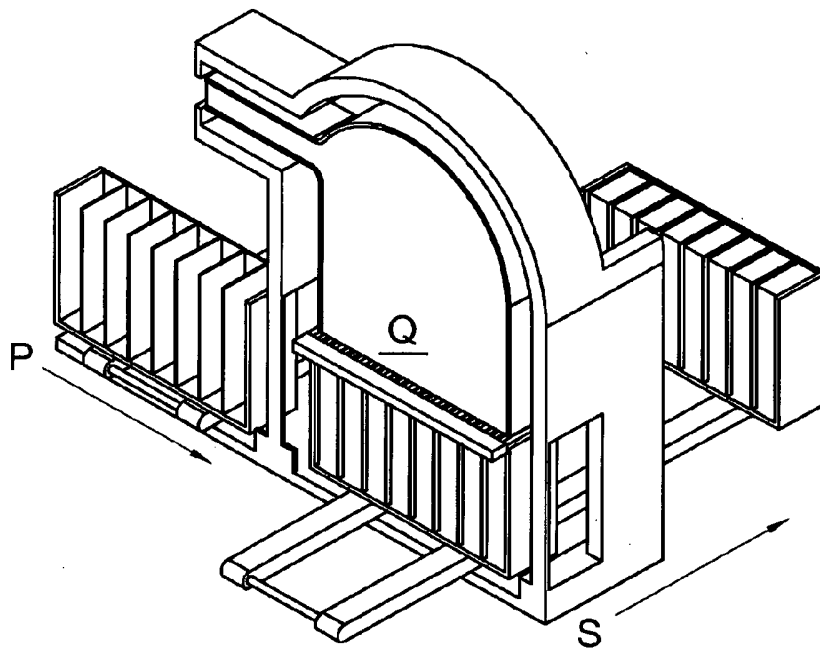


Fig. 17

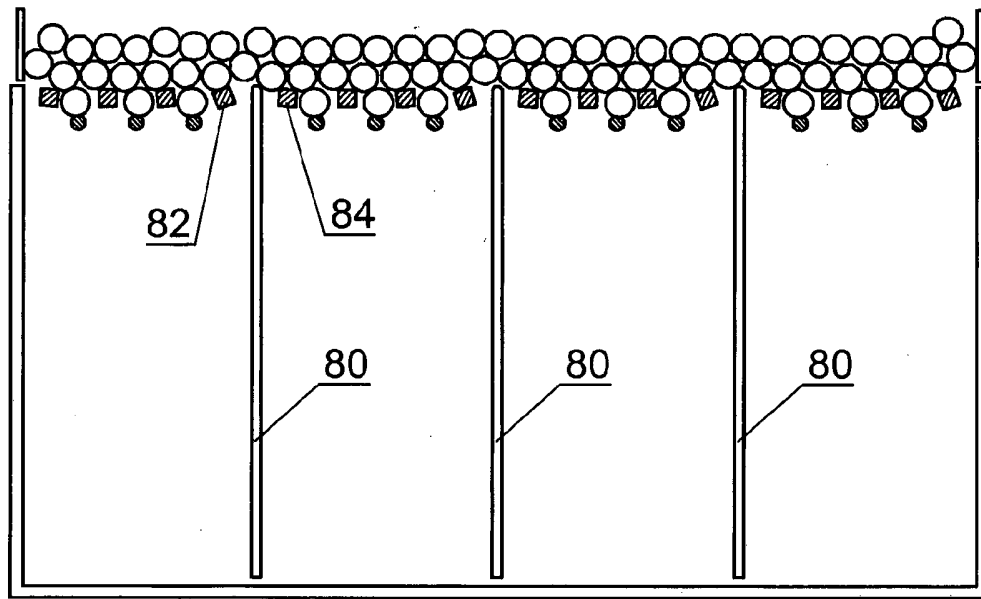


Fig. 18

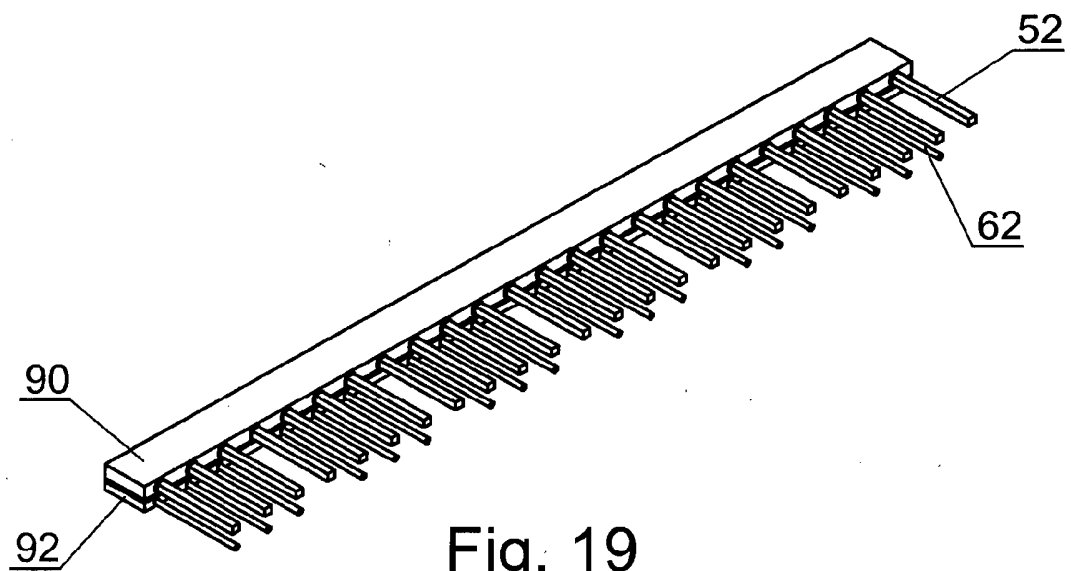


Fig. 19

REFERENCES CITED IN THE DESCRIPTION

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SZABADALMI IGÉNYPONTOK

1. Árucikkek tárolására szolgáló tárolóeszközt (2, 14, 15, 16) adagolótölcsérből (9) gravitációsan feltöltő, átellenes oldalfalak (5, 6, 56, 58) közötti oszlopszerű üreg (54) formájú berendezés, ahol az adagolótölcsérből (9) egymással párhuzamos rúd alakú árucikkek (60) áramlanak ki, és ahol a berendezésnek az üreget (2, 14, 15, 54) feltöltő üregtöltő eszköze (12) van, ahol használat közben az üregtöltő eszköz (12) az árucikkeknek az eszközön (12) áthaladó, lefelé irányuló áramlását megakadályozó zárt helyzet és az árucikkeknek az eszközön (12) áthaladó áramlását megengedő nyitott helyzet között oda-vissza átváltható,

azzal jellemezve, hogy:

az üregtöltő eszköz (12) felváltva felfelé, illetve lefelé irányuló mozgásütemből álló haladó mozgást végez az üregben (2, 14, 15, 54), ahol az eszköz (12) a lefelé irányuló mozgásütemben zárt, míg a felfelé irányuló mozgásütemben nyitott helyzetű.

2. Az 1. igénypont szerinti berendezés, amelynél az üregtöltő eszköznek (12) azonos síkban elrendezett, megnyúlt rudakból (52) álló első rúdcsoportha van, ahol az első csoport rúdjai egymástól egyenlő, a rúd alakú árucikkeknek (60) a rudak (52) közé történő becsúszását megengedő kellően nagy szélességű térközökkel vannak elválasztva, és az eszköznek (12) azonos síkban elrendezett rudakból (62) álló második rúdcsoportha van, ahol a második csoport rúdjai egymástól egyenlő térközzel vannak elválasztva oly módon, hogy a zárt helyzetben az első csoport rúdjai (52) közötti, az üregtöltő eszköz (12) nyitott helyzetben az árucikkeket áteresztő rések mindegyikét lezárja a második csoport legalább egy rúdja (62).

3. A 2. igénypont szerinti berendezés, amelynél az első csoportba tartozó rudak (52) négyszög keresztmetszetűek, és elfordíthatóan vannak felerősítve.

4. A 2. igénypont szerinti berendezés, amelynél a második csoportba tartozó rudak (62) kör keresztmetszetűek.

5. A 2, 3, vagy 4. igénypont szerinti berendezés, amelynél a nyitott és a zárt helyzet közötti váltáshoz az első csoportba tartozó rudak (52) és a második csoportba tartozó rudak (62) egymáshoz viszonyítva a felfelé, illetve lefelé mutató irányhoz képest keresztirányú mozgást végeznek.

6. Az 5. igénypont szerinti berendezés, amelynél az első csoportba tartozó rudak (52) tartóelemre (90) elfordíthatóan vannak felszerelve, míg a második csoport rúdjai (62) az első csoport rúdjai (52) alatt elrendezett, vízszintesen elmozdítható tartóra (92) vannak felerősítve.

7. A megelőző igénypontok bármelyike szerinti berendezés tárolóeszköz feltöltésére, ahol a tárolóeszköz egyetlen sorban elrendezett oszlopszerű üregeket (54) meghatározó oldalfalakkal (56, 58, 80) rendelkező tálca (16), és a berendezés a sorban elhelyezkedő több oszlopszerű üreg (54) egyidejű feltöltésére van kialakítva.

8. Az 1-5. igénypontok bármelyike szerinti, adagolótölcsérrel (9) rendelkező berendezés, amelynél az üregtöltő eszköz (12) zárt helyzetében a lefelé irányuló mozgásútem előtt az adagolótölcsér (9) talpán elhelyezkedő kiömlőnyílást lezáró záróelemként funkcionál.

9. A megelőző igénypontok bármelyike szerinti berendezés, amelynek az üregtöltő eszközt (12) az eszköz (12) alatt elhelyezkedő tárolóeszköz (2, 14, 15, 16) töltöttségi állapotától függően működtető eszköze van.

10. A megelőző igénypontok bármelyike szerinti berendezés, amelynek az üregtöltő eszközt (12) felfelé és lefelé egyaránt állandó sebességgel mozgató eszköze van.

11. Töltőállomás (1) üres tárolóeszközök (2, 15, 16) sorozatának egymással párhuzamosan elhelyezkedő rúd alakú árucikkkel (60) történő feltöltésére, amelynek adagolótölcsére (9), az 1-10. igénypontok bármelyike szerinti töltőberendezése, és az üres tárolóeszközök (2, 15, 16) sorozatát a töltőberendezés alatti töltési helyzetbe, majd a feltöltött tárolóeszközöket (14) a töltési helyzetből tovább mozditó szállítóeszköze van.

12. Eljárás tárolóeszközök (2, 15, 16) sorozatának gravitációs feltöltésére adagolótölcsérből (9) egymással párhuzamos helyzetben kiáramló rúd alakú árucikkkel, ahol a tárolóeszközök (2, 14, 15, 16) oldalfalak (5, 6) közötti oszlopszerű üregként vannak kialakítva, melynek során az alábbi lépéseket hajtjuk végre:

az adagolótölcsér (9) alatt üregtöltő eszközt (12) rendezünk el az árucikk eszközön át történő áramlását megakadályozó zárt helyzetben; és az üregtöltő eszköz (12) alatt üres tárolóeszközt (2, 16) helyezünk el;

azzal jellemezve, hogy

még az alábbi eljárási lépéseket is végrehajtjuk:

az üregtöltő eszközt (12) a tárolóeszköz (2, 16) alapfaláig lefelé mozgatjuk;

az üregtöltő eszközt (12) zárt helyzetéből az árucikkeknek az üregtöltő eszközön (12) át történő áramlását megengedő nyitott helyzetbe átváltjuk; az üregtöltő eszközt (12) felfelé, a tárolóeszköz (2, 16) tetejének közelébe elmozdítjuk;

az üregtöltő eszközt (12) a nyitott helyzetből a zárt helyzetbe átváltjuk; és
a feltöltött tárolóeszközt (2, 16) másik, üres tárolóeszközre (2, 16) cseréljük le.

13. Az 12. igénypont szerinti eljárás, amelynél az üregtöltő eszköznek (12) azonos síkban elrendezett, megnyúlt rudakból (52) álló első rúdcsoportha van, ahol az első csoport rúdjai egymástól egyenlő, a rúd alakú árucikkeknek (60) a rudak (52) közé történő becsúszását megengedő kellően nagy szélességű térközökkel vannak elválasztva, és az eszköznek (12) azonos síkban elrendezett rudakból (62) álló második rúdcsoportha van, ahol a második csoport rúdjai egymástól egyenlő térközzel vannak elválasztva oly módon, hogy az első csoport rúdjai (52) közötti, az üregtöltő eszköz (12) nyitott helyzetében az árucikkeket áteresztő rések mindegyikét az üregtöltő eszköz (12) nyitott helyzetéből zárt helyzetbe történő átváltásakor lezárja a második csoport legalább egy rúdja (62), és amelynél az átváltási lépésben a második csoportba tartozó rudakat (62) az első csoport rúdjaihoz (52), illetve a tárolóeszközhöz viszonyítva oldalirányban elmozdítjuk.

14. A 13. igénypont szerinti eljárás, amely szerint még az alábbi eljárási lépést is végrehajtjuk:

a felfelé és/vagy lefelé történő elmozdítás során az első csoport rúdja (52) és/vagy a második csoport rúdja (62) elfordítjuk.

15. A 12-14. igénypontok bármelyike szerinti eljárás, amely szerint még az alábbi eljárási lépést is végrehajtjuk:

az üregtöltő eszközt (12) felfelé és lefelé állandó sebességgel mozgatjuk.

16. A 12-15. igénypontok bármelyike szerinti eljárás, amelynél az eljárást többrekeszes tárolóeszköz (16) több oszlopszerű üregének (54) egyidejű feltöltésére alkalmazzuk.

A meghatalmazott:

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