

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 February 2008 (21.02.2008)

PCT

(10) International Publication Number
WO 2008/020775 A1

(51) International Patent Classification:
A24C 5/356 (2006.01)

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(21) International Application Number:
PCT/PL2007/000058

(22) International Filing Date: 17 August 2007 (17.08.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
P 380439 18 August 2006 (18.08.2006) PL

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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

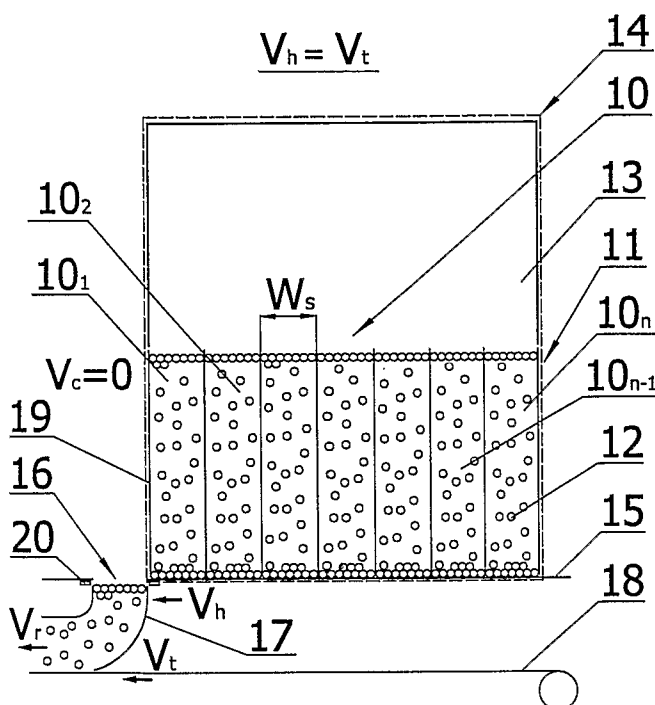
Declaration under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report
— with amended claims

(54) Title: TRAY EMPTYING METHOD FOR TOBACCO INDUSTRY



(57) Abstract: Rod-like elements are transferred by gravity from a tray to many segments of an intermediate store, the segments being separated from each other with vertical partition walls and then, independently of each other, are emptied through a throat formed within store base, wherein both the intermediate store and its base together with the throat, independently of each other, reciprocate along a receiving conveyor so that consecutive segments of the store could meet the throat, while the segment emptying sequence is in backward relationship to the receiving direction of rod-like elements transported on the conveyor. The rod-like elements are delivered onto the conveyor through a chute firmly connected to the throat whereas the throat has surface that in size complies with horizontal cross section of a segment of the intermediate store and each time receives elements from one consecutive segment, and the complete segment emptying is monitored by a sensor. The width of emptied segments corresponds to the layer height of mass flow of the rod-like elements and placed on the above mentioned conveyor. Furthermore, this invention presents in detail three alternative methods presenting how to empty the above segments in compliance with the mentioned principles.

TRAY EMPTYING METHOD FOR TOBACCO INDUSTRY

BACKGROUND AND SUMMARY

The present invention relates to a tray emptying method, the tray being filled up with rod-like elements transported to farther operating work-stands of a cigarette production line.

Known production lines designed for production of cigarettes and packaging thereof or cigarette filters include a machine or group of machines designed for production of cigarettes or filters, a machine or group of machines to join the cigarette filters and cigarettes together and cigarette packaging machine. In order to compensate for a non-uniform production capacity of the above machine types, various store systems are applied to maintain continuity of the cigarette production. One example of such systems is a tray system, wherein cigarettes and/or cigarette filters are stored, the trays being filled up with cigarettes or filters at exit of a cigarette or filter-producing machine. The filled up trays are unloaded into a hopper of cigarette packaging machine or cigarette filter attaching machine. An intermediate store is applied to unload trays where from rod-like elements are transferred onto conveyor that transports them to the above mentioned hopper. That type of device is presented in US patent specification No. 4,365,703 where a system of conveyors for rod-like elements is disclosed, wherein rod-like elements transferred from production machine are loaded from top of an intermediate store downward, the store including many trays with vertical segments. At required instant, segments are consecutively emptied onto a receiving conveyor that farther transports them to the pack-

aging machine, wherein the plate to close bottom of respective segment, if actually open, ensures emptying within the same vertical sector where tray loading is realized. Both loading and emptying of consecutive trays of the intermediate store is possible due to their crosswise movement relative to direction of the receiving conveyor. Also from European patent specification EP 1,020,126 a cigarette transport method and device are known wherein cigarettes are transferred by means of trays from production machine to intermediate store, wherein they are unloaded, and then transported on receiving conveyor to a hopper of a packaging machine. According to that invention, the intermediate store is divided with partition elements into many vertical paths of cigarette flow, neighboring each other, and to each path has an appropriate supporting element. The supporting element together with cigarettes moves from the store top downward. The partition elements are shaped like teardrops and have a comb-like design. Cutouts of supporting elements that are formed like flat combs enter into and between protruding ribs of the comb like design. Cutouts of supporting element are shaped like a flat comb. From the packaging machine side, movable vertical sidewall of the intermediate store runs together with conveyor that removes cigarettes toward hopper of the packaging machine. Length of partition elements is smaller than the intermediate store height, and the shortest element is located nearest to the above movable vertical sidewall. Length of subsequent elements gradually increases and the longest element end is significantly away from the receiving conveyor. Thus, cigarettes transported to hopper are shaped as a layer, which in principle corresponds to movable sidewall height of the intermediate store, while the layer height is kept up by the moving sidewall until the layer finally arrives at the hopper. Other tray unloading method, the trays being filled with rod-like elements, especially with cigars, and device designed for application of that method, are presented in European patent specification EP 1,308,101. Referring to that invention, the tray filled up with cigars is placed on movable supporting surface by means of special gripping device the tray top opening being directed downwards to the surface and temporarily protected with a protective shield, the above supporting surface being provided with movable throat which has width smaller than the width of the tray top opening but bigger than single cigar diameter. The movable

supporting surface forms a bottom of enclosure. It has width a little greater than the total width of two trays that form entry stand and exit stand. Below the supporting surface, a receiving conveyor is located. A Tray that arrived at the entry stand, after removal of the protective shield, is unloaded through the throat and cigars fall out onto the conveyor and are transported to the hopper of the packaging machine. Due to the applied driving system control of guiding wheels for endless driving belt, multiple reciprocate movements of the throat are ensured so that throat could always stay within tray unloading site, and ultimately be placed in the exit stand. The device construction ensures that supporting surface together with tray moves with velocity twice higher than that of throat carriage, and thus the throat permanently changes its position relative to the tray opening. Unloading having been completed, empty tray is removed by means of the above mentioned gripping device. All the known tray unloading methods and devices are characterized by their operation based on a common principle i.e. single element emptying onto receiving conveyor is by gravitation due to removal of individual elements that support cigarettes from below in every segment or segment groups which requires multiple driving, control and monitoring systems.

SUMMARY

This invention relates to tray emptying method for tobacco industry where rod-like elements are transferred by gravitation simultaneously from a tray to many segments of an intermediate store, the segments being separated from each other with vertical partition walls of the intermediate store, and the store being an equivalent to one volumetric tray capacity, and then the rod-like elements are transferred onto movable receiving conveyor located below. According to this invention, the vertical segments of the intermediate store filled up with rod-like elements and independent of each other are emptied through a throat formed in the intermediate store base, while the intermediate store, the base and the throat reciprocate, independently of each other, along the receiving conveyor so that consecutive segments of the intermediate store could meet the throat, and the sequence of segment emptying is in backward relationship to the receiving direction of rod-like elements at the receiving conveyor. Rod-like elements are placed onto

the receiving conveyor through a profiled chute firmly connected to the throat, wherein the throat with its area that corresponds in size to the horizontal cross section of a segment of the intermediate store each time receives elements from only one consecutive segment. A sensor monitors complete segment emptying. Widths of emptied segments correspond to the layer height of mass flow of rod-like elements placed on the receiving conveyor. After the last segment of the intermediate store filled up with rod-like elements supplied from preceding tray is emptied, the throat together with chute moves concurrently to the receiving direction of rod-like elements placed on the conveyor and at conveyor velocity, the layer height of rod-like elements remaining unchanged at the site close under the throat level until the throat arrives at the site before the first segment of intermediate store, the latter being meantime loaded with rod-like elements from a consecutive tray. At the time, the intermediate store executes its short-term plane motion concurrently with the throat movement and the receiving direction of rod-like elements at velocity higher than that of receiving conveyor so that throat could meet the first segment of intermediate store and ensure the emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector. Then the store and the throat return at equal velocity and in backward relationship to receiving direction of rod-like elements until the intermediate store takes up position within the tray unloading sector, wherein the complete emptying of first segment takes place. Analogically, emptying of each consecutive segment follows after receiving enable signal, wherein each time the throat is positioned at site before the next segment planned to be emptied, but so as to determine the mutual position of the throat and the segment, it is necessary to consider the opposite direction relative to the receiving direction of rod-like elements. Unloading of a consecutive tray in sequence takes place during the emptying operation of the last segment at a rate not higher than emptying rate of that segment and also at any rate during the motion of the throat together with the chute concurrently with the receiving direction of rod-like elements, wherein the throat velocity equals velocity of the receiving conveyor. In whole emptying cycle of intermediate store segments, the receiving conveyor is continuously in motion at established direction.

In alternative preferred embodiment of the method according to this invention, after the last segment of the intermediate store filled up with rod-like elements from a preceding tray is emptied, the throat together with chute moves concurrently to the receiving direction of rod-like elements placed on the receiving conveyor, and at the conveyor velocity, while the rod-like element layer height is unchanged close under the throat level until the throat arrives at the site before the first segment of the intermediate store that meantime was loaded with rod-like elements from a consecutive tray, and at the time, a short-term stop of the throat together with the chute follows, whereas the intermediate store is in plane motion concurrently to the receiving direction of rod-like elements so that throat could meet the first segment of the intermediate store and ensure its emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector. Then return of the store and the throat follows at equal velocity in backward relationship to the receiving direction of rod-like elements until the intermediate store is positioned at the tray unloading sector wherein the complete emptying of the first segment takes place. Analogically, any next consecutive segment emptying follows after receiving enable signal, wherein the throat is each time positioned before a next segment to be emptied, but the mutual position of throat and the segment shall be determined considering direction opposite to the receiving direction of rod-like elements. Unloading of a consecutive tray in sequence takes place during emptying of the last segment at a rate not higher than emptying rate of that segment and at any rate during movement of the throat together with chute concurrently to the receiving direction of rod-like elements, wherein throat velocity equals to that of the receiving conveyor. During the complete emptying cycle of the intermediate store segments the receiving conveyor continuously moves forward at the established direction.

In yet another alternative preferred embodiment of the method according to this invention, after emptying the last segment of intermediate store filled up with rod-like elements from a preceding tray, the throat together with chute moves in concurrent relationship to the receiving direction of rod-like elements on the receiving conveyor, at conveyor velocity, while the layer height of rod-like elements close under throat level is not

changed until the throat arrives at site before the first segment of the intermediate store that meantime was loaded with rod-like elements from a consecutive tray. Then a short-term stop of the throat together with the chute follows and the receiving conveyor stops as well. During the above short-term stop, the intermediate store is in plane motion at concurrent relationship to the receiving direction of rod-like elements so that the throat could meet the first segment of the intermediate store and ensure the emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector. After that the receiving conveyor starts up, and return of the intermediate store and the throat together with the chute follows in backward relationship to the receiving direction of rod-like elements, at equal velocity, to the tray unloading sector, where the complete emptying of the first segment takes place. Analogically, emptying of each consecutive segment will follow after receipt of enable signal, wherein each time the throat is positioned before a next segment to be emptied, while so as to determine mutual position of the throat and the segment it is necessary to consider opposite direction to the receiving direction of rod-like elements. Unloading of a next tray in sequence takes place during the last segment emptying at a rate not higher than that of the last segment emptying and at any rate during movement of the throat together with the chute and at concurrent relationship to the receiving direction of rod-like elements, wherein the throat velocity equals the receiving conveyor velocity. In the complete cycle of emptying the intermediate segment store, the receiving conveyor that moves at the established direction, is periodically stopped. The preferred embodiment according to this invention allows to form on the receiving conveyor a mass flow out of the rod-like elements collected in a tray, wherein rod-like elements move from a wide duct i.e. the tray itself, to many smaller segments, while each of the segments is emptied independently on the others. In effects within the segment there is no element displacement in horizontal direction or any rolling of those elements which might happen in case of different solutions. Joining rod-like elements to those at the throat level is carried out so as to ensure the minimum dynamic loads and prevent any crosswise positioning of rod-like elements, thus the quality of transported elements cannot be reduced. Movement of rod-like elements through the throat into the chute and farther

on the receiving conveyor takes place with no local thickening thereof due to the matched cross sections. All the above advantages ensure the optimum maintenance of rod-like element flow continuity to the machines that are the following part of the production line. Other features and advantages of the present invention will be apparent to persons skilled in the art from the following detailed description of a preferred embodiment accompanied by the attached drawings as follows.

THE DRAWING

Fig. 1 to fig. 21 present individual steps of segment emptying method and tray unloading according to preferred Embodiment I of this invention during continuous motion of the receiving conveyor and fig. 22 shows up a diagram that illustrates displacements of intermediate store and throat as well as velocity of receiving conveyor motion and also the consecutive segment emptying rate depending on the movements of individual units in the preferred Embodiment I. Fig. 23 to fig. 43 present individual steps of segment emptying method and tray unloading according to preferred Embodiment II of this invention, also during continuous motion of the receiving conveyor, and fig. 44 shows up a diagram that illustrates displacements of intermediate store and throat as well as velocity of receiving conveyor motion and consecutive segment emptying rate depending on the movements of individual units according to Embodiment II. Fig. 45 to fig. 65 present individual steps of segment emptying method and tray unloading according to Embodiment III of this invention with periodical stoppages of the receiving conveyor, and fig. 66 shows up a diagram that illustrates displacements of intermediate store and throat as well as velocity of the receiving conveyor motion, and also emptying rate of consecutive segments depending on the motion of individual units according to Embodiment III of this invention. In the drawing, motion of all the segments at individual steps has letter markings.

DETAILED DESCRIPTION

Embodiment I.

In fig. 1, identical segments 10 of an intermediate store 11 are completely filled up with rod-like elements 12, while an unloaded tray 13 together with the intermediate store 11 is situated in an unloading sector 14 for unloading trays 13, while a throat 16 formed

within a movable base 15 of the intermediate store 11 is firmly connected to a chute 17 is moved out to the site before the first segment 10_1 , beyond the unloading sector 14, wherein a receiving conveyor 18 positioned below the chute 17 moves at velocity V_t toward farther operational work-stands not shown in the drawing. The Throat 16 together with the chute 17 is in continuous motion and moves at velocity V_h equal to velocity V_t of the receiving conveyor 18 in concurrent relationship to the receiving direction of rod-like elements 12. At the moment shown in fig. 1, hitherto motionless intermediate store 11 starts up its plane motion concurrent with the receiving direction of the rod-like elements 12 and with motion of the throat 16 at velocity V_c higher than velocity V_h of the throat 16, which is illustrated in fig. 2, wherein the rod-like elements 12 move along their receiving direction at velocity V_r together with the receiving conveyor 18. Such a state will be present till the instant when the first segment 10_1 catches up with the throat 16, which will take place beyond the unloading sector 14 at distance S_c of the sidewall 19 away from the unloading sector 14, distance S_c being greater than width W_s of the segments 10, while path S_c covered by the intermediate store 11 is greater than width W_s of the segments 10, wherein the rod-like elements 12 fall down by gravity into the chute 17. The Throat 16 having caught up with the segment 10_1 , the intermediate store 11 and the base 15 together with the throat 16 (fig. 3) are then stopped, while the receiving conveyor 18 is in its continuous motion at velocity V_t . Then, return to the sector 14 (fig. 5) of the store 11 and the base 15 together with the throat 16 at equal velocity (fig. 4) will follow and continuous emptying of the first segment 10_1 will take place, wherein complete emptying of the sector 10_1 follows monitored with a sensor 20 placed at the level of the throat 16, while the intermediate store 11 and the throat 16 (fig. 6) are motionless. After emptying of the first segment 10_1 , the throat 16 starts up its motion concurrent with the receiving direction of rod-like elements 12 at velocity V_h equal to velocity V_t together with the receiving conveyor 18, and as well, the store 11 begins its plane motion at concurrent relationship with the receiving direction of the rod-like elements 12 and compatible with the motion of the throat 16 at velocity V_c greater than velocity V_h of the throat 16 (fig. 7) until the second segment 10_2 catches up with the throat 16 (fig. 8), which takes place at the boundary of

the unloading sector 14 at distance S_c of the sidewall 19 of the store 11 from the unloading sector 14, the distance S_c being greater than width W_s of the segments 10, wherein path S_c covered by the intermediate store 11 is greater than width W_s of the segments 10, while the rod-like elements 12 fall down by gravity into the chute 17. After throat 16 catches up with the second segment 10_2 , the intermediate store 11 and the base 15 together with the throat 16 (fig. 8) are stopped at continuous motion of the receiving conveyor 18 at velocity V_t . Then the return of the intermediate store 11 and the base 15 together with the throat 16 will follow at velocity V_c equal to velocity V_h (fig. 9), while the second segment 10_2 is continuously emptied and the intermediate store 11 arrives at the unloading sector 14 (fig. 10), wherein complete emptying of the second segment 10_2 will follow, monitored with the sensor 20, while the intermediate store 11 and the throat 16 (fig. 11) are then motionless. Analogically, the emptying of consecutive segments 10 will follow, but it will take place within the unloading sector 14. Next drawing (fig. 12) presents the end moment of emptying that refers to the last but one segment 10_{n-1} , when the throat 16 and the intermediate store 11 are motionless, and next drawing (fig. 13) illustrates the start of the throat 16 that moves concurrent with the receiving direction of the rod-like elements 12 at velocity V_h equal to velocity V_t in order to empty the last segment 10_n , wherein the intermediate store 11 begins its plane motion compatible with motion of the throat 16 at velocity V_c higher than velocity V_h of the throat 16. After the last segment 10_n catches up with the throat 16 (fig. 14), which takes place within the unloading sector 14 at distance S_c of sidewall 19 of the intermediate store 11 from the unloading sector 14, distance S_c being greater than width W_s of the segments 10, and also considering path S_c covered by the intermediate store 11 greater than width W_s of the segments 10, motion of the intermediate store 11 and the throat 16 is stopped, and next, the intermediate store 11 together with the throat 16 will return until it arrives at the sector 14 while the last segment 10_n is continuously emptied, and while a consecutive tray 13 filled up the with rod-like elements 12, supported from below with a supporting plate 21, is loaded into the sector 14. After the intermediate store 11 and the throat 16 are stopped, in the sector 14, a multi-segment plate 22 will enter the top part of the intermediate store 11, below the supporting plate 21.

The multi-segment plate 22 is slid ably fixed and moves within the segments 10 from top downward (fig. 15). Then, during emptying of the last segment 10_n (fig. 16), the supporting plate 21 is removed and the rod-like elements 12 fall down onto the multi-segment plate 22 and lowered down together with the plate 22 along the segments 10 (fig. 17). After the complete emptying of the last segment 10_n (fig. 18), which is monitored with the sensor 20, the base 15 together with the throat 16 move concurrently with the receiving direction of the rod-like elements 12 at velocity V_h equal to velocity V_t of the conveyor 18 when the intermediate store 11 (fig. 19 and fig. 20) is motionless until the throat 16 arrives at the site before the first segment 10_1 beyond the sector 14 (fig. 21), meantime the multi-segment plate 22 being displaced so that the rod-like elements 12 could be placed onto the base 15 and the cycle of emptying the intermediate store 11 begins, the store 11 containing the rod-like elements 12 from the tray 13 that was unloaded recently. In fig. 22, displacements S_h of the throat 16 and displacements S_c of the intermediate store 11 are graphically presented, velocity V_t of the receiving conveyor 18 and emptying rate Q_s of the segments 10.

Embodiment II.

In fig. 23, equal segments 30 of an intermediate store 31 are completely filled up with rod-like elements 32, and an unloaded tray 33 is located together with the intermediate store 31 in an unloading sector 34 of the tray 33, while a throat 36 formed in a base 35 of the intermediate store 31 firmly connected to a chute 37 and is moved out to a site located before the first segment 30_1 beyond the sector 34 and stays there motionless, whereas a receiving conveyor 38 placed below the chute 37 moves at velocity V_t toward farther operating work-stands not shown in the drawing. The throat 36 together with the chute 37 is motionless, while the receiving conveyor 38 moves at velocity V_t concurrent to the receiving direction of the rod-like elements 32. At the instant shown in fig. 23, hitherto motionless intermediate store 31 begins its plane motion at velocity V_c concurrent to the receiving direction of the rod-like elements 32, at velocity V_t of the receiving conveyor 38, which is seen in fig. 24, whereas the rod-like elements 32 travel in their receiving direction at velocity V_r together with the receiving conveyor 38. The above state exists

till the first segment 30_1 catches up with motionless throat 36, which takes place beyond the sector 34 at distance S_c of a sidewall 39 of the store 31 away from the sector 34, distance S_c being equal to width W_s of segments 30, while path S_c covered by the intermediate store 31 greater than width W_s of the segments 30, whereas the rod-like elements 32 fall down by gravity into the chute 37. After the throat catches up with the segment 30_1 , the intermediate store 31 is stopped (fig. 25) while the receiving conveyor 38 runs in continuous motion at velocity V_t . Then, return of the intermediate store 31 and the base 35 together with the throat 36 follows to the sector 34 (fig. 27) at equal velocity $V_c = V_h$ in backward relationship to the receiving direction of the rod-like elements 32 (fig. 26) and during continuous emptying of the segment 30_1 , wherein complete emptying of the sector 30_1 takes place which is monitored with a sensor 40 placed at the level of the throat 36 while the store 31 and the throat 36 are motionless (fig. 28). In order to empty the second consecutive segment 30_2 , the intermediate store 31 begins its plane motion concurrent to the receiving direction of the rod-like elements 32 (fig. 29), while the throat 36 is motionless, the latter being located close to the side edge of the sector 34 and inside thereof. After the throat 36 catches up with the second segment 30_2 (fig. 30), which takes place within the sector 34 and after the intermediate store 31 has covered path S_c equal to width W_s of the segments 30, the second segment 30_2 is emptied, where after the intermediate store 31 with the base 35 and the throat 36 returns in backward relationship to the receiving direction of the rod-like elements 32 at equal velocity $V_c = V_h$ (fig. 31), while the second segment 30_2 being continuously emptied until its arrival at the sector 34, where the second segment 30_2 becomes completely emptied, which is monitored with the sensor 40 placed at the level of the throat 36, and both the intermediate store 31 and the throat 36 are motionless (fig. 32 and fig. 33). Analogically, emptying of consecutive segments 30 follows and takes place within the sector 34. Next drawing (fig. 34) refers to the instant when emptying the last but one segment 30_{n-1} is completed, whereas the intermediate store 31 and the throat 36 are motionless, and another drawing (fig. 35) illustrates the start up of emptying the last segment 30_n , wherein the intermediate store 31 begins concurrent motion relative to the receiving direction of the rod-like elements 32 at velocity V_c

when the throat 36 is motionless and stays inside the sector 34. After the throat 36 catches up with the segment 30_n (fig. 36), which takes place after the intermediate store 31 has completed its travel on path S_c equal to width W_s of the segments 30, return to the sector 34 of the intermediate store 31 together with the base 35 and the throat 36 will follow at backward relationship to the receiving direction of the rod-like elements 32 and at equal velocity $V_c = V_h$ (fig. 37), whereas complete emptying of the last sector 30_n (fig. 39) is monitored with the sensor 40 (fig. 40). During emptying of the last segment 30_n (fig. 39), a consecutive tray 33 filled up with the rod-like elements 32 is delivered to the sector 34, and the rod-like elements 32 are supported from below with a supporting plate 41 (fig. 36 and fig. 37). After the intermediate store 31 and the throat 36 are stopped, a multi-segment plate 42 enters top part of the intermediate store 31 below the supporting plate 41. Being movably fixed the multi-segment plate 42 moves from top downward along the segments 30 (fig. 38). Then (fig. 39) the supporting plate 41 is removed and the rod-like elements 32 fall down onto the multi-segment plate 42, being lowered down together with the plate along the segments 30, wherein after complete emptying of the last segment 30_n , the base 35 together with the throat 36 moves concurrent with the receiving direction of the rod-like elements 32 at velocity V_h equal to velocity V_t of the receiving conveyor 38, when the intermediate store 31 (fig. 41 and fig. 42) is motionless, until the throat 36 arrives at the site before the first segment 30_1 beyond the sector 34 (fig. 43). Meantime, the multi-segment plate 42 is removed so that the rod-like elements 32 could be placed on the base 35. The consecutive cycle of emptying the store 31 begins, the store 31 comprising the rod-like elements 32 from recently unloaded tray 33. Referring to fig. 44, displacements S_h of the throat 36 and displacements S_c of the intermediate store 31 and constant velocity V_t of the receiving conveyor 38 as well as emptying rate Q_s of the segments 30 are graphically presented.

Embodiment III.

Referring to fig.45, equal segments 50 of an intermediate store 51 are completely filled up with rod-like elements 52 and an unloaded tray 53 together with the intermediate store 51 is situated in an unloading sector 54 of the tray 53, while a throat 56 formed in

a base 55 of the intermediate store 51 is firmly connected to a chute 57 and moved out to the site before the first segment 50_1 beyond the sector 54. The intermediate store 51, the throat 56 and a receiving conveyor 58 are motionless, and also flow of the rod-like elements 52 is stopped. At the instant shown in fig. 45, the intermediate store 51, which hitherto is motionless, starts up its plane motion at velocity V_c concurrent with the receiving direction of the rod-like elements 52 toward the throat 56 as shown in fig. 46, wherein the throat 56, the conveyor 58 and the elements 52 still remain motionless. This state will last until the first segment 50_1 catches up with the motionless throat 56, which will take place beyond the sector 54, after the intermediate store 51 has covered path S_c equal to width W_s of the segments 50, whereas a sidewall 59 of the intermediate store 51 has arrived at the site beyond the sector 54, and after that the intermediate store 51 is stopped (fig. 47). Then return of the intermediate store 51 and the base 55 follows together with the throat 56 at backward relationship to the receiving direction of the rod-like elements 52, at equal velocity $V_c = V_h$ (fig. 48) and continuous emptying of the first segment 50_1 and the receiving conveyor 58 running at velocity V_t toward farther operational work-stands not shown in drawing, and also motion of the rod-like elements 52 at velocity V_r at the receiving direction thereof together with the receiving conveyor 58. After return to the sector 54, the intermediate store 51 and the throat 56 are stopped (fig. 49), while the rod-like elements 52 travel on the receiving conveyor 58 that runs until the first segment 50_1 is completely emptied, which is monitored with a sensor 60 placed at the level of the throat 56 (fig. 50). In order to empty the consecutive second segment 50_2 , the intermediate store 51 starts plane motion at velocity V_c concurrent with the receiving direction of the rod-like elements 52 (fig. 51), wherein the throat 56, the receiving conveyor 58 and the rod-like elements 52 still remain motionless. It lasts until the second segment 50_2 catches up with the motionless throat 56, which takes place inside the sector 54 and after the travel of the intermediate store 51 along path S_c that equals to width W_s of the segments 50 (fig. 52), then the intermediate store 51 is stopped. Then the intermediate store 51, the base 55 and the throat 56 return at backward relationship to the receiving direction of the rod-like elements 52 at equal velocity $V_c = V_h$ (fig. 53) as well as during continuous

emptying of the second segment 50_2 and motion of the receiving conveyor 58 at velocity V_t toward farther operational work-stands, while the rod-like elements 52 travel at velocity V_r at the direction of their receiving together with the receiving conveyor 58. After return of the sidewall 59 of the intermediate store 51 to the sector 54, the intermediate store 51 and the throat 56 are stopped (fig. 54) whereas the rod-like elements 52 travel on the running conveyor 58 until the second segment 50_2 is completely emptied, which is monitored with the sensor 60 placed at the level of the throat 56 (fig. 55). Analogically as above, emptying of consecutive segments 50 follows and takes place inside the unloading sector 54. Next drawing (fig. 56) shows up the last but one segment 50_{n-1} when its emptying ends up, the intermediate store 51, the throat 56, the conveyor 58 remain motionless and flow of the rod-like elements 52 is stopped. Yet another drawing (fig. 57) illustrates the emptying start of the last segment 50_n . The intermediate store 51 begins plane motion at velocity V_c concurrent with the receiving direction of the rod-like elements 52 toward the throat 56, wherein the throat 56, the conveyor 58 and the rod-like elements 52 remain motionless. It lasts until the last segment 50_n catches up with the motionless throat 56, which takes place inside the sector 54 and path S_c covered by the intermediate store 51 equals to width W_s of the segments 50 (fig. 58), after that the intermediate store 51 is stopped. At this instant, the empty tray 53 is substituted for the consecutive tray 53 filled up with the rod-like elements 52 supported from below with a supporting plate 61. Then return of the intermediate store 51 and the base 55 together with the throat 56 follows at backward relationship to the receiving direction of the rod-like elements 52 and at equal velocity $V_c = V_h$ (fig. 59) during continuous emptying of the last segment 50_n and motion of the conveyor 58 at velocity V_t toward farther operating work-stands, also the rod-like elements 52 move at their receiving direction and at velocity V_r together with the receiving conveyor 58. When the intermediate store 51 and the throat 56 are stopped, in the sector 54, a multi-segment plate 62 enters top part of the intermediate store 51 below the supporting plate 61. The multi-segment plate 62 is movably fixed and moves from top downward inside the segments 50 (fig. 60). Then (fig. 61), the supporting plate 61 is removed, the rod-like elements 52 fall down onto the multi-segment plate 62 and, together with it,

they are lowered down inside the segments 50. After complete emptying of the last segment 50_n (fig. 62), the base 55 together with the throat 56 move concurrent with the receiving direction of the rod-like elements 52 and the conveyor 58 at equal velocity $V_h = V_t$, when the intermediate store 51 is motionless (fig. 63 and fig. 64) and until the throat 56 arrives at the site before the first segment 50_1 beyond the unloading sector 54 (fig. 65), the throat 56 and the conveyor 58 being stopped. Meantime the multi-segment plate 62 is removed so that the rod-like elements 52 could be placed onto the base 55. Then a consecutive emptying cycle of the intermediate store 51 including the rod-like elements 52 from the recently unloaded tray 53 begins. In fig. 66, displacement S_h of the throat 56, displacement S_c of the intermediate store 51 and velocity V_t of the periodically stopped receiving conveyor 58 are graphically presented as well as emptying rate Q_s of the segments 50.

Claims

1. Tray emptying method for tobacco industry, wherein rod-like elements are transferred by gravity from the tray simultaneously to many segments of an intermediate store, the segments being separated from each other with vertical partition walls of the intermediate store, the latter being a volumetric equivalence of the tray, and then the rod-like elements are transferred down onto a running receiving conveyor located below, characterized in that vertical segments of the intermediate store filled up with rod-like elements are emptied independently of each other through a throat formed in the intermediate store base, wherein both the intermediate store and the base thereof together with the throat, independently of each other, reciprocate along the receiving conveyor so that consecutive segments of the store could meet the throat, while the segment emptying sequence is in backward relationship relative to the receiving direction of the rod-like elements on the receiving conveyor.
2. Method as in claim 1, characterized in that the rod-like elements are placed onto the receiving conveyor through a profiled chute firmly connected to the throat, wherein the throat has area that complies with the area of horizontal cross section of a segment of the intermediate store and it receives the rod-like elements from one consecutive segment at a time while the complete emptying of a segment is monitored with a sensor and the width of the emptied segments complies with height of mass flow layer of rod-like elements placed on the receiving conveyor.

3. Method as in claim 1 or 2, characterized in that after the last segment of the intermediate store filled up with the rod-like elements from a preceding tray is emptied, the throat together with the chute moves concurrently with the receiving direction of the rod-like elements on the receiving conveyor at conveyor velocity while the unchanged layer height of the rod-like elements close under the throat level is kept up until the throat arrives at the site before the first segment of the intermediate store meantime loaded with the rod-like elements from a consecutive tray, and then for short time the intermediate store runs a plane motion concurrent with the throat and to the receiving direction of the rod-like elements at velocity greater than velocity of the receiving conveyor so that the throat could meet the first segment of the intermediate store and thus to ensure the emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector and then a return of the store and the throat follows at equal velocity and in backward relationship to the receiving direction of the rod-like elements until the intermediate store is placed in the tray unloading sector, where complete emptying of the first segment takes place while analogically the emptying of each consecutive segment follows after receiving enable signal, each time the throat being placed before a next segment to be emptied, whereas in order to determine mutual position of the throat and the segment, an opposite direction to the receiving direction of the rod-like elements is considered and unloading of the next tray in sequence takes place during the last segment emptying at rate not higher than emptying rate of that segment, and at any rate during motion of the throat together with the chute concurrent with the receiving direction of the rod-like elements, the throat velocity being equal to the receiving conveyor velocity, and during the complete segment emptying cycle of the intermediate store, the conveyor runs with no interruption at established direction.
4. Method as in claim 1 or 2, characterized in that after emptying of the last segment of the intermediate store filled up with the rod-like elements from the preceding tray, the throat together with the chute moves concurrently to the receiving direction of the rod-like elements on the receiving conveyor at conveyor velocity, wherein layer

height of the rod-like elements below the throat level will be kept up unchanged until the throat is placed at a site before the first segment of the intermediate store loaded meantime with the rod-like elements from a consecutive tray, and then a short-term stop of the throat together with the chute follows, whereas the intermediate store runs at plane motion concurrent to the receiving direction of the rod-like elements so that the throat could meet the first segment of the intermediate store and ensure the emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector and then a return of the store and the throat at equal velocity and in backward relationship to the receiving direction of the rod-like elements follows until the intermediate store is placed in the tray unloading sector, where complete emptying of the first segment takes place, while analogically emptying of each consecutive segment follows after receiving enable signal and each time the throat is placed at the site before a next segment to be emptied, whereas in order to determine mutual position of the throat and the segment opposite direction to the receiving direction of the rod-like elements is considered, and unloading of the next tray in sequence takes place during the last segment emptying at a rate not higher than the emptying rate of that segment and also at any rate during displacement of the throat together with the chute concurrent with the receiving direction of the rod-like elements, the throat velocity being equal to the receiving conveyor velocity, while during the complete segment emptying cycle of the intermediate store, the receiving conveyor runs with no interruption and at the established direction.

5. Method as in claim 1 or 2, characterized in that after the last segment of the intermediate store filled up with rod-like elements from a preceding tray is emptied, the throat together with the chute moves concurrently to the receiving direction of rod-like elements on the receiving conveyor at conveyor velocity, the layer height of the rod-like elements being kept up unchanged close below the level of the throat until the throat is placed at the site before the first segment of the intermediate store meantime loaded with the rod-like elements from a consecutive tray, and then a short-term stop of the throat together with the chute and the receiving conveyor follows, during which

the intermediate store runs at plane motion concurrent to the receiving direction of the rod-like elements so that throat could meet the first segment of the intermediate store and ensure the emptying possibility, wherein the intermediate store partly moves out beyond the tray unloading sector and then receiving conveyor starts up and the return of the store, throat and chute follows at backward relationship to the receiving direction of the rod-like elements at equal velocity to the tray unloading sector wherein the complete first segment emptying takes place, while analogically the emptying of each consecutive segment follows after receiving enable signal, and each time the throat is placed at the site before a next segment to be emptied, and in order to determine a mutual position of the throat and the segment, the opposite direction to the receiving direction of the rod-like elements is considered, and unloading of the next tray in sequence takes place during the last segment emptying at a rate not higher than the emptying rate of that segment and also at any rate during displacement of the throat together with the chute concurrent with the receiving direction of the rod-like elements, the throat velocity being equal to the receiving conveyor velocity, while during the complete segment emptying cycle of the intermediate store the receiving conveyor runs at the established direction and is periodically stopped.

AMENDED CLAIMS**received by the International Bureau on 28 January 2008 (28.01.08)**

1. Tray (13, 33, 53) emptying method for tobacco industry, wherein rod-like elements (12, 32, 52) are transferred by gravity from the tray (13, 33, 53) simultaneously to many segments (10, 30, 50) of an intermediate store (11, 31, 51), the segments (10, 30, 50) being separated from each other with vertical partition walls of the intermediate store (11, 31, 51), the latter being a volumetric equivalence of the tray (13, 33, 53), and then the rod-like elements (12, 32, 52) are transferred down onto a running receiving conveyor (18, 38, 58) located below, characterized in that vertical segments (10, 30, 50) of the intermediate store (11, 31, 51) filled up with rod-like elements (12, 32, 52) are emptied independently of each other through a throat (16, 36, 56) formed in the intermediate store (11, 31, 51) base (15, 35, 55) wherein both the intermediate store (11, 31, 51) and the base (15, 35, 55) thereof together with the throat (16, 36, 56), independently of each other, reciprocate along the receiving conveyor (18, 38, 58) so that consecutive segments (10, 30, 50) of the store (11, 31, 51) could meet the throat (16, 36, 56), while the segments (10, 30, 50) emptying sequence is in backward relationship relative to the receiving direction of the rod-like elements (12, 32, 52) on the receiving conveyor (18, 38, 58).
2. Method as in claim 1, characterized in that the rod-like elements (12, 32, 52) are placed onto the receiving conveyor (18, 38, 58) through a profiled chute (17, 37, 57) firmly connected to the throat (16, 36, 56), wherein the throat (16, 36, 56) has area that complies with the area of horizontal cross section of a segment (10, 30, 50) of the intermediate store (11, 31, 51) and it receives the rod-like elements (12, 32, 52) from one consecu-

tive segment (10, 30, 50) at a time while the complete emptying of a segment (10, 30, 50) is monitored with a sensor (20, 40, 60) and the width of the emptied segments (10, 30, 50) complies with height of mass flow layer of rod-like elements (12, 32, 52) placed on the receiving conveyor (18, 38, 58).

3. Method as in claim 1 or 2, characterized in that after the last segment (10_n) of the intermediate store (11) filled up with the rod-like elements (12) from a preceding tray (13) is emptied, the throat (16) together with the chute (17) moves concurrently with the receiving direction of the rod-like elements (12) on the receiving conveyor (18) at conveyor (18) velocity (V_t) while the unchanged layer height of the rod-like elements (12) close under the throat (16) level is kept up until the throat (16) arrives at the site before the first segment (10_1) of the intermediate store (11) meantime loaded with the rod-like elements (12) from a consecutive tray (13), and then for short time the intermediate store (11) runs a plane motion concurrent with the throat (16) and to the receiving direction of the rod-like elements (12) at velocity (V_c) greater than velocity (V_t) of the receiving conveyor (18) so that the throat (16) could meet the first segment (10_1) of the intermediate store (11) and thus to ensure the emptying possibility, wherein the intermediate store (11) partly moves out beyond the tray (13) unloading sector (14) and then a return of the store (11) and the throat (16) follows at equal velocity ($V_c = V_h$) and in backward relationship to the receiving direction of the rod-like elements (12) until the intermediate store (11) is placed in the tray (13) unloading sector (14), where complete emptying of the first segment (10_1) takes place while analogically the emptying of each consecutive segment ($10_2, \dots, 10_n$) follows after receiving enable signal, each time the throat (16) being placed before a next segment ($10_2, \dots, 10_n$) to be emptied, whereas in order to determine mutual position of the throat (16) and the segment (10), an opposite direction to the receiving direction of the rod-like elements (12) is considered and unloading of the next tray (13) in sequence takes place during the last segment (10_n) emptying at rate not higher than emptying rate of that segment (10_n), and at any rate during motion of the throat (16) together with the chute (17) concurrent with the receiving direction of the rod-like elements (12), the throat (16) velocity (V_h) being equal to the receiving conveyor (18) ve-

locity (V_t), and during the complete segments (10) emptying cycle of the intermediate store (11), the conveyor (18) runs with no interruption at established direction.

4. Method as in claim 1 or 2, characterized in that after emptying of the last segment (30_n) of the intermediate store (31) filled up with the rod-like elements (32) from the preceding tray (33), the throat (36) together with the chute (37) moves concurrently to the receiving direction of the rod-like elements (32) on the receiving conveyor (38) at conveyor (38) velocity (V_t), wherein layer height of the rod-like elements (32) below the throat (36) level will be kept up unchanged until the throat (36) is placed at a site before the first segment (30_1) of the intermediate store (31) loaded meantime with the rod-like elements (32) from a consecutive tray (33), and then a short-term stop of the throat (36) together with the chute (37) follows, whereas the intermediate store (31) runs at plane motion concurrent to the receiving direction of the rod-like elements (32) so that the throat (36) could meet the first segment (30_1) of the intermediate store (31) and ensure the emptying possibility, wherein the intermediate store (31) partly moves out beyond the tray (33) unloading sector (34) and then a return of the store (31) and the throat (36) at equal velocity ($V_c = V_h$) and in backward relationship to the receiving direction of the rod-like elements (32) follows until the intermediate store (31) is placed in the tray (33) unloading sector (34), where complete emptying of the first segment (30_1) takes place, while analogically emptying of each consecutive segment ($30_2, \dots, 30_n$) follows after receiving enable signal and each time the throat (36) is placed at the site before a next segment ($30_2, \dots, 30_n$) to be emptied, whereas in order to determine mutual position of the throat (36) and the segment (30) opposite direction to the receiving direction of the rod-like elements (32) is considered, and unloading of the next tray (33) in sequence takes place during the last segment (30_n) emptying at a rate not higher than the emptying rate of that segment (30_n) and also at any rate during displacement of the throat (36) together with the chute (37) concurrent with the receiving direction of the rod-like elements (32), the throat (36) velocity (V_h) being equal to the receiving conveyor (38) velocity (V_t), while during the complete segments (30) emptying cycle of the intermediate store (31), the receiving conveyor (38) runs with no interruption and at the established direction.

5. Method as in claim 1 or 2, characterized in that after the last segment (50_n) of the intermediate store (51) filled up with rod-like elements (52) from a preceding tray (53) is emptied, the throat (56) together with the chute (57) moves concurrently to the receiving direction of rod-like elements (52) on the receiving conveyor (58) at conveyor (58) velocity (V_t), the layer height of the rod-like elements (52) being kept up unchanged close below the level of the throat (56) until the throat (56) is placed at the site before the first segment (50₁) of the intermediate store (51) meantime loaded with the rod-like elements (52) from a consecutive tray (53), and then a short-term stop of the throat (56) together with the chute (57) and the receiving conveyor (58) follows, during which the intermediate store (51) runs at plane motion concurrent to the receiving direction of the rod-like elements (52) so that throat (56) could meet the first segment (50₁) of the intermediate store (51) and ensure the emptying possibility, wherein the intermediate store (51) partly moves out beyond the tray (53) unloading sector (54) and then receiving conveyor (58) starts up and the return of the store (51), throat (56) and chute (57) follows at backward relationship to the receiving direction of the rod-like elements (52) at equal velocity ($V_c = V_h$) to the tray (53) unloading sector (54) wherein the complete first segment (50₁) emptying takes place, while analogically the emptying of each consecutive segment (50₂, ..., 50_n) follows after receiving enable signal, and each time the throat (56) is placed at the site before a next segment (50₂, ..., 50_n) to be emptied, and in order to determine a mutual position of the throat (56) and the segment (50), the opposite direction to the receiving direction of the rod-like elements (52) is considered, and unloading of the next tray (53) in sequence takes place during the last segment (50_n) emptying at a rate not higher than the emptying rate of that segment (50_n) and also at any rate during displacement of the throat (56) together with the chute (57) concurrent with the receiving direction of the rod-like elements (52), the throat (56) velocity (V_h) being equal to the receiving conveyor (58) velocity (V_t), while during the complete segments (50) emptying cycle of the intermediate store (51) the receiving conveyor (58) runs at the established direction and is periodically stopped.

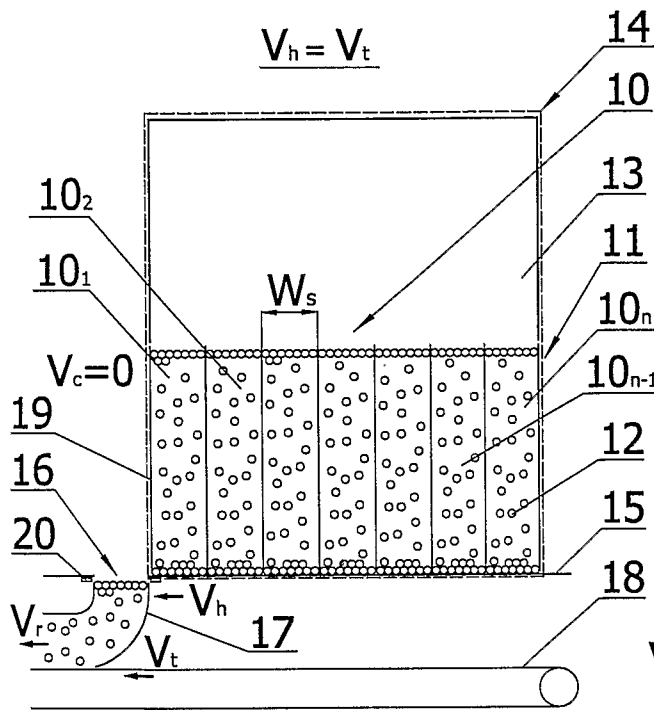


Fig.1

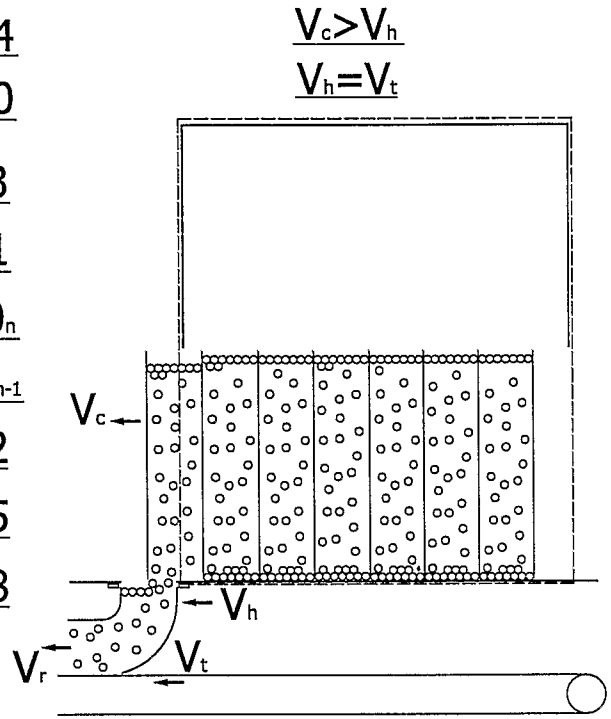


Fig.2

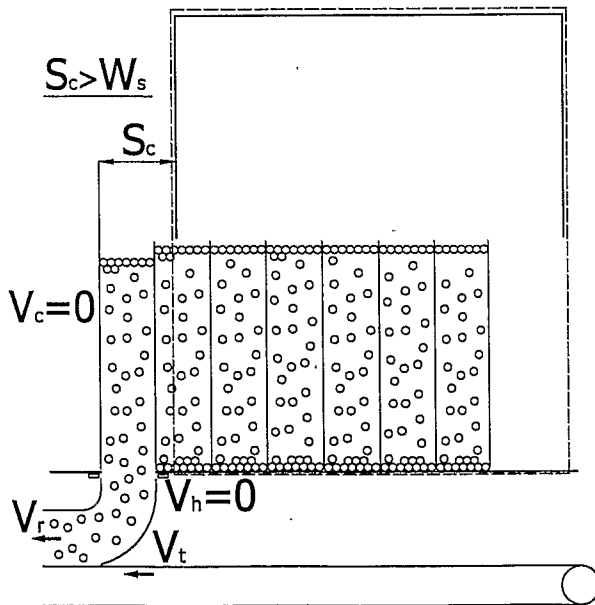


Fig.3

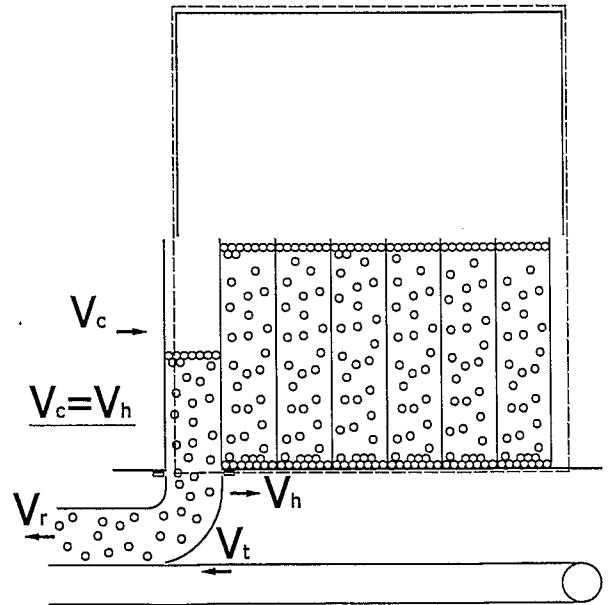


Fig.4

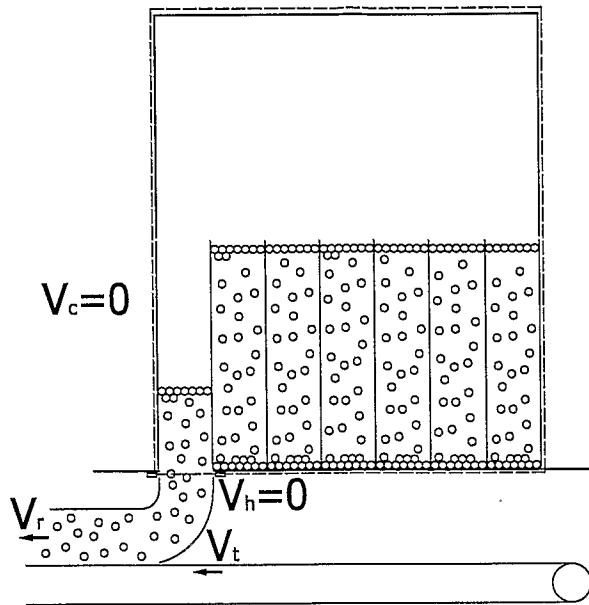


Fig.5

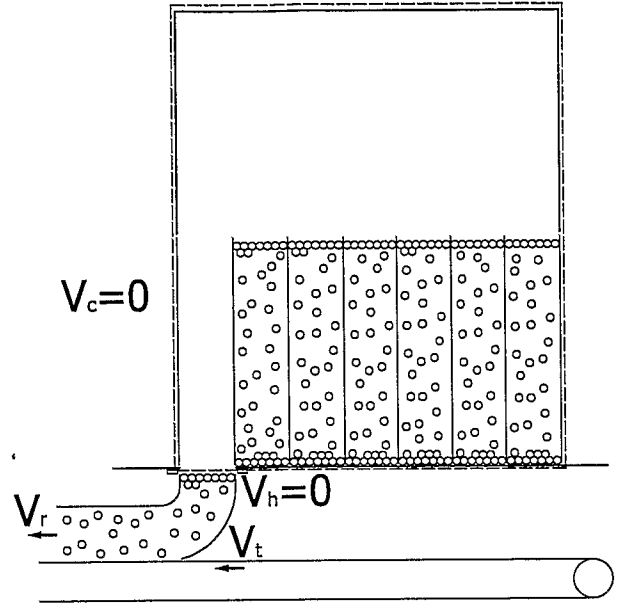


Fig.6

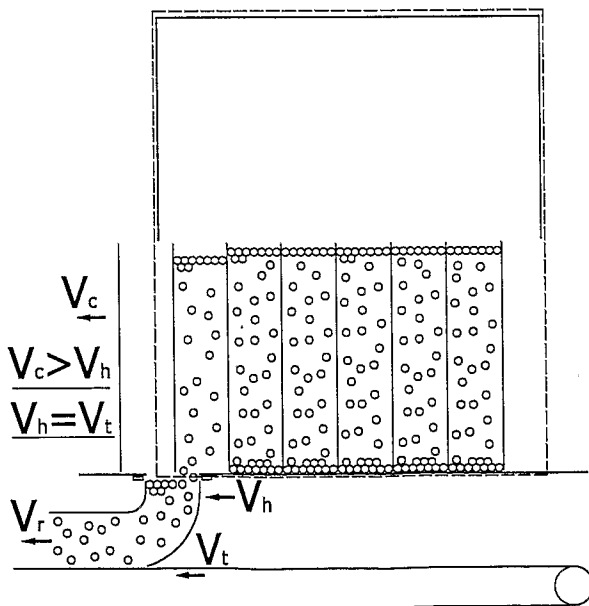


Fig.7

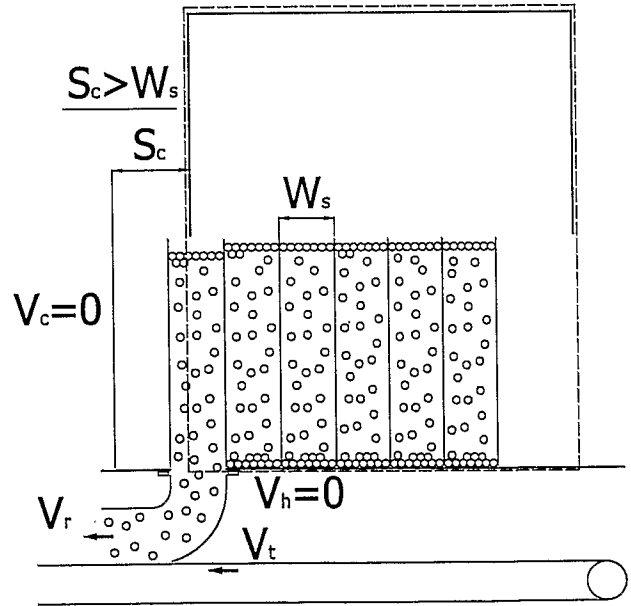


Fig.8

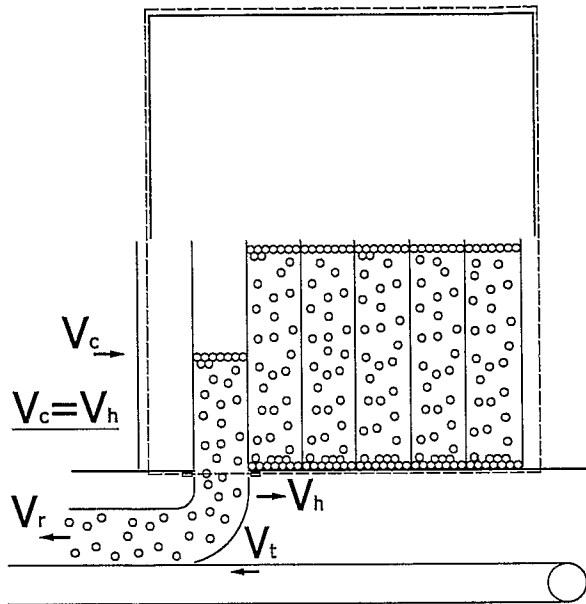


Fig. 9

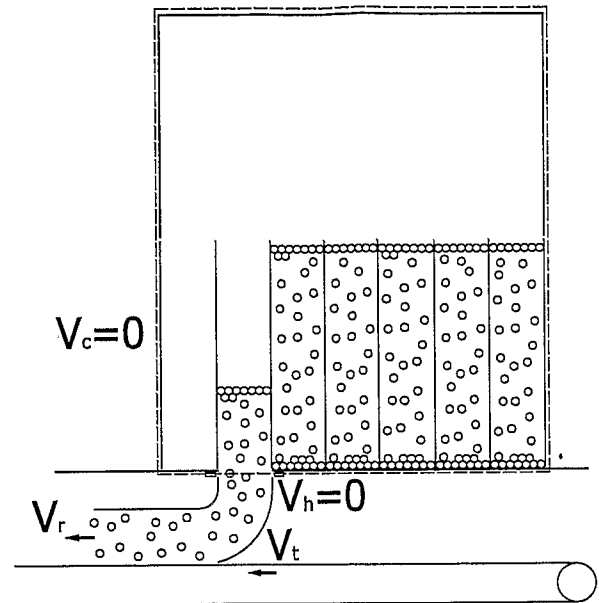


Fig. 10

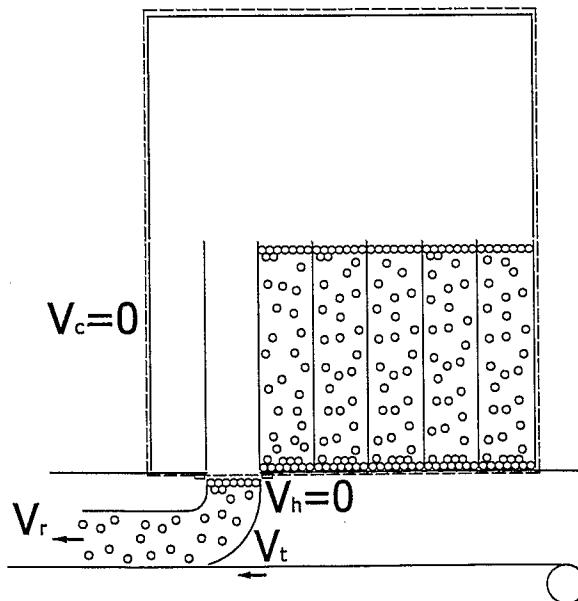


Fig. 11

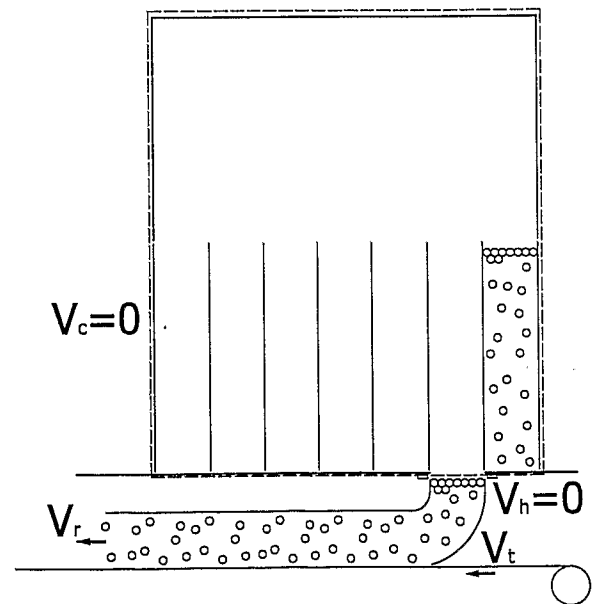


Fig. 12

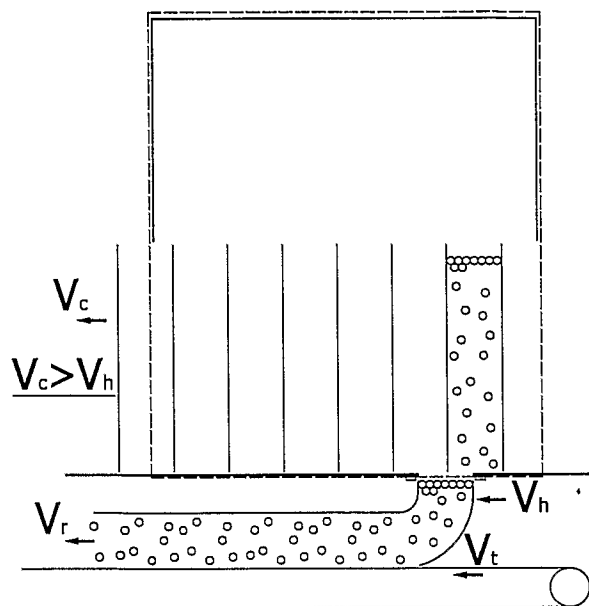


Fig. 13

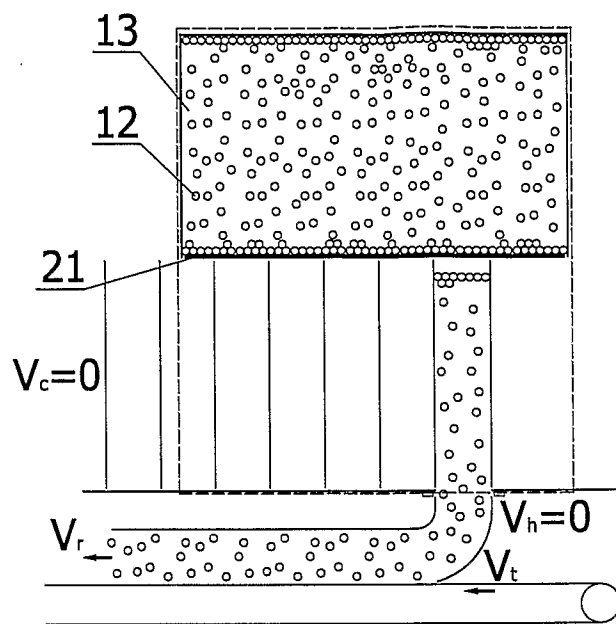


Fig. 14

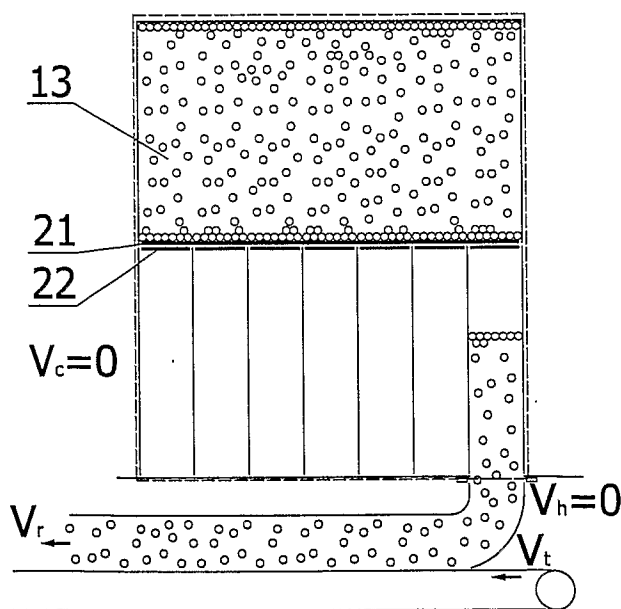


Fig. 15

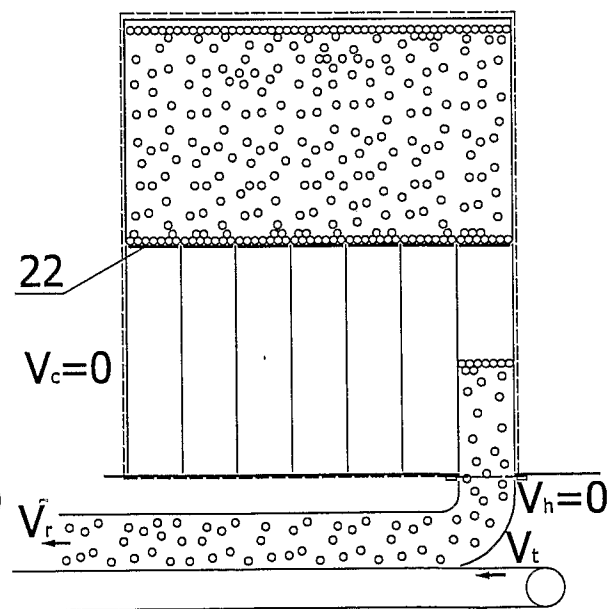


Fig. 16

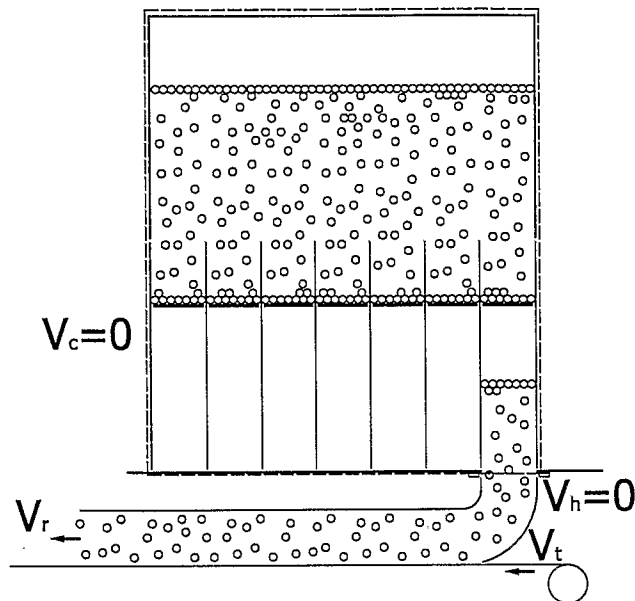


Fig. 17

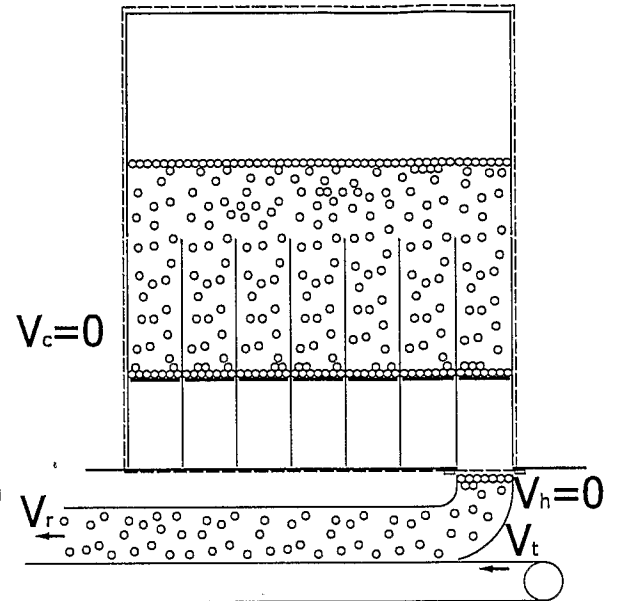


Fig. 18

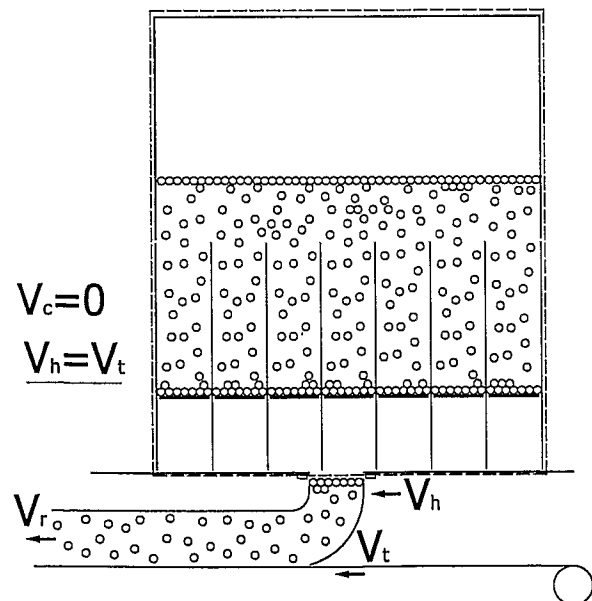


Fig. 19

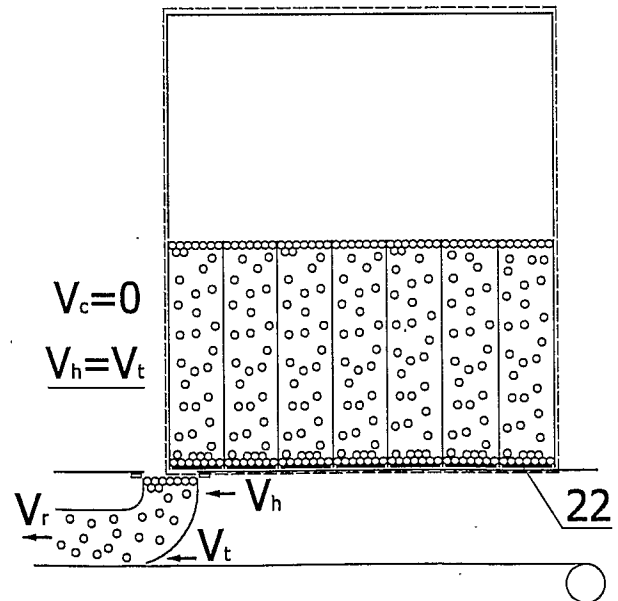


Fig. 20

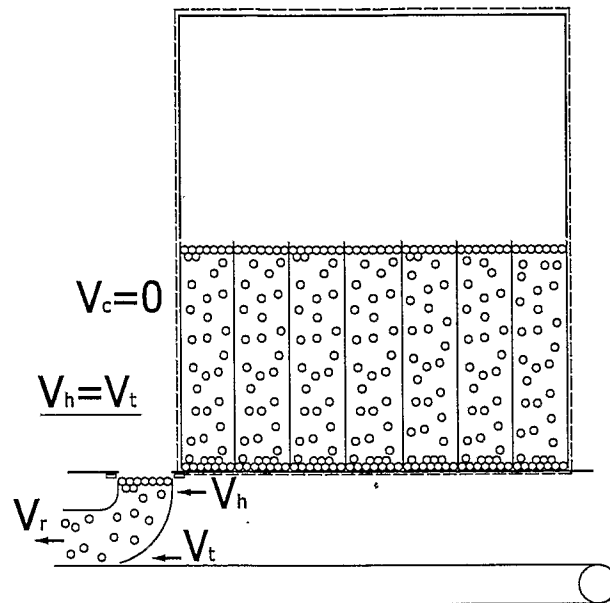


Fig.21

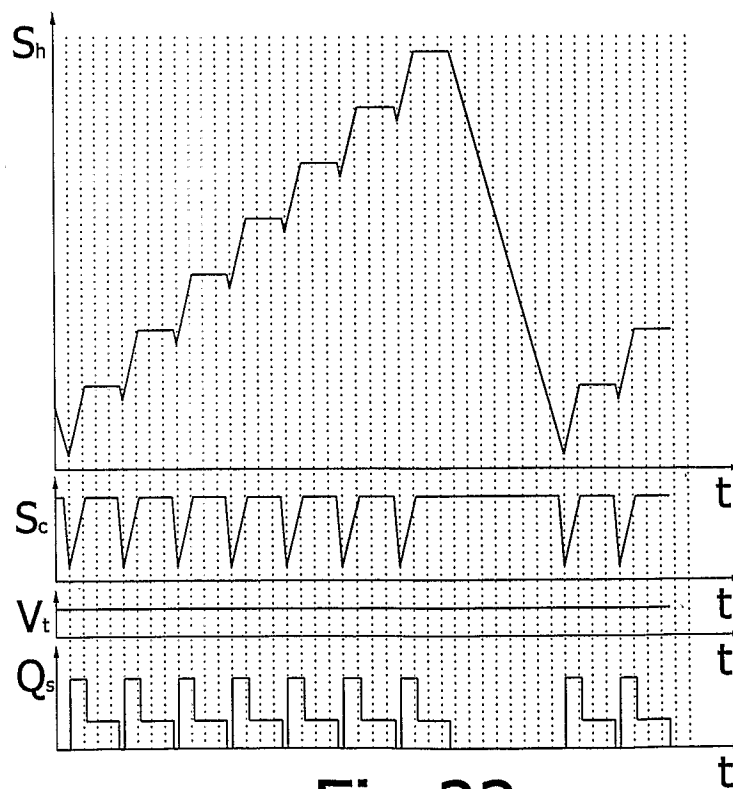


Fig.22

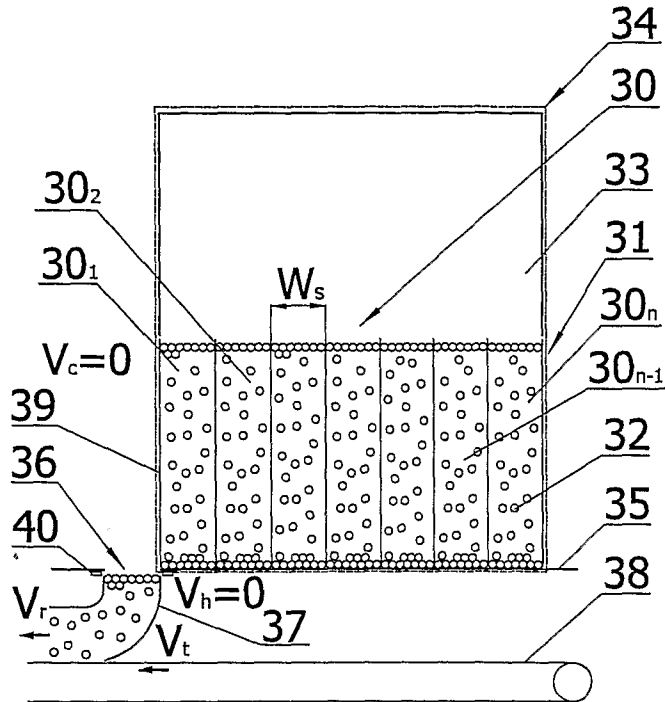


Fig. 23

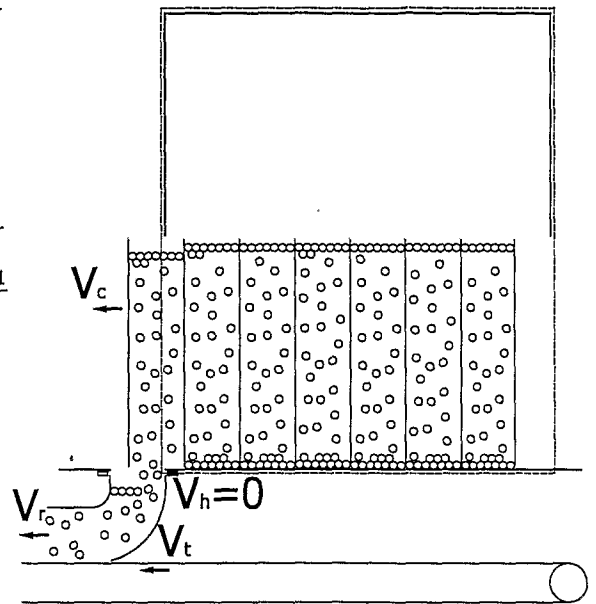


Fig. 24

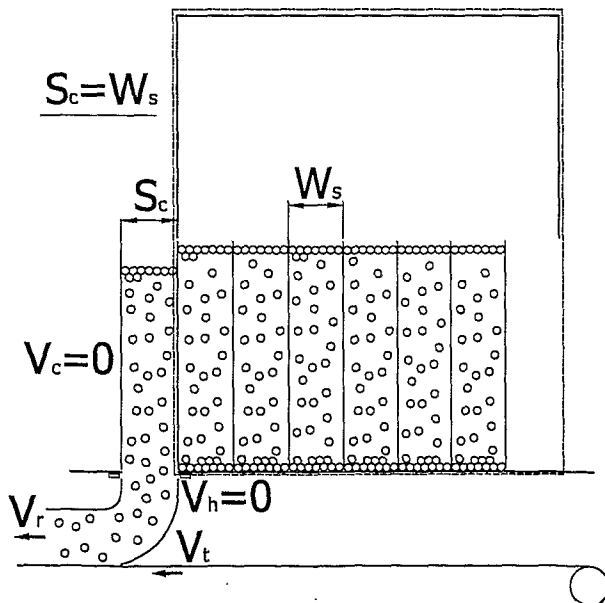


Fig. 25

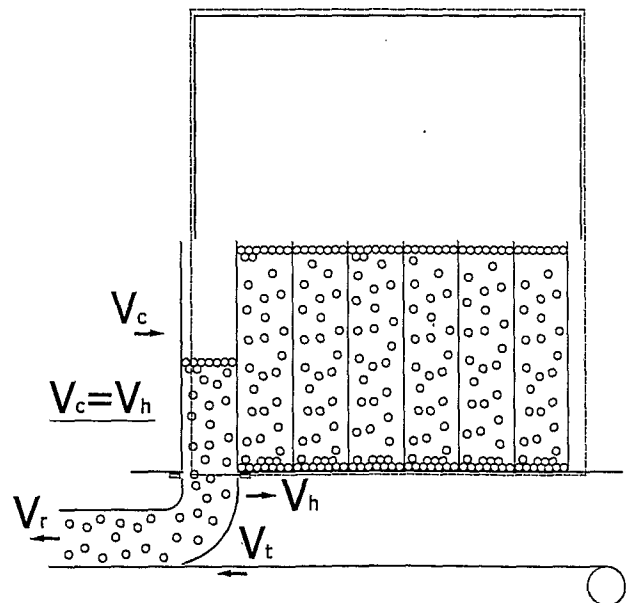


Fig. 26

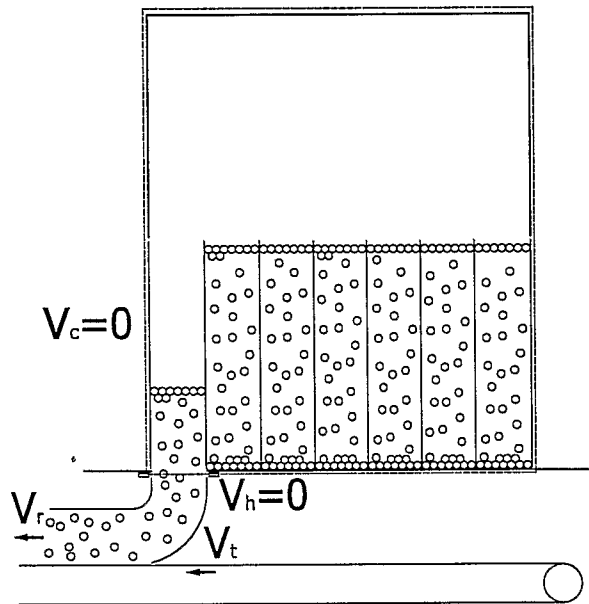


Fig.27

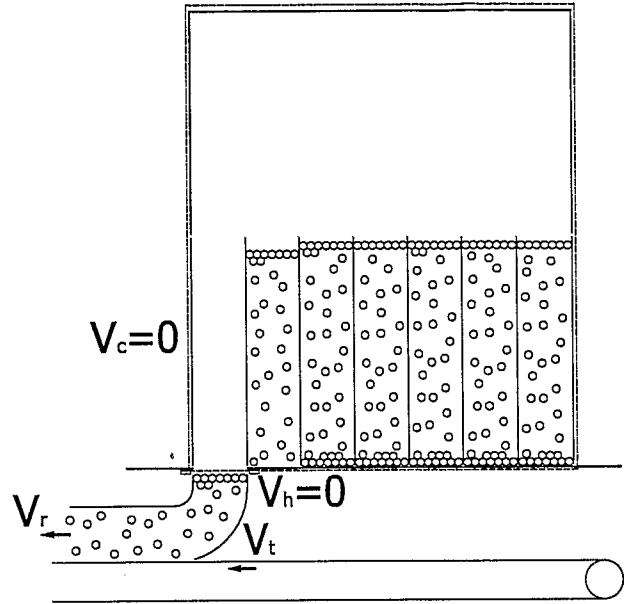


Fig.28

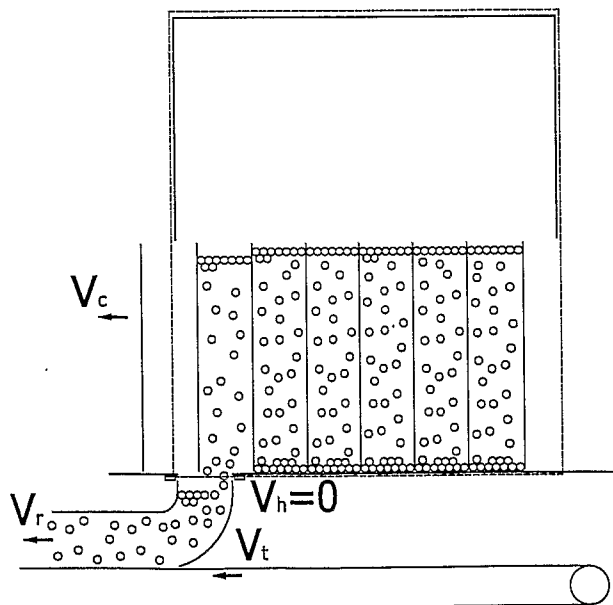


Fig.29

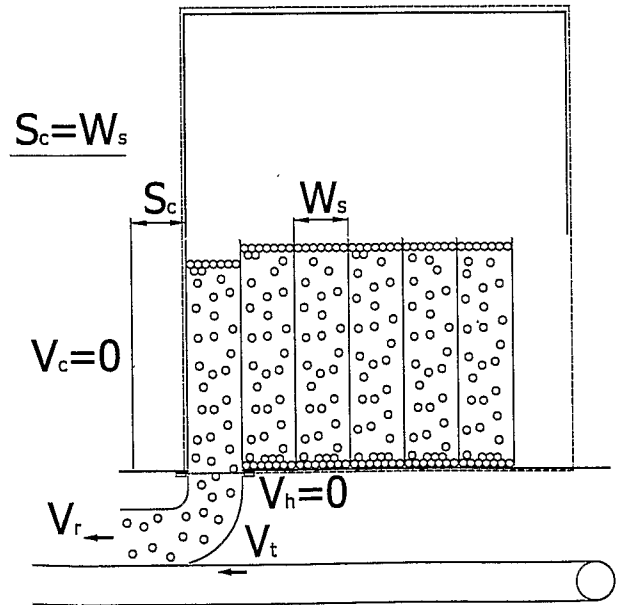


Fig.30

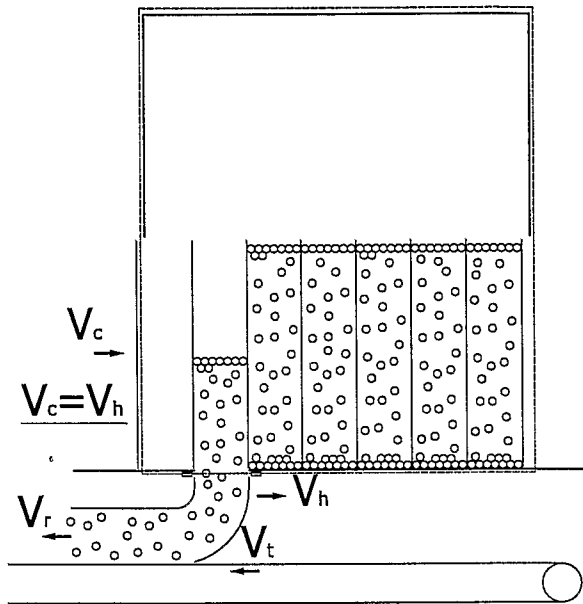


Fig.31

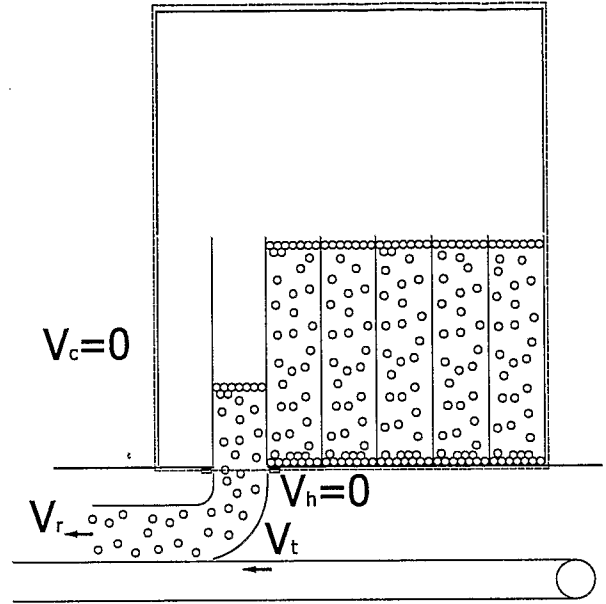


Fig.32

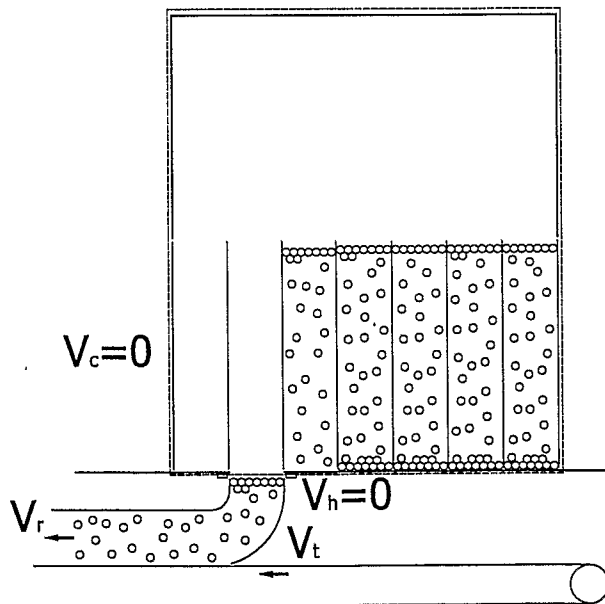


Fig.33

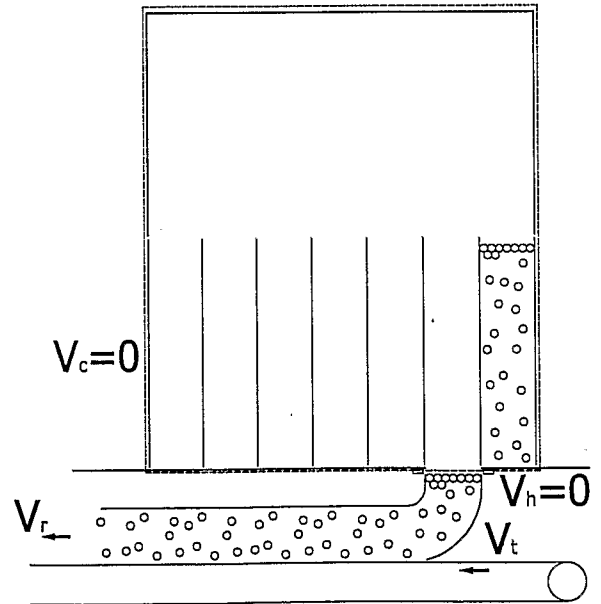


Fig.34

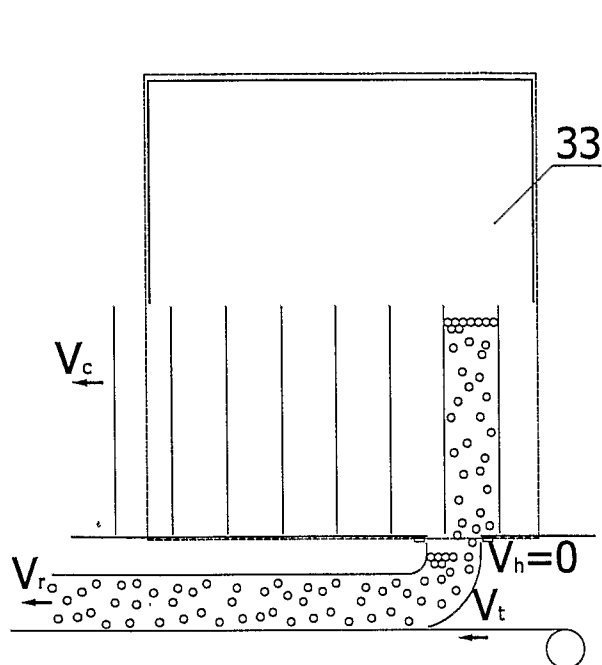


Fig. 35

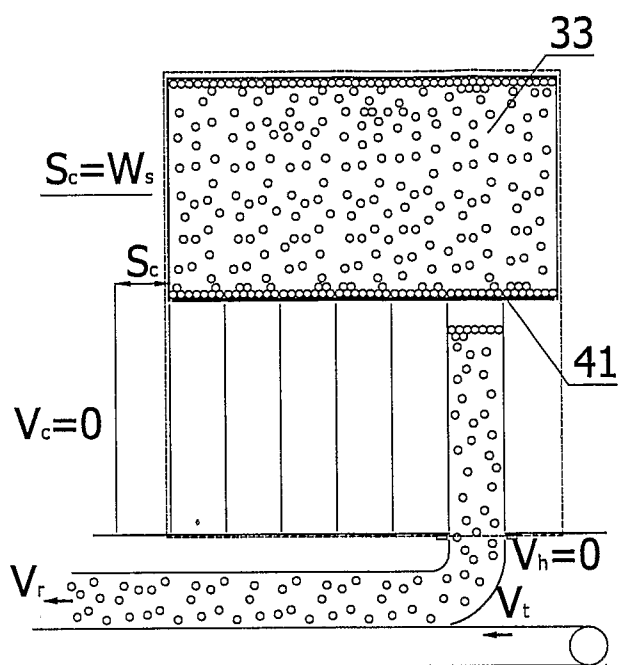


Fig. 36

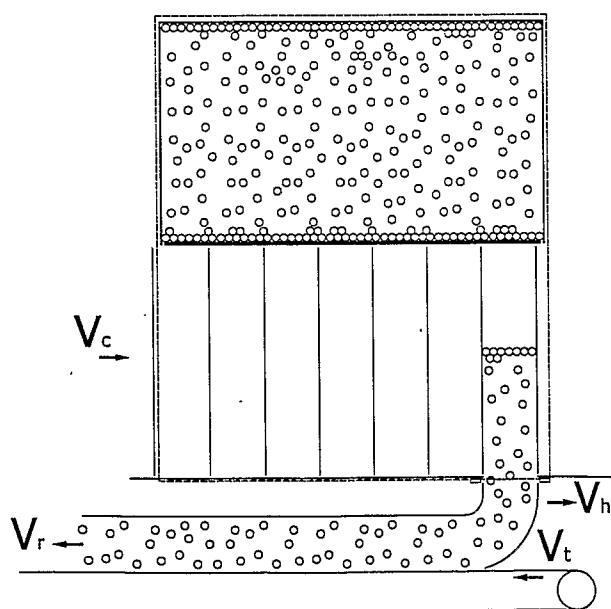


Fig. 37

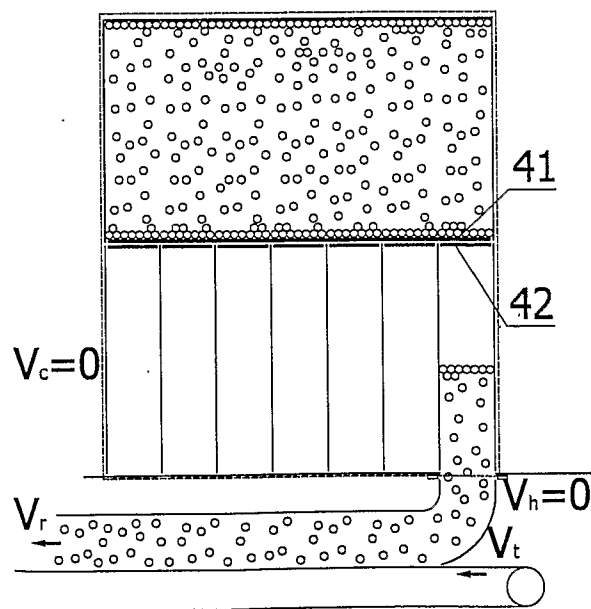


Fig. 38

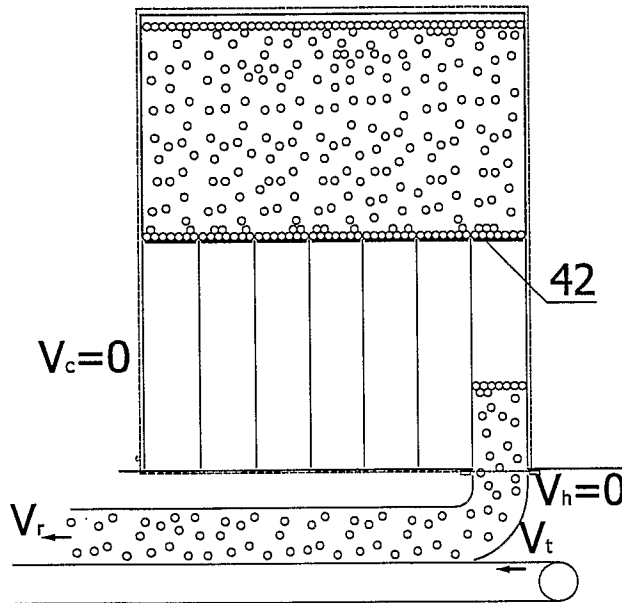


Fig. 39

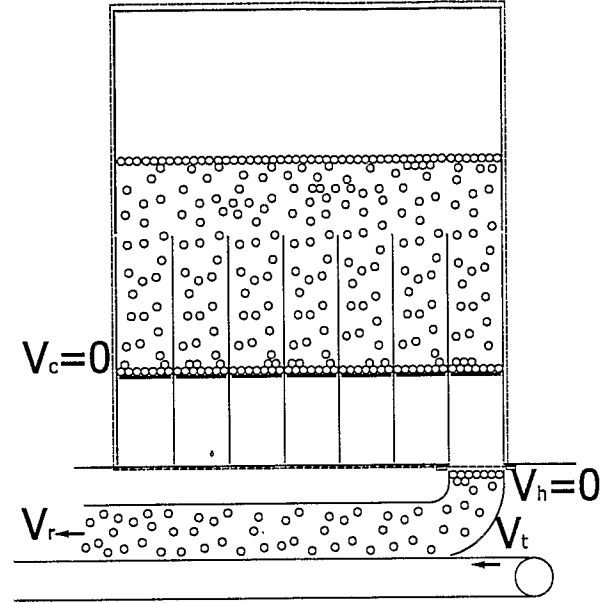


Fig. 40

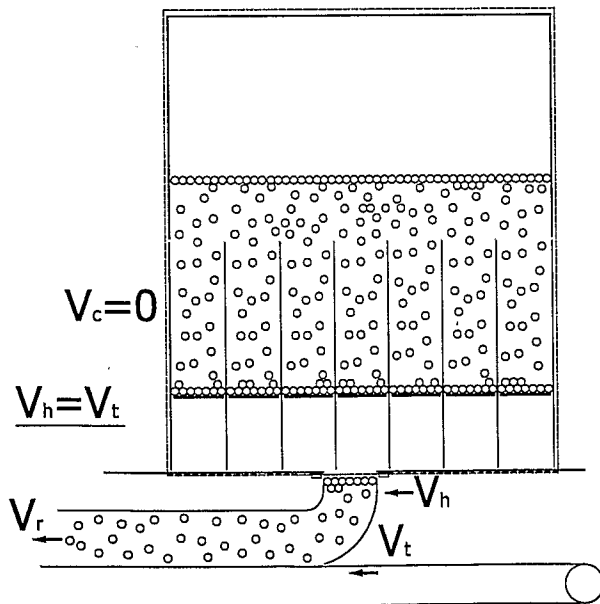


Fig. 41

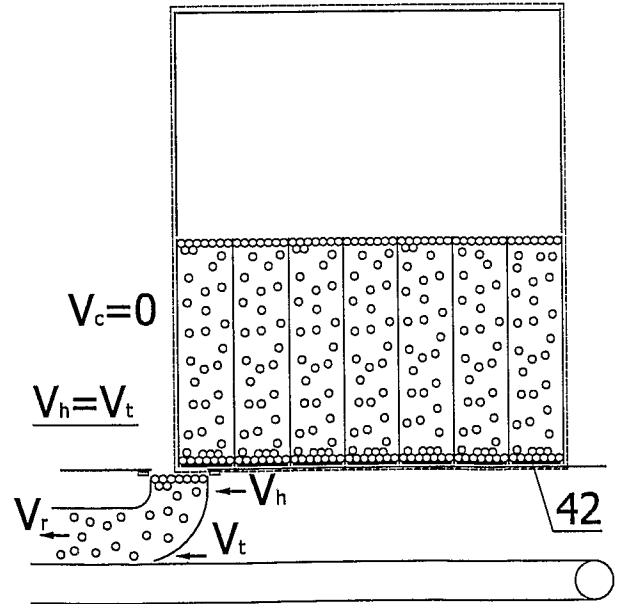


Fig. 42

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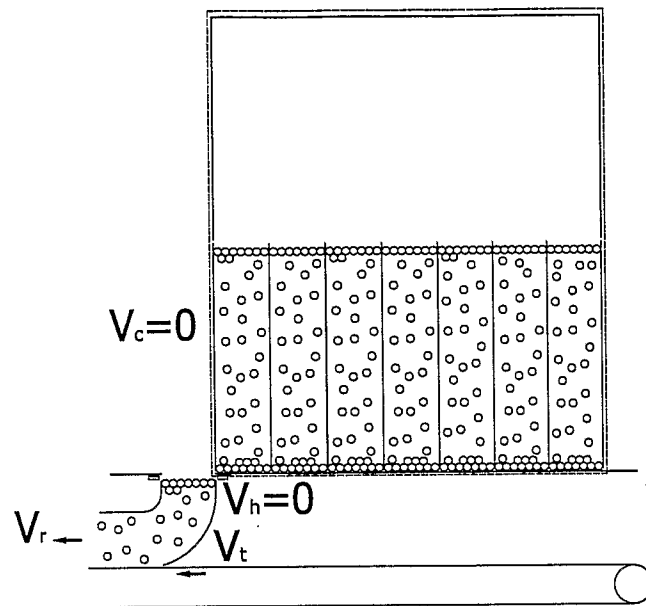


Fig.43

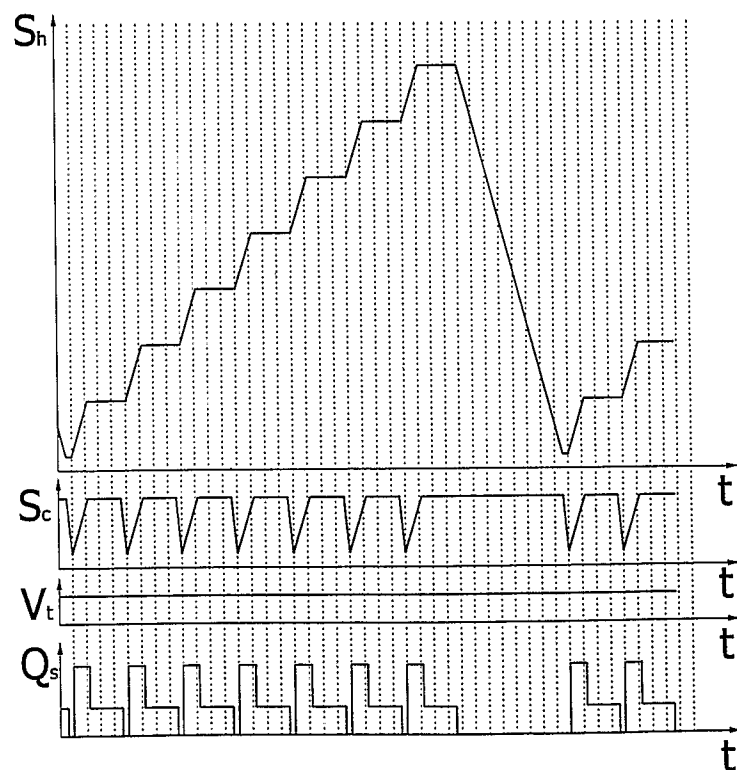


Fig.44

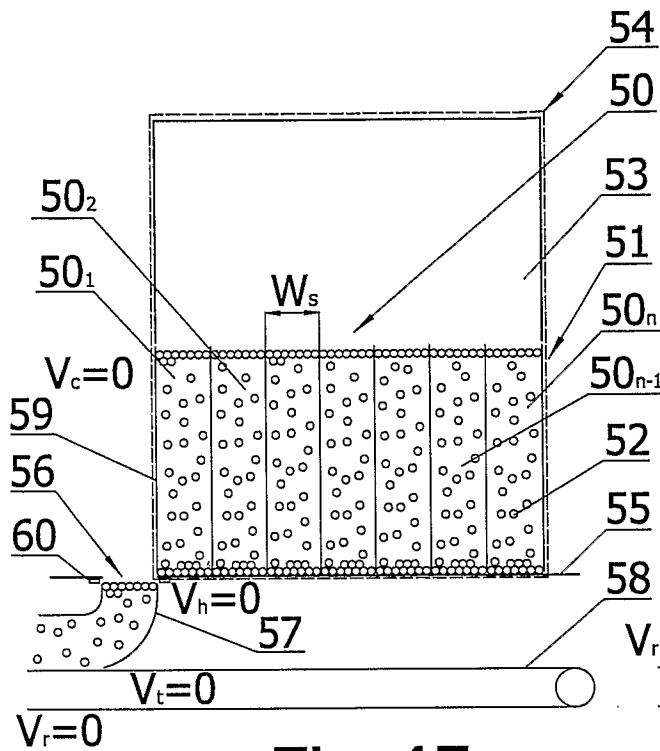


Fig. 45

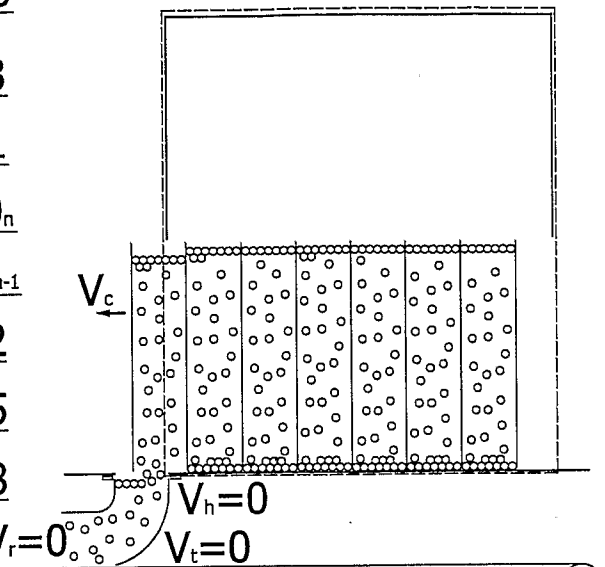


Fig. 46

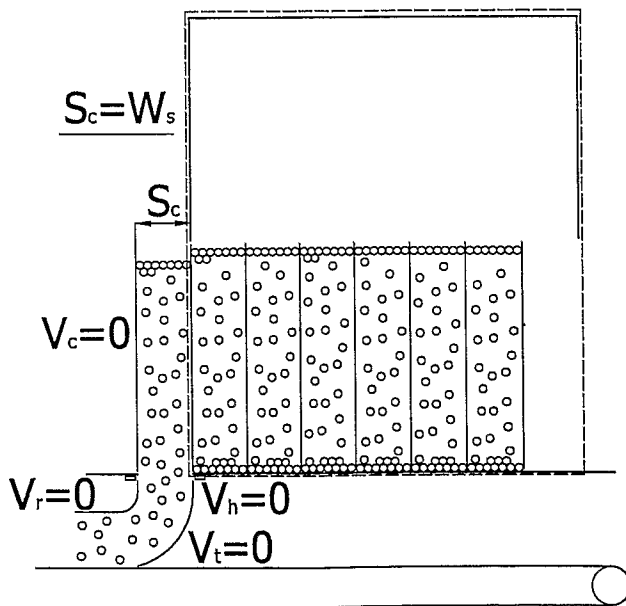


Fig. 47

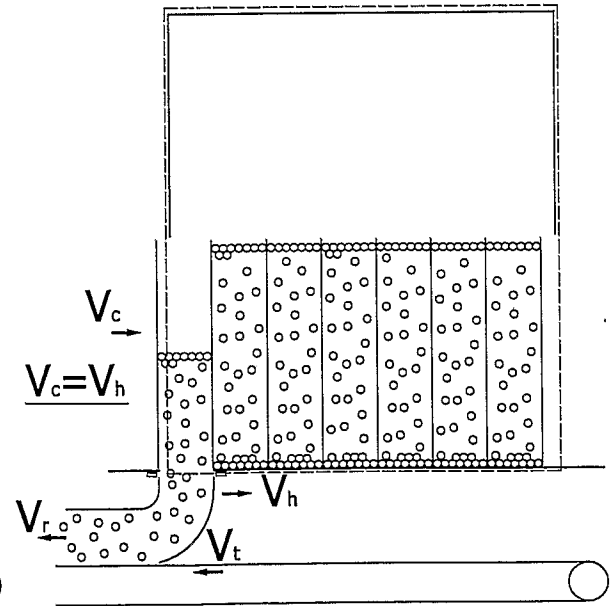


Fig. 48

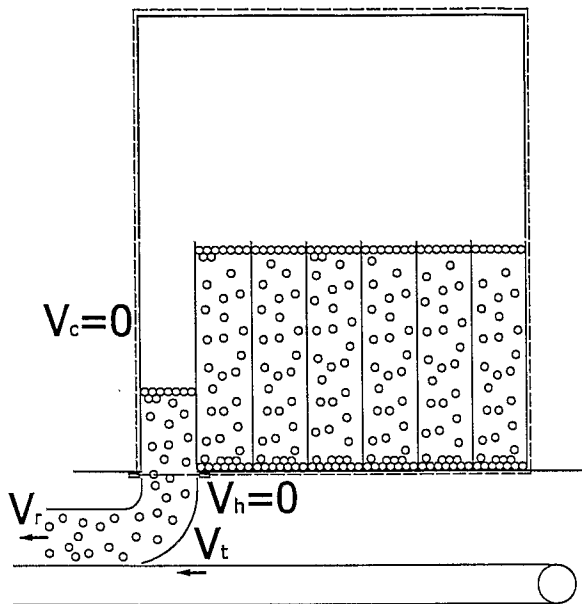


Fig.49

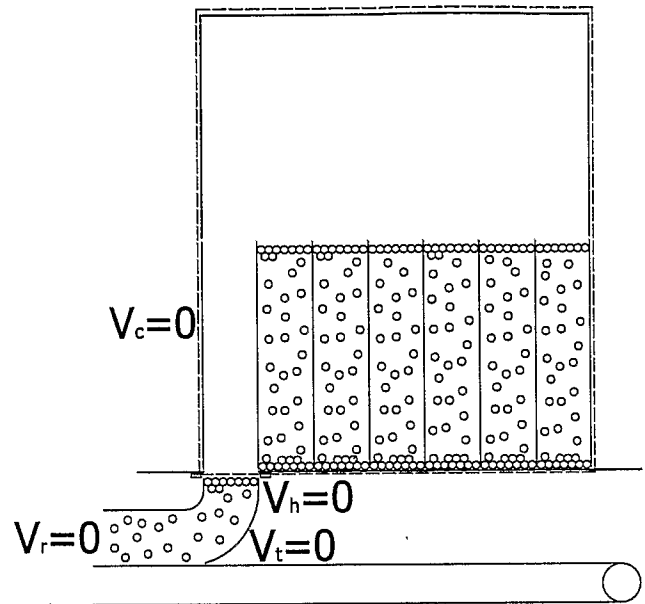


Fig.50

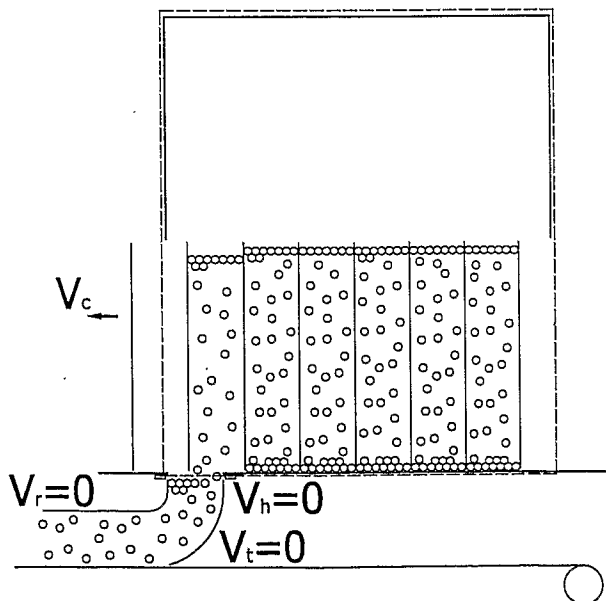


Fig.51

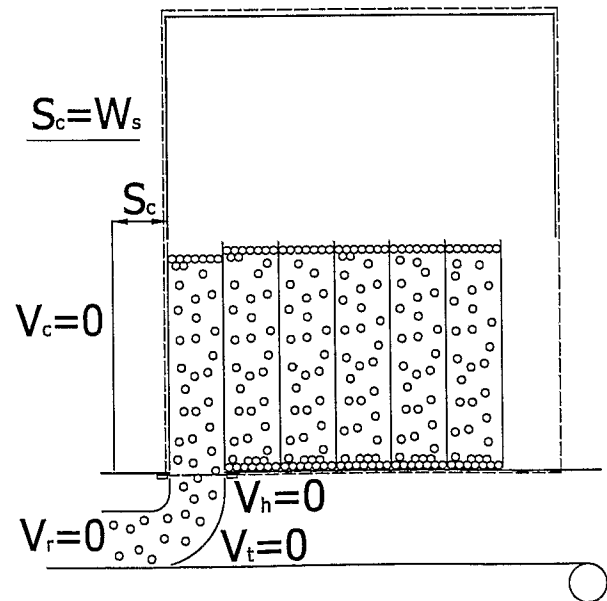


Fig.52

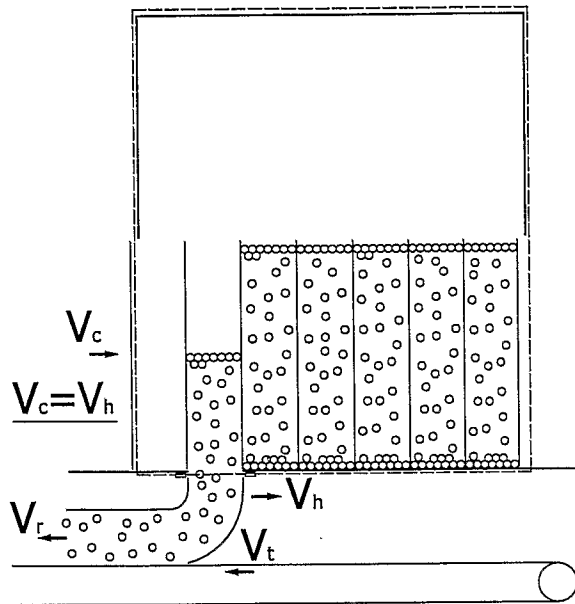


Fig.53

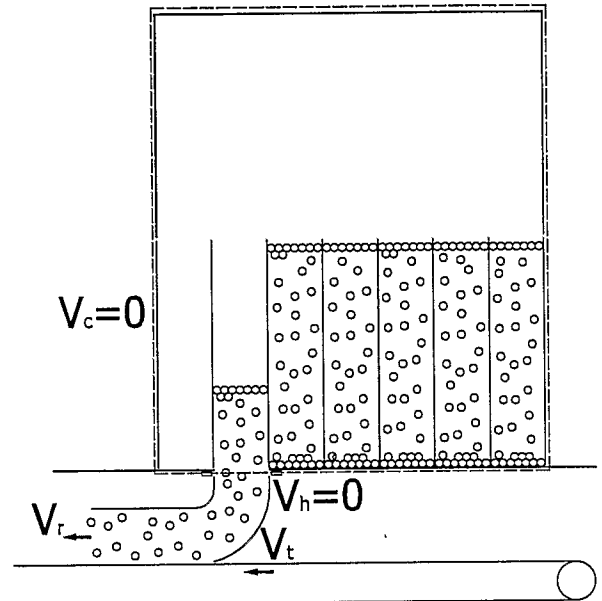


Fig.54

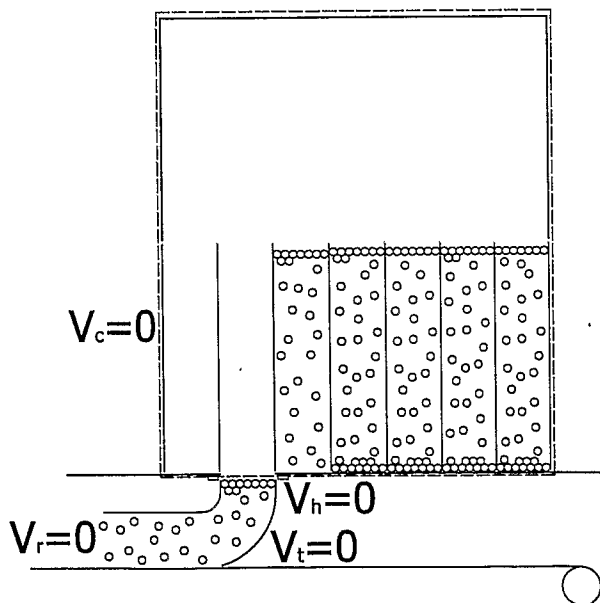


Fig.55

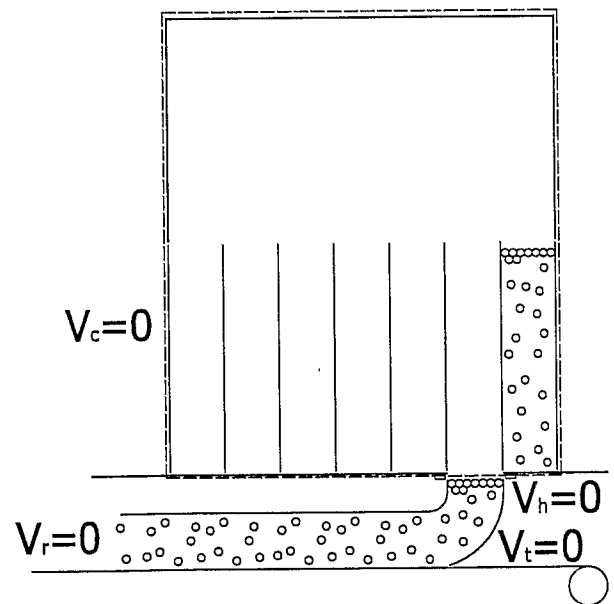


Fig.56

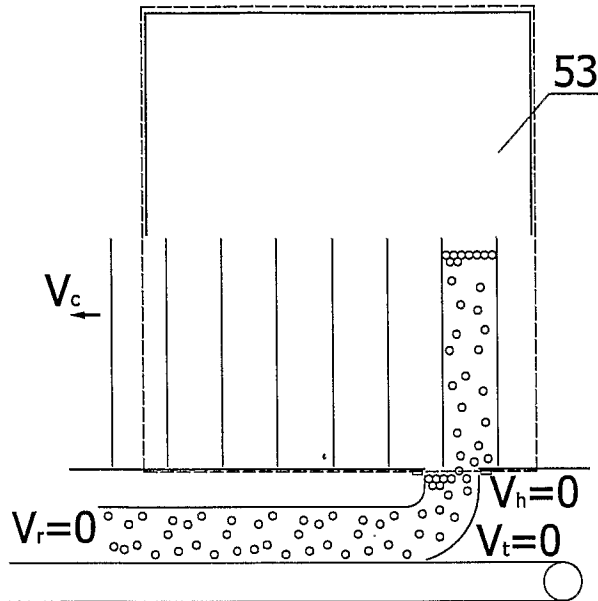


Fig. 57

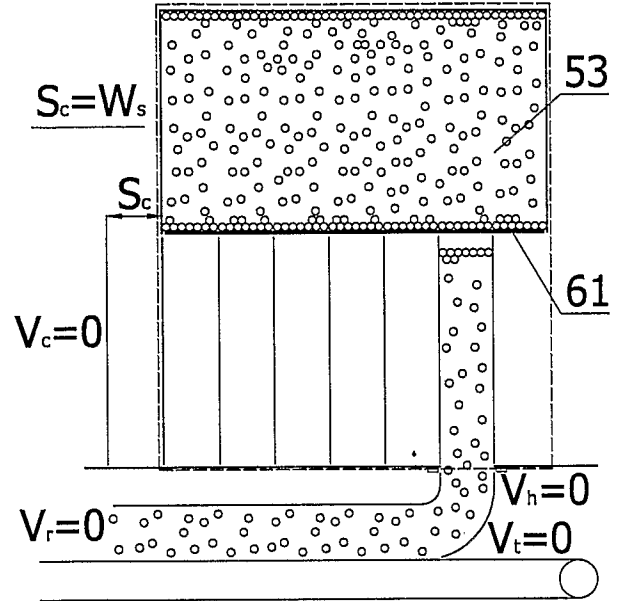


Fig. 58

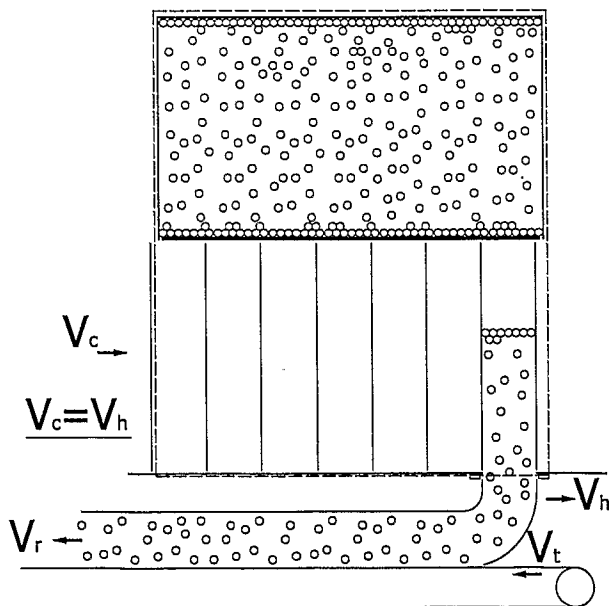


Fig. 59

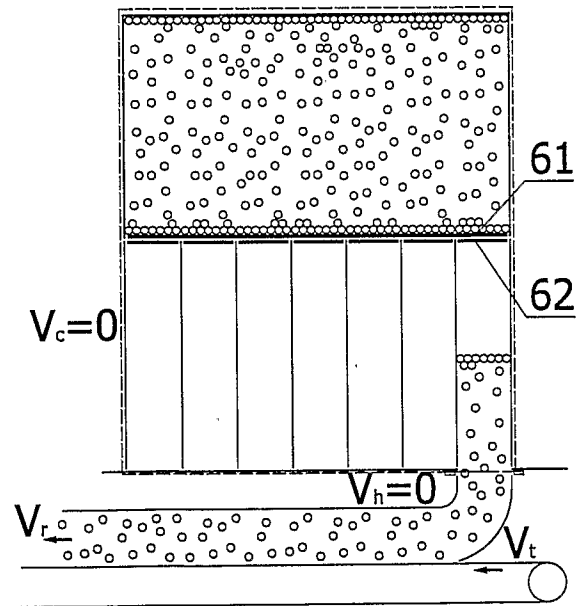


Fig. 60

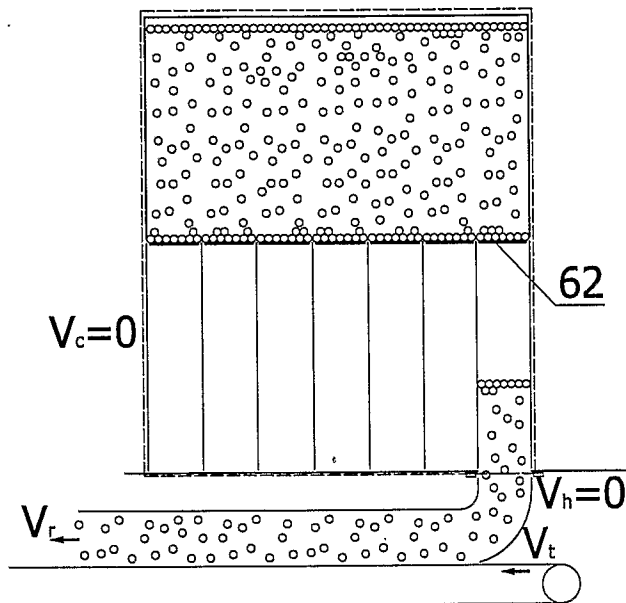


Fig.61

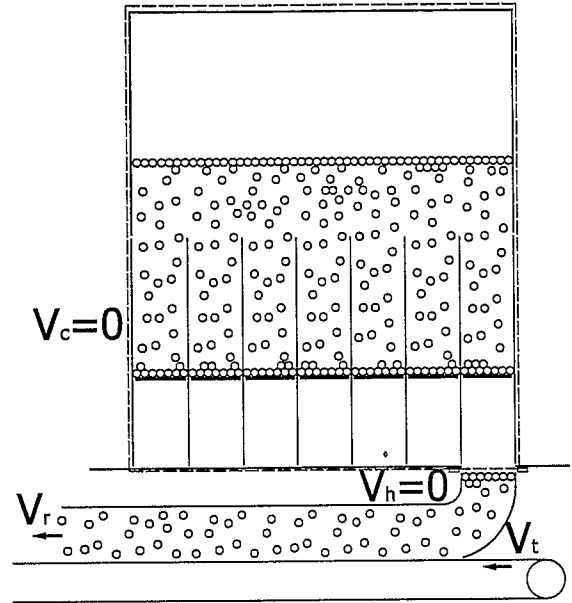


Fig.62

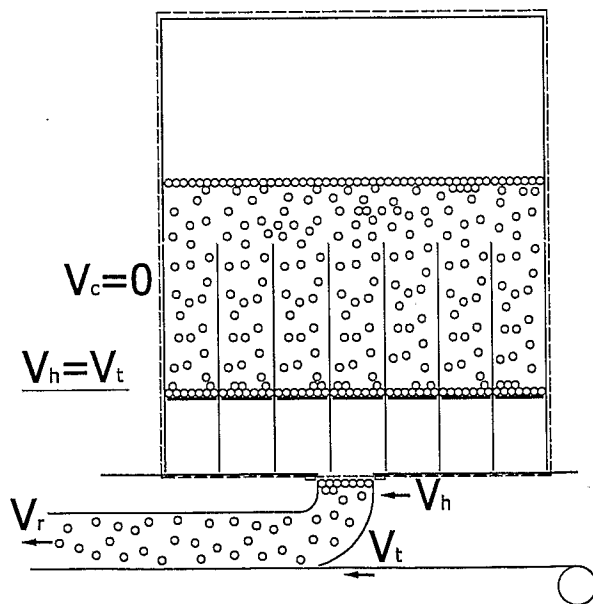


Fig.63

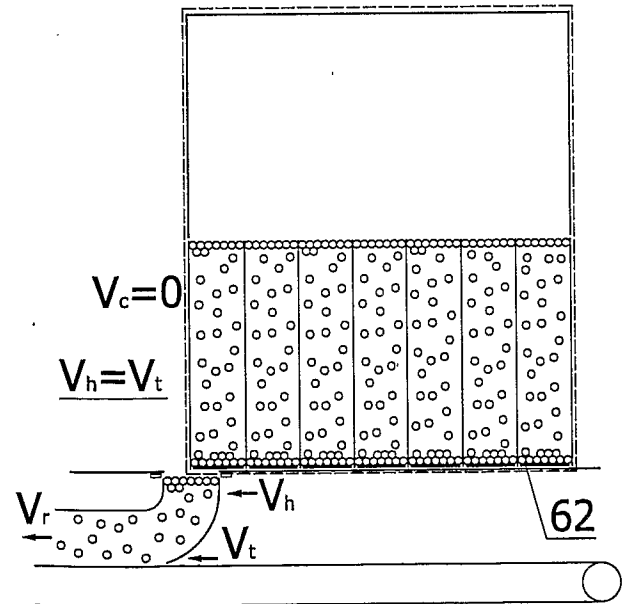


Fig.64

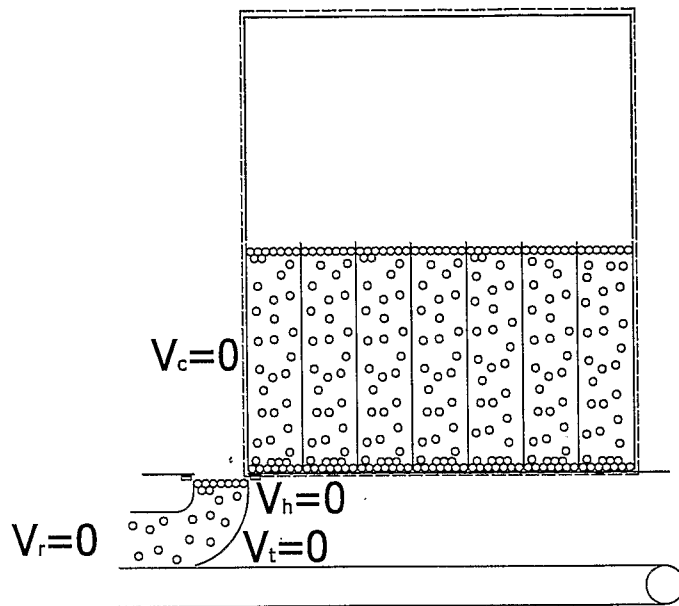


Fig.65

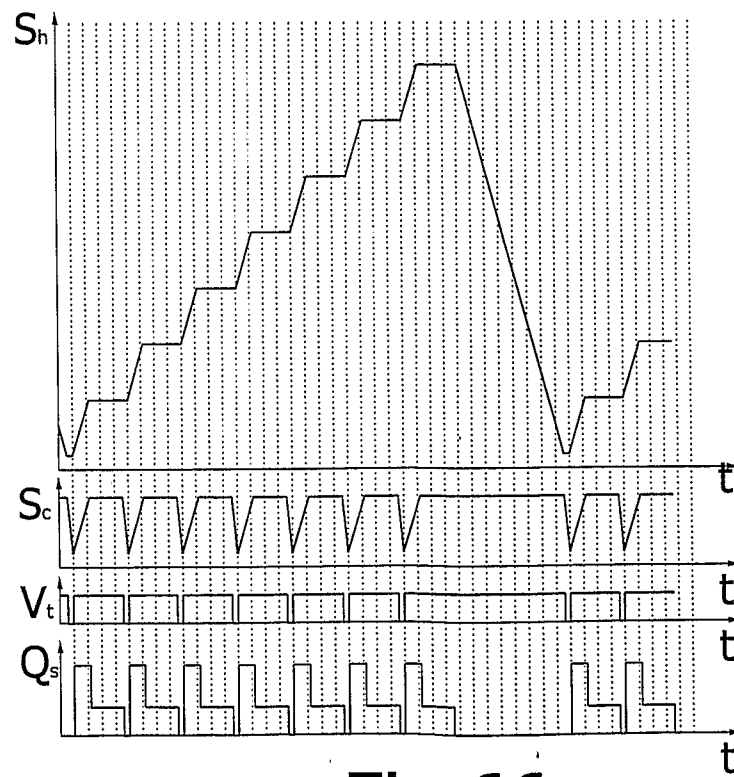


Fig.66

INTERNATIONAL SEARCH REPORT

International application No

PCT/PL2007/000058

A. CLASSIFICATION OF SUBJECT MATTER

INV. A24C5/356

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A24C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 020 126 A (FOCKE & CO [DE]) 19 July 2000 (2000-07-19) cited in the application figure 1	1-5
A	US 4 365 703 A (HINCHCLIFFE DENNIS ET AL) 28 December 1982 (1982-12-28) cited in the application the whole document	1-5
A	EP 1 308 101 A (GD SPA [IT]) 7 May 2003 (2003-05-07) cited in the application figures 4-7	1-5
	----- -/-- -----	



Further documents are listed in the continuation of Box C.



See patent family annex.

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X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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Date of the actual completion of the international search

21 December 2007

Date of mailing of the international search report

15/01/2008

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Pille, Stefaan

INTERNATIONAL SEARCH REPORT

International application No

PCT/PL2007/000058

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 4 303 366 A (HINCHCLIFFE DENNIS ET AL) 1 December 1981 (1981-12-01) figure 3 -----	1-5
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Information on patent family members

International application No

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