Method and arrangement for controlled refuse discharge

The present invention relates generally to vacuum refuse collection systems and primarily to such systems handling larger amounts of refuse in larger residential areas, office buildings, hospitals etc., and more specifically relates to a method an arrangement and a refuse limitation valve for controlling the discharge of refuse from a refuse chute in such a system to a transport pipe and of the kind indicated in the preamble of claims 1, 5 and 8 respectively.

Background of the invention

Vacuum refuse collection systems have been in use for many years and are well known to present an efficient, clean and convenient solution to the waste disposal problem. However, problems are sometime encountered in applications such as those mentioned initially, especially in cases where the chutes are located in high-rise buildings where the amounts of refuse inserted into each chute in a short time are often too large to be handled by the system. More specifically, between the emptying cycles of the individual chutes, the pillar of refuse gathering on top of the discharge valve at the lower end of each chute will frequently become too high, thereby jeopardizing the safe transport of the refuse through the valve and into the transport pipe.

In many instances the above discussed problem can be solved by shortening the intervals between the emptying cycles for the - or each - chute so that said chute is emptied more frequently. However, in applications where a larger number of similar refuse chutes are connected to the system and must be emptied in sequence, it is not possible to solve the problem in such a manner since the cycle time between emptying each individual chute, even when reduced to its minimum, is still too long to secure satisfactory operation.

In our earlier US Patent 3 887 053 we presented a solution to the above problem. The disclosed arrangement of refuse chutes in high buildings required that two separate refuse chutes were provide throughout the entire building. Not only did such a solution increase the overall costs of the entire system, but the provision of the additional refuse chute did also require space.

The object of the invention

The basic object of the present invention is therefore to provide a method, an arrangement and a refuse limitation valve of the kind indicated in the introduction, by means of which the above discussed problems are eliminated in a cost efficient manner without requiring any significant amount of space.

In accordance with the invention said basic object is achieved by means of a method, an arrangement and a refuse limitation valve having the characterizing features of claims 1, 5 and 8 respectively.

Preferable embodiments of the invention are indicated in the dependent subclaims.

Brief description of the drawings

The invention and its further objects, features and advantages are described more closely below with reference to the exemplifying and non-delimiting embodiment thereof which is illustrated in the enclosed drawings. In the drawings:

Fig. 1 is an elevational view from one side of the lower part of a refuse chute provided with the arrangement in accordance with the invention, illustrating the refuse limitation valve and its supporting frame,

Fig. 2 is a view of the refuse chute of Fig. 1 as seen in 90° angle in relation thereto.

Fig. 3 is a side view of the the refuse limitation valve of Figs. 1 and 2, supported by a frame having a slightly different configuration, and

Fig. 4 is a cross-section through the refuse limitaion valve along line A-A in Fig. 3.

Description of the preferred embodiment

As seen in the drawing figures a refuse chute 1, of which only the lower part is illustrated and which is part of a typical vacuum refuse collection system, is installed in a building 2 which may be a high rise building in a residential estate or in a business area. The lower end of the refuse chute 1 is equipped with an openable and closable refuse disharge valve 3 (RDV), preferably positioned in the basement of the building 2, which, when opened establishes communication between the chute 1 and an underground vacuum transport pipe 4 for discharging the refuse collected upon the valve into the pipe, and which, when closed completely blocks the lower end of the chute 1 and provides an air-tight seal between the chute 1 and the pipe 4 in order to secure proper operation of the vacuum transport pipe 4 when other chutes of the system are emptied.

The invention is not concerned with the specific design of the refuse discharge valve 3 which is only schematically illustrated in the drawing Figures and which may be of any conventional kind used in this type of vacuum refuse collection system, such as the one disclosed in our JP Patent Publication No. 1640550. The configuration of the remainder of the waste system, such as the vacuum/collection station to which the transport pipe is connected and to which it transports the refuse for collection in at least one container, is also not any part of the invention, is well known in the art and will therefore not be illustrated or described in any detail herein. For a complete understanding of the entire vacuum refuse collection system to which the present invention relates and to which it may be applied a specific reference is made to i.e. said US Patent No. 3 887 053 mentioned in the introduction.

As was mentioned initially problems may occur in the conventional refuse chute 1 when it is part of a vacuum refuse collection system containing a larger number of such chutes 1 connected to a common transport pipe 4 and vacuum station (not shown) and/or when it is installed in a high rise building or otherwise receives such large amounts of refuse in relatively short time that the refuse piles up too high above the closed discharge valve 3 before the chute may be emptied in the normal emptying cycle. The critical level with

respect to a safe refuse discharge through the valve 3 to the transport pipe 4 may vary depending upon the design and geometry of the valve 3 and/or the lower part of the chute 1, but normally lies in the order of 2-3 meters above the discharge valve 3.

The solution suggested according to the invention for eliminating the above discussed problem and for securing undisturbed refuse transport through the discharge valve is basically the provision of a refuse limitation valve 5 (RLV) at a suitable distance, typically 2-3 meters, above - that is upstream from - the discharge valve 3. The refuse limitation valve 5 need not be airtight but has the main purpose of holding back all refuse above its level when activated to its closed condition. This activation takes place prior to opening the refuse discharge valve 3 (RDV), as will be explained further below.

In the illustrated, presently preferred embodiment the RLV 5 consists of two generally cylindrical bars 6 slidably extending through the wall 1a of the refuse chute 1, whereby their passage through the chute wall is preferably sealed by means of fluid tight seals (not shown) . The bars 6 may be reciprocated between a first position in which they are substantially completely withdrawn from inside the chute to allow free passage of the refuse therethrough, and a second position in which they are extended across part of or substantially the full width of the chute for blocking the passage therein. Outside the chute 1 the bars 6 are slideably journalled by means of suitable slide bearings 7 (see Fig. 4) in a frame 8 which is in turn fixed to a support structure 9 preferably firmly mounted to a wall 2a of the building 2.

At their rear ends 6a the bars 6 are firmly connected to a connecting plate 19 thereby maintaining them extended alongside each other and parallell to each other. To the side of the frame 8 facing away from the chute 1 a cylinder bracket 10 is firmly connected, preferably by welding, with one 10a (see Fig. 4) of its sides. The bars 6 pass freely through corresponding openings in said side 10a of the bracket 10, whereby said side in cooperation with the connecting plate 19 serves as a stop for the extension of the bars 6 into the chute 1. A pneumatic cylinder 11 is mounted on the frame 10 and the free end of it´s piston rod 11a is connected to the connecting plate 19, whereby actuation of the cylinder 11

in its respective directions, that is extending or retracting the piston rod 11a, causes the bars 6 to reciprocate between said positions for opening and blocking respectively the passage through the chute 1.

In order to protect the RLV 5 from the effects of refuse falling onto the bars 6 in their fully or partly extended position, and specifically to eliminate the risk of such impacts generating bending forces that may cause breakage in the connections between the bars 6, the connecting plate and the piston rod 11a, vibration dampers 20, 21 and 22 are provided between the slide bearings 7 and the frame 8 and between the rear end of the bracket 10 and a damper support 23 respectively. Said damper support 23 is fixed to the support structure 9 at its forward end, with respect to the direction of extending the piston rod 11a, and supports the bracket 10 through the damper 22 at its opposite end. With regard to the dampers 20, 21 these are in fact the only connection between the bars 6 and their bearings 7 on one hand and the frame 8 on the other hand, with the result that the bars are "floatingly" supported in the frame 8. Although not specifically illustrated in the drawings, it should be obvious that the openings in the side wall 10a of the bracket 10 are dimensioned so that they allow for such "floating" movements of the bars 6 passing therethrough.

With respect to the support structure 9 this is illustrated in two alternative embodiments in Figs. 1,2 and 3, 4 respectively. In Figs 1 and 2 the support structure is adapted to an inclined chute section extending through a special wall structure, and therefore has vertical support struts 9a which "straddle" the chute 1 and are attached to the wall 2a. In the embodiment illustrated in Figs. 3 and 4 the support structure 9 is adapted to a vertical chute section 1 positioned at a distance from the wall 2a and therefore does not require the vertical struts, but instead employs horizontal struts 9b supplemented with inclined struts 9c all "straddling" the chute 1 and being attached to the wall 2a behind the chute.

At a position substantially immediately below, that is downstream from, the RLV 5 a schematically illustrated level sensor 12 is positioned in the chute wall 1a or in its immediate vicinity, depending upon the type of sensor used. The sensor may preferably be a limit switch of a type consisting of a spring biassed finger extending into the chute 1

passage and responding to diplacements from its basic position only if such displacements are lasting, that is the switch does not respond to transitory displacements such as by refuse falling past it but only to refuse piling up past said level. Any other conventional type of sensor capable of sensing the continued presence of refuse may be employed, as long as it does not interfere with or risk being damaged by the passage of the refuse past it.

Through a connection 12a the level sensor 12 is connected to a control box 13 schematically indicated in the drawings. The specific components included in the control box for obtaining the functions described below will not be described in detail herein, since they are in themselves no part of the invention but may be chosen freely in accordance with accepted control technology. Through connections 14 the control box 13 furthermore receives a signal from the control system of the vacuum refuse collection system, initiating opening of the RDV in accordance with the automatic emptying cycle of the system and sends a signal to the control system regarding the status of the level sensor, that is regarding the level of the refuse piled up in the chute 1.

The control box 13 is finally connected, through the connections 15, to the pneumatic cylinder 11 for operating the same - through an appropriate valve 16 - in response to signals from the control box 13 and for receiving signals indicating the position of the cylinder 11, that is whether it is in the position for closing or opening respectively the RLV 5.

The method according to the invention will now be described. Basically it should be emphasized that the RLV may be operated in different manners depending primarily upon the mode of operation chosen for the complete emptying cycle of the entire vacuum system, namely on the one hand emptying of all chutes in the system in a fixed sequence determined by their position in the system and on the other hand emptying of the chutes in a variable cycle determined by the amounts of refuse piled up in each chute 1.

In either case, when a signal initiating opening of the RDV is received by the control box the status of the level sensor is checked before actually opening the RDV. When the level

sensor is not activated the RDV is immediately opened, but when the level sensor is in fact activated by refuse piling up above its level, the RLV is operated to its closed position before opening the RDV. Thereby only refuse accumulated underneath the RLV will pass through the RDV and into the transport pipe without any disturbance. Next, the RDV is closed and the RLV is once more opened so that refuse from above the RLV may fall down by gravity and pile up on the closed RDV. In case the level sensor remains activated the procedure is repeated either in the next fixed emptying cycle or immediately - depending upon the type of cycle employed for the entire system, as indicated above - until the chute is empty.

In order not to subject the RLV to undue load it is preferred that it is only operated to its closed position during the time that the RDV is open, thereby pressing into the refuse pillar in the chute and holding up all refuse above it, but the RLV may also be operated to its closed position as soon as the level sensor is activated and maintained in closed position until the RDV has opened and closed in the emptying cycle. It is appreciated that he former case is preferred since the bars of the RLV, by pressing the refuse against the opposite chute, wall do not carry the full weight of the refuse above the valve by their free ends, whereas they in the latter case would in fact do that, thereby being subjected to high bending forces.

Although the invention has been described herein with specific reference to preferred embodiments thereof, it should be emphasized that modifications and variations thereof may be carried out by men skilled in the art, without departing from the scope of the invention which should be determined solely by the appended claims.

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CLAIMS

1. A method for controlling the discharge of refuse from a refuse chute (1) through a discharge valve (3) into a transport pipe (4) in a vacuum refuse collection system, communication between said refuse chute and transport pipe being established by opening said discharge valve (3) in accordance with a fixed or variable emptying cycle, characterized by sensing the existence of refuse piled up at a position upstream from the discharge valve (3), by operating a refuse limitation valve (5) provided upstream from said position in response to sensing the existence of refuse piled up at said position.

2. A method according to claim 1, characterized in that the refuse limitation valve (5) is operated prior to the operation of the refuse discharge valve (3), when a signal indicating the existence of refuse at said position and a signal for operation of the refuse discharge valve in accordance with said fixed or variable emptying cycle are simultaneously present.

3. A method accoding to claim 1, characterized in that the refuse limitation valve (5) is operated to its closed position when a signal indicating the existence of refuse at said position is present and in that in response to the operation of the refuse limitation valve the refuse discharge valve (3) is operated as soon as this is allowed by the status of the vacuum refuse collection system.

4. A method according to any of claims 1-3, characterized in that the position for sensing the existence of refuse is located at approximately 2-3 meters upstream from the refuse discharge valve (3).

5. An arrangement in a refuse chute (1) of a vacuum refuse collection system, said chute being connected to a transport pipe (4) in turn connected to a vacuum/collection station and said refuse chute communicating with the transport pipe through a discharge valve (3), characterized by a refuse limitation valve (5) provided in said chute at a distance upstream of the discharge valve (3) and by a level sensor (12) positioned down-

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stream of the refuse limitation valve for providing a signal initiating closing of the refuse limitation valve (5) when refuse gathered upstream of the discharge valve (3) reaches the level thereof.

6. An arrangement in a refuse chute (1), in accordance with claim 5, characterized in that the refuse limitation valve (5) and the level sensor (12) are provided at a distance of approximately 2 - 3 meters above the discharge valve (3).

7. An arrangement in a refuse chute (1), in accordance with claim 5 or 6, said chute being installed in a building (2), characterized in that the refuse limitation valve (5) is attached to a support structure (9) attached to a wall (2a) in the building (2) and in that the refuse limitation valve is provided with bars (6) extendable into the chute for partly blocking the passage therethrough.

8. Refuse limitation valve (5) for selectively blocking the passage in a refuse chute (1) of a refuse vacuum collection system, characterized in that the refuse limitation valve is provided with bars (6) extendable into the chute for partly blocking the passage therethrough, by a drive means (11) for operating the bars between extended and retracted positions and by a support structure (9) for carrying the valve (5) in its position relative to the chute.

9. Refuse limitation valve (5) according to claim 8, characterized in that the bars (6) and the drive means are floatingly supported on the support structure (9) by means of vibration dampers (20, 21,22).

10. Refuse limitation valve (5) according to claims 8 or 9, characterized in that the bars (6) are slidable in slide bearings (7) carried by a frame (8) attached to the upport structure (9), in that at one end (6a) the bars are connected to a common connecting plate (19) in turn connected to the drive means (11).

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