United States Patent

Ekstrom et al.

[15] **3,687,503**

[45] **Aug. 29, 1972**

[54] **SYSTEM FOR PNEUMATIC TRANSFER OF GOODS**

[72] Inventors: **Per-Olof Ekstrom,** Johanneshov; **Hans Hyden,** Stockholm, both of Sweden

[73] Assignee: **AB Centralsug,** Solna, Sweden

[22] Filed: **Oct. 28, 1970**

[21] Appl. No.: **84,885**

[30] **Foreign Application Priority Data**

Oct. 29, 1969 Sweden 14795/69
Sept. 15, 1970 Sweden 12577/70

[52] **U.S. Cl.**.....**302/39,** 193/34
[51] **Int. Cl.**.....**B65g 53/46**
[58] **Field of Search** 137/609, 611, 625.4; 193/33, 193/34; 222/144.5, 145, 193, 504, 506; 302/27, 34, 39, 42, 52

[56] **References Cited**

UNITED STATES PATENTS

1,016,415	2/1912	Jorn	302/47 X
3,439,841	4/1969	Rhodes	222/142.9 X
1,895,180	1/1933	Tough	302/57 X
1,961,321	6/1934	Young	222/145 X
3,193,143	7/1965	Mareli	222/504 X
3,217,927	11/1965	Bale et al.	222/145 X
1,482,144	1/1924	Pender	193/34
2,802,434	8/1957	Dowse	193/34 X
954,944	4/1910	Dunn	302/47
241,447	5/1881	Thorpe	302/42
3,497,109	2/1970	Leach	222/144.5

FOREIGN PATENTS OR APPLICATIONS

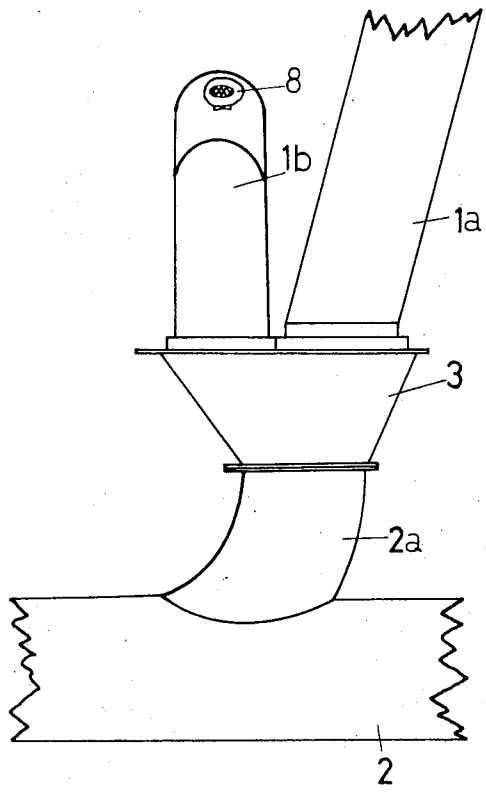
455,154	2/1913	France	193/34
1,084,661	9/1967	Great Britain	193/34

Primary Examiner—Evon C. Blunk
Assistant Examiner—W. Scott Carson
Attorney—Spencer & Kaye

[57] **ABSTRACT**

A system for pneumatic transfer of goods, in particular garbage from each of a plurality of vertical disposal chutes to a main collecting tube for delivery to a handling central via periodically operated valves, two such chutes being attached to one such valve.

7 Claims, 5 Drawing Figures



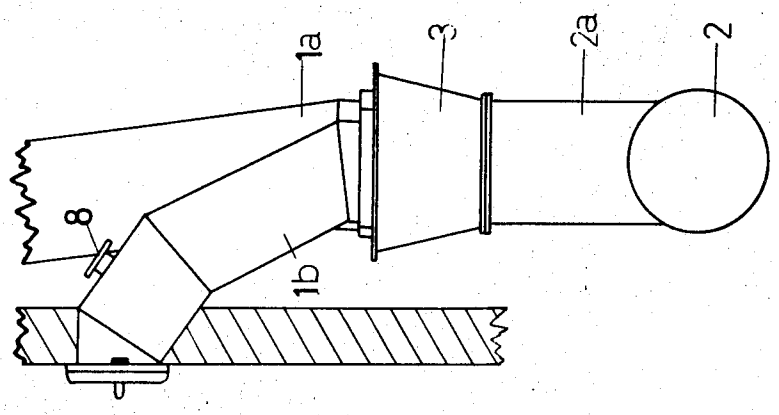


FIG. 2

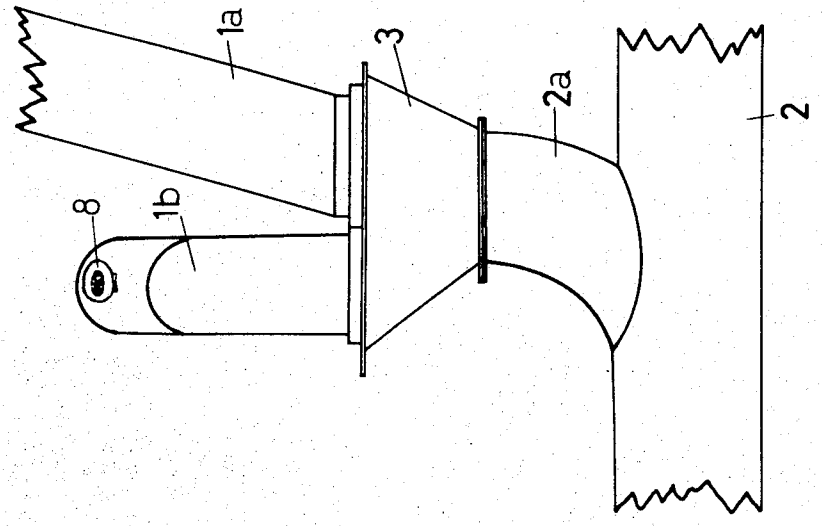


FIG. 1

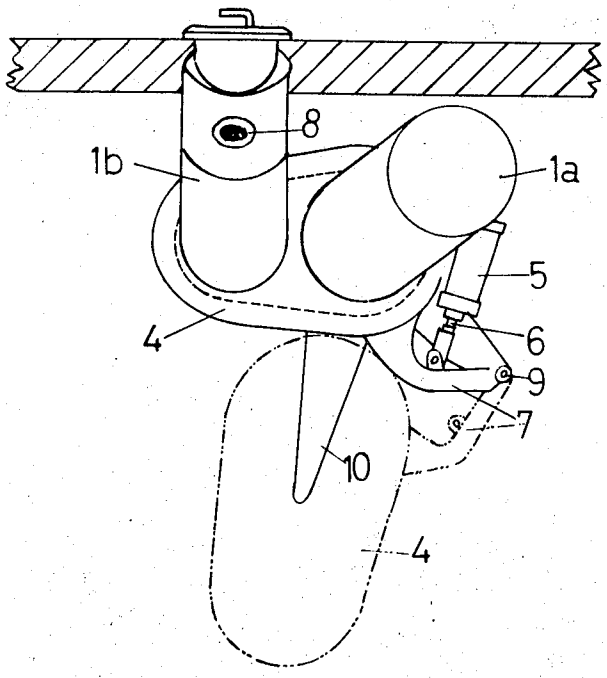


FIG.3

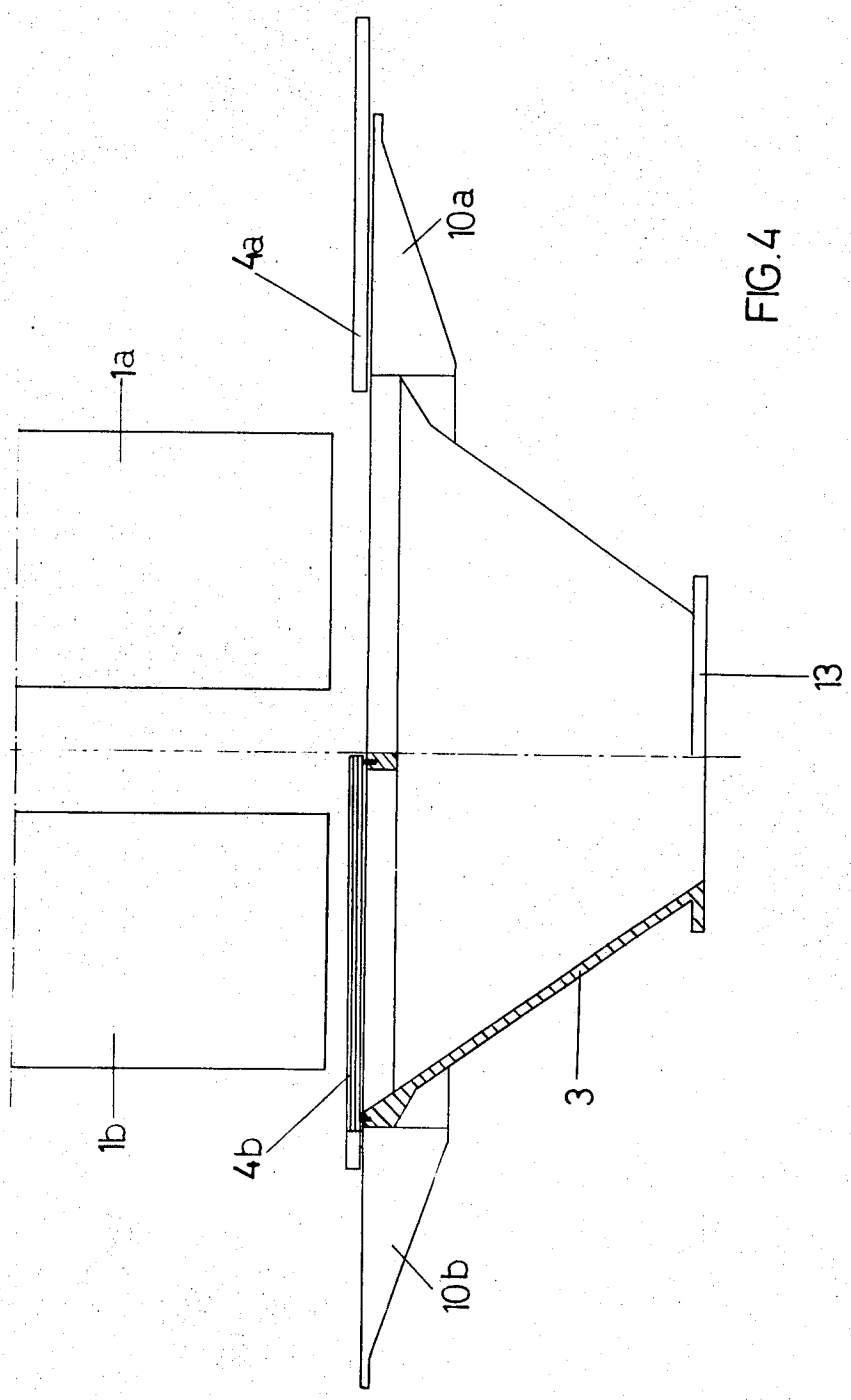


FIG. 4

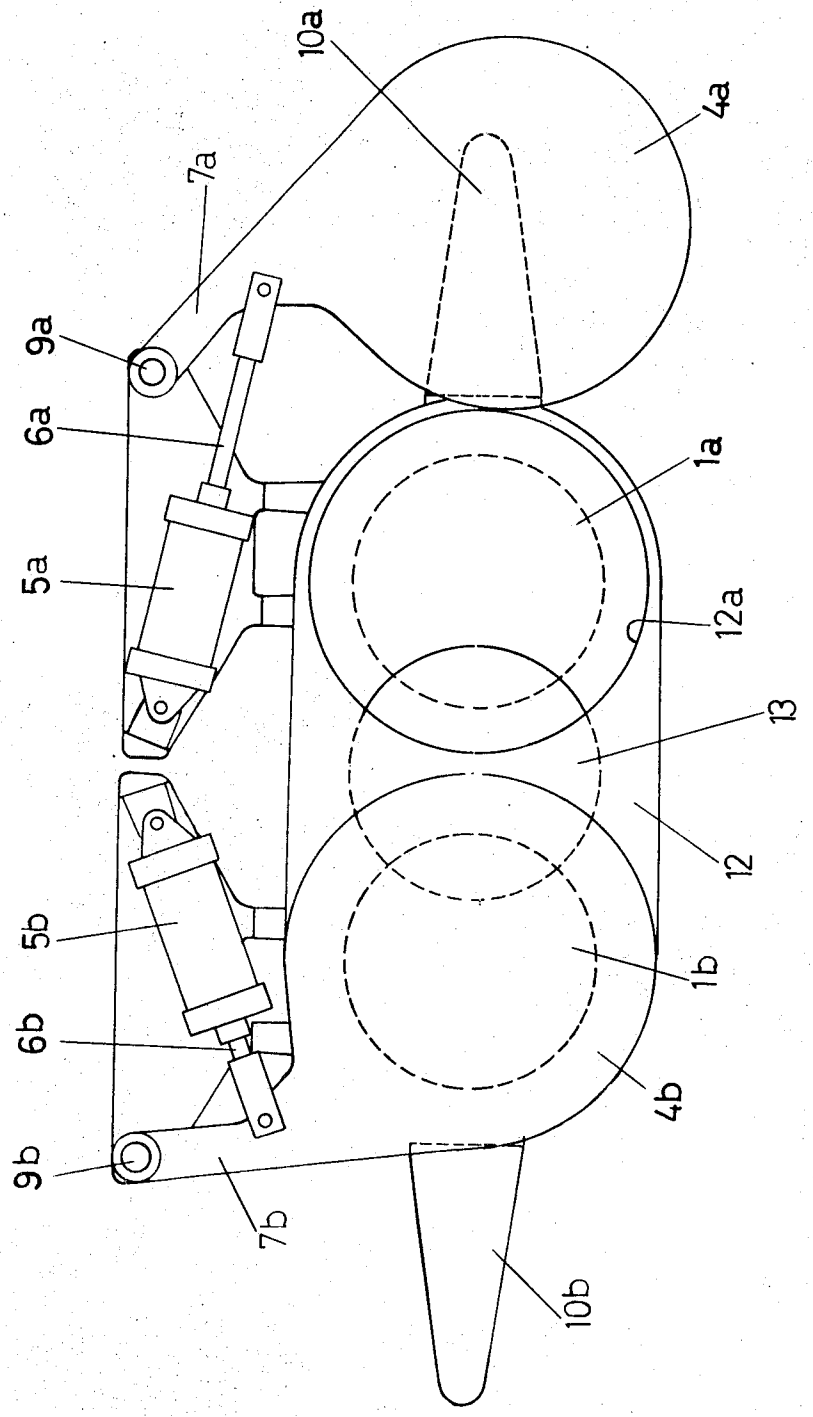


FIG.5

SYSTEM FOR PNEUMATIC TRANSFER OF GOODS

The present invention relates to a system for pneumatic transfer of goods from each of a plurality of vertical disposal chutes to a main collecting tube for delivery to a handling central. A main example of such a system is a pneumatic garbage collecting system which in communication to a common main suction transport conduit leading to a garbage incinerator or similar disposal station comprises a plurality of disposal chutes provided in the individual houses of a residential area with disposal openings on every floor.

For obvious reasons the main suction transport conduit cannot, without interruption, be in open connection with the disposal chutes in such a way that individual garbage portions immediately pass through the chutes into the main transport tube as with such an operation the vacuum conditions necessary for uninterrupted operation would require the provision of a suction plant of excessive dimensions.

The normal way of operating systems of the type here in question is thus based on periodically recurring discharge of garbage portions collected in the lower ends of the chutes. For this purpose the chutes are provided with valves the valve elements of which, and which for example are in the form of laterally shiftable disks, during intermediate periods support the garbage collected within each chute. These valve elements are periodically opened to permit transfer of the collected garbage from each chute into the main conduit while at the same time air is admitted at the valve to support the gravity induced movement of the refuse from the end of the chute through the valve and into the main transport tube. Immediately after discharge of the collected garbage the valve element returns to its closing position.

This system operates satisfactorily as long as the height of each chute between the transition of the chute into the valve and the lowest injection opening along the chute is sufficient to receive the amount of garbage introduced between successive discharge periods. However, under certain conditions, e.g., in houses lacking underground basement or having very low basement facilities or in sky scrapers, in which every chute is provided with a very great number of individual disposal openings, the distance between the valve and the lowermost disposal opening may become so small that the chamber formed therebetween is insufficient to receive the volume of refuse collected between successive discharges. This may mean that the lowermost disposal opening is no longer usable already some time prior to the next discharge process.

An apparently obvious solution of this problem would be to connect the lowermost disposal opening via a separate chute of minor cross section and via a separate valve to the main suction tube. However, this solution is actually not feasible due to the fact that in modern apartment houses only very restricted space is available for the valve system because the basement floor space is urgently required for many other important functions. The provision of extra valves for additional chutes is objectionable also for economic reasons.

On the other side, it has so far not been considered feasible to connect two chutes, such as a main chute and an auxiliary chute for the lowermost disposal opening, to the same valve because there is obviously some risk that the garbage suddenly discharged from the ends of both chutes during opening of the valve disk will jam and permanently block the valve.

According to the present invention it has surprisingly been found that no operating difficulties have been observed if, in a system of the type being considered the lower end openings of at least two chutes are in communication with an open upper portion of a common valve. This common valve has a body, the cross sectional area of which decreases towards a lower discharge opening communicating directly or via a connecting conduit, with the main collecting tube. In addition a valve disk is journaled for movement between a closing position underlying the lower end openings of each of the chutes and an open position uncovering the lower end openings.

This system will operate satisfactorily both in the case referred-to above, in which a main chute of greater dimension and an auxiliary chute of restricted dimension are in communication with the common valve, and in a related case in which the auxiliary chute is required to handle comparatively great amounts of garbage. This may be the case if a building, in addition to apartments, also contains workshops, restaurants or the like which produce amounts of refuse comparable to the amounts produced by a great number of households. While in this latter case there is no distinction between the two chutes provided adjacent each other as far as the required capacity is concerned, it is equally important here to avoid duplication of the valve and connecting tube equipment. There is obtained, even upon substantially simultaneous uncovering of the lower end openings of the two chutes, a practically unimpeded discharge of both a main chute and an auxiliary chute, or two main chutes, without any jamming of the garbage. This occurs in spite of a considerable restriction of the area of the valve housing at the end thereof where it opens into the main collecting tube or an intermediate connecting tube. Depending on the operating conditions it may be advantageous to so journal the unitary valve element that, upon movement of the valve element from the closing position to the open position, the lower end opening of one of the chutes, for example the auxiliary chute, is uncovered before the lower end opening of the other chute is completely uncovered for release of collected garbage. This solution may be advantageous if the garbage is supplied in comparatively large units such as bags, packs or the like, in which case it is preferred that the discharge of one chute already be substantially completed when the opening of the other chute is uncovered.

In cases where there is substantial equilibrium between the two chutes as far as the average charge is concerned the valve is suitably shaped in such a way that the lower discharge opening of the valve body is disposed symmetrically below the two lower end openings of the two chutes. In cases where the average charge of the main chute is in excess of the average charge of the auxiliary chute the valve body may have an unsymmetrically conically downwardly tapering shape, the angle of taper being more acute in a zone below the main chute than in a zone below the auxiliary chute.

In valves serving two substantially equal chutes it may be advisable to provide separate valve elements,

each adapted to cooperate with one of the chutes, means being preferably provided to operate the separate valve elements independently of each other.

The invention will now be described in greater detail by reference to the attached drawings illustrating two embodiments of the invention. In the drawings,

FIG. 1 is a front elevation of the valve and chute portion of a garbage disposal system according to the invention,

FIG. 2 is a side view of the same parts as in FIG. 1,

FIG. 3 is an upper plane view of the parts shown in FIGS. 1 and 2,

FIG. 4 is a side view, in part in section, and

FIG. 5 is an upper plane view of another embodiment of a valve and chute assembly according to the invention.

The embodiment of a valve and chute assembly for a garbage disposing system as shown in FIGS. 1 to 3 comprises a hopper-like valve housing 3 having an open upper side where the lower end openings of a main chute 1a and an auxiliary chute 1*b* terminate. A valve disk 4 (FIG. 3) is journaled by means of an arm 7 for swinging movement in a horizontal plane about a pivot 9 exteriorly of valve housing 3 under the action of a hydraulic assembly comprising a cylinder 5 and a piston rod 6, the cylinder being pivotally attached to valve housing 3 and the piston rod 6 being pivoted to arm 7. In its swinging movement valve disk 4 is supported by a support 10, this swinging movement taking place between a position of the valve disk within the valve housing below the lower end openings of the chutes and a position indicated in broken lines in FIG. 3 exteriorly of valve housing 3. It will be understood that support 10 is firmly attached to the valve housing 3, not shown, in such a position that the support underlies the swinging plane of valve disk 4. Support 10 is necessary to prevent excessive strain on the pivot or journal 9 due to the relatively heavy disk 4. When this disk 4 is in the position indicated by the broken lines the lower end openings of chutes 1*a* and 1*b* are completely uncovered for discharge of garbage material previously supported upon the valve disk, such garbage being discharged through the hopper-like housing 3 and a conduit 2*a* attached to the lower end opening of housing 3 into the main transport conduit 2.

In the embodiment of the invention illustrated in FIGS. 1, 2, and 3 the two chutes of differential dimensions have been attached to a common valve 3 without risk of jamming under normal operating conditions. This is due to the fact that the valve disk element 4 is of elongate symmetrical configuration and is journaled at 9 for swinging movement about an axis extending exteriorly of said valve body in such a position that the longitudinal axis of symmetry of the valve disk member, at least during an initial phase of said swinging movement from closing to open position will move away from a line connecting the centers of the lower end openings of the two chutes 1*a* and 1*b*. In this case both the open upper end portion of common valve 3 and the valve disk member 4 have a configuration adapted to the common contour of the lower end openings of the two chutes 1*a* and 1*b* as will appear from FIG. 3. It is also clearly shown in FIGS. 1 and 3 that the angle of taper of the valve housing 3 is more acute in a zone below the main chute 1*a* than in a zone below the auxiliary chute 1*b* which means that also the valve housing has a configuration adapted to the common contour of the lower end openings of the two chutes.

From a consideration of FIG. 3 it will appear that the position of pivot 9 is chosen so that after an initial phase of movement in which the longitudinal axis of symmetry of valve disk 4 moves away from a line connecting the centers of the open ends of chutes 1*a* and 1*b* the valve disk will move in such a way that auxiliary chute 1*b* will be fully uncovered at a time when disk 4 still in part covers the open end of main chute 1a. The auxiliary chute thus is completely emptied, or the discharge of goods from auxiliary chute 1*b* is going on, at a time when the discharge of garbage from main chute 1*a* starts.

In the embodiment illustrated in FIGS. 1 to 3 both chutes 1*a* and 1*b* are shown to be slightly inclined to the vertical within the zone of the communication of the chutes with valve 3. Such inclination which under the conditions shown for example in FIG. 2 may be due to local conditions, is in many cases preferable for reasons of operation because it permits a control of the dynamic conditions prevailing during more or less simultaneous discharge of garbage from both chutes 1*a* and 1*b*.

The embodiment shown in FIGS. 4 and 5 is distinguished from the previously described embodiment in that a main chute 1*a* and a substantially identically dimensioned auxiliary chute 1*b* have their lower end openings disposed symmetrically above a hopper-like valve housing 3 having an upper opening shaped substantially in consideration of the combined end opening area of both chutes. The lower discharge opening 13 of the valve housing is in this case disposed symmetrically below the two lower end openings of chutes 1*a* and 1*b*.

While in this case a valve disk of the general type and disposition illustrated in FIG. 3 could be used, the embodiment shown in FIGS. 4 and 5 actually is provided with separate valve disks 4*a*, 4*b*, each cooperating with the lower end opening of one of the chutes 1*a* and 1*b*. In FIG. 5 one valve disk 4*a* is shown in the open position uncovering the lower end opening of the chute 1*a* whereas the other valve disk 4*b* is shown in the closing position below the lower end opening of chute 1*b*. In any embodiment of the valve having one single valve disk serving both chutes, the upper end of valve housing 3 may be entirely open. However it is preferred in connection with the arrangement where there are two separate valve disks, to provide the valve housing with a lid 12 having port openings, such as opening 12*a*, adapted to be covered and uncovered respectively during movement of the respective valve disk between its closing and open positions.

In a way similar to the embodiment described in connection with FIGS. 1 to 3 the two valve disks 4*a* and 4*b* of the embodiment according to FIGS. 4 and 5 are operated by means of hydraulic cylinders 5*a*, 5*b*, pivotably attached to the valve housing structure, and corresponding piston rods 6*a*, 6*b* pivotably attached to respectively arms 7*a* and 7*b* by means of which valve disks 4*a* and 4*b* are journaled on pivots 9*a* and 9*b* respectively on the valve housing structure. In the extended open position each valve disk is supported on a support 10*a* and 10*b* respectively extending from opposite sides of the valve housing structure.

It has previously been considered necessary to provide rather large air access openings adapted to be opened prior to the opening of a chute for the purpose of pneumatically conveying the garbage or the like stored and compacted in the lower portion of the chute. In connection with the present invention it has been found that in a valve as described here it is fully sufficient to rely on the air leaking into the valve as soon as the valve disk starts moving from its closing position to release the garbage plug in each chute. In certain cases it may be necessary, depending on operating conditions such as wholly or partly successive discharge of garbage from the two chutes, to provide for an additional air access opening. In the embodiment shown in FIGS. **1** to **3** the provision of an air access opening **8** in combination with the access opening exposed by the outward movement of valve disk **4** has given excellent working conditions in that air supply is adequate during the whole process, i.e., when garbage just begins to be discharged from the first-opened chute **1***b* and during full discharge from both chutes or chute **1***a* alone. The air entering through the slot in the valve housing **3** through which valve disk **4** has been extended additionally serves the important purpose to prevent loose garbage particles as well as dust from leaving the system and depositing around the valve mechanism outside the valve.

While the general way of operating a system of the type here in question will be obvious from the above description it may be additionally stated that normally the discharge of collected garbage from the chutes will take place at predetermined intervals of time chosen in consideration of normal supply of garbage. In extended residential areas served by the same system the timing will preferably be such that all the chutes are not discharged simultaneously but in a order of succession giving optimum transport conditions throughout the system during the shortest possible time and thus with the lowest energy consumption compatible with complete garbage transport without risk of overloading of the main transport tube or tubes.

It is within the scope of the present invention to provide within the valve and chute assembly garbage-level responsive sensing devices adapted to start the garbage discharge process as soon as a critical level has been found to exist in one or more of the chutes.

The invention is not restricted to the specific embodiments shown and described and comprises all alternative solutions of the general and specific problems solved by the present invention within the scope of the attached claims.

What we claim is:

1. In a system for pneumatic transfer of goods from each of a plurality of vertical disposal chutes to a main collecting tube for delivery to a handling central, the system including valves interposed between the lower end openings of said chutes and said main collecting tube, said valves being adapted in a closed condition to prevent goods from passing from the respective chute into the collecting tube and in an open condition to permit periodical discharge into the main collecting tube of goods deposited during the intermediate period and collected in the lower portion of the chute, the improvement comprising: the lower end openings of at lest two chutes being in communication with an open upper portion of a common one of said valves, said common valve having a housing, the cross sectional area of which decreases towards a lower discharge opening communicating with the main collecting tube, a valve disk associated with said housing, said disk being a unitary member of elongate symmetrical configuration which, along with the open upper portion of said common valve, is adapted to the common contour of the lower end openings of said at least two chutes, said valve disk being journalled for swinging movement about an axis extending exteriorly of said valve housing and in a plane intersecting the path of goods moving from the lower end openings of each of said at least two chutes through said valve housing toward said lower discharge opening, said valve disk in a closing position underlying the lower end openings of each of said at least two chutes and in an open position uncovering said lower end openings, and said valve disk being journalled in such a position that the longitudinal axis of symmetry of said valve disk, at least during an initial phase of said swinging movement from closing to open position, will move away from a line connecting the centers of the lower end openings of said at least two chutes.

2. The system as defined in claim **1**, wherein the axis about which said valve disk swings has such a position that during the swinging movement of said valve disk one of said end openings is uncovered prior to the other one for at least in part successive discharge of goods.

3. The system as defined in claim **1**, wherein said at least two chutes having mutually identical lower end openings which are in communication with said common valve and said lower discharge opening of said valve housing is disposed symmetrically below said lower end openings.

4. The system as defined in claim **1** in which the pneumatic transfer is performed by applying suction from the main collecting tube, and wherein a slot in a wall of said housing provides an access opening through which said valve disk moves during swinging movement from its closing to its open position, and said slot also provides an access opening for air required for the discharge of goods from the chutes.

5. The system as defined in claim **1** in which the pneumatic transfer is performed by applying suction from said main collecting tube, and wherein there is an opening in one of said at least two chutes to provide an access for air required for discharge of goods from said chutes.

6. The system as defined in claim **5**, wherein said opening for the access of air is provided in one of said at least two chutes the lower end opening of which is adapted to be opened prior to the lower end opening of another one of said chutes.

7. The system as defined in claim **1**, wherein at least one of said chutes is inclined at an angle to the vertical near the zone of its communication with said valve.

* * * * *