

CHUTE MECHANISM & METHOD

FIELD OF INVENTION

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The present invention relates to chutes through which numerous objects pass. The invention also relates to a flow retard mechanism and method used for disposal of objects, especially impact-shatterable objects down a chute in a multi-level building.

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BACKGROUND

In multi-level or multi-storey buildings, for example residential apartments, the buildings are often provided with waste disposal chutes. These chutes often include a main passage that extends from the top of the building to the bottom. At each level or storey of the building, there are entrances to the main passage where people at each level can dispose of waste items into the chute. Typically, at the bottom of the chute, the waste materials are collected periodically.

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Particularly in residential apartments, the disposed objects can include glass bottles and other impact-shatterable items.

The first problem is that, if glass objects are thrown down the chute, these can impact with objects and materials that people at lower levels are throwing into the chute, at the same time. Hence, there is a risk of collision or impact between items thrown from different levels. When glass or impact-shatterable items are involved, the problem and danger of shattered glass falling down the chute is self-evident, for example, increased noise due to the shattering of glass on impact.

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Moreover, if these items are broken, they will pose a hazard for waste management operators handling or collecting the waste material.

The second problem is that, objects falling from a great height would impart high stress upon impact with equipment installed below the chute that are used to contain objects thrown into the chute.

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An object of the present invention is to overcome or at least ameliorate one or more of the problems in the prior art, or to provide an improved alternative.

5 DETAILED DESCRIPTION OF THE INVENTION

According to an aspect of the invention, there is provided a chute mechanism adapted to allow objects to pass therethrough without breakage, including a main passage through which objects are able to pass, and a side entrance associated with
10 an entrance-mechanism that is operable between a closed and an open state, only in which open state further objects are able to enter through the side entrance into the main passage, wherein the mechanism further includes a fall retard mechanism for temporarily obstructing objects in the main passage so that the rate of fall of these objects is reduced.

15 Preferably, the fall retard mechanism is an impact-absorbing surface adapted to receive a falling object thereon without shattering.

Still preferably, the impact-absorbing surface extends from a wall of the main
20 passage and partially obstructs the main passage upstream of the side entrance.

In an embodiment, the impact-absorbing surface is a resilient tentacle.

In another embodiment, the impact-absorbing surface is spring-loaded to provide
25 resiliency and thereby absorb a kinetic energy of the falling object.

Preferably, the impact-absorbing surface further includes a padding or a sponge-like material.

30 Preferably, the impact-absorbing surface at least partially protrudes into the main passage such that contact of a falling object with the impact-absorbing surface slows the rate of fall of the object through the main passage.

In a preferred embodiment, the flow retard mechanism further includes an object
35 stoppage mechanism operatively connected to the entrance mechanism, whereby the object stoppage mechanism is operable between an unobstructed and obstructed state such that, in the unobstructed state, the main passage is substantially

unobstructed by the object stoppage mechanism so as to allow objects to pass through, and such that, in the obstructed state, the object stoppage mechanism temporarily obstructs the main passage sufficient to prevent objects passing through the main passage from reaching the side entrance, when the entrance-mechanism is in the closed state, the object stoppage mechanism is in the unobstructed state, and when the entrance mechanism is in the open state, the entrance-mechanism causes the object stoppage mechanism to be in the obstructed state, so that any further objects that enter through the side entrance will not collide with any objects passing through the main passage from upstream.

Preferably, the object stoppage mechanism in the obstructed state is adapted to temporarily hold any object from upstream of the main passage until the entrance mechanism reverts to the closed state which causes the object stoppage mechanism to revert to the unobstructed state in which objects from upstream are able to continue passing through the main passage.

Still preferably, the flow retard mechanism further includes a agitation mechanism, to impart a degree of motion onto the object at the stoppage mechanism.

In a preferred embodiment, the main passage is substantially upright such that the objects are able to fall down through the main passage by gravity.

In another preferred embodiment, the main passage is at least partially or wholly made of flexible material to minimise breakage and noise of the impact-shatterable objects that pass therethrough.

Preferably, the main passage is at least partially or wholly further includes a cushioning material to minimise breakage and noise of the impact-shatterable objects that pass therethrough.

Preferably, the object stoppage mechanism is adapted to enable disposal of - objects down a main passage of a disposal system in a multi-storey building such that the objects inserted into the main passage through a side entrance of the chute mechanism avoid collision with the objects coming from upstream, each chute mechanism being of the preferred embodiments of the present invention.

The invention further provides for a disposal system adapted to enable disposal of objects down a main passage in a multi-storey building, the main passage including a plurality of chute mechanisms wherein the objects inserted into the main passage through the side-entrance mechanism avoid collision with the objects coming from upstream, each chute mechanism being of the preferred embodiments of the present invention.

The invention also provides for a method of disposing objects down a main chute in a multi-level building, including the steps of providing the multi-level building with a disposal system having at least a main passage through which objects can be dropped down for disposal, providing the main passage at each level of the building with at least one integrated mechanism that enables further objects to enter through a side entrance into the main passage without the further objects impacting any objects passing through the main passage from upstream, the flow retard mechanism being in accordance with a preferred embodiment of the present invention.

FIGURES

In order that the present invention might be more fully understood, embodiments of the invention will be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a side elevation of a chute module showing first embodiment of a flow retard mechanism of a chute.

Figure 2A shows a side elevation of a chute module showing a second embodiment of a flow retard mechanism of a chute in an obstructed state.

Figure 2B shows the second embodiment in an unobstructed state

Figure 3A shows a side elevation of a third embodiment of a flow retard mechanism of a chute in an obstructed state.

Figure 3B shows the third embodiment in an unobstructed state.

Figure 4A shows a side elevation view in which objects are passing through a main passage of the flow retard mechanism of Figure 1 with the side entrance in a closed state, and its object stoppage mechanism in an unobstructed state so that waste material from upstream can pass through the flow retard mechanism;

Figure 4B shows a side elevation of the flow retard mechanism of Figure 1, with the side entrance in an open state, and with its object stoppage mechanism in an obstructed state so that waste material from upstream cannot pass through the chute mechanism;

Figure 5A shows a side elevation of the flow retard mechanism of Figure 1, with the side entrance in a closed state, and with its object stoppage mechanism in an unobstructed state, so that waste material upstream can pass through the flow retard mechanism.

Figure 5B shows a side elevation view of the flow retard mechanism of Figure 1, with the side entrance in an open state, and with its object stoppage mechanism in an obstructed state, so that objects upstream cannot pass through the flow retard mechanism.

Figure 6 shows a side elevation of a first embodiment of an upright flow retard mechanisms provided at each level or storey of a multi-level building, in which a main passage runs down through each of the levels.

In each of the embodiments, the same reference numerals have been used for similar components, merely for ease of understanding the specification.

EMBODIMENTS

Referring to the accompanying drawings, Figure 1 shows a side elevation of a chute mechanism showing a first embodiment of a flow retard mechanism installed in a conventional chute.

A chute module 10 allows refuse objects, especially impact-shatterable objects such as glass bottles to enter the module from at least two directions, and to pass through without collision or shattering.

5 To understand the overall function of the chute module, Figure 6 shows a series of chute modules 10 that are provided at each level of a multi-storey building. A common main passage 4 passes down through each of the levels of the building. People at each level of the building can dispose of impact-shatterable objects down the main passage 4.

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In Figure 1, the main passage 4 is located above and below the chute module 10, however, part of the main passage 4 also passes through the chute module 10 itself.

15 The main passage 4 is substantially upright such that the impact-shatterable objects are able to fall down through the main passage 4 by gravity.

In Figure 1, the chute module 10 is attached to the wall 6 of the building.

20 As can be seen from Figure 1, objects (identified as "A") falling through the main passage 4 of the chute module 10 do not fall in a perfectly vertical path. Rather, the objects are made to deviate slightly as they pass through the main passage as seen in Figure 1, inside the chute. The objects travelling through the main passage 4 are made to contact at least one flow retard mechanism, in the form of an impact
25 absorbing surface 3. The impact-absorbing surface 3, absorbs the impact of a falling object, so that the rate of fall of the object will be reduced. In this way, objects falling through a chute module having a fall retard mechanism will not shatter or break, when it eventually travels down to the bottom of the main passage.

30 Inside the chute module 10, the main passage has a laterally extended space in the form of a laterally extended hopper segment 5. In the embodiment of Figures 1, 4A, 4B, 5A and 5B, this extended hopper segment 5 is generally located opposite the hopper 1. In Figures 1, 4 and 5, the impact absorbing surface 3, resides in this extended hopper segment 5.

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In Figure 1, an object passing through the main passage 4 from upstream of the chute module 10 is diverted or deflected by an impact-absorbing surface 3 in the

form of a spring-loaded stopper plate 9 into the extended hopper segment 5, before the object reverts to falling through the main passage 4 downstream of the chute module 10. In Figure 1, the spring loaded stopper plate 9 is located within the chute module. However, the impact-absorbing surface 3 may also be positioned along the main passage 4.

The spring loaded stopper plate 9 at least partially protrudes into the main passage 4, so that contact with a falling object with the plate 9, slows the rate of fall of the object, through the main passage 4.

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It can be appreciated, from Figure 1, that when the objects are deflected by the impact-absorbing surface 3, the objects can often impact the sidewalls of the extended hopper segment 5. Therefore, to minimise the chance of shattering, the internal surfaces of the extended hopper segment 5, which are mostly likely to make contact with the falling objects, are provided with a cushion or padding material, or some other form of impact absorbing material.

In Figure 1, the contact with the impact-absorbing surface deflects objects falling through the chute. This slight deviation of the path of falling objects in the chute module, firstly, has the effect of slowing the rate of fall of the objects, and lessens the likelihood of these objects reaching terminal velocity as they fall down the main passage 4. Secondly, especially when the impact-absorbing surface 3 is positioned above the hopper 1, has the added advantage in that it directs the objects away in order to avoid collision with the physical components of the hopper-mechanism 1.

To better understand the effect and advantage of the invention, looking at Figure 6, the diversion of objects at each level of the building ensures that the objects do not reach the ground floor at too fast a speed, to cause breakage or damage.

In the first embodiment of Figure 1, the stopper plate 9 is hingedly connected to a wall 6 of the building. A spring 150, preferably a compressional spring, is affixed, at one end, to a wall 6 of the building, and at the other end, to a bottom position of the stopper plate 9. In this way, the spring loaded stopper plate 9 is biased towards an extended position, ready to receive and deflect any objects passing through the main passage, so as to slow the rate of fall of the objects.

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Functionally, the spring loaded stopper plate 9 acts like a third class lever, where the fulcrum and object or load, are at opposed ends of the stopper plate 9.

5 It is to be appreciated that the stopper plate 9 returns to the original extended position once it receives the object or load, and the load is deflected back to the main passage 4.

Advantageously, and as seen in Figures 1, 4A, 4B, 5A and 5B the stopper plate 9 is arranged with a sloping inclination so that any objects received thereon will
10 eventually slide off the plate, and into the main passageway, by way of gravity, and will not otherwise settle on the plate.

The second embodiment of the flow retard mechanism in the form of an impact absorbing surface is shown in Figure 2A. An object passing through the main
15 passage 4 from upstream would make contact with the impact-absorbing surface 3 in the same way as the first embodiment.

The impact-absorbing surface 9 is shown as a concave surface, made of two curved plates 93 and 94, jointed and pivoted around the centre by a pin 81. Also
20 holding the two curved plates together is a gas strut 152 pin jointed on to the curve plates 93 and 94 by pins 82 and 83 respectively.

It can also be seen, from Figure 2A, that the impact-absorbing surface 3 is pivoted at pin 84. A torsion spring 153 is attached to the stopper plate 9 on one end
25 and to the sidewall of the chute on the other. A projecting elbow 158 is affixed to sidewall 6 of the chute and limits the extension of the stopper plate, and acts as a fulcrum. Advantageously, this elbow further limits the extension of the stopper plate 9 and prevents particles of falling objects from getting into the rear of the flow retard mechanism.

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It is seen in Figure 2B that the impact absorbing surface 3 has contacted and received the falling object from upstream and is in a fully opened state. During its operation of receiving the falling object, the impact absorbing surface plate 9 swings counter-clockwise about pin 82, and at the same time the two curved plates would
35 fold down and compress the gas strut 152 below them. This mechanism acts in tandem to absorb kinetic energy of the falling object and dissipate this energy to the gas strut 152, torsion spring 84 and bumpers 156 and 157.

The impact-absorbing surface 9 is preferably made curved, layered with cushioning material and pin jointed around the centre to minimise the rebound/deflection of the falling object. Therefore, the flow retard mechanism functions as a two-way articulated (2 degree of motion) plate mechanism. It is to be appreciated that the added degree of motion serves to also allow more area for the falling object to pass through the main passage 4. It is to be appreciated that the impact-absorbing surface returns to the original extended position by action of the torsion spring 84, and bumpers 156 and 157.

Figure 3A shows a side elevation of the third embodiment of a flow retard mechanism. In this third embodiment, the fall retard mechanism has a telescopic arm in the form of a gas strut 153, biased towards an extended position, ready to receive and deflect objects passing through the main passage so as to slow the rate of fall of the objects.

An object passing through the main passage 4 from upstream would make contact with the flow retard mechanism. The flow retard mechanism in Figure 3A consists of an impact-absorbing surface 9 and a gas strut 152.1. The impact-absorbing surface 9, similar to the second embodiment of Figures 2A and 2B is a concave surface, made of two curved plates 93 and 94, jointed and pivoted around the centre by a pin 81. Holding the two curved plates together is a gas strut 152 pins jointed to the curve plates 93 and 94 by pins 82 and 83 respectively.

It is seen, from Figure 3A, that the impact-absorbing surface 91 is pivoted and hinged at pin 85 at sidewall 6, above the hopper unit 1. A second pivot at pin 81 joins the gas strut 153 from the impact-absorbing surface 9 to the sidewall 6 by pin 86.

It can be seen from Figure 3B that the flow retard mechanism has contacted and received the falling object from upstream and is in a fully opened state. During the operation of receiving the falling object, the impact-absorbing surface 9 swings clockwise about pin 85. The gas strut would similarly rotate about pin 86 and at the same time compress to primarily absorb the impact of the falling object. A secondary impact-absorbing mechanism, similar to the first embodiment, is also activated when the gas strut 152 is compressed. Similar to the second embodiment, the flow retard mechanism 3 acts in tandem to absorb kinetic energy of the falling object and dissipate this energy to the gas strut 152 and 153.

The impact-absorbing surface 9 would return to the original extended position once it receives the object by the extending motion of gas struts 152 and 153.

5 The chute module 10 in is provided with a side entrance in the form of a side-opening 11. Through this side-opening 11 in the chute module 10, persons at each level of the building can throw objects into the main passage 4.

10 The side-opening 11 is associated with an entrance-mechanism. This entrance-mechanism consists of several parts, which combine to operate between a closed, and an open state. Only in the open state can a person throw objects through the side entrance 11 into the main passage 4.

15 In the figures, the entrance-mechanism that is associated with the side-opening 11 is configured as a hopper-mechanism 1. When not in use, the hopper-mechanism 1 is closed and in a vertical orientation, as shown in Figures 3A, 4A and 5A. In this closed state, the hopper-mechanism 1 blocks entry to the side-opening 11 so that a person cannot insert objects through the side-opening 11.

20 However, when the person wishes to throw something through the side-opening 11 into the main passage 4, the person pulls back the hopper-mechanism 1 to reveal the side-opening 11, as shown in Figures 3B, 4B and 5B. The person can then throw the object through the side-opening 11 where it falls into the main passage 4.

25 In the fourth embodiment of the chute mechanism, the fall retard mechanism further includes an object stoppage mechanism 120 that is operatively connected to the hopper-mechanism as shown in 4A, 4B, 5A and 5B.

30 It can be appreciated that, if further objects are being introduced into the main passage 4 through the side-opening 11, there might be a possibility of impact with objects coming down the main passage 4 from upstream above. Therefore, to avoid this, the main passage 4 of the chute module 10 is provided with an object stoppage mechanism 120, operatively connected to the hopper mechanism.

35 The fall retard mechanism of the fourth embodiment includes the impact-absorbing surface 3 and the object stoppage mechanism.

The object stoppage mechanism of the fall retard mechanism is operable between an unobstructed and obstructed state. Figure 4A shows the fourth embodiment of the flow retard mechanism, and specifically the object stoppage mechanism 120 in the unobstructed state. Figure 4B shows the object stoppage mechanism in the obstructed state.

Figure 4B shows that the object stoppage mechanism, in the obstructed state, operates to obstruct the main passage 4, upstream of the side entrance 11.

Preferably the flow retard mechanism is positioned above the object throw-in hopper sub-mechanism 1. Advantageously, this position of the flow retard mechanism will ensure that objects thrown in via the throw-in hopper 1 would be protected from heavy impact of upstream falling objects. The embodiment is designed to have a smooth and unobstructed throw-in process through the hopper, irrespective of activities from the flow retard mechanism 3 by virtue of the space between them.

For clarification, it is noted that, even through some or all of the components of the object stoppage mechanism, in the unobstructed state, may be located at the level or downstream of the side entrance, the fact is that once the object stoppage mechanism changes to its obstructed state, it operates functionally upstream of the side entrance.

In the figures, the object stoppage mechanism is in the form of a movable plate 170, the movable plate being movable in an obstructed state, and an unobstructed state.

In the unobstructed state, in Figure 4A, the main passage 4 is substantially unobstructed by the object stoppage mechanism, to allow objects to pass through. Figure 4A shows objects passing through the main passage 4 of the chute module 10.

In contrast, in the obstructed state in Figure 4B, the object stoppage mechanism temporarily obstructs the main passage 4 sufficient to prevent objects that would have otherwise passed through the main passage 4 of the chute module 10, from reaching the side entrance 11.

In Figure 4A, the hopper 1 is connected to the movable plate 170 by a connecting-arm 12. Thus, in Figure 4B, when the hopper-mechanism 1 is pushed forwards to close the side-entrance 11, the connecting-arm 12 pushes the movable plate 170 out of the path of the main passage 4 of the chute module 10. In this unobstructed position, the movable plate 170 cannot prevent objects from passing through the main passage 4 of the chute module 10.

Conversely, in Figure 4B, when the hopper-mechanism 1 is pulled backwards to reveal the side-entrance 11, the connecting-arm 12 pulls the movable plate 170 forwards into the path of the main passage 4 of the chute module 10. In this obstructed position, the movable plate 170 prevents objects passing through the main passage 4 of the chute module 10. Simultaneously, this allows the person to throw further objects through the side-entrance 11 without these further objects colliding with objects coming from upstream.

The mechanism works as follows: the connecting-arm 12 is pivotally connected to a lower plate 14. When the hopper-mechanism 1 is pulled back, as in Figure 4B, the connecting-arm 12 is pulled towards the hopper-mechanism. Since the lower plate 14 is in contact with the under-surface of the movable plate 170, the outward movement of the lower plate 14 causes the movable plate 170 to swing outwards and upwards, as in Figure 4B.

Thus in summary, when the hopper-mechanism 1 is the closed state, the movable plate 170 is in the unobstructed state (Figure 4A). And when the hopper-mechanism 1 is in the open state, it causes the movable plate 170 to be in the obstructed state (Figure 4B), so that any further objects that enter through the side-entrance 11 will not collide with any objects passing through the main passage 4 from upstream.

The movable plate 170, in the obstructed state in Figure 4B, temporarily holds any object from upstream of the main passage until the hopper-mechanism 1 reverts to its closed state. That causes movable plate 170 to revert to its unobstructed state in Figure 4A whereupon the objects from upstream can continue to pass through the main passage 4.

It is appreciated that this mechanism in Figures 4A and 4B for operating the object stoppage mechanism 120 can be modified in many ways to achieve a similar function, and a further embodiment of Figures 5A and 5B are described further below.

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Materials

In the embodiment of the flow retard mechanism, the various parts of the chute module 10 are made of metal, or alternatively plastic or layered internally with a cushioning material other suitable material.

The various parts of the main passage 4 are at least partially or wholly made of a flexible hose or layered with a cushioning material. This choice of flexible material is to minimise breakage of the impact-shatterable objects that pass through, especially the impact shatterable materials, since the flexible material will tend to accommodate any impact between the falling object and the sidewalls of the main passage 4. This will advantageously also reduce noise that may be generated during impact between the falling object and the sidewalls. An internally layered cushioning material will also achieve the above advantages.

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The chute module 10 is joined to the main passage 4 of the chute by a segment connector in the form of a screw-tightenable collar 7. Hence, the embodiment is a modular design that can be assembled. However, in other modifications, the apparatus can be assembled in a permanent manner, particularly when it is installed during construction of the overall building of which it is a part.

The inside surfaces of the main passage may be lined with a resilient or sponge-like material to perform this same function of minimising breakage and noise reduction.

In the embodiments, the impact-absorbing surface 9 preferably includes a surface layer of padding or a sponge-like material.

As seen in Figure 2A and 2B the bumper 156 and 157 are made of a rubber composite material. These bumpers possess the ability to absorb the kinetic energy of the falling object and dissipate them into heat energy. It is also to be appreciated that these bumpers compress rapidly when absorbing the impact and expand back into their original shape slowly when the load is removed.

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The gas struts 152 and 153 in Figures 2A, 2B, 3A and 3B are usually made of metal and contain some form of hydraulic fluid. They compress to absorb the kinetic energy of the falling object and dissipate them into heat energy. Springs or shock absorbers can also replace the gas struts in the applications of the embodiments.

In Figures 2A, 2B, 3A and 3B, the impact-absorbing surface 9 of the flow retard mechanism is essentially a metal plate layered with some cushioning material. This would further absorb impact from the falling object and also reduce the noise created when the falling objects hits the impact absorbing surface 9.

In the embodiments, the hopper mechanism 1 is usually made of stainless steel and when in a closed state, is relatively air tight to prevent any air from the chute to escape through this mechanism. Furthermore, the object throw-in hopper sub-mechanism is designed such that only objects that are smaller in size than the main passage 4 is allowed to enter.

As seen in Figure 4A and 4B, the movable plate 170 of the object stoppage mechanism 120 is made of metal and is layered with a cushioning material. This is to absorb impact from the falling object that is to be held by the movable plate 160. Furthermore, the cushioning material is able to reduce the noise created when the falling objects hits the movable plate 170. The connecting arm 12 of the stop-fall sub-mechanism is made of metal is functions as a bar-linkage from the movable plate 170 to the object throw in the hopper mechanism 1.

From Figure 5A and 5B, the motorised agitation mechanism 160 comprises a small motor to drive a rotating cylindrical drum usually made of metal. It can be seen that the rotating drum has spaced protrusions on the surface. These protrusions are essentially made of a hard rubber compound. Optical sensors using light or laser or infra –red are also mounted to detect the presence of an object at the area of the movable plate 170.

As previously described, the laterally extended hopper segment 5 also provides great room for components of the fall retard mechanism to expand into its obstructed state in Figure 6. However, the various embodiments of the fall retard mechanism may also be equally positioned throughout the main passage 4, and does not necessarily limit its location to the laterally extended hopper segments.

In the embodiments, the impact-absorbing surface 3 preferably includes a surface layer of padding or a sponge-like material.

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Alternatives

As mentioned above, the mechanism for operating the object stoppage mechanism of Figures 4A and 4B can be modified in many ways to achieve a similar function. A further embodiment shown in Figures 5A and 5B are described here.

In a fifth embodiment in Figures 5A and 5B, the movable plate 170 in this example is swung from the unobstructed state of Figure 5A, into the obstructed state of Figure 5B, using a different mechanism to that of the fourth embodiment of Figure 4A and 4B. In this fifth embodiment, the object stoppage mechanism further includes an agitation mechanism, which will be described later.

In Figure 5A, the hopper 1 is, once again, connected to the movable plate 170 by a connecting-arm 12. Thus, in Figure 5A, when the hopper-mechanism 1 is pushed forwards to close the side-entrance 11, the connecting-arm 12 pushes the movable plate 170 out of the path of the main passage 4 of the chute module 10. In this unobstructed position, the movable plate 170 cannot prevent objects passing through the main passage 4 of the chute module.

Conversely, in Figure 5B, when the hopper-mechanism 1 is pulled backwards to reveal the side-entrance 11, the connecting-arm 12 pulls the movable plate 170 forwards into the path of the main passage of the chute module 10. In this obstructed position, the movable plate 170 prevents objects passing through the main passage of the chute module. This allows the person to throw further objects through the side-entrance 11 without these further objects colliding with objects coming from upstream.

In Figures 5A and 5B, the path of movement of the lower part of the movable plate 170 is guided by guide-track 15. The guide-track 15 has an internal groove. A

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pin of the movable plate 170 rides in the groove, such that the sweeping motion of the plate 170 is governed by the movement of the pin within this guide-track 15.

As previously explained in the fifth embodiment of the fall retard mechanism, seen in Figures 5A and 5B the object stoppage mechanism of the fall retard mechanism further includes an agitation mechanism, shown in Figures 5A and 5B as a rotating drum 160.

The agitation mechanism transfers a degree of motion, or agitation, or vibration, onto the movable plate. This degree of motion advantageously urges objects that may have settled onto the movable plate, off the movable plate, and towards the main passage.

As seen in Figures 5A and 5B the agitation mechanism is a rotating drum 160, with spaced protrusions along the surface of the drum. When objects settle on the movable plate for a pre-determined period of time, the rotating drum will be caused to rotate, to transfer a degree of motion to the plate 170, thus urging the settled objects towards the main passage. In the examples shown in Figures 5A and 5B, the object stoppage mechanism is of the fifth embodiment. However, it is to be appreciated, that the agitation mechanism may also be applied together with the object stoppage mechanism of the third and fourth embodiments.

Figure 5A shows the object stoppage mechanism when in an unobstructed state, and in Figure 5B, in an obstructed state. As previously described, the rotating drum 160 has protrusions 161 along its surface. These protrusions 161 are dimensioned to be in direct contact with the movable plate 170. When the drum rotates, the spaced protrusions 161 will strike the movable plate 170, at an interval, thereby conveying a motion to the movable plate. The level of vibration or motion, may be varied by varying the number of protrusions, or by varying the rotational speed of the drum

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The rotating drum 160 may be caused to rotate upon a manual activation, or it may be caused to activate only when an object settles or rests on the movable plate 170, for a pre-determined period of time. This may be achieved by the interaction of a sensor and a time, so that, when the sensor senses an object on the movable plate 170, the timer starts timing, so that, after a pre-determined period of time has passed, for example, 1 minute, the rotating drum is activated to cause a vibration or motion, to urge the object off the plate 170, and into the main passage.

In the examples shown in Figures 5A and 5B, the agitation mechanism is shown with the fifth embodiment, but it is to be appreciated that the agitation mechanism may also be applied with the fourth embodiment.

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Although the exemplary embodiments have been described in the context of a building where the chute mechanism and method are used for waste disposal, other embodiments can be used, for example, in factories or production processes where components or objects need to be passed down a chute from various levels.

10 Embodiments can also be used in hotels.

In the embodiments, only one side-entrance has been provided, but it is conceivable that other modifications may include two or more side-entrances. For instance, in an apartment block, the same chute mechanism might be shared by two

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The impact-absorbing surface 3 in Figures 2A, 2B, 3A and 3B is formed as a plate or of two section plates, however, other modifications may use different mechanisms, such as a rim or rank of resilient tentacles that project into the centre of the passage. The tentacles would make contact with the falling objects, and the combined effect of all the projecting tentacles would be to slow down the rate of fall of the objects. In other modifications, these tentacles can be provided all along the length of the main passage to also slow down the rate of fall.

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In the embodiments, only one object throw-in hopper mechanism has been provided, but it is conceivable that other modifications may include two or more object throw-in hopper sub-mechanisms. For instance, in an apartment block, two adjoining apartments might share the same chute mechanism.

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In the embodiments, the main passage is substantially upright or vertical, however, in other embodiments, the main passage can be inclined such that objects slide down the passage.

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In other embodiments, the operative connection between the entrance mechanism and the object stoppage mechanism can be electronic in nature, such that the information of the movement of each component is transmitted electronically to the other component, rather than being strictly a mechanical connection.

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The embodiments of the invention have been advanced by way of example only, and modifications are possible within the scope of the invention as defined by the appended claims.

CLAIMS:

1. A chute mechanism adapted to allow objects to pass therethrough without
5 breakage, including:
 - a main passage through which objects are able to pass, and
 - a side entrance associated with an entrance-mechanism that is operable between a closed and an open state, only in which open state further objects are able to enter through the side entrance into the main passage,
- 10 wherein the mechanism further includes a fall retard mechanism for temporarily obstructing objects in the main passage so that the rate of fall of these objects is reduced.
2. A mechanism of claim 1 wherein the fall retard mechanism is an impact-
15 absorbing surface adapted to receive a falling object thereon without shattering.
3. A mechanism of claim 2 wherein the impact-absorbing surface extends from a wall of the main passage and partially obstructs the main passage upstream of the side entrance.
- 20 4. A mechanism of claim 3 wherein the impact-absorbing surface is a resilient tentacle.
5. A mechanism of claim 3 wherein the impact-absorbing surface is spring-
25 loaded to provide resiliency and thereby absorb a kinetic energy of the falling object.
6. A mechanism of any one of claims 2 to 5 wherein the impact-absorbing surface further includes a padding or a sponge-like material.
- 30 7. A mechanism of any one of claims 3 to 6 wherein the impact-absorbing surface at least partially protrudes into the main passage such that contact of a falling object with the impact-absorbing surface slows the rate of fall of the object through the main passage.
- 35 8. A chute mechanism, according to any one of claims 1 to 7, wherein the flow retard mechanism further includes an object stoppage mechanism operatively

connected to the entrance mechanism, whereby the object stoppage mechanism is operable between an unobstructed and obstructed state;

such that, in the unobstructed state, the main passage is substantially unobstructed by the object stoppage mechanism so as to allow objects to pass through,

and such that, in the obstructed state, the object stoppage mechanism temporarily obstructs the main passage sufficient to prevent objects passing through the main passage from reaching the side entrance,

when the entrance-mechanism is in the closed state, the object stoppage mechanism is in the unobstructed state, and

when the entrance mechanism is in the open state, the entrance-mechanism causes the object stoppage mechanism to be in the obstructed state, so that any further objects that enter through the side entrance will not collide with any objects passing through the main passage from upstream.

9. A mechanism of claim 8 wherein the object stoppage mechanism in the obstructed state is adapted to temporarily hold any object from upstream of the main passage until the entrance mechanism reverts to the closed state which causes the object stoppage mechanism to revert to the unobstructed state in which objects from upstream are able to continue passing through the main passage.

10. A mechanism of claims 8 or 9, wherein the flow retard mechanism further includes a agitation mechanism, to impart a degree of motion onto the object at the stoppage mechanism.

11. A mechanism of claim 8 or 9 wherein the main passage is substantially upright such that the objects are able to fall down through the main passage by gravity.

12. A mechanism of any one of claims 1 to 11 wherein the main passage is at least partially or wholly made of flexible material to minimise breakage and noise of the impact-shatterable objects that pass therethrough.

13. A mechanism of any one of claims 1 to 11 wherein the main passage is at least partially or wholly further includes a cushioning material to minimise breakage and noise of the impact-shatterable objects that pass therethrough.

14. A mechanism according to claim 8, wherein the object stoppage mechanism is adapted to enable disposal of - objects down a main passage of a disposal system
 5 in a multi-storey building such that the objects inserted into the main passage through a side entrance of the chute mechanism avoid collision with the objects coming from upstream, the chute mechanism being in accordance with any one of claims 1 to 13.

10 15. A disposal system adapted to enable disposal of objects down a main passage in a multi-storey building, the main passage including a plurality of chute mechanisms wherein the objects inserted into the main passage through the side-entrance mechanism avoid collision with the objects coming from upstream, each chute mechanism being in accordance with any one of claims 1 to 13.

15 16. A method of disposing objects down a main chute in a multi-level building, including the steps of:

providing the multi-level building with a disposal system having at least a main passage through which objects can be dropped down for disposal,

20 providing the main passage at each level of the building with at least one integrated mechanism that enables further objects to enter through a side entrance into the main passage without the further objects impacting any objects passing through the main passage from upstream,

the flow retard mechanism being in accordance with any one of claims 1 to
 25 13.