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This Sheet Has Been Replaced



### **"A DAMPER ARRANGEMENT"**

**THE PRESENT INVENTION** relates to a damper arrangement. The damper arrangement may damp an up and down motion. The invention more particularly relates to a damper arrangement for use with a toilet seat which may include a cover assembly.

It has been proposed previously to provide a toilet seat assembly in which the seat is self-lifting. Thus, when the toilet is not in use with the seat in a lowered position, the seat is automatically lifted to a raised position.

A problem with some of the prior art toilet seat assemblies is that the seat may be moved to the raised position, for example by a spring, relatively swiftly, which is undesirable.

The present invention seeks to provide a damper arrangement, and more particularly seeks to provide a damper arrangement suitable for use with a toilet seat assembly, which may include a cover.

According to this invention there is provided a damper arrangement for damping motion of an element which is to rotate about a first axis, the damping arrangement incorporating a cam member adapted to rotate about a

predetermined axis on rotation of the element, the cam member presenting an exterior surface which is eccentric with respect to the axis of rotation of the cam member, there being a damper member engaging said cam surface and adapted to move linearly in a plane substantially perpendicular to the predetermined axis in response to rotation of the cam surface, the damper member being associated with means which resist such linear movement for rotation in a predetermined sense, thus also resisting rotation of the cam member, said movement resisting means comprising means defining part of the chamber, there being a flow passage for permitting a restricted flow of air into the chamber.

Conveniently the chamber is defined between a rubber sucker and a substantially planar element. A rubber sucker may act as a one-way valve to permit air to be exhausted from the chamber if the element is rotated in the opposite sense. The chamber may be provided with alternative forms of one-way valve.

Conveniently the means defining said flow passage comprise an adjustable bleed valve. By adjusting the adjustable bleed valve, the rate at which the element may rotate can be adjusted.

Conveniently the exterior of the cam member is circular, and the cam member is received within a circular aperture of an equivalent diameter formed in part of the said damper member. The engagement of the circular exterior of the cam with a circular aperture of an equivalent diameter means that the damper member is not simply a cam follower which can become disengaged from the cam, but instead any rotation of the cam results in a movement of the damper member, and a force applied to the damper member may be sufficient to resist, and even prevent rotation of the cam.

Advantageously the cam member is adapted to rotate about an axis coincident with the axis of rotation of the said element. However, in alternative arrangements, the cam may rotate about an axis which is off-set from the axis of rotation of the said element.

Preferably the said pivotally mounted element is associated with a timing mechanism adapted to prevent substantial rotation of the element until a predetermined period of time has elapsed.

Conveniently the timing mechanism comprises a rubber sucker carried by the element engageable with a substantially planar surface to define a volume between the rubber sucker and the surface, there being a restricted air-flow passage communicating with the volume.

Advantageously means are provided to impart a rotational bias to said element. The rotational bias imparting means may comprise a spring connected between a convenient part of the element which is to rotate and a fixed anchoring point. In one embodiment it is envisaged that the spring may be connected between part of the cam member and a fixed anchoring point. The spring may be an adjustable spring, and thus the anchoring point may be adjustably located. The precise position of the anchoring point may, for example, be adjusted by means of an adjustment screw.

Conveniently the said element supports a toilet seat, and optionally a cover.

In a preferred embodiment where a toilet seat is supported, a toilet is also supported for rotation about the first axis.

An advantage of embodiments of the invention is that there is no necessity for a motor to drive the arrangement being damped, since the element to rotate about a first axis can be spring-biased. It is to be appreciated that in the embodiment where a rubber sucker is used, or another embodiment in which a non-return valve is associated with the chamber, part-way through a rotational motion about the first axis, which is being damped, the direction of rotation of the element may be swiftly reversed without the damper arrangement suffering any damage.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 is a diagrammatic exploded view showing a toilet seat and a toilet lid, and a housing containing a damper arrangement in accordance with the invention,

FIGURE 2 is an exploded view of the housing of Figure 1 illustrating the components within the housing,

FIGURE 3 is an enlarged view of a cam forming a component within the housing,

FIGURE 4 is a perspective view, with parts cut-away for the sake of clarity of illustration, of the housing of Figure 1 illustrating the components within the housing,

FIGURE 5 is a sectional view taken on the line V-V of Figure 4 showing the components in a first position in which the toilet seat is lowered,

FIGURE 6 is a sectional view taken on the line VI-VI of Figure 4, again showing the toilet set lowered,

FIGURE 7 is a view corresponding to Figure 5 at a later moment during the raising of the seat,

FIGURE 8 is a view corresponding to Figure 6 at that later moment,

FIGURE 9 is a view corresponding to Figure 7 at a further later moment during the raising of the seat,

FIGURE 10 is a view corresponding to Figure 8 at that further later moment,

FIGURE 11 is a view corresponding to Figure 9 showing the seat in the fully raised position, and

FIGURE 12 is a view corresponding to Figure 10 showing the seat in the fully raised position.

Referring initially to Figure 1 of the accompanying drawings, a housing 1 is illustrated which contains a damper mechanism which will be described in detail hereinafter. As will be appreciated from the follow description, the housing 1 may be secured to a toilet pan. Projecting from the housing 1 is a toilet seat support arm 2, and a toilet lid support arm 3. It is to be appreciated that the toilet seat support arm 2 is adapted to be connected to a

conventional toilet seat 4, and the toilet lid support arm 3 is adapted to be connected to a conventional toilet lid 5.

It will be appreciated that when the toilet seat 4 has been mounted on the toilet of the support arm 2, and the toilet lid has been mounted on the toilet lid support arm 3, the combination of the housing and the toilet seat 4 and toilet lid 5 will have an appearance which is generally similar to the appearance of a conventional toilet seat and lid combination, although the housing 1 may be slightly more bulky than the conventional hinge arrangement used to connect the seat 4 and lid 5 to the toilet bowl.

Referring now to Figure 2 of the accompanying drawings, it can be seen that the housing 1 comprises a generally planar upper wall 6 having depending side walls 7. The side walls 7 are cut-away to define, towards the front of the housing, two substantially vertically extending slits 8, 9. The precise configuration of the housing is not critical, and thus the housing may be designed to have a pleasing appearance.

The housing 1 is adapted to cover and protect various components including, of course, the toilet seat support arm 2, and the toilet lid support arm 3.

Contained within the cover is a base plate 10. The base plate 10 has a configuration equivalent to the configuration of a planar upper wall 6 of the housing 1. The base plate 10 is provided with a plurality of elongate apertures 11 adapted to receive fixing bolts to fix the base plate to a conventional toilet pan. The elongate apertures 11 are dimensioned to enable the fixing bolts to be utilised with any conventional toilet pan. The base

plate 10 is also provided with two parallel rows of apertures 12 which are spaced apart.

An inner housing 13 is provided, located within the housing 1, the inner housing 13 having a generally planar upper wall 14 and depending side walls 15, 16. The depending side walls terminate with outwardly directed flanges 17, 18, the flanges 17, 18 being provided with apertures 19. The apertures 19 on the two outwardly directed flanges 17, 18 are dimensioned and positioned to be brought into alignment with the apertures 12 formed on the base plate 10. Nuts or rivets may pass through the co-aligned apertures to secure the inner housing 13 to the base plate 10.

The inner housing 13 has a depending rear wall 20. Located at a central position in the rear wall 20 is an air bleed valve 21. The air bleed valve may be of an adjustable type, with the adjustability being effected by rotating an element mounted to the rear of the rear wall 20.

A front part of the upper wall 14 of the inner housing 13 is provided with a depending flange 22. The depending flange 22 carries two forwardly directed lugs 23, 24, the lugs being apertured. The apertures in the lugs 23, 24 are co-aligned with apertures 25, 26 formed in the side walls 15, 16. A pivot rod 27 may extend through the co-aligned apertures.

The depending flange 22 is provided, at a central position, with an air bleed valve 27. The air bleed valve 27 may be adjustable.

The central part of the upper wall 14 of the interior housing 13 is provided with a recess or depression 28 adapted to receive a fixing mounted on

the interior of the housing 1 on the under-surface of the upper horizontal wall 6 thereof. The fixing will releasably retain the housing 1 in position.

The lid support arm 3 comprises a generally planar portion 30 provided with apertures 31 adapted to receive fixing bolts or the like engaging the toilet lid. The horizontal portion 30 carries two arms 32, 33, each of which lies in a vertical plane. The arm 32 ends in an apertured disc 34, and the arm 33 ends in an apertured disc 35. The discs are intended to be mounted adjacent the side walls 15, 16 of the inner housing 13 with the apertures therein aligned with the apertures 25 and 26 formed in the side walls 15 and 16 of the inner housing so that the pivot rod 27 may pass through the apertures in the discs 34, 35. Thus the toilet lid is freely and rotatably mounted on the pivot rod 27. It is to be appreciated that the arms 32 and 33 emerge, from the housing 1, through the slits 8 and 9.

The toilet seat support arm 2 comprises a horizontal portion 36 provided with apertures 37 adapted to receive bolts or the like to secure the horizontal portion to the toilet seat. The horizontal portion 36 is provided, at each end thereof, with a vertical rearwardly extending flange 38, 39. The flanges are provided with apertures, such as the aperture 40 shown in flange 38, and the toilet seat support arm 2 is intended to be inserted into the inner housing 13 with the apertures in a position such that the pivot rod 27 may pass through the apertures. Thus the toilet seat support arm 36 is connected to the pivot rod 27. The toilet seat support arm 2 is provided with apertures 40 such a size and configuration that the toilet seat support arm 2 is firmly connected to the pivot rod 27 so that the pivot rod 27 rotates in synchronism with the toilet seat support arm 2.

Extending between the inner ends of the flanges 38 and 39 is a vertical transversely extending wall 41. The wall 41 carries, on its front face (as shown most clearly in Figure 5), a rubber "sucker" 42. The rubber sucker is positioned so that when the toilet seat is in the lowered position, the rubber sucker is brought into firm engagement with the interior surface of the depending flange 22 carried by the upper horizontal wall 14 of the inner housing 13 in alignment with the air bleed valve 27 provided therein.

Mounted on the pivot rod 27 for rotation with the rod are a pair of corresponding eccentric cam 43, 44. Each cam has a configuration as shown in Figure 3. The cam has a substantially circular outer periphery 45 and has an off-centre aperture 46 adapted to receive the pivot rod 27. The cam is provided with additional apertures, such as the two symmetrically arranged circular apertures 47, 48, and a lower elongate aperture 49. Each cam rotates about the axis of the first rod 27.

It is to be appreciated that as the pivot rod 27 rotates about its axis, which is fixed relative to the inner housing 13, so the outer periphery 40 of the cam will rotate about that axis, that axis not being coincident with the centre of the circular outer periphery of the cam 43.

The cam 43 is located to be positioned between the flange 38 provided on the toilet seat support arm 2 and the disc 35 carried by the toilet lid support arm 3, and the flange 44 is located in a corresponding position between the flange 39 and the disc 34.

A damper element 50 is provided comprising a transverse plate 51 carrying two rearwardly directed parallel arms 52, 53. Each arm 52, 53 lies in a plane which is perpendicular to the axis of rotation of the cams. Each arm is

provided with a circular aperture, the arm 52 having an aperture 54 and the arm 53 having an aperture 55. The diameter of each circular aperture is equivalent to the diameter of a corresponding cam 43 or 44. Each cam is received in a respective aperture.

The transverse plate is provided with a central aperture 56 which carries a rubber sucker 57 as shown most clearly in Figure 6. The rubber sucker is located so that in one position of the damper element 50 the rubber sucker is in firm engagement with the inner surface of the rear wall 20 of the inner housing 13 in alignment with the air bleed valve 21.

Referring now to Figures 5 and 6, when the toilet seat is in an initial, lowered position, the rubber sucker 42 is pressed firmly against the inner surface of the depending flange 22 provided on the inner housing 13. The air bleed valve 27 provides an air-flow passage from the atmosphere to a very small volume of space defined between the rubber sucker 42 and the inner face of the depending flange 22. The effect of the rubber sucker 42 is to resist any upward pivoting movement of the toilet seat support arm 2 about the axis of the pivotal support rod 27, as such an action tends to separate the sucker 42 from the flange 22.

As can be seen from Figure 6, when the toilet seat support arm 22 is in the initial lowered position, the effect of the cam 43 in the aperture 55 of the damper element 50 is such that the damper element 50 is driven to a maximum rearward position in which the rubber sucker 57 carried by the transverse plate 51 of the damper element 50 is pressed firmly against the inner surface of the rear wall 20 of the housing 13 at a position in alignment with the air bleed valve 21. Thus a very small volume of space is defined between the rubber sucker 57 and the inner surface of the rear wall 20 of the inner housing 13, that

small space being in communication with the atmosphere through the air bleed valve 21.

A spring is provided within the housing which imparts a bias to the toilet seat support arm 2 in a clockwise direction as shown in Figure 6. The precise nature and location of the spring is not crucial to the invention, and indeed other means may be utilised to provide the desired rotational bias. The spring may, however, engage one of the apertures 47, 48 in the cam.

In the described embodiment, in response to the bias provided by the spring, the toilet seat support arm 2 will tend to rotate in the clockwise direction. A force will be applied to the rubber sucker 42 tending to draw the rubber sucker 42 away from the depending flange 22, and thus air is drawn into the space between the rubber sucker 42 and the inner surface of the depending flange 22 through the air bleed valve 27. After a short period of time a sufficient volume of air has been drawn into that space for the rubber sucker 42 to become released from the inner surface of the depending flange 22, thus enabling the toilet seat support arm 2 to commence a substantial pivotal movement in the clockwise direction. As the arm begins to rotate, so the effect of the cam 43 within the aperture 55 (and equally the effect of the cam 44 within the aperture 54) is to begin to draw the damper element 50 forwardly from its initial position in which the plane of the plate 51 of the damper element is spaced from the plane of the rear wall 20 of the inner housing 13 by a distance of 6.52 millimetres. As the rotation of the pivot rod 27 tends to move the cam so that the cam applies a force tending to move the damper element forwardly, that forward movement of the damper element is resisted by the effect of the rubber sucker 57. Thus an equal and opposite force is applied to the cam 43 resisting rotation of the pivotal shaft 27, and thus resisting an upward rotational movement of the toilet seat. The toilet seat can, however,

move pivotally in a clockwise direction, under the influence of the spring force applied thereto by the spring, in a slow and regulated manner as air is drawn into the chamber defined between the rubber sucker 57 and the inner face of the rear wall 20 of the housing 13 through the air bleed valve 21.

Figures 7 and 8 illustrate the situation that exists shortly after the toilet seat has commenced its upward pivoting movement. It can be seen that the rubber sucker 42 has become totally separated from the inner surface of the depending flange 22, and is thus not influencing the movement of the toilet support arm 2 in any way. However, it can be seen that the volume of the chamber defined between the rubber sucker 57 and the inner surface of the rear wall 20 of the inner housing 13 has increased. It can be observed that the spacing between the plane of the plate 51 of the cam element 50, and the plane of the rear wall 20 of the housing 13 has now increased to 9.42 millimetres.

Figures 9 and 10 illustrate a situation when the toilet support arm 2 has rotated further in the clockwise direction. At this stage, the volume of the chamber between the rubber sucker and the inner surface of the rear wall 20 of the inner housing 13 has further increased, and the spacing between the plate 51 of the damper element 50 and the plane of the rear wall 20 of the housing 13 is 10.06.

As the toilet seat support arm passes through a position in which the initially horizontal part 36 thereof is substantially vertical, so the effect of the cam 43 within the aperture 55 (and equally the effect of the cam 44 within the aperture 54) is to drive the damper element 50 slightly rearwardly, thus slightly reducing the spacing between the plate 51 of the damper element 50, and the plane of the rear wall 20 of the inner housing 13 to a distance of 9.56 millimetres. Thus the volume of the chamber defined between the rubber

sucker and the inner surface of the rear wall 20 of the housing 13 is reduced. The effect of this is that if the toilet seat is such that when it is moved towards the lowered position, the volume of the chamber must initially be increased slightly. Thus the rubber sucker will help retain the toilet seat lid in the upright, or elevated position.

It will therefore be appreciated that, in operation of the damper arrangement as described, an initial "timing" rubber sucker 42 is provided to resist or prevent substantial upward movement of the toilet seat support arm, until a predetermined period of time has elapsed, that predetermined period of time being the time that it takes for a sufficient quantity of air to flow through the bleed valve 27 to break the seal between the rubber sucker 42 and the inner surface of the depending flange 22. Equally it is to be noted that upward movement of the toilet seat support arm is resisted by the rubber sucker 57. The rubber sucker 57 is effectively connected to the toilet seat support arm by means of a cam arrangement which converts rotational movement of the support arm into linear movement of the cam element, that linear movement of the cam element being resisted by the effect of the rubber sucker. The linear movement of the cam element is resisted by the rubber sucker, and the resisting effect is achieved by the rubber sucker being moved in such a way as to attempt to increase the volume of the chamber defined between the rubber sucker and the inner surface of the depending wall 20 of the inner housing 13, with that chamber being connected to the atmosphere through a bleed valve which permits a relatively low flow of air into the chamber. In a preferred embodiment of the invention, the bleed valve is adjustable, thus effectively enabling the speed of rise of the toilet seat support arm to be adjusted. The speed of rise of the support art may also be adjusted by varying the strength or effect of the spring that is used to bias the support arm to rotate in the clockwise direction as shown in Figures 5 and 6.

Should a substantial downward force be applied to the seat as it is rising, the cams will rotate in the opposite sense, thus swiftly driving the rubber sucker 57 towards the wall 20. the rubber sucker, in this situation, acts as a one-way valve, permitting air to be rapidly exhausted from the chamber defined between the sucker 57 and the wall 20.

The term "rubber sucker" is intended to mean elements usually defined by this term, including elements of synthetic rubber or of other material with appropriate resilience.

Whilst one embodiment of the invention has been described, it is to be appreciated that many modifications may be effected without departing from the invention.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately, or in any combination of such features, be utilised for realising the invention in diverse forms thereof.



## CLAIMS:

1. A damper arrangement for damping motion of an element which is to rotate about a first axis, the damping arrangement incorporating a cam member adapted to rotate about a predetermined axis on rotation of the element, the cam member presenting an exterior surface which is eccentric with respect to the axis of rotation of the cam member, there being a damper member engaging said cam surface and adapted to move linearly in a plane substantially perpendicular to the predetermined axis in response to rotation of the cam surface, the damper member being associated with means which resist such linear movement for rotation in a predetermined sense, thus also resisting rotation of the cam member, said movement resisting means comprising means defining part of a chamber, there being a flow passage for permitting a restricted flow of air into the chamber.
2. An arrangement according to Claim 1 wherein the chamber is defined between a rubber sucker and a substantially planar element.
3. An arrangement according to Claim 1 or 2 wherein the means defining said flow passage comprise an adjustable bleed valve.
4. An arrangement according to any one of the preceding Claims wherein the exterior of the cam member is circular, and the cam member is received within a circular aperture of an equivalent diameter formed in part of the said damper member.



5. An arrangement according to any one of the preceding Claims wherein the cam member is adapted to rotate about an axis coincident with the axis of rotation of the said element.
6. An arrangement according to any one of the preceding Claims wherein the said element is associated with a timing mechanism adapted to prevent substantial rotation of the element until a predetermined period of time has elapsed.
7. An arrangement according to Claim 6 wherein the timing mechanism comprises a rubber sucker carried by the element engageable with a substantially planar surface to define a volume between the rubber sucker and the surface, there being a restricted air-flow passage communicating with the volume.
8. An arrangement according to any one of the preceding Claims wherein means are provided to impart a rotational bias to said element.
9. An arrangement according to any one of the preceding Claims wherein the said element supports a toilet seat.
10. A damper arrangement substantially as herein described with reference to and as shown in the accompanying drawings.
11. Any novel feature or combination of features disclosed herein.