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(54) **Reduced water consumption flush toilet having a common actuation mechanism that controls a water valve by a first flexible cable and controls a waste valve by a second flexible cable**

(57) A reduced water consumption flush toilet includes a bowl assembly defining a bowl and a discharge opening at a lower end of the bowl. The toilet additionally includes a valve mounted to the flush toilet for selectively opening and closing the discharge opening of the bowl assembly and a water valve for selectively delivering a source of flush water to the bowl. The toilet further includes a common actuator assembly for controlling both the waste valve and the water valve. The actuator assembly is coupled to the water valve through a first flexible cable and coupled to the waste valve through a second

flexible cable. The actuator assembly includes a lever that is movable from a first position to an intermediate position and from the intermediate position to a second position such that in the first position the waste valve closes the discharge opening and the water valve is in the closed condition, in the intermediate position the waste valve closes the discharge opening and the water valve is in the open position for adding water to the bowl, and in the second position the waste valve opens the discharge opening and the water valve is in the open position for flushing the bowl.

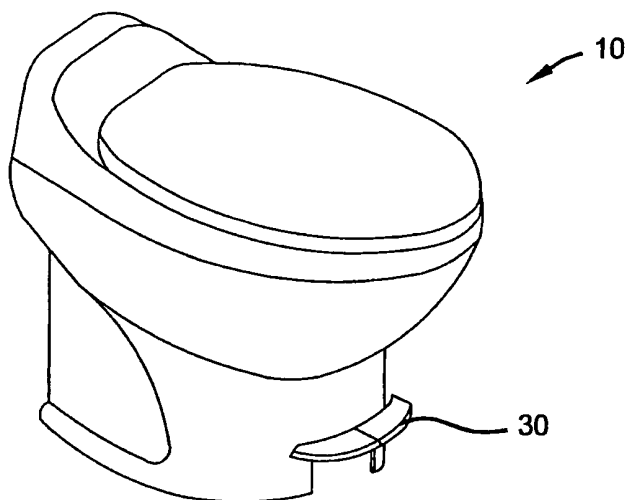


FIG 1

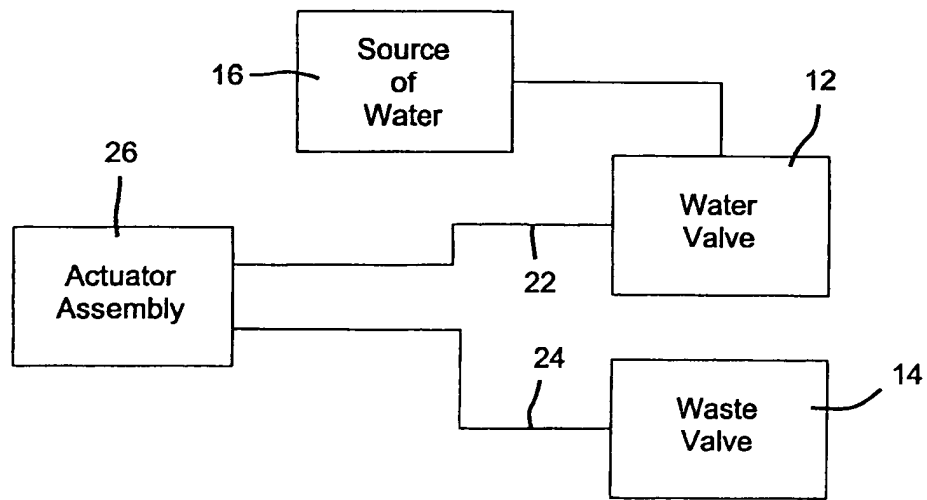


FIG 2

Description

FIELD OF THE INVENTION

[0001] The present invention relates to waste management systems. More particularly, the present invention relates to a flush toilet. More specifically, but without restriction to the particular embodiment and/or use which is shown and described for purposes of illustration, the present invention pertains to a reduced water consumption flush toilet.

BACKGROUND OF THE INVENTION

[0002] Vehicles including recreational vehicles ("RVs"), airplanes, boats, trains, and the like often include toilets for the comfort and convenience of the passengers. The toilets of vehicles must perform under operating conditions that are significantly different from non-transitory toilets conventionally found in homes and businesses ("home toilets"). For example, vehicle toilets are typically required to operate often in a confined area and often rely on a source of on-board water for flushing. For the latter reason, vehicle toilets are typically designed to operate with reduced water consumption for water conservation.

[0003] The design of vehicle toilets must accommodate the distinct operating conditions and preferably provide the customer with the comforts and customary features associated with home toilets. One example of a vehicle toilet is shown and described in commonly assigned United States Patent No. 5,060,320 which is hereby incorporated by reference as if fully set forth herein. United States Patent No. 5,060,320 discloses a toilet having a foot pedal flush control arrangement including two pedals. One of the pedals opens a toilet bowl discharge outlet and the other pedal supplies flush water to the bowl. The pedals both operate through actuation cables having a wire member slidable within a conduit. The flush water pedal can be independently actuated to partially fill the bowl prior to use of the toilet while the outlet closure member pedal co-acts with the flush water pedal so that upon opening of the bowl outlet, the flush water pedal is depressed providing water to the bowl. The wire members are solid wire members coupled to the pedals for both pull and push operation so that upon a failure of the pedal return mechanism, the pedals can be manually returned closing the bowl outlet and terminating the flow of flush water to the bowl.

[0004] While known vehicle toilets, including the toilet disclosed by United States Patent No. 5,060,320, have proven acceptable for their intended applications, there remains a need for continuous improvement in the pertinent art.

SUMMARY OF THE INVENTION

[0005] It is an object of the present invention to pro-

vide a reduced water consumption flush toilet for a motor vehicle that has a common actuation mechanism that controls a water valve by a first flexible cable and controls a waste valve by a second flexible cable.

[0006] It is a more particular object of the present invention to provide a reduced water consumption flush toilet for a motor vehicle that includes a common actuator coupled to a water valve through a first flexible cable and coupled to a waste valve through a second flexible cable such that such movement of the actuator from a first position to an intermediate position opens the water valve without opening the waste valve for adding flush water to the bowl and movement of the actuator from the intermediate position to a second position opens the waste valve and opens the water valve for flushing of the toilet.

[0007] It is a related object of the present invention to provide reduced water consumption flush toilet having a common actuator coupled to a water valve through a first flexible cable and coupled to a waste valve through a second flexible cable the actuator including a first and second cam member members having distinct following surfaces for cooperating with the first and second flexible cables, respectively.

[0008] In one form, the present invention provides a reduced water consumption flush toilet including a bowl assembly defining a bowl and a discharge opening at a lower end of the bowl. The toilet additionally includes a valve mounted to the flush toilet for selectively opening and closing the discharge opening of the bowl assembly and a water valve for selectively delivering a source of flush water to the bowl. The toilet further includes a common actuator assembly for controlling both the waste valve and the water valve. The actuator assembly is coupled to the water valve through a first flexible cable and coupled to the waste valve through a second flexible cable. The actuator assembly include a lever that is movable from a first position to an intermediate position and from the intermediate position to a second position such that in the first position the waste valve closes the discharge opening and the water valve assembly is in the closed condition, in the intermediate position the waste valve closes the discharge opening and the water valve is in the open position for adding water to the bowl, and in the second position the waste valve opens the discharge opening and the water valve is in the open position for flushing the bowl.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] Figure 1 is a front perspective view of a reduced water consumption toilet constructed in accordance with the teachings of a preferred embodiment of the present invention.

[0011] Figure 2 is a schematic illustration showing the

interconnection of the actuator with the water valve and waste valve.

[0012] Figure 3 is an enlarged perspective view of the actuator assembly of the reduced water consumption toilet of Figure 1.

[0013] Figure 4 is a top view of the reduced water consumption toilet of Figure 1.

[0014] Figures 5A-5C represent a series of cross-sectional views taken along the line 5-5 of Figure 4 through a first cam and first cam follower of the actuator as the actuator rotates from a closed position (Figure 5A), to a water-add position (Figure 5B), and to a flush position (Figure 5C).

[0015] Figures 6A-6C represent a series of cross-sectional views taken along the line 6-6 of Figure 4 through a second cam and second cam follower of the actuator as the actuator rotates from a closed position (Figure 6A), to a water-add position (Figure 6B), and to a flush position (Figure 6C).

[0016] Figure 7 is an enlarged portion of the cross-sectional view of Figure 5A.

[0017] Figure 8 is an enlarged cross-sectional view of Figure 6A.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0018] The following description of the preferred apparatus of the present invention is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0019] With reference to Figures 1 through 6A-6C of the drawings, a reduced water consumption flush toilet constructed according to the teachings of a preferred embodiment of the present invention is illustrated and generally identified at reference character 10. In the particular embodiment illustrated, the flush toilet 10 is intended to be operated with a reduced amount of water. Such reduced water consumption flush toilets are particularly desirable for motor vehicle such as a recreational vehicle or the like where the water supply is limited. After a reading of the remainder of this detailed description, however, those skilled in the art will readily appreciate that certain teachings of the present invention are not limited to reduced water consumption toilets. Rather, various of the teachings of the present invention have applicability to other vehicle and non-vehicle applications.

[0020] As schematically shown in Figure 2, the reduced water consumption flush toilet 10 of the present invention is illustrated to generally include a water valve 12 and a waste valve 14. The water valve 12 is operative for delivering a source of water from a source of water 16 to a bowl 18 of the toilet 10 for flushing of the bowl 18. The waste valve 16 is selectively operable for opening a discharge outlet 20 defined by a lower portion of the bowl 18. Insofar as the present invention is concerned, the water valve 12 and the waste valve 14 are

conventional in construction. Suitable water valves and waste valves are well known in the art and available from Thetford Corporation of Ann Arbor, Michigan, for example.

[0021] In a manner to be more fully discussed below, the water valve 14 is opened by a first flexible cable 22. The waste valve 16 is similarly controlled for selective opening of the discharge outlet 20 by a second flexible cable 24.

[0022] Operation of the water valve 14 and the waste valve 16 is controlled by an actuator assembly 26. In the embodiment illustrated, the actuator assembly 26 is foot actuated. The actuator assembly 26 is illustrated in the drawings to generally include a mounting portion 28 and a foot lever 30. The mounting portion 28 is secured to a base of the toilet 10.

[0023] The foot lever 30 is illustrated to generally include a central portion 32 that extends from the base of the toilet 10 and a pair of mounting arms 34. Figure 3 illustrates one of the arms 34. It will be understood that the other arm is a mirror image thereof. The arms 34 pivotally coupled to the mounting portion 28 for rotation about a common pivot axis X. Explaining further, pivotally attachment of the arms 34 permits the lever 30 to articulate from a first position (as shown in Figures 5A and 6A) to a second position (as shown in Figures 5C and 6C) downwardly pivoted about 25° from the first position. As will be further discussed below, articulation of the lever 30 from the first position to an intermediate position functions to add water to the bowl 18 without opening the discharge opening 20. Continued articulation of the lever 30 from the intermediate position to the second position functions to selectively open the discharge outlet 20 of the bowl assembly 12 and functions to selectively deliver a source of flush water to the bowl 18 for flushing. It will be appreciated by those skilled in that art that various teachings of the present invention may alternatively be employed with a hand actuated lever or an electronically controlled arrangement.

[0024] The actuator assembly is further illustrated to include a first cam member 36 and a second cam member 38. The first and second cam members 36 and 38 are rotatably mounted to the mounting portion 28. In the embodiment illustrated, the first and second cam members 36 and 38 are mounted to the mounting portion 28 for articulation about a common pivot axis Y. The common pivot axis Y is positioned upwardly and forwardly relative to the pivot axis X. Upper ends of the first and second cam members 36 and 38 are pivotally coupled to the mounting portion 28. The first and second flexible cables 22 and 24 are secured to lower ends of the first and second cam members 36 and 38.

[0025] A rear surface 40 of the first cam member 36 defines a cam following surface for cooperating with a cam 44 carried by the lever 30. The cam 44 is shown to include a convexly curved surface 45 for engaging the cam following surface 40. The cam following surface 40 includes a central raised portion 47.

[0026] A rear surface 46 of the second cam member 38 similarly defines a cam following surface for cooperating with a cam 48 carried by the lever 30. The cam 48 is again shown to include a convexly curved surface 49 for engaging the cam following surface 46. The cam following surface 46 includes a central recessed portion 51.

[0027] With particular reference to the cross-sectional views of Figures 5A through 5C and 7, operation of the actuator assembly 26 to control the water valve 12 will be further described. When the lever 30 is in the first position, the cam 44 carried by the lever 30 engages an upper portion of the cam following surface 40 of the first cam member 36. When the lever 30 is downwardly articulated to the intermediate position, the cam 44 carried by the lever 30 rides on the raised portion 47 of the cam following surface 40 and forces the first cam member 36 to rotate clockwise (as shown in Figure 7, for example). Clockwise rotation of the first cam member 36 operates to pull the first flexible cable 22 secured to the lower end of the first cam member 36 for actuating the water valve 12. In this manner, water is added to the bowl 18 of the toilet 10. As will be addressed below, the waste valve 14 remains closed.

[0028] As the lever 30 is articulated from the intermediate position to the second position, the cam 40 rides down off the raised portion 47 of the cam following surface 40. In this manner, the relative rotation of the first cam member 36 about the pivot axis Y is relatively maintained as the lever 30 is further rotated downwardly. As will be discussed below, in this lever position the waste valve 14 is now open for flushing of the bowl 18.

[0029] With particular reference to the cross-sectional views of Figures 6A through 6C and 8, operation of the actuator assembly 26 to control the waste valve 14 will be further described. When the lever 30 is in the first position, the cam 44 carried by the lever 30 engages an upper portion of the cam following surface 46 of the second cam member 38. When the lever 30 is downwardly articulated to the intermediate position, the cam 48 carried by the lever 30 is received within the recessed portion 49 of the cam following surface 46 and prevents significant rotation of the second cam member 38 about the pivot axis Y. In this manner, the second flexible cable 24 secured to the lower end of the second cam member 38 is not pulled and the waste valve 14 remains closed for the adding of water to the bowl 18 prior to flushing.

[0030] As the lever 30 is articulated from the intermediate position to the second position, the cam 44 rides past the recessed portion of the cam following surface 46. In this manner, the second cam member 38 is forced to rotate counterclockwise about the pivot axis Y (as shown in Figure 8, for example). This clockwise rotation of the second cam member 38 about the pivot axis Y functions to pull the second flexible cable 24 for opening of the waste valve 14 as water continues to flow into the bowl 18 from the water valve 12.

[0031] The description of the invention is merely ex-

emplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.

Claims

1. A reduced water consumption flush toilet for a motor vehicle comprising:

a bowl assembly defining a bowl and a discharge opening at a lower end of the bowl;
a base downwardly extending from the bowl assembly;
a waste valve mounted to the flush toilet for selectively opening and closing the discharge opening of the bowl assembly;
a water valve for selectively delivering a source of flush water to the bowl; and
a common actuator assembly mounted to the base for controlling both the waste valve and the water valve, the actuator assembly coupled to the water valve through a first flexible cable and coupled to the waste valve through a second flexible cable, the actuator assembly including a lever movable from a first position to an intermediate position and from the intermediate position to a second position such that in the first position the waste valve closes the discharge opening and the water valve is in the closed condition, in the intermediate position the waste valve closes the discharge opening and the water valve is in the open position for adding water to the bowl, and in the second position the waste valve opens the discharge opening and the water valve is in the open position for flushing the bowl.

2. The reduced water consumption flush toilet of Claim 1, wherein the actuator assembly includes a first cam member and a second cam member, the first and second cam members having distinct following surfaces for cooperating with one or more cam members carried by the lever.

3. The reduced water consumption flush toilet of Claim 1, wherein the lever is a foot controlled lever.

4. The reduced water consumption flush toilet of Claim 1, wherein the first and second flexible cables are secured to the first and second cam members.

5. The reduced water consumption flush toilet of Claim 2, wherein the first and second cam members are both mounted to the toilet for pivotal motion.

6. The reduced water consumption flush toilet of Claim 2, wherein the first and second cam members are mounted to the toilet for pivotal motion about a common pivot axis. 5
7. The reduced water consumption flush toilet of Claim 1, wherein the lever is rotatably mounted to the toilet. 10
8. The reduced water consumption flush toilet of Claim 7, wherein the actuator assembly includes a mounting portion and the lever is rotatably mounted to the mounting portion. 15
9. The reduced water consumption flush toilet of Claim 8, wherein the bowl assembly and the base are constructed of china and the mounting portion is constructed of plastic. 20
10. The reduced water consumption flush toilet of Claim 2, wherein the first cam member is pivotally coupled to the toilet for rotation about a first pivot axis and includes a first cam following surface for engaging a first cam member carried by the lever, the first cam following surface configured such that the first cam follower causes the first cam member to pivot about the first pivot axis as the lever is moved from the first position to the intermediate position. 25
11. The reduced water consumption flush toilet of Claim 2, wherein the second cam member is pivotally coupled to the toilet for rotation about a second pivot axis and includes a second cam following surface for engaging a second cam member carried by the lever, the second cam following surface configured such that the second cam follower avoids substantial rotation about the first pivot axis as the lever is moved from the first position to the second position and causes the second cam member to pivot about the second pivot axis as the lever is moved from the intermediate position to the second position. 30 35 40
12. The reduced water consumption flush toilet of Claim 2, wherein the first cam member is pivotally coupled to the toilet for rotation about a first pivot axis and includes a first cam following surface for engaging a first cam member carried by the lever, the first cam following surface configured such that the first cam follower causes the first cam member to pivot about the first pivot axis as the lever is moved from the first position to the intermediate position; and 45 50
further wherein the second cam member is pivotally coupled to the toilet for rotation about a second pivot axis and includes a second cam following surface for engaging a second cam member carried by the lever, the second cam following surface configured such that the second cam follower avoids substantial rotation about the first pivot axis 55
- as the lever is moved from the first position to the second position and causes the second cam member to pivot about the second pivot axis as the lever is moved from the intermediate position to the second position.
13. The reduced water consumption flush toilet of Claim 10, wherein the first cam following surface includes a raised central portion.
14. The reduced water consumption flush toilet of Claim 11, wherein the second cam following surface includes a recessed portion.

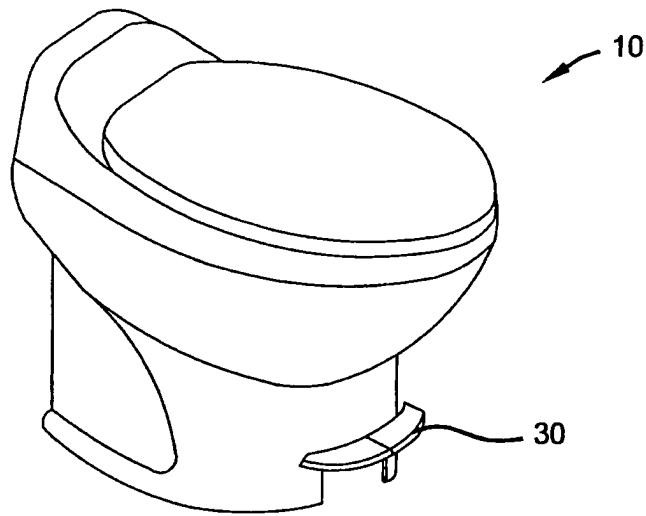


FIG 1

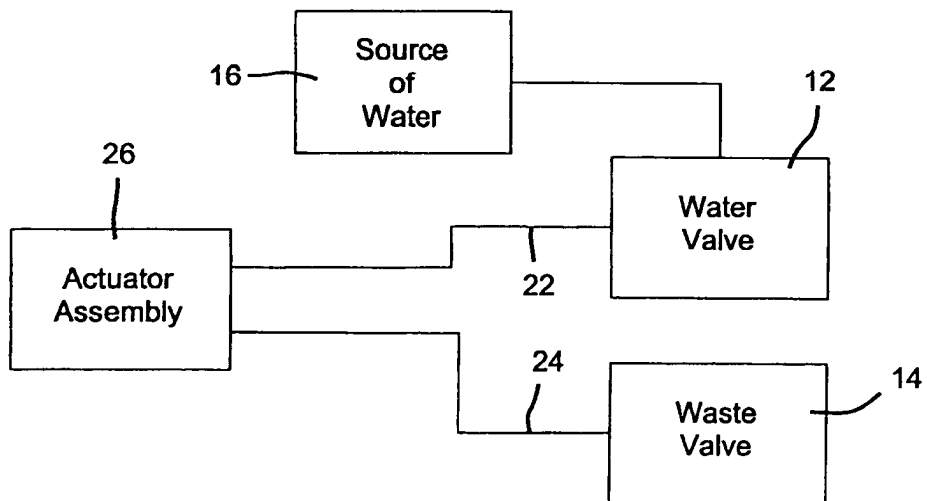


FIG 2

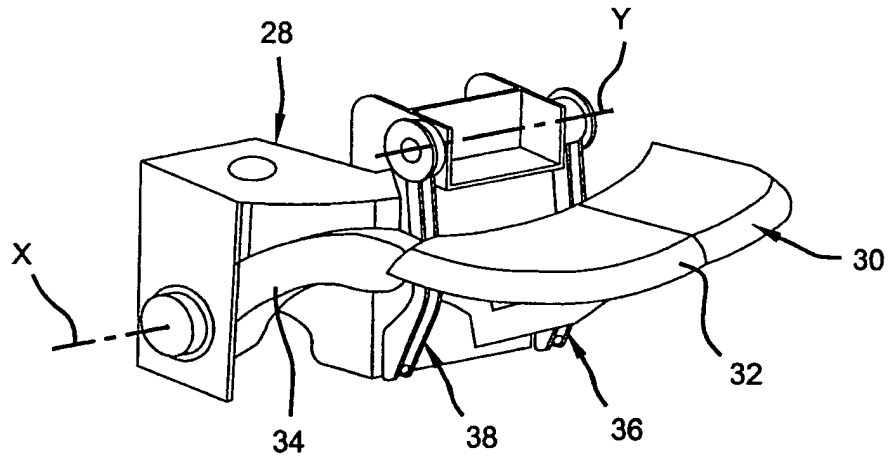


FIG 3

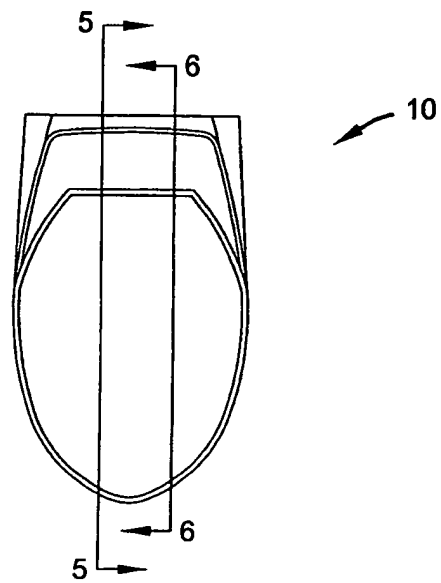


FIG 4

FIG 5A

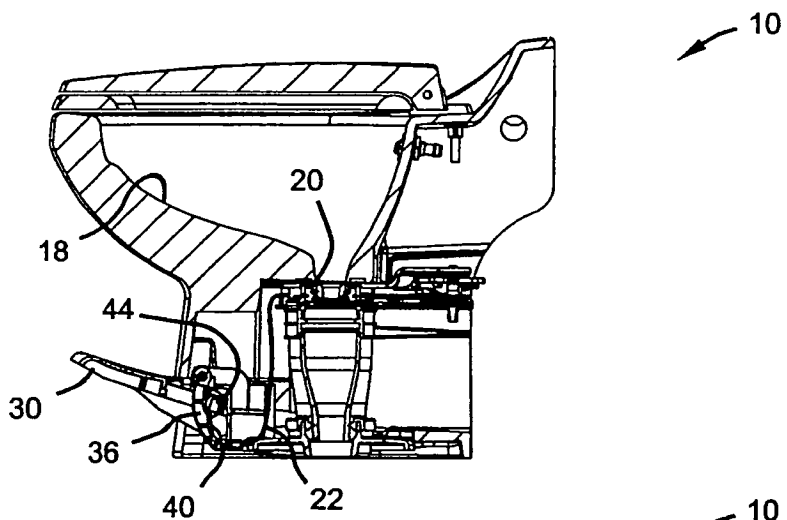


FIG 5B

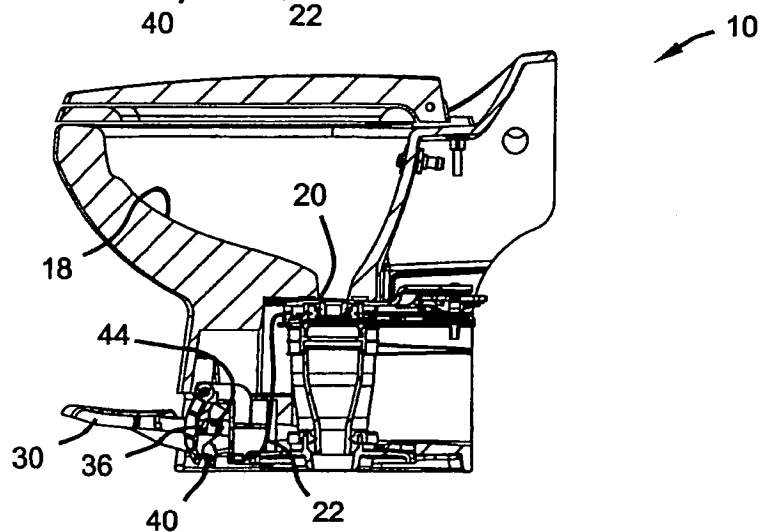


FIG 5C

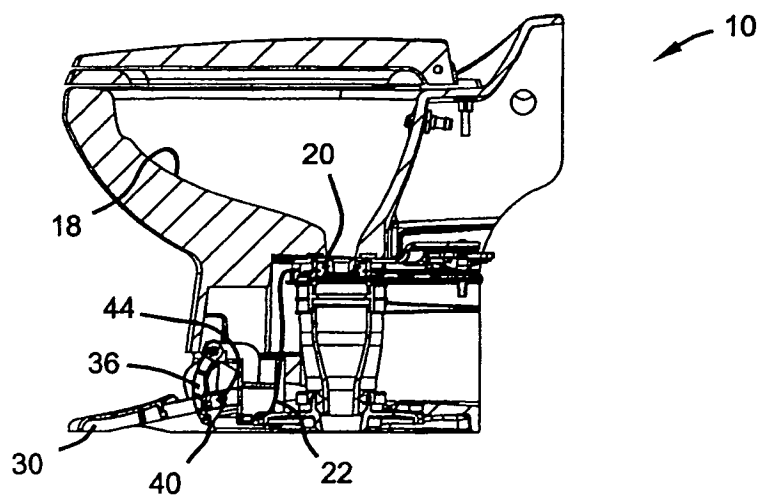


FIG 6A

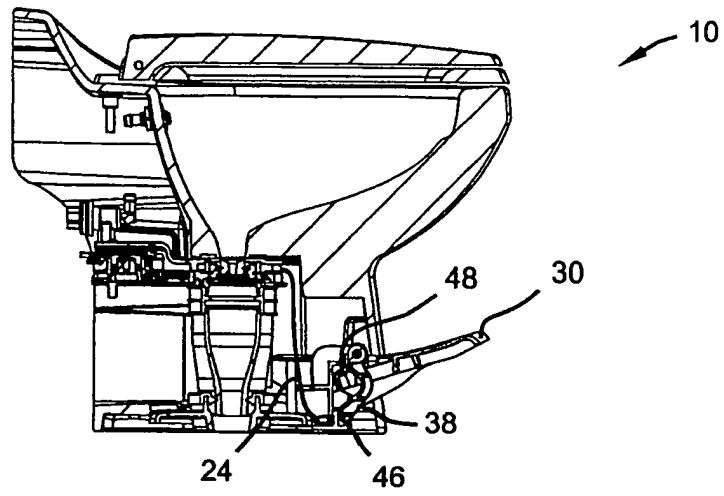


FIG 6B

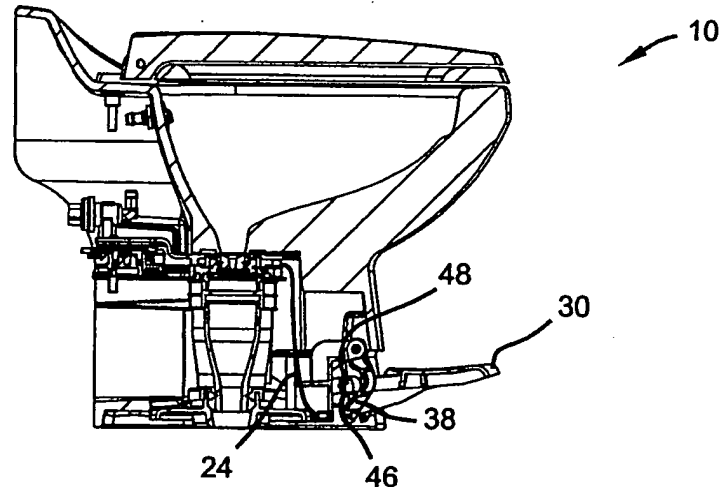
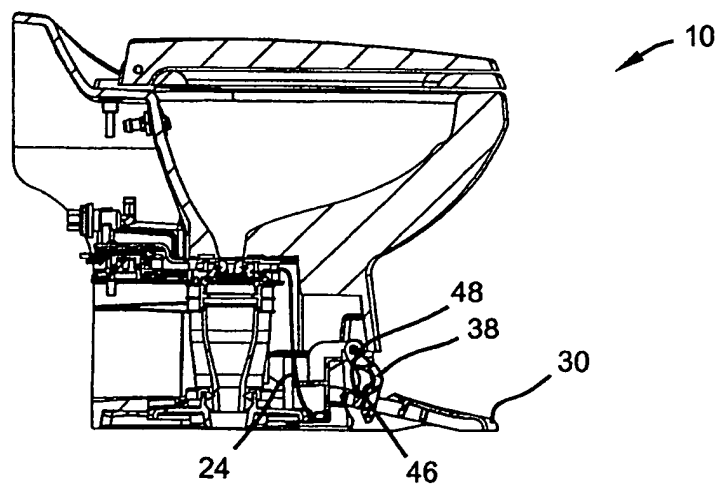


FIG 6C



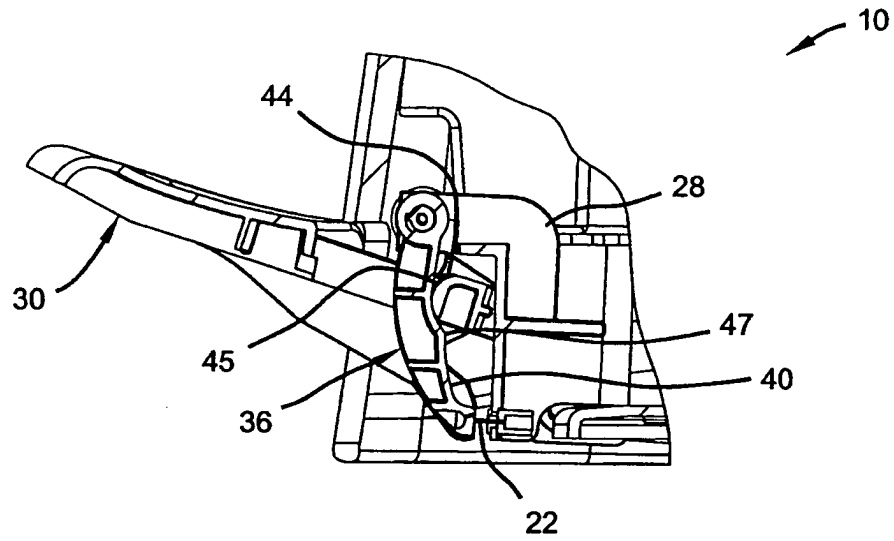


FIG 7

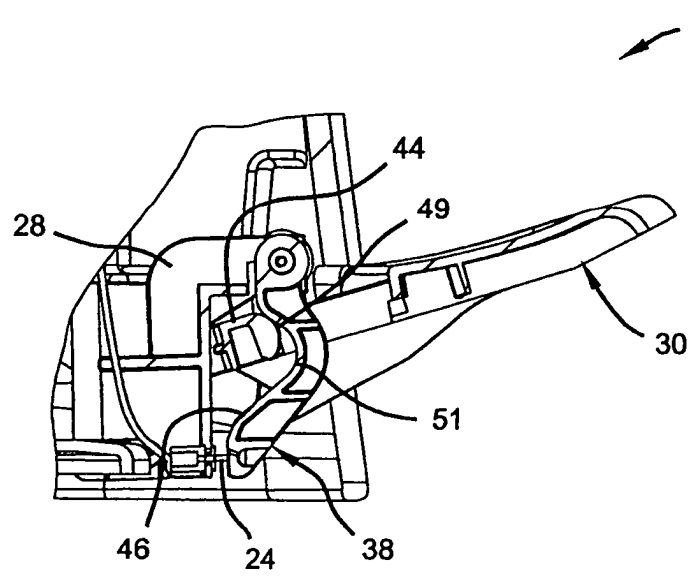


FIG 8