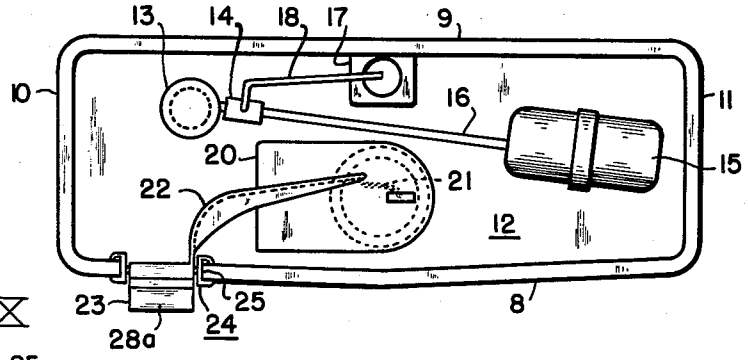
March 16, 1965 S. F. KOROL ETAL 3,173,153

FLUSH LEVER

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Fig. 1



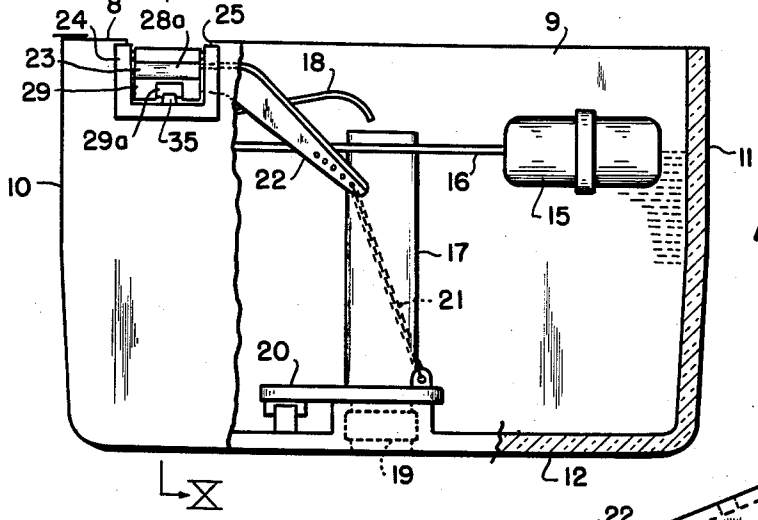


Fig. 2

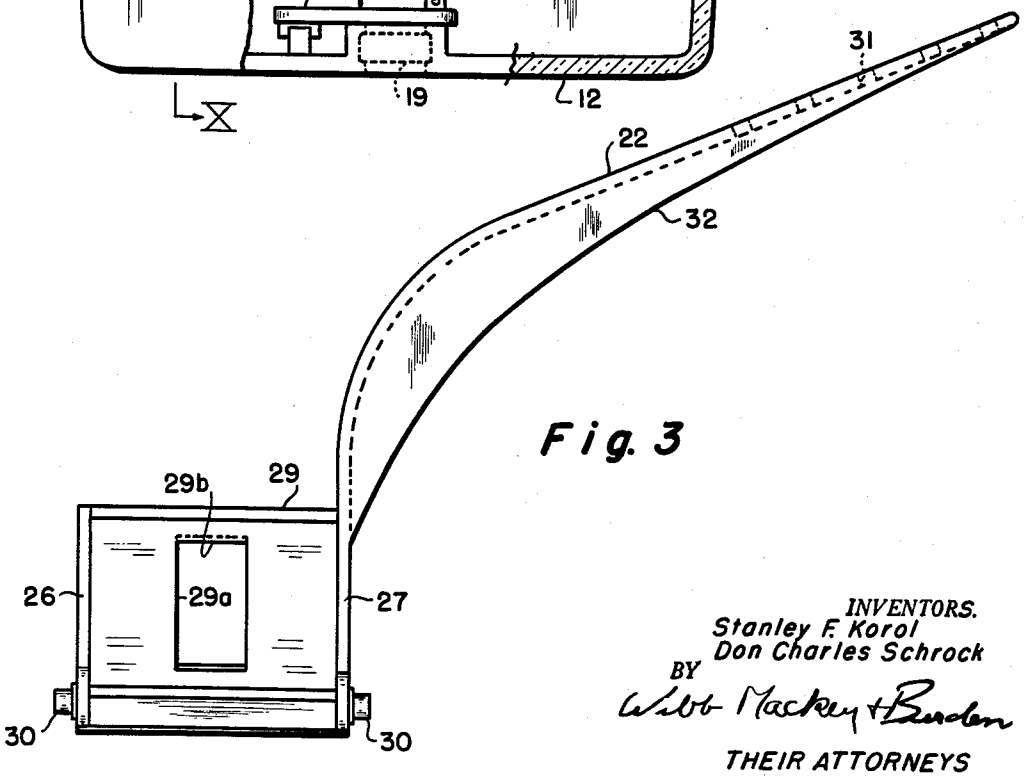


Fig. 3

INVENTORS.
Stanley F. Korol
Don Charles Schrock
BY
Wibb Mackey & Burden
THEIR ATTORNEYS

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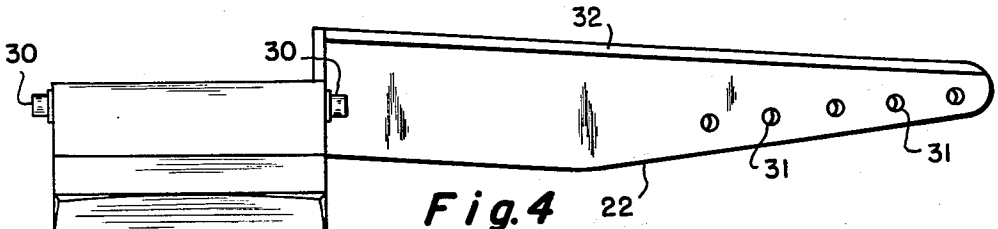


Fig. 4

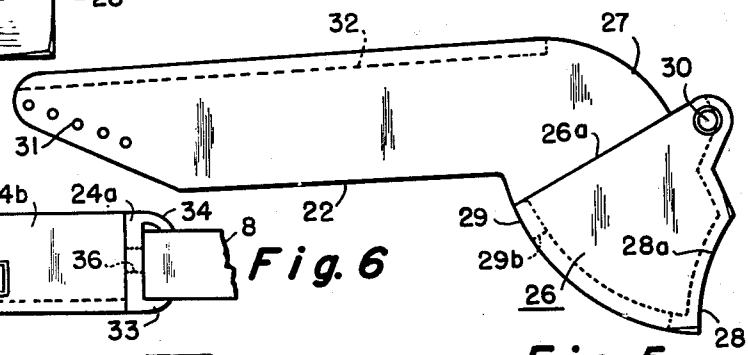


Fig. 5

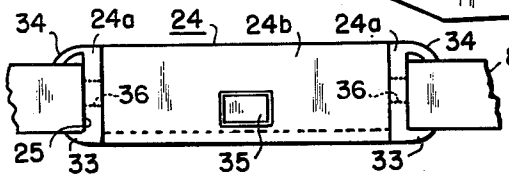


Fig. 6

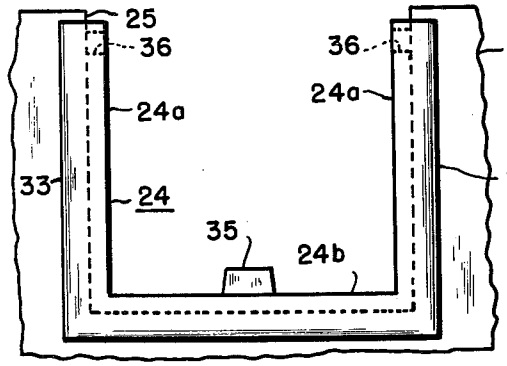


Fig. 7

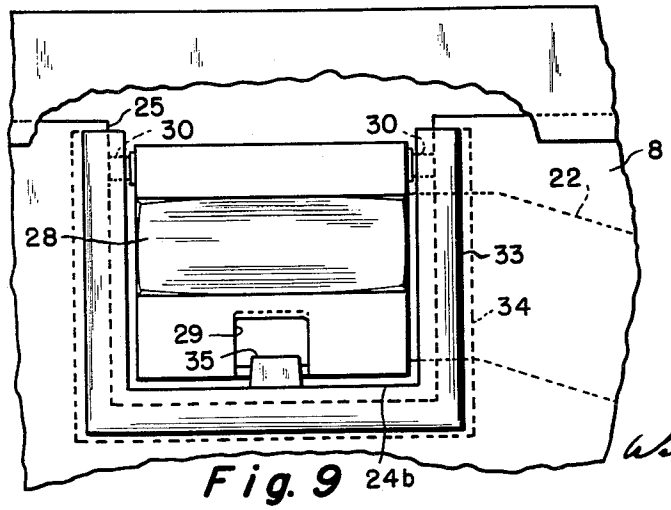


Fig. 9

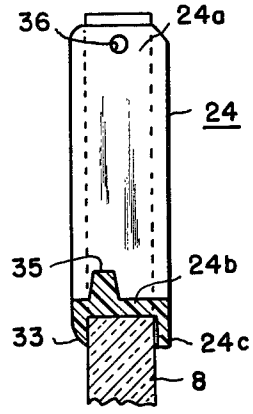


Fig. 8

INVENTORS.
Stanley F. Korol
Don Charles Schrock
BY Wolf Mackey & Purdon
THEIR ATTORNEYS

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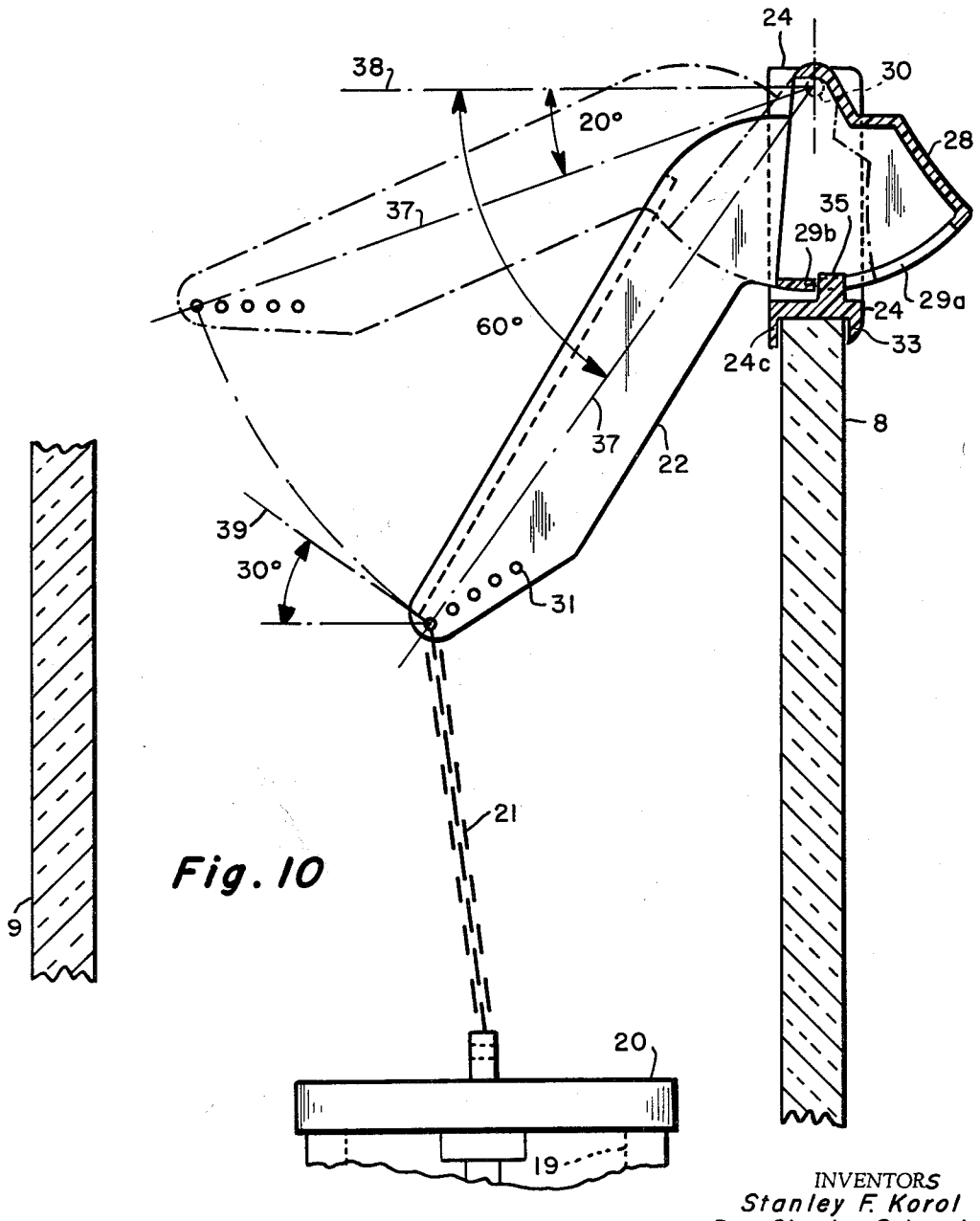


Fig. 10

INVENTORS
Stanley F. Korol
Don Charles Schrock

BY Webb Mackey + Burden
THEIR ATTORNEYS

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3,173,153

FLUSH LEVER

Stanley F. Korol and Don Charles Schrock, Johnstown, Pa., assignors to Crane Co., Johnstown, Pa., a corporation of Illinois

Filed Dec. 3, 1962, Ser. No. 242,852
4 Claims. (Cl. 4—67)

This application relates to a flush lever, more particularly, a flush lever for actuating flush mechanism of a water tank for a water closet. It is a continuation-in-part of our application Serial No. 99,120 filed March 29, 1961, now abandoned.

Our flush lever is characterized by simplicity in construction, installation and operation. It can be manufactured and installed at a considerably lower cost than has been possible with flush levers heretofore known.

In the accompanying drawings, we have illustrated certain presently preferred embodiments of our invention in which:

FIGURE 1 is a plan view of a water tank for a water closet with the top cover removed and showing our flush lever installed on the tank;

FIGURE 2 is a front view of the tank shown in FIGURE 1 with a portion of the front wall removed to show the interior of the tank;

FIGURE 3 is a plan view of the lever portion of our flush lever;

FIGURE 4 is a front view of the lever shown in FIGURE 3;

FIGURE 5 is a left-hand end view of the lever shown in FIGURES 3 and 4;

FIGURES 6, 7 and 8 are respectively plan, front and side views of a portion of a tank wall showing a mounting base for the lever shown in FIGURES 3–5;

FIGURE 9 is a partial plan view with portions broken away of a front wall of a water tank showing our flush lever in place; and

FIGURE 10 is a section along the lines X—X of FIGURE 2 with certain parts omitted.

Referring to the drawings, FIGURE 1 shows a plan view of a water tank for a water closet with the top cover removed. The tank comprises a front wall **8**, a rear wall **9**, end walls **10** and **11**, and a bottom **12**. Within the tank, there is a water inlet pipe **13** and a float valve **14** actuated by a float **15** mounted on a lever **16** extending from the float valve **14**. The tank also has an overflow pipe **17** which may be integral with the rear wall **9** of the tank. A pipe, not shown, extends from the float valve into the tank to refill the tank. A bowl refill pipe **18** leads from the float valve **14** to the overflow pipe **17**. In the bottom **12** of the tank, there is a flush outlet **19** which is opened and closed by a flapper-type flush valve **20** operated by a chain **21** attached to an operating flush lever. The valve may be of the type shown in U.S. Patents Nos. 2,741,775, 2,763,872 or 2,774,972.

The structure so far described is conventional. Our invention is directed to the flush lever which pulls the chain **21**, lifts the valve **20**, and thereby opens the flush outlet **19** so that water can flow out of the tank. Our flush lever comprises a lever which has an arm **22** extending from an axis of rotation of the lever into the interior of the tank. The chain **21**, which is connected to the flush valve **20**, is connected to the outer end of the arm **22** and provides a pivoted connection between the end of the arm and the flush valve. The lever has a second arm **23** which extends from the axis to form an angle about the lever axis with the arm **22** and which is manually engaged to actuate the lever by rotating the lever about its axis. The lever comprising the arms **22** and **23** is rotatably mounted in a base, designated generally by the reference number **24**, which is fitted into a slot **25** cut in the top of a wall of the tank.

Preferably, the flush lever is mounted in the front wall of the tank, as is shown in FIGURES 1 and 2 of the drawings.

FIGURES 3, 4 and 5 show the lever portion of our flush lever. The lever is in the form of an elongated trough having ends **26** and **27**, a front side **28** irregularly shaped in cross-section, and a curved rear side **29** which joins at its lower edge with the lower edge of the front side. Pins **30** integral with or secured to the ends **26** and **27** are positioned adjacent the top and front of these ends. As will be hereinafter described, these pins extend into holes in the base **24** so that the lever may be rotated about an axis parallel to the wall of the tank in which the flush lever is mounted.

The end **27** is extended to form the arm **22** which, as shown in FIGURE 2, extends into the interior of the tank and is curved so as to extend laterally of the point of rotation of the lever. The outer end of the arm **22** has a series of holes **31** whereby the chain **21** can be adjustably secured to the arm **22**. The arm **22** also has a reinforcing web **32**.

As stated, the front side **28** of the lever is irregularly shaped in cross-section. This is done for purposes of decoration and appearance. The side may have any form in cross-section but should provide a surface **28***a* extending generally parallel to the axis of rotation of the lever with sufficient area that it may be manually engaged to actuate the lever.

The rear side **29** of the lever extends from the bottom of the front side **28** to the rear edge **26***a* of the end **26** and from the end **26** to the end **27**. The rear side has a slot **29***a* which, as hereinafter described, limits downward movement of the arm **22** within the tank.

The base **24** in which the lever is mounted is shown in FIGURES 6–8. It is dimensioned to fit within an opening cut in the wall of the tank on which the flush lever is mounted. Preferably, the slot is rectangular or square and, therefore, the base **24** is a frame in the shape of a square U having legs **24***a* and a cross member **24***b* dimensioned to have a frictional fit with the edges of the wall opening when the lever is installed in the base.

To further secure the base in the opening, it has flanges **33** which extend outwardly from the legs **24***a* and downwardly from the cross member **24***b* along the front or outer side of the wall. Flanges **34** extend from the rear or inner edges of the legs **24***a* at a point slightly spaced from the inner side of the wall and are curved so as to press against the wall. Preferably, the base **24** is made of resilient plastic so that, when it is inserted in the opening, the flanges **33** and the flanges **34** frictionally grip the sides of the wall adjacent the opening. The cross member **24***b* has a downwardly extending flange **24***c* which extends along the inner side of the wall adjacent the opening.

The cross member **24***b* has a boss **35** which extends into the slot **29***a* in the lever when the lever is installed in the base and cooperates with the slot to limit downward movement of the arm **22**, as will be later explained. Holes **36** are formed in the upper ends of the legs **24***a* and the pins **30** of the lever extend into these holes when the base and lever are assembled. The dimensions of the pins **30** and of the holes **36** are such that the pins can turn in the holes **36** and thus provide a lever with an axis of rotation which extends parallel to the wall of the tank in which the flush lever is mounted.

To install the flush lever on a tank, the legs **24***a* are spread apart so that the pins **30** can be inserted into the holes **36**. At the same time, the boss **35** on the base is placed into the slot **29***a* in the lever. The assembly is then pressed into the slot **25** formed in the top edge of a wall of the tank. The base frictionally grips the edges of the opening in the wall and is also held in position by the top cover of the tank. FIGURE 9 shows the flush lever in assembled position on a wall of a tank.

Referring to FIGURE 1, it will be seen that, if a person presses on the surface **28***a*, he will rotate the flush lever about the axis of rotation formed by the pins **30** in the holes **36** and thereby raise the arm **22**. The arm **22** is curved rearwardly into the interior of the tank and laterally from the point of rotation of the lever and rotation of the lever will raise the outer end of the arm **22**, pull the chain **21**, and thereby open the flush valve **20**. The lever arm will then fall by gravity, returning the lever assembly to normal position. When the tank has been emptied, the flush valve will return to the position shown in FIGURE 2. Downward motion of the arm **22** is limited by the fact that, when the arm reaches the position shown in FIGURE 2, the inner end **29***b* of the slot **29***a* will engage the boss **35** on the base.

FIGURE 10 illustrates an important feature of our invention. In opening a flush valve, the maximum force is applied at the time of the initial movement of the valve against pressure of the water in the tank tending to hold the valve closed. Our flush lever is arranged so that on initial movement of the lever to open the valve, the end of the lever connected to the valve follows a circular path of movement in which the horizontal component of movement is considerably greater than the vertical component, with the result that there is a considerable initial movement of the arm with a relatively small amount of direct lifting action. This provides a high mechanical advantage at the time when maximum lifting force is required to unseat the flush valve.

Referring to FIGURE 10, it will be seen that a line **37** drawn through the axis of rotation of the lever provided by the pins **30** and the point where the chain **21** is connected to the outer end of the lever makes an angle of approximately 60° with a horizontal line **38** passing through the axis of rotation. When the lever is rotated, the outer end of the lever moves in a circular path, and, at the start of this movement, it moves in a direction indicated by a tangent **39** to the circular path of movement which makes an angle of 30° with a horizontal line passing through the point of tangency. Thus, on initial movement of the outer end of the lever, its horizontal component of movement is considerably greater than its vertical component of movement. This is due to the fact that as shown in FIGURE 10, the dihedral angle between the vertical plane passing through the axis of rotation and the plane including said axis and said pivoted connection is less than 45°. After the flush valve has been opened, the lever has moved along its circular path of movement to a point where the vertical component exceeds the horizontal component and completes the full opening of the valve quickly. In the full open position shown in chain lines in FIGURE 10, the line **37** makes an angle of approximately 20° with the horizontal line **38** passing through the axis of rotation of the lever.

The length of the slot **29***a* is such that its inner end **29***b* engages the boss **35** on downward valve closing movement of the lever to hold the lever **2** when at rest in the position shown in solid lines in FIGURE 10. In an actual embodiment of our invention in which the radius of the circular path of the outer end of the lever **22** is 5⅜" and in which the lever rotates approximately 40°, the point where the chain is attached to the end of the lever will move through an arc approximately 3½" long and rise vertically 2⅝".

Preferably, both the base and the arm are molded of suitable plastic materials so that they can be manufactured at low cost. It is particularly desirable to have the base made of a flexible plastic such as polyethylene so that its legs can be separated to install the pins **30** in the holes **36** and then returned to a position to fit tightly in the opening formed in the tank. When mounted in the tank, the base cannot spread and the pivot pins cannot be dislodged from the pivot holes.

From the foregoing, it is apparent that we have invented a flush lever which can be manufactured and

installed at low cost. An unusual advantage arising from our flush lever is that, in using our lever, the force required to actuate a flush valve has been found to be approximately one half of the force required to actuate a conventional lever.

While we have described certain presently preferred embodiments of our invention, it is to be understood that it may be otherwise embodied within the scope of the appended claims.

We claim:

1. A water closet comprising,
   (A) a tank having a wall,
   (B) a slot in the wall extending from the top edge of said wall,
   (C) a flush valve in the base of the tank,
   (D) a frame for a flush lever mounted within said slot,
   (E) a cover for the tank above said wall and holding said frame within the slot,
   (F) a flush lever mounted in said frame for rotation about an axis extending parallel to the wall, said lever having,
      (1) a first arm
         (*a*) extending inwardly from said axis into the interior of the tank, and having
         (*b*) means pivotally connecting the outer end of this arm to the flush valve,
      (2) a second arm extending from said axis and forming an angle about said axis with the first arm whereby pressure on the second arm will rotate the lever about its axis and raise the first arm within the tank to open said flush valve.
   (G) the connection between the outer end of the inwardly extending arm and the flush valve in the closed position of the flush valve holding the first lever arm downwardly in the tank at an angle of approximately 30° with a vertical plane passing through said axis of rotation whereby, on rotation of said lever, said first arm initially moves in a circular path greater than the vertical movement of the flush valve.

2. A flushing device for a water closet tank having a flush valve adjacent the bottom of the tank comprising,
   (A) said tank being provided with a frame on its front wall,
   (B) a lever having,
      (1) means for mounting the lever on said frame for rotation about a substantially horizontal axis extending parallel to said wall,
      (2) a first arm,
         (*a*) extending inwardly from said axis into the interior of the tank, and having
         (*b*) means pivotally connecting the outer end of this arm to the flush valve,
      (3) a second arm extending from said axis and forming an angle about said axis with the first arm whereby pressure on the second arm will rotate the lever about its axis and raise the first arm within the tank to open said flush valve,
   (C) the connection between the outer end of the inwardly extending arms in the closed position of the flush valve holding the first lever arm downwardly in the tank at an angle of approximately 30° with a vertical plane passing through said axis of rotation whereby, on rotation of said lever, said first arm initially moves in a circular path greater than the vertical movement of the flush valve.

3. A flushing device as described in claim 2 in which the frame is dimensioned to frictionally grip the edges of a slot cut in the top edge of the wall on which the frame is mounted.

4. A flushing device as described in claim 3 in which the frame has flanges which extend along the sides of the edges of the opening in which the frame is mounted.

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