Oct. 10, 1967 J. A. CABRA 3,345,649

MECHANICAL CONTROL DEVICE FOR A LIQUID-CONTAINING WATER CLOSET

Filed June 25, 1965 2 Sheets-Sheet 1

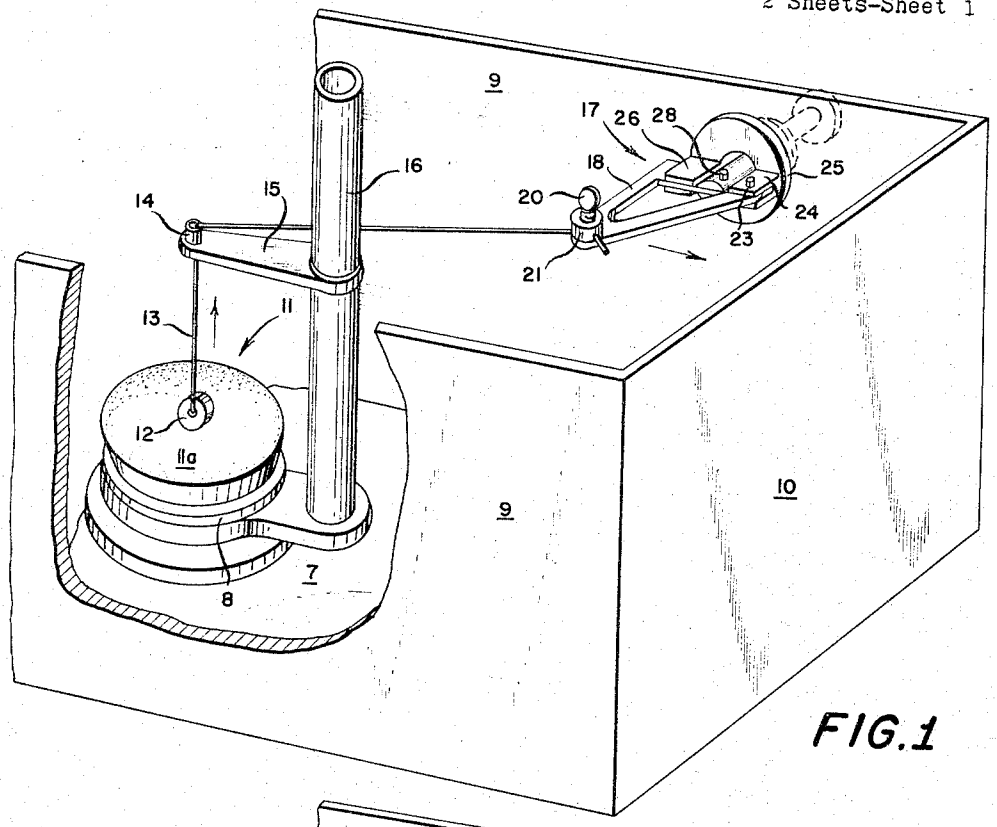
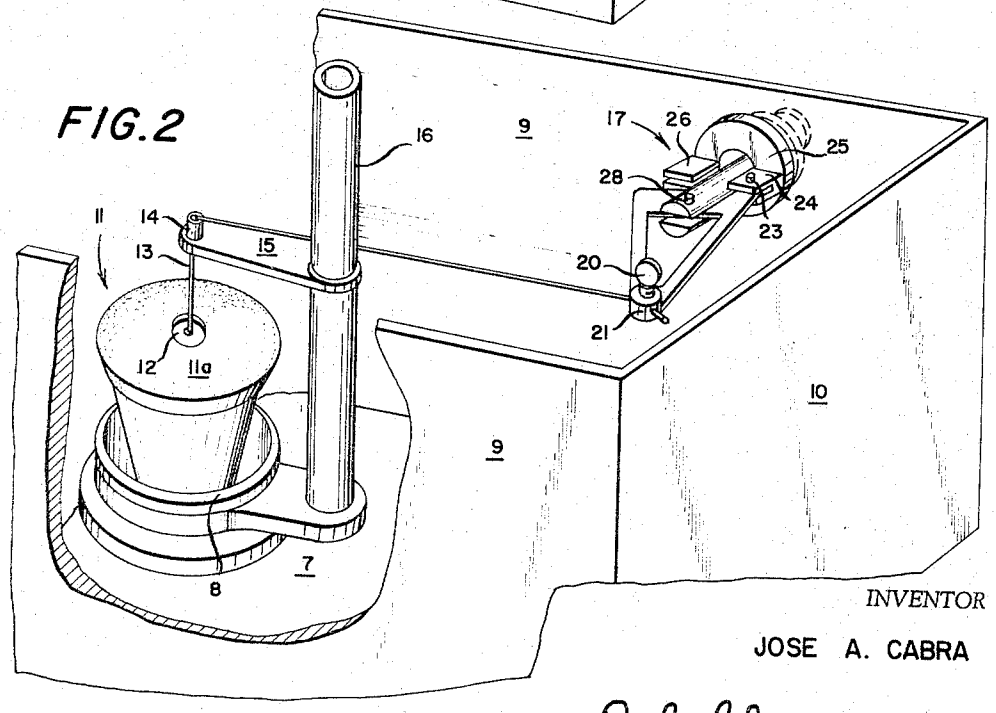


FIG. 1

FIG. 2



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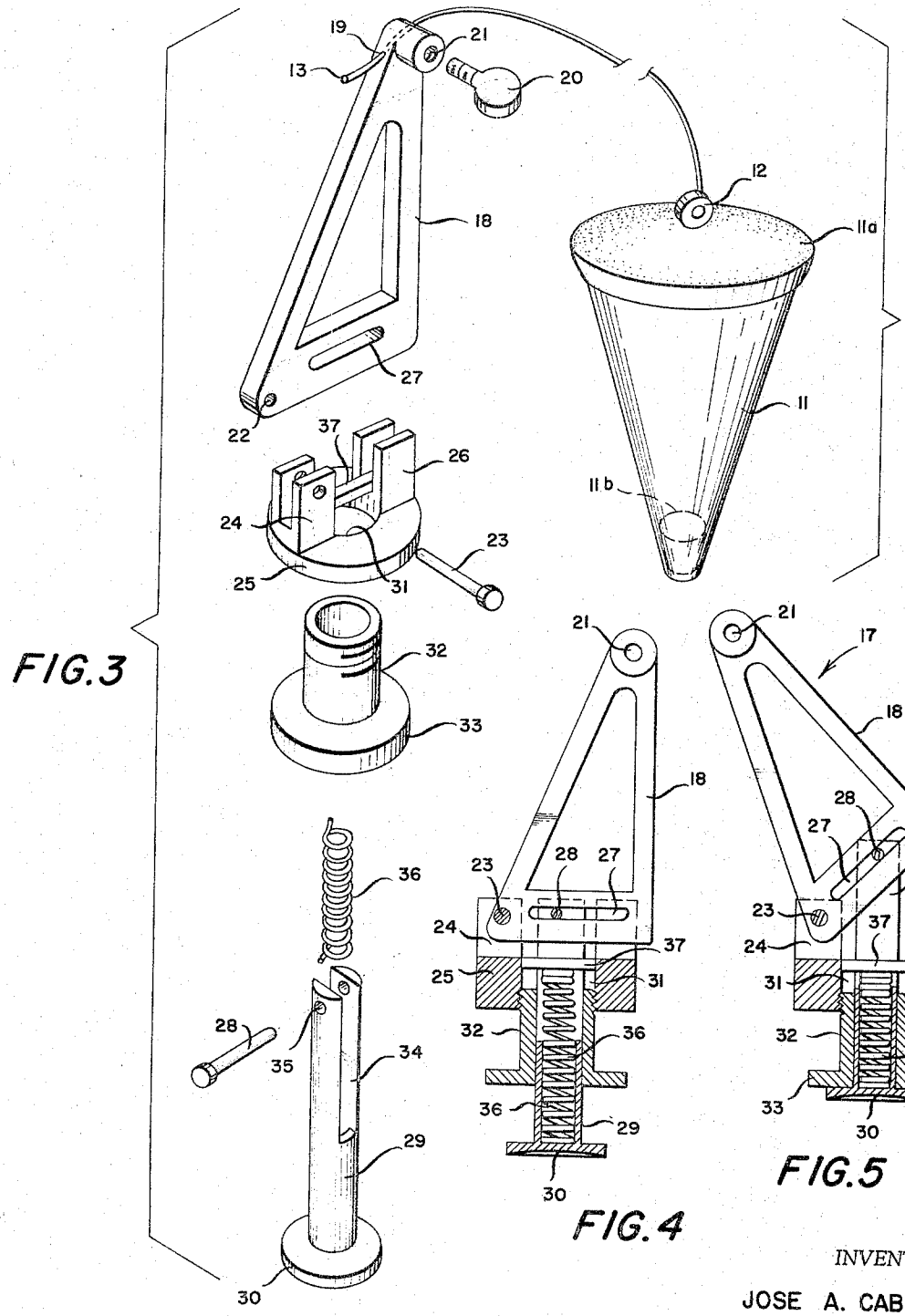


FIG. 3

FIG. 4

FIG. 5

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MECHANICAL CONTROL DEVICE FOR A LIQUID-CONTAINING WATER CLOSET

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ABSTRACT OF THE DISCLOSURE

A valve control assembly for a liquid-containing tank having a discharge port and a vertically shiftable valve plug in its bottom. A horizontal actuating lever supported on a vertical pivot at one end is laterally offset from the valve plug, and its opposite end is connected to the plug by a flexible cord. The lever is provided with a cam slot at the end adjacent its pivot, and an externally controlled, horizontally movable push rod having means for slidably engaging the cam slot actuates the lever and plug.

This invention relates to a remote control mechanism for ball-type valves and consists more particularly in new and useful improvements in a control mechanism for use in connection with the discharge valve of a liquid containing tank, such, for example, as a toilet flush tank.

Heretoforce, numerous mechanisms have been designed to control ball-type valves for the liquid discharge openings in the bottom walls of liquid containing tanks and operated by means exterior of the tank to lift the ball from the discharge valve and automatically permit its return to closed position after the liquid has been discharged. However, most conventional structures of this nature which usually employ a rubber ball are operated by a complicated leverage system articulated to the ball by a series of metallic levers and rods, the ball stem or rod being guided through a fixed centering ring or collar. Structures of this type have a number of disadvantages, such, for example, as the inability to properly align the ball supporting stem for perfectly centered action in dropping the ball into the valve seat, which inevitably results in leakage unless the ball is replaced by hand.

Another disadvantage of these conventional structures lies in the large number of metal fittings required for proper operation of the ball and the fact that corrosion of the moving parts ultimately results in failures and hinders easy operation.

It is an object of the present invention to provide a ball-type valve for controlling the discharge from liquid storage tanks wherein the conventional ball is replaced by a hollow closure plug, preferably formed of plastic which may either blown or molded into the proper shape, said plug being suspended by a cord of nylon or other flexible material which is unaffected by the liquid being controlled, said cord passing through a centering guide, with its opposite end operatively connected to a remotely controlled lever device.

Another object of the invention is to provide a control mechanism of this nature wherein the lower portion of the conical valve plug, when in open position, is normally retained within the confines of the discharge valve opening, which thereby facilitates proper alignment with the valve seat when the plug descends into closed position.

A further object of the invention is to provide a remote control mechanism for liquid storage tanks which is durable, economical to manufacture due to its simplicity in construction, and which is easy and accurate in its operation.

A still further object of the invention is to provide an improved valve operating lever system, preferably composed of suitable plastic material and including a horizontally disposed lever arm pivotally mounted on a vertical axis, said lever arm being cennected to a valve plug by a flexible cord, means being provided adjacent the end of said cord which is connected to said plug for translating horizontal movement of said cord in response to corresponding movement of said lever arm into direct vertical movement of the end of said cord connected to said plug.

With the above and other objects in view which will appear as the description proceeds, the invention consists in the novel features herein set forth, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views:

FIG. 1 is a perspective view of a liquid containing tank, partly broken away, to illustrate the operating parts of the invention which are shown in closed position;

FIG. 2 is a similar view showing the position of the parts when the valve plug is in open position;

FIG. 3 is an exploded view illustrating the individual elements of the invention in perspective;

FIG. 4 is a top plan view of the plug controlling lever in the position assumed when the valve plug is closed and showing the lever mounting structure in section; and

FIG. 5 is a similar view showing the lever in the position assumed when the valve plug is open.

In the drawings, referring first to FIG. 1, **6** generally represents a conventional liquid storage tank, such as a toilet flush tank, having a bottom wall **7**, side walls **9**, and end walls **10**, only one of which is shown in the drawings. The bottom wall **7** is provided with a discharge port bounded by an annular valve seat **8**, the sealing surface of which is preferably beveled to facilitate proper sealing when the coacting valve plug **11** descends to closed position in the manner hereinafter described.

As best seen in FIG. 3, the valve plug **11** comprises a hollow conical body, preferably formed of suitable plastic such as polyethylene or polystyrene, the upper end of which is closed by a head **11***a*, the periphery of which has a beveled annular surface complementary to the sealing surface of the valve seat **8** and preferably projects radially a slight distance beyond the adjacent surface of the plug body **11**. Within the lower extremity of the conical plug **11**, a weighted element **11***b* of any suitable material, such as lead, is secured by any means to facilitate the descent of the plug during closure. Centrally of the head **11***a*, a connecting lug **12** provides means for suspending the plug from the lower end of a flexible cord **13** which is preferably composed of nylon or the like.

In order to insure the accurate vertical reciprocation of the plug **11**, the cord **13** is threaded through a centering eye **14** carried at the outer end of a horizontal guide arm **15** and positioned concentrically with respect to the plug and valve seat. The guide arm **15** is preferably mounted on an upright support **16**, and for this purpose, liquid containing tank is in the form of a toilet flush tank.

The opposite end of the cord **13** is connected to an actuating lever device, generally indicated by the numeral **17**, the particular construction of which will best be understood by reference to FIGS. 3 and 4. The horizontally disposed main lever **18** is preferably substantially the conventional overflow tube may be employed if the triangular in shape, and as seen in the exploded view in FIG. 3, is provided adjacent its apex with a cord receiving opening **19**, through which one end of the cord **13** is passed and secured in place by a suitable threaded set screw **20**. The set screw is insertable in a complementary

threaded boss **21**, the opening of which intersects the cord receiving opening **19**. One extremity of the base of the triangular lever **18** is provided with an opening **22** to enable its pivotal connection by vertical pivotal pin **23** to a projecting, bifurcated ear **24** carried by a support member **25**. The opposite ear **26** of the support member is aligned with the ear **24** and adapted to accommodate the pivotal movement of the base of the lever **18** as seen in FIG. 4. The base of the lever **18** is provided with an elongated, transverse cam slot **27**, adapted to slidably receive a cross-pin **28** which extends through the stem **29** of a pushbutton **30**, to be described.

The base of the support **25** is preferably in the form of a circular flange having a central, internally threaded opening **31** adapted to receive the threaded tubular neck of a locking collar **32**. In assembly, the base of the support **25** is placed against the inner surface of a side wall **9** of the tank **6**, as seen in FIG. 1, and an outer flange **33** on the locking collar abuts the outer surface of the tank wall, a suitable hole being provided in the tank wall to receive the collar **32**. Thus, by tightening the collar in the opening **31**, the leverage assembly is firmly secured in place with respect to the tank wall. The stem **29** of the pushbutton **30** is slidably disposed within the tubular collar **32**, and as best seen in the exploded view of FIG. 3, the inner end of the stem **29** is bifurcated by a longitudinal slot **34**, and the extremity of the bifurcated end is provided with aligned transverse openings **35** to receive the cross-pin **28** previously referred to. The stem **29** is preferably hollow, as best seen in FIG. 4, and receives a coil spring **36**, one end of which abuts the end of the stem closed by the head of the pushbutton **30**, while its opposite end abuts a cross-piece **37** which extends between the bifurcated ears **24** and **26** of the base member **25** and intersects the opening **31** through which the control stem **29** reciprocates.

Thus, as seen in FIG. 5, when the pushbutton **30** is forced inwardly against the tension of spring **36**, the cross-pin **28** lying in the slot **27** provides a camming action which rocks the lever **18** on its pivot **23**. This causes the outer end of the lever which is secured to the cord **13** to swing in an arc and exert a horizontal pulling force on the cord **13**. The horizontal pull on the cord is translated to direct vertical movement of the plug supporting end thereof by the centering eye **14** so that the plug **11** is partially elevated as shown in FIG. 2. Upon release of pressure from the pushbutton **30**, the spring **36** immediately returns the lever **18** to its original position, as shown in FIG. 4, and the plug drops into the valve seat **8**, returning to the closed position shown in FIG. 1. As previously noted, the weighted element **11***b* in the plug and the fact that it is only partially withdrawn from the valve seat during the opening movement causes a perfect centering action when the plug is released for descent. The extent of withdrawal of the plug from the valve seat is regulated by the length of the cord **13**.

It will be apparent that the simplicity of the valve mechanism of the present invention and its control provides a highly efficient, easily operable, and durable means for controlling the discharge opening of a liquid containing tank. It will also be apparent that while the

structure is illustrated as adapted for use with a toilet flush tank, there are many comparable uses to which the invention may be put with equal effect.

From the foregoing, it is believed that the invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed without departing from the spirit of the invention as set forth in the following claims.

I claim:

1. In a valve and control assembly for a liquid containing tank or the like having a discharge port in its bottom; a vertically movable valve plug concentrically engageable with said port, a flexible cord connected to the top of said plug at one end, a horizontally disposed lever arm pivotally supported in laterally offset relation to said valve plug on a vertical axis for horizontal swinging movement and operatively connected to the opposite end of said cord, stationary centering means for said cord disposed concentrically above said port and plug, an externally controlled lever actuating device, a cam slot in said lever, and means responsive to movement of said actuating device, engageable with said cam slot for rocking said lever in either direction, whereby horizontal movement of said cord in response to corresponding movement of said lever is translated to direct vertical movement of the end of said cord connected to said plug.

2. Apparatus as claimed in claim **1**, wherein said actuating device is manually operatable in one direction and including spring means for automatically returning said device to its original position.

3. A valve and control assembly in a liquid containing water closet for transmitting motion to a vertically reciprocable element, comprising a horizontally disposed lever arm mounted for swinging movement on a vertical pivot, a longitudinally reciprocable, spring-biased actuating member, a transverse cam slot in said lever, a cross-pin supported by said actuating member slidably embracing said cam slot, a flexible cord connecting said lever arm to said vertically reciprocable element, and a centering device for said cord disposed concentrically above said vertically reciprocable element, whereby horizontal movement of said cord in response to corresponding movement of said lever arm is translated to direct vertical movement of the end of said cord connected to said vertically reciprocable element.

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