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EXHAUST FAN SWITCH

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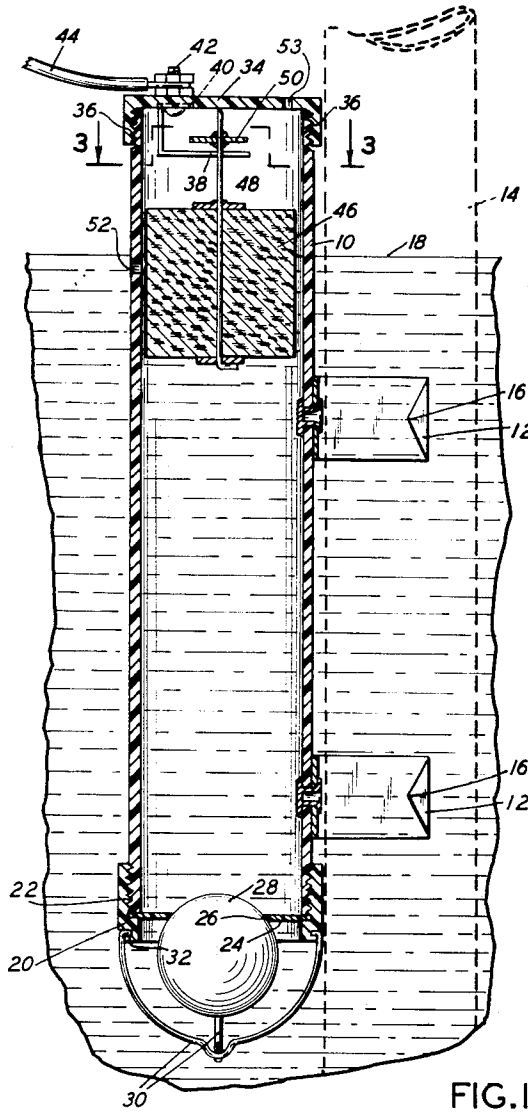


FIG. 1

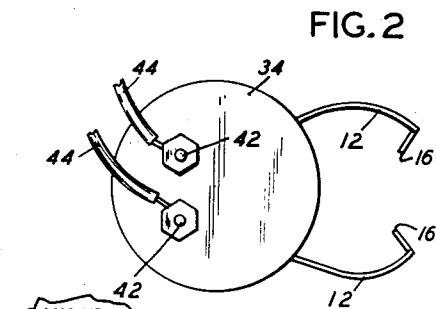


FIG. 2

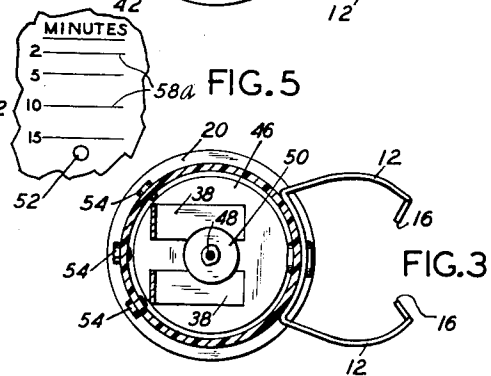


FIG. 3

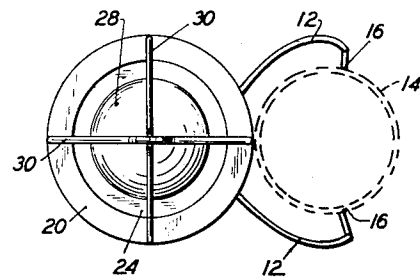


FIG. 4

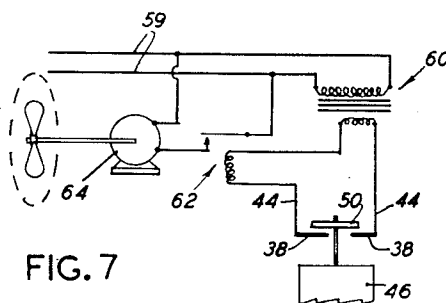


FIG. 5

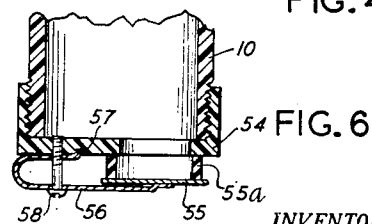


FIG. 6

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## EXHAUST FAN SWITCH

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7 Claims. (Cl. 200—84)

This invention relates to an exhaust fan switch and more particularly to a water actuated switch suitable for mounting in the flush tank of a toilet so as to start an exhaust fan when the toilet bowl is flushed and stop the fan after a time delay which will usually be several minutes.

Various types of time delay switches have been provided for stopping and starting an exhaust fan for a bathroom or other enclosure containing a toilet. In most cases such switches depend upon manual actuation of the switch to start the fan and then automatically stop the fan after a time delay. Various types of time delay devices including dashpots and also thermostatically operated switches with a heater have been employed but such devices have either been expensive or subject to rapid deterioration or are not capable of operating to provide repeated cycles of time delay immediately following each other. Also, such switches do not, in general, provide for automatic starting of a fan.

In accordance with the present invention, a switch is provided which is adapted to be mounted within the interior of the flush tank of a toilet so that the exhaust fan is automatically started whenever the toilet bowl is flushed. The switch is simple in construction and utilizes the changes in the level of the water in the flush tank to produce a time delay. The time delay is of greater duration than the period it takes to empty and again fill the flush tank, is adjustable over a wide range and the delay time starts again each time the toilet bowl is flushed.

It is therefore an object of the present invention to provide an improved exhaust fan switch.

Another object of the invention is to provide a time delay switch for an exhaust fan automatically actuated by changing water levels in the flush tank of a toilet when the water level in such flush tank varies.

A further object of the invention is to provide a switch which can be easily mounted in the flush tank of a toilet to automatically start and then after a time delay stop an exhaust fan.

A still further object of the invention is to provide a switch actuated by changing water levels in the flush tank of a toilet so that an exhaust fan connected to such switch is started when the toilet bowl is flushed and is stopped after a time delay of greater length than the time it takes to again fill the tank.

Other objects and advantages of the invention will appear in the following description of a preferred embodiment of the invention given in connection with the attached drawing of which:

Fig. 1 is a vertical sectional view through the switch of the present invention;

Fig. 2 is a top view of the device of Fig. 1;

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 1;

Fig. 4 is a bottom view of the device of Fig. 1;

Fig. 5 is a fragmentary view showing a portion of the outside of the casing of the device of Fig. 1;

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Fig. 6 is a fragmentary vertical section showing a modified water discharge valve; and

Fig. 7 is a schematic diagram showing a suitable circuit for the switch of the present invention when employed for stopping and starting a fan.

Referring more particularly to the drawing, the switch of the present invention includes a vertically extending casing 10 which may be of any desired cross-sectional shape but preferably is tubular and of the circular cross section shown. The casing 10 is provided with laterally extending spring clips 12 of non-corroding spring metal, such as brass, suitably secured thereto and spaced vertically therealong. The clips 12 are adapted to fasten the casing 10 to the usual water supply post 14 found in flush tanks of toilets and shown in dotted lines in Fig. 1 by merely pressing the casing 10 sidewise toward such post in a manner causing the post to enter the clips between the points 16 so that such clips partially surround the post. The points 16 engage the surface of the post to provide secure attachment of the casing to the post. The casing is positioned on the post so that a major portion of its height is submerged in the water when the tank is full, i. e., most of the casing extends below the upper water level indicated at 18.

The casing 10 may be of any suitable non-corroding material, such as a molded or extruded thermoplastic or thermoset resin, and has a collar 20 suitably secured to its lower end, for example, by screw threads 22. The collar has a shoulder holding a valve seat member 24 in watertight relationship against the lower end of the casing 10 and the valve seat member is provided with a centrally disposed opening 26 therein. The valve seat member 24 cooperates with a float valve 28, preferably in the form of a hollow ball made of any suitable resilient material such as a rubber or rubber-like material. The valve seat member 24 may be of rigid material, for example, it may be made of one of the resins referred to above or alternatively it may be made of a flexible material such as rubber in which case the ball 24 may be of rigid material, for example, the ball may be a table tennis ball. The ball 24 is retained in position adjacent the valve seat member 24 by a cage, which may for example, be made of crossed wires 30 engaging in recesses 32 in the lower portion of the collar 20. It will be apparent that the ball float valve 28 will discharge water from the interior of the casing 10 when the water level in the tank falls below the valve and that such valve will prevent entrance of water into the interior of the casing 10 when the water level again rises above the valve.

The upper end of the casing is closed by a cap 34 secured thereto in any suitable manner such as by threads 36. The cap 34 is of insulating material such as one of the resins referred to above and has a pair of spring contact members 38 secured to its inner surface. The contact members are preferably of a non-corroding spring metal, such as brass, and extending laterally of the casing so as to be spaced from each other and from the top of the cap 34. The contact members each have an upwardly extending portion at one end terminating in a reversely bent portion 40 which may be positioned in one of a pair of spaced recesses in the lower surface of the cap 34. The portions 40 are held in the recesses by screws 42 which also form spaced electrical connectors for wires 44 positioned exteriorly of the cap 34.

A float 46 which may be of waterproofed cork or other suitable material is positioned in the interior of the casing 10 adjacent its upper portion. The float has attached thereto by means of a rod 48 an upper contact element 50 also of non corroding metal. The contact element extends over the contact members 38 so as to engage such contact members when the float is in its lower

position and is raised such above contact members when the float is in its upper position shown in Fig. 1. It will be apparent that the float 46 will fall to its lower position when the interior of the chamber 10 is emptied of water so as to cause the contact element 50 to bridge the contact members 38 and close an electric circuit including the wires 44. When the water in the tank again rises, the float valve 28 closes the opening 26 in the valve seat member 24 to prevent water from entering the lower portion of the casing 10.

The casing 10 is provided with an opening 52 for controlled admission of water into the casing. As soon as the water in the tank reaches a level above the opening 52, a small stream of water enters the casing 10 to slowly fill the same and it will be apparent that after a time delay, the float 46 will be carried upwardly to move the bridging contact element 50 out of contact with the contact members 38. An air vent 53 may be provided in the cap 34 to enable air trapped in the casing to be exhausted therefrom and also to enable water to be more rapidly discharged from the casing 10 when the water level in the flush tank falls below the valve 28.

A modified form of discharge valve for the lower end of the casing 10 is shown in Fig. 6 and includes a cap 54 having a discharge opening therein surrounded by a tubular gasket 55 of rubber or similar resilient gasket material having its upper end adhesively secured to the outer surface of the cap 54 and its lower end providing a valve seat. A valve in the form of a disc 55 of non corrosive metal, such as brass, is pressed against the lower end of the gasket 55a by a leaf spring 56 having one end secured to the disc 55 and its other end reversely bent and engaged in a slot 57 in the lower surface of the cap 54. The spring is secured to the cap by an adjusting screw 58 extending through holes in the reversely bent portions of the spring and screw threaded into the cap 54. The force of the spring tending to hold the disc 55 against the gasket 55a can be adjusted by the screw 58 and such force is made just sufficient to engage the disc with the gasket when the water has been discharged from the casing 10 and the water level in the flush tank is below the disc. By employing a spring having a low spring force and the adjustment just described, the valve opens to discharge water from the casing 10 when the water level in the flush tank falls and closes to prevent entrance of water into such casing when the water level in the flush tank again raises.

The opening 52 is preferably positioned near the upper end of the casing 10 but spaced from such upper end so that the contacts 38 and 50 are maintained above the water level in all adjusted positions of the casing vertically along the water supply post 14 and so that the time required to fill the major portion of the chamber in the casing 10 is added to the time required for the water in the flush tank to reach the level of the opening 52. As is well known, the flush tank of a toilet rapidly fills until the float valve of the flush tank begins to close, after which the increase in water level becomes progressively slower. By vertically adjusting the casing 10 along the water supply post 14 the time delay before the contacts 50 and 38 are disengaged, after having been engaged by downward movement of the float 46, can be adjusted through a considerable range. Calibrations 53a are preferably placed on the exterior surface of the casing 10 adjacent the opening 52, as indicated in Fig. 5. Such calibrations indicate the approximate time delay in minutes and the casing 10 is adjusted so that the appropriate calibration registers with the final level of water in the flush tank when the flush tank float valve has completely closed.

Fig. 7 shows an example of a circuit in which the switch including the contact members 38 and contact element 50 may be employed. Such circuit may be supplied from the usual 110 volt house service lines 59 through a stepdown transformer 60, for example, a

transformer of the door bell ringing type, to secure a low voltage low power circuit at the switch. A 6 volt circuit is entirely satisfactory although voltage up to approximately 20 volts can be safely employed. The contacts 38 and 50 are connected in series with the secondary winding of the transformer 60 and the actuating winding of a relay 62 having its normally open contacts in series with a fan motor 64 and with the line 59.

The operation of the switch of the present invention is believed to be apparent from the above description. The switch casing 10 is secured to the water supply post 14 in the tank by means of the clips 12 so as to extend below the upper water level 18. When the water level is at 18, the casing 10 will fill with water and the float 46 will occupy its upper position such that the low voltage electric circuit including the wires 44 is broken by the contact element 50. When the toilet bowl is flushed, the water level in the flush tank is lowered below the discharge valve of Fig. 6, and such valve opens to discharge the water from the casing 10. This causes contact element 50 to engage contact members 38 to cause a closing actuation of relay 62 so as to start the fan motor 64. The water level in the tank thereafter rises to cause the discharge valve in the lower end of the casing 10 to close and as the water approaches its maximum level, a small stream of water enters the casing 10 through the opening 52. At a predetermined time after the toilet bowl has been flushed, the chamber 10 will fill sufficient to cause the float 46 to be carried upwardly and again break the low voltage electric circuit to cause the relay 62 to open and stop the fan motor. The time delay can be adjusted by the user of the switch over a considerable time range by varying the vertical height of the casing 10 in the flush tank. Thus the time delay may be varied from one or two minutes up to ten or fifteen minutes, the usual time being about five minutes. It will be noted that the time cycle starts again each time the toilet bowl is flushed such that the fan continues to run for a predetermined period of time after the last flushing operation.

I claim:

1. A time delay switch for mounting in a tank in which the level of water is varied between two spaced levels, said switch comprising a vertically extending casing, means for supporting said casing in said tank with the lower portion of said casing below the upper and above the lower water level in said tank, a valve for discharging water from said lower portion when the water level in said tank falls below said valve and for preventing entrance of water into said casing when said water level rises above said valve, said casing having an opening through a wall thereof below said upper level of water in said tank for controlled entrance of water into said casing, a float in said casing having an upper and lower position, and an electrical contact actuated by said float to complete an electric circuit when said float is in one of said positions and to break said circuit when said float is in the other of said positions.

2. An exhaust fan switch for mounting in the flush tank of a toilet, said switch comprising a vertically extending casing, means for supporting said casing in said tank with at least a substantial portion thereof below the upper water level in said tank, said casing having a discharge opening for discharging water from the lower portion of said casing, a spring actuated valve for said discharge opening, said valve being biased to closed position by said spring and opening when the water level in said tank falls below said valve and closing to prevent entrance of water into said casing when said water level rises above said valve, said casing having an opening through a wall thereof below said upper level of water in said tank for controlled entrance of water into said casing, a float in said casing having an upper and lower position, and an electrical contact actuated by said float to complete an electric circuit when said

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float is in one of said positions and to break said circuit when said float is in the other of said positions.

3. An exhaust fan switch for mounting in the flush tank of a toilet, said switch comprising a vertically extending casing, means including spring clips for attaching said casing to the water supply post of said tank with at least a substantial portion of said casing below the upper water level in said tank, a valve for discharging water from the lower portion of said casing when the water level in said tank falls below said valve and for closing said lower portion to prevent entrance of water into said casing when said water level rises above said valve, said casing having an opening through a wall thereof adjacent its upper end and below said upper level of water in said tank for controlled entrance of water into said casing, a float in said casing having an upper and lower position, and an electrical contact actuated by said float to complete an electric circuit when said float is in one of said positions and to break said circuit when said float is in the other of said positions.

4. An exhaust fan switch for mounting in the flush tank of a toilet for starting a fan when the toilet bowl is flushed and stopping said fan after a time delay, said switch comprising a vertically extending casing, means for supporting said casing in said tank for vertical adjustment and with a substantial portion of the length of said casing below the upper water level in said tank, a valve for discharging water from the lower portion of said casing when the water level in said tank falls below said valve and for closing said lower portion against entrance of water past said valve when the water level in said tank rises above said valve, said casing having an opening for controlled entrance of water from said tank into said casing when the water level in said tank rises toward said upper level, a float in said casing and an electrical contact actuated by said float to start said fan when the water level in said casing falls due to flushing of said toilet bowl and for stopping said fan after a time delay when the water level in said chamber rises to raise said float.

5. An exhaust fan switch for mounting in the flush tank of a toilet for starting a fan when the toilet bowl is flushed and stopping said fan after a time delay, said switch comprising a vertically extending casing, means for attaching said casing to the water supply post of said tank with a substantial portion of the length of said casing below the upper water level in said tank, a float valve for discharging water from the lower portion of said casing when the water level in said tank falls below said valve and for closing said lower portion against entrance of water past said valve when the water level in said tank rises above said valve, said casing having an

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opening for controlled entrance of water from said tank into said casing when the water level in said tank rises toward said upper level, a float in said casing and an electrical contact actuated by said float to start said fan when the water level in said casing falls due to flushing of said toilet bowl and for stopping said fan after a time delay when the water level in said chamber rises to raise said float.

6. An exhaust fan switch for mounting in the flush tank of a toilet for starting a fan when the toilet bowl is flushed and stopping said fan after a time delay, said switch comprising a vertically extending casing, means for supporting said casing in said tank for vertical adjustment and with a substantial portion of the length of said casing below the upper water level in said tank, a discharge opening in the lower end of said casing, a float valve for discharging water through said discharge opening when the water level in said tank falls below said valve and for closing said opening against entrance of water when the water level in said tank rises above said valve, said casing having an opening for controlled entrance of water from said tank into said casing when the water level in said tank rises toward said upper level, a float in said casing and an electrical contact actuated by said float to start said fan when the water level in said casing falls due to flushing of said toilet bowl and for stopping said fan after a time delay when the water level in said chamber rises to raise said float.

7. An exhaust fan switch for mounting in the flush tank of a toilet for starting a fan when the toilet bowl is flushed and stopping said fan after a time delay, said switch comprising a vertically extending casing, means including clips for supporting said casing on the water supply post in said tank for vertical adjustment and with a substantial portion of the length of said casing below the upper water level in said tank, a discharge opening in the lower end of said casing, a valve for discharging water through said discharge opening when the water level in said tank falls below said valve and for closing said opening against entrance of water when the water level in said tank rises above said valve, said casing having an opening for controlled entrance of water from said tank into said casing when the water level in said tank rises toward said upper level, a float in said casing and electrical contacts actuated by said float to start said fan when the water level in said casing falls due to flushing of said toilet bowl and for stopping said fan after a time delay when the water level in said chamber rises to raise said float.

No references cited.