

Design, Development and Fabrication of High Pressure Automatic Flushing System

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Abstract— In today's life, most people of any age forget to flush the urinal system after using it. It creates bad odor and unpleasant environment especially in public restrooms, schools and colleges which affects the health of the people using it. This causes various problems to the environment. Water is an important resource, which we owe the responsibility to pass to the future generations. The wastage of excess water as well as the unpleasant conditions in the surrounding is the threat to the environment and it is also very unhygienic. To overcome these environment and unhygienic problems, it is proposed to design an automatic flushing system for both urinal and commode by using the hydraulic method and Pascal's law, which flushes the urinal and commode system automatically after every usage. Only limited amount of water at high pressure is used to flush after every usage so that wastage of water would be stopped. The body weight of user is used to actuate the system eliminating need of user to press button after use. Commode lid will close automatically and gets locked till flushing is complete. It is very economic and provides a good and clean hygienic environment for the public and the students of schools and colleges. It does not require any electrical power for operation and can be utilized in large scale in rural areas with minimum capital cost and maintenance.

Key words: Automatic Flushing, Automatic Lid Open and Close, Water Saving, Pressurized Water

I. INTRODUCTION

In our world every people rich or poor, tribe or countrymen, Indian or American or any living organism, the very common thing is that everyone intake food and water daily and do the excretion of waste through various forms. In public restrooms, schools and colleges due to the improper flushing of toilet and maintenance, bad odor and unpleasant environment are common things. This unhygienic environment causes many diseases like, Nausea and Asthma etc. On the other hand people feel uncomfortable to use the toilet and commode as well as. This leads to the wastage of water also. To overcome these entire problems automatic toilet flushing system is use which has sensor or microcontroller. This electronic flushing system is expensive and require power unit to operate. So it is proposed to device a high pressure automatic flushing system which is based on hydraulic mechanism and it does not require any electronic devices and because of its high pressure it will save water also.

The flushing mechanism provides a large amount of flow of water through Generally three classification of toilet flushing system are tank style gravity-flow toilet, tank style pressure-assist toilet, tank less style high-pressure toilet (flush meter). Among these three toilets type's pressure-assist and flush meter types are commonly used and better from gravity-flow toilets because they use the water system pressure to assist their operations the toilet or

urinal. This system uses the gravity pressure to flush the toilet. After pressing the flushing button water falls into the bowl with the help of gravity pressure.

II. OBJECTIVES

While the need for the automatic flushing system is obvious requirement, the objective of this project is to develop a complete automatic flushing system that would

- 1) Automatically flush the toilet.
- 2) Use the minimum amount of water for every flush.
- 3) Give a pleasant and hygienic environment.
- 4) Prevent the wastage of water and save the water.
- 5) Avoid the electrical output for the flushing.
- 6) Provide a cheapest flushing system.
- 7) Give a solution for automatic close and open of the lid.
- 8) Provide a high pressure water output so then more waste will be clean.
- 9) Provide less installation charge.
- 10) Give comfort in using the toilet and enable the user to have a good opinion about the management of the public toilets, schools and colleges.

III. DRAWBACKS IN EXISTING SYSTEM

Flushing system which is generally used in public toilets, schools and colleges are done by manually. People go and do their work and after doing the work they need to push the flush button for flushing operation. 50 percent of people forgot to push the flush button after use. So we need an automatic flushing system which will do the flushing operation automatically with less amount of water and also do the flush at high pressure. When high pressure will be use the cleaning of waste will be more and it will be more hygienic.

So many automatic flushing systems are available in the market. Some of the need electric power or batteries to do the operation and some of them use mechanical and kinematic system for flushing. But in every existing flushing system we can see that water needs for every flushing is average 2-6 liters and water output pressure is about 20-50 psi. A normal person or an adult urinary output is between 400-500 ml. So 1 liter water is enough to flush out all the waste after every use with high pressure. But all the existing system uses 2-6 liters water in every flush, so we can say that more water is waste during the flushing system.

Electrical flushing system and sensor flushing system is required electrical power output or batteries and they are too expensive. So they cannot be use in public toilets, schools and colleges. Sometimes it is seen that user is at the middle of the use of toilet and it starts flushing at the middle. Sometimes it is also seen that sensor is not able to sense the human body so it cannot be able to flush also. As a result the person before you did not flush the toilet because they thought that it would flush automatically but it

did not flushed. This will cause bad odor and unpleasant environment.

IV. METHODOLOGY

The automatic flushing system is proposed with the action of hydraulic linkage using cylinder and piston. To design and fabricate the automatic flushing system with more pressure at the exit some design consideration need to be mentioned in table (i).

- For 40 kg of body weight acting pressure on the pedestal is 0.27 psi.
- For 20 feet of height water pressure is 8.66 psi.
- Flow rate through 3/4" pipe from 20 feet height water tank is 31 GPM.
- Velocity through the 3/4" pipe from 20 feet height water tank is 23 feet/second.
- Pressure through the 3/4" pipe from 20 feet height water tank is 50 psi.

V. DESIGN OF A UFS

The high pressure automatic flushing system proposed in this paper, is contains the following design consideration:

- Cylinder 1 design.
- Cylinder 2 design.
- Cylinder 3 design.
- Pedestal to cylinder 1 design mechanism.
- Pedestal to lid and ball valve design mechanism.

A. Cylinder 1 design

Input pressure from the main water tank and the pedestal around 70 psi is applied to the cylinder 1. Cylinder 1 contains piston 1 in which pressure is applied. Cylinder 1 is the large cylinder which is used to make additional pressure for cylinder 2. It is filled up with water and when input pressure is applied to the piston that time piston will move and will create high pressure to the cylinder 2. After flushing cycle done piston 1 will be in its initial position.

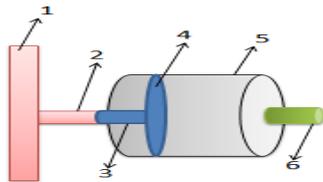


Fig. 1: Cylinder 1 assembly

SL NO	Material	Specification
1	3/4" pipe	As needed
2	1/2" pipe	Length=155mm
3	Shaft	Length=150mm
4	Piston 1	Diameter=110mm, Thickness=10mm
5	Cylinder 1	Diameter=110mm, height=220 mm
6	3/4" pipe	Length=75mm

Table 1: Design specification of cylinder 1 assembly

B. Cylinder 2 Design

Cylinder 2 is the small cylinder as compared to cylinder 1. Cylinder 2 will give the output pressure to the water cylinder. It contains the piston 2 which is connected to the cylinder 3 and pushes the piston 3 for storing the water for flushing. Cylinder 2 has the output pressure around 140-150 psi. When user stand on the pedestal piston 2 will push the

piston 3 and after flushing again it will come to its initial position.

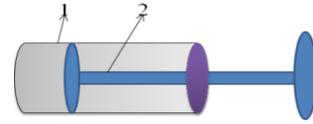


Fig. 3: Cylinder 2 assembly

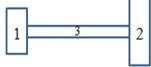
SI No	Material	Specification
1	Cylinder 2	Diameter=50mm, height=350mm
2	Piston 2	 For 1, Diameter=50mm, Thickness=10mm For 2, Diameter=80mm, Thickness=10mm For 3, Diameter=10mm, length=350mm

Table 2: Design specification of cylinder 2 assembly

C. Cylinder 3 Design

Cylinder 3 is used to store the 1 liter water for flushing the toilet. Piston 2 is connected to the cylinder 3 and one more piston is connected to the cylinder 3. One non-return valve is connected to the exit point of the water for flushing. Non-return valve stop the water to stop the water leakage. When the piston 2 push the piston 3, water will store into the cylinder 3 and after the user gets off from the pedestal piston 3 will push the piston 2 to flush the water. After pushing the water piston 3 and piston 2 will come to its initial position and the flushing cycle will complete.

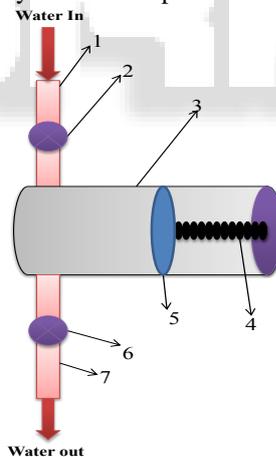


Fig. 3: Cylinder 3 assembly

SL NO	Material	Specification
1	3/4" Pipe	As needed
2	Non-return valve	3/4"
3	Cylinder 3	Diameter=80mm, Height=350mm
4	Spring	Diameter=15mm, Length=200mm
5	Piston 3	Diameter=80mm, Thickness=10mm
6	Non-return valve	1/2"
7	1/2" Pipe	As needed

Table 3: Design specification of cylinder 3 assembly

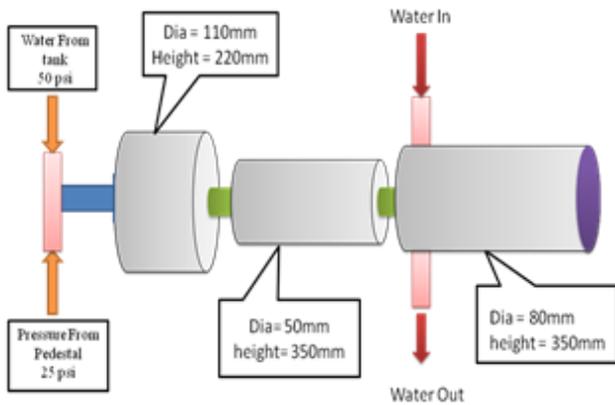


Fig. 4: Assembly of all cylinders

D. Pedestal to Cylinder 1 Mechanism Design

Below the platform, cycle inner tube is joined which is loaded with high pressure water around 25 psi. At the point when user stand on the pedestal that high pressure water course through a pipe to the cylinder 1 to push the piston and to begin the water stream from the main water tank for extra pressure. After complete the work when user gets off from the pedestal water will again fill to the tube and the pedestal will go to its initial position. One non return valve is additionally joined with the pipe which will prevent the water flow from the main water tank. 3/4" PVC pipe is associated from main water tank to the cylinder. 50 psi pressure from the main water tank and 25 psi pressure from the pedestal together move the piston in the cylinder 1. At the point when user gets off from the pedestal piston will return to its initial position.

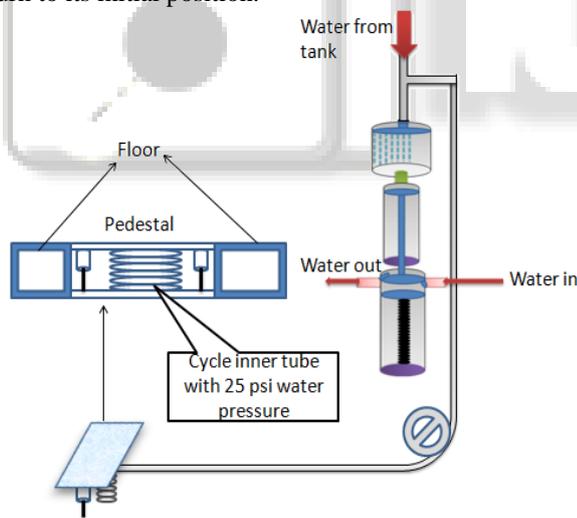


Fig. 5: Pedestal to cylinder 1 mechanism

E. Pedestal to Lid and Ball Valve Design Mechanism

At the flushing's beginning user will remain on the platform which is appended with the floor. One cable is connected from pedestal to valve and the lid. At the point when user remains on the platform cable pull the valve and the lid too. The valve will be at close position and the lid will be at open position until the user gets off from the pedestal. Spring is at compressed position on the grounds that cable is pulling the spring which is joined with the top of the lid.

At the point when user gets off from the pedestal spring will discharge the power and the lid will close consequently. Around then link will discharge the valve and

water with high pressure will get out from the cylinder for flushing. The body weight of user is used to actuate the system eliminating need of user to press button after use.

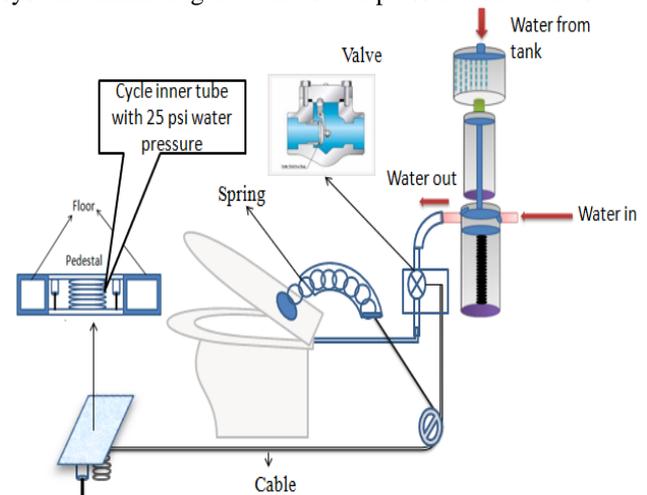


Fig. 6: Pedestal to lid and Valve Mechanism

VI. WORKING PLAN

This high pressure automatic flushing system working can be easily explained by three stages, which are initial stage, secondary stage and final stage.

A. Initial Stage:

At the initial stage of the flushing system whole system at its initial position. The pedestal would be at its rest position and the water in the pipes would be at its rest position. Water from the main water tank cannot enter to the cylinder 1, so the piston 1 would be at its initial position. At this stage both the valve is in closed position, so no water flow to the cylinder inside and outside.

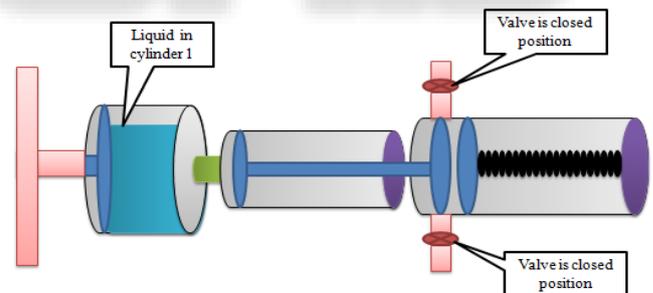


Fig. 7: Initial stage of hydraulic operation

B. Secondary Stage:

At the secondary stage pressure from the main water tank and the pedestal flowing to the cylinder 1. Because of pressure piston 1 is moving towards and liquid from the cylinder 1 is flowing to the cylinder 2 and pushing the piston 2. Pressure is flowing from large cylinder to small cylinder, so at the end of piston 2 pressure will be more. When the piston 2 is moving toward water is filling to the cylinder 3 for flushing and the spring which is connected to the piston 3 is getting compressed. At this stage water filling valve is in open position and the water out valve is in closed position. User is using the toilet in secondary stage and water gets filled to the cylinder 3 until 1 liter water is not filled to the cylinder 3. Filling water cannot get out the cylinder 3 because water out valve is in closed position. The spring remains compressed during this stage.

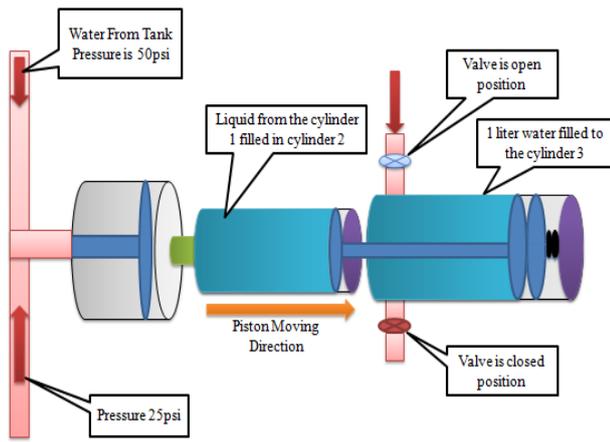


Fig. 8: Secondary Stage

C. Final Stage:

At the final stage of the operation user gets off from the pedestal. Due to contraction of the closed spring piston 3 push the piston 2 and the stored water at cylinder 3 flow out for flushing operation. No more water can fill to the cylinder 3 because water filling valve is in closed position and water out valve is in open position. Liquid from the cylinder 2 again move to the cylinder 1 and the piston 1 will again come to its initial position. After flowing out of all the water from the cylinder 3 again the system will be at its initial position and also will be ready for another user. Even when the user stands on the pedestal more than usual time water does not flow to the cylinder because the cylinder has limited amount of space for water. Thus wastage of water can be reduced. This system greatly reduces the wastage of water, with less amount of money and with greater advantages.

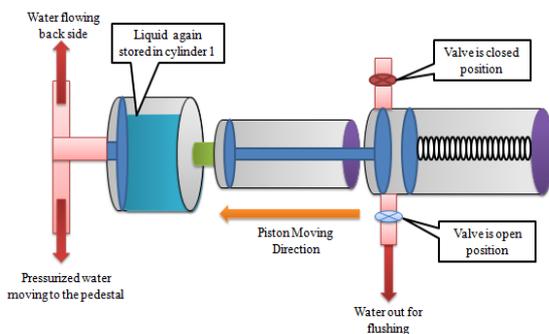


Fig. 9: Final Stage

VII. RESULT

This automatic flushing system is fairly simple and requires no manually handling during the flushing and lid operating mechanism. Following activities were achieved and results were satisfactory.

- User stands on the pedestal, the lid gets open and the valve gets closed.
- Pedestal push the cycle inner tube, so pressurized water flow to the cylinder 1 and water pressure from the main water tank pushes the piston 1.
- Piston 1 pushes the liquid to the cylinder 2 and pushes the piston 2. When piston 2 moves then water will fill in the cylinder 3.
- After using the toilet user moves out of the pedestal and piston 3 push piston 2 backward directions to

flow the water for flushing. That time valve will be in open position, so water will flow through it and flush the toilet.

- Lid will also close automatically when user moves out of the pedestal.

A. One Full Flushing Cycle Timing:

Generally human takes 30-35 seconds to pass the urine. Total flushing cycle takes less than 20-25 seconds for one full flushing.

- Lid open and close timing is 6-8 seconds.
- Water filling timing including piston moving timing is 14-17 seconds.

B. Practical Implementation:

This project contains all the features of automatic flushing system and all the parts are working correctly. The results are obtained below

- High pressure water at the exit point.
- Cleaned effectively with this pressure.
- Water used for flushing is 1 liter.
- Cleaning the toilet basin is widely reduced.
- Wastage of water is greatly prevented.

C. Estimation of Cost:

SL NO	Part Description	Cost (in INR)
1	Piston 1	40
2	Piston 2	50
3	Piston 3	30
4	Cylinder 1	110
5	Cylinder 2	75
6	Cylinder 3	80
7	3/4" pipe	50
8	1/2" pipe	40
9	3/4" non-return valve	155
10	1/2" ball valve	150
11	Shaft	35
12	O rings	30
13	Cable	130
14	Wooden platform	120
15	Cycle tube	135
16	Spring	60
Total cost of the product		1290

Table 4: Cost Estimation

VIII. CONCLUSION

It has been growing need for the automation of urinal flushing system to reduce manual operation, increased pressure and less water efficiency. This project is to develop a fully automatic high pressure flushing system and is successfully achieved by this above mechanism. This process can be successfully used in public toilet, schools and colleges. This process is fairly easy and simple to use.

Every human being has the rights to use clean and hygienic water. So it is our responsibility to pass this natural resource to the future generation. This type of flushing system can reduce the water wastage and save the water for future. Toilet cleaning had done with more pressure and less water. Because of automatic flushing toilet maintain clean environment. When another user wants to use the toilet they will a clean and more hygienic toilet.

IX. FUTURE SCOPE

This process is mainly used for urinal flushing purposes, so next phase of the project is to concentrate on solid waste flushing system. Also this automatic flushing system is easy accessible for men in public toilets, schools and colleges. But women also use public toilets so in future this flushing process will be available for women also and one small container will be fitted which contain cleaning liquids and freshener liquid. While flushing very less amount of liquid will mix up with the flushing water, then it will give more clean and pleasant environment.

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