Mechanically Autonomous System for Efficient Coach Water Refilling in Indian Railways

Aman Kaushik
Near Khadi Bhandar, Fatwaria Mohalla
V.P.O.Beri, District-Jhajjar, Haryana-124201

ABSTRACT

Indian Railways is the biggest railway system in the world having more than 10000 trains and 115000 Km railway tracks. Amount of water wasted in Indian railways at various Water Refilling Stations for more than 2000 trains, given the water flow rate (which generally fills one tank of the coach in 340 seconds) is over 50000 cubic meter or 1.3 million gallons per day. Here a small and cheap SELF CLOSING refilling mechanism is devised with estimated cost of Rs.50 that fits with existing system that is present at all the refilling stations across our country. This mechanism consists of a pipe (7cm long) having a Lid inside it that opens up opposite to the water flow by leverage function provided by a steel wire. This wire runs parallelly with the rubber pipe that is attached to the coach of the train. The worker just need to pull this wire and attach it to a specially designed hook at the coach inlet which provides the constant holding force responsible for opening of Lid against high pressure of water. As soon as train moves or tank is filled, this hook detaches INSTANTANEOUSLY from the wire causing Lid to close. This detachment does not depend upon the movement of direction of the train i.e. it will work when the train moves forward or backward also. In addition the same mechanism will be able to save thousands of liter of water wasted in refilling stations/junctions from where the train starts also (i.e. train is fully filled with water before running). This process wastes more water while refilling in mid-journey. Thus water leakage is prevented till the worker arrives to close the valve (ultimately conserving millions of gallons of water per day). Thus this self-closing mechanism is cheaper and very efficient for our railways.

Keywords: Conservation, Wastage, Water, Railways, Environment, Water Pollution

1. INTRODUCTION

Indian Railways is the biggest railway network in the entire world. We have more than 10000 trains running on 115000 Km railway tracks. Approximately 2000 trains run over distances of more than 1000 Km. These are the trains which consume maximum quantity of water during the journey as refilling is mandatory for such trains. The amount of water wasted during these refilling is more

than 50000 cubic metre or 1.3 million gallons per day, given the water flow rate used for refilling the train (which generally fills one tank of the coach in 340 seconds).

This makes Indian railways the biggest consumer of fresh water and also the source of its wastage.

2. MAIN REASONS OF WATER WASTAGE WHILE RE-FILLING:

Figure 1

There are primarily three main reasons for this wastage of water-

a) Less personnel to operate refilling. Normally only 3 or 4 personnel are allotted to do this work. The general configuration of such long route trains is shown in *Table-1* follows-

Table-1

Type	Length(m)	Quantity
Engine	20.5	1
Sleeper Coach	23.54	12 to 14
AC Coach(all 1st, 2nd & 3rd Class)	23.54	4 to 6
Pantry Car	23.54	1
General Coaches	23.54	3 to 4
TOTAL	467	20 to 25

So it is very much difficult for three persons to cover 467m long train.

b) Carelessness of personnel responsible for refilling

c) Unfavorable conditions for fast response (Walking fast on Sleepers is very difficult)

3. COACH CONFIGURATION

The capacity of a normal Indian Coach Factory coach is 500L per tank as shown in the *Figure-2:*

Figure-2

A coach has four of these tanks (so the total capacity is 2000L per coach). Time required to fill one coach in *mid-journey* is between 3 and 4 minutes depending upon the flow of water (varies continuously). While the time required for filling the coach *while shunting or before staring* is between 15 and 20 minutes.

4. SOLUTION

Design a self-closing mechanism which is independent of all the above stated problems and fully autonomous and that fits with the existing setup of Indian Railways. The main working principle is as shown in *Figure-3:*

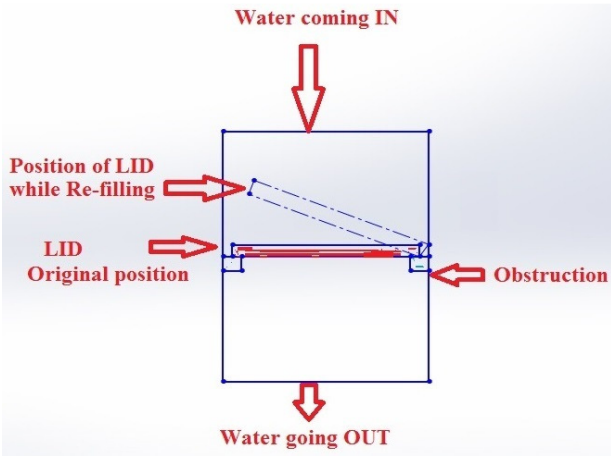


Figure-3

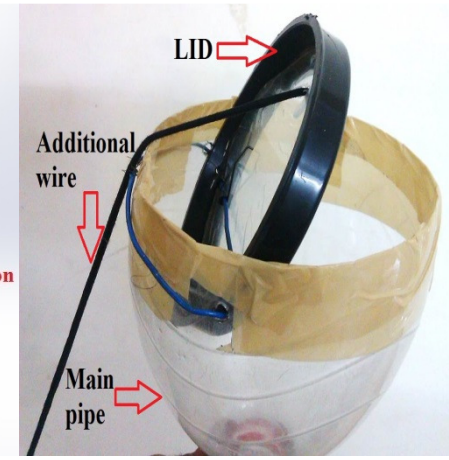


Figure-4

Add an extra pipe assembly to the valve of the existing pipe of the shape as shown in *Figure3*.Here this assembly contains a LID which opens up against the flow of the water while refilling. For refilling to be done, we need a large holding force for the LID in this position against the huge force of water that is trying to close this LID down thus blocking the flow of water. It is done using an *additional wire* which is connected to this LID as shown in *Figure-4*. This *additional wire* runs parallel with the main pipe which is connected to the coach inlet pipe on other end. Now first of all, this main pipe is attached to the coach inlet and the additional wire that runs parallel to the refilling pipe is hooked up using a rod to a specially designed groove on the coach inlet pipe as shown in *Figure-5*.

Figure-5

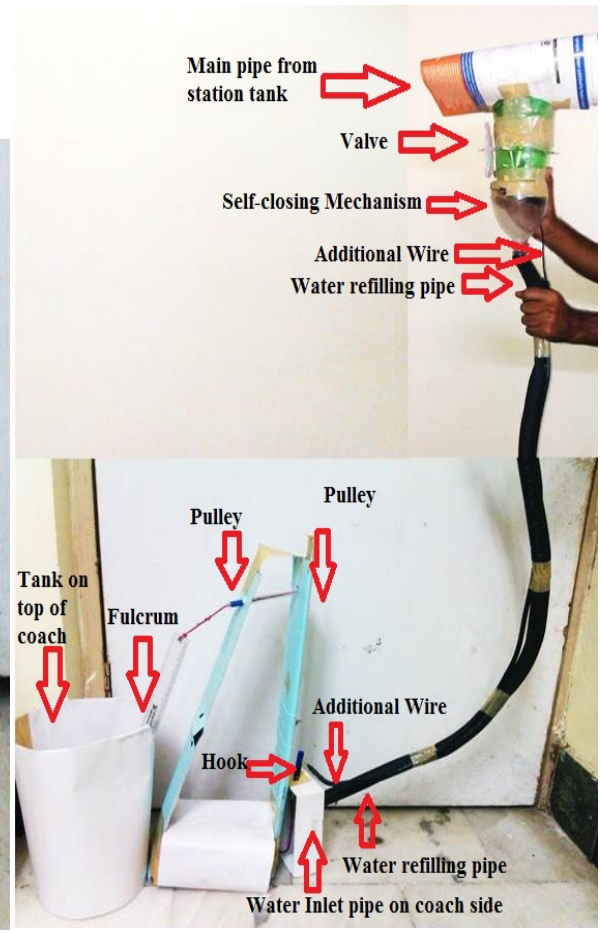
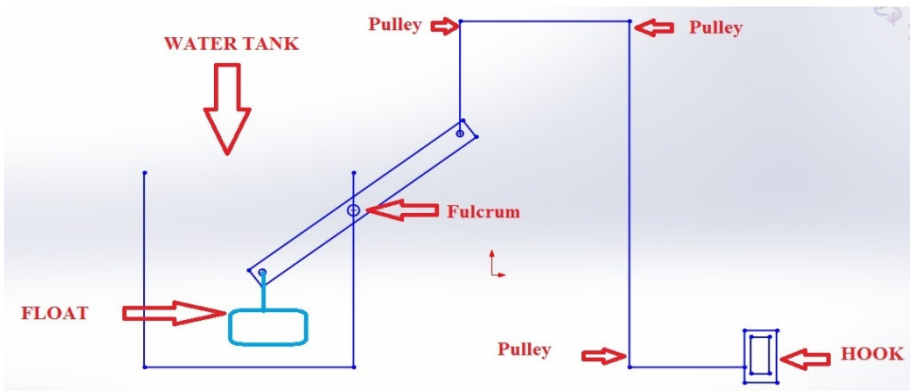


Figure-6

The shape of this groove is designed such that it will detach the rod that runs parallel with the refilling pipe and in turn stop the water flow as soon as the train moves in any direction i.e. whether

forward or reverse. The whole system can be understood from *Figure-6,* where the location of each and every part is shown is a confined space.

This solves one half of the problem i.e. when the train is refilled in mid-journey. Now for the cases when the train is refilled before starting, a new problem arises i.e. there are many times when the tank is full with water and starts over-flowing till the time the responsible person comes and closes the valve. The solution of this problem is shown in *Figure-7.*



Here the On-Off Float type methodology is used to stop the flow from refilling pipe. As the level of water rises inside the tank, the float rises and thus pulls the wire that is connected with the hook or the groove. The inner shape of this hook or groove and its working methodology is as shown in *Figure 8:*

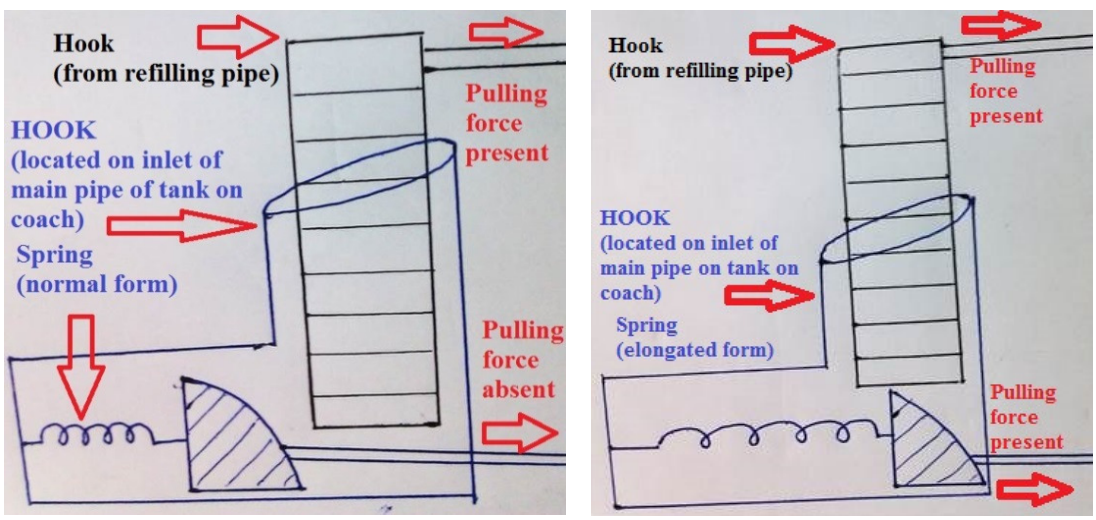


Figure-8

So with the above mentioned techniques, all the water wastage problem while refilling the train can be solved.

Material Specifications: a) Lid- Steel/Aluminium alloy

b) Additional Wire- Steel

c) Float for tank-Plastic

d) Pulleys- Plastic/wood

Main Features: a) Self Closing of fully autonomous.

b) Compatible with existing system of Railways.

c) Fully mechanical (any worker can tinker and modify according to need in non-availability of material in order to avoid wastage during that time)

d) Very simple working (easy for non-trained people also, no need of extra training).

e) Fully efficient in saving water throughout the country.

Advantages: a) Very cheap (can be manufacture within Rs.70)

b) Easy to manufacture and install.

c) Rugged construction which is fit for public use and can sustain rough man-handling.

d) Eco-friendly system.

e) Highly efficient.

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