PORTABLE EYEWASH & SHOWER FOR PRE TREATMENT OF CHEMICAL SPILLAGE

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Abstract— **In every industry, at least for a single purpose chemicals are being used, which may sometimes leads to accident. Exposure to chemicals can be corrosive, toxic, and they may react, often explosively. There is an existing system for the safety of eyes and skin named as eyewash and shower, gives the First Aid treatment to prevent the severity of injury by washing chemicals off a person in the event of chemical spill. In this project it's a try to make this system much user friendly by making it as portable.**

Keywords—eyewash, safety shower, bladder pressure tank Pressure regulator.

I. INTRODUCTION

In today's world chemical accidents in industry are playing a major role. A chemical accident is the unintentional release of one or more hazardous substances which could harm human health or the environment.

Human skin has seven layers of ectodermal tissue which guards the underlying muscles, bones, ligament and internal organs. And also human eye is an organ of vision which plays a very important role in our life, gives us the sense of sight allowing us to observe many things.

Chemical accidents may occur whenever toxic materials are stored, transported or used, the most severe accidents are industrial accident involving major chemical manufacturing and storage facilities.

I. PROBLEMS ARISING DUE TO CHEMICAL SPILLAGE

A. *Hazards due to chemicals*

Chemicals can be:

(1) Corrosive

(2) Toxic

(3) Explosively Reaction.

The impacts of chemical accidents can be deadly, for both human beings and the environment.

B. *Effects of chemicals on direct contact with skin*

There are two types of skin damages due to chemical spillage. It can be as the following:

(1) Temporary damage

a. Dry skin

b. Red skin

c. Cracked skin, etc.

(2) Permanent damage

a. Change in color

b. Burns may leave a permanent Scar

c. Exposure to certain chemicals may result in liver damage, etc.

II. METHODOLOGY OF PROJECT

With the concept of water pressure tank, this portable eyewash and shower is being designed. The principle of water pressure tank is that, the water is pressurized with the help of normal compressed air. This is performed with the help of a Bladder type pressure tank.

A. *Bladder type pressure tank*

It is a type of tank containing pressurized air and water separated by a membrane (bladder). They are pre- charged with air at the factory. On average, a bladder pressure tank lasts 5-7 years.

B. *Working and function of bladder type pressure tank*

Working:

- As increase in air pressure, it enforces the volume of water in a bladder pressure tank to get compressed. And periodically, the amount of air in the tank should be measured and should be recharged if the air pressure is too low.

Function:

- ❖ Maintain a desired range of water pressure in the distribution system. And also it minimizes pump cycling, preventing frequent starts and stops protecting facilities from damage.

C. Principle of bladder type pressure tank

Initially we need fill the tank with water from the top of the tank valve then we need to apply air pressure in the bottom of the pressure tank. This air pressure make the bladder (balloon) to bulge upwards and the pressure tends to act on the water above the bladder (balloon) inside the tank.

In this way the water stored in the tank tends to be in a pressure and when the valve is opened, it comes out with the pressure what we have provided at the bottom of tank through the bladder without any other external energy.

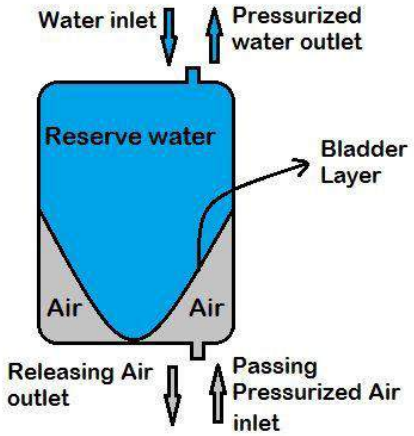


Fig.1 Before applying input air pressure

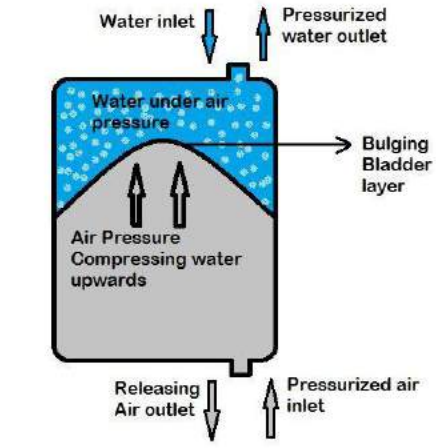


Fig.2 After applying input air pressure

D. Flexible bladder

- Flexible bladder tanks are made with high resistance PVC material and are welded with high frequency (HF) soldering techniques.
- The bladder walls are made up of polyester with PVC induction.
- The materials used in bladder walls are generally UV resistant and are chosen for their chemical stability and resistance to mechanical operation.

E. Function of Pressure Gauge

- **Manometer**: An instrument for measuring the pressure of a fluid, consisting of a tube filled with a liquid, the level of the liquid being determined by the fluid pressure and the height of the liquid being indicated on a scale.

F. Function of Pressure Regulator

- **Pressure regulator**: It is a control valve that reduces the input pressure of a liquid to a desired value at its output.
- Regulators are used for gases, liquids and can be an integral device with an output pressure setting, a restrictor and a sensor all in the one body, or consist of a separate pressure sensor, controller and flow valve.

III. DESIGN OF PROJECT

With the reference of ANSI standards the design is worked out as the following:

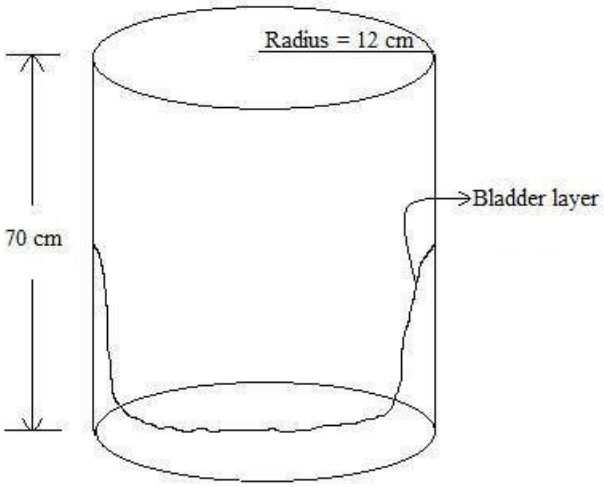
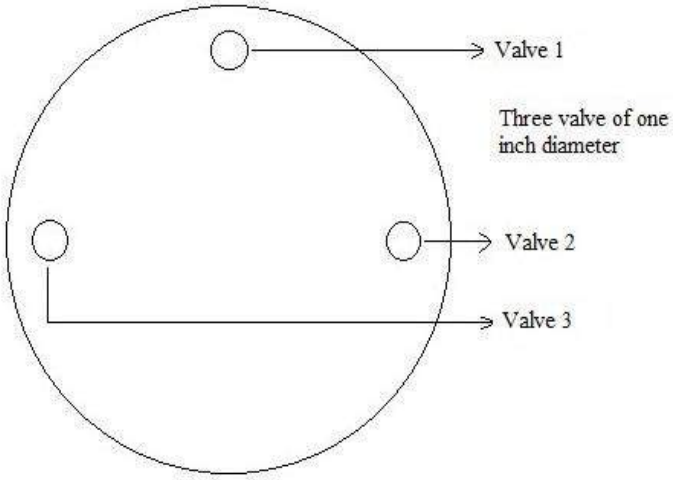


Fig.3 View of cylindrical tank



Valve 1 - Pressure gauge
Valve 2 - Eyewash and Shower
Valve 3 - Inlet of water

Fig.4 Top view of cylindrical tank

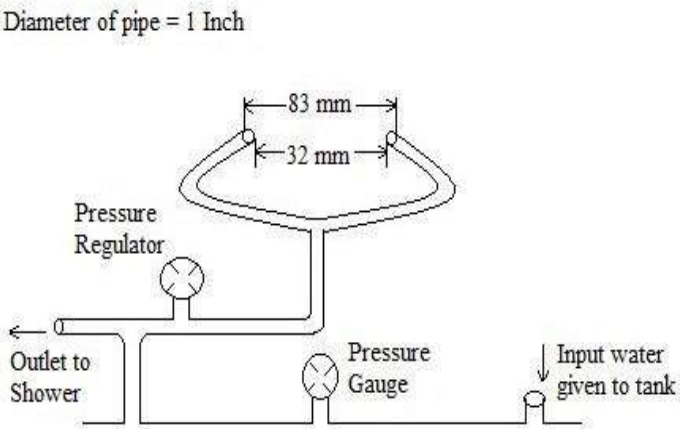


Fig.5 Side view of upper part of cylinder

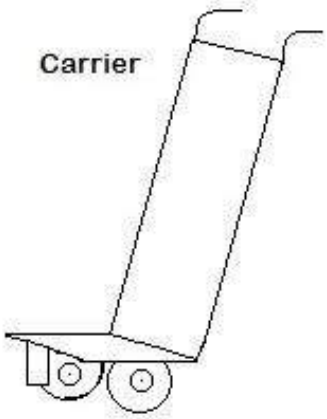


Fig.6 Carrier

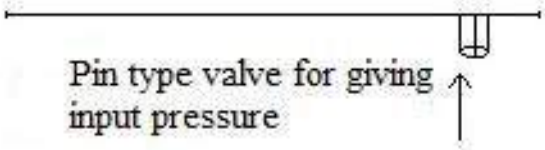


Fig.7 Side view of bottom part of cylinder

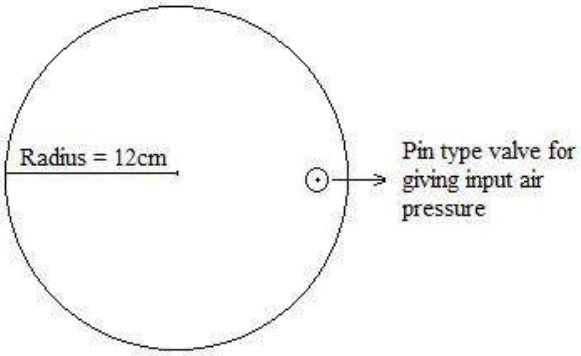


Fig.8 Bottom view of the cylinder

IV. CALCULATIONS AND PROOF

As per ANSI standard, Diameter of pipe used is **1 inch**, and includes the following parameters:

1. **0.4 gallon/min** (means **1.5 liters/min**)
2. This flow rate provides **30 PSI** (Means **2bar)** pressure of water in the pipe.
3. Allowed for **15 mins** (standard time for first aid treatment).

Therefore , if the flow rate is 1.5 liters per minute, then for 15 minutes total outlet water would be:

Total outlet water = 15mins * 1.5

= 22.5 liters.

Which means **22.5 liters** of water is enough to continuously operate for 15mins as per the ANSI standard.

So we can consider the following dimensions for the project:

Height of the cylinder = 70cms

Radius of the base circle = 12cms

Then, the volume of the cylinder can be calculated as,

Volume = $\pi r^2 h$

= $\pi*(12)^2 *70$

= 31667.25cubic centimeter

Then, in liters, volume = 31.667 liters.

Approximately we can fill 30 liters of storage water.

V. CONCLUSION

Hence it is proved that all the parameters discussed above will give the required output,

- Flow of water at a pressure 2bar.
- Time for continuous flow of water is achieved more than 15 minutes.
- Easy to move the equipment.
- User friendly
- Life of the equipment is minimum 5 years.
- Purpose of the equipment is successfully achieved.

Therefore, the severity of chemical spill on skin and eyes can be minimized.

REFERENCES

- ANSI-Z358.1
  (American National Standards Institute).
- OSHA
  (Occupational Safety and Health Administration).
- EN-15154
  (European Committee for Standardization).
- ISEA SELECTION, INSTALLATION AND USE GUIDE EMERGENCY EYEWASH AND SHOWER EQUIPMENT.
- SWAT (Sanitizing Wash And Treatment).
- SLAC (SLAC Environment, Safety, and Health Manual).