Combination of Air and Water Pressure in Applied Fields

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ABSTRACT

Our discussion of fluids has two parts, statics and dynamics. Fluid statics concentrates on the properties of fluids at rest, while fluid dynamics focuses on fluids in motion. There are static fluids in the hydraulic systems that transmit the large pressures. In this paper a hydrostatic system is recommended. This system is able to save the potential energy of water in a new procedure by using the combination of air pressure and pressure of the fluids. The potential energy of water in the back of the dams is utilized to produce electricity. So, using this recommended hydrostatic system, we can reuse the water exiting out of turbines in power plants.

Keywords: *air, fluids, pressure, potential energy*

1 Introduction

As we know, the atmosphere around the earth applies a pressure on the bodies. This pressure is called "Air Pressure" and is caused by the weight of the air which is located above the bodies. So far many different experiments have been performed about the air pressure. Perier (et.al) was the first one who accomplished many experiments and found out the effect of air pressure. Torichelli continued the Perier's studies and showed that the air pressure applies on all of the bodies. Pascal studied the Torichelli's works and he concluded that the amount of air pressure in the top of a mountain is less than the value of air pressure in the valley.

On the other hand, we know that all of the liquids apply a pressure on the bodies which are submerged in liquids. Many scientists like as Archimedes, Pascal and Bernoulli have performed many experiments about the pressure of liquids. Anyone who has tried to push a beach ball under the water has felt how the water pushes back with a strong upward force.

This upward force is called the buoyant force, and all fluids apply such a force to objects that are immersed in them. The buoyant force exists because fluid pressure is larger at greater depths. The hydrostatic properties of a liquid are not constant and the main factors influencing it are the density of the liquid and the local gravity. Both of these quantities need to be known in order to determine the hydrostatic pressure of a particular liquid [1,2,3].

In this paper, performing a series of experiments, is shown that we can save the pressure of liquids in the form of potential energy in a hydrostatic system. This energy with combination of air pressure can be used in many applied fields.

2 Experiments

2-1 Equipments of Experiments

According to (Fig. 1), a vessel is chosen including two throats. One throat (A) is wide and the other one (B) is narrow so that the section related to (B) throat is crisscross. Then (B) throat is closed with a cork completely.

2-2 Explanation of Experiments

In this case some water is poured into the (A) throat as shown in (Fig. 2).

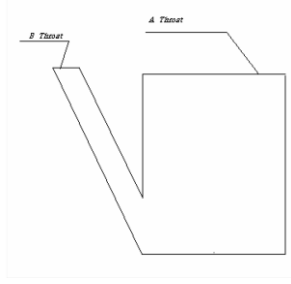

Fig. 1: Schematic of equipment used in the experiment

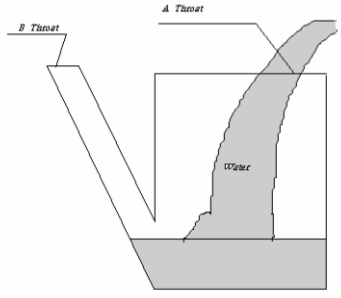

Fig. 2: Pouring some water into the vessel

Water rises in the vessel to the height of "h". If we continue pouring the water, the height of water in tube (B) remains constant while water rises in section (A) to the height of "H" as shown in (Fig. 3).

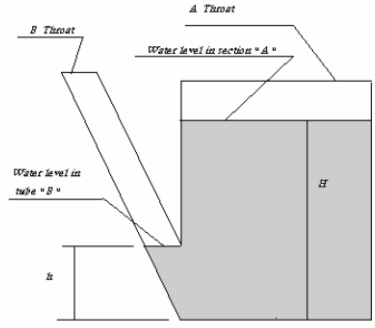

Fig. 3: The height of water in two sections of vessel

As shown in (Fig. 3), if we pick up the cork from the (B) throat suddenly, water barrels in tube (B). So, water slats out of the tube (B) as shown in (Fig. 4). As it can be seen, the height of (H) in section (A) will be reduced.

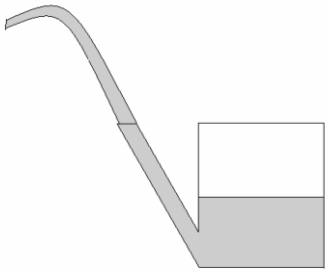

Fig. 4 :Water slats out of the tube (B) by removing the cork

3 Analysis of Experiments

As it can be seen in (Fig. 2), water rises in the vessel to the height of (h). Continuing the pouring of water, the height of water in tube (B) doesn't change while the height of water increases in section (A), because (B) throat had been closed with a cork completely and the air can not exit out of this tube. On the other hand, (A) throat had not been closed, so the air in this section can exit and water can be replaced. Therefore, the height of water increases as shown in (Fig. 5).

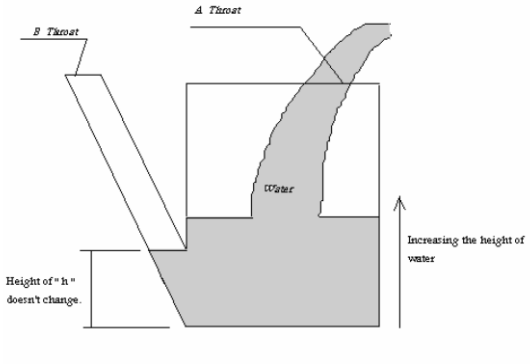

Fig. 5: Air is locked in tube (B)

Refer to (Fig. 6) and consider the points "C" and "D" on the water levels in (A) and (B) sections, respectively. The pressure of "C" and "D" points are equal because these points are located in a horizontal line. Thus we can write (Eq. 1):

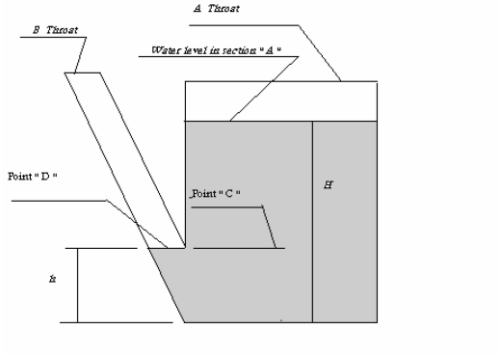

Fig. 6: Equilibrium of pressure in "C" and "D" points

$$P_C = P_D \quad (1)$$

The formula for calculating the hydrostatic pressure of a column of liquid in SI units is (Eq. 2):

$$P_2 = \rho g h + P_{1.} \quad (2)$$

On the other hand the pressure of point "C" can be written as follows (Eq. 3):

$$P_C = (H - h)\rho g + P_{atm.} \quad (3)$$

Then (Eq. 4):

$$P_D = (H - h)\rho g + P_{atm.} \quad (4)$$

According to equation (3), it is obvious that the more the H, the more the P_D (because the height of "h" is constant). Suddenly removing the cork from (B) throat, the pressure due to the difference between "H" and "h" causes the water rises the (B) tube rapidly[1,2].

5 Discussion

Perceiving the above analysis, it can be considered that the recommended hydrostatic system is able to save the potential energy. For increasing the value of this energy, P_D should be increased by adding the value of the difference between "H" and "h". In this way, water can exit out of tube (B) with high speed.

As we know, the potential energy of water in the back of dams is utilized to produce electricity. So, using the above recommended hydrostatic system, we can reuse the water exiting out of turbines in power plants.

It should be noted that we can improve the ability of this recommended hydrostatic system by reducing the diameter of tube (B) for increasing the propulsion of water.

References

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[3] http://www.sensorsone.co.uk/pressure-measurement-glossary/hydrostatic-pressure.html