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The Influence of The Material Type on The Reservoir Air Pressure in The Knife Tool Heating Furnace

Ikhlasul Amal Wijaya[1], Harlin[2], Rudi Hermawan[3], Anugrah Agung Ramadhan[4]
[1,2,3,4]Mechanical Engineering Education, Faculty of Teacher Training and Education Science, Universitas Sriwijaya, Indonesia

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ABSTRACT

A reservoir is a vessel or storage container used to store pressure resulting from the evaporation of a liquid. In its use, the Reservoir's constituent material must be good to produce maximum results. This experimental research aims to study the influence of the reservoir material types, such as aluminum, steel, and stainless steel, on the air pressure produced by each material. The experiment was conducted by aluminium, steel, and stainless steel material testing. The results showed that aluminum, steel, and stainless steel produce a pressure of 2.00 bar, 2.50 bar, 1.50 bar, respectively.. The comparison of results shows that the type of reservoir material will affect the final result of reservoir pressure.

Corresponding Author:

Harlin
Department of Mechanical Engineering Education, Faculty of Teacher Training and Education Science, Universitas Sriwijaya, 30862 Indralaya, Sumatera Selatan, Indonesia.
Email: harlin@fkip.unsri.ac.id

INTRODUCTION

One way to make an iron pande furnace that is effective, efficient, and environmentally friendly is to apply a boiler blower. With the manufacture of furnaces that utilize the residual heat source of combustion, it is hoped that it can be a solution for knife tool artisans to save production costs or make the work process more effective and efficient (Sodikin et al., 2016). Production costs can be reduced by replacing electric-powered blowers or replacing ubub workers with blower boilers.In its application, the use of this boiler blower was designed as a prototype to produce and accommodate steam produced by the remaining heat energy from the furnace, which is then used to make water in the boiling container and produce steam, which then be used to blow hot coals in the furnace. This place of heating, as well as collecting water and steam, can be called the Reservoir.

Speaking of design, it was essential that we consider the use of materials such as reservoir materials. Designing a proper pressurized tube system can increase the distribution efficiency of pressurized fluid flow and reduce a significant percentage of fluid flow pressure losses. Then, Febrian et al. (2019) suggested that the material used would affect the amount of pressure a tube produces. Existing studies only tested one of the existing types of metals, such as steel or aluminum. In other studies, there were differences in the comparison results between conductivity values in some metals, as it was stated that pure aluminum is an excellent conductor compared to carbon steel and stainless steel (Agustina & Astuti, 2015). Another study explained the heat comparison of the two sides of the aluminum metal, which is very drastic. According to (Aminah et al., 2013), the heat transfer rate of aluminum on side one is 200.96 W, and on the second side, it is 0.8038 W, and iron plates have a heat transfer value of 315.2 W. Therefore, researchers are interested in further examining the differences between existing reservoir materials. Researchers used three types of materials and compare which is more efficient in generating air pressure between reservoirs: steel, stainless steel, and aluminum materials.

METHOD

This research applied an experimental research method. The experimental research method determines the effect of specific treatments but under controlled circumstances (Sugiyono, 2016), particulary in this study determines the effect of various materials of aluminum, steel, and stainless steel on reservoir air pressure.

The experiments were conducted tests with three reservoirs equipped with pressure gauges and thermometers with different types of materials, containing water with a volume of 12 liters, which were then baked on a gas stove with a stable flame for 42 minutes then compared the resulting pressure and the amount of Reservoir.

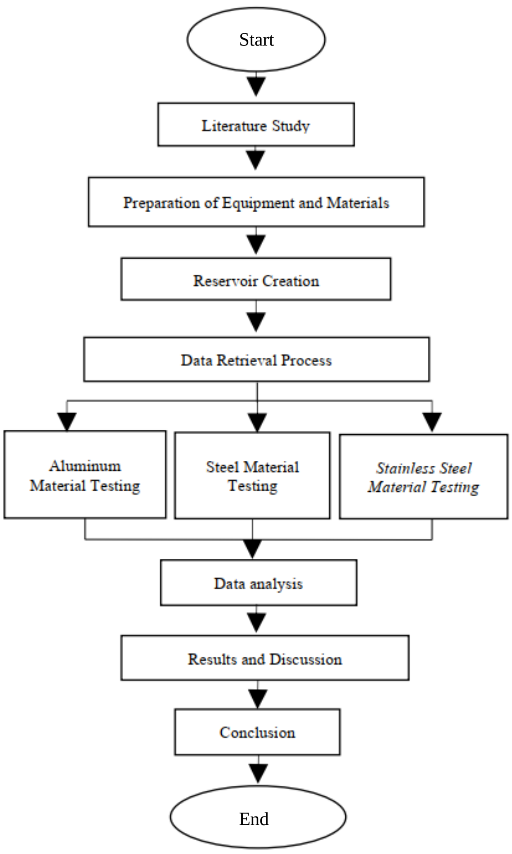

Figure 1. Research Flowchart

RESULTS AND DISCUSSION

Three reservoirs equipped with pressure gauges and thermometers with different types of material, containing water with a volume of 12 liters were tested, which were then baked on a gas stove with a stable flame for 42 minutes and then compared the resulting pressure and the amount of reservoir temperature. Thus, temperature and air pressure between each type of existing material were compared,. Steel, aluminum, and stainless-steel material plates with dimensions of 30 cm x 30 cm as many as two plates and plates measuring 30 cm x 20 cm as many as 4. A total of 6 plates of each material then be formed to become a box tube measuring 30 x 30 x 20 cm.

The heating process takes place once in each type of reservoir material alternately with the volume of water in the Reservoir, as much as 12 liters in each Reservoir, and then the heating process lasts for 42 minutes, or at least until the temperature in the Reservoir reaches a temperature of 110° C (above the boiling point of water) the goal is that the evaporation process occurs in the Reservoir and produce the air pressure that the data researcher wants.

Table 1. Test Results

Material Type	Time	Temperature	Pressure
A1	42 Minutes	120°C	2.00 bar/ 1.97 atm
Steel	42 Minutes	120°C	2.50 bar/ 2.46 atm
Stainless Steel	42 Minutes	110°C	1.50 bar/ 1.48 atm

Based on the pressure comparison graph, we can see that each reservoir material produces various pressure and temperature values. Compared with others, the lowest yield pressure value is the pressure value of the stainless-steel material type reservoir. In contrast, steel-type materials produce the highest pressure value with a pressure of 1.50 bar or 1.48 atm for stainless steel-type materials, and 250 bar or 2.46 atm for aluminum-type materials produce a pressure of 2.00 bar or 1.47 atm. The temperature value produced by each type of reservoir material includes the minor temperature produced by stainless steel material, while aluminum and steel reservoirs have the same temperature. Sequentially, the temperature produced by stainless steel is 110° C, and the final heating temperature of aluminum and steel materials is 120° C.

Heating the Reservoir is carried out using a stove with LPG gas fuel. Then, the Reservoir filled with 12 liters of water was heated for 42 minutes. The time of 42 minutes is used as a reference because, during the experimental process, it becomes the most extended time value among all materials, reaching a temperature of 110° C. The material used as a reference is a stainless steel type material; for the use of a temperature of 110° C, it is intended that the water in the Reservoir reaches its boiling point; as is known, the boiling point of water is 100° C then it would be waited until the temperature exceeds the boiling point in order to give the water time to evaporate, So that the vapors that appear accumulated to produce pressure in the Reservoir.

In this study, there were differences in the pressure and temperature values in each Reservoir. These values are found in the process of heating the Reservoir where when the process of heating the

Reservoir occurs on a stove made of gas when the heating process on the stove is carried out, electrons in the reservoir material get heat energy from the stove, and heat energy from this stove then be converted into kinetic energy. Heating that occurs in metals causes the movement of electrons to accelerate; if heating lasts a long time, the metal had an increasing temperature. As the temperature of the reservoir material metal and liquid increases, the high temperature made the water evaporate, causing pressure to appear in the Reservoir.

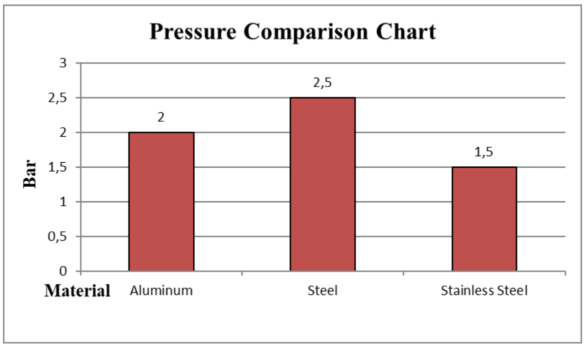

Figure 2. Pressure Comparison Chart

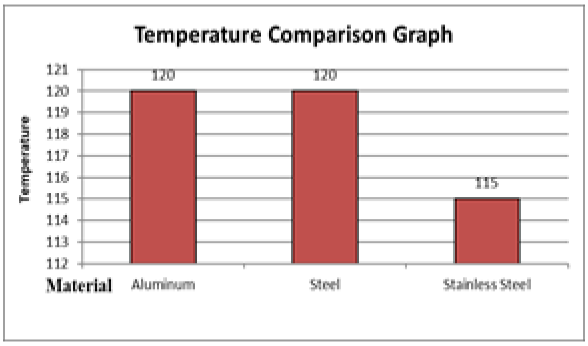

Figure 3. Temperature Comparison Graph

CONCLUSION

it was found that the value of the compressive amount produced by each type of Reservoir after being tested for 42 minutes was a pressure of 2.00 bar or 1.97 atm on aluminum material, then a pressure of 2.56 bar or 1.48 atm on steel material, and finally a pressure of 1.50 bar or 1.48 atm produced by stainless steel material. Factors that affect the pressure value of reservoir heat testing results are the value or price of the conductivity of the reservoir material. The greater the value of material conductivity, the better the material conduct heat from the stove fire source to the liquid or fluid in the Reservoir. Next is the factor of the heating price of the type of material, where the higher the heat of the type of material, the longer it take for the material to raise its temperature. Another factor is the test time factor; the longer the testing time, the greater the pressure in the Reservoir.

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