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Geothermal Energy in Secondary Pressure Drainers (A concept)

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Abstract: - **geothermal energy is thermal energy generated and stored in the earth. The geothermal energy of the earth's crust originates from the original formation of the planet. Geothermal power is cost-effective, reliable, renewable, and environment friendly. Geothermal power does not involve fuels. Hence, in terms of fuel cost fluctuations it is quite beneficial. However high costs are involved in setting up the plant. A geothermal heat pump can extract enough heat from shallow ground anywhere in the world to provide home heating, but industrial applications need the higher temperatures of deep resources. The thermal efficiency and profitability of electricity generation is particularly sensitive to temperature. A secondary pressure drainer is a device which collects a liquid and by alternately pressurizing and depressurizing it through a valve arrangement, discharges it by using gas pressure as the operating source. A suitable mechanism with valves and sensors are used to collect and discharge the liquid. Secondary pressure drainers are mainly used for collection and discharge of steam condensate. Initially, a pipeline is inserted into the earth's crust at a predetermined site suitable for geothermal plant. Cold water is passed through this pipeline and as a result of the heat present inside the earth, the water is converted into high pressure and high temperature steam. The pipeline is further connected to the inlet of a secondary pressure drainer, where the steam coming from the geothermal plant is the motive fluid. Inside the pressure drainer, the high temperature, high pressure steam when combined with the low pressure steam, from the extracted surface is directed to the condenser and as a result, the resultant outward flow is converted into a medium pressure steam. The major advantage with this system is older systems of secondary pressure drainers involves heating up the motive fluid by conventional energy sources but our design uses renewable sources of energy which are reliable and sustainable.**

***Keywords:*—geothermal energy, motive fuid, secondary pressure drainers, valves**

I. INTRODUCTION

Geothermal energy is thermal energy generated and stored in the earth. The geothermal energy of the earth's crust originates from the original formation of the planet. [1] Geothermal power is cost-effective, reliable, renewable, and environment friendly. Geothermal power does not involve fuels. Hence, in terms of fuel cost fluctuations it is quite beneficial. However high costs are involved in setting up the plant. These include drilling cost and exploration of deep resources, which also involves certain risks.

A geothermal heat pump can extract enough heat from shallow ground anywhere in the world to provide home heating, but industrial applications need the higher temperatures of deep resources. The thermal efficiency and profitability of electricity generation is particularly sensitive to temperature [2]. Compared to the earth's heat content, the heat removed from a geothermal plant is very small. Hence, geothermal energy is considered renewable. Geothermal power is considered to be sustainable thanks to its power to sustain the earth's intricate ecosystems.

By using geothermal sources of energy present generations of humans will not endanger the capability of future generations to use their own resources to the same amount that those energy sources are presently used. Further, due to its low emissions geothermal energy is considered to have excellent potential for mitigation of global warming [3]. A secondary pressure drainer is a device which collects a liquid and by alternately pressurizing and depressurizing it through a valve arrangement, discharges it by using gas pressure as the operating source.

A suitable mechanism with valves and sensors are used to collect and discharge the liquid. Secondary pressure drainers are mainly used for collection and discharge of steam condensate. When the operating pressure of heat transfer equipment falls below the back pressure in the condensate return line, a negative pressure differential is formed, causing stall. Stall is a condition in which heat

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transfer equipment is unable to drain condensate and becomes flooded. Stalling can cause a variety of problems like frozen coils, reduction in equipment life, and reduction in heat transfer capacity etc. Some possible factors which can cause a stall are oversized equipment, back pressure at equipment discharge due to elevation, obstruction or static pressure in the line and equipment operating at lower pressures due to light load demands. [4]

II. DESIGN

Secondary pressure drainer

The secondary pressure drainer is a device which collects a liquid, alternately pressurizes it and depressurizes it using a valve arrangement and then discharges it. It is used here for the collection and discharge of steam condensate. The low pressure steam is converted to a medium pressure steam by impinging it with the high pressure steam in a pressure drainer. This helps in effectively transferring the steam to the condenser.

Condenser

Condensation is a process in which a substance is converted from its gaseous state to liquid state. The device or unit used for condensation is known as a condenser. It has an inlet and exit through which cooling water is passed for the condensation process.

Inlet and outlet valves

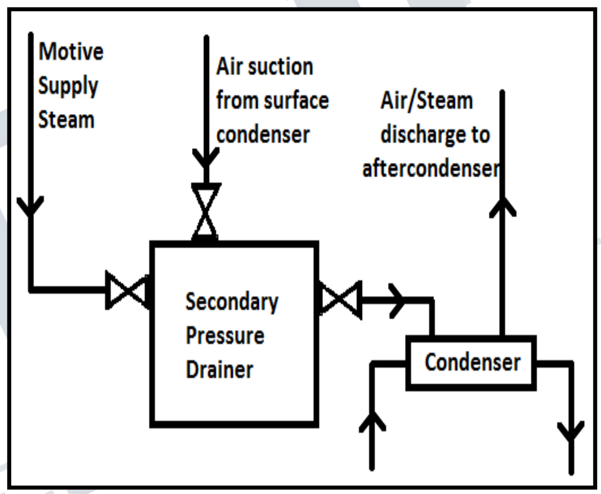
A valve is a device used for regulating the flow of a fluid. The inlet valve controls the flow of steam entering into the secondary pressure drainer while the outlet valve controls the same at the exit.

Other auxiliaries

Our design makes use of pipelines to transfer the steam. A pipeline is inserted into the earth with water flowing through it. Due to heating, steam is generated which is then transferred through pipes to the drainer. Pipelines are also used at the drainer outlet to transfer the medium pressure steam to the condenser.

III. CONSTRUCTION AND WORKING

Initially, a pipeline is inserted into the earth's crust at a predetermined site suitable for geothermal plant. Cold water is passed through this pipeline and as a result of the heat present inside the earth, the water is converted into high pressure and high temperature steam. The pipeline is further connected to the inlet of a secondary pressure drainer, where the steam coming from the geothermal plant is the motive fluid. The inlet flow is controlled by using an inlet valve. Also, a flow of low pressure steam coming from the surface of the desired surface by suction, is directed into the pressure drainer by means of pipelines and the secondary inlet valves. Inside the pressure drainer, the high temperature, high pressure steam when combined with the low pressure steam is directed to the condenser and as a result, the resultant outward flow is converted into a medium pressure steam. The medium pressure steam is then passed into a condenser by means of a regulating outlet valve and pipelines. Here in the condenser, there is a cooling circuit which consists of water inlet and water outlet, which helps in maintaining continuous cold environment in the condenser. Finally, the steam is condensed and used for various applications.



Advantages

Older systems of secondary pressure drainers involves heating up the motive fluid by conventional energy sources but our design uses renewable sources of energy which are reliable and sustainable.

In this system, the low pressure steam with low velocity might not have enough energy to reach the condenser. Thus the motive fluid, which uses non-conventional energy sources, is forced to attain the pressure required to reach the condenser.

This system is inexpensive to use and since the plant has less moving parts, very low maintenance costs are involved.

Applications

Steam can also be used as a direct "motive" force to move liquid and gas streams in piping.

They can be used to pull vacuum on process equipment such as distillation towers to separate and purify process vapor streams.

They are also used for continuous removal of air from surface condensers, in order to maintain desired vacuum pressure on condensing (vacuum) turbines.

It can be used to entrain air from surface condenser.[5]

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