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Design for Recovery of Waste Heat from a common Gas Stove used in homes and large scale Cooking Purposes.

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Abstract:
Heat is a form of `Energy` and energy conservation is one of the prime requirement in the present scenario, therefore consuming energy in any form is important so as to protect the global environment. This paper will actually propose a design for recovery of Waste Heat from a common Gas stove used in homes and large scale cooking purposes, by actually entrapping large amount of heat emitted while cooking in form of (Radiation and Convection) i.e. (Remained Emitted Gases) and using it to heat up water that will actually save consumption of Electrical units and fuel used in heating up Water for the Domestic Purposes.

Keywords: Remained Emitted Gases.

1. INTRODUCTION

In our day to day life we come across to see various processes that involve the emission of heat, and we term this emitted heat as Waste heat. Waste Heat Recovery is actually a mechanism which involves the method of transferring or exchanging the amount of heat of a certain emitted stream with a certain component. Since most of the waste heat is being transferred or released to the environment, so using the amount of energy of that waste heat is practically an economical idea.

It is also observed that most of the modern kitchens have gas stove as primary equipment and electric chimneys as its secondary equipment. If we go into the engineering aspect the heat energy released by the LPG through gas stove is used for cooking. As we all know that whole of the heat cannot be used therefore is wasted to the kitchen atmosphere and further to the environmental atmosphere by the help of the chimneys. In order to remove this excess heat we install chimneys. The idea behind the proposed design is to use this so called waste heat, to heat up water and use it for various residential purposes.

Therefore the proposed design will actually use the heat of the emitted stream (that was previously just discarded to the atmosphere by the chimneys), and consume a considerable amount of the electrical units (kWh) and the LPG fuel that was being used to heat up water for various residential purposes.

2. STRATEGY FOR RECOVERING THE HEAT.

As seen in Fig.1, the primary Gas Stove will emit a huge amount hot gases which are a result of combustion of the L.P.G gas and of course due to cooking, weather it may be boiling or frying of any food component. Since all the modular Kitchens are using Chimneys as the equipment which will actually suck all the hot gases that are being emitted so as to maintain comfortable working conditions. (Also, conventionally these hot gases are directly being delivered to the environment).

As per the working design a spherical Heat Exchanger is designed, which will have an inlet of the normal tap water available at normal temperatures (T1) and use the heat of the emitted gases so as to increase the temperature of the water to (T2).

Further after using the heat the remaining gases will be spent out to the environment and called as the Remained Emitted Gases (R.E.G).Therefore the hot water that is required for many residential purposes will now be just available after cooking, which will save a considerable amount of Electrical Units that will be used by the Electrical Geysers or the amount of L.P.G gas.

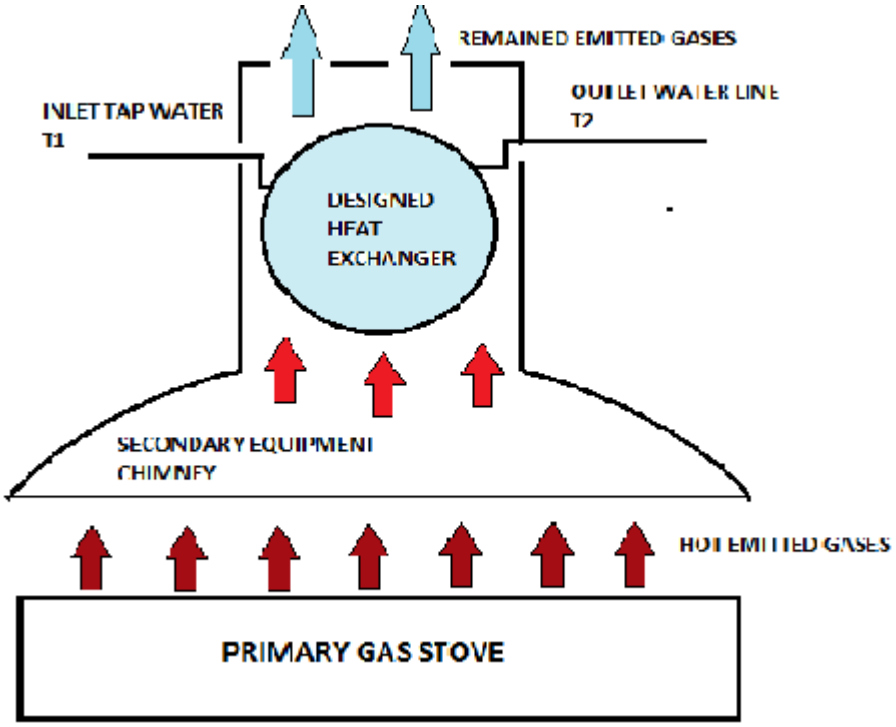

Fig.1: figure showing the basic strategy to be adopted.

3. PROPOSED DESIGN OF THE HEAT EXCHANGER.

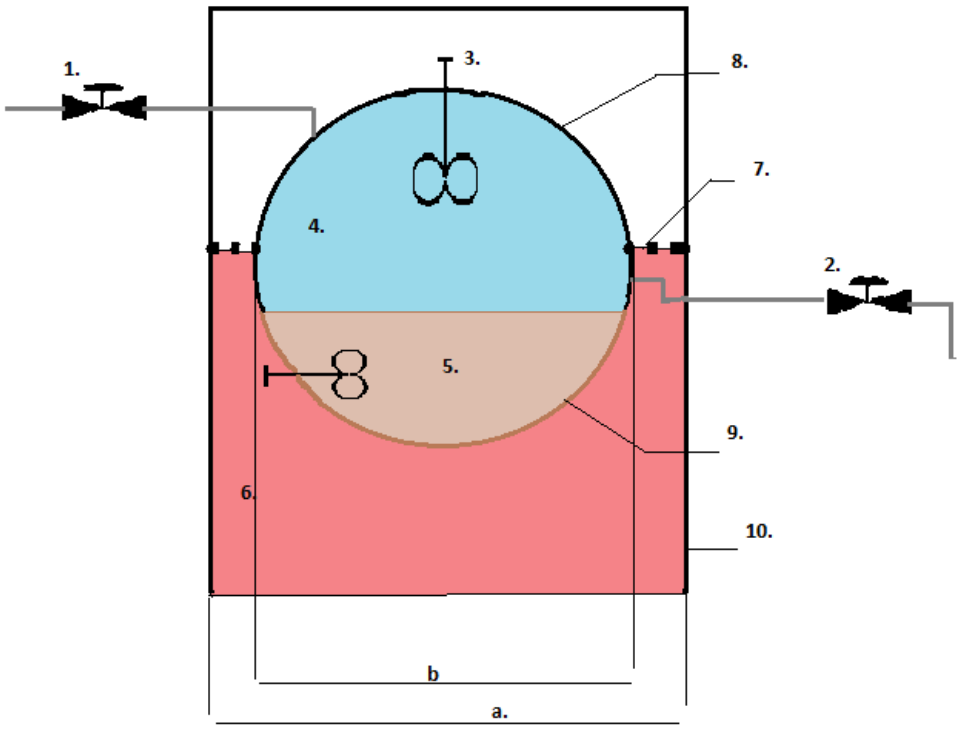

Fig 2: figure showing the complete design of the Heat Exchanger.

COMPONENT DESCRIPTION				
(1 and 2): OPERATING CONTROL VALVES	**(3):** AGITATORS	**(4):** WATER TO BE HEATED	**(5):** WORKING FLUID	**(6):** HOT EMITTED GASES
(7): SUPPORTS (H.E)	**(8):** HEAT EXCHANGER MATERIAL 1	**(9):** HEAT EXCHANGER MATERIAL 2	**(10):** BODY OF THE CHIMNEY	**a:** ACTUAL WIDTH **b:**DIAMETER OF THE (H.E).

3.1 COMPONENT WISE DESCRIPTION.

3.1.1 OPERATING CONTROL VALVES.

These valves will actually control the inlet and the outlet of the water that is to be heated for the desired purpose. The valve 1 will direct the inlet flow of the water and the valve 2 will direct the outlet flow of the water which will be at a higher temperature than the inlet.

3.1.2 AGITATORS.

Agitators are actually being employed inside the two sections of the Heat Exchanger so as to regulate a uniform distribution of the heat.

3.1.3 WATER TO BE HEATED.

This is actually the inlet water that is to be heated.

3.1.4 WORKING FLUID.

This is actually a fluid which will be covering or being contained in a certain section of the heat exchanger. The amount of this working fluid will be approximately equal to (35-40) percent of the Heat Exchanger volume. The basic job of this working fluid is to absorb the maximum amount of the heat from the hot emitted gases. The properties of this fluid will be:

- It should have a high heat transfer coefficient.
- It should be very sensitive to absorb heat.
- It should be non corrosive and slightly be having low viscosity.

3.1.5 HOT EMITTED GASES.

Majorly all of the Indian kitchens use L.P.G i.e. (Liquefied Petroleum Gases) for the purpose of cooking. Therefore the heat that is required for cooking is being obtained by combustion of the L.P.G fuel. Also it must be observed that this heat is being lost to the surrounding in form of radiation and convection.

Conventionally Indian kitchens dint do anything with that emitted heat, due to which the atmosphere in the kitchen became bit uncomfortable. So as we come to the modern era we see the invention of Modular Kitchens,

which completely emphasize on making the cooking environment comfortable and easy and one of the well known component of the Modular Kitchens is the Electrical Chimneys whose major job is to suck all of the emitted gases and eject it to the atmosphere.

3.1.6 HEAT EXCHANGER SUPPORTS.

These are actually the mechanical supports which will support the heat exchanger inside the walls of the Electrical Chimney.

3.1.7 HEAT EXCHANGER.

The heat exchanger that is being employed is a spherical plate type heat exchanger, that will poses a very simple design. As per the proposed design the Heat Exchanger will be fabricated in two materials. The bottom part of the Heat Exchanger will be of a material named as (Material 2) and the top part will be fabricated with a material named as (Material 2). The mid section i.e. the Plate that will be separating the Working fluid and the Water to be heated will be also of the material named as (Material 2).

3.1.7.1 HEAT EXCHANGER MATERIAL (1).

The Material 1 of the heat exchanger posses the upper region of the heat exchanger. This portion of the heat exchanger will be containing water. So as per the concept the water present in the upper section will be gaining heat from the working fluid by the help of the inter-sectioned plate, so it desired that any amount of heat gained by the water should not be loosed to the atmosphere, therefore the properties of this material are:

- It should posses very low thermal conductivity (i.e. it should be an heat insulator)
- It should be non corrosive.
- Suggested material which is most favorable as per the design:

VACCUM FLASK (HEMISPHERICAL IN SHAPE)	VACCUM CREATED BY CAPPING IT AT THE CROSS-SECTION.	STAINLESS STEEL WITH SILVER LINING INSIDE.

3.1.7.2 HEAT EXCHANGER MATERIAL (2).

The Material 2 of the heat exchanger will possess the working fluid and the inter-sectioned plate. This material should also allow the working fluid to gain maximum amount of heat from the electrical chimney and transfer it to the water to be heated via inter sectioned plate. Therefore the bottom outer periphery and the inter section plate will be of this material and the properties of this material are:

- It should posses very high thermal conductivity (i.e. it should be an heat conductor)
- It should be non corrosive.
- Suggested material which is most favorable as per the design:
-

OXYGEN FREE COPPER. GRADE:C10100 (HEMISPHERICAL IN SHAPE)

The heat transfer mechanism is shown by Fig: 3.

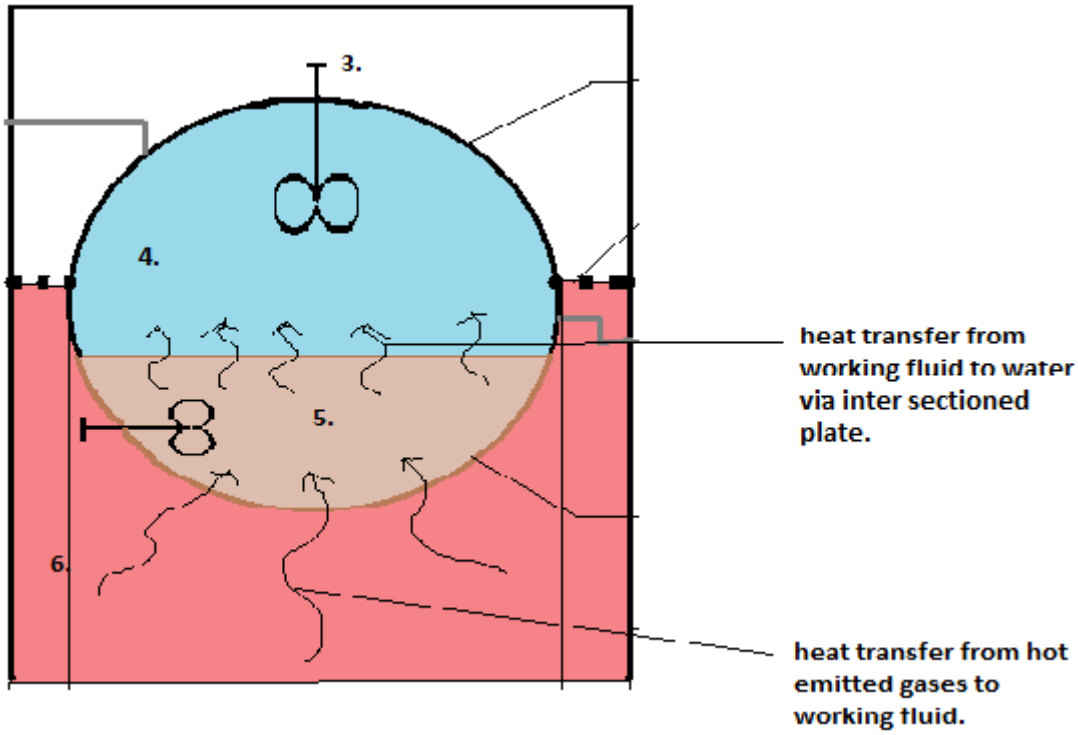

Fig 3: Mechanism of heat

4. CONCLUSIONS.

1. By implementing this proposed Design one could recover a lot of waste emitted heat which was previously just being emitted to the ambient surrounding/atmosphere.

2. Electrical units that were being used to heat up the water for the domestic purposes could be saved by 40-50% that is more than sufficient to conserve energy.

3. Waste heat is utilized and being used.

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