

Fabrication of Heater-Oven

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Abstract

The aim of this project is to develop a Fabrication of Heater-Oven which is useful to cook and room heating in home simultaneously. This project is to design and construct a Fabrication of Heater-Oven. This machine is used to cook food and room heating in winter season at home simultaneously. The size of machine will be very convenient for portable and less weight. Moreover, it will be easy to carry and use at any time and any place. It will be reduced human effort and also requires low less skill to operate this machine. We are designing and Fabricating Heater-Oven by using heating element, fans, and casing and grills. This device is used to cook food and to heat room simultaneously as well as individual work.

Keywords: Heater, oven, compact space, cheap, combination called Heater Oven

I. INTRODUCTION

A. *General Introduction:*

B. **Room heaters:-**

Room heaters are used to warm a small room and are normally moveable or fixed to a wall. Most room heaters utilize gas or electricity. Room heaters are suitable appliances that provide focused and localized heat which is particularly suitable in a space for people that are aged, ill or with limited mobility. But they can be costly. They use a lot of gas or electricity if used to heat up a space quickly, and are likely to cost a lot more than a central heating system.



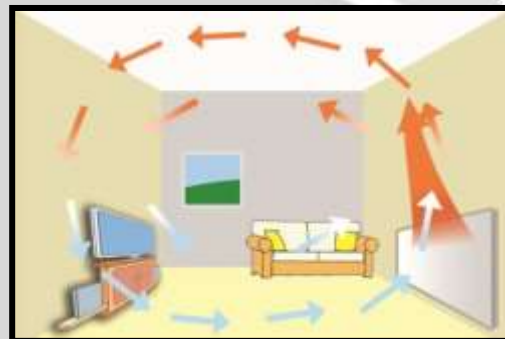
Oven:-

An oven is a thermally insulate compartment used for the heating, baking, or drying of a material, and the majority commonly used for cooking. Kiln and furnace are special- purpose ovens use in earthenware and metalworking, in that order.



Convection heat transfer heaters:-

A convection heater is a type of space heater that use air convection current to produce and spread heat. These currents flow throughout the body of the device and across its heating element. This method, following the principle of thermal conduction, heats up the air and cause air molecules to become buoyant or rise in volume and rise.



As heated air molecules rise, they displace space-temperature air molecules and cause them to move near the heat device. As a result, the displace air gets heated up, decrease in density, rises, and repeat the same sequence until the device is turned off either manually or automatically.

So by using this convection heat transfer principle we think that why not to make a device which is a combination of these devices i.e. of heater and oven. Which requires less space, compact, cheap, easy to use, and most important think that this device will perform the function of both the devices i.e. heater and oven.

1. Problem Statement:

In the olden days oven and heating of room is done by fuel which is coal and wood. As the years passed the both devices work on electricity.

But As we know that, In cold season the temperature goes down decreasing , So we uses Heater to warm up our room and also the body. The Heater only performs the function of increasing temperature of room.

As well as we uses oven to cook food, to eat hot food. So we find out that both the devices requires more space, it cost too much money to buy a single device. This is the problem with these devices.

2. Objectives:

The main objective of present work is to fabricate a device which is a combination of Heater and Oven. Also it should be compact, it should be cheap.

It should be design in such a way that it will not harm environment as well as to human being eco-friendly.

It should be easy to use; it should work well as Heater as well as Oven.

3. Scope:

Our project heater oven combination is only limited for domestic use like at home and at offices and at small scale industry for room heating and cooking.

The use of heater portion is only limited to winter season in other seasons only the oven will be used for cooking or grill the food.

The maximum temperature set limit is 130 degree Celsius.

II. COMPONENTS USED AND CONSTRUCTION

A. Device body:

The body is a circular tomb. This is a closed chamber which traps the heat coming from the heating element/coil. Which consist the heating element coils, base grill, fans etc.

It has two sections one is for to cooking food and there is also a heating coil present. In second section the fan is fitted to regulate the hot air in the room.

Sr. No	parameters	Dimensions (mm)
1.	Upper section	210
2.	Bottom section	260
3.	Stand	100
4.	Outer diameter	550
5.	Inner diameter	250
6.	Insulation	20
7.	Total height	570
8.	Area covered by device	129.75mm square.

B. grills:

The grills are placed at the base of the casing for cooking the food. On the grill the plate is placed on which food is placed.

The heating coil is placed at bottom of the grill .when the heating element is heated the grill and the plate is heated and then the food is cooked.

C. Heating element/coil:-

The heating element is the main part of the heater-oven which is used to heating the element to produce a hot vapour gas for cooking and room heating. This is made up of nickel-chromium. The heating element is used in device. It is used to generate heat for cooking and for room heating. The heating element is of spiral type. The material used is nickel- chromium. The material used is on the basis on the properties required for heating element and for long life as nickel has high melting and boiling point of 1453°C and 2913°C respectively. It also has high heat carrying capacity. And the chromium is used as it has to reduce the corrosion or to control the corrosion which is form by oxidation or by flames.

Sr. No	Parameters	Information.
1	Type	Spiral coil
2	Material used	Nickel-chromium
3	Phase	Single phase
4	Rated voltage	230volt
5	Rated watt	2000watt
6	Diameter	420mm
7	Thickness	4mm



D. Fan:-

The fans are placed in the casing to forced circulate the hot air in the room for room heating, generated by heating up the heating element. It is placed at the bottom section of the body. The metal fan is used in the device. The material used for fan is steel. The fan has motor of 60watt and having Max.RPM of 2400. The fan is used for the room heating. Due to the fan speed the hot air generated by the heating element is circulated in the room and room heating is done. When user has to operate the oven then the fen speed should be less that is regulated by the regulator provided at the controller panel box.

E. temperature controller:-

A temperature controller TC19 is used in device. This temperature controller is used to control the temperature of the device or of the heating element. It has 3 controlling buttons 1st for choose command of SET other two buttons are for setting the temperature or to increase or decrease the temperature. It also has one display on which the temperature of the device is displayed.



Temperature controller.

Sr. No	Parameters	Information
1	Make	MULTISPAN
2	Model name	TC-19
3	Display	4 Digit 7 seg 0.56", red LED Display
4	Size (mm)	96 (H) X 96 (W) X 50 (D) mm
5	Panel Cutout	92 X 92 mm
5	Input	J, K, PT-100 (Factory Set)
6	Temperature Range	PT-100: 0 to 400°C
7	Control Action	ON-OFF
8	Output	1Relay, 1C/O Contact, 5A, 230V AC
9	Power Supply	230V AC, 50 Hz, Approx 3VA
10	Protection Level	IP-65 (Front side) As per IS/IEC 60529: 2001
11	Operating Temperature	0°C to 55°C
12	Relative Humidity	Up to 95% RH Non Condensing

F. contactor:-

The power contactor is used to control the temperature of the device. When the temperature is set on the controller then the temperature of device is sense by the thermocouple sensor and this sensor is connected to the contactor, when the set temperature is reached then the contactor is get tripped off and device is get shut off. Then when temperature is goes down then the contactor get tripped on and again device gets on to maintain the set temperature.

G. RTD Sensor PT100:-

In device the thermocouple sensor RTD pt100 is used. The sensor is used to sense the temperature of the device. The sensing element used is made up of platinum. The sensing element can sense the temperature from -50 to 300°C. The accuracy of the sensing element is +- 0.002°C. This temperature sensor is connected to the contactor. After sensing the temperature from device it sends to the contactor and temperature controller. The contactor tripped off after temperature reaches to the set temperature by the user.

H. Connector:-

The connector is used in device. The connector is having made of CONNECTWELL. It used in device for the secure connections of wires to all the circuit. The connector is made up of polyimide material. It has M3 screw size.

III. WORKING*A. Working Principle:*

Our project works on the principle of heat transfer by convection method i.e. convective heat transfer, often referred to simply as convection, is the transfer of heat from one place to another by the movement of fluids. Convection is usually the dominant form of heat transfer in liquids and gases. Although often discussed as a distinct method of heat transfer, convective heat transfer involves the combined processes of unknown conduction (heat diffusion) and advection (heat transfer by bulk fluid flow). In this method the heating coil is used to generate the heat by using electricity and this heat is transfer through air .

B. Working:

Working of the heater-oven starts with putting the uncooked food into the oven. And then check that the uncooked is placed at right position or not. Then switch on the heater-oven.

When device is gets switch on then the heating coil element get starts to heat. Also the fan which is at the bottom section gets starts. Then set the temperature of the oven which is required to cook the food, by using controller panel and buttons given on that controller. After that control the speed of the fan by using controller according to the need Or we can also switch off the fan. After setting the temperature of oven wait for food to be cook. The temperature set at the controller, this temperature is get sensed by the thermocouple RTD sensor pt100 which is at just side of the heat element . Sensor senses that temperature and gives that information to the controller and contactor. When set temperature of body reaches then contactor tripped and device get shut off, after that the temperature is get down to maintain that set temperature the contactor get tripped on and again device get ON, by this way the temperature of the device is get maintain by using the contactor. In this way the food is get cooked. For room heating the fan is get switch ON for regulating the flow of the hot air in the room. The speed of the fan gets control by using the regulator. In this way the heater-oven works and cooks food as well as heats the room.



II. RESULT AND CONCLUSION

A. Result:

Sr. No.	Test Perform	Set Temp.	Actual Temp.
1	Auto on off	90°C	90°C
2	Room heating test (200 sq.ft)	30°C	27°C
3	Boiling of water	110°C	110°C

Table:-Result Table

SR No	Watt used	Current	Time	Unit rate
1	2000 watt	AC	1hour	Rs. 3.50/

Table:-Electricity Consumption.

B. Interpretation of Result:

A. Temperature result of auto on off:-

For the auto on off test of device we perform the test and set the temperature at the 90°C in the controller unit. We switch on the device and as time go the temperature of device rising continuously, when temperature shown on the controller unit is 90°C the device automatically gets shut off at 90°C. for testing we used infrared thermometer we get that device close to the device and measure temperature And the device shows reading 90°C. So the result we get is in the range what we expected.

B. Temperature result of room heating:-

For room we do the same thing set the temperature i.e. 30°C and waits for device to get that temperature. For regulation of hot air in the room we set the fan speed at the speed setting 2. After reaching temperature to 30°C we checked the temperature of room by the infrared thermometer. The result we get is 27°C. the obtained result is in the range.

C. Temperature result for Boiling of water:-

For cooking food test we set the temperature 110°C and after and we get that the food is cooked at 110°C at the temperature we set. It is again measured by the infrared thermometer. Hence the result we get is in the safe range.

D. Electricity Consumption:-

The commonly used convection electric oven is a common kitchen appliance found in most homes, ovens are used for cooking many different meals and especially for baking. Ovens can use a lot of energy depending on the temperature set; most cooking is done at 100 to 300 degree Celsius. Ovens use 1000 to 5000 watts, with an average modern oven using around 2400 watts on medium to high heat. In our project we use only 2000 watt on medium to high heat, depending on the temperature set; most cooking is done at 100 to 300 degree Celsius.

The electricity consumption for any common convention oven:-

Formula for electricity consumption

$$\frac{\text{Device wattage} \times \text{Hour Used} \times \text{KWH Rate}}{1000}$$

So electricity consumption for common device is,

$$= 2400 \times 1 \times 3.5 / 1000$$

$$= \text{Rs } 8.6/- \text{ Per Hour.}$$

$$\text{cost per day} = 8.6 \times 2 \text{ hour}$$

(commonly use of oven in homes is 2 hour)

$$= \text{Rs } 17.2/-$$

The electricity consumption of our fabricated device,

Formula for electricity consumption

$$\frac{\text{Device wattage} \times \text{Hour Used} \times \text{KWH Rate}}{1000}$$

So electricity consumption for fabricated device is,

$$= 2000 \times 1 \times 3.5 / 1000$$

$$= \text{Rs } 7/- \text{ Per Hour.}$$

$$\text{cost per day} = 7 \times 2 \text{ hour}$$

(commonly use of oven in homes is 2 hour)

$$= \text{Rs } 14/-$$

C. Conclusion:

This work has provided an excellent opportunity and experience, to use limited knowledge. It has gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. The “fabrication of heater-oven”, will be designed for cooking and room heating. In this system the cooking and heating of room can be done simultaneously. The system will be handled any operator very easily. Due to low cost and simple design this can be marketed to any of the nation. Cheap, easy, simple, compact device is obtained. This device is mainly fabricated for cheap and for performing the function of both heater and oven.

III. FUTURE SCOPE AND APPLICATIONS.

A. Future Scope:

The main objective of present work is to fabricate a device which is a combination of Heater and Oven, also it should be compact, it should be cheap, it should be design in such a way that it will not harm environment as well as to human being ecofriendly, it should be easy to use, It should work well as Heater as well as Oven. By considering this conditions the Heater-oven will be used and manufactured in greater amount in the future for household uses. Also who want to buy a heater as well as oven for house they will give preference to this device. In the future it will be modified as a Heater-oven which will cook, heat rooms and also heat the water. Also we can modify it as heater-oven-cooler. by using refrigerant in it.

B. Advantages:-

1. It has a very reasonable structure.
2. It is safe and ecofriendly.
3. It is a convenient device at reasonable price.
4. Cooking food and room heating is done simultaneously.
5. Ensures easy portability and multi-purpose use of one device.
6. Cooking is cleaner with lesser odors.
7. Microwave ovens rapidly cook foods.

C. Disadvantages:-

1. Accuracy and repeatability can sometimes be a problem.
2. Heating the bottle in a oven can cause slight changes in the milk. In infant formulas, there may be a loss of some vitamins. In expressed milk, some protective properties may be destroy.
3. The minerals in vegetables are altered into cancerous free radicals when cooked in microwave ovens.

D. Application:-

1. The room heater is used to heat rooms in the winter season.
2. Domestic and house use.
3. Useful where less space is available.
4. Also useful for small scale industry.

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