Automatically Controlled Industrial Air Heat Blower & Chamber System

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Automatically Controlled Industrial Air Heat Blower & Chamber System

A Thesis By:

MD.REZAUL HAQUE
Student ID: BME1601008126
Session: 2016

ABU YOUSUF
Student ID: BME1601008024
Session: 2016

MD.SAZZAD HOSSEN
Student ID: BME1601008040
Session: 2016

MD.AL AMIN RANA
Student ID: BME1601008042
Session: 2016

MD.SAGOR TARAFDAR
Student ID: BME1601008121
Session: 2016

Supervisor

AHMED ZAWAD UL HOQUE
Lecturer
Sonargaon University (SU)
Department of Mechanical Engineering

DECLARATION

This is to endorse that the work presented through this project entitled Auto controlling industrial air heat blower and chamber System" is the outcome of the investigation carried out by us, under the supervision of Mr. Ahmed Zawad Ul Hoque, Lecturer, Department of Mechanical Engineering (ME), Sonargaon University-(SU), Dhaka. It is also proclaimed that neither of the particular work nor any part of the work presented here has been submitted elsewhere for the award of any degree or diploma. The Project/Thesis report, the necessary files, and the hardware of this project had been submitted to the Department of Mechanical Engineering, Sonargaon University through thesis/project supervisor.

Supervised by:

Ahmed Zawad Ul Hoque
Lecturer
Department of Mechanical Engineering
Sonargaon University-(SU)

…….
Signature of Supervisor

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ABSTRACT

The critical issueis not finding the proper heat in a space. It causes many problems like a spreading or a working problem. In a workplace proper heat needed for various types of work. Nowadays different types of machines are run by heat. If it can't get the proper heat then it can't give us needed output. Besides that in a living place sometimes heat is not adjustable for our body. It causes problems in different seasons. We can adjust the heat for our needs in the living place and working place through the heating chamber. So this project can easily solve the problem. This project depends on two parts are mechanical and electrical. We used a heater for heat and heat controller for controlling the heat as per our need. We used a blower motor for giving the output. For controlling the circuit we used magnetic contactor, switches, Connected wire. All these things are settled in a DB box. So this heating chamber is a proper solution to this problem.

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CHAPTER I

INTRODUCTION

1.1 Introduction

Heating chambers are laboratory ovens for thermal convection applications. A heating chamber generally provides consistent temperatures throughout and is available in many configurations, including clean rooms, forced convection, horizontal airflow, natural convection, electrical machines, etc. Process applications for heating chambers include annealing, curing, drying, baking, sterilizing, and other industrial laboratory functions.
We use four pencil heater in this heating chamber. Each heater is about 250W. This heater can control the temperature from 50 to 100 degrees Celsius.

1.2 Objectives

1. To produce heat and control the heat by the use of a heater.
2. To control the heat as per our work.
3. To heat raw materials i.e polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), etc.
4. To detect and regulate temperature via room thermostat.
5. To control output heating and to switch between heating.
6. Keep printing rolls at acertain temperature.

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

Over the years, many approaches have been adopted in configuring Air heat blower systems. One of these systems is a Manual controlled heat chamber.

In this system, we must control the device manually. They used different types of switch to operate the system. But the output is as same as our system. Its limitations are

1. It is time-wasting
2. A lot of energy required
3. It causes device process or product damage
4. It has the potential to cause a fire outbreak
5. A lot of noise which may sometimes be psychologically destabilizing
6. Maintenance is more frequent

2.2 Research

In our heat chamber system, we are using a magnetic contactor to control the device. We also did the same thing as others but we used automatic circuits against manual systems. Because it is easy to use more than a manual system. Because in manual control we must change the switch to operate the heating chamber. So we need not used extra manpower to do the work. It is more reliable. We used a heat controller to control the heat we expected

1. It is more effective
2. More reliable
3. More secure
4. Low cost
5. Lower Maintenance
6. Easy to use

CHAPTER III
METHODOLOGY

3.1 Method

In this system, there are two parts. These are -

1. Mechanical
2. Electrical

3.1.1 Mechanical

In this part, we make the body of the heating chamber. On the right side of the heating chamber, there is a chamber of the heater[7]. We used four pencil heater for heating. It produced heat and it will go through a pipe. There is a blower in the middle part of the heating chamber. A pipe connects with a chamber to the blower. Then it will give the heat to the room for the raw material. On the left side of the heating chamber, there is a chamber. It is made for the control circuit.

The full body is made of metal. We used a scale for leveling the body. There is a screw that is attached to the blower.

Figure 3.1: Automatically Controlled Industrial Air Heat Blower and Chamber System.

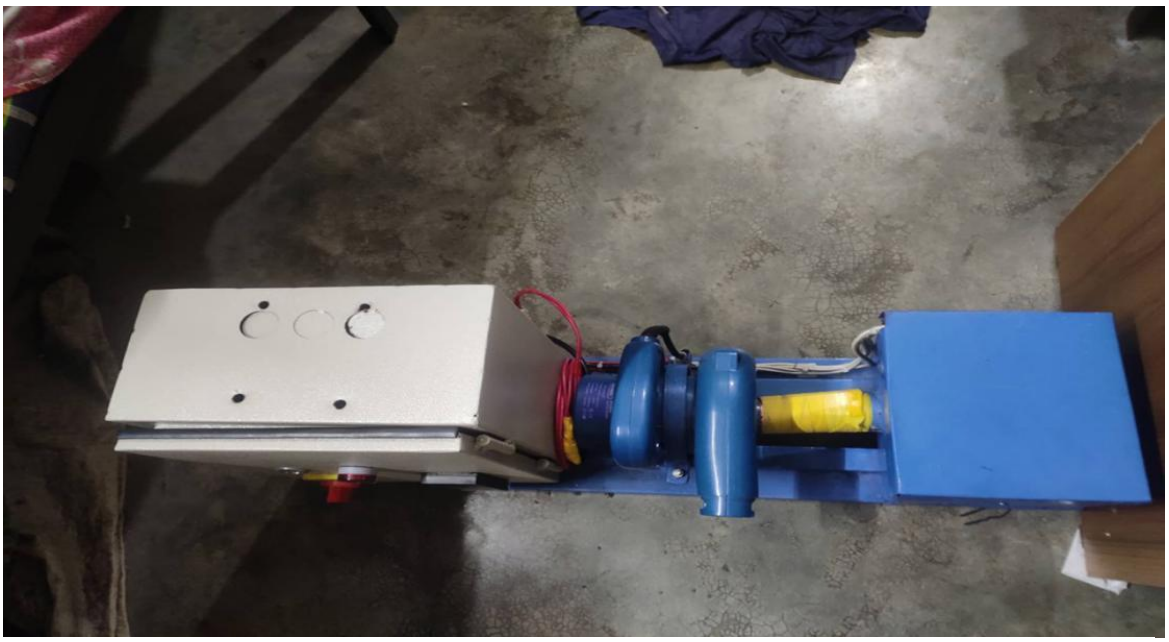

Figure 3.2: Auto Controlling Industrial Air Heat Blower and Chamber System. (Top view)

3.1.2. Electrical

There are two points of a pencil heater that are positive and negative. We used a four pencil heater. We connect two heater parallel. Four heaters used as two heaters. We used a magnetic contactor for controlling the system. By this, the system will run automatically. A heater is connected with a magnetic contactor. We used three magnetic contactors. One foe blower and the other two for the heater. All these three contactors control the full system. We also used a heat controller to control the heat. A thermocouple is connected with the heat controller. A thermocouple is a temperature sensor. It senses the heat of the room. When we get the expected heat contactor switched off the system and when the temperature is low than the expected heat then the contactor automatically runs the system. We used a digital voltage indicator. It indicates the voltage level of the system. We used connected wire for wiring the control circuit. A blower is connected with a magnetic contactor.

Figure 3.3: Automatically Controlled Industrial Air Heat Blower and Chamber System.
(Electrical wearing)

3.2 Specifications

Power	2600 W
Voltage	220 V
Current	10-16 A
Circuit Breaker	16 A
Capacity	50-100 Degree Celsius

Table 3.1 : Specifications

3.3. Block Diagram

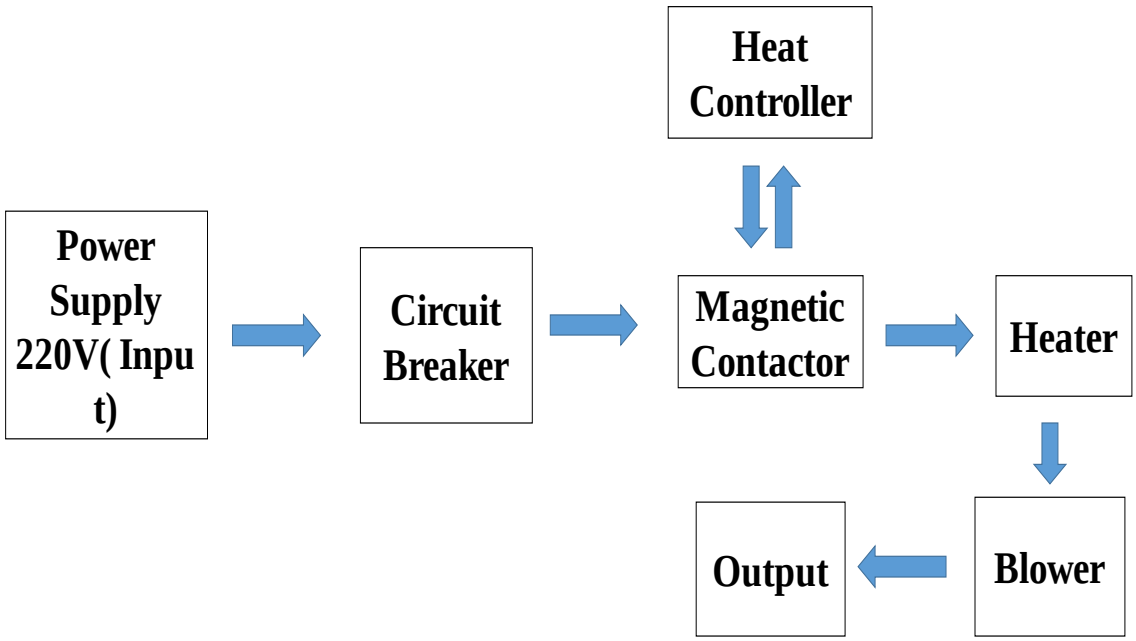

Figure. 3.4: Black Diagram

3.4 Calculation

Sl. No.	Time	Heater Temp. ^{0}C	Room Temp. Temp. ^{0}C
1.	0	0	25
2.	5	10	25
3.	10	20	25
4.	15	30	30
5.	17	35	35

Table 3.2: Time with Temperature Difference

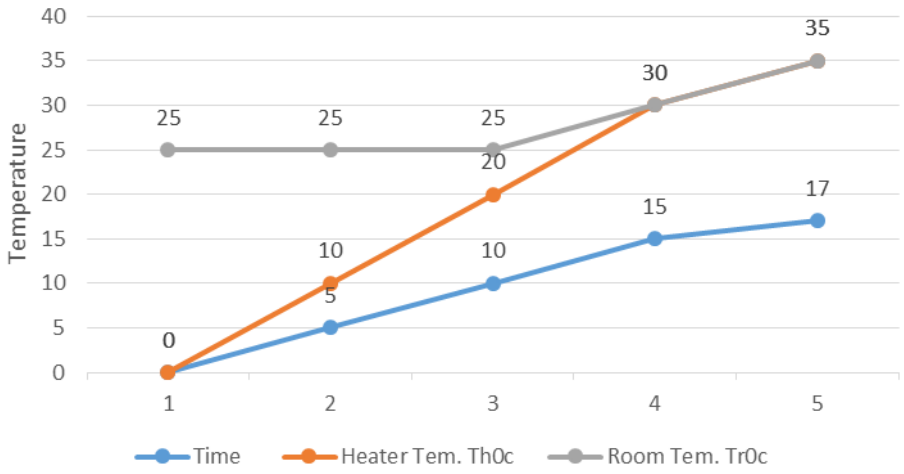

Figure 3.5: Time vs. Temperature Curve

Given data,

T = 17 min = 0.28333 hrs.

P= 1600 W = 1.6 kW

We know

Power,

$$P = \frac{W}{t}$$

W = Pt

= 1.6 × 0.28333

=0.453328 kWh

Let,

Cost per unit = 5.00 Tk.

∴ Cost for 0.453328 unit = (5× 0.453328) Tk

= 2.266Tk.

3.5 Advantages

- Heat control easy by this method.
- This method of heat reduction is easy.
- It's a lower price than other hit chambers.
- It doesn't need more space.
- It saves electricity.
- It is very useful for the industry.

3.6 Disadvantages

- Have to be monitored every day.
- The dirt inside the chamber.
- It has to be cleaned after a few days.

CHAPTER IV
EQUIPMENT AND COMPONENTS

4.1 List of Equipment's

1. Heat Chamber
2. Air Blower
3. Circuit Breaker
4. Magnetic Contract
5. Heat Controller
6. Selector Switch
7. Indicator lamp
8. Terminal Blocks
9. Hot air pipe
10. Aluminum Chanel
11. DB Box
12. Electric Wire
13. Pencil Heater
14. Thermocouple
15. Frame

4.2 Description

4.2.1 Heat Chamber

Heating chambers are laboratory ovens for thermal convection applications. The demand of the heating chamber is growing day by day in the plating industry[3]. This unit is a better system for drying job items of various sizes & got advantages over centrifugal dryer like no vibration, no mechanical or electrical sound with an auto cut system for temperature and time. The cores are made of M.S sheet/ steel sheet and steel tray fitted with nets or trolley fitted with hanger. The heating chambers are highly efficient and steady enough to ensure smooth trouble-free services.

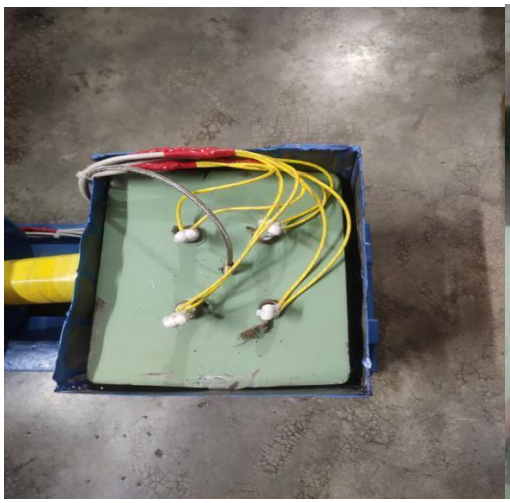

Figure 4.2.1A: Heat chamber (Inside)

Figure 4.2.1.B: Heat chamber (Outside)

4.2.1.1 Features

- Effective usage
- Long functional life
- Durable

4.2.2 Air Blower

An air blower is a machine used for generating the flow of air at substantial pressure. The airflow generated is used for different purposes such [1]. Centrifugal Blower - Air enters axially and leaves the blade radial direction.

Figure 4.2.2: Air Blower

4.2.2.1 Specifications

Model:	ST-EB005
Blower Power	1600 w
Capacity	2.5m³ /min
Rated voltage	220V
Rated Frequency	50/60Hz
No load/load speed	0-16000 r/min

Table 4.1 : Specifications

4.2.2.2 Type of Blower

- Positive Displacement / Rotary Lobe Blowers.
- A positive displacement blower has a function that's straightforward yet effective.
- Helical Screw Blowers.
- Centrifugal Blowers.
- High-Speed Blowers.
- Regenerative Blowers.

4.2.3 Circuit Breaker

A circuit breaker is a switching device that interrupts the abnormal or faults current. It is a mechanical device that disturbs the flow of high magnitude (fault) current and in addition, performs the function of a switch. The circuit breaker is mainly designed for the closing or opening of an electrical circuit, thus protects the electrical system from damage.

Figure 4.2.3: Circuit Breaker.

4.2.3.1 Working principle

Under normal working conditions, it operates as a switch (manual one) to make the circuit ON or OFF. Under overload or short circuit condition, it automatically operates or trips so that current interruption takes place in the load circuit[2]. The visual indication of this trip can be observed by the automatic movement of the operating knob to the OFF position. This automatic operation can be obtained in two ways as we have seen in construction; those are magnetic tripping and thermal tripping.

Under overload condition, the current through the bimetal causes to raise the temperature of it. The heat generated within the bimetal itself enough to cause deflection due to the thermal expansion of metals[8]S. Abrate, Impact on composite structures, Cambridge University Press, 2005. This deflection further releases the trip latch and hence contacts

get separated. In some, the magnetic field generated by the coil causes develops pull on bimetal such that its deflection activates the tripping mechanism.

4.2.4 Magnetic Contractor

Magnetic contactors are a form of electrical relay found on most electrically powered motors. They act as a go-between for direct power sources, and high-load electrical motors in order to homogenize or balance out changes in electrical frequency which may come from a power supply as well as to act as a safeguard. It should be noted that though they are similar in design, magnetic contactors are not circuit breakers[9]. They do not sever the connection between appliance, and power source during a short circuit. They are detachable from a motor so that an operator may work with that motor; disassemble or maintain it, without the possibility of live current still passing through the device.

Figure 4.2.4: Magnetic Contractor

4.2.4.1 Specifications

LS GMC-12 1a1b Contactor

AC 110V 50/60Hz

1. Electricity Type: AC
2. Number of Pole: 3
3. Phase: 3
4. Main Circuit Rating Current: 630a
5. Is customized: Yes
6. Main Circuit Rating Voltage: 220 V
7. Type: 1a1b
8. Model: GMC-12

4.2.5 Heat Controller

A temperature controller is a device that is used to control the temperature. It does this by first measuring the temperature (process variable), it then compares it to the desired value (set value). The difference between these values is known as the error (Deviation). Temperature controllers use this error to decide how much heating or cooling is required to bring the process temperature back to the desired value. This output signal is known as the (manipulated value**)** and is normally connected to a heater, control valve, fan or some other “final control element" which actually injects or removes heat from the process[6].

Figure 4.2.5: Temperature Controller

4.2.5.1 Working Principle

Temperature controllers form one of the four parts of a temperature-controlled system. To help visualize this we will consider an oven. The four parts would be:

1. The oven
2. The heater
3. The thermometer (or thermocouple)
4. The controller

The role of the temperature controller is to measure the temperature on the thermocouple, compare it to the setpoint and to calculate the amount of time the heater should remain switched on to maintain a constant temperature.

The important point is that the temperature controller has one input, one output, and one set point.

4.2.5.2 Specifications

1. Product Name: Temperature Control Meter
2. Model: REX-C400FK02-M*AN
3. Power Supply: AC 220V, 50/60 Hz
4. Display: PV (Process Value) & SV (Setting Value)
5. Display Range: 0 - 400 oC
6. Working Temperature: 50 oC (max.)
7. Measurement Precision: ±0.5%FS 1 character
8. Relay Output: AC 250V, 3A
9. Plate Size: 96 x 48mm/ 3.8" x 1.9" (L*W)
10. Overall Size: 113 x 48 x 96mm/ 4.4" x 1.9" x 3.8" (L*W*H)

4.2.6 Selector Switch

Selector Switch: Selector Switch works on a general principle; they contain a simple selector switch on the front of the panel, and a broad range of potential contact combinations (via the contact blocks), on the inside of the enclosure[5]. The major difference between the selector switch and the pushbutton is that, while a pushbutton has a plate that pushes down both contact plungers at the same time, a selector switch has a rotating cam with ridges and flats, allowing to actuate the plungers independently.

Selector switches are available in 2, 3, or 4-position versions, and are often used when more than one control option is needed. In general, the center position of the selector switch is the starting cam position. The left position presses the left plunger in the selector switch. Turning the selector switch to the right presses down the right plunger.

Figure 4.2.6: Selector Switch

4.2.6.1 Working Principle

Selector switches use cams in combination with contact blocks to provide a wide range of circuit openings and/or closings. In the following diagram, "X" designates a closed circuit (energized or "on") for a particular selector switch position, and "O" to designate an open circuit (not energized or "off").

In the figures below, a 3-position selector switch is used to open or close two circuits, "hand" and "auto", for a pump application. It works in the following manner (reflects a left, center and right selector switch positions). Indicating lights are part of selector switches. Setting a selector switch is how we tell machines how to operate. Indicating lights tell us what the machine is doing or failing to do. When light is connected to a machine process, and the light is on, the machine shows that it's working.

Selector switches are used when more than one control option is needed (e.g. Hand-Off-Auto). These switches are preferred when a maintained contact is needed.

4.2.7 Indicator Lamp

Voltage indicators are small installation devices for measuring both alternating and direct voltages. Voltage indicators continuously show the current-voltage. Voltage indicators are used to check batteries or mains voltage.

Figure 4.2.7: Indicator lamp

4.2.7.1 Specifications

Lighting Type	LED
Body Material	ABS
Brand	Be Switchgears
Color	Blue
Product Code	BE 16-22VD BLUE
Features	Indicating voltage up to 500V particular phase
Diameter	22.5mm
Minimum Order Quantity	10 No

4.2.8 Terminal Block

A terminal block is a tool used to safely connect two or more wires together. Also known as a terminal block connector, these blocks use a clamping component and conducting strip to secure and organize connecting wires. A terminal block allows users to join multiple outgoing wires to one singular incoming wire, thanks to its insulated frame and multiple terminals.

Figure 4.2.8. : Terminal Blocks

4.2.8.1 Reasons for using a terminal block

While it is possible to connect two wires together without a terminal block, connecting more than two can be challenging and dangerous. Once wires are stripped, the clamping element within the block keeps the lines securely in place, allowing the user to easily determine where everything needs to go. The insulated frame that[4].

Houses the wires keep the wires secure and create a simple mounting for ongoing electrical projects.

Terminal blocks tend to have high current and voltage ratings and are much tougher than standard connectors. Because of their rugged, touch-safe design, blocks provide versatility and reliability that lends their use to a wide variety of uses and industries.

4.2.9 Thermocouple

A thermocouple is a sensor that measures temperature. It consists of two different types of metals, joined together at one end. When the junction of the two metals is heated or cooled, a voltage is created that can be correlated back to the temperature. A thermocouple is a simple, robust and cost-effective temperature sensor used in a wide range of temperature measurement processes.

Figure 4.2.9: Thermocouple

4.2.9.1 Working Principle

When two wires composed of dissimilar metals are joined at both ends and one of the ends is heated, there is a continuous current that flows in the thermoelectric circuit. If this circuit is broken at the center, the net open circuit voltage (the See beck voltage) is a function of the junction

4.2.9.2 Specifications

1. Product Name : Thermocouple; Transfer Type : T .Temperature Range : 0-500C
2. Thread Diameter : 8mm / 0.31";Probe Diameter : 5mm/ 0.1";Fork Terminal Spacing : 4mm / 0.16"
3. Probe Length : 50mm/ 2";External Shielding : Metal Shield
4. Total Length : 3 Meters / 9.8Ft;Color : Silver Tone
5. Weight : 50g;Package Content : 1 x Thermocouple

4.2.10 Pencil Heater

A cartridge heater is a tube-shaped, heavy-duty, industrial Joule heating element used in the process heating industry, usually custom manufactured to a specific watt density, based on its intended application[10]. Compact designs are capable of reaching a watt density of up to 50W/cm² while some specialty high-temperature designs can reach 100w/ cm².

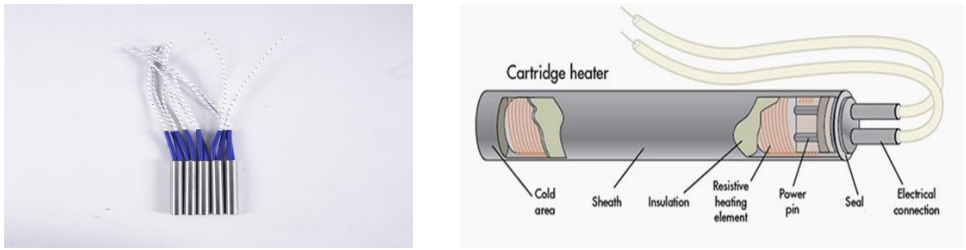

Figure 4.2.10: Pencil Heater

4.2.10.1 Specifications

High heat transfer cartridge tube, 2 wires, and corrosion-resistant stainless steel heater. It is widely used in a heating metal mold, molds and dies, hot mold core box, vacuum equipment, bolt heating element, high-temperature equipment, hot stamping, etc.
This high-quality single head electric heat pipe used for both ends of the wiring in not heating medium.

1. Rated Voltage: 220 V
2. Wire Length: Approx. 24.6cm
3. Diameter: Φ 10
4. Rod length：100mm
5. Usage: Industrial
6. Max Measuring Temperature: 120°C & Above

CHAPTER V
DISCUSSION & CONCLUSION

5.1 Discussion

In this modern life, heat chamber is a very familiar machine that is used in home and different types of industry. Our heat chamber is also made for home. We made the experiment at home. This device can be used in 4:4 meter room. It can produce the expected heat in this type of room. That can make feel comfortable for the family member. So our device can fulfil the demand of the consumer. If it can make broadly then it can be used in any type of industry where we need to control the heat as our expectation.

5.2 Conclusion

Our device can solve the problem which creates for unbalance heat. We can easily use this device for this problem. We can easily balance the heat at home and working place. Nowadays almost every machine needs heat to operate. At home, it is used for a comfortable life. Almost everywhere we can use this device. This device is mostly used in foil and plastic industries.

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