MICROCONTROLLER BASED INDUCTION HEATER FOR INDUSTRY GEAR & BEARING

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Abstract-

To reduce the risk of incorrect mounting ,Induction Heater helped pioneer the use of portable Induction heater for bearing mounting application . This Induction heater is safer more efficient & user friendly beraring Induction heater .The Induction heater has been designed to heat rolling bearings . However ; other metal work piece that form a closed circuit can also be heated .Examples of acceptable work piece include bushing , shrink ring pulleys & gear . All bearing that fit over the Inductive coil & between the vertical support with the top yoke in place can be heated using the induction heater . Additionally a software phase locked loop for induction heating application is designed & implemented to prove its flexibility & reliability . the modeling of a continuous induction heating to allows high production with reduced space requirement &high power industrial process working 24 hour per day .

Keyword : *induction heater , bearing , gear , flexibility, reliability , Microcontroller , workpiece*

1. INTRODUCTION

Induction heating is a method of heating electrically conductive material taking advantage of the heat produced by the eddy current generated in the material . It has many advantages compared to other heating system .such a quicker heating faster start up more energy saving & higher production rates .Since Michael Faraday discovered electromagnetic inducton in 1831 .this phenomenon has been widely studied in many application as for example transformer & other magnetic design this basic electromagnetic phenomenon in which induction heater relies has been described & discussed extensively used .This induction heater is designed to heat bearing that are mounted with an interference into a shaft . the heat cause the bearing to expand which eliminates the need to use force during installation . A 90^0C (194^0f) temperature difference between the bearing &shaft is generally sufficient to enable installation .

2 METHODOLOGY

Microcontroller based Induction Heater Industrial Gear Bearing consist of following components – Temperature controller , digital timer , set reset start switches , relay 5v DC , display indicator , Temperature sensor , induction heater coil , SSR, connector strip , twp pin , winding paper , transformer core
Epoxy resin .
The below given diagram of Induction Heater for gear & bearing assembly primary function of IH induction heater

- **Safety form Over heating & over current**
- **Temperature Controller**

It provides heat energy into a substance at desired temperature if there is sudden change in the current value then this controller give signal to save the equipment as well as save the health of operator from induction heater

- **Performance Optimization**
  Solid state relay platform best when the static flow of current to the heater maintaining inductive load & get break the line from over loading in this system .
- **Communication**
  The microcontroller based induction heater is liable for communication with Electronic control unit digital timer & temperature control with in the time period . Its nearly give sure running of the model .
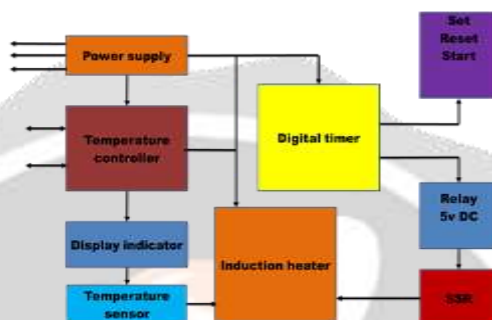
Fig: BLOCK DIAGRAM OF MICROCONTROLLER BAISED I NDUCTION HEATER FOR INDUSTRY GEAR & BEARING
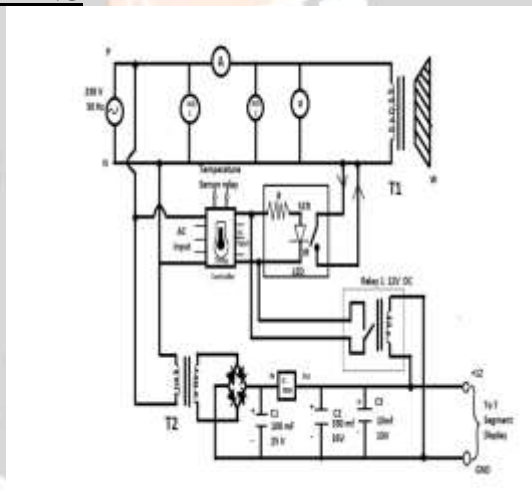
Fig: Circuit Diagram

2   WORKING PRINCIPLE

The most basic elements composing an induction heating system are the piece to be heated also known as a work piece , & the inductor or call that producers the magnetic field need to generate the heat . the inductor & the work piece can have shape & the piece is usually placed inside the coil to have better couiling . considering that this study focused an the negative of round wires, the inductor used us a solenoid & the work piece a round wire . Induction heating phenomenon is based on two mechanism of energy dissipation .

Energy losses due to joule effected *:-* When applying an alternating voltage to an induction coil an alternating current is generated in the coil .This current produces an alternating magnetic field .Ampere is lagging that induce voltage in the work piece ,Which opposes to the variation of this magnetic field (Lenz's law) . These voltage creates current in the work piece , called eddy ,Which have the same frequency but opposite direction than the original current , these eddy current produce heat in the piece of joule effect .

Energy losses due to Hysteresis *:* These losses are caused by friction between dipoles when ferromagnetic materials are magnetized in one direction & another .They appear in ferromagnetic material below their curie temperature at which the material becomes non- magnetic
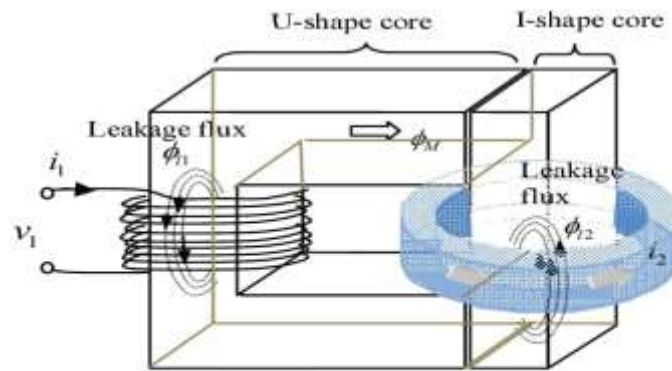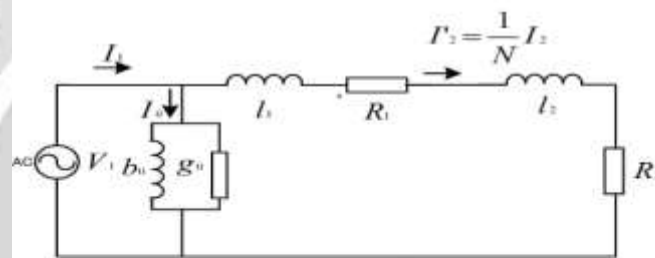
Fig. 1   Schematic diagram of
the induction heating machine

V_1 : heating coil voltage(primary voltage)

I_1 : heating coil current(primary current)

R_1 : heating coil winding resistance

l_1 : heating coil leakage inductance

N_1 :turn of heating coil

R_2 : ring(secondary) resistance

l_2 :ring(secondary)leakage inductance

3   SYSTEM WORKING

 Microcontroller based Induction heating automotive industry to shrink fit gears & rings . They are also employed to repair trins truck & cars . OUR system are used for shrink fitting task on off shore platform & are used to remove the giant bearing & gear , ring in the motor , wheel of car & trucks in their bearing . Typically metals will expand in response to heating & contact when is cooling . This dimensional response to temperature change is known as thermal expansion induction shrink fitting is where we are this effect to either fit or remove parts. A metal bearing is heated to between 90^0C to 360^0C . Which cause it to expand an allow for the insertion or removal of another components like as gear from the shaft of vehicals .This induction heating have benefits of accuracy & speed, consistency . If we set 150^0C in the temperature control then after heat reaches at it desired value . It cut off line supply & save from overheating another way is the digital timer .There also we set time in minutes for the heating it give also reliable performance after reach at proper temperature of bearing it also break the supply .

The system have the controller , device , temperature controller & digital timer whenever any fault condition occur it cut the power supply from system give 100% safty to operation as well as equipment .
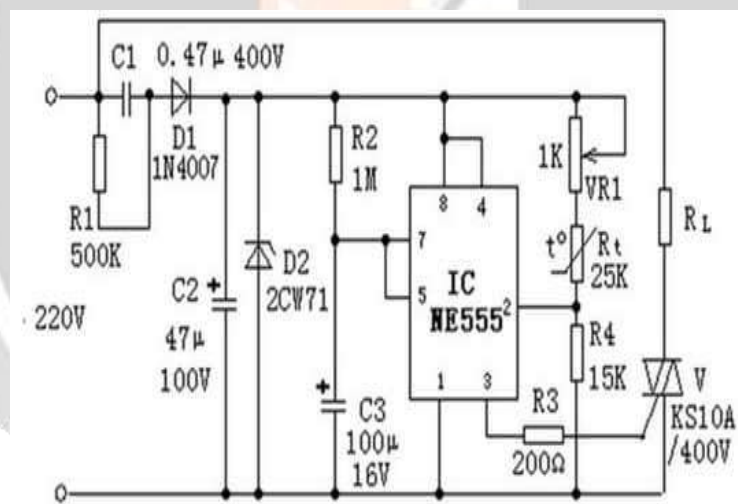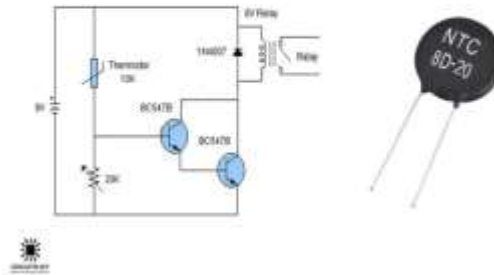
ON CONDITION

图 6 采用 555 时基电路的简易温度控制器电路图

Fig: MICROCONTROLLER CIRCUIT

OFF CONDICTION

Temperature sensor relay switch circuit. This is just like a normal heat or temperature sensor with a relay so whenever the circuit will receive heat the relay will activate and so will the load or device connected to the relay. Any AC 110V or 220V or DC appliance can be connected to the relay so that you can operate it automatically on the desired temperature. The circuit is inexpensive and simple it is using only 5-6 components. It is an ideal circuit for beginners looking for an easy electronic project or for those who need an inexpensive fix for their heat-sensing requirements. This circuit can be operated on a 9 volts battery, transformer, or an adaptor. We have connected two BC547B transistors as a Darlington pair. This increases the sensitivity and the gain of the circuit. To adjust the desired level of heat at which you want your relay to activate we have used a 20K ohms variable resistors. A thermostat is the main component as it is sensing the heat. You need to connect it a little away from other components in the circuit so that the heat doesn't get to them.

4   TRANSFORMER CORE

The transformer works on the principle of Faraday's law of electromagnetic induction &mutual induction .There are usually two coils primary coil & secondary coil on the transformer core . The core lamination are joined in the form of strips . The two coils have high mutual inductance . When an alternating current pass through the primary coil it creates a varying magnetic flux . As per faraday's law of electromagnetic induction , this change in magnetic flux induces an emf in the secondary coil which is linked to the core having a primary coil . This is mutual induction .

Overall , a transformer carries the below operation :

- Transfer of electrical energy from energy from circuit to another

- Transfer of electrical power through electromagnetic induction

- Electric power transfer without any change in frequency

- Two circuits are linked with mutual induction
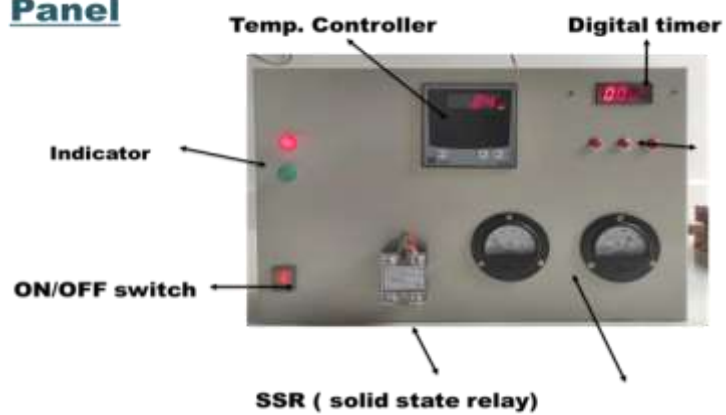
5   RESULT

Sr. No	Operating Frequency	Applied Voltage	Operating Current
1	50Hz	230v	2A
2	50Hz	230v	2A
3	50Hz	230v	2.5A
4	50Hz	230v	3A

6   CONCLUSION

The high temperature is particularly important for precious metals .Induction heating efficiency is higher than the flame furnace with about 30-50%& higher than traditional electric resistance furnace with about 20%-30% & it has the advantages of convenient operation & long Service Life .

7   ACKNOWLEDGEMENT

8   REFERENCES

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