DESIGN AND FABRICATION OF SEMI AUTOMATIC PACKING CONTROL MACHINE

A PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report entitled "**DESIGN AND FABRICATION OF SEMI AUTOMATIC PACKING CONTROL MACHINE**" is the bonafide work of

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ABSTRACT

In most of the small scale industries, the material packing is done manually. This process consumes more time and human labour. There are number of pneumatic packing machines available in market but the disadvantage is that the costs of those machines are very high. Not only is this, also the packing rates of this pneumatically controlled machine is less while compared to electrically operated one.

Now this project mainly concentrates on the above said difficulty, and hence a suitable electronic control unit has been designed such that the material can be packed in a proper condition and hence there is a considerable variation in terms of cost. The objective of our project is to,

- Design and fabricate an electrically operated automatic material packaging control machine at a comparatively low cost.
- Increase the packaging rate by controlling the timer unit in the electronic circuit.
- Explore opportunities to implement the machine into the market and hence achieving suitable goals for that purpose.

The fabrication part of this project has been considered with almost care for its simplicity and economy, such that this can be accommodated as one of the essential tools on industrial applications. The rate of packing was also achieved to be 50 grams/sec which

ACKNOWLEDGEMENT

First and foremost, we pay our sincere and humble salutations to the almighty for equipping us with all the strength and courage throughout our venture in the project work.

At this pleasing moment of having successfully completed our project, we wish to convey our sincere thanks and gratitude to our guide **Mr.S.R.Rajabalayanan,** Assistant Professor, Department of Mechanical Engineering, for his kind guidance and encouragement throughout our endeavour.

We are also grateful to **Dr.T.Kannan,** Head of the Department, for his constructive suggestions and encouragement during our project.

We would like to express our sincere thanks to **Prof.R.Annamalai,** Vice Principal, for forwarding us to do our project and offering adequate duration in completing our project.

We would like to express our sincere thanks to **Mr. R.Subburaj** and **Mr.N.S.Sivakumar,** lab technicians for rending their guidance continuously in doing the project.

We shall be failing in our duty if we do not thank all the teaching and non teaching staff of the Mechanical Engineering Department and our friends for having encouraged us and supported us morally while doing the project. Finally, our humble gratitude is due to our parents who were a constant source of inspiration

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LIST OF ABBREVIATIONS

N	SPEED IN rpm
D	PITCH DIAMETER
m	MODULE
D_o	OUTSIDE DIAMETER
ψ	HELIX ANGLE
λ	LEAD ANGLE
a	CENTRE DISTANCE
T	TORQUE
M_t	DESIGN TORQUE
b	FACE WIDTH
Z_1	No. OF TEETH ON PINION
Z_2	No. OF TEETH ON GEAR
d_1	PINION DIAMETER
d_2	GEAR DIAMETER
N_1	SPEED OF PINION
N_2	SPEED OF GEAR

CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

Packaging machineries are basically used to pack products or components. They are without a doubt one of the important equipments used in various Industrial Applications starting from food processing, prolonging till the application of robots. There are many different package types. Examples include: aerosol containers, bags and pouches, blister packs, bottles and jars, cartons and boxes, cans, capsules, cartridges, cases, cups and trays, drums, kegs and pails, pallets and intermediate bulk containers (IBC), tubes, and vials. Much food processing Industries are greatly in need of packaging machines, since packing which is the most important department in that aspect. A good packaging of any product in general is usually required and is desired by any people in this world. Applications for packaging machinery include: automotive, chemical and petrochemical, cosmetics and perfumery, electronics and semiconductor, food and food service, garment, household product, medical, military, music, video and software, pharmaceutical, stationary, and tobacco.

1.2 WORKING

A packaging machine is an industrial tool used to assist packing of products in a precise and neat manner with or without human intervention. The human assistance depends on the criteria whether the machine is manual or automatic or a semi automatic one. For manual machines each cover must be filled manually and then taken for packing which also is done manually. This usually increases the time and moreover quality of packing varies since it is being carried out manually. In the case of an automatic material packaging machine, the conveyor carries an empty cover wherein object falls into the cover through hopper. This is then carried to the packing section where a heating element is used. The movement of the conveyor, heating element and the hopper are operated by means of an electric motor, sensor and timer unit. Since our project is an automatic material packaging machine the operation is briefly explained.

First a cover that has a bearable thickness such that it does not get smoked up by the heating element is taken. The cover is then placed on the conveyor and roller assembly which is operates by means of an electrical motor i.e, Driving motor and Spur Gear assembly. This takes the cover to the hopper assembly wherein the object to be packed is filled. Here comes the operation of the timer unit and the sensors. The Sensor used here is an IR sensor which senses all colors except white. For this it uses an IR transmitter and an IR receiver at opposite ends so that they both pass IR signals across the width of the conveyor belt. Hence if there are no obstructions between the signals then free signals occur which means the relay in the timer unit is turned ON. So the object continues to flow through the conveyor till the signal cuts off.

Now if an object comes near the hopper and passes through the line of signal between the transmitter and the receiver, the signal between these sensors get cuts off immediately. This means that, if the signal is OFF then the relay in the timer will be ON thereby stopping the conveyor action and switching timer function onto the hopper arrangement. Now the hopper assembly is operated by a

DC motor which is connected to the timer unit. Nor the hopper's slit opens so that the object falls into the cover. After the opening time is over the timer unit switches its operation to the conveyor motion again.

Hence the object starts flowing through the conveyor till it reaches the next operation. Now the cover reaches the packing section which also contains the same DC motor and IR sensor assembly. As the cover reaches the packing section, the same procedure occurs in the timer switching. Here in the packing section are placed plates in which one is fixed or welded to the frame and the other is placed opposite to the fixed plate and is free to move and strike the fixed plate. These plates are placed opposite to each other across the width of the conveyor. The movable plate is welded with a heating element at its bottom such that the heating element strikes exactly at the tip of the fixed plate at the opposite side. The heating of the element is obtained electrically by connecting insulated wires from it to an external supply. Now if the object reaches the heating element and the conveyor motion stops similarly then the heating element goes and strikes the fixed plate stuffing the tip of the cover.

Due to the amount of heat produced, the cover gets a packed or sealed in a neat and precise manner. After this operation the cover starts flowing again and is collected in a tray. Now the product is packed and is ready for the next process. Hence products are packed in the same manner by placing the covers on the machine successively. The timer unit is a variable one in which time of operation can be varied from 1-10 seconds. By changing the time of operation, the rate of packing the products can be increased appropriately.

1.3 TYPES OF PACKAGING MACHINES

Based on operation

- Manual Packaging Machine
- Semi Automatic Packaging Machine
- Automatic Packaging Machine

Based on product

- Cleaning Machine : To sanitize containers or packaging devices
- Decorating Machine : To decorate packages
- Collating Machine : To package or assemble product in proper numerical order
- Counting Machine : To count products before, during or after a process
- Erecting Machine : To build packages such as cartons or boxes
- Filling Machine : To fill bags, bottles, and cans with a Predetermined volume of product
- Forming Machine : To form containers or packages
- Inspection Machine : To review products for blemishes, leaks, Consistency or types

For the purpose of simplicity, we will assume there are only three types of packaging machines: manual, semi automatic and automatic packaging machines.

CHAPTER 2

COMPONENTS AND DESCRIPTION

2.1 INTRODUCTION:

The components used in the Automatic Material Packaging Machine were fabricated with at most ease. Many components were used which were then welded onto the frame stand and some were placed in the IC circuit. Most of the components used here are Mechanical ones wherein the Timer Unit is alone exceptional.

All the components other than the gear are made up of Mild Steel material. The Spur Gear Used is alone made of Cast Iron. Hence, based on the above details the important components used in this machine along with their uses are briefly discussed below. The components used are:

- Battery
- Bearings and Bearing Cap
- Timer Unit
- Heating Element
- Conveyor Belt and Roller
- DC motors
- Frame Stand
- Spur Gears
- Hopper
- Shaft

2.2 BATTERIES

2.2.1 LEAD-ACID WET CELL:

Where high values of load current are necessary, the lead-acid cell is the type most commonly used. The electrolyte is a dilute solution of sulfuric acid (H_2SO_4). In the application of battery power to start the engine in an auto mobile, for example, the load current to the starter motor is typically 200 to 400A. One cell has a nominal output of 2.1V, but lead-acid cells are often used in a series combination of three for a 6-V battery and six for a 12-V battery.

The lead acid cell type is a secondary cell or storage cell, which can be recharged. The charge and discharge cycle can be repeated many times to restore the output voltage, as long as the cell is in good physical condition. However, heat with excessive charge and discharge currents short ends the useful life to about 3 to 5 years for an automobile battery. Of the different types of secondary cells, the lead-acid type has the highest output voltage, which allows fewer cells for a specified battery voltage.Fig.2.2.1 shows the detailed view & Fig 2.2.2 shows the top view of lead acid battery.

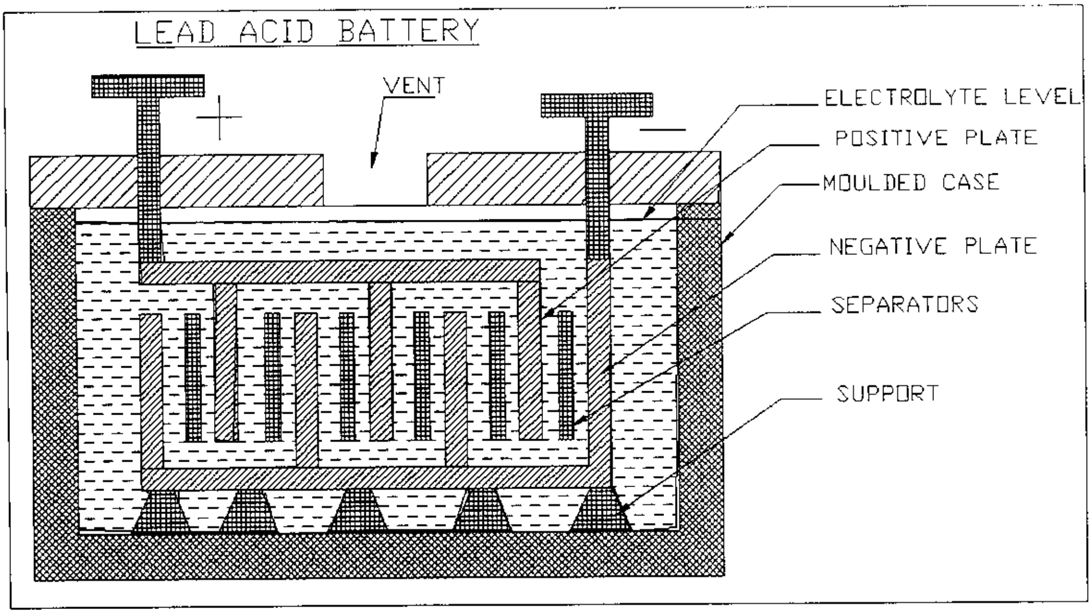

FIG. 2.2.1 DETAILED VIEW OF LEAD ACID BATTERY

FIG. 2.2.2 TOP VIEW OF LEAD ACID BATTERY

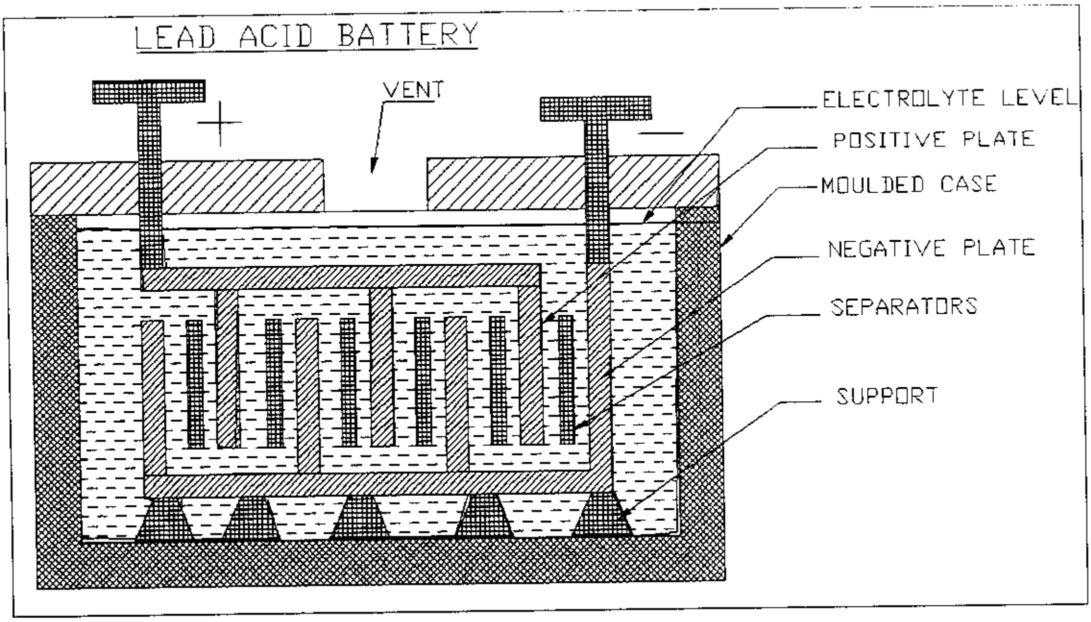

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FIG. 2.2.2 TOP VIEW OF LEAD ACID BATTERY

2.3 BEARING WITH BEARING CAP:

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel.

2.3.1 Introduction

A **bearing** is a device to allow constrained relative motion between two parts, typically rotation or linear movement. Bearings may be classified broadly according to the motions they allow and according to their principle of operation as well as by the directions of applied loads they can handle.Cut sec. of bearing is shown in fig 2.3.1.

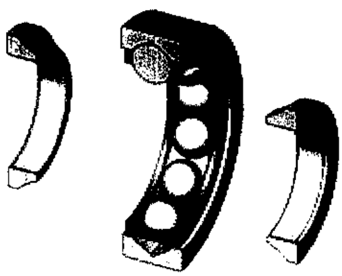

FIG. 2.3.1 CUT SECTION VIEW OF BEARING

Common motions permitted by bearings are:

- Axial rotation e.g. shaft rotation
- Linear motion e.g. drawer
- spherical rotation e.g. ball and socket joint
- hinge motion e.g. door

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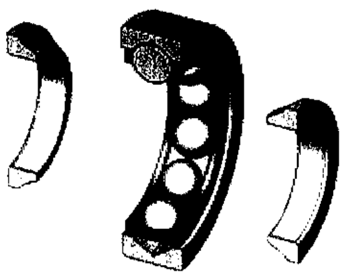

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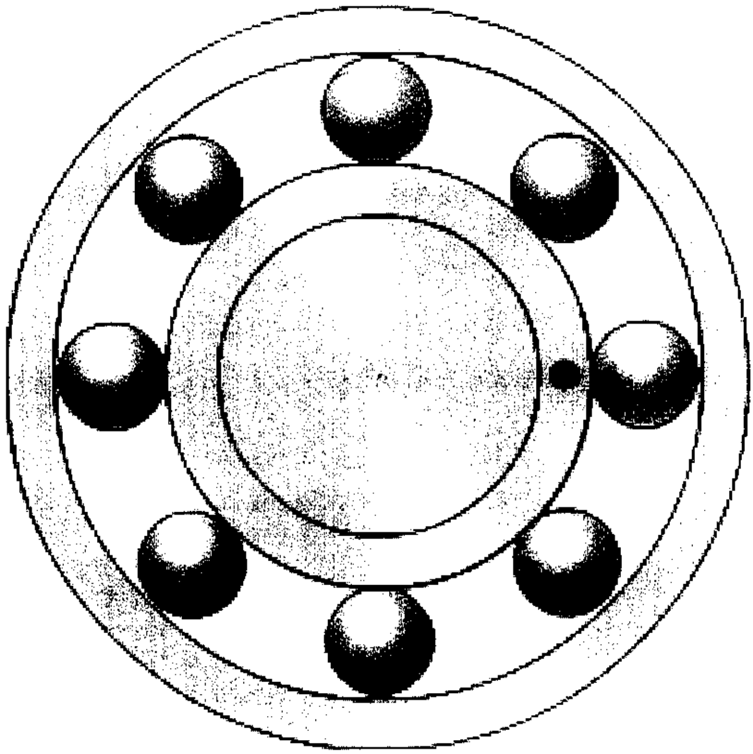


FIG. 2.3.2 VIEW OF ROTARY BEARING

Rotary bearings as shown in fig 2.3.2. are required for many applications, from heavy-duty use in vehicle axles and machine shafts, to precision clock parts. The simplest rotary bearing is the **sleeve bearing**, which is just a cylinder inserted between the wheel and its axle. This was followed by the **roller bearing**, in which the sleeve is replaced by a number of cylindrical rollers. Each roller behaves as an individual wheel.

2.3.2 Types of Bearings

Plain bearing	Rubbing surfaces, usually with lubricant
Rolling element bearing	Ball or rollers are used to prevent or minimize rubbing
Jewel bearing	Off-center bearing rolls in seating
Fluid bearing	Fluid is forced between two faces and held in by edge seal
Magnetic bearings	Faces of bearing are kept separate by magnets (electromagnets or eddy currents)
Flexure bearing	Material flexes to give and constrain movement

Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss. While the concept of the ball bearing dates back at least to Leonardo da Vinci, their design and manufacture has become remarkably sophisticated.

This technology was brought to its present state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type.

However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application:

a) Textbooks

b) Manufacturers'

Catalogs Textbooks are excellent sources; however, they tend to be overly detailed and aimed at the student of the subject matter rather than the practicing designer. They, in most cases, contain information on how to design rather than how to select a bearing for a particular application. Manufacturers' catalogs, in turn, are also excellent and contain a wealth of information which relates to the products of the particular manufacturer. These catalogs, however, fail to provide alternatives – which may divert the designer's interest to products not manufactured by them. Our Company, however, provides the broadest selection of many types of bearings made by different manufacturers.

For this reason, we are interested in providing a condensed overview of the subject matter in an objective manner, using data obtained from different texts, handbooks and manufacturers' literature. This information will enable the reader to select the proper bearing in an expeditious manner. If the designer's interest exceeds the scope of the presented material, a list of references is provided at the end of the Technical Section. At the same time, we are expressing our thanks and are providing credit to the sources which supplied the material presented here.

2.3.3 Rolling – element bearing

A **rolling-element bearing** is a bearing which carries a load by placing round elements between the two pieces. The relative motion of the pieces causes the round elements to roll with very little rolling resistance and with little sliding.

A rolling-element rotary bearing uses a shaft in a much larger hole, and cylinders called "rollers" tightly fill the space between the shaft and hole. As the shaft turns, each roller acts as the logs. However, since the bearing is round, the rollers never fall out from under the load.

Rolling-element bearings have the advantage of a good tradeoff between cost, size, weight, carrying capacity, durability, accuracy, friction, and so on. Other bearing designs are often better on one specific attribute, but worse in most other attributes, although fluid bearings can sometimes simultaneously outperform on carrying capacity, durability, accuracy, friction, rotation rate and sometimes cost. Only plain bearings have as wide use as rolling-element bearings.

2.3.4 Ball bearings

Ball bearings as shown in fig 2.3.3. use spheres instead of cylinders. Clever use of surface tension allows balls of high accuracy to be made much more cheaply than comparable cylinders. Ball bearings can support both radial (perpendicular to the shaft) and axial loads (parallel to the shaft). For lightly-loaded bearings, balls offer lower friction than rollers. Ball bearings can operate when the bearing races are misaligned

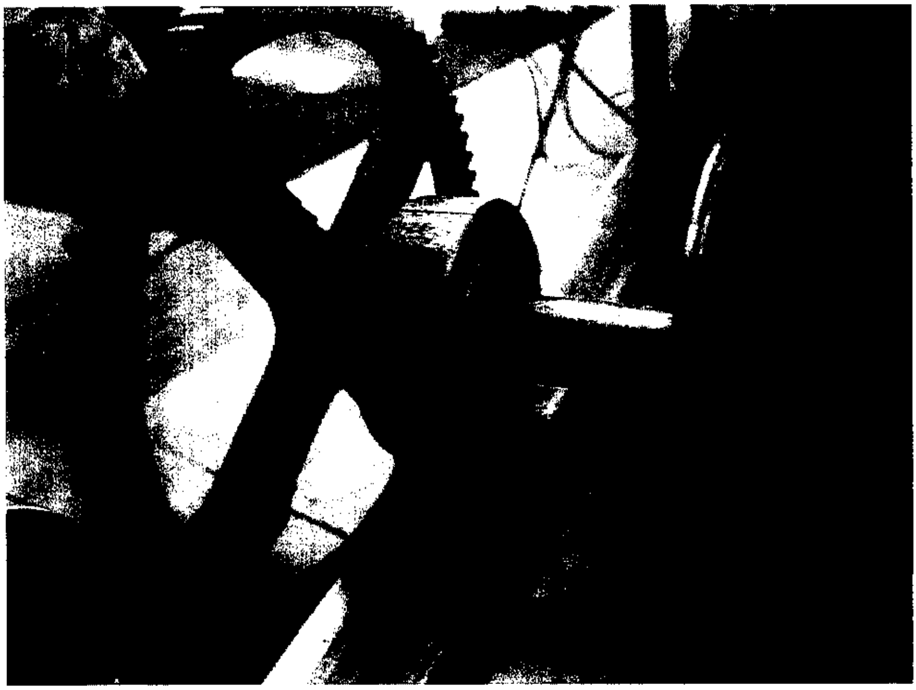
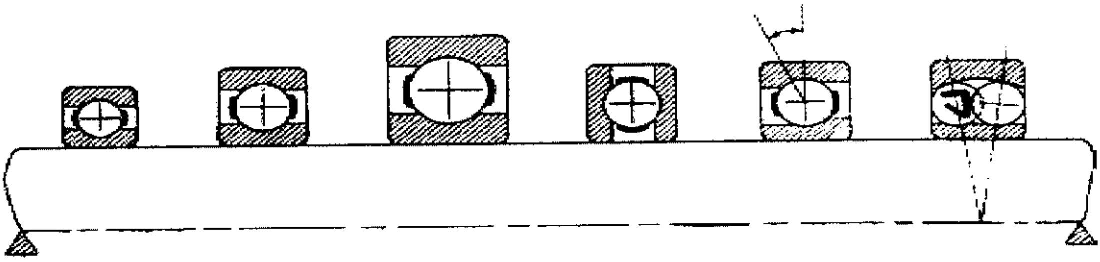


FIG. 2.3.3 VIEW OF BALL BEARING

2.3.5 Construction and Types of Ball Bearings

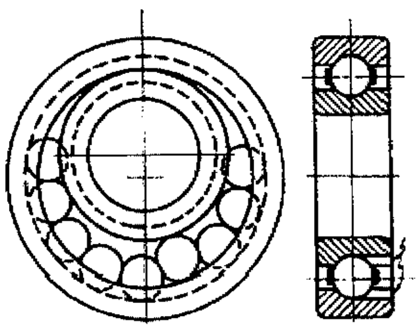
A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator.

To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore, as illustrated in Fig. 1-3(a), (b), and (c).



100 Series 200 Series 300 Series Axial Thrust Angular Contact Self-aligning Bearing Fig. 2.3.4 TYPES OF BALL BEARINGS

The heavy series of bearings is designated by 400. Most, but not all, manufacturers use a numbering system so devised that if the last two digits are multiplied by 5, the result will be the bore in millimeters. The digit in the third place from the right indicates the series number. Thus, bearing 307 signifies a medium-series bearing of 35-mm bore. For additional digits, which may be present in the catalog number of a bearing, refer to manufacturer's details.



Some makers list deep groove bearings and bearings with two rows of balls. For bearing designations of Quality Bearings & Components (QBC), see special pages devoted to this purpose. The radial bearing is able to carry a considerable amount of axial thrust.

However, when the load is directed entirely along the axis, the thrust type of bearing should be used. The angular contact bear- ing will take care of both radial and axial loads. The self-aligning ball bearing will take care of large amounts of angular misalignment. An increase in radial capacity may be secured by using rings with deep grooves, or by employing a double-row radial bearing. Radial bearings are divided into two general classes, depending on the method of assembly. These are the Conrad, or nonfilling-notch type, and the maximum or filling-notch type. In the Conrad bearing, the balls are placed between the rings as shown in Fig. 1-4(a). Then they are evenly spaced and the separator is riveted in place. In the maximum-type bearing, the balls are a (a) (b) (c) (d) (e) (f) 100 Series Extra Light 200 Series Light 300 Series Medium Axial Thrust Bearing Angular Contact Bearing Self-aligning Bearing Fig. 1-3 Types of Ball Bearings Fig. 1-4 Methods of Assembly for Ball Bearings (a) Conrad or non-filling notch type (b) Maximum or filling notch type

2.3.6 Bearing cap

A device designed to fit around a **bearing** to support or immobilize.

2.4 CONTROL UNIT – TIMER UNIT

2.4.1 Introduction

Control units are now often implemented as a microprogram that is stored in a control store. Words of the microprogram are selected by a micro sequencer and the bits from those words directly control the different parts of the device, including the registers, arithmetic and logic units, instruction registers, buses, and off-chip input/output. In modern computers, each of these subsystems may have its own subsidiary controller, with the control unit acting as a supervisor.

2.4.2 Function of a Control Unit

The functions performed by the control unit vary greatly by the internal architecture of the CPU, since the control unit really implements this architecture. On a regular processor that executes x86 instructions natively the control unit performs the tasks of fetching, decoding, managing execution and then storing results. On a x86 processor with a RISC core, the control unit has significantly more work to do. It manages the translation of x86 instructions to RISC micro-instructions, manages scheduling the micro-instructions between the various execution units, and juggles the output from these units to make sure they end up where they are supposed to go. On one of these processors the control unit may be broken into other units (such as a scheduling unit to handle scheduling and a retirement unit to deal with results coming from the pipeline) due to the complexity of the job it must perform.

FIG. 2.4.1 TOP VIEW OF TIMER UNIT

FIG. 2.4.2 TIMER UNIT CIRCUIT

2.5 CONVEYOR

2.5.1 Introduction

A **belt conveyor** consists of two or more pulleys, with a continuous loop of material - the conveyor belt - that rotates about them. One or both of the pulleys are powered, moving the belt and the material on the belt forward. The powered pulley is called the drive pulley while the unpowered pulley is called the idler. There are two main industrial classes of belt conveyors; Those in general material handling such as those moving boxes along inside a factory and bulk material handling such as those used to transport industrial and agricultural materials, such as grain, coal, ores, etc. generally in outdoor locations. Generally companies providing general material handling type belt conveyors do not provide the conveyors for bulk material handling. In addition there are a number of commercial applications of belt conveyors such as those in grocery stores.

The belt consists of one or more layers of material they can be made out of rubber. Many belts in general material handling have two layers. An under layer of material to provide linear strength and shape called a carcass and an over layer called the cover. The carcass is often a cotton or plastic web or mesh. The cover is often various rubber or plastic compounds specified by use of the belt. Covers can be made from more exotic materials for unusual applications such as silicone for heat or gum rubber when traction is essential.

Material flowing over the belt may be weighed in transit using a beltweigher. Belts with regularly spaced partitions, known as *elevator belts*, are used for transporting loose materials up steep inclines. Belt Conveyors are used in self-unloading bulk freighters and in live bottom trucks. Conveyor technology is also used in conveyor transport such as moving sidewalks or escalators, as well as on many manufacturing assembly lines. Stores often have conveyor belts at the check-out counter to move shopping items. Ski areas also use conveyor belts to transport skiers up the hill. A wide variety of related conveying machines are available, different as regards principle of operation, means and direction of conveyance, including screw conveyors, vibrating conveyors, pneumatic conveyors, the moving floor system, which uses reciprocating slats to move cargo, and roller conveyor system, which uses a series of powered rollers to convey boxes or pallets. Conveyors are used as components in automated distribution and warehousing. In combination with computer controlled pallet handling equipment this allows for more efficient retail, wholesale, and manufacturing distribution. It is considered a labor saving system that allows large volumes to move rapidly through a process, allowing companies to ship or receive higher volumes with smaller storage space and with less labor expense.

Rubber Conveyor Belts are commonly used to convey items with irregular bottom surfaces, small items that would fall in between rollers (e.g. a sushi conveyor bar), or bags of product that would sag between rollers. Belt conveyors are generally fairly similar in construction consisting of a metal frame with rollers at either end of a flat metal bed. The belt is looped around each of the rollers and when one of the rollers is powered (by an electrical motor) the belting slides across the solid metal frame bed, moving the product. In heavy use applications the beds which the belting is pulled over are replaced with rollers. The rollers allow weight to be conveyed as they reduce the amount of friction generated from the heavier loading on the belting. Belt conveyors can now be manufactured with curved sections which use tapered rollers and curved belting to convey products around a corner. These conveyor systems are commonly used in postal sorting offices and airport baggage handling systems.

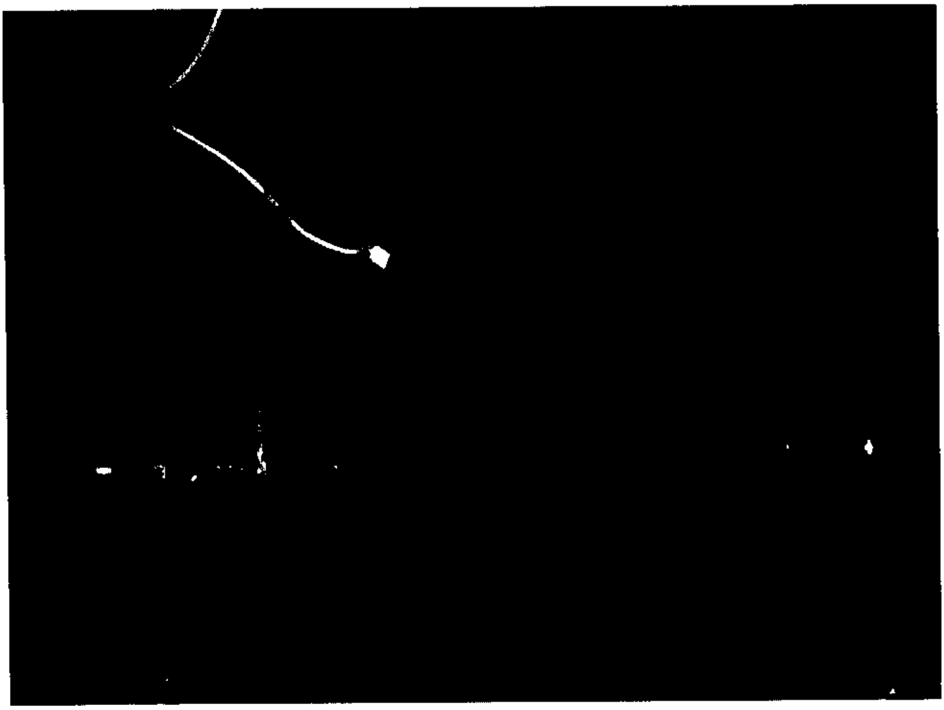


FIG. 2.5.1 REXIN CLOTH BELT

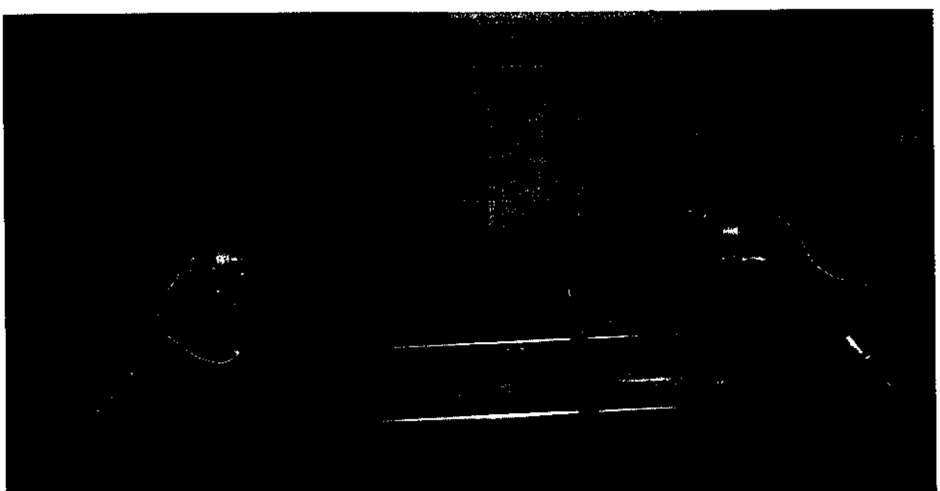


FIG. 2.5.2 CONVEYOR SETUP

2.6 DC MOTOR

2.6.1 Introduction

An electric motor uses electrical energy to produce mechanical energy, nearly always by the interaction of magnetic fields and current-carrying conductors. The reverse process, that of using mechanical energy to produce electrical energy, is accomplished by a generator or dynamo. Traction motors used on vehicles often perform both tasks.

Electric motors are found in a myriad of uses such as industrial fans, blowers and pumps, machine tools, household appliances, power tools, and computer disk drives, among many other applications. Electric motors may be operated by direct current from a battery in a portable device or motor vehicle, or from alternating current from a central electrical distribution grid.

The smallest motors may be found in electric wristwatches. Medium-size motors of highly standardized dimensions and characteristics provide convenient mechanical power for industrial uses. The very largest electric motors are used for propulsion of large ships, and for such purposes as pipeline compressors, with ratings in the thousands of kilowatts. Electric motors may be classified by the source of electric power, by their internal construction, and by application.

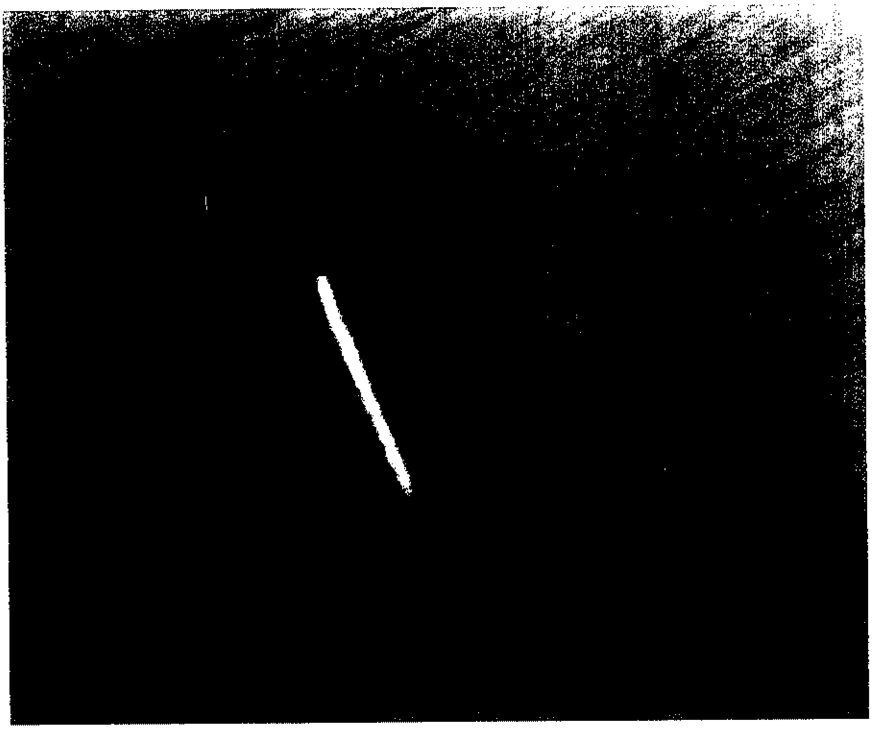


FIG. 2.6.1 FRONT VIEW OF DC MOTOR

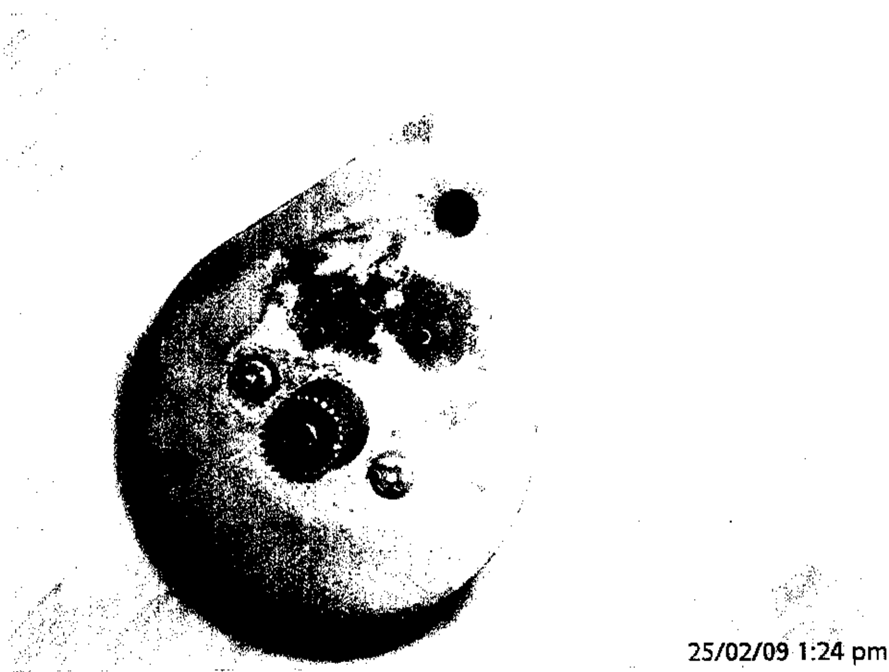


FIG. 2.6.2 BOTTOM VIEW OF DC MOTOR

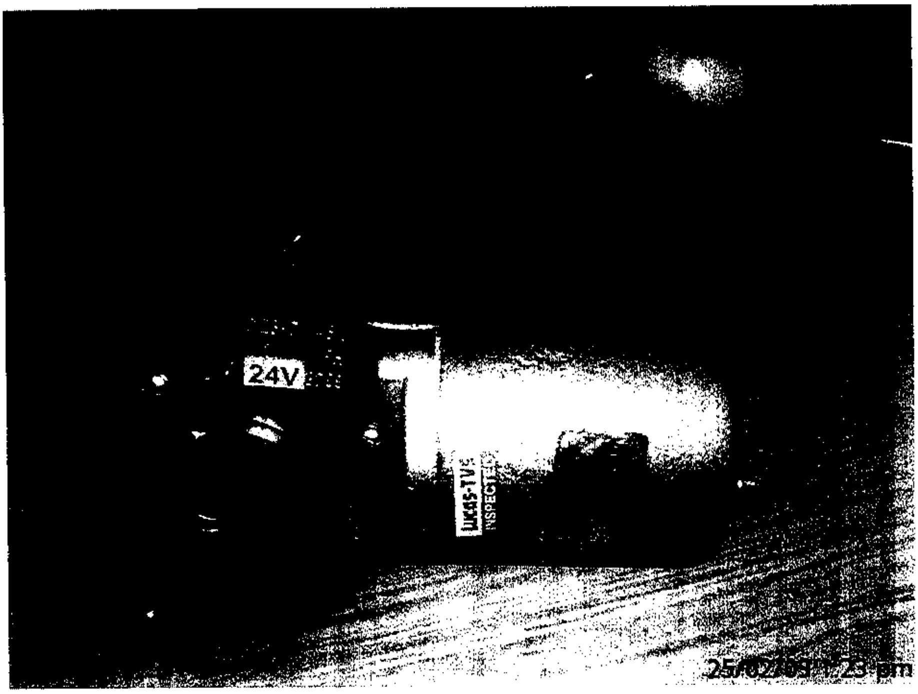


FIG. 2.6.3 FRONT VIEW OF DC MOTOR (2)

A DC motor shown in fig 2.6.1, 2.6.2 &2.6.3 is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearing motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

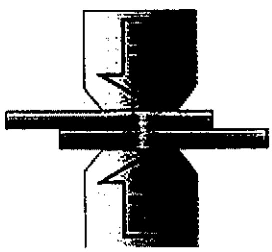
2.6.2 Types of DC Motor

There are three types of DC motor:

- DC series motor
- DC shunt motor
- DC compound motor - there are also two types:
    1. cumulative compound
    2. differentially compounded

2.7 HEATING ELEMENT

2.7.1 RESISTANCE HEATING:-



Electric resistance heating offers precise control and direct heating for applications such as preheating billets for forging, producing unique hardening patterns on metals, selectively heating forging dies and maintaining solutions at constant temperature. Any material, either solid or liquid can be heated with an encased resistance heater; electrically conductive work pieces can be heated directly using resistance heating

2.7.2 INDUCTANCE HEATING

Induction heating is a non-contact heating process. It uses high frequency electricity to heat materials that are electrically conductive. Since it is non-contact, the heating process does not contaminate the material being heated. It is also very efficient since the heat is actually generated inside the workpiece. This can be contrasted with other heating methods where heat is generated in a flame or heating element, which is then applied to the workpiece. For these reasons Induction Heating lends itself to some unique applications in industry.

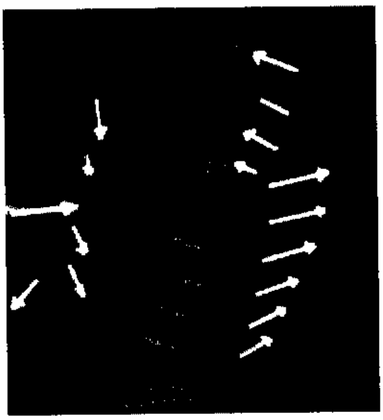


FIG. 2.7.1 ILLUSTRATION OF INDUCTION HEATING

A source of high frequency electricity is used to drive a large alternating current through a coil. This coil is known as the work coil. The passage of current through this coil generates a very intense and rapidly changing magnetic field in the space within the work coil. The work piece to be heated is placed within this intense alternating magnetic field. Depending on the nature of the work piece material, a number of things happen.

The alternating magnetic field induces a current flow in the conductive work piece. The arrangement of the work coil and the work piece can be thought of as an electrical transformer. The work coil is like the primary where electrical energy is fed in, and the work piece is like a single turn secondary that is short-circuited. This causes tremendous currents to flow through the work piece. These are known as eddy currents.

In addition to this, the high frequency used in induction heating applications gives rise to a phenomenon called skin effect. This skin effect forces the alternating current to flow in a thin layer towards the surface of the work piece. The skin effect increases the effective resistance of the metal to the passage of the large current. Therefore it greatly increases the heating effect caused by the current induced in the work piece

FIG. 2.7.2 HEATING ELEMENT

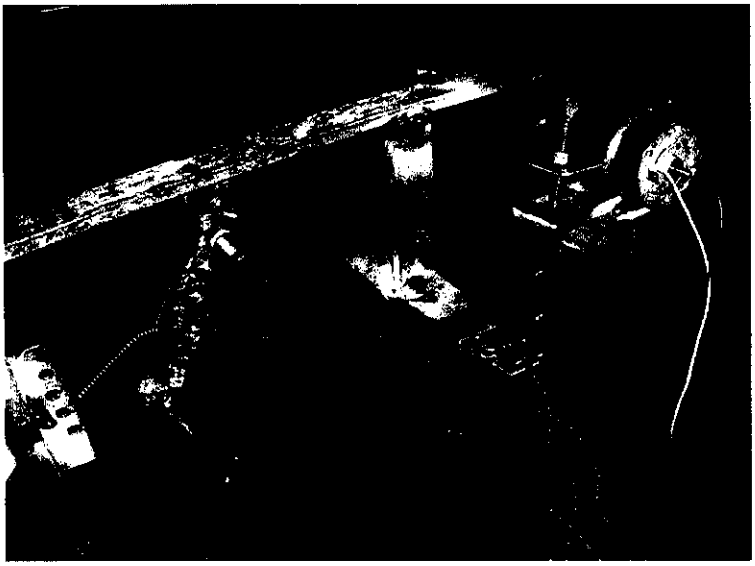


FIG. 2.7.3 EXP SETUP OF HEATING ELEMENT

FIG. 2.7.4 FRONT VIEW OF HEATING ELEMENT SETUP

In theory only 3 things are essential to implement induction heating:

1. A source of High Frequency electrical power,
2. A work coil to generate the alternating magnetic field,
3. An electrically conductive work piece to be heated.

2.8 HOPPER

2.8.1 Introduction

A **chute** is a vertical or inclined plane, channel, or passage through which objects are moved by means of gravity. A chute is also called as hopper.

In our project the hopper used is of square / pyramid type hopper. The top section is about 6" x 4" and the bottom section is about 1" x 1" dimensions.

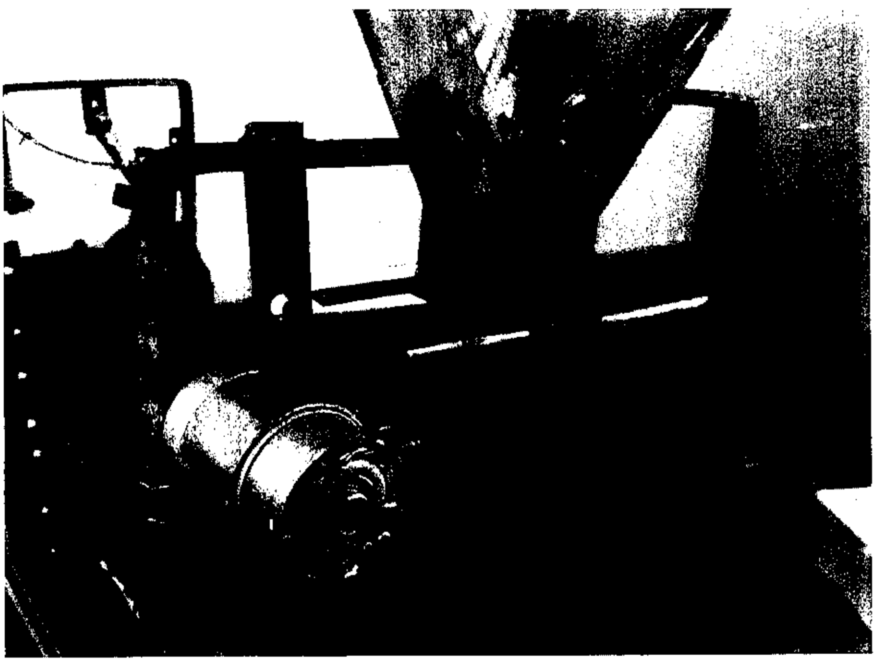


FIG. 2.8.1 FRONT VIEW OF HOPPER

FIG. 2.8.2 TOP VIEW OF HOPPER SETUP

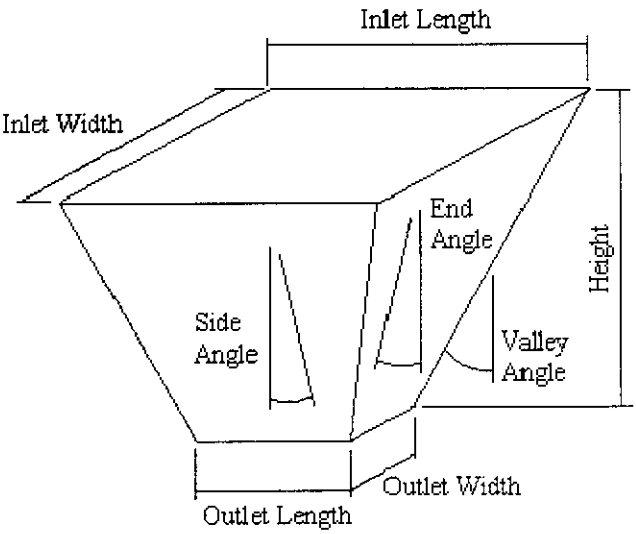


FIG. 2.8.3 FRONT VIEW OF HOPPER

2.9 IR SENSOR UNIT

The IR transmitter and IR receiver circuit is used to sense the obstacle.

2.9.1 IR TRANSMITTER CIRCUIT

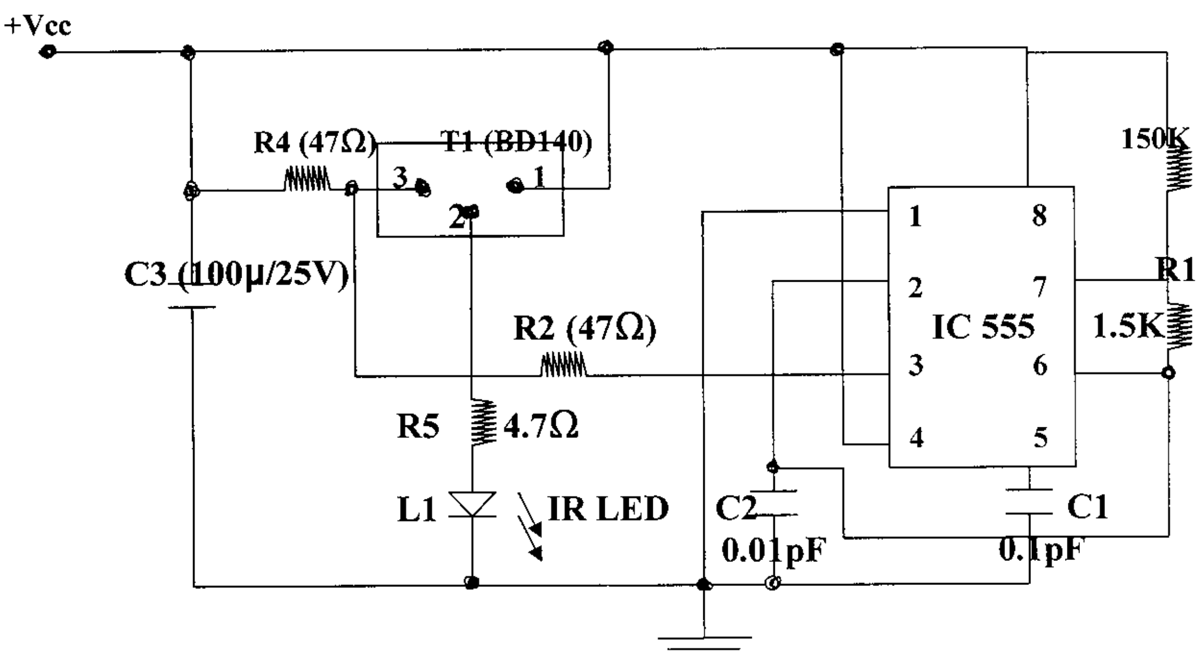


FIG. 2.9.1 IR TRANSMITTER CIRCUIT

RECEIVER CIRCUIT

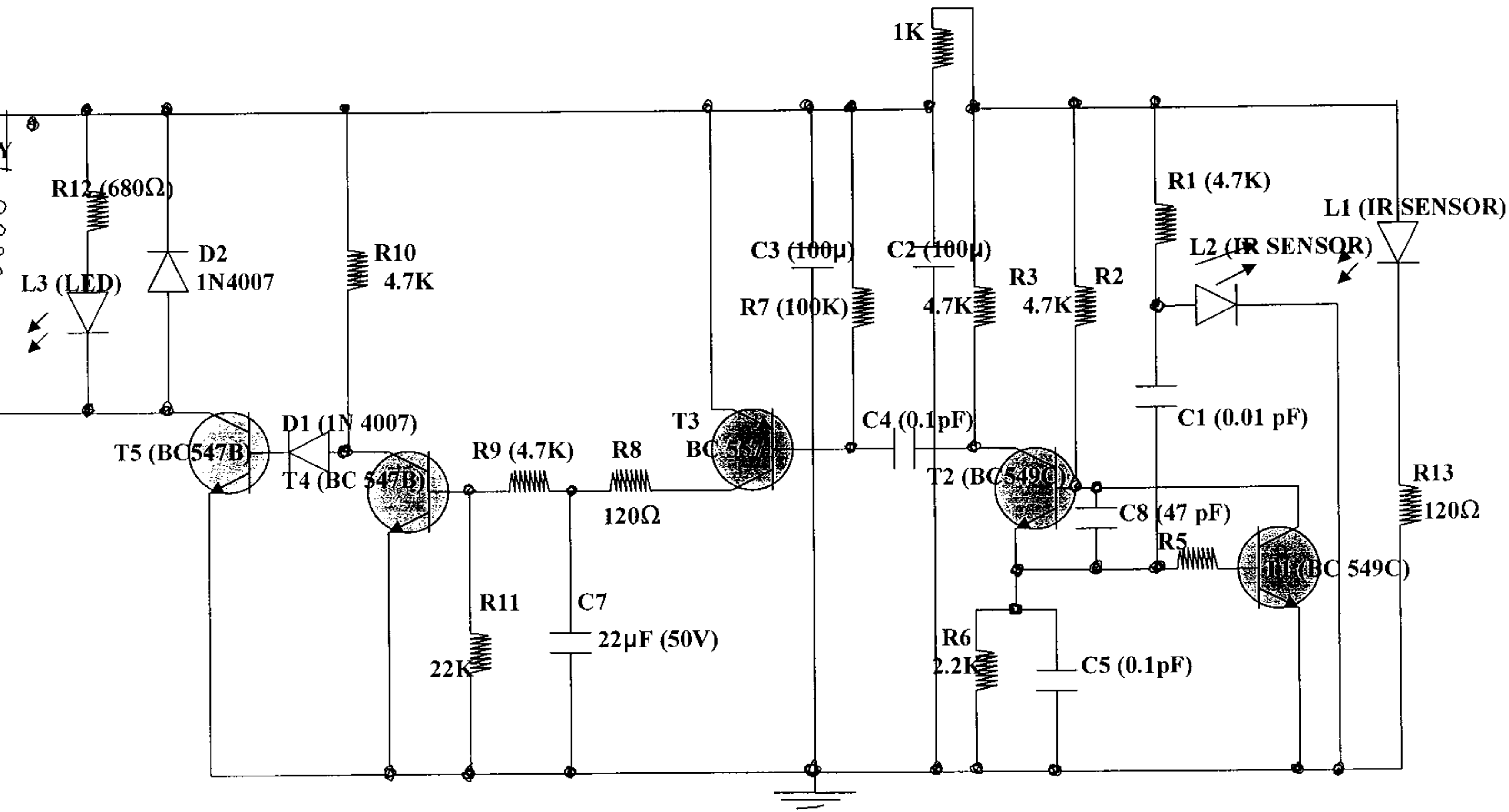


FIG. 2.9.2 IR RECEIVER CIRCUIT

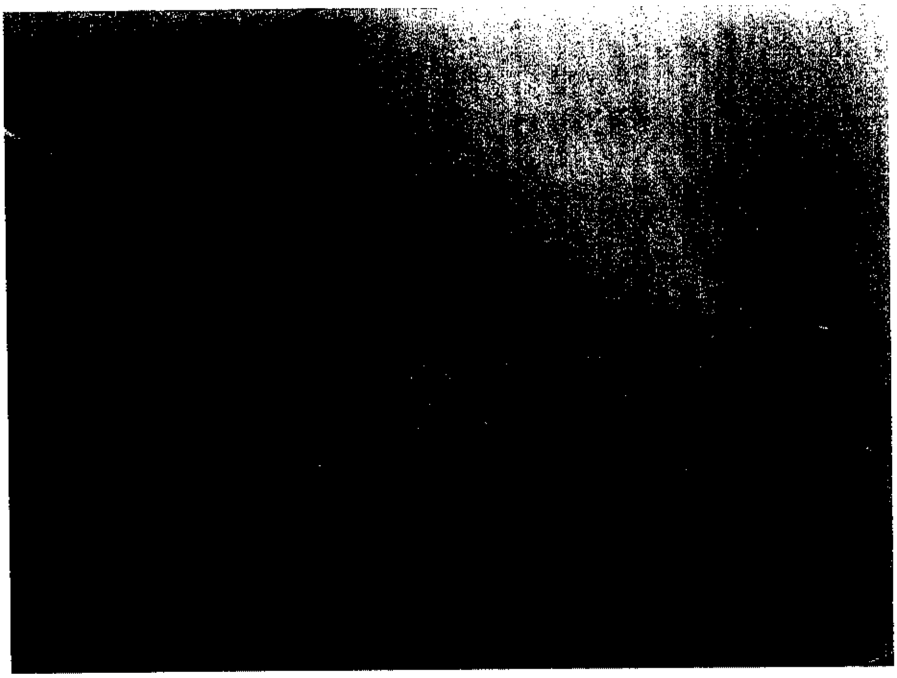


FIG. 2.9.3 IR TRANSMITTER

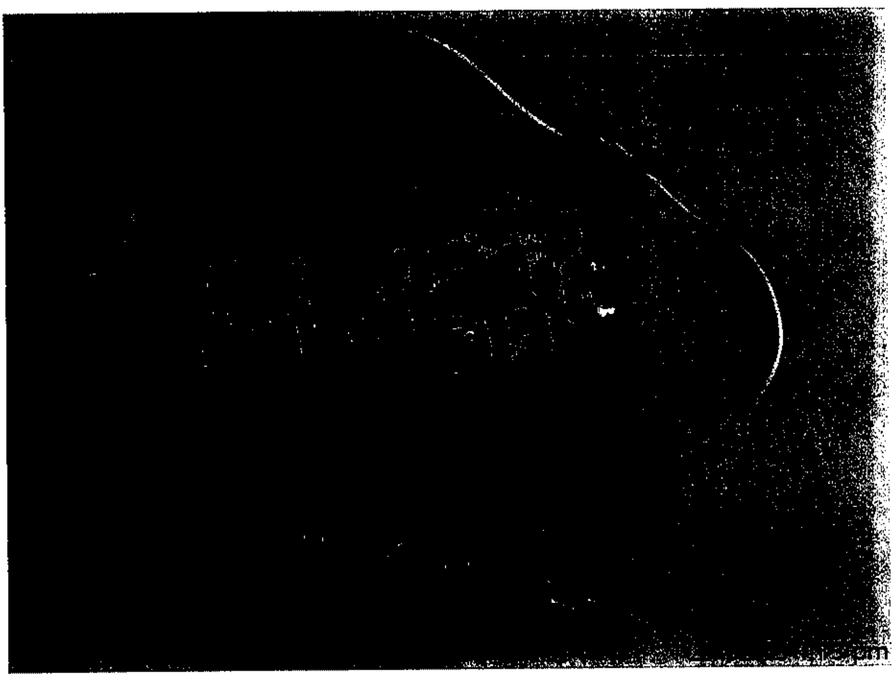


FIG. 2.9.4 IR TRANSMITTER AND RECIEVER

2.9.3 WORKING CONDITIONS

AT NORMAL CONDITION:

The IR transmitter sensor is transmitting the infrared rays with the help of 555 IC timer circuit. These infrared rays are received by the IR receiver sensor. The Transistor T1, T2 and T3 are used as an amplifier section. At normal condition Transistor T5 is OFF condition. At that time relay is OFF, so that the conveyor running continuously.

AT OBSTACLE CONDITION:

At Obstacle conditions the IR transmitter and IR receiver, the resistance across the Transmitter and receiver is high due to the non-conductivity of the IR waves. So the output of transistor T5 goes from OFF condition to ON stage. In that time the relay is ON position. In that time, this obstacle signal is given to the microcontroller unit.

2.10 ROLLERS

2.10.1 Introduction

Rollers are usually fixed at one end of the conveyor so that the conveyor belt can move in order to transport the material. They are supported by bearings which in turn are held by a set of bearing caps. They are usually made up of Mild Steel.

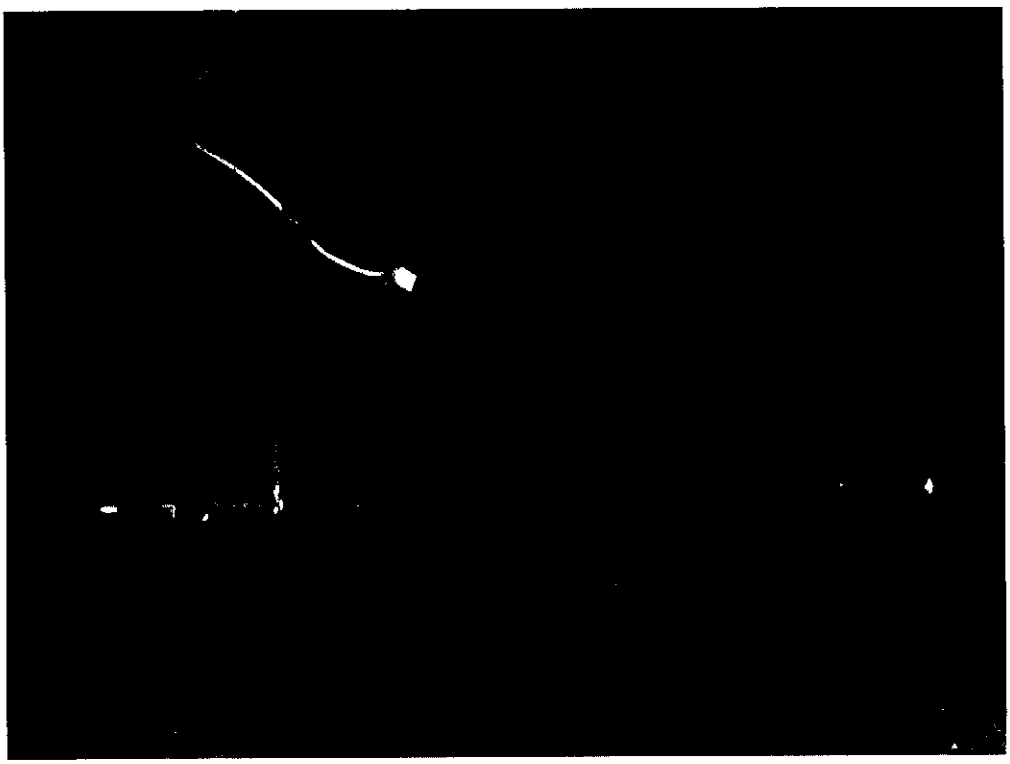


FIG. 2.10.1 FRONT VIEW OF ROLLERS

2.11 GEARS

2.11.1 Introduction

A gear is a component within a transmission device that transmits rotational force to another gear or device. A gear is different from a pulley in that a gear is a round wheel which has linkages ("teeth" or "cogs") that mesh with other gear teeth, allowing force to be fully transferred without slippage.

Depending on their construction and arrangement, geared devices can transmit forces at different speeds, torques, or in a different direction, from the power source.

The most common situation is for a gear to mesh with another gear, but a gear can mesh with any device having compatible teeth, such as linear moving racks.

A gear's most important feature is that gears of unequal sizes (diameters) can be combined to produce a mechanical advantage, so that the rotational speed and torque of the second gear are different from that of the first.

2.11.2 Spur gears

Spur gears are the simplest and most common type of gear. Their general form is a cylinder or disk. The teeth project radially, and with these "straight-cut gears", the leading edges of the teeth are aligned parallel to the axis of rotation. These gears can only mesh correctly if they are fitted to parallel axles. Spur gears on non-parallel shafts can mesh, but only point contact will be achieved, not line contact across the full width of the tooth; also the length of the path of contact may be too short.

FIG. 2.11.1 SPUR GEAR SETUP

CHAPTER 3

DESIGN DETAILS

The design specifications of the components and also the design calculation of the essential components of the Automatic Material Packaging Machine are explained as follows.

3.1 DESIGN SPECIFICATIONS:

3.1.1 DC MOTOR:

- Voltage : 12 Volts
- Current : 0.8 Amps
- Speed : 1200 rpm
- Power : 5 watts
- Length : 3.53 inches

3.1.2 DRIVING MOTOR:

- Voltage : 12 Volts
- Current : 2.5 Amps
- Speed : 60 rpm
- Power : 90 watts
- Length : 3.53 inches

3.1.3 CONVEYOR BELT AND ROLLER:

3.1.3.1 CONVEYOR BELT:

- Type : Flat Belt Conveyor
- Belt Material : Rexin Cloth
- Length : 3 feet
- Width : 4 inches

3.1.3.2 ROLLER:

- Material : Mild Steel
- Diameter : 55 mm
- Width : 6 inches
- Centre Distance : 1.3 feet

3.1.4 HOPPER:

- Type : Square/Pyramid Hopper
- Top Section : 6 inches x 4 inches
- Bottom Section : 1 inch x I inch

3.1.5 BEARING CAP:

- Material : Mild Steel
- Outer Bore : 45 mm
- Inner More : 35 mm

3.1.6 BEARING:

- Type : Ball Bearing
- Inner Bore : 15 mm
- Outer Bore : 35 mm
- Thickness : 15 mm
- Material : Steel

3.1.7 SHAFT:

- Material : Mild Steel
- Diameter : 15 mm

3.1.8 FRAME STAND:

- Material : Mild Steel
- Type : Square Pipes
- Cross Section : 1 inch x 1 inch

3.1.9 HEATING ELEMENT:

- Type : Inductance Heating
- Voltage : 220-230 Volts
- Power : 65 watts

3.1.10 GEAR:

• Type	:	Spur Gear
• Material	:	Cast Iron
• Module, m	:	1.25
• Centre Distance, a	:	75 mm
• Torque, T	:	14.32 N-m
• Design Torque, M_t	:	18.616 N-m
• Face Width, b	:	18.75 mm
• No. of teeth on Pinion, Z_1	:	30
• No. of teeth on Gear, Z_2	:	60
• Pinion Diameter, d_1	:	50 mm
• Gear Diameter, d_2	:	100 mm
• Speed of Pinion, N_1	:	60 rpm
• Speed of Gear , N_2	:	30 rpm

3.2 DESIGN CALCULATIONS:

3.2.1 SPUR GEAR:

- Calculation of Speed Ratio (i):

$$i = d_2 / d_1 = 100/50 = 2$$

(Or)

$$i = N_1/N_2 = 60/30 = 2$$

- Calculation of Pitch Angle (δ) :

$$\tan\delta_2 = i = 2$$

$$\delta_2 = \tan^{-1}(2)$$

$$\delta_2 = 63.43$$

$$\delta_1 = 90 - 63.43$$

$$\delta_1 = 26.565$$

- Material Selection:

For i<4, from design data book pg no. 8.4, Pinion = C45

Wheel (or) Gear = Cast Iron

From data book pg no. 1.3 – 1.18,

For C45,

Tensile Strength = 70

Yield Strength = 36

Brinell Hardness Number (BHN) = 229

For Cast Iron,

Young's Modulus, $E = 1 \times 10^5$ N/mm^2

- Calculation of Young's Modulus (E_{eq}):

$$E_{eq} = (2E_1E_2)/(E_1 + E_2)$$

From data book pg no. 8.14, table 9

$E_1 = 2.15x10^6$ Kgf/cm^2

$E_2 = 2.15x10^6$ Kgf/cm^2

Therefore, $E_{eq} = 2.15x10^6$ Kgf/cm^2

- Calculation of Compressive Strength $[\sigma_c]$:

$[\sigma_c] = C_B x H_B x K_{cl}$

$= 0.585x23x225$

$= 3027.375$ Kgf/cm^2

$[\sigma_c] = 302.74$ N/mm^2

- Calculation of Centre Distance, a:

$a = (d_1+d_2)/2$

$= (100 + 50)/2$

$= 75$ mm

- Calculation of number of Number of Teeth:

$Z_1 = 2a/m(i+1)$

$= 2x70/1.5x3$

$Z_1 = 30$

$Z_2 = ixZ_1$

$= 2x30$

$Z_2 = 60$

- Calculation of Design Torque $[M_t]$:

The power of the motor is, P = 90W

Therefore, Torque, $T = (60xP)/(2x\pi xN)$

$T = (60x90)/(2x\pi x60)$

T = 14.32 N-m

Design Torque, $[M_t] = TxK_dxK$

From data book pg no. 8.15, Assuming $K_d x K = 1.3$

$[M_t] = 14.32 \times 1.3$

$[M_t] = 18.616$ N-m

- Calculation of Bending Strength $[\sigma_b]$:

$[\sigma_b] = (1.4xK_{bl}x\sigma_{-1})/(nxK\sigma)$

$[\sigma_b] = (1.4x1x28x10)/(2x1.2)$

$[\sigma_b] = 163.33$ N/mm^2

- Calculation of Module, m:

m = 1.26x (Cube Root of $([M_t])/(yx[\sigma_b]x\psi_m xZ_1))$

m = 1.26x (Cube Root of (18.616x1000)/0.44x163.33x10x30))

m = 1.25 approx.

- Calculation of Pitch Circle Diameters:

Calculated $Z_1 = (2x75)/(1.25x3)$

$Z_1 = 45$

Calculated $Z_2 = 2x45$

$Z_2 = 90$

For pinion, pitch circle diameter $d_p = mxZ_1$

$d_p = 1.25x45$

$d_p = 56.25$ mm

For Gear, pitch circle diameter $d_g = mxZ_2$

$d_g = 1.25x90$

$d_g = 112.5$ mm

- Calculation of Face Width (b):

$b = \psi \text{ x } a$

$b = 0.25 \text{ x } 75$

$b = 18.75$ mm

- Design Verification :

If $[\sigma_c] > \sigma_c$, the design is safe.

$\sigma_c = 0.74x((i+1)/a)x(Sq.rt((i+1)xEx[M_t])/ixb))$

$\sigma_c = 28.61\ N/mm^2$

Therefore, $[\sigma_c] > \sigma_{c.}$

If $[\sigma_b] > \sigma_b$, the design is safe.

$\sigma_b = ((i+1)x[M_t])/(axmxbxy)$

$\sigma_b = 56.216\ N/mm^2$

Therefore, $[\sigma_b] > \sigma_{b.}$

From the above two verifications, it can be concluded the design of spur gear is safe.

CHAPTER 4

FABRICATION

4.1 INTRODUCTION:

The fabrication part of Automatic Material Packaging Machine has been considered with almost case for its simplicity and economy, such that this can be accommodated as one of the essential tools on industrial applications. The fabrication of the essential components of the machine as well is explained as follows.

4.2 ELECTRONIC EQUIPMENT:

The electronic circuit was fabricated with the help of a Printed Circuit Board. All the electronic components were welded on this board using insulated wires to join from corresponding components. The circuit comprises of mainly two parts namely Timer or Control Unit and an IR sensor setup.

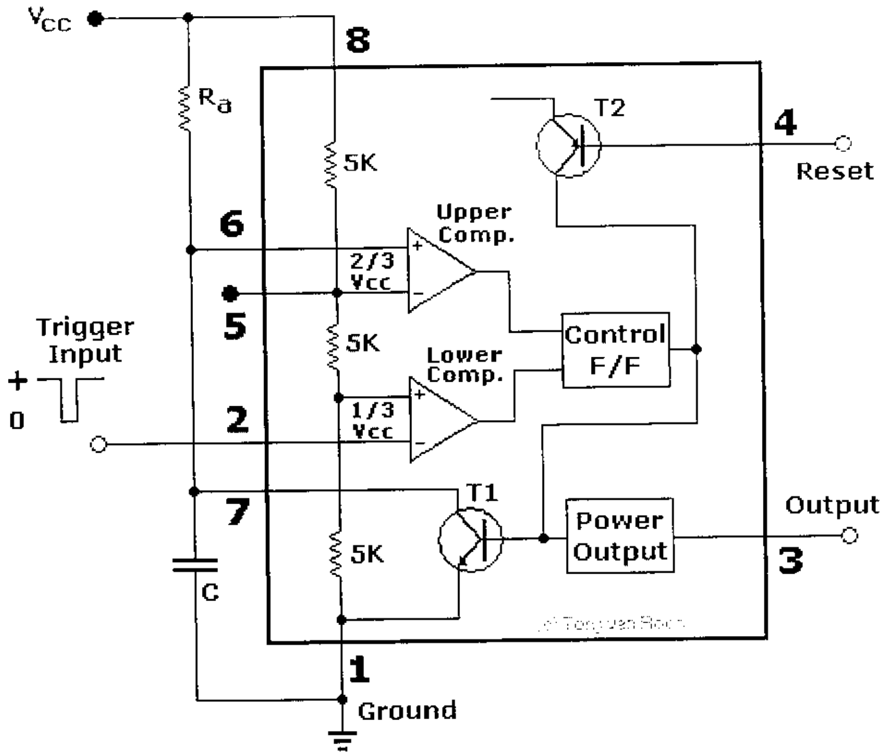


FIG. 4.2.1 555 IC TIMER UNIT

The 555 IC Timer Unit has been used in this fabrication. Inside the 555 timer, are the equivalent of over 20 transistors, 15 resistors, and 2 diodes. The equivalent circuit is used in providing the functions of control, triggering, level sensing or comparison, discharge, and power output. Some of the more attractive features of the 555 timer are: Supply voltage between 4.5 and 18 volt, supply current 3 to 6 mA, and a Rise/Fall time of 100 nanoseconds. It can also withstand quite a bit of abuse. The variable timer can be set between 1 to 10 seconds of time switching and the rate of packaging can be varied accordingly.

4.3 FRAME STAND:

The material used for the supporting frame is 18 gauge mild steel. The frame is an 'L' shaped structure. Four rectangular shaped frames of cross sections 1inch by 1 inch is used in this fabrication to connect the driving motor till the end of the conveyor belt where the packed product is obtained. This frame is fixed by means of arc welding technique. The type of joint used is edge joint. Before welding it must be ensured that all the frames are at right angles to each other. On the outer sides of the frame, screws are welded in order to place the electronic circuit setup, battery and the motors as well. Spot weld was used to join the frame stand and the component.

4.4 CONVEYOR BELT:

The conveyor belt used is a flat belt conveyor, made up of rexin cloth material. The conveyor motion takes place between two rollers placed at two longitudinal ends of the frame stand. The roller is made up of a mild steel material. The conveyor belt of such a material is chosen because of the load that has to be carried away for packing purpose. Rubber conveyor belts can be used in case, if products with heavy weights are to be packed up. Since, in this project only industrial products like nuts, bolts etc, and food products like grains are only being packed the particular material is chosen. The conveyor setup is also placed on the stand. The rollers are connected to the stand by means of ball bearings. The bearings along with Mild Steel shaft are welded along the sides of the stand. To these are inserted the roller in the middle of the shaft. It must be ensured that the belt must be straightly wound around the roller and the longitudinal length as well without any puckers.

4.5 EXPERIMENTAL SETUP:

The entire experimental setup of the machine is quite simple to understand. To begin, the whole setup is placed on the frame stand. Wires are taken from two terminals of an external battery source and are welded to the terminals of the timer unit. The timer or control unit plays a vital role in this machine. One wire is taken from the control unit and is connected to the driving motor which is responsible to drive the conveyor. Two more wires are taken from this unit and are connected to the two DC Motors which are used for Hopper feed and Sealing purposes. Now that the mechanical operating connections are done, two wires are again welded from the control unit to the IR Sensors which serves the purpose for driving the two DC Motors being used. The heating element is welded with wires and is taken to another external power supply through which heating can be done. That is all about the fabrication of this entire packaging machine.

CHAPTER 5

FACTORS DETERMINING THE CHOICE OF MATERIALS

5.1 FACTORS FOR CHOOSING M.S and C.I

The various factors which determine the choice of material are discussed below.

1. Properties:

The material selected must posses the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc.

The following four types of principle properties of materials decisively affect their selection

a. Physical
b. Mechanical
c. From manufacturing point of view
d. Chemical

The various physical properties concerned are melting point, Thermal Conductivity, Specific heat, coefficient of thermal expansion, specific gravity, electrical Conductivity, Magnetic purposes etc.

The various Mechanical properties Concerned are strength in tensile, compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

The various properties concerned from the manufacturing point of view are.

- Cast ability,
- weld ability,
- Brazability,
- forge ability,
- merchantability,
- surface properties,
- shrinkage,
- Deep drawing etc.

2. Manufacturing Case:

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

3. **Quality Required:**

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go for casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

4. **Availability of Material:**

Some materials may be scarce or in short supply. It then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed.

The delivery of materials and the delivery date of product should also be kept in mind.

5. **Space Consideration:**

Sometimes high strength materials have to be selected because the forces involved are high and the space limitations are there.

6. **Cost:**

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored.

Some times factors like scrap utilization, appearance, and non-maintenance of the designed part are involved in the selection of proper materials.

5.2 MATERIALS USED :-

- Mild Steel
- Cast Iron

5.2.1 CAST IRON :-

Cast iron usually refers to grey cast iron, but also identifies a large group of ferrous alloys, which solidify with a eutectic. The color of a fractured surface can be used to identify an alloy. **White cast iron** is named after its white surface when fractured due to its carbide impurities which allow cracks to pass straight through. **Grey cast iron** is named after its grey fractured surface, which occurs because the graphitic flakes deflect a passing crack and initiate countless new cracks as the material breaks.

Iron (Fe) accounts for more than 95 %wt of the alloy material, while the main alloying elements are carbon (C) and silicon (Si). The amount of carbon in cast irons is 2.1-4 %wt. Cast irons contain appreciable amounts of silicon, normally 1-3 %wt, and consequently these alloys should be considered ternary Fe-C-Si alloys. Despite this, the principles of cast iron solidification are understood from the binary iron-carbon phase diagram, where the eutectic point lies at 1154 °C and 4.3 wt% carbon. Since cast iron has nearly this composition, its melting temperature of 1150 to 1200 °C is about 300 °C lower than the melting point of pure iron.

Cast iron tends to be brittle, except for malleable cast irons. With its low melting point, good fluidity, castability, excellent machinability, resistance to deformation, and wear resistance, cast irons have become an engineering material with a wide range of applications, including pipes, machine and car parts, such as cylinder heads, blocks, and gearbox cases. It is resistant to destruction and weakening by oxidization (rust).

5.2.2 GREY CAST IRON :-

Silicon is essential to making **grey cast iron** as opposed to white cast iron. When silicon is alloyed with ferrite and carbon in amounts of about 2 percent, the carbide of iron becomes unstable. Silicon causes the carbon to rapidly come out of solution as graphite, leaving a matrix of relatively pure, soft iron. Weak bonding between planes of graphite lead to a high activation energy for growth in that direction, resulting in thin, round flakes. This structure has several useful properties.

The metal expands slightly on solidifying as the graphite precipitates, resulting in sharp castings. The graphite content also offers good corrosion resistance.

Graphite acts as a lubricant, improving wear resistance. The exceptionally high speed of sound in graphite gives cast iron a much higher thermal conductivity. Since ferrite is so different in this respect (having heavier atoms, bonded much less tightly) phonons tend to scatter at the interface between the two materials. In practical terms, this means that cast iron tends to "damp" mechanical vibrations (including sound), which can help machinery to run more smoothly.

All of the properties listed in the paragraph above ease the machining of grey cast iron. The sharp edges of graphite flakes also tend to concentrate stress, allowing cracks to form much more easily, so that material can be removed much more efficiently.

Easier initiation of cracks can be a drawback once an item is finished, however: grey cast iron has less tensile strength and shock resistance than steel. It is also difficult to weld. However,compressive strength can be almost as high as for some mild steels.

Grey cast iron's high thermal conductivity and specific heat capacity are often exploited to make cast iron cookware and disc brake rotors.

5.2.3 MILD STEEL :-

Carbon steel, also called plain carbon steel, is steel where the main alloying constituent is carbon. The AISI defines carbon steel as: "Steel is considered to be carbon steel when no minimum content is specified or required for chromium, cobalt, columbium [niobium], molybdenum, nickel, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect; when the specified minimum for copper does not exceed 0.40 per cent; or when the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, copper 0.60."

The term "carbon steel" may also be used in reference to steel which is not stainless steel; in this use carbon steel may include alloy steels.

Steel with a low carbon content has properties similar to iron. As the carbon content rises, the metal becomes harder and stronger but less ductile and more difficult to weld. In general, higher carbon content lowers the melting point and its temperature resistance. Carbon content influences the yield strength of steel because carbon atoms fit into the interstitial crystal lattice sites of the body-centered cubic (BCC) arrangement of the iron atoms. The interstitial carbon reduces the mobility of dislocations, which in turn has a hardening effect on the iron. To get dislocations to move, a high enough stress level must be applied in order for the dislocations to "break away". This is because the interstitial carbon atoms cause some of the iron BCC lattice cells to distort.

85% of all steel used in the U.S. is carbon steel.

5.2.4 MILD AND LOW CARBON STEEL

Mild steel is the most common form of steel as its price is relatively low while it provides material properties that are acceptable for many applications. Low carbon steel contains approximately 0.05–0.15% carbon and mild steel contains 0.16–0.29% carbon, therefore it is neither brittle nor ductile. Mild steel has a relatively low tensile strength, but it is cheap and malleable; surface hardness can be increased through carburizing.

It is often used when large amounts of steel is needed, for example as structural steel. The density of mild steel is 7,861.093 kg/m^3 (0.284 lb/in^3), the tensile strength is a maximum of 500 MPa (73,000 psi) and the Young's modulus is 210,000 MPa (30,000,000 psi).

Low carbon steels suffer from *yield-point runout* where the materials has two yield points. The first yield point (or upper yield point) is higher than the second and the yield drops dramatically after the upper yield point. If a low carbon steel is only stressed to some point between the upper and lower yield point then the surface may develop luder bands.

CHAPTER 6

COST ESTIMATION

6.1 LIST OF MATERIALS

Sl. No.	PARTS	Qty.	Material
i.	Stand (Frame)	1	Mild Steel
ii.	Bearing with Bearing Cap	4	Aluminium
iii.	Timer Unit	2	-
iv.	IR Sensor	2	-
v.	DC Motor (Capacity – 5 Watts)	2	-
vi.	DC Motor (Capacity - 90 Watts)	1	-
vii.	Rollers	2	Mild Steel
viii.	Conveyor Belt	1	Rexin
ix.	Battery	1	-
x.	Heating Element	1	-
xi.	Hopper	1	Mild Steel
xii.	Shaft	1	Mild Steel

6.2 COST ESTIMATION

6.2.1 COST ESTIMATION FOR SEMI-AUTOMATIC PACKING CONTROL MACHINE

6.2.1.1 MATERIAL COST

Sl. No.	PARTS	Qty.	Material	Price inRs.
i.	Stand (Frame)	1	Mild Steel	250
ii.	Bearing with Bearing Cap	4	Aluminium	600
iii.	Timer Unit	2	-	1500
iv.	IR Sensor	2	-	1000
v.	DC Motor (Capacity – 5 Watts)	2	-	700
vi.	DC Motor (Capacity - 90 Watts)	1	-	800
vii.	Rollers	2	Mild Steel	550
viii.	Conveyor Belt	1	Rexin	100
ix.	Battery	1	-	800
x.	Heating Element	1	-	80
xi.	Hopper	1	Mild Steel	100
xii.	Shaft	1	Mild Steel	100

TOTAL = Rs.6580

6.2.1.2 LABOUR COST

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW :

Cost = Rs. 200

6.2.1.3 OVERHEAD CHARGES

The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = Material Cost + Labour cost

= 6580 + 200

= Rs. 6780

Overhead Charges = 20% of the manufacturing cost

= Rs. 1356

6.2.1.4 TOTAL COST

Total cost = Material Cost + Labour cost + Overhead Charges

= 6580 + 200 + 1356

= Rs. 8136

Total cost for this project = Rs. 8136

6.3.1 COST ESTIMATION FOR FULLY AUTOMATIC PACKING CONTROL MACHINE

6.3.1.1 MATERIAL COST

Sl. No.	PARTS	Qty.	Material	Price inRs.
i.	Stand (Frame)	1	Mild Steel	250
ii.	Bearing with Bearing Cap	4	Aluminium	600
iii.	Timer Unit	2	-	1500
iv.	IR Sensor	2	-	1000
v.	Pneumatic Cylinder	2	-	4000
vi.	Solenoid Valve	2	-	3000
vii.	Rollers	2	Mild Steel	550
viii.	Conveyor Belt	1	Rexin	100
ix.	Battery	1	-	800
x.	Heating Element	1	-	80
xi.	Hopper	1	Mild Steel	100
xii.	Shaft	1	Mild Steel	100
xiii.	Flow control valve	1	-	500

TOTAL = Rs.12580

6.3.1.2 LABOUR COST

LATHE, DRILLING, WELDING, GRINDING, POWER HACKSAW :

Cost = Rs. 200

6.3.1.3 OVERHEAD CHARGES

The overhead charges are arrived by "Manufacturing cost"

Manufacturing Cost = Material Cost + Labour cost

= 12580 + 200

= Rs. 12780

Overhead Charges = 20% of the manufacturing cost

= Rs. 2556

6.3.1.4 TOTAL COST

Total cost = Material Cost + Labour cost + Overhead Charges

= 12580 + 200 + 2556

= Rs. 15336

Total cost for Fully Automatic Packing Control Machine = Rs. 15336

CHAPTER 7

RESULT AND ANALYSIS

7.1 INTRODUCTION

In order to verify whether the design was safe, suitable Design Calculations were performed. The calculations confirmed that the design was safe. Spur Gear was used mainly to get the advantages like: Rotary Action, Speed Reduction and Increased Torque. The rate of packaging was also verified by adjusting the timings. Since the Timer Unit is a variable one, and here the limits are between 1-10 seconds, various time spans were adjusted and the packing rate was also verified. Also the packaging was tested with covers of varying thickness in order to see the quality of packaging. In order to verify this, the heating element that is connected to an external supply is left for sometime to get heated up to a higher temperature. This also proved to hold good for the packaging process. The project as said earlier holds good for packaging small industrial components and food products. The conveyor belt speed can also be increased by upgrading the motor speed to a higher value. Based on these analyzed verifications, suitable advantages, disadvantages and the applications as well can be discussed.

7.2 ADVANTAGES:

- Low Cost when compared to a Pneumatic Operated Material Packaging Machine.
- Simple Fabrication.
- Fast Pick-up.
- Improved Efficiency.
- Lesser Packaging time.
- It requires simple maintenance cares.
- Human participation is negligible.

7.3 DISADVANTAGES:

- Heating time of the heating element is more.
- Skilled Labour is required.

7.4 APPLICATIONS:

- Small Scale Industrial products like Bolts, Nuts, Screws and small toys within specified limits of the belt size.
- Food Processing Industrial products like grains, cereals, etc.

The products that were tested for packaging had the following specifications:

- Hexagonal Bolts:

  Diameter: ½ to 1 inch.

  Length : 30 inches (maximum).

  Bolt Head Length: 4 inches.

  Weight: 25 grams.

- Other Food Products:

  Weight: 50 grams.

Thus the packaging rate was achieved for the two different cases of products used.

- For Bolts, the packaging rate was obtained as 25 grams/second.
- For food products, the rate was 50 grams/ second.

Hence the prime objective was satisfied and can be varied by varying the Timer Unit accordingly.

7.5 FUTURE ENHANCEMENTS:

- The Power Rating of the motor can be increased to a higher level, so that comparatively large products can be used for packaging.
- Calculation of the spur gear design according to the power of the motor must be done and the driving torque must be increased to a greater level.
- Manual loading of the products to be packed must be converted to an automatic one by placing a separate conveyor to take these products.
- Special Inspection Probes are to be fitted after the sealing portion in the machine, so that any flaw in packaging can be detected and can be taken as a reject, to improve the quality of package.

CHAPTER 8

CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the limited time successfully. The "**SEMI AUTOMATIC PACKING CONTROL MACHINE**" is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work.

Thus we have developed a "**SEMI AUTOMATIC PACKING CONTROL MACHINE**" which helps to know how to achieve low cost automation. The operating procedure of this system is very simple, so any person can operate. By using more techniques, they can be modified and developed according to the applications.

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