CONSTRUCTION AND PERFORMANCE TEST OF PNEUMATIC CAN CRUSHER

Supervised By

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A thesis submitted in partial fulfilment of the requirements for the degree of
B.Sc. in Mechanical Engineering

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We acknowledge with appreciation the co-operation of Professors Md. Mostafa Hossain for him help at various stage of project work.

We deeply thank our friends and families for always believing in us even at the moment when we were losing our confident.

"AUTHORS"

ABSTRACT

The project can crusher is a device used for crushing aluminum cans for easier storage in recycling bins. While most recyclers don't require You to crush cans, if you do recycle a lot, your normal bin may fill up Quickly. The crusher gives you extra space by flattening either single and fabricating the recycle bin tin can crusher to help people to crush The tin and aid easier transportation. This project is mainly about generating a new concept of tin can crusher that would make easier to bring anywhere and easier to crush the tin.

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LIST OF FIGURE

CHAPTER NO-01
INTRODUCTION

INTRODUCTION:

A mechanical tin can crusher is basically one of the most aid able machines. It helps to reduce the pollute environment of this world. Thus helps create a better place to live in. apart from that, this tin can crusher can actually be the future mode of recycles apart from the recycle bins. It can be placed everywhere, in the park, houses, even in cars. Using a similar type of a design from the diagram below, but with the added a bin bellow the tin can crusher concept of recycling can be applying. this project interest and expose me the field of mechanism and design engineering.

1.1 PROJECT SYNOPSIS

In this project, development of a recycle bin tin can crusher so the tin can might crush as flat and look as symmetrically as possible and inserted the bin. The designs are an environment friendly and use simple mechanism properties such as fulcrum system.

The design is done so that the knowledge of designing, mechanism and forces.

1.2 OBJECTIVE

- To develop of a recycle bin tin can crusher.
- To fabricate recycle bin tin can crusher low cost and time consuming [1]

1.3 SCOPE OF WORK

- Literature review on the knowledge of mechanism design
- design the mechanical part of a tin can crusher using CAD software Solid Work.
- Develop the model tin can crusher using bending process, welding process, drilling process and cutting process
- Fabricate the model tin can crusher using welding skill and machining [2]

1.4 PROBLEM STATEMENT

When people footstep the tin after finishes their drink, the tin always not look symmetrically flat and it look messy. This condition sometime makes tin produce the sharp adage will harm or injured the people.

Furthermore, people always throw the can anywhere. These conditions make pollution for this environment, become bad surrounding and separate the ditches.

So this design is use to crush the can as flat as possible and try to reduce time, cost consuming and the sharp edge also have been below the crusher.

1.5 PROJECT PLANNING

To start of this project, a meeting with supervisor in the first week is done to manage the schedule of weekly meetings. The purpose is to inform the supervisor on the progress of the project and guided by the supervisor to solve difficulty.

Briefing based on the introduction and next task of the project is given by supervisor. Make research of literature review with the means of the internet, books, available published articles and materials that is related to the title.

Designing phase start of by sketching few model models using manual sketch on A4 papers. Following up, is the fabrication of make some method for this project. Choose the material, make some list for the material and dimension. Do it planning of fabrication process for this project.

After that, start the fabrication process. It would take seven weeks to get this design and fabrication process alteration done. Make some analysis and testing for the project. Do it correction for error this project. Finish the fabrication process with painting process.

After that, the final report writing and final presentation will be the last task to be accomplished. The supervisor will review the final presentation and revise mistakes to be amended. The final presentation then again will be presented to three panels. A draft report would then be submitted to the supervisor to be point out the flaws. Corrections are done and the real final report is handed over as a completion of the final year project. [3]

CHAPTER NO-02
LITERATURE SURVEY

2.1 PNEUMATICS

The word ‘pneuma’comes from greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma.today pneumatics is mainly understood to means the application of air as a working medium in industry especially the driving and controlling of machines and equipment.

Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has Played a more important role in the development of pneumatic technology for automation.

Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.

Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature.

The compressibility of the air was first investigated by Robot Boyle in 1962 and that found that the product of pressure and volumes of particular quantity of gas.

The usual written as

$$PV = C \quad \text{(or)} \; P_1V_1 = P_2V_2$$

In this equation the pressure is the absolute pressured which for free is about 14.7Psi and is of courage capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a day. [4]

2.2 SELECTION OF PNEUMATICS:

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low Cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power).

The main advantage of an all pneumatic system is usually Economic and simplicity the latter reducing maintenance to a low level. It can have outstanding advantages in terms of safety.

2.3 PNEUMATIC POWER:

Pneumatic systems use pressurized gases to transmit and control power. Pneumatic systems typically use air as the fluid medium because air is safe, low cost and readily available.

2.4 THE ADVANTAGES OF PNEUMATICS:

1. Air used in pneumatic systems can be directly exhausted back
In to the surrounding environment and hence the need of special reservoirs and no-leak system designs are eliminated.

2. Pneumatic systems are simple and economical

3. Control of pneumatic systems is easier

2.5 THE DISADVANTAGES OF PNEUMATICS:

1. Pneumatic systems exhibit spongy characteristics due to compressibility of air.

2. Pneumatic pressures are quite low due to compressor design limitations(less that 250 psi).

2.6 PRODUCTION OF COMPRESSED AIR

Pneumatic systems operate on a supply of compressed air, which must be made available. In sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply.

At intake conditions namely at atmosphere pressure and normal ambient temperature. Clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result increased precipitation of condense from the compressed air.

Compressor may be classified in two general types.

1. positive displacement compressor

2. Turbo compressor

Positive displacement compressors are most frequently employed for

Compressed air plant and have proved highly successful and supply air for pneumatic control application.

The types of positive compressor

1. Reciprocating type compressor

2. Rotary type compressor

Turbo compressors are employed where large of air required at low discharge pressures. They cannot attain pressure necessary for pneumatic control application unless built in multistage designs and are seldom encountered in pneumatic service.

2.7 RECIPROCATING COMPRESSORS:

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500m^3/min.In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15bars.

Discharge pressure in the range of 250bars can be obtained with high pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable

For applications, with preference going to the two stage design as soon as the discharge pressure exceeds 6 bars, because it in capable of matching the performance of single stage machine at lower costs per driving powers in the range.[5]

CHAPTER NO-03
DESCRIPTION OF EQUIPMENT

3.1 PNEUMATIC CONTROL COMPONENT

3.1.1 PNEUMATIC CYLINDER:

An air cylinder is an operative device in which the state input energy of compressed air i.e. pneumatic power is converted into mechanical Output power, by reducing the pressure of the air to that of the atmosphere.

3.1.1a) SINGLE ACTING CYLINDER:

Single acting cylinder is only capable of performing an operating medium in only one direction. Single acting cylinders equipped with one inlet for the operating air pressure, can be production in several fundamentally different designs. Single cylinders Develop power in one direction only.

Therefore, no heavy control equipment should be attached to them, which requires to be moved on the piston return stroke single action cylinder requires only about half the air volume consumed by a double acting for one operating cycle.

3.1.1 b) DOUBLE ACTING CYLINDERS:

A double acting cylinder is employed in control systems with the full pneumatic cushioning and it is essential when the cylinder itself is required to retard heavy messes. This can only be done at the end positions of the piston stroke. In all intermediate position a separate externally mounted cushioning derive most be provided with the damping feature.

The normal escape of air is out off by a cushioning piston before the end of the stroke is required. As a result, the sit in the cushioning chamber is again compressed since it cannot escape but slowly according to the setting made on reverses. The air freely enters the cylinder and the piston strokes in the other direction at full Force and velocity.

3.2.1 SOLENOID VALVE

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV; this valve is used to control the direction of air flow in the pneumatic system. The directional valve does this by changing the position of its internal movable parts.

This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into automatic machine by means of using a solenoid valve.

A solenoid is an electrical device that converts electrical energy into straight line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. Solenoid is one is which the plunger is pulled when the solenoid is energized.

The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs, to do service work or to install them.[6]

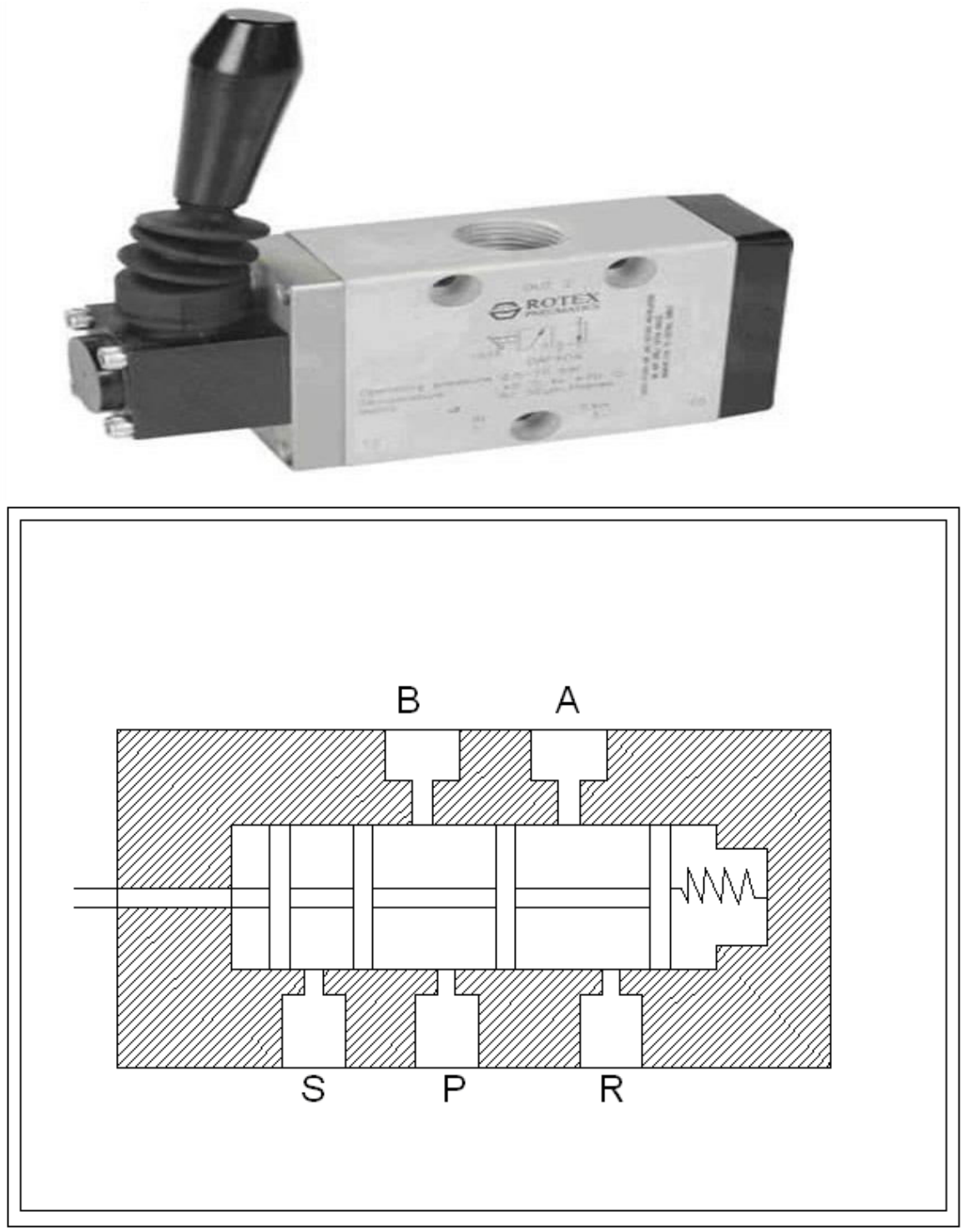

Fig-01: Solenoid Valve

PARTS OF A SOLENOID VALVE

1. COIL

The solenoid coil is made of copper wire. The layers of wire are separated by insulating layer. The entire solenoid coil is covered with a varnish that is not affected by solvents, moisture, cutting oil or often fluids. Coils are rated in various voltages such as 115 volts AC,230volts AC,460volts Ac,575 Volts AC.6Volts DC,12Volts DC,

24 Volts DC, 115 Volts DC &230Volts DC. They are designed for such Frequencies as 50Hz to 60Hz.

2. FRAME

The solenoid frame serves several purposes. Since it is made of laminated sheets, it is magnetized when the current passes through the coil. The magnetized coils attract the metal plunger to move. The frame has provisions for attaching the mounting. They are usually bolted or welded to the frame. The frame has provisions for receivers, the plunger. The wear strips are mounted to the solenoid frame, and are made of materials such as metal or impregnated less Fiber.

3. SOLENOID PLUNGER

The solenoid plunger is the mover mechanism of the solenoid. The plunger is made of steel laminations which are riveted together under high pressure, so that there will be no movement of the lamination with respect to one another. At the top of the plunger a pin hole is placed for making a connection to some device. The solenoid plunger is moved by a magnetic force in one direction and is usually returned by spring action.

Solenoid operated valves are usually provided with cover either the solenoid or the entire valve. This protects the solenoid from dirt and other foreign matter, and protects the actuator. In many applications it is necessary to use explosion proof solenoids.

WORKING OF SOLENOID VALVE:

The solenoid valve has 5 openings. These ensure easy exhausting of 5/4Valve.the spool of the 5/4 valve slide inside the main bore according to spool position: the ports get connected and disconnected.

The working principle is as follows.

Position-1

When the spool is actuated towards outer direction port ‘P’ gets

Connected to ‘B’ and ‘S’ remains closed while ‘A’ gets connected to ‘R’.

Position-2

When the spool is pushed in the inner direction port ‘P’ and ‘A’

Gets connected to each other and ‘B’ to ‘S’ while port ‘R’ remains closed.

SOLINOID VALVE (OR) CUT OFF VALVE:

The control valve is used to control the flow direction is called cut off valve or solenoid valve. This solenoid cutoff valve is controlled by the electronic control unit.

In our project separate solenoid valve is used for flow direction of vice cylinder. It is used to flow the air from compressor to the single acting cylinder.

3.2.2 FLOW CONTROL VALVE:

In any fluid power circuit, flow control valve is used to control the speed of actuator. The flow control can be achieved by varying the area of flow through which the air in passing.

When area is increased, more quantity of air will be sent to actuator as a result its speed will increase. If the quantity of air entering into the actuator is reduced, the speed of the actuator is reduced.

3.2.3 PRESSURE CONTROL VALVE:

The main function of the pressure control valve is to limit (or) Control the pressure required in a pneumatic circuit. Depending upon the method of controlling they are classified as

1. Pressure relief valve

2. Pressure reducing valve

3.2.4 HOSES:

Hoses used in this pneumatic system are made up of polyurethane. These hose can with stand at a maximum pressure level of $10N/m^2$.

Connectors:

In our system there are two type of connectors used. One is the Hose connector and the other is the reducer. Hose connectors normally comprise an adopt hose nipple and cap nut. These types of connectors are made up of brass (or) aluminum (or) hardened pneumatic steel.

3.3 PRESSURE GAUGE:

Pressure gauges are usually fitted with the regulators. So the air Pressure adjusted in the regulator is indicated in the pressure Gauge, is the line pressure of the air taken to the cylinder.

CHAPTER NO-04
DESIGN OF EQUIPMENT AND DRAWING

4.1 PNEUMATIC COMPONENTS AND ITS SPECIFICATION

The pneumatic auto feed drilling machine consists of the following components to full fill the requirements of complete operation of the machine.

1. Double acting pneumatic cylinder

2. Solenoid vale

3. Flow control valve

4. Connectors

5. Hoses

6. Pneumatic driller

7. Control unit

4.1.1. DOUBLE ACTING PNEUMATIC CYLINDER:

Technical Data

Stroke length : cylinder stroke length 100mm =0.1m

Piston rod : 10mm =10 $X10^{-3}$m

Quantity : 1

Seals : Nitride (Buna-N) Eastover

End cones : Cast iron

Piston : EN-8

Medium : Air

Temperature : 0-80°C

Pressure Range : $8N/m^2$

4.1.2. SOLENOID FLOW CONTROL VALVE

Technical data

Port Size : 0.635×10^{-2}m

Maximum pressure : $0\text{-}10 \times 10^{5}$ N/m^2

Quantity : 1

Medium : Air

4.1.3. CONNECTORS

Technical data

Max working pressure : 10×10^{5} N/m^2

Temperature : 0-100°C

Fluid medium : Air

Material : Brass

4.1.4. HOSES

Technical data

Max pressure : 10×10^{5} $^{\mathbf{N/m}^2}$

Outer diameter : 6mm =6×10^{-3} m

Inner diameter : 3.5mm =3.5×10^{-3}m

4.1.5. PNEUMATIC UNIT

Type of cylinder : Double acting cylinder

Type of valve : flow control valve &solenoid valve

Max air pressure : 8 x10^5 N/m^2

4.2 DESIGN CALCULATION

pressure applied in the cylinder (p) : 8N/m^2

Area of cylinder (A) : (3.14/4*(10^2)

: 80.38cm^2

: 80.38 X $10^{-4}m^2$

Force exerted in the piston (F) : Pressures applied X area of cylinder.

: 8N/m^2

LIST OF DRAWINGS

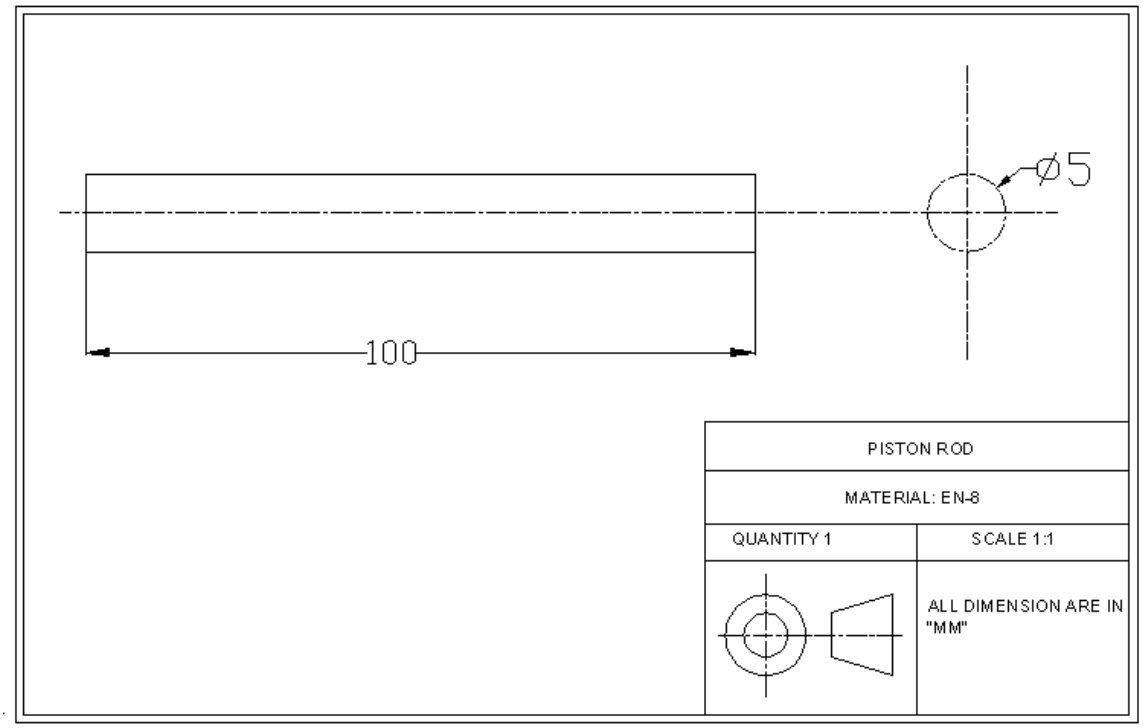

Fig-02: PISTON ROD

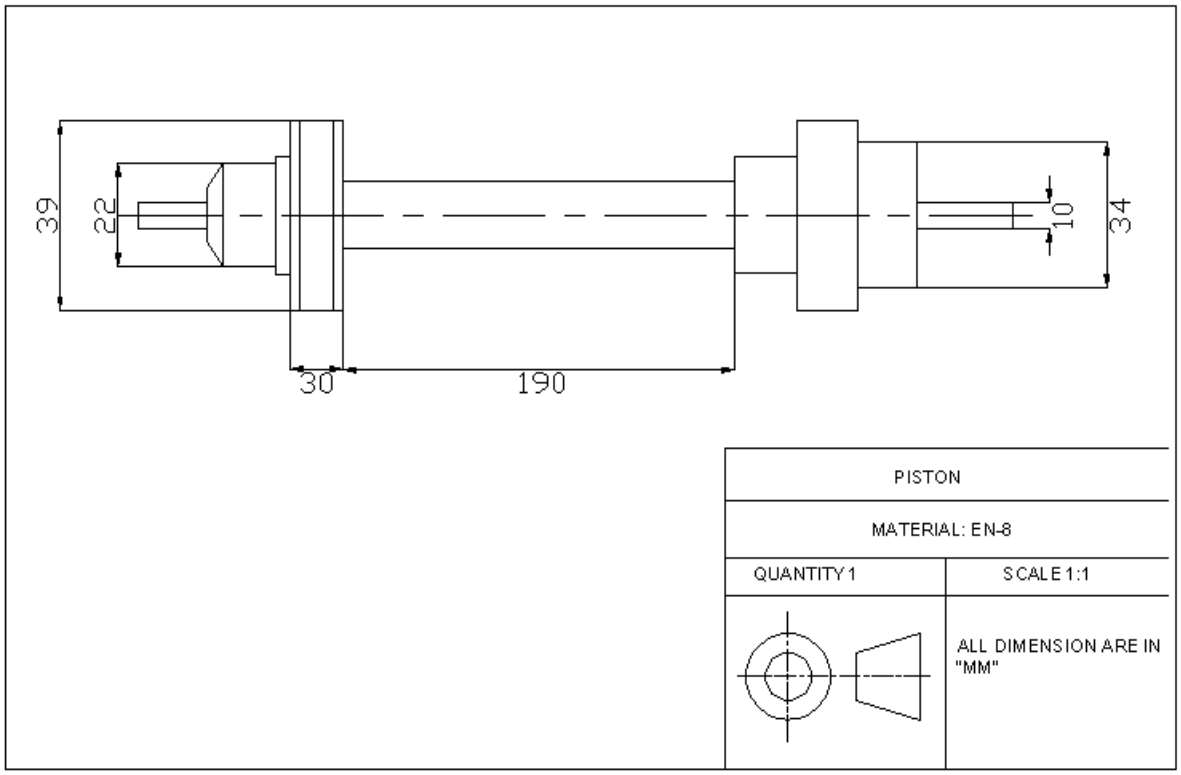

Fig-03: PISTON

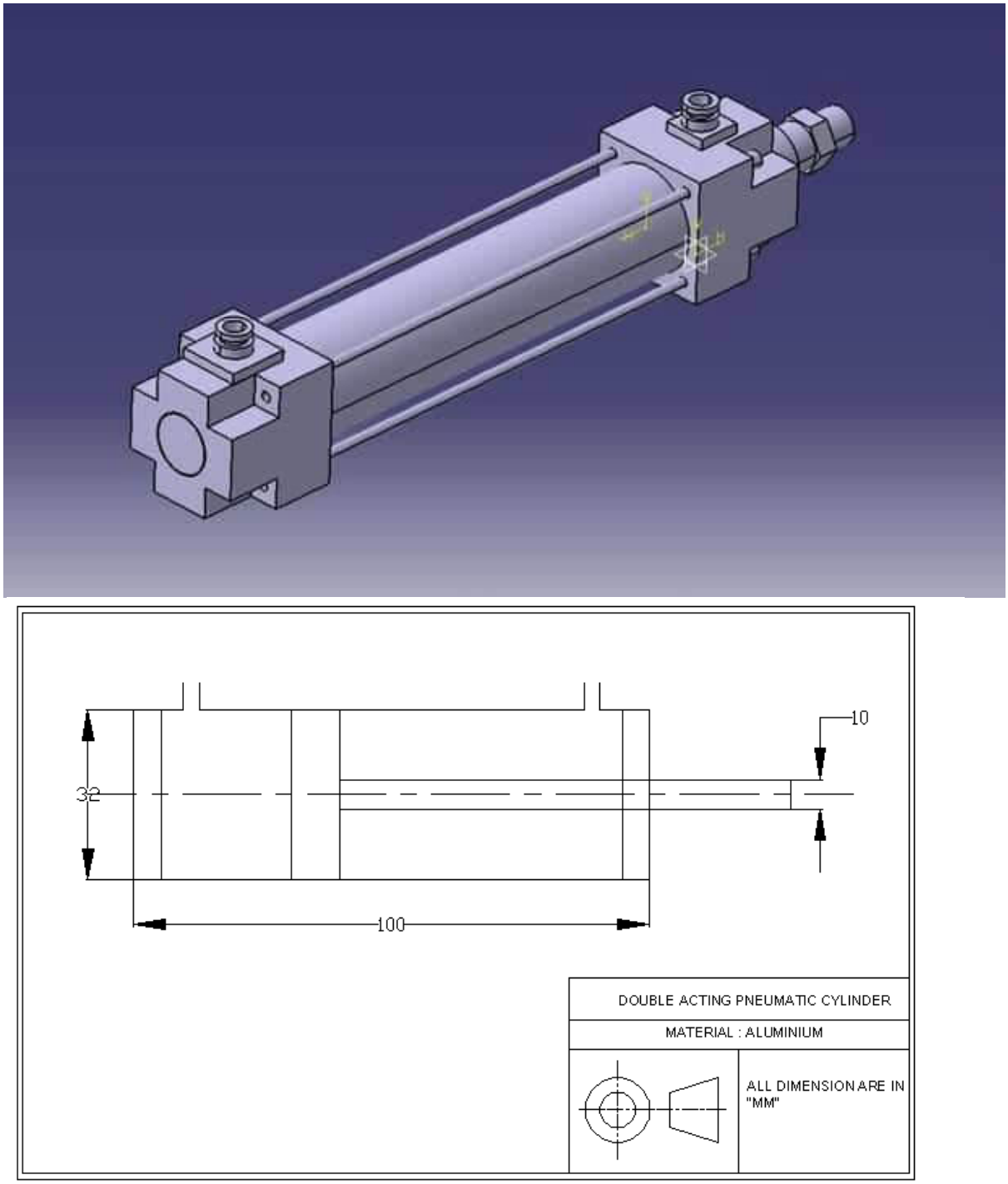

Fig-04: DOUBLE ACTING PNEUMATIC CYLINDER

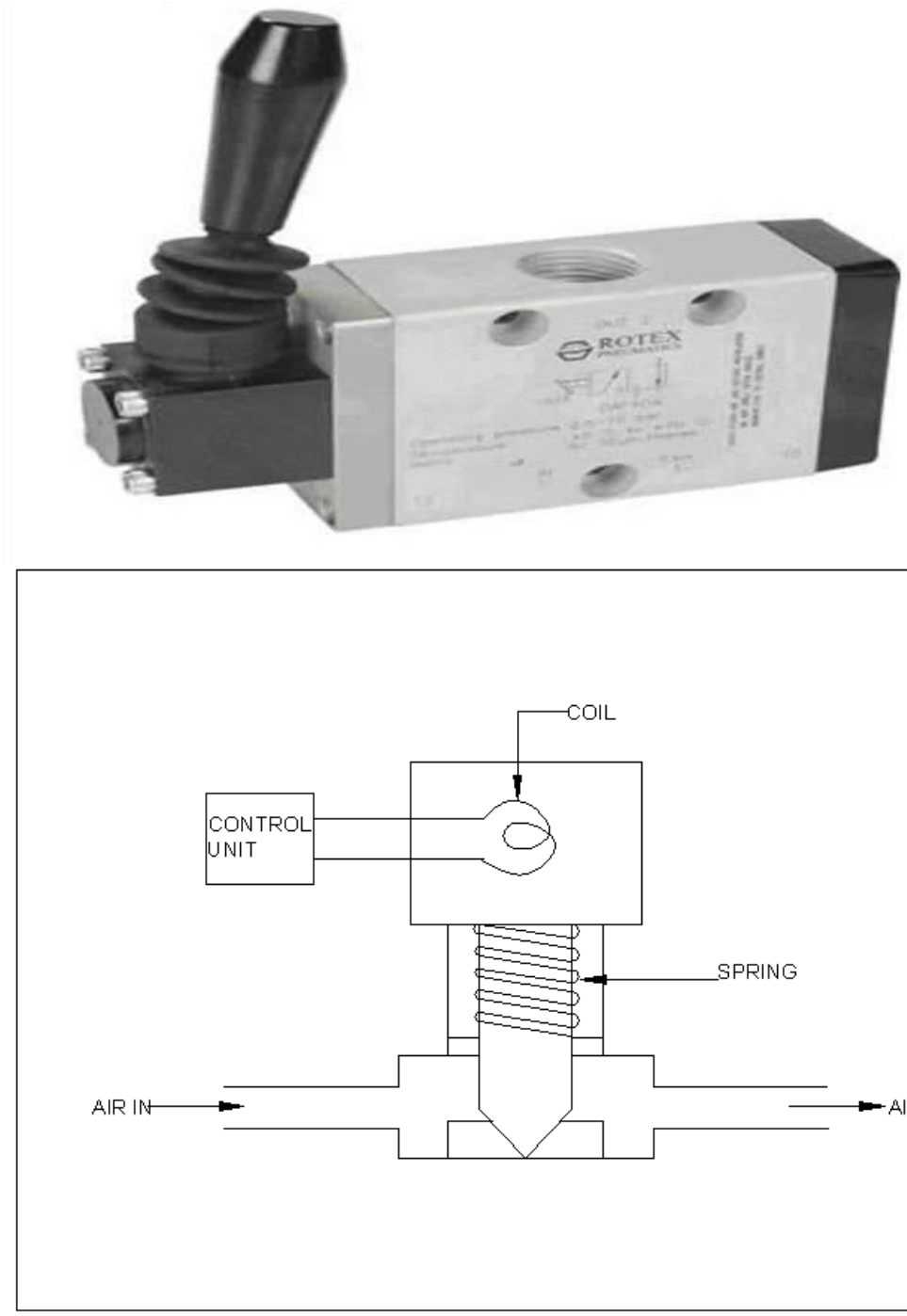

Fig-05: SOLENOID VALVE (CUT OF VALVE)

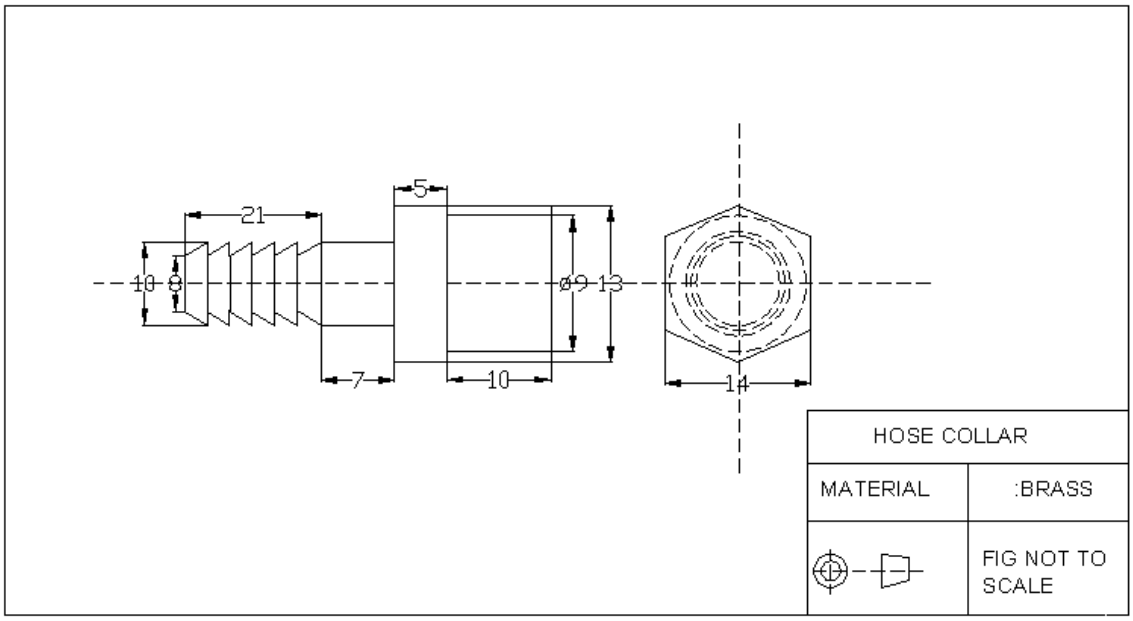

Fig-06: HOSE COLLAR

CHAPTER NO-05
WORKING PRINCIPLE

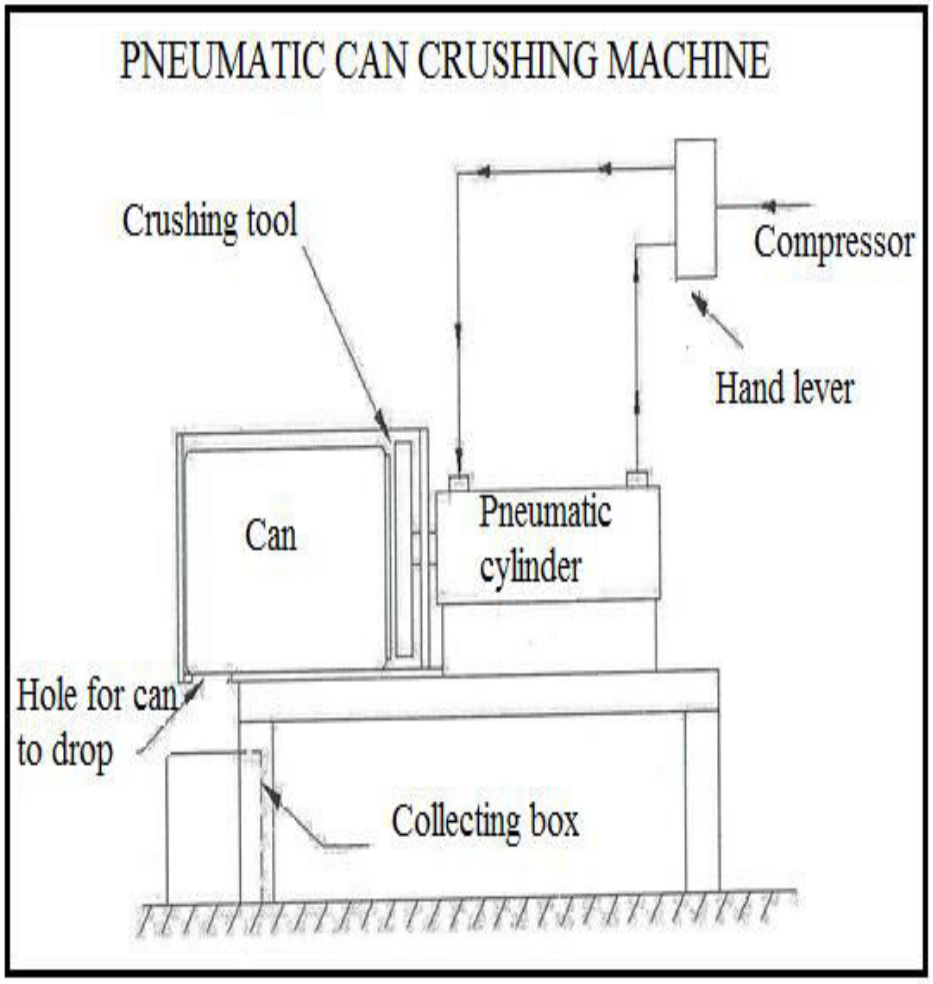

Fig-07: CONSTRUCTION OF PNEUMATIC CAN CRUSHING MACHINE

This cane crusher is operated under pneumatic principle. This pneumatic cylinder is powered by compressed air. Hand liver is used to control the pneumatic cylinder movement. By using this hand liver we can operate the pneumatic cylinder front and back, this movement is used for cane crushing operation.

The compressed air is stored in the compressor cylinder. This compressed air is given to the pneumatic cylinder through hand liver. This hand liver will give the front and back movement to the pneumatic cylinder based on that movement. In this machine inlet and outlet is provided for cane movement.

Used cane is dropped to the machine through inlet, then it crushed by pneumatic cylinder. The crushed can will come out from the machine through outlet way.

CHAPTER NO-06
MERITS

6.2 MERITS

- Easy operation since pneumatic is used for providing effort for crushing
- Manual control is possible while
- Low cost
- Less expensive
- Eco friendly
- By reducing size of can huge amount of cans can be transported for
- recycling
- Easy to handle
- Occupy less space
- Easy to fabricate

6.2 APPLICATIONS

- It is used in Recycling process and recycling industries
- It is used for easy transportation of cool drinks cans by crushing and compressing its volume
- Aluminum can recycling is easier
- Plastics bottles, Nylon bottles can also be crushed for industries to reduce the volume of wastages by crushing

CHAPTER NO-07
LIST OF MATERIALS

FACTORS DETERMINING THE CHOICE OF MATERIALS

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

7.1. PROPERTIES:

]

The material selected must possess 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, eleastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties.

- Cast ability
- Weld ability
- Bribability
- Forge ability
- Merchantability
- Surface properties
- Shrinkage

7.2. 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.

7.3. QUALITY REQUIRED:

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

7.4. 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.

7.5. SPACE CONSIDERATION:

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

7.6. COST:

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

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

CHAPTER NO-08
COST ESTIMATION

8.1. LABOUR COST:

- Lathe
- Drilling
- Welding,
- Grinding,
- Power hacksaw,
- Gas cutting cost

8.2. OVERHEAD CHARGES:

The overhead charges are arrived by" manufacturing cost"

Manufacturing Cost =Material Cost +Labour Cost

= 8500 +1500

= 10,000

Overhead Charges = 20%of the manufacturing cost

= 2000

8.3. TOTAL COST:

Total cost = Material Cost +Labour Cost +Overhead Charges

Total cost = 8500+1500+2000

= 12,000

8.4. CONCLUSION

The above design procedure is being adopted for the fabrication of fully automatic can crusher machine which will make the product durable for the long time as well as make it efficient and also helps to understand the concept of design. Thus with the help of this design we can fabricate an automatic can crusher machine to simply reduce the volume of cans as well as to reduce the human fatigue.

Also the automatic operation can be possible using the mechanical power transmission operated by electric motor or electric actuator etc. This solely will reduce the volume of the cans or bottles to reduce the transportation cost by reducing its volume.

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