International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 7 July 2021, pp: 2427-2431 www.ijaem.net ISSN: 2395-5252

Pneumatic sheet metal cutting

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Submitted: 01-07-2021 Revised: 13-07-2021 Accepted: 16-07-2021

ABSTRACT: Pneumatics systems are extensively used in a wide range of industries and factories and manufacturing sector entities. Pneumatics system are noted for their simplicity, reliability, and ease of operation. Also they are suitable for fast and rapid application offorce.

Normally the sheet metal cutting machine is manually hand operated for medium and small scale industries. This paper gives an insight about the automatic sheet metal cutting machine. Any automatic machine aimed for economical use of man. In this paper, pneumatic cylinder is used for cutting in easy way which can be use in small scale industries at lower cost. The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The piston is connected to the moving cutting tool which his used to cut the sheet metal. The cutting process is operated by a direction control valve by using compressor. In manual method sheet metals goes to the scrap sometime because of wrong dimensions, improper cutting etc. Hydraulic machines are also used for sheet metal cutting. But these machines are used for heavy metal cutting and its cost is very high. Hence, we are using a pneumatic system for sheet metal cutting in an easy manner. The main advantage of pneumatic sheet metal cutting machine is to improve product quality, repetition of work and increasing production rate.

The sheet metal cutting process is a main part of the all industries. Normally the sheet metal cutting machine is manually hand operated one for medium and small scale industries. In our project is "PNEUMATIC SHEET METAL CUTTING MACHINE".

Automation in the modern world is inevitable. Any automatic machine aimed at the economical use of man, machine, and material worth the most. In our project is solenoid valve is used for automation.

The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The piston is connected to the moving cutting tool. It is used to cut the small size of sheet metal. The machine is portable in size, so easy transportable.

I. INTRODUCTION:

The shearing machine and bending machine is most important in sheet metal industry. This machine should be used for straight cutting machine with wide application. But in some industry hand sheet cutter and hand bender are used. For that machine to operate the human effort are required. The machine should be simple to operate and easy to maintain, hence we tried out to develop the Pneumatic Shearing and Bending Machine.

In shearing operation as the punch descends upon the metal, the pressure exerted by the punch first cause the plastic deformation of the metal. Since the clearance between the punch and the die is very small, the plastic deformation takes place in a localized area and the metal adjacent to the cutting edges.

Hence, we are introducing a pneumatic sheet metal cutting machine which will reduce manufacturing cost and minimize industrial labor problems which is the biggest headache for human. The main objective of our project is to perform job holding operation effectively with less human efforts by using a machine with the pneumatic power. This will also reduce the time required for metal cutting. By using these machines we can increase the production rate and automatically the industry will be in profit. Automation plays an important role in mass production. Automation can be achieved through pneumatic form. The main advantage of pneumatic system is economically cheap and easy to handle.

The formation of any business begins with someone producing the initial idea for the project. The continued success of an established business depends upon the number and quality of the ideas fed into it. Without a continual flow of new ideas, a business cannot function profitably or expand successfully and must, therefore eventually fade into total obscurity. Ideas for a new business project, a new product, a means of reducing manufacturing costs or for solving industrial labor problems, begin in the human mind. Most people conceive their ideas unconsciously, and because

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they are unaware of the mental mechanics that caused the 'idea' to be produced, they cannot repeat the ideation process to produce further profitable ideas at will.

Fortunately, there are available established creative techniques which, when used correctly, do enable a person to produce a large number of first-class ideas at will. One such creative technique, and probably the most widely used in American industry, is 'brainstorming'.

Sheet metal is simply a metal formed into thin and flat pieces. It is one of the fundamental forms used in metal working and can be cut and bent into a variety of different shapes. Countless everyday objects are constructed of the material.

Thicknesses can vary significantly, although extremely thin thicknesses are considered foil or leaf, and pieces thicker than 6 mm (0.25 in) are considered plate. Sheet metal is available in flat pieces or as a coiled strip. The coils are formed by running a continuous sheet of metal through a roll slitter. The thickness of the sheet metal is called its gauge. Commonly used steel sheet metal ranges from 30 gauge to about 8 gauge. The larger the gauge number, the thinner the metal. Gauge is measured in ferrous (iron based) metals while nonferrous metals such as aluminum or copper are designated differently; i.e., Copper is measured in thickness by ounce. There are many different metals that can be made into sheet metal, such as aluminum, brass, copper, steel, tin, nickel and titanium. For decorative uses, important sheet metals include silver, gold and platinum (platinum sheet metal is also utilized as a catalyst). Sheet metal also has applications in car bodies, airplane wings, medical tables, roofs for buildings (Architectural) and many other things. Sheet metal of iron andother

II. METHODOLOGY:

The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The piston is connected to the moving cutting tool. It is used to cut the small size of the sheet metal. Auto Feed Pneumatic Sheet Metal Cutting Machine. The machine is portable in size, so easy transportable. The compressed air from the compressor is used as the force medium for this operation. There is pneumatic double acting cylinders solenoid valves, flow control valve and the timer unit is used. The sheet metal cutting process is a main part of the all industries. Normally the sheet metal cutting machine is manually hand operated one for medium and small scale industries. Automation in the modern world is inevitable. Any automatic machine aimed at the economical use of man, machine, and material worth the most. In our project is solenoid valve and control timing unit is used for automation The sheet metal cutting machine works with the help of pneumatic double acting cylinder. The manually operated machine is converted into pneumatically operated machine by applying proper design procedure. At the end of task, the conclusion is made and several recommendations are suggests to make an improvement about the result and the project for futurestudy.

The main goal of project studies is to study about pneumatic control system. Then, to study about double acting cylinder. Then, to study about the advantage of pneumatic hand operated valve. Then, to study about high speed blade.Then, to design & fabrication pneumatic sheet metal cutting machine.Then, collecting the proper components. Then, machining them. Then, assembling the all components to a proper shape. Finally, Completion the process to make a proper pneumatic sheet metal cuttingmachine.

materials with high magnetic permeability, also known as laminated steel cores.

The production of iron and steel is of great importance for any country's economy. This is because the iron and steel industry directly influences the development of a sustainable society and also it the basis for all other industries. Thus the trend in production and consumption in steel is also viewed as an indicator of the condition of the country's economy. This the reason why steel is called the "backbone" of a country's economy. Hence by increasing the production of steel, we can help in the growth of our country's economy. But this where the problem arises. A sheet metal cutting or a punching machine is very important to the sheet metal industry and since large scale industries are well established they can afford to equip themselves with hydraulically operated cutting and punching machines that generate a large amount of force and also are easily automated. Thus the production output of large scale industries is enormous. Same is not the case with medium to small scale industries. Since hydraulic machines are too costly most of these industries restrict themselves to only using hand-operated cutting or punching machines. The production output of hand-operated machines is low. Because of this problem, we are developing a pneumatically operated cutting and punching machine. Pneumatics is the branch of engineering which uses pre-compressed air or inert gas as a means to drive machinery. Certain properties of air make it extremely suitable for its usage in modern machinery. The advantage of using a pneumatic

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Volume 3, Issue 7 July 2021, pp: 2427-2431 www.ijaem.net ISSN: 2395-5252

system is that it can generate a considerable amount of force while beingcost-effective.

PRINCIPLE OFWORKING:

Initially starting with air compresses, its function is to compress air from a low inlet pressure (usually atmospheric) to a higher pressure level. This is an accomplished by reducing the volume of theair.

Air compressors are generally positive displacement units and are either of the reciprocating piston type or the rotary screw or rotary vane types. The air compressor used here is a typically small sized, two-stage compressor unit. It also consists of a compressed air tank, electric rotor and pulley drive, pressure controls and instruments for quick hook up and use. The compressor is driver by a 10HP motor and designed to operate in 145 – 175 PSI range. If the pressure exceeds the designed pressure of the receiver a release value provided releases the excesses air and thus stays a head of any hazards to take place.

The stored air from compressor is passed through an air fitter where the compressed air is filtered from the fine dust particles. However, before the suction of air into compressor a filter process take place, but not sufficient to operate in the circuit here the filter is used. Then having a pressure regulator where the desired pressure to the operated is set. Here a variable pressure regulator is adopted. Through a variety of direction control value are available, a hand operated solenoid Valve with control unit is applied. The solenoid valve used here is 5 ports, 3 positions.There are two exhaust ports, two outlet ports and one inlet port. In two extreme positions only the directions can be changed while the Center is a neutral position and no physical changes are incurred. The 2 outlet ports are connected to an actuator (Cylinder). The pneumatic activates is a double acting, single rod cylinder. The cylinder output is coupled to further purpose. The piston end has an air horning effect to prevent sudden thrust at extreme ends. The compressed air from the compressor reaches the solenoid valve. The solenoid valve changes the direction of flow according to the signals from the timingdevice.

The compressed air pass through the solenoid valve and it is admitted into the front end of the cylinder block. The air pushes the piston for the cutting stroke. At the end of the cutting stroke air from the solenoid valve reaches the rear end of the cylinder block. The pressure remains the same but the area is less due to the presence of piston rod.

Thisexertsgreaterpressureonthepiston,push ingitatafasterratethus enabling faster return stroke. The non-return valve is fixed to the hydraulic cylinders two side (Four numbers). The stroke length of the piston can be changed by making suitable adjustment in the timer

Pneumatic Transmission of Energy:

The reason for using pneumatics, or any other type of energy transmission on a machine, is to perform work. The accomplishment of work requires the application of kinetic energy to a resisting object resulting in the object moving through a distance. In a pneumatic system, energy is stored in a potential state under the form of compressed air. Working energy (kinetic energy and pressure) results in a pneumatic system when the compressed air is allowed to expand. For example, a tank is charged to 100 with compressedair.

When the valve at the tank outlet is opened, the air inside the tank expands until the pressure inside the tank equals the atmospheric pressure. Air expansion takes the form of airflow. To perform any applicable amount of work then, a device is needed which can supply an air tank with a sufficient amount of air at a desired pressure. This device is positive displacement compressor. A positive displacement compressor consists of a movable memberinside housing.

The compressor has a piston for a movable member. The piston is connected to a crankshaft, which is in turn connected to a prime mover (electric motor, internal combustion engine). At inlet and outlet ports, valves allow air to enter and exit thechamber.

Control of PneumaticEnergy:

Working energy transmitted pneumatically must be directed and under complete control at all times. If not under control, useful work will not be done and machinery or machine operators might be harmed. One of the advantages of transmitting energy pneumatically is that energy can be controlled relatively easily by using valves.

Control ofPressure:

In a pneumatic system must be controlled at two points - after the compressor and after the air receiver tank. Control of pressure is required after the compressor as asafetyforthe system. Controlofpressureafteranairreceivertankisnecessary so that an actuator receives a steady pressure source.

Control of Pressure after a Compressor In a pneumatic system, energy delivered by a

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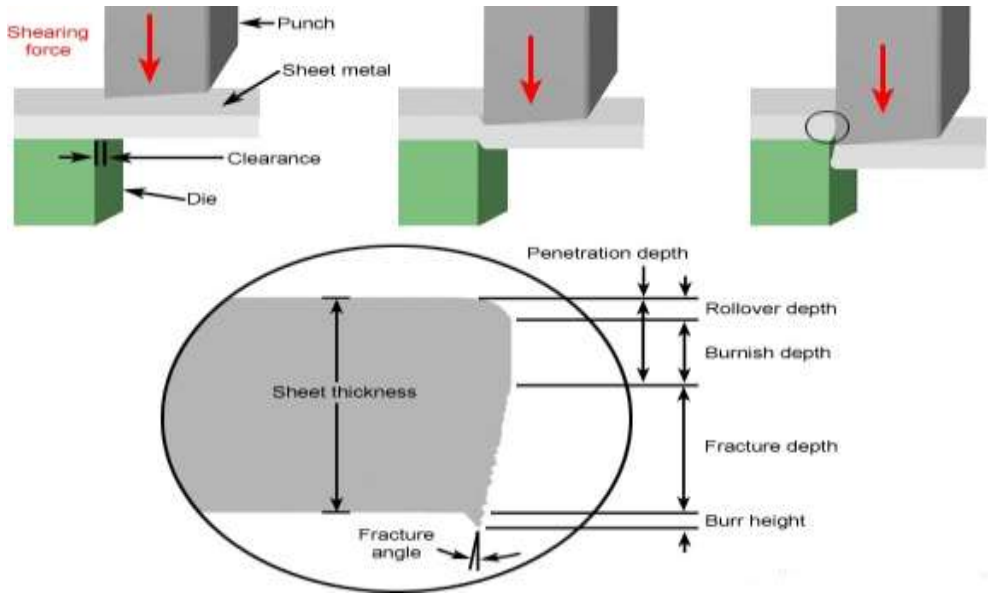
compressor is not generally used immediately, but is stored as potential energy in air receiver tank in the form of compressed air. In most instances, a compressor is designed into a system so that it operates intermittently. A compressor usually delivers compressed air to a receiver tank until high pressure is reached, and then it is shut down. When air pressure in the tank decreases, the compressor cuts in and recharges the tank. Intermittent compressor operation in this manner is a power saving benefit for the system. A common way of sensing tank pressure and controlling actuation and de actuation of relatively small (2-15 HP) compressors, is with a pressureswitch.

Cutting of SheetMetal:

The most common cutting processes are performed by applying a shear force, and are therefore sometimes referred to as shearing processes. Cutting processes are those in which a piece of sheet metal is separated by applying a great enough force to cause the material to fail. When a great enough shearing force is applied, the shear stress in the material will exceed the ultimate shear strength and the material will fail and separate at the cut location. This shearing force is applied by two tools, one above and one below the sheet. Whether these tools are a punch and die or upper and lower blades, the tool above the sheet delivers a quick downward blow to the sheet metal that rests over the lower tool. A small clearance is present between the edges of the upper and lower tools, which facilitates the fracture of thematerial.

The effects of shearing on the material change as the cut progresses and are visible on the edge of the sheared material. When the punch or blade impacts the sheet, the clearance between the tools allows the sheet to plastically deform and "rollover" the edge. As the tool penetrates the sheet further, the shearing results in a vertical burnished zone of material, finally, the shear stress is too great and the material fractures at an angle with a small burr formed at the edge. The height of these portions of the cut depends on several factors, including the sharpness of the tools and the clearance between the tools.



III. CONCLUSIONS:

Light utility vehicles are ending up exceptionally well-known methods for autonomous transportation for short separations. Cost and contamination with petroleum and diesel are driving vehicle producers to create vehicles energized by elective energies. Designers are guiding their endeavors to make utilization of air as a vitality source to run the light utility vehicles.

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, designing drawing, purchasing, computing and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution industries.

We are proud that we have completed the work with the limited time successfully. The 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 availablefacilities.

In conclusion remarks of our project work, let us add a few more lines about our impression project work.

The chief advantage of our system is that, it cutting speed is varied. The fast operation is done by the timer unit. This project is a low cost automation project.

Further Scope of Work:

Since old age man is always trying to gain more and more luxurious. Man is always trying to develop more and more modified technique with increasing the aesthetic look and economic consideration. Hence there is always more and more scope. But being the degree Engineers and having the ability to think and plan. But due to some time constraints, and also due to lack of funds, we only have thought and put in the report the following future modifications:-

It can be made to run has bottle cap sealing machine. The stationary platform can be made auto swiveling type by installing the timer and heat sensor arrangement on the platform. It can be done such that when the bottle mouth is sealed up to the desired temperature the electrical heater circuit gets cut off. At the same time the motor installed on the reduction gear box starts operating the bevel gearing and the platform starts rotating thus it can be made auto rotating type.

It can be made hydraulic operated type by replacing the hand lever by hydraulic cylinder and along with the ratchet and Paul arrangement.

It can be made hydraulically power operated by installing the gear oil pump at the place of air compressor and pneumatic cylinder arrangement.

It can be made rack and pinion operated or spring and lever operated, by replacing the pneumatic circuit by rack and the pinion arrangement by the square threaded screw and nut arrangement.

REFERENCES:

[1]. Madhukumar V, Arun Kumar N, Harsha B S, Navin Kumar K N,NagarajaT.K.2 International Journal of Engineering Research and Advanced Technology (IJERAT) ISSN: 2454-6135 [Special Volume. 02 Issue, 01, May- 2016].

[2]. T. Z. Quazi, R.S.Shaikh, “An Overview of Clearance Optimization in Sheet Metal Blanking Process” International Journal of Modern Engineering Research (IJMER) Vol.2, Issue.6, Nov-Dec. 2012 pp-4547-4558 ISSN: 2249- 6645.

[3]. Viraj N. Suryawanshi, NileshV.Wakade, Prof. Prashant A. Narwade “Design and Development of Pneumatic Punching Machine” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 06 Issue: 05 | May 2019 p-ISSN:2395-0072

[4]. K.K. Alaneme, B.O. Adewuyi, F.A. Ofoegbu “Failure analysis of mould dies of an industrial punchingmachine”

[5]. NeerajPandita , NarenKesar , AkshitJasrotia , Surya Dev Singh, Lakshay Jolly, AnantKhajuria , Vishwarth Singh , “Pneumatic Sheet Cutting Machine- A Review” International Journal of Scientific and Technical Advancements ISSN:2454-1532

[6]. SudeepKelaginamane, Sridhar D. R. “PLC Based Pneumatic Punching Machine” Journal of Mechanical Engineering andAutomation.

[7]. A.K. Gupta, P. Bharadwaj, S. Sahgal, P. M. Pradhan, "Experimental Investigation and Fabrication of Pneumatic Punch", International Journal of Innovative Research in Science, Engineering and Technology, Volume 2, Issue 6, June2013.

[8]. M.KhajaGulamHussain, T. John babu, “Fabrication of Pneumatic Shearing Machine”, 2016 IJRTI | Volume 1, Issue 2 | ISSN:2456-3315.

[9]. Arun S, SreeRajendra, VijayavithalBongale, “Automatic Punching Machine: A Low Cost Approach”, International Journal of Advanced Mechanical Engineering ISSN 2250-3234 Volume 4, Number 5 (2014), pp.509-517

[10]. ShubhkumarBhandari, Rajkumar B. Chadge, “ Methodology of Special Purpose Sheet Metal Cutting Machine”, IJPRET, 2014; Volume 2 (9): 1-8 ISSN:2319-507X