

Automatic Pneumatic Stamping Machine

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Abstract:

The pneumatic system has gained a large amount of importance in last few decades. This importance is due to its accuracy and cost. It can be operated easily with semi-skilled operators. This convenience in operating the pneumatic system has made us to design and fabricate this unit which is operated by pneumatics as our project. The project is further elaborated to the function of pneumatics with their behavior in several aspects. This machine has an advantage of working even at low pressures, that is even pressure of 6 bars is enough for the operation. The pressurized air passing through the cylinder, forces the piston out whose power through linkages is transmitted to the work piece. The work piece thus got it for the required dimensions and the impression is made on it.

The stamping machine uses a mechanism of quick retrieval done by acting of pressurized air inside of it. The operation of the compressed air is done by using a solenoid valves. This project also elaborates about the other applications just by changing its arm

Key Words:

Electrolysis, hydrogen, Water gas, gasified system.

I.INTRODUCTION: Pneumatic Systems:

Though most of us do not realize it, we are surrounded by systems based on pneumatics. Below are some examples.

- Air brakes on buses and trucks are formally known as compressed air brake systems. These systems use a type of friction brake in which compressed air presses on a piston, and then applies the pressure to the brake pad that stops the vehicle.

- Exercise machines can be built on pneumatic systems. A pneumatic cylinder creates resistance that can be adjusted with air pressure.

- Compressed-air engines, also called pneumatic motors, do mechanical work by expanding compressed air. Usually the compressed air is converted to mechanical action by rotary or linear motion.

- Pressure regulators are valves designed to automatically stop the flow of a liquid or gas when it reaches a certain pressure.

- Pressure sensors are used to measure the pressure of gases or liquids.

- Pipe organs produce sound by pushing pressurized air through pipes that are chosen by pressing keys on a keyboard.

- Inflatable structures, such as balloons, bouncy castles, or blow up figures are inflated with a gas – air, helium, nitrogen, or hydrogen. The pressure of the gas keeps the structure inflated.

- Cable-jetting is a technique used to put cables into ducts. Compressed air is inserted and flows through the duct and along the cable.

Automatic pneumatic stamping machine consists of following component's which are helpful for the effective functioning:

- 1)Transformer
- 2)Air compressor
- 3)Pneumatic cylinder
- 4)Micro controller
- 5)Relays
- 6)Solenoid switches

Assembly of components:

Before assembling of components and materials the layout should be planned for the placing of components on the wooden sheet as we are using wooden sheet as our basement.



fig : layout plan

After planning of the layout on a wooden sheet the components should be placed in their desired locations. The placements should be planned in such a way that there should be any over occupying of one component over another.

frame attachments:

The marked wooden sheet should be fixed to cast iron frame by drilling the holes in to the wooden sheet by proper measurement and then fix it by using bolts and nuts.



fig : drilling operation on wooden sheet.



fig : fixing frame with wooden sheet

components placements:

components should be placed in their particular location where they are marked and drilled to the wooden sheet. Where we should prepare another cabin on the upper side to place the cylinder part.



fig : arrangement of upper case

After the components like compressor, transformer, solenoid valves and controller board should be placed which will be shown in below figure



fig : after arrangement of components Initial testing.

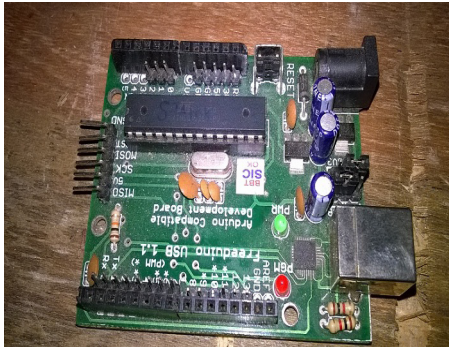
Compressor capacity of air withdrawing is checked by connecting compressor to the cylinder which is shown in the below figure.



picture 4.6 testing with cylinder

Coding:

As the cylinder is connected to solenoids and there-after to the compressor to run it as a automatic machine a controller is needed which is to be programmed. The controller is shown in below figure



picture 4.7 micro controller

The coding that had executed for the controller board is written below

Code:

```
int void()
solenoid 1 = 11
solenoid 2 = 12
compressor = 13
set up
pinMode (solenoid1, OUTPUT);
pinMode (solenoid2, INPUT);
{
digitalWrite(compressor, HIGH)
digital Write(solenoid 1, HIGH)
delay(4000);
digitalWrite(compressor,LOW)
digitalWrite(solenoid 1, LOW)
delay(3000);
digitalWrite(compressor, HIGH)
digitalWrite(solenoid 2, HIGH)
delay(4000);
digitalWrite(compressor, LOW)
digitalWrite(solenoid 2, LOW)
delay(3000);
}
```

After preparing the code dump it in to micro controller using a USB. Here we are connecting controller to a relay so that the controller can be able to amplify its voltage and make the components to run.After assembling each of the component the final outlook will be as shown in figure



picture 4.8 overall outlook

components:

1)compressor: the compressor we are using is a DC compressor which has no fluctuation because there is no need of conversion of DC to AC or vice-versa. It has a capacity of 300 psi with airflow capacity of 14 ltr/min at 0 psi.



fig : dc compressor

Capacity = 300 psi
Air flow = 14.0 at 0 psi
Power required = DC 12 V, 10A

2)transformer: the transformer we are using is a step-down transformer which amplifies the high voltage to low required voltage with two terminals one for main power supply and other for alternative one. So that we can even charge a battery by connecting it with to the alternate plugs.



fig : transformer

3)relay: relay is just like a booster, but in the actual meaning it doesn't mean that. It increases the voltage from the microcontroller from 5 v to 36 v i.e., equal to the power utilizing by the solenoid valves. The number of working devices increases the number of solenoid valves increases. It runs in operating the solenoids according to the programmed.

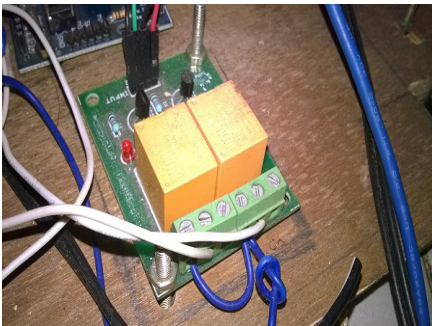


fig : relay board

Type of relay = one per component
Switcher = two way ON / OFF

4)splitter:

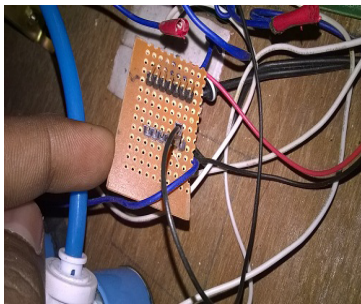


fig : splitter

This is used to split the current from transformer to various components equally. In this the knobs or plugs are connected in parallel which makes that equal amount of power is distributed.

5)Solenoids: solenoids are type of devices which acts just like a switcher. It opens and closes the valves according to the program. It runs by using power from the transformer which in turns plays a crucial role in opening and closing the valve by giving a delay time.



fig : solenoid

Type = 2 way – 2 valve

6)Cylinder: a pneumatic cylinder works on allowing the pressurized air inside the valve by which the reciprocatory motion of the piston is achieved.



fig : cylinder

working:

when the power supply is ON the compressor starts working the air from the compressor is passed on to solenoid valves through nozzle. Solenoids are connected to relay board. Transformer will be giving power to both solenoid and relay where compressor is run by a battery. Relay switching will be controlled by program in micro controller. Based on its code the relay are operated and solenoids starts working by passing air to the cylinder valves which will be making the piston to reciprocate up and down the cylinder is a double acting cylinder type.

Line diagram:

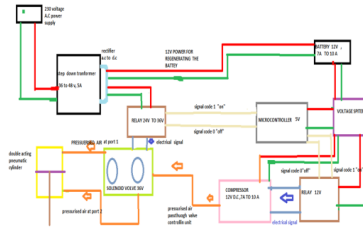
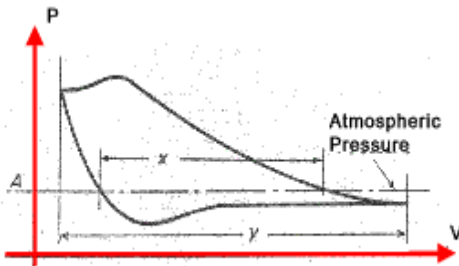


Figure: line diagram representing process flow
The line diagram above representing the work flow of this automatic pneumatic stamping machine.

TESTING AND PERFORMANCE:

Compressor is machine ,it is generate the required pressurized air as a input source of electrical or mechanical energy . In this fabrication of automatic pneumatic stamping machine we are using the continuous flow of air compressor as the power source is direct current.



Actual air compressor Indicator diagram

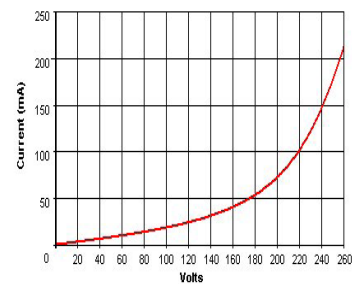
Graph 1.1 operating pressure graph in a compressor

we have to test the compressor with 12v ,1.2 amp /hr battery power supply , the air generating of compressor is very slow in terms of required psi . So we have taken alternative power source with step down transformer as an input and converting these input alternate power source in to direct power source as a rectification process and to maintain constant pressure scale indication in air compressor . Now we observe in this case the speed and air generating flow of the compressor double, when compare to first case and we can see the these pressure regulation variation in air compressor pressure gauge and the applied input loads will consider the specification of compressor .

TRANSFORMER:

The transformer is a static piece of device we utilized if for maintaining current amp from the required psi . When compare to direct current, alternative current has constant v/i characteristics. It is suitable behind this process is absorbing 10 kg/cm at the rate of 145 psi.

⑤



Graph 1.2 V-I graph

We used multi meter and compressor for checking no load characteristics in this no load, observe voltage with standing constant pressure load condition. The tolerance in load condition has limited amount of current is absorbed. We have check the these tolerance with help of multi meter, the tolerant current increase the pneumatic cylinder is maintained constant pressure bar.

SOLENOID VALVE:

The A.S company solenoid is very expensive in the market because they utilizing industrial application only, but our proto-type condition is stamping and banding. For this small application we require a low level solenoid for activating air comparison through relay for these requirement we taking this solenoid. . We can't directly operate pneumatic cylinder with air compressor because we are duel acting cylinder so it is complicated for liner motion of cylinder rod .we are using solenoid for rectifying this problem but at time we con not controller these solenoids open and close operation , for avoiding this complex situation . We are using a open source of microcontroller and the entire machine is under controlled by this microcontroller .by triggering a pulse from microcontroller the logical algorithm is depended as '0' and '1'. When microcontroller code 1 then solenoid is open and code '0' valve will closed .

Operation and performance of the solenoid has depending on microcontroller program and applied voltage when these are not in proper way than performance of solenoid is poor. Our research pattern we found a successful condition in utilizing microcontroller to make alternating linear motion (down and up direction) of pneumatic cylinder rod.

MICROCONTROLLER:

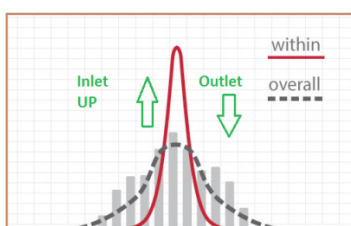
The arduino has operating voltage is 5v, it can deliver 5v of output current and 11 to 20 mill amp. It is requiring making trigger relay for activating solenoid. Arduino has 14 digital pin in that we are utilizing 3 pins as a input and 3 pins output to make the compressor and solenoid operating. The microcontroller performance totally depending on program. We have to check program manually and also we are using program testing software.

RELAY:

Relay working is similar to switch in our requirement we are using solid state relay it acts like smart switch by working on electro-magnetic principle. Performance of the relay has check at various voltage level. we are absorbing the solenoid valve opening and closing positions at various levels of the voltages. When we are applied required voltage than the valve fully open and close, applied low voltage the valve are partially open and close.

PNEUMATIC CYLINDER :

We have to check the pneumatic cylinder at various pressure loads. At gives high air pressure the cylinder rod move fast and low pressure situation the cylinder move slowly by applying pressure for considering specification of the pneumatic cylinder and various pressure variation will give by using pressure regulator.



Graph 1.3 pressures varying in pneumatic cylinder

BATTERY :

Battery store the electrical energy in form of chemical solution. We have to check the capacity of battery (voltage and current) by using multi meter by considering they standards.

Applications:

Automatic pneumatic stamping machine has various applications by which some may not be applied now but in further extension of this, the main application of this machine is stamping.

- 1) Creating impression on metal sheets with small thickness.
- 2) It can also be used as a punching machine as its pressure range is sufficient for it.
- 3) It can create impression on paper and also on low ductile materials.
- 4) In further extension it can also be used a sheet bending machine.

Advantages:

This automatic pneumatic stamping machine has many advantages while comparing with already existing models. Those are as follows:

- 1) This machine is portable and lite weight when compared with bigger machines.
- 2) The power supply doesn't have any voltage fluctuations with because of using a step-down transformer.
- 3) Compressor that is in application here is a DC compressor, so there will not be any wastage of current in over-heating.
- 4) Generally solenoids used for pneumatic machines are quite different from the solenoids that are used in this machine, here we are using a basic solenoid that are commonly used for small causes but these are enough for running this machine.
- 5) In this machine we are using an alternate power source for compressor which will help in achieving the maximum performance of the compressor.
- 6) Current from transformer is equally distributed to solenoid and relay which helps in effective working of solenoid and relay.
- 7) Rectification arrangement at the transformer is perfectly arranged.

Conclusion:

The general purpose of the present invention, which will be described subsequently in greater details, is to provide a portable automatic pneumatic stamping machine which has many advantages of the low power consumption and effective performance and many specified features of the system, which is not anticipated

The further objective of the system is, this is susceptible of a low cost of manufacturing with regards to both cost and labor, and which accordingly is then susceptible of low prices of sale to the public, so thereby making such automatic stamping machine are very economically to available to the public.

Future work:

The process and the work is done in the initial stages up to fabrication process and testing its performance on various materials and calculating its efficiency and characteristics. Its applications are also limited to stamping and punching with regarding to its die's and efficiency. Any further extension of this project will be heading in increasing its range of applications with improvement in its performance.

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