

Automated System Design Suitable for Batch Production of Components

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Abstract

Brake tubes are used to transmit hydraulic pressure generated by the master cylinder to the brake units in the wheels. We are designing the automatic press for fitting rubber sleeves into the bore of machine parts i.e. brake tubes for an Industry application as organization is facing problem during assembly. As company was ordering these sleeves fitted parts from the vendor, vendors are manipulating the bore diameters. So, we are designing automatic press for fitting these sleeves on bar pneumatically. This will reduce time required currently for fitting sleeves and will also reduce accidents during fitting of sleeve into bar. It will also reduce the cost involved in defective sleeves. The project focuses on making the process of fitting the sleeves upon the brake tubes automatic so that it will be convenient and feasible as well as overall expenditure of the process will become ultimately economical since it is one-time investment and this will save labor cost and man power also.

Keywords: Sleeve Inserting Machine, Microcontroller, Roller, PLC, Sensors.

1. Introduction

One of the most important brake parts in turning pedal action into stopping power is a vehicle's brake lines. Most cars and light trucks have hydraulic braking systems. That means they use fluid to transfer the braking power from your foot to the brakes. In extremely basic terms, here's how a typical disc brake system operates: The fluid is stored in the master cylinder. When the brake pedal is applied, it moves fluid from the master cylinder to the brake calipers, forcing them to clamp down on the brake rotors to slow the car. That fluid is carried through the brake lines, making them a rather critical brake part. If your brake lines don't work, your brakes won't work.

vehicles, this happens via the brake lines. Brake lines are categorized as brake pipes or brake tubes on the basis of their design. Brake pipes are rigid they are made from steel.

They are installed in the engine compartment, underneath the car body or in the wheel arches, i.e. anywhere where movements of brake lines are not to be expected. Depending on the application, brake tubes vary in shape, length, diameter and connection fittings. A plastic or zinc coating provides protection against corrosion.

2. Automation Techniques

The basic types of automation techniques which are quite renowned are programmable logic control (PLC), relay logic control and microcontroller technique. Relay logic control uses relays that are internally connected to each other by using wires which operates it. Relay logic control panels are big. The life expectancy of a relay is limited so some of them need to be replaced. In order to replace a relay, the machine needs to be stopped which indirectly creates an impact on the production. It is also difficult and tedious to find an error as it is a very complex system. Electrician finding these errors needs to be skillful. Being a complex and inflexible control system changes cannot be done easily. Due to these implications, relay logic control is not a good choice for running the SPM's. A programmable logic controller (PLC) is a digital computer employed for automating electromechanical processes. PLCs are used globally in lot of industries. The PLC's are designed for multiple inputs and output arrangements; immunity to electrical noise, extended temperature ranges resistance to vibration etc. Programs to control the machine operations are basically stored in a non-volatile memory. Microcontroller is a term used for a small computer running on a single chip, which contains the memory, microprocessor and few accessories. Microcontroller comes in reduced size and affordable price as compared to

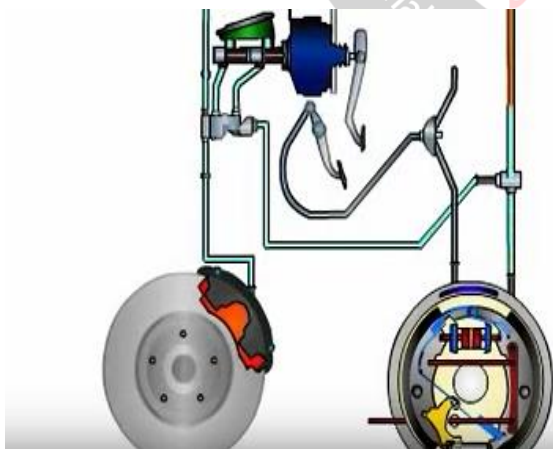


Fig. 1. Braking in Automobile

When the driver presses the brake pedal, hydraulic pressure is generated in the master brake cylinder. So that a braking force can be produced from this, the hydraulic pressure must be transmitted to the wheel brakes with the assistance of the brake fluid. In motor

other devices. Microcontrollers can accommodate accessories like analog to digital converter, digital to analog converter, programmable timer, counter etc. Powerful and carefully chosen electronics embedded in the microcontrollers can run almost any system. PLC requires a computer to operate, programming software and a PLC control console but a microcontroller combined with some accessories can complete the job of automating a machine. The cost of PLC based controllers is more than that of microcontroller units. PLCs are flexible than microcontroller units but for automation of sweet making machine, flexibility criteria are very low in the requirements. Due to these reasons, the microcontroller technique is highly suitable to achieve automation of sweet making machine. Hence, in making sweet making machines microcontroller technique is optimal to go with.

3. Design of Model and Block diagram

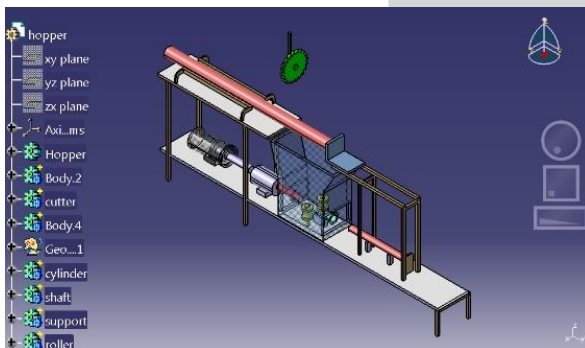


Fig.2 CAD design

3.1 Construction

Following are the parts of the automatic sleeve inserting machine

3.1.1 Pneumatic cylinder

Function of the cylinder is to push the sleeve when sleeve falls inside the hopper. The stroke length and base diameter of pneumatic cylinder is 50 mm and 16mm.

3.1.2 Solenoid valve

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design. The valve is controlled by an electric current through a solenoid. In the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

3.1.3 Hopper

Function of the cylinder is to push the sleeve into brake tube. Brake tube is placed in front of the sleeve to be inserted such that the axis of brake tube and sleeve is properly aligned. When piston from pneumatic cylinder gives the forward stroke to the sleeve, the sleeve will

move forward and will cover the brake tube until the piston from pneumatic cylinder touches the brake tube. The stroke length and base diameter of pneumatic cylinder is supposed to be 50 mm and 16mm.

3.1.4 ARDUINO Controller

Arduino is an open source computer hardware and software company, project, and user community that designs and manufacturing microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical world.



Fig.3 ARDUINO controller

Code for controlling a DC Motor:

```
const int pwm = 2 ; //initializing pin 2 as pwm

const int in_1 = 8 ;
const int in_2 = 9 ;
//For providing logic to L298 IC to choose the direction of the DC motor
void setup()
{
  pinMode(pwm,OUTPUT) ; //we have to set PWM pin as output
  pinMode(in_1,OUTPUT) ; //Logic pins are also set as output
  pinMode(in_2,OUTPUT) ;
}

void loop()
{
  //For Clock wise motion , in_1 = High , in_2 = Low
  digitalWrite(in_1,HIGH) ;
  digitalWrite(in_2,LOW) ;
  analogWrite(pwm,255) ;
  /*setting pwm of the motor to 255 we can change the speed of rotation by changing pwm input but we are only using arduino so we are using highest value to driver the motor */
  //Clockwise for 3 secs
  delay(3000) ;
  //For brake
  digitalWrite(in_1,HIGH) ;
  digitalWrite(in_2,HIGH) ;
  delay(1000) ;
  //For Anti Clock-wise motion - IN_1 = LOW , IN_2 = HIGH
  digitalWrite(in_1,LOW) ;
  digitalWrite(in_2,HIGH) ;
  delay(3000) ;
}
```

```
//For brake digitalWrite(in_1,HIGH);  
digitalWrite(in_2,HIGH);  
delay(1000);}
```

The above code is used for controlling the speed of rollers used for sleeve movement which is controlled by DC motor.

3.6 Sensors

In the broadest definition, a sensor is an electronic component, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as computer.

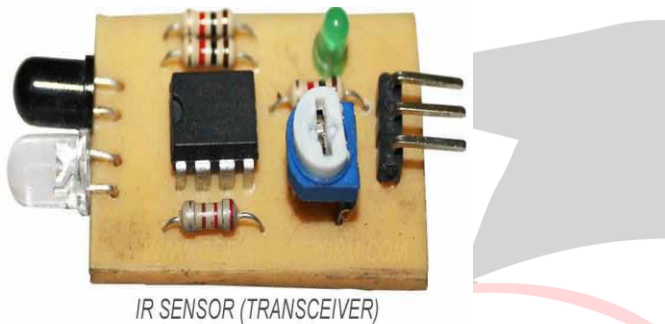


Fig 4. Sensor

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware. With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the traditional fields of temperature, pressure or flow measurement, for example into MARG sensors. Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine, robotics and many other aspects of our day-to-day life.

Sensors are used in our working model to detect the position of sleeve under the cutter. The cutter will become on only when the sleeve is present under it to perform action. The position of sleeve will be sensed by sensor and it will give signal to cutter to become on. Same purpose is followed at the position in front of the piston of pneumatic cylinder. When sleeve will be present there in front of pneumatic cylinder, the sensor will sense the position of sleeve and it will give signal to the cylinder and further stroke is given by the cylinder.

3.7 Cutter

The side-and-face cutter is designed with cutting teeth on its side as well as its circumference. They are made in varying diameters and widths depending on the application. The teeth on the side allow the cutter to make *unbalanced cuts* (cutting on one side only) without

deflecting the cutter as would happen with a slitting saw or slot cutter (no side teeth).

Cutters of this form factor were the earliest milling cutters developed. From the 1810s to at least the 1880s they were the most common form of milling cutter, whereas today that distinction probably goes to end mills.

3.8 Block Diagram

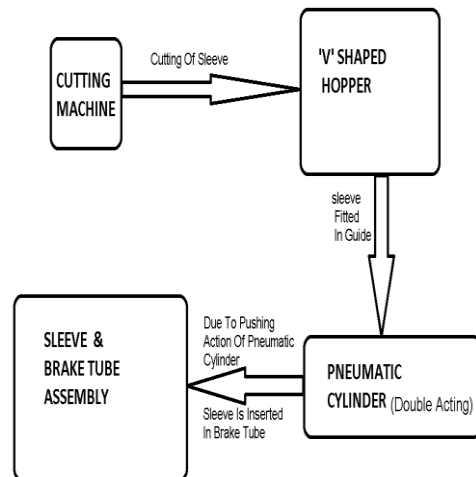


Fig. 5

4. Conclusion

Hence, we can conclude that brake tubes are one of the most vital parts in braking system of vehicle. The hollow Brake tubes have insulated coating upon its body i.e. sleeve which is to be inserted on that tube. Now a day, a lot of industries are manufacturing brake tubes and sleeves on heavy demand. When we visited Bundy India Limited, we observed that the sleeves are being inserted into brake tubes manually. Hence, we were encouraged by our respected guides to make this process of cutting the sleeve and fitting it into the brake tube completely automated.

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