INDIVIDUAL PNEUMATIC JACK FOR FOUR WHEELERS WITH PRESSURE MONITORING AND AIR FILLING

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Abstract- *The main target of project is to improve version of a mini pneumatic jack. This will be more efficient for the user. This machine is pneumatic powered which has low co-efficient of friction. A pneumatic cylinder erected provides power to lift up the Jacky. This is a pneumatic powered machine and requires no other means of power to operate. The required components are Compressor, Pneumatic cylinder, Control circuit and Jack. Tire Pressure Monitoring and Automatic Filling System is a system being developed for use by commercial vehicles. It is an electronic system designed to monitor air pressure and temperature inside the tires and inform to driver via display. If the pressure is below the desired, the compressor will refill the tire. If it is above the desired excess pressure will release through a valve*

INTRODUCTION

Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. The main advantages of all pneumatic systems are economy and simplicity. Automation plays an important role in mass production. Nowadays almost all the manufacturing processes are being made automatic in order to deliver the products at a faster rate.

The following reasons affirms the benefits of automation,

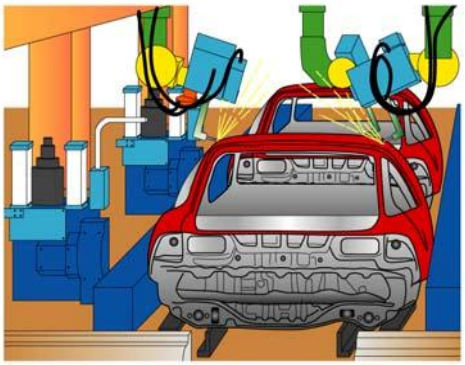
- To achieve mass production
- To reduce man power
- To increase the efficiency of the plant
- To reduce the work load
- To reduce the production cost
- To reduce the production time
- To reduce the material handling
- To reduce the fatigue of workers
- To achieve good product quality
- Less maintenance

The standard vehicle jacks require the operator to retrieve the jack from the trunk, place it under the vehicle in the proper location, and then manually rotate the screw thread in order to lift the vehicle. This process is time consuming, physically demanding and poses several safety hazards. Adverse weather conditions can exacerbate the process and make it a greater safety hazard. Those who are physically weaker (women, senior citizens, young drivers) may face great difficulties in jacking a vehicle in case of an emergency repair. The purpose of this senior design project is to counter the safety hazards and physical demands related to using manual jacks or aftermarket hydraulic jacks by designing a jack system that is permanently attached to the vehicle. This vehicle mounted jack system will be automated so that operator input is kept to a minimum and thus safety hazards can be avoided.

The tire pressure monitoring and automatic air filling system (TPMAFS) can not only make the driver more safety, but also save fuel and protect the tire. Tire safety is attracting the driver's attention, the United States had developed laws to enforce the TPMS installation in the car. In this paper, the basic structure and the implement method, automatic filling of air are introduced. This is an electronic system designed to monitor air pressure inside the tires on various types of vehicles. This system report real time tire pressure information to the driver via a display. Proper tire inflation pressure improves fuel efficiency, reduces breaking distance, improves handling, and increases tire life, while under inflation creates overheating and can lead to accidents. The main causes of under inflation are natural leakage, temperature changes and road hazards. The accurately measured temperature and pressure values were obtained by using SMART transmitter pressure sensor. The excellent agreement between the pressure and temperature results measured by the sensor and the direct measurement data is presented. The practical results in the certain ranges of pressure and temperature demonstrated that the micro sensor is able to measure temperature (20ºC-100ºC) and pressure (0kPsi- 150Psi) at the same time.

PNEUMATIC SYSTEMS:

A pneumatic system is a system that uses compressed air to transmit and control energy. Pneumatic systems are used in controlling train doors, automatic production lines, mechanical clamps, etc.



(a) Automobile production lines

(b) Pneumatic system of an automatic machine

ADVANTAGES OF PNEUMATIC SYSTEMS:

Pneumatic control systems are widely used in our society, especially in the industrial sectors for the driving of automatic machines. Pneumatic systems have a lot of advantages.

(i) High effectiveness:

Many factories have equipped their production lines with compressed air supplies and movable compressors. There is an unlimited supply of air in our atmosphere to produce compressed air. Moreover, the use of compressed air is not restricted by distance, as it can easily be transported through pipes. After use, compressed air can be released directly into the atmosphere without the need of processing.

(ii) High durability and reliability:

Pneumatic components are extremely durable and cannot be damaged easily. Compared to electromotive components, pneumatic components are more durable and reliable.

(iii) Simple design;

The designs of pneumatic components are relatively simple. They are thus more suitable for use in simple automatic control systems.

(iv)High adaptability to harsh environment:

Compared to the elements of other systems, compressed air is less affected by high temperature, dust, corrosion, etc.

(v) Safety:

Pneumatic systems are safer than electromotive systems because they can work in inflammable environment without causing fire or explosion. Apart from that, overloading in pneumatic system will only lead to sliding or cessation of operation. Unlike electromotive components, pneumatic components do not burn or get overheated when overloaded.

(vi) Easy selection of speed and pressure:

The speeds of rectilinear and oscillating movement of pneumatic systems are easy to adjust and subject to few limitations. The pressure and the volume of air can easily be adjusted by a pressure regulator.

(vii) Environmental friendly:

The operations of pneumatic systems do not produce pollutants. The air released is also processed in special ways. Therefore, pneumatic systems can work in environments that demand high level of cleanliness. One example is the production lines of integrated circuits.

(viii) Economical:

As pneumatic components are not expensive, the costs of pneumatic systems are quite low. Moreover, as pneumatic systems are very durable, the cost of repair is significantly lower than that of other systems.

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Problem Domain

TPMS system uses only in small end vehicles and automatic air filling is not considered. The tire pressure monitoring and automatic air filling system can also use both in small-end and high-end vehicles. Automatic air filling, when pressure is below desired value, is also included with this system. This system will re-fill the pressure on tyres. The tire pressure monitoring system (TPMS) can not only make the driver more safety, but also save fuel and protect the tire.

Motivation

Tire pressure monitoring and automatic filling system provide automatic air filling into the tire when air pressure inside the tire becomes low. There occur many traffic accidents due to the malfunction of tyres that can reduced by continuous pressure monitoring. Fuel efficiency then transformed to a digital count by the Analog to Digital Converter (ADC). This digital count, representative of the process variable (PV), is then fed into the conversion section which contains the microprocessor. A field calibrator is not required for configuration. The transmitter software compensates for thermal effects, improving performance. EEPROM stores configuration settings and stores sensor correction coefficients in the event of shutdowns or power loss. The Series 3100MP is FM and ATEX approved for use in hazardous (classified) locations. The 100:1 range ability allows the smart transmitter to be configured to fit any application.

Program Logic Controller:

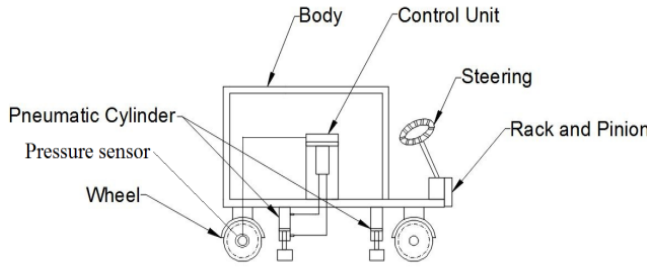
A Programmable Logic Controller, PLC or Programmable Controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures. PLCs are used in many industries and machines. Unlike general-purpose computers, the PLC is designed for multiple inputs and output arrangements, extended temperature ranges, immunity to electrical noise, and resistance to vibration and impact. Programs to control machine operation are typically stored in battery-backed-up or non-volatile memory. A PLC is an example of a hard real-time system since output results must be produced in response to input conditions within a limited time, otherwise unintended operation will result. Allen Bradley Micrologix PLC using Micrologix/SLC 500 (Full Duplex) protocol. For other supported Allen Bradley PLCs and communication settings/range of addresses, please refer to WindO/I- NV2 manual. Select “Host Interface,” then select Connection to a PLC.

Pressure Gauge:

Pressure gauges and switches are among the most often used instruments in a plant. But because of their great numbers, attention to maintenance--and reliability--can be compromised. As a consequence, it is not uncommon in older plants to see many gauges and switches out of service. This is unfortunate because, if a plant is operated with a failed pressure switch, the safety of the plant may be compromised. Conversely, if a plant can operate safely while a gauge is defective, it shows that the gauge was not needed in the first place. Therefore, one goal of good process instrumentation design is to install fewer but more useful and more reliable pressure gauges and switches. One way to reduce the number of gauges in a plant is to stop installing them on the basis of habit (such as placing a pressure gauge on the discharge of every pump). Instead, review the need for each device individually. During the review one should ask: "What will I do with the reading of this gauge?" and install one only if there is a logical answer to the question. If a gauge only indicates that a pump is running, it is not needed, since

one can hear and see that. If the gauge indicates the pressure (or pressure drop) in the process, that information is valuable only if one can do something about it (like cleaning a filter); otherwise it is useless. If one approaches the specification of pressure gauges with this mentality, the number of gauges used will be reduced. If a plant uses fewer, better gauges, reliability will increase.

WORKING PRINCIPLE



- The working medium adopted is compressed air. The compressed air is transmitted through tubes to pneumatic cylinder where power is converted into reciprocating motion.
- The reciprocating motion is obtained by using an electrically controlled solenoid valve.
- The input to the solenoid valve is given through the control unit. The reciprocating motion transmitted to the jack through the piston which moves on the cylinder.
- The jack is placed under the vehicle chassis, where the vehicle to be lifted. The vehicle can be lifted when the solenoid valve is switched.
- The vehicle over the jack gets the reciprocating motion through the piston which is connected to the jack.
- Pressure sensor is used to the sense the pressure and control passes to the control unit.

Thus using a pneumatic jack the vehicle can be lifted with ease in operation.

CONCLUSION

The project carried out by us made an impressing task in the field of automobile vehicles. It is very usefully for the workers to work in the automobile workshop are in the service station. This project has also reduced the cost involved in the concern. Project has been designed to perform the entire requirement task which has also been provided.

Any tire pressure monitoring system will work effectively if and only if the right sensors are fitted into a tire. The lack in standardization of manufacturing and delivering of such sensor-fitted tires poses a big problem. Air bag systems works using compressors. By using high speed compressor and implementing crash sensors with this system airbag system can be developed in future. By applying tire pressure monitoring and automatic air filling system properly it is easy for the driver to monitor the pressure and temperature on each tire. Tire's inflation pressure is always under check and is maintained at a standard level, as stated by the manufacturer by using TPMAFS. Using this system gives safety of drivers and passengers become a forefront benefit, fuel efficiency is improved by having standard tire pressure and helps to avoid accidents caused with low inflated tires

REFERENCE

1. Design data book -P.S.G.Tech.
2. Pneumatic handbook -R.H.warrning
3. Machine tool design handbook –Central machine tool Institute, Bangalore.
4. Strength of Materials -R.S.Kurmi
5. Manufacturing Technology -M.Haslehurst.
6. Carlson, Christopher R, and J Christian Gerdes, "Identifying tire pressure variation by nonlinear estimation of longitudinal stiffness and effective radius," Stanford University, 2002, www-cdr. Stanford.edu/dynamic/WheelSlip/NLSlipAVEC2002.pdf.
7. "An evaluation of existing tire pressure monitoring systems," US NHTSA, DOT HS 809 297, July 2001, www. nhtsa.com.