Automatic Air Inflation System

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Abstract— The Main Aim of Our Project Is to Develop an AUTOMATIC AIR INFLATION SYSTEM. This can be placed in all automobiles while long drives and that can be utilized while climbing uphill or down hills. It is very necessary for the every automobile to be cautious while driving through long distances. So we have fabricated this machine to fill the air automatically by using control units.

Key words: Air Inflation System, Automobile

I. Introduction

The AUTOMATIC AIR INFLATION SYSTEM is a Mechanical device which is widely used in automobile works. The manual work increases the effort of the man power (operator) during the air checking in vehicles. The Air Maintenance Technology system developed through this project replenishes lost air and maintains optimal tyre cavity pressure whenever the tyre is rolling in service, thus improving overall fuel economy by reducing the tyre's rolling resistance.

A. *Need for Automation*

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 process is being automated in order to deliver the products at a faster rate. The manufacturing operation is being atomized for the following reasons.

- 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.

II. Literature Review

A tyre (U.S. English) or tyre (British English) is a ring-shaped covering that fits around a wheel's rim to protect it and enable better vehicle performance. Most tyres, such as those for automobiles and bicycles, provide traction between the vehicle and the road while providing a flexible cushion that absorbs shock.

The earliest tyres were bands of iron (later steel), placed on wooden wheels, used on carts and wagons. The tyre would be heated in aforge fire, placed over the wheel and quenched, causing the metal to contract and fit tightly on the wheel. A skilled worker, known as a wheelwright, carried out this work. The outer ring served to "tie" the wheel segments together for use, providing also a wear-resistant surface to the perimeter of the wheel. The word "tyre" thus emerged as a variant spelling to refer to the metal bands used to tie wheels. The first practical pneumatic tyre was made by Scottish inventor John Boyd Dunlop while working as a veterinarian in May Street, Belfast in 1887 for his son's bicycle, in an effort to prevent the headaches his son had while riding on rough roads (Dunlop's patent was later declared invalid because of prior art by fellow Scot Robert William Thomson). Dunlop is credited with "realizing rubber could withstand the wear and tear of being a tyre while retaining its resilience". The development of this technology hinges on myriad engineering advances. In terms of materials, the vulcanization of natural rubber is credited to Charles Goodyear and Robert William Thomson. Synthetic rubbers were invented in the laboratories of Bayer in the 1920s.

III. Description of Equipments

A. *Air Pressure Sensor*

The Smart Pressure Device SPD series of pressure sensors are silicon based and capsulated in modified plastic Dual in Line packages, to accommodate six pins for through-board printed circuit mounting. The sensors come in two distinct types: Gauge and absolute. The gauge type merely measures the pressure with respect to the atmospheric pressure. The absolute type contains a reference vacuum chamber, which is formed on the die during manufacturing. The output voltages of both types are proportional to the pressure that is measured. Various pressure ranges are available. On request, other ranges and encapsulations can be supplied. Please contact our sales department for more information.

Because of its bridge resistance value, the SPD pressure sensor is especially suited for use in combination with the Universal Transducer Interface (UTI03), which gives an easy and very accurate interface to a digital environment

1) *Outline drawings and dimensions:*

For a good scale design, the readings must be perfectly stable. That is, it should not flicker or toggle between codes because of noise. This requirement in turn places additional demands on the digitizer, resulting in the need for internal resolution much better than what the scale reports to the user. Given the very small signal nature of bridge sensors, and the need for very high resolution measurements, scale manufacturers traditionally have used a very low noise gain stage to amplify the signal from the bridge before digitizing. The gain stage be extremely stable over temperature and time. Most scales are calibrated only periodically, either at the factory or by the customer. Any change in the gain resulting from time or temperature drift of the PGA will adversely affect the accuracy of the scale. Typically, a high-resolution analog-to-digital converter (ADC) then follows the PGA to digitize the amplified voltage. Additionally, the ADC should be able to make ratio-metric measurements by supporting use of the bridge excitation voltage as the reference voltage .The output signal from the bridge is directly proportional to the excitation voltage with an attenuation factor that is determined by the weight applied to the load cell. By measuring the load cell signal with the ADC ratio-metrically — that is, with the excitation voltage serving as the ADC reference voltage — variations in the absolute value of the excitation voltage are cancelled out. This, in turn, makes for a less sensitive and more robust scale design. In practice, the load cell itself will introduce some noise. There also will be some drift due to time and temperature of the load cell along with the Ads1230's drift. To determine the accuracy of the complete system, the weigh scale can be connected to the Microcontroller. The weight will be shows on Decimal values in the LCD display. The output of the sensor is depend upon the pressure. Then the analog output is given to ADC IC and then the digital values are monitored by Microcontroller or any interfacing circuit. Then the values are shown in display.

B. *Control Unit*

1) *Microcontroller:*

a) Introduction:

Microcontrollers are destined to play an increasingly important role in revolutionizing various industries and influencing our day to day life more strongly than one can imagine. Since its emergence in the early 1980's the microcontroller has been recognized as a general purpose building block for intelligent digital systems. It is finding using diverse area, starting from simple children's toys to highly complex spacecraft. Because of its versatility and many advantages, the application domain has spread in all conceivable directions, making it ubiquitous. As a consequence, it has generate a great deal of interest and enthusiasm among students, teachers and practicing engineers, creating an acute education need for imparting the knowledge of microcontroller based system design and development. It identifies the vital features responsible for their tremendous impact, the acute educational need created by them and provides a glimpse of the major application area

b) Microcontroller:

A microcontroller is a complete microprocessor system built on a single IC. Microcontrollers were developed to meet a need for microprocessors to be put into low cost products. Building a complete microprocessor system on a single chip substantially reduces the cost of building simple products, which use the microprocessor's power to implement their function, because the microprocessor is a natural way to implement many products. This means the idea of using a microprocessor for low cost products comes up often. But the typical 8-bit microprocessor based system, such as one using a Z80 and 8085 is expensive. Both 8085 and Z80 system need some additional circuits to make a microprocessor system. Each part carries costs of money. Even though a product design may requires only very simple system, the parts needed to make this system as a low cost product.

To solve this problem microprocessor system is implemented with a single chip microcontroller. This could be called microcomputer, as all the major parts are in the IC. Most frequently they are called microcontroller because they are used they are used to perform control functions.

The microcontroller contains full implementation of a standard MICROPROCESSOR, ROM, RAM, I/0, CLOCK, TIMERS, and also SERIAL PORTS. Microcontroller also called "system on a chip" or "single chip microprocessor system" or "computer on a chip".

A microcontroller is a Computer-On-A-Chip, or, if you prefer, a single-chip computer. Micro suggests that the device is small, and controller tells you that the device' might be used to control objects, processes, or events. Another term to describe a microcontroller is embedded controller, because the microcontroller and its support circuits are often built into, or embedded in, the devices they control.

Today microcontrollers are very commonly used in wide variety of intelligent products. For example most personal computers keyboards and implemented with a microcontroller. It replaces Scanning, Debounce, Matrix Decoding, and Serial transmission circuits. Many low cost products, such as Toys, Electric Drills, Microwave Ovens, VCR and a host of other consumer and industrial products are based on microcontrollers.

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory (both ROM and RAM)
- Some parallel digital i/o

(1) Microcontrollers will combine other devices such as:

- A timer module to allow the microcontroller to perform tasks for certain time periods.
- A serial i/o port to allow data to flow between the controller and other devices such as a PIC or another microcontroller.
- An ADC to allow the microcontroller to accept analogue input data for processing.

(2) Microcontrollers are:

- Smaller in size
- Consumes less power
- Inexpensive

Micro controller is a stand alone unit, which can perform functions on its own without any requirement for additional hardware like i/o ports and external memory. The heart of the microcontroller is the CPU core. In the past, this has traditionally been based on a 8-bit microprocessor unit. For example Motorola uses a basic 6800 microprocessor core in their 6805/6808 microcontroller devices.

In the recent years, microcontrollers have been developed around specifically designed CPU cores, for example the microchip PIC range of microcontrollers.

C. *RELAY*

A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off. So relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first. The link is magnetic and mechanical. The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available. Most relays are designed for PCB mounting but you can solder wires directly to the pins providing you take care to avoid melting the plastic case of the relay. The animated picture shows a working relay with its coil and switch contacts. You can see a lever on the left being attracted by magnetism when the coil is switched on. This lever moves the switch contacts. There is one set of contacts (SPDT) in the foreground and another behind them, making the relay DPDT.

D. Solenoid Valve

A solenoid valve is an electromechanical valve for use with liquid or gas controlled by running or stopping an electrical current through a solenoid, which is a coil of wire, thus changing the state of the valve. The operation of a solenoid valve is similar to that of a light switch, but typically controls the flow of air or water, whereas a light switch typically controls the flow of electricity. Solenoid valves may have two or more ports: 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

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.

Besides the plunger-type actuator which is used most frequently, pivoted-armature actuators and rocker actuators are also used.

A solenoid valve has two main parts: the solenoid and the valve. The solenoid converts electrical energy into mechanical energy which, in turn, opens or closes the valve mechanically. An excellent source of information on the different types of solenoid valve

Solenoid valves may use metal seals or rubber seals, and may also have electrical interfaces to allow for easy control. A spring may be used to hold the valve opened or closed while the valve is not activated.

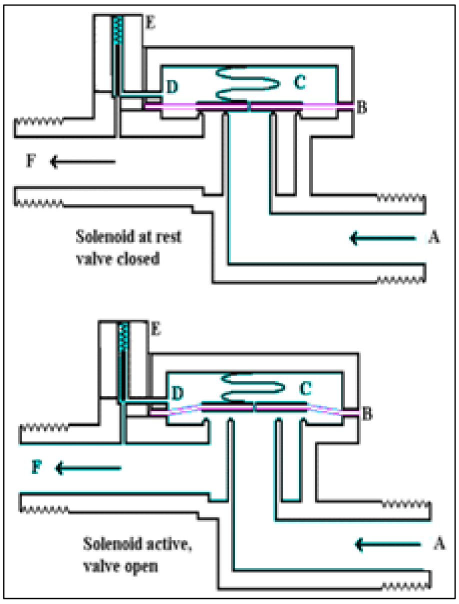

Fig. 1: Solenoid valve open & close Diagram

A- Input side
B- Diaphragm
C- Pressure chamber
D- Pressure relief conduit
E- Solenoid
F- Output side

In some solenoid valves the solenoid provides the full power for the operation of the main valve. Others use a small, complete solenoid valve, known as a pilot, to operate a larger valve which provides the main output of the unit. While the second type is actually a solenoid valve combined with a pneumatically actuated valve, they are sold and packaged as a single unit which is referred to as a solenoid valve. Piloted valves require much less power to control, but they are noticeably slower.

The diagram to the right shows the design of a basic valve. If we look at the top figure we can see the valve in its closed state. The water under pressure enters at A. B is an elastic diaphragm and above it is a weak spring pushing it down. The function of this spring is irrelevant for now as the valve would stay closed even without it. The diaphragm has a pinhole through its center which allows a very small amount of water to flow through it. This water fills the cavity C on the other side of the diaphragm so that pressure is equal on both sides of the diaphragm. While the pressure is the same on both sides of the diaphragm, the force is greater on the upper side which forces the valve shut against the incoming pressure. By looking at the figure we can see the surface being acted upon is greater on the upper side which results in greater force. On the upper side the pressure is acting on the entyre surface of the diaphragm while on the lower side it is only acting on the incoming pipe. This results in the valve being securely shut to any flow and, the greater the input pressure, the greater the shutting force will be.

Now let us turn our attention to the small conduit D. Until now it was blocked by a pin which is the armature of the solenoid E and which is pushed down by a spring. If we now activate the solenoid, the water in chamber C will flow through this conduit D to the output side of the valve. The pressure in chamber C will drop and the incoming pressure will lift the diaphragm thus opening the main valve. Water now flows directly from A to F.

When the solenoid is again deactivated and the conduit D is closed again, the spring needs very little force to push the diaphragm down again and the main valve closes. In practice there is often no separate spring, the elastomer diaphragm is moulded so that it functions as its own spring, preferring to be in the closed shape.

From this explanation it can be seen that this type of valve relies on a differential of pressure between input and output as the pressure at the input must always be greater than the pressure at the output for it to work. The pressure at the output, for any reason, rise above that of the input then the valve would open regardless of the state of the solenoid and pilot valve.

A common use for 2 way solenoid valves is in central heating. The solenoid valves are controlled by an electrical signal from the thermostat to regulate the flow of heated water to the heating elements within the occupied space. Such valves are particularly useful when multiple heating zones are fed by a single heat source. Commercially available solenoid valves for this purpose are often referred to as Zone valves.

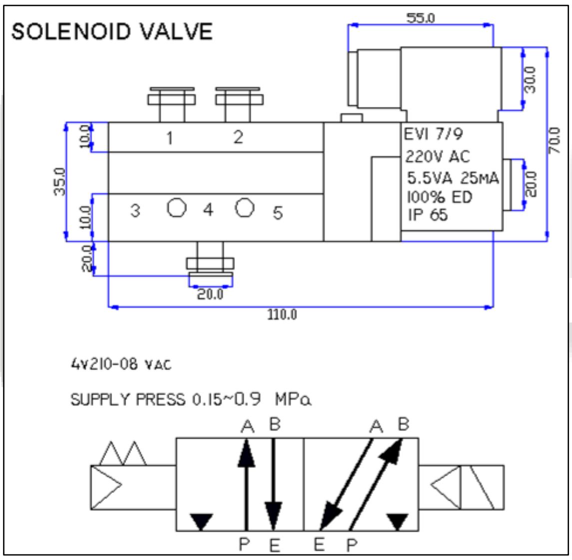

Fig. 2: Solenoid valve

E. Universal Coupling

A universal joint, universal coupling, U-joint, Cardan joint, Hardy-Spicer joint, or Hooke's joint is a joint or coupling in a rigid rod that allows the rod to 'bend' in any direction, and is commonly used in shafts that transmit rotary motion. It consists of a pair of hinges located close together, oriented at 90° to each other, connected by a cross shaft.

The main concept of the universal joint is based on the design of gimbals, which have been in use since antiquity. One anticipation of the universal joint was its use by the Ancient Greeks on ballistae[citation needed]. The first person known to have suggested its use for transmitting motive power was Gerolamo Cardano, an Italian mathematician, in 1545, although it is unclear whether he produced a working model. In Europe, the device is often called the Cardan joint or Cardan shaft. Christopher Polhem of Sweden later reinvented it, giving rise to the name Polhemsknut in Swedish.

The mechanism was later described in Technica curiosa sive mirabilia artis (1664) by Gaspar Schott, who called it the paradoxes, but mistakenly claimed that it was a constant-velocity joint.[1] Shortly afterwards, between 1667 and 1675, Robert Hooke analysed the joint and found that its speed of rotation was non uniform, but that this property could be used to track the motion of the shadow on the face of a sundial. In fact, the component of the equation of time which accounts for the tilt of the equatorial plane relative to the ecliptic is entyrely analogous to the mathematical description of the universal joint. The first recorded use of the term universal joint for this device was by Hooke in 1676, in his book Helioscopes. He published a description in 1678, resulting in the use of the term Hooke's joint in the English-speaking world. In 1683, Hooke proposed a solution to the nonuniform rotary speed of the universal joint: a pair of Hooke's joints 90° out of phase at either end of an intermediate shaft, an arrangement that is now known as a type of constant-velocity joint.

The term universal joint was used in the 18th century and was in common use in the 19th century. Edmund Morewood's 1844 patent for a metal coating machine called for a universal joint, by that name, to accommodate small alignment errors between the engine and rolling mill shafts. Lardner's 1877 Handbook described both simple and double universal joints, and noted that they were much used in the line shaft systems of cotton mills. Jules Weisbach described the mathematics of the universal joint and double universal joint in his treatise on mechanics published in English in 1883.

19th century uses of universal joints spanned a wide range of applications. Numerous universal joints were used to link the control shafts of the Northumberland telescope at Cambridge University in 1843. Ephriam Shay's locomotive patent of 1881, for example, used double universal joints in the locomotive's drive shaft. Charles Amidon used a much smaller universal joint in his bit-brace patented 1884. Beauchamp Tower's spherical, rotary, high speed steam engine used an adaptation of the universal joint circa 1885.

The term Cardan joint appears to be a latecomer to the English language. Many early uses in the 19th century appear in translations from French or are strongly influenced by French usage. Examples include an 1868 report on the Exposition Universelle of 1867 and an article on the dynamometer translated from French in 1881

A coupling is a device used to connect two shafts together at their ends for the purpose of transmitting power. Couplings do not normally allow disconnection of shafts during operation, however there are torque limiting couplings which can slip or disconnect when some torque limit is exceeded.

The primary purpose of couplings is to join two pieces of rotating equipment while permitting some degree of misalignment or end movement or both. By careful selection, installation and maintenance of couplings, substantial savings can be made in reduced maintenance costs and downtime

IV. BLOCK DIAGRAM

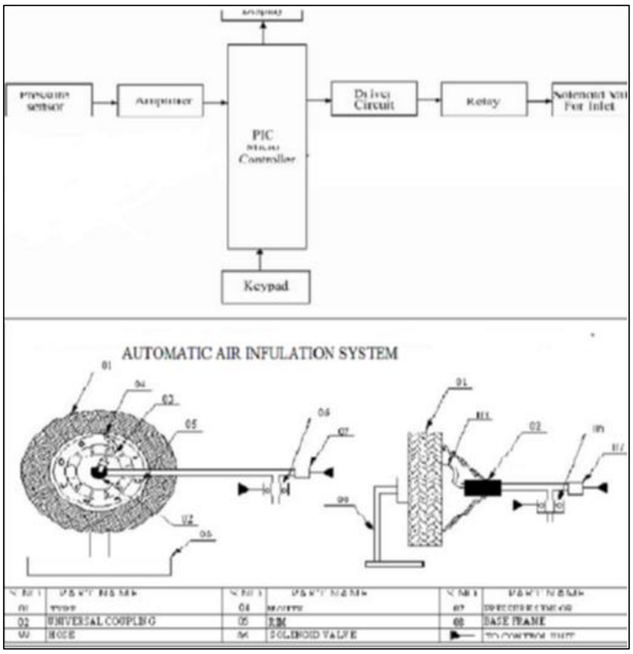

Fig. 3: Block Diagram

V. WORKING PRINCIPLE

Our project consists of solenoid valve, control unit, pressure sensor and Tyre model. We are using pressure sensor to detect the pressure level in the Tyre. The level of pressure is already programmed in the control unit. When the pressure level is decreased, the sensor gives signal to the control unit. After that the controller unit will open the solenoid valve for filling the air when the required pressure is obtained the control unit will turn OFF the solenoid valve. In case the pressure level will be more than the required level means control unit will switch ON another solenoid valve for air to the atmosphere. When the required pressure is reached the operation will be stopped by the control unit.

A. Factors Determining the Choice of Materials

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

1) Properties:

The material selected must posses 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

1) Physical
2) Mechanical
3) From manufacturing point of view
4) 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.

The various properties concerned from the manufacturing point of view are,

– Cast ability
– Weld ability
– Forge ability
– Surface properties
– Shrinkage
– Deep drawing etc.

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.

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.

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.

5) Space consideration:

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

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.

VI. CONCLUSION

In this study, the project carried out by us made an impressing task.in the field of automobile field this project will reduce the cost involved in the concern. Project has been designed to perform the entyre requirement task at the shortest time available. Thus the “Automatic air inflation system” project finally completed in successful working model and get result positively. In this system applying real time model is very useful for heavy duty vehicles and trucks

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