Auto Tyre Pressure Inflation System
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Abstract:
The Project is concerned about and to develop an “automatic tyre pressure inflation system”. As we are aware that by drop of few pressure units in vehicle its results in the reduction in mileage, tyre life, safety and performance. This system can be placed in every in automobile under any operating condition, this will not only maintain the correct tyre pressure but also increase tyre life, mileage and safety so we have fabricated this system to inflate and deflate the tyre automatically by using control units. This system is named automatic because it checks the tyre pressure continuously using built control device and accordingly gives alert signals to the driver about the tyre condition. Driven by studies that show that a drop in tyre pressure by just a few PSI can result in the reduction of gas mileage, tire life, safety, and vehicle performance, we have developed an automatic, self-inflating tire system that ensures that tyres are properly inflated at all times. Our design proposes and successfully implements the use of a portable compressor that will supply air to all four tyres via hoses and a rotary joint fixed between the wheel spindle and wheel hub at each wheel. The rotary joints effectively allow air to be channeled to the tyres without the tangling of hoses. With the recent oil price hikes and growing concern of environmental issues, this system addresses a potential improvement gas mileage; tyre wear reduction; and an increase in handling and tyre performance in diverse conditions.

Keywords: Inflation, Heat transfer, Compressed air, Reciprocating compressor, Pneumatics.

I. INTRODUCTION

The “Automatic tyre inflation and deflation 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 tire cavity pressure whenever the tire is rolling in service, thus improving overall fuel economy by reducing the tire’s rolling resistance. Automation can be achieved through computers, hydraulics, pneumatics, robotics, etc., of these sources, pneumatics form an attractive medium for low cost automation. Today automobile sector plays a big role in the economics of all the countries in the world and lots of researches have been carried out to improve the efficiency of the vehicle one the techniques to improve the efficiency of an automobile is inflate the tyre regularly. As its well-known, one of the most serious problem that the large motor vehicle have whether they are for the transportation of passenger or cargo and especially those used for middle or longer distance travel, resides the ensuring the correct performance of the tyres. This means making sure that tyre are inflated and stay inflated for the right amount of pressure for the load being carried and for road condition this way one can ensure not only the preservation of outer covering of the tyres, but also the correct operation of vehicle without any risks. Tires are designed and built with great care to provide thousands of miles of excellent service. But for maximum benefit they must be maintained properly.

The most important factors in tyre care are:
- Proper Inflation Pressure
- Proper Vehicle Loading
- Proper tyre Wear
- Regular Inspection
- Vehicle condition

The Benefits of Proper Inflation
With the right amount of air pressure, you will achieve optimum tyre performance. This means your tires wear longer, save fuel and help prevent accidents. The "right amount" of air is the pressure specified by the vehicle manufacturer, which may be different on the front than the rear tires on your particular model car or light truck. The correct air pressure is shown on the tyre placard (or sticker) attached to the vehicle door edge, door post, glove box door or fuel door. If your vehicle doesn't have a placard, check the owner's manual or consult with the vehicle manufacturer, tyre manufacturer or your local tyre dealer for the proper inflation. The tyre placard tells you the maximum vehicle load, the cold tyre air pressures and the tyre size recommended by the vehicle manufacturer. If you don't take proper care of your tires, the results can be serious. Most tyre companies are either supplying a handbook or are molding a safety warning right onto the tyre sidewall. A typical warning is shown on this page. As you see, it points out that serious injury may result from tyre failure due to under inflation or overloading. Motorists are strongly advised to follow the vehicle owner's manual or the tyre placard in the vehicle for proper inflation and loading. Only specially trained persons should mount or demount tires. An explosion of a tyre and wheel assembly can result from improper or careless mounting procedures. Persons who do mount tires must have the right equipment, the right training and the right information before proceeding. Never exceed 40 psi to seat the beads. Always use a restraining device when mounting a tyre on a rim, and be sure to stay back from the tyre when inflating it. Remember, mounting and demounting tires and wheels should be left to skilled professionals who are aware of the safety hazards involved and who have the proper tools and equipment to do the job safely.

II. LITERATURE REVIEW

[1] A tyre is a ring-shaped covering that fits around a wheel's rim to protect it and enable better vehicle performance. Most tires, 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 tires were bands of iron placed on wooden wheels, used on carts and...
wagons. The tire would be heated in a forge 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 "tire" thus emerged as a variant spelling to refer to the metal bands used to tie wheels. The first practical pneumatic tire 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. S. Dunlop is credited with "realizing rubber could withstand the wear and tear of being a tire while retaining its resilience."

[2] Central Tyre Inflation (CTI) is a mechanical component system installed on a vehicle that enables the vehicle operator to adjust the inflation pressure of each individual tyre while the vehicle is in motion in accordance with changing vehicle speed, road and load conditions (Stuart et al., 1987). Industry has identified central tyre inflation (CTI) as a technology that could improve vehicle performance and reduce costs. This specific need is due to the fact that transport comprises up to 20% of a cane grower’s production costs because of poor vehicle utilization. Consequently, it is important that transport costs should be reduced in order for the sugarcane industry to maintain profitability (Bezuidenhout, 2006).

[3] Central tyre inflation technology offers benefits such as improved mobility and savings in road maintenance costs, but more importantly can also reduce the two largest operational expenses on a transport vehicle namely fuel and tyres (Oberholzer, 2003).

[4] Kaczmarek (1984) stated that “One of the most effective and well proven systems that have been adapted to wheeled tactical vehicles to improve the overall vehicle mobility is CTI.” However, after World War II no serious consideration of the benefits of CTI occurred until the early 1980’s, where after most of the military tactical vehicles produced in the United States were equipped with CTI (Adams, 2002).

[5] Today the largest application of CTI is in the forestry industry. Since 1983 the United States Forest Service has been testing the feasibility of Central Tyre Inflation technologies (Altunel and de Hoop, 1998). Brown and Sessions (1999) summarized several of the United States Forest Services sponsored research programs to evaluate the impact of CTI in commercial logging operations on Forest Service lands. The rough nature of logging roads forces vehicles to slow down in order to limit the vehicle vibrations which negatively impact the vehicle as well as the health of the operators. The results of their research showed that, with CTI the overall vehicle’s speed could be increased as a result of the tyres being optimally suited to the road surface conditions.

III. PROBLEM STATEMENT
Improperly inflated tyres are fairly common problems on passenger vehicles. In fact, 80% of passenger vehicles on the road have at least one under-inflated tire and 36% of passenger cars have at least one tyre that is 20% or more under-inflated. Often pressure loss in tires is a result of natural permeation of the gas through the elastic rubber, road conditions (such as potholes), and seasonal changes in temperature. Most vehicle owners are unaware of the fact that their tyres are not at the correct pressures because it is difficult to determine the tyre pressure visually; a tyre that is properly inflated to the correct pressure looks very similar to one that is either over-inflated or under-inflated.

According to the Rubber Manufacturing Association (RMA) survey, 80% of people are unsure of how to check their tyre pressures. Thus, from the view point of passenger vehicle owners, they are losing money due to increased tyre wear and decreased fuel efficiency, and a solution needs to be found to correct this issue. From the viewpoint of the designers, however, the root cause of improperly-inflated tyres is due to vehicle owners not knowing proper tire pressures for certain conditions, difficulty finding an air pump, lack of pressure measuring device, and a general lack of concern. Thus, the combination of the user and expert viewpoints will be used to make decisions in our design process of this product.

To develop an automatic air filling system, this recognizes and fills air in respective tyre when its pressure goes below the desired /required pressure (under inflated condition). Underinflated tyres overheat more quickly than properly inflated tyres, which cause damage to tyres. To reduce this problem, we are designing this system. As soon as a Tyre Pressure goes under inflated, then a pressure switch senses it and send it to the Controller which activates the solenoid valve and air is filled up to proper inflation.

IV. OBJECTIVES AND METHODOLOGY

4.1 OBJECTIVES
The ideal functional objective of the design is its capability to adjust the pressures in all four tires of a passenger vehicle to obtain the proper pressure for varying road/driving conditions. Specifically, it is desired that:
• Maintains the required tyre pressure: The function of the system is to maintain and adjust the pressure in all the tyres of the system according to varying loading and driving conditions.
• An Automatic System: An automatic system further saves human energy & time in filling the air in tyres when they are in under inflated conditions.
• Builds a Low-cost system. The installation of such a system in vehicles is a low-cost affair.
• Improves fuel efficiency & tyre life: This system helps in less consumption of fuel and also improves tyre life by reducing chances of wear in tyre.

4.2 METHODOLOGY
The proper selection of material for the different part of a machine is the main objective in the fabrication of machine. For a design engineer it is must that he be familiar with the effect, which the manufacturing process and heat treatment have on the properties of materials. The Choice of material for engineering purposes depends upon the following factors:
• Availability of the materials.
• Suitability of materials for the working condition in service.
• The cost of materials.
• Physical and chemical properties of material.

Mechanical properties of material. The mechanical properties of the metals are those, which are associated with the ability of the material to resist mechanical forces and load. We shall now discuss these properties as follows:
• Strength: It is the ability of a material to resist the externally applied forces
• Stress: Without breaking or yielding. The internal resistance offered by a part to an externally applied force is called stress.
• Stiffness: It is the ability of material to resist deformation under stresses. The modules of elasticity of the measure of stiffness.
Compressed air is given to the 2/2 solenoid valve inlet. The pressure switch is used to sense the tyre pressure. The required tyre pressure is set by the pressure switch reading. This pressure switch is used to sense the current pressure and this output signal is given to the solenoid valve. Whenever the tyre pressure is below the set value the pressure switch activates the solenoid valve. The compressed air goes to the tyre with the help of quick release coupling which is used to rotating the wheel freely. The required pressure is filled then the pressure switch will be deactivated the solenoid valve so that the tyre pressure will be maintained in constant level.

IV. PNEUMATICS NEED OF COMPRESSED AIR

The word ‘pneuma’ comes from Greek and means breather wind. The word pneumatics is the study of air movement and its phenomena is derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in industry especially the driving and controlling of machines and equipment. Pneumatics has for some considerable time between used for carrying out the simplest mechanical tasks in more recent times has played a more important role in the development of pneumatic technology for automation. Pneumatic systems operate on a supply of compressed air which must be made available in sufficient quantity and at a pressure to suit the capacity of the system. When the pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature. The compressibility of the air was first investigated by Robert Boyle in 1692 and that found that the product of pressure and volume of a particular quantity of gas.

The usual written as

\[ PV = C \] (or) \[ P_1V_1 = P_2V_2 \]

In the equation the pressure is the absolute pressured which for free is about 14.7Psi and is capable of maintaining a column of mercury, nearly 30 inches high in an ordinary barometer. Any gas can be used in pneumatic system but air is the mostly used system now a days.

5.1 SELECTION OF PNEUMATICS

Mechanization is broadly defined as the replacement of manual effort by mechanical power. Pneumatic is an attractive medium for low cost mechanization particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and the control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power). The main advantage of an all pneumatic system are usually economic and simplicity the latter reducing maintenance to a low level. It can also have outstanding advantages in terms of safety.

5.2 PRODUCTION OF COMPRESSED AIR

Pneumatic systems operate on a supply of compressed air, which must be made available, in sufficient quantity and at a pressure to suit the capacity of the system. When pneumatic system is being adopted for the first time, however it wills indeed the necessary to deal with the question of compressed air supply. The key part of any facility for supply of compressed air is by means using reciprocating compressor. A compressor is a machine that takes in air, gas at a certain pressure and delivered the air at a high temperature. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmosphere pressure and normal ambient temperature. Clean condition of the suction air is one of the factors, which decides the life of a compressor. Warm and moist suction air will result in increased precipitation of condense from the compressed air. Compressor may be classified in two general types.

1. Positive displacement compressor.
2. Turbo compressor

Positive displacement compressors are most frequently employed for compressed air plant and have proved highly successful and supply air for pneumatic control application.

The types of positive compressor
1. Reciprocating type compressor
2. Rotary type compressor

Turbo compressors are employed where large capacity of air required at low discharge pressures. They cannot attain pressure necessary for pneumatic control application unless built in multistage designs and are seldom encountered in pneumatic service.

5.3 RECIPROCATING COMPRESSOR

Built for either stationary (or) portable service the reciprocating compressor is by far the most common type. Reciprocating compressors lap be had is sizes from the smallest capacities to deliver more than 500 m³/min. In single stage compressor, the air pressure may be of 6 bar machines discharge of pressure is up to 15 bars. Discharge pressure in the range of 250 bars can be obtained with high pressure reciprocating compressors that of three & four stages. Single stage and 1200 stage models are particularly suitable for pneumatic applications, with preference going to the two stage design as soon as the discharge pressure exceeds 6 bar , because it in capable of matching the performance of single stage machine at lower costs per driving powers in the range.

5.4 CHARACTERISTICS OF COMPRESSED AIR

The greatest advantage of pneumatic system is the availability of working medium free of cost and it plentiful. Compressed air can also be transported easily and can be easily stored in a reservoir. Another notable advantage is the insensitivity of compressed air to temperature fluctuations. It ensures reliable operation even under extreme conditions of temperature. Compressed air offers no risk of explosion; hence no expensive protection cost is required. Compressed air is a very fast working medium where speed and force are infinitely variable.

5.5 CHARACTERISTICS OF PNEUMATICS

1. Compressibility

A pneumatic fluid is compressible. Compressibility plays a major role in the actuation of piston, i.e., opening a valve does not move the piston immediately, rather sufficient fluid must flow into the volume to increase the pressure until the force overcomes that on the other side.
Compressibility is the energy storage of a fluid. As it is possible to store compressed fluids and transport them, pneumatics has the advantage of transportability. Another advantage of the energy storage capacity is the small compressor charging a tank can supply a system having high peak loads but small average loads.

2. Leakage Sealing Problems

Several methods are used to minimize leakage. One is to use a low operating pressure. Another method to prevent leakage is sealing. Good sliding and rotating sealing are to obtain in pneumatics is because of low viscosity of the fluids. Diaphragms and bellows are used to avoid sliding seats.

3. Low Viscosity:

A highly uncounted problem due to low viscosity is that of sealing. They provide less viscous damping due to low viscosity hence sliding parts wear considerably. This adds the necessity for external sources of lubrication. Another problem is that the pneumatic cylinder should be thinner enough to maintain a laminar flow inside.

1. Low Density

Fluids especially gases are usually of low density. Low density fluids require large mechanical work and more time for high pressure build up.

2. Wide Range of Temperatures

The limitations often may lead to a view point that the use of pneumatic equipment is coupled with high cost. It is proved to be false, however, since a calculation of production cost includes not only the power cost but also all other compared with wages, installation cost, and maintenance cost that they are insignificant.

VI. COMPONENTS AND DESCRIPTION

The physical setup of this project is given below and it is been explained as follows:

1. Pressure switch
2. Power supply
3. Bearing with bearing cap
4. Wheel Arrangement
5. Frame Stand
6. Quick release coupling
7. Rotary joint

![Figure.6.1 Tyre inflation system](http://ijesc.org/)

1. PRESSURE SWITCH

It is a device which is used to sense the pressure and transmit the signal (ON/OFF) to the solenoid valve depending upon the current pressure. In this switch a piston is present with a calibrated spring. One end of the piston the pressure is exerted which is the current pressure and the other end is connected to the switch. Whenever there is a change in the pressure the signal is transmitted. When pressure of the tyre is dropped the switch transmit the signal to the solenoid valve and the valve opens and start inflated the tyre up to calibrated level. When the pressure sense that it can achieve the calibrated level switch give the signal and the solenoid valve will stop inflating the valve.

![Figure.6.2. Pressure switch](http://ijesc.org/)

2. POWER SUPPLY

In electrical engineering, single-phase electric power refers to the distribution of alternating current electric power using a system in which all the voltages of the supply vary in unison. Single-phase distribution is used when loads are mostly lighting and heating, with few large electric motors. A single-phase supply connected to an alternating current electric motor does not produce a revolving magnetic field; single-phase motors need additional circuits for starting, and such motors are uncommon above 10 or 20 kW in rating. In contrast, in a three-phase system, the currents in each conductor reach their peak instantaneous values sequentially, not simultaneously; in each cycle of the power frequency, first one, then the second, then the third current reaches its maximum value. The waveforms of the three supply conductors are offset from one another in time (delayed in phase) by one-third of their period.

3. BEARING WITH BEARING CAP

Ball and roller bearings are used widely in instruments and machines in order to minimize friction and power loss. While the concept of the ball bearing dates back at least to Leonardo da Vinci, their design. This technology was brought to its present state of perfection only after a long period of research and development. The benefits of such specialized research can be obtained when it is possible to use a standardized bearing of the proper size and type. However, such bearings cannot be used indiscriminately without a careful study of the loads and operating conditions. In addition, the bearing must be provided with adequate mounting, lubrication and sealing. Design engineers have usually two possible sources for obtaining information which they can use to select a bearing for their particular application:

a) Textbooks
b) Manufacturers’

Catalogs Textbooks are excellent sources; however, they tend to be overly detailed and aimed at the student of the subject matter rather than the practicing designer. They, in most cases, contain information on how to design rather than how to select a bearing for a particular application. Manufacturers’ catalogs,

http://ijesc.org/
in turn, are also excellent and contain a wealth of information which relates to the products of the particular manufacturer. These catalogs, however, fail to provide alternatives – which may divert the designer’s interest to products not manufactured by them. Our Company, however, provides the broadest selection of many types of bearings made by different manufacturers. For this reason, we are interested in providing a condensed overview of the subject matter in an objective manner, using data obtained from different texts, handbooks and manufacturers’ literature. This information will enable the reader to select the proper bearing in an expeditious manner. If the designer’s interest exceeds the scope of the presented material, a list of references is provided at the end of the Technical Section. At the same time, we are expressing our thanks and are providing credit to the sources which supplied the material presented.

### 3.1 Construction and Types of Ball Bearings

A ball bearing usually consists of four parts: an inner ring, an outer ring, the balls and the cage or separator. To increase the contact area and permit larger loads to be carried, the balls run in curvilinear grooves in the rings. The radius of the groove is slightly larger than the radius of the ball, and a very slight amount of radial play must be provided. The bearing is thus permitted to adjust itself to small amounts of angular misalignment between the assembled shaft and mounting. The separator keeps the balls evenly spaced and prevents them from touching each other on the sides where their relative velocities are the greatest. Ball bearings are made in a wide variety of types and sizes. Single-row radial bearings are made in four series, extra light, light, medium, and heavy, for each bore, as illustrated in Fig. 1-3(a), (b), and (c).

Some makers list deep groove bearings and bearings with two rows of balls. For bearing designations of Quality Bearings & Components (QBC), see special pages devoted to this purpose. The radial bearing is able to carry a considerable amount of axial thrust. However, when the load is directed entirely along the axis, the thrust type of bearing should be used. The angular contact bearing will take care of both radial and axial loads. The self-aligning ball bearing will take care of large amounts of angular misalignment. An increase in radial capacity may be secured by using rings with deep grooves, or by employing a double-row radial bearing. Radial bearings are divided into two general classes, depending on the method of assembly. These are the Conrad, or non-filling-notch type, and the maximum, or filling-notch type. In the Conrad bearing, the balls are placed between the rings as shown in Fig. 1-4(a). Then they are evenly spaced and the separator is riveted in place. In the maximum-type bearing, the balls are a (a) (b) (c) (d) (e) (f) 100 Series Extra Light 200 Series Light 300 Series Medium Axial Thrust Bearing Angular Contact Bearing Self-aligning Bearing Fig. 1-3 Types of Ball Bearings Fig. 1-4 Methods of Assembly for Ball Bearings (a) Conrad or non-filling notch type (b) Maximum or filling notch type.

### 4. WHEEL ARRANGEMENT

The simple wheel and braking arrangement is fixed to the frame stand. Near the brake drum, the pneumatic cylinder piston is fixed.

### 5. FRAME STAND

This is a supporting frame and made up of mild steel.

### 6. Quick release coupling

A quick connect fitting, also called a quick disconnect or quick release coupling, is a coupling used to provide a fast, make-or-break connection of fluid transfer lines. Operated by hand, quick connect fittings replace threaded or flanged connections, which require wrenches. When equipped with self-sealing valves, quick connect fittings will, upon disconnection, automatically contain any fluid in the line.

### 7. ROTARY JOINT

We are designing this device for common passenger vehicles, and the main challenge is the presence of the axle shaft that runs straight into the center of the wheel forcing us to find an alternative method of routing the air. Our proposed solution to this challenge is to place rotary joint that has one half spinning with the drive axle hub and the other half stationary with the spindle. Within this rotary joint will be an air chamber that will allow air to pass from the stationary half of the joint into the half that is rotating.

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Figure 6.3. Types of Ball Bearings

Figure 6.4. Ball bearing

Figure 6.5. Pressure switch
VII. AC MOTOR

7.1 SINGLE PHASE INDUCTION MOTOR
It is found to drive the roller shaft which fixed on the end of the frame structure. The free end of the shaft in the motor a large pulley is found around which the belt runs. The other specification about the motor is discussed in design part of the machine.

7.2 SINGLE PHASE THEORY
Because it has but a single alternating current source, a single-phase motor can only produce an alternating field: one that pulls first in one direction, then in the opposite as the polarity of the field switches. A squirrel-cage rotor placed in this field would merely twitch, since there would be no moment upon it. If pushed in one direction, however, it would spin. The major distinction between the different types of single-phase AC motors is how they go about starting the rotor in a particular direction such that the alternating field will produce rotary motion in the desired direction. This is usually done by some device that introduces a phase-shifted magnetic field on one side of the rotor. The figure the performance curves of the four major types of single-phase AC motors. They are described below.

7.3 SPILT PHASE MOTOR
The split phase motor achieves its starting capability by having two separate windings wound in the stator. The two windings are separated from each other. One winding is used only for starting and it is wound with a smaller wire size having higher electrical resistance than the main windings. From the rotor's point of view, this time delay coupled with the physical location of the starting winding produces a field that appears to rotate. The apparent rotation causes the motor to start. A centrifugal switch is used to disconnect the starting winding when the motor reaches approximately 75% of rated speed. The motor then continues to run on the basis of normal induction motor principles.

7.3 CAPACITOR-START MOTORS
Capacitor start motors form the largest single grouping of general-purpose single-phase motors. These motors are available in a range of sizes from fractional through 3HP. The winding and centrifugal switch arrangement is very similar to that used in a split phase motor. The main difference being that the starting winding does not have to have high resistance. In the case of a capacitor start motor, a specialized capacitor is utilized in a series with the starting winding. The addition of this capacitor produces a slight time delay between the magnetization of starting poles and the running poles. Thus, the appearance of a rotating field exists. When the motor approaches running speed, the starting switch opens and the motor continues to run in the normal induction motor mode. This moderately priced motor produces relatively high starting torque, 225 to 400% of full load torque. The capacitor start motor is ideally suited for hard to start loads such as conveyors, air compressors and refrigeration compressors. Due to its general overall desirable characteristics, it also is used for many applications where high starting torque may not be required. The capacitor start motor can usually be recognized by the bulbous protrusion on the frame where the starting capacitor is located.

7.4 PERMANENT-SPLIT CAPACITOR MOTORS
The capacitor of this motor is left in series with the starting winding during normal operation. The starting torque is quite low, roughly 40% of full-load, so low-inertia loads such as
fans and blowers make common applications. Running performance and speed regulation can be tailored by selecting an appropriate capacitor value. No centrifugal switch is required.

![Permanent split capacitor motor](image)

**VIII. DESIGN AND CALCULATION**

1. **DESIGN OF BELT**

   \[ L = \pi \left( r_1 + r_2 \right) 21 + \left( r_1 - r_2 \right)^2 \]

   Where,
   - \( r_1 \) = Radius of driving pulley = \( \frac{63}{2} \)
   - \( r_2 \) = Radius of followers = \( \frac{200}{2} \)
   - \( l \) = Distance between two pulleys = 135 mm
   - \( \Delta L \) = Distance between two pulleys = 135 mm
   - \( L \) = 5375 mm

2. **POWER TRANSMITTED BY BELT DRIVE**

   \[ d = \text{Diameter of the drive pulley in mm} \]
   \[ n = \text{Speed of the drive pulley in rpm} \]
   \[ r = \text{Velocity of the belt in m/sec} \]
   \[ V = \pi d n \]
   \[ = \pi \times 63 \times 1440 \]
   \[ = 4.75 \text{ m/sec.} \]

3. **MAXIMUM EXTENSION OF THE BELT**

   \[ T = \text{Maximum stress X Cross section Area of the belt} \]
   \[ = f \times b \times t \]
   \[ = 2 \text{ N/mm}^2 \times 2 \times 10 \times 12 \]
   \[ = 240 \text{ N} \]

4. **DESIGN OF BALL BEARING**

   Bearing No. 6404
   - Outer Diameter of Bearing (D) = 47 mm
   - Thickness of Bearing (B) = 14 mm
   - Inner Diameter of the Bearing (d) = 20 mm
   - \( r_1 \) = Corner radii on shaft and housing
   - \( r_1 \) = 1 (From design data book)
   - Maximum Speed = 14,000 rpm (From design data book)
   - Mean Diameter (dm) = \( \frac{(D + d)}{2} \)
   - \( = \frac{47 + 20}{2} \)
   - \( = 33.5 \text{ mm} \)
   - Spring index (C) = \( \frac{(D \times d)}{2} \)
   - \( = 12 \text{ / 2} \)
   - \( = 6 \)

5. **WALL STRESS FACTOR**

   \[ K_s = 4C - 1 + 0.65 \]
   \[ 4C - 4C \]
   \[ = (4 \times 6) - 1 + 0.65 \]
   \[ (4 \times 6) - 4 \]
   \[ K_s = 1.258 \]

6. **1. DESIGN OF PULLEYS**

   **SPEED IN PULLEYS**
   Measured Specifications:
   - \( N_1 / N_2 = D_2 / D_1 \)
   - Where,
   - \( N_1 \) = Input speed to the Motor = 1440 rpm
   - \( N_2 \) = Output speed from the pulley-2
   - \( D_2 \) = Diameter of the pulley-2 = 200mm
   - \( D_1 \) = Diameter of the Motor pulley = 63mm
   - \( \Delta N_2 = (D_2 / D_1) \times N_1 \)
   - \( = (63 / 200) \times 1440 = 453.6 \text{ rpm} \)
   - This speed is equal to the small Sprocket speed = 453.6 Rpm
   - The speed of the huller shaft (N4) = (D3/D4) \times N
   - Where,
   - N4 ---- Speed of the rolling huller Shaft
   - N3 ---- Speed of the Small sprocket = Speed of Pulley – 2 = 453.6 rpm
   - D3 ---- Diameter of Small sprocket = 61 mm
   - D4 ---- Diameter of Big sprocket = 183 mm
   - So, the speed of the rolling huller shaft = (61/183) \times 453.6
   - \( = 151.2 \text{ Rpm} \)

**IX. WORKING PRINCIPLE**

Compressed air is given to the 2/2 solenoid valve inlet. The pressure switch is used to sense the tyre pressure. The required tyre pressure is set by the pressure switch reading. This pressure switch is used to sense the current pressure and this output signal is given to the solenoid valve. Whenever the tyre pressure is below the set value the pressure switch activate the solenoid valve. The compressed air goes to the tyre with the help of quick release coupling which is used to rotating the wheel freely. The required pressure is filled then the pressure switch will be deactivated the solenoid valve so that the tyre pressure will be maintained in constant level.

![Tyre pressure inflation system](image)

**X. ADVANTAGES AND DISADVANTAGES**

There are many dangers to having under inflated tyres, because they are designed for use at their recommended pressure. Under inflation can lead to increased deformation in the tyre wall as it concentrates the load upon the tread shoulders, this
reduces the amount of surface contact the tyre has with the road. This can have many consequences.
• Increased wear of the tyres treads which will lead to a higher chance of aquaplaning in the wet.
• Reduced handling characteristics and a reduced control of the vehicle.
• Longer stopping distances.
• Higher chance of the tyre delaminating, which could lead to a sudden tyre failure.

DEMERITS
• High capital investment
• In measurement of high pressures, cost of sensors is more.
• Higher temperature will affect the proper working of the sensors.

XI. APPLICATIONS
• Automobile Application
• Car Manufacturing Industry
• All two-wheeler application
• All four-wheeler applications
Industries where different pneumatic pressures are required from the same compressor used in pneumatic, controller machines.

XII. CONCLUSION

Thus, we have made a TYRE PRESSURE INFLACTION SYSTEM, using this arrangement we can control the drunken drive. There by a large amount of energy is saved and it gives a smooth operation. We are proud that we have completed the work with the limited time successfully. The TYRE PRESSURE INFLATION SYSTEM 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 available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus, we have developed an “TYRE PRESSURE INFLATION SYSTEM” which helps to know how to achieve low cost automation. The application of pneumatics produces smooth operation. By using more techniques, they can be modified and developed according to the applications. We can conclude that this system ensures us that each and every tyre is properly inflated to the proper tyre pressure throughout the journey and it also improves tyre life, reduces tyre wear, increases fuel efficiency and also increases the overall safety of the vehicle, it also monitors the tyre pressure constantly, provide us the proper inflation and deflation of the tyre, and helps in providing a comfortable ride with better mileage.

XIII. REFERENCE
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