DESIGN AND ANALYSIS OF PNEUMATIC TRANSMISSION RAISED CAR

A PROJECT REPORT

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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER **EXTERNAL EXAMINER**

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ABSTRACT

This paper describe the research. design, construction of a viable experimental pneumatic driven vehicle the main goal is to find ways ti drive efficient by using alternative energy not necessary cheaper but more environmental friendly in increasing polluted metropolis. this is done by taking the emission source from the vehicle's tail pipe to the central electrical generating plant emission control measure at a central generating plant may be more effective and less costly, then treating the emission of widely dispersed vehicles' where source low emission are available like, gasoline, water solar and nitrogen byproduct , net pollutant can be reduced the background result used in this study are obtained by designing building and testing by experimental configuration of compressed air vehicles this study present latest one of this vehicles

CHAPTER-01

INTRODUCTION

pneumatic pumps, in particular, use compressed air to create force that is used to move fluids through a piping system. essentially, pneumatic pumps use air in the same way that hydraulic pumps use fluids.

It is recommended for all the applications on textile, glass making and plate deforming machines. The pump allows a 3-second working-time and a 10second pause-time depending on lubricant viscosity. Pump control unit consists of a cylinder in which an anti-oil rubber seal runs. A spring ensures pistonreturn to the starting position.

3.7.1 pump components

- Pump main component is the base plate on which pump components are fixed.
- The reservoir is made of light-coloured Moplen which allows to check oil level.
- Pneumatic pump air inlet and lubricant outlet are both located on the base plate.
- The re-circulating oil filter, needed for all the applications involving oil recycling, is supplied with four inlets. one or more inlet (depend on the version)
- The Samba sensor level indicates the minimum level achievement through an electric contact closure.]

3.7.2 pump operation

1) Push-button hand control
2) 3-way solenoid valve control
3) Circular or rectilinear cam drive

pressure setting

It is possible to adjust lubricant outlet pressure by regulating the inlet air pressure.

reservoir refilling

Use compatible lubricant and refill the reservoir through the oil refilling plug with a filter. Do not pour lubricant directly into the reservoir.

air discharge

Air in the system does not affect pump well-functioning. However, it is advisable to discharge air by starting the pump until lubricant comes out air bubbles-free.

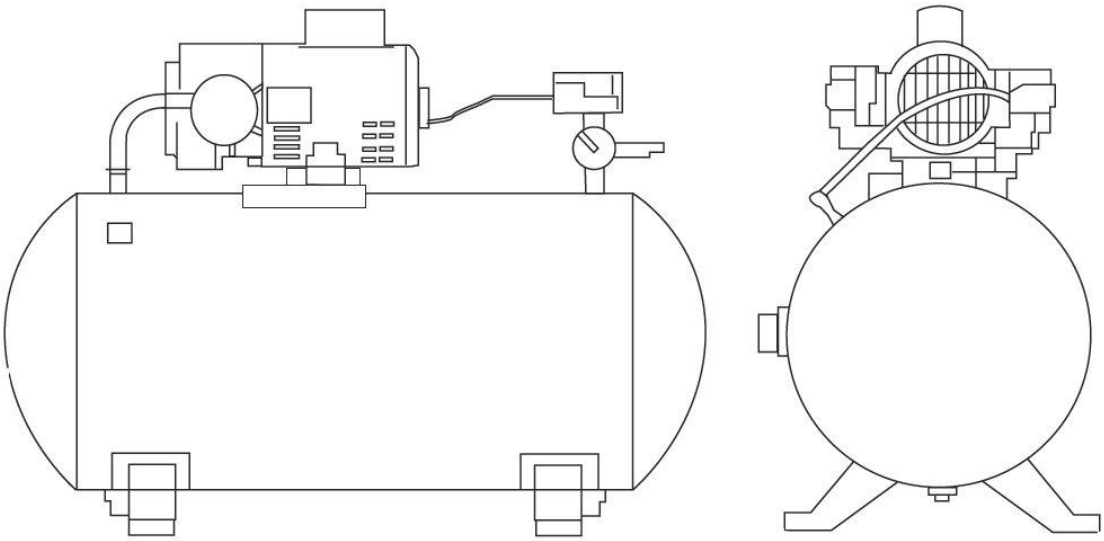


Fig 3.7.2 air compressor

3.7.3 maintenance procedure

Pump has been designed and constructed to require a minimum maintenance. For an easy maintenance, it is advised to assemble the pump in a comfortable and reachable location. The machine does not require any special tool for check or maintenance tasks. However, it is recommended the use only of appropriate and in good conditions tooling, protective devices (gloves) and clothing to avoid injury to persons or damage to machine parts.

Periodically check the pipe joints to detect possible leaks. Furthermore, keep the machine unit clear to readily detect possible leaks.

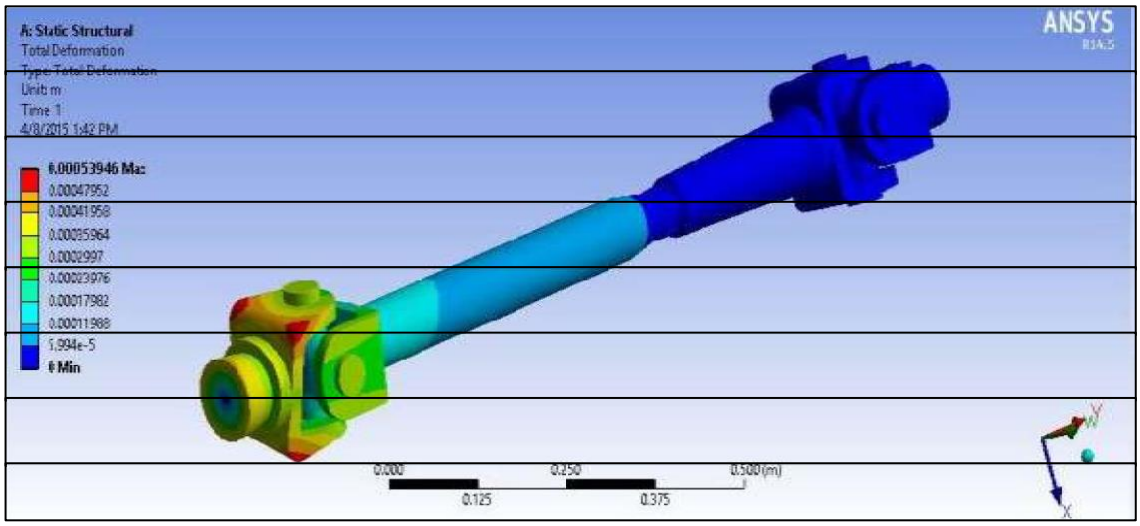


Fig 3.8 propeller shaft

3.8 Propeller shaft

A driveshaft is a rotating shaft that transmits power from the engine to the differential gear of a rear wheel drive vehicles Driveshaft must operate through constantly changing angles between the transmission and axle.

The two piece steel drive shaft consists of three universal joints, a centre supporting bearing and a bracket, which increase the total weight of a vehicle. Power transmission can be improved through the reduction of inertial mass and light weight.

3.8.1 working principle

The torque that is produced from the engine and transmission must be transferred to the rear wheels to push the vehicle forward and reverse. The drive shaft must provide a smooth, uninterrupted flow of power to the axles. The drive shaft and differential are used to transfer this torque. First, it must transmit torque from the transmission to the differential gear box. During the operation, it is necessary to transmit maximum low-gear torque developed by the engine. The drive shafts must also be capable of rotating at the very fast speeds required by the vehicle. The drive shaft must also operate through constantly changing angles between the transmission, the differential and the axles. As the rear wheels roll over bumps in the road, the differential and axles move up and down. This movement changes the angle between the transmission and the differential.

advantages

- The power is not wasted in friction
- The overall noise emission of the system is usually lower.
- Longer lifetime
- 4) Mechanical backlash, hysteresis and elasticity is removed avoiding use of gearbox or ball screw mechanisms.

applications

- High Speed
- Medium or Variable

- Very low rotational Speed

3.9 gear box

Gear reducers are used in all industries, they reduce speed and increase torque. You will find them between the prime mover

An gearbox is defined as a machine for the majority of drives requiring a reliable life and factor of safety, and with the pitch line velocity of the gears limited to below 25 m/s, as opposed to mass produced gearboxes designed for a specific duty and stressed to the limit, or used for very high speeds etc., e.g. automobile, aerospace, marine gearboxes.

Gearboxes can be designed using the same type of gearing throughout, or a combination depending on powers, speeds and application.

3.10 universal joint

The universal joint is considered to be one of the oldest of all flexible couplings. It is commonly known for its use on automobiles and trucks. A universal joint in its simplest form consists of two shaft yokes at right angles to each other and a four point cross which connects the yokes.

Industrial applications operate continuously and with high torque loads. This demands maximum strength and long life of the universal joint components. The modern universal joint has become much more complex than its simple a the universal joints manufactured by Renold are made for demanding industrial applications.

The universal joint can be used as a single joint or it can be used in pairs. When used as a single joint, only angular misalignment is accommodated.

Since nearly every installation requires the coupling to also accommodate offset misalignment, universal joints should be used in pairs.

advantages

- Domestic manufacture
- High torque capacity
- Long bearing life
- High operating angle capability
- One piece yoke and bearing housing construction
- Eliminates unnecessary bolted connections and serrations
- Heat treated alloy steel components
- Ideal loading across entire bearing length due to balanced
- Replaceable inner bearing race on size RA440 and larger
- Technical support and engineering services available
- Extensive repair facility
- Special sizes and designs available upon request
- Large sizes available

- Air tank
- Air gun
- Chain drive
- Sprockets
- Frame
- Pressure gauge

air tank

- Storage can be used to control demand events (peak demand periods) in a compressed air system by reducing both the amount of pressure drop and the rate n of decay. Storage can be used to protect critical pressure applications from other events in the system.
- Storage can also be used to control the rate of pressure drop in demand while supporting the speed of transmission response from supply. For some systems, it is important to provide a form of refill control such as a flow control valve
- Air tank is a container designed to hold gases or liquids at a pressure substantially different from the ambient pressure. The pressure differential is dangerous, and fatal accidents have occurred in the history of pressure vessel development and operation
- Consequently, pressure vessel design, manufacture, and operation are regulated by engineering authorities backed by legislation. For these reasons, the definition of a pressure vessel varies from country to

country, but involves parameters such as maximum safe operating pressure and temperature, and are engineered with a safety factor, corrosion allowance, minimum design temperature (for brittle fracture), and involve nondestructive testing, such as ultrasonic testing, radiography, and pressure tests, usually involving water, also known as a hydro test, but could be pneumatically tested involving air or another gas.

- The preferred test is hydrostatic testing because it's a much safer method of testing as it releases much less energy if fracture were to occur (water does not rapidly increase its volume while rapid depressurization occurs, unlike gases like air, i.e. gasses fail explosively).
- In the United States, as with many other countries, it is the law that vessels over a certain size and pressure be built to Code, these vessels also require an Authorized Inspector to sign off on every new vessel constructed and each vessel has a nameplate with pertinent information about the vessel such as maximum allowable working pressure, maximum temperature, minimum design metal temperature.

air tank safety measures

Each air tank shall be protected by 1 or more safety valves and other indicating and controlling devices that will insure safe operation of the tank. If the tank has a volumetric capacity in excess of 2,000 gallons, it shall be fitted with at least 2 safety valves, the smallest of which shall have a relieving capacity of at least 50 percent of the relieving capacity of the largest valve.

Safety relief valves shall be constructed and installed in accordance with ASME Boiler and Pressure Vessel Code, Be located and installed so that they cannot be readily rendered inoperative. No valve of any description shall be placed between the required safety valve or rupture disc and the air tank.

The opening or connection between the tank and safety valve or valves shall have a cross-sectional area at least equal to the combined areas of all attached safety valve inlets. Be of the direct spring-loaded type. The springs shall not be adjusted to carry more than: 10 percent greater pressure than the set pressure stamped on the valve up to and including 250 psig .

For pressures of 2000 psig or less safety valves shall be equipped with a substantial lifting device so that the disc can be easily lifted from its seat not less than 1/8 the diameter of the seat when the pressure in the tank is 75 percent of that at which the safety valve is set to open. For pressures exceeding 2000 psig, the lifting device may be omitted providing the valve is removed for testing at least once each year and a record kept of this test and made available to the qualified inspector.

Discharge pipes from safety valves and rupture discs installed on air tanks shall Have a cross-sectional area at least equal to the combined outlet areas of all valves discharging into them. Be designed and installed so that there will be no interference with the proper operation or discharge capacity of the safety valve or rupture disc.

Have no valve of any description. Be fitted with open drains which will prevent the accumulation of liquid above the safety valve or rupture disc. Be installed and supported in a manner that will prevent undue stresses on the safety valve or rupture disc. Be led to a safe place of discharge.

Each air tank shall be equipped with a suitable pressure indicating gage with the dial graduated to approximately double the operating pressure, but in no case less than 1.2 times the pressure at which the safety-relieving device is set to function.

Each air tank shall be equipped with a manually operated, Valves drain located at the lowest point where water can collect. The valve for this

drain shall be suitably located for convenient operation. Automatic drains shall not be considered as complying with this order unless also equipped with a manually operated by-pass.

Pressure gauge

- Many techniques have been developed for the measurement of pressure and vacuum. Instruments used to measure and display pressure in an integral unit are called pressure gauges or vacuum gauges. A manometer is a good example as it uses a column of liquid to both measure and indicate pressure.
- Likewise the widely used Bourdon gauge is a mechanical device which both measures and indicates, and is probably the best known type of gauge. A vacuum gauge is an absolute pressure gauge used to measure the pressures lower than the ambient atmospheric pressure.
- Other methods of pressure measurement involve sensors which can transmit the pressure reading to a remote indicator or control system. Everyday pressure measurements, such as for vehicle tire pressure, are usually made relative to ambient air pressure.
- In other cases measurements are made relative to a vacuum or to some other specific reference. When distinguishing between these zero references, the following terms are used,
    1. **absolute pressure** is zero-referenced against a perfect vacuum, using an absolute scale, so it is equal to gauge pressure plus atmospheric pressure.
    2. **gauge pressure** is zero-referenced against ambient air pressure, so it is equal to absolute pressure minus atmospheric pressure. Negative signs are usually omitted. To distinguish a negative pressure, these are further divided into two subcategories, high and low vacuum.

3. **differential pressure** is the difference in pressure between two points.

frame

This is made of mild steel material. The whole parts are mounted on this frame structure with the suitable arrangement. Boring of bearing sizes and open bores done in one setting so as to align the bearings properly while assembling. Provisions are made to cover the bearings with grease.

sprockets

A sprocket or sprocket-wheel is a profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material. The name 'sprocket' applies generally to any wheel upon which radial projections engage a chain passing over it. It is distinguished from a gear in that sprockets are never meshed together directly, and differs from a pulley in that sprockets have teeth and pulleys are smooth.

Sprockets are used in bicycles, motorcycles, cars, tracked vehicles, and other machinery to transmit rotary motion between two shafts where gears are unsuitable or to impart linear motion to a track, tape etc. Perhaps the most common form of sprocket may be found in the bicycle, in which the pedal shaft carries a large sprocket-wheel, which drives a chain, which, in turn, drives a small sprocket on the axle of the rear wheel. Early automobiles were also largely driven by sprocket and chain mechanism, a practice largely copied from bicycles.

Sprockets are of various designs, a maximum of efficiency being claimed for each by its originator. Sprockets typically do not have a flange. Some sprockets used with timing belts have flanges to keep the timing belt centered.

Sprockets and chains are also used for power transmission from one shaft to another where slippage is not admissible, sprocket chains being used instead of belts or ropes and sprocket-wheels instead of pulleys.

chain drive

Chain drive is a way of transmitting mechanical power from one place to another. It is often used to convey power to the wheels of a vehicle, particularly bicycles and motorcycles. It is also used in a wide variety of machines besides vehicles.

Most often, the power is conveyed by a roller chain, known as the drive chain or transmission chain, passing over a sprocket gear, with the teeth of the gear meshing with the holes in the links of the chain. The gear is turned, and this pulls the chain putting mechanical force into the system.

Another type of drive chain is the Morse chain, invented by the Morse Chain Company of Ithaca, New York, United States. This has inverted teeth.

Sometimes the power is output by simply rotating the chain, which can be used to lift or drag objects. In other situations, a second gear is placed and the power is recovered by attack own as idler-wheels. By varying the diameter of the input and output gears with respect to each other, the gear ratio can be altered. For example, when the bicycle pedals' gear rotate once, it causes the gear that drives ring shafts or hubs to this gear.

Though drive chains are often simple oval loops, they can also go around corners by placing more than two gears along the chain; gears that do not put power into the system or transmit it out are generally knee the wheels to rotate more than one revolution.

air gun

A chuck is a specialized type of clamp. It is used to hold an object with radial symmetry, especially a cylinder. In drills and mills it holds the rotating tool whereas in lathes it holds the rotating work piece. On a lathe the chuck is mounted on the spindle which rotates within the headstock. For some purposes (such as drilling) an additional chuck may be mounted on the nonrotating tailstock.

Many chucks have jaws, (sometimes called dogs) that are arranged in a radically symmetrical pattern like the points of a star. The jaws are tightened up to hold the tool or work piece. Often the jaws will be tightened or loosened with the help of a chuck key, which is a wrench-like tool made for the purpose. Many jawed chucks, however, are of the keyless variety, and their tightening and loosening is by hand force alone Keyless designs offer the convenience of quicker and easier chucking and upchucking, but have lower gripping force to hold the tool or work piece, which is potentially more of a problem with cylindrical than hexagonal shanks.

Some lathe chucks have independently moving jaws which can also hold irregularly shaped objects (ones that lack radial symmetry). Colet chucks, rather than having jaws, have collets, which are flexible collars or sleeves that fit closely around the tool or work piece and grip it when squeezed. A few chuck designs are more complex yet, and they involve specially shaped jaws, higher numbers of jaws, quick-release mechanisms, or other special features.

non return valve

A check valve, clack valve, non-return valve or one-way valve is a valve that normally allows fluid (liquid or gas) to flow through it in only one direction. Check valves are two-port valves, meaning they have two openings in the body, one for fluid to enter and the other for fluid to leave. There are various types of check valves used in a wide variety of applications.

An important concept in check valves is the cracking pressure which is the minimum upstream pressure at which the valve will operate. Typically the check valve is designed for and can therefore be specified for a specific cracking pressure. Heart valves are essentially inlet and outlet check valves for the heart ventricles, since the ventricles act as pumps.

bearing with bearing cap

The bearings are pressed smoothly to fit into the shafts because if hammered the bearing may develop cracks. Bearing is made up of steel material and bearing cap is mild steel.

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 davinci, their design and manufacture has become remarkable.

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:

- Textbooks
- Manufacturers

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 are most cases; contain information on how to design rather than how to select a bearing for a particular application. Manufacturers' catalogs, 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.

CHAPTER-04

DESCRIPTION OF MECHANICAL PARTS

4.1 crank shaft

The crankshaft, sometimes casually abbreviated to crank, is the part of an engine which translates reciprocating motion into rotary motion or vice versa. Crank shaft consists of the shaft parts which revolve in the main bearing, the crank pins to which the big ends of the connecting rod are connected, the crank webs or cheeks which connect the crank pins and the shaft parts.

Crank shafts can be divided into two types,

- Crank shaft with a side crank or overhung crank.
- Crank shaft with a centre crank.

A crank shaft can be made with two side cranks on each end or with two or more centre cranks. A crank shaft with only one side crank is called a single throw crank shaft and the one with two side cranks or two centre cranks as a multi throw crank shaft.The overhung crank shaft is used for medium size and large horizontal engines. Its main advantage is that only two bearings are needed, in either the single crank or two crank, crank shafts. Misalignment causes most crank shaft failures and this danger is less in shafts with two bearings than with three or more supports. Hence, the number of bearings is very important factor in design. To make the engine lighter and shorter, the number of bearings in automobiles should be reduced.

4.2 connecting rod

Connecting rod is a part of the engine which is used to transmit the push and pull from the piston pin to the crank pin. In many cases, its secondary function is to convey the lubricating oil from the bottom end to the top end i.e. from the crank pin to the piston pin and then for the splash of jet cooling of piston crown. The usual form of connecting rod used in engines has an eye at the small end for the piston pin bearing, a long shank, and a big end opening which is usually split to take the crankpin bearing shells.The connecting rods of internal combustion engine are mostly manufactured by drop forging. The connecting rod should have adequate strength and stiffness with minimum weight. The materials for connecting rod range from mild or medium carbon steel to alloy steels

The usual shape of connecting rod is:

- Rectangular
- Circular
- Tubular
- I section
- H section

In low speed engines, the section is usually circular with flattened sides, or rectangular, the larger dimension being in the plane of rotation. In high speed engines, lightness of connecting rod is a major factor. Therefore tubular, Isection or H-section rods are used.

4.3 bearing

The concept behind a bearing is very simple: Things roll better than the y slide. The wheels on your car are like big bearings. If you had something like skis instead of wheels, your car would be a lot more difficult to push down the road. That is because when things slide, the friction between them causes a force that tends to slow them down. But if the two surfaces can roll over each other, the friction is greatly reduced. Bearings reduce friction by providing smooth metal balls or rollers, and a smooth inner and outer metal surface for the balls to roll against. These balls or rollers "bear" the load, allowing the device to spin smoothly

working of a bearing

As one of the bearing races rotates it causes the balls to rotate as well. Because the balls are rolling they have a much lower coefficient of friction than if two flat surfaces were rotating on each other.

Ball bearings tend to have lower load capacity for their size than other kinds of rolling-element bearings due to the smaller contact area between the balls and races. However, they can tolerate some misalignment of the inner and outer races.Compared to other rolling-element bearings, the ball bearing is the least expensive, primarily because of the low cost of producing the balls used in the bearing

CHAPTER -05

CALCULATION OF CHASSIS AND SHAFT DESIGN

3.1 design of chassis

Let us assume that, Weight of a person=60kg, Weight of chassis & other accessories=40kg, Therefore, Total weight of the vehicle=100kg (Assuming) Force =W x g =100 x 9.81 =981N

Sketch of chassis

There are 4 key points as shown in the figure where total weight acts. So, considering load is distributed equally at the each point i.e. on each each link. Force acting on each link(F1)=981/4 F1 = 245.25N Let, =1222.80 mm4

IP2= (IG2+A2 h22) = 1333.33 + {40 x (15.76 - 10)2} =2660.434 mm4 So, Moment of inertia (I), I= IP1 + IP2 = 1222.80 + 2660.434 I = 3883.234 mm4 We know that, (M/I)= (σ/y)

σactual= (M x y)/ I = (223.17 x 103 x 15.76) / 3883.234= 90.572N/mm2 As, σactual<σpermissible Design is safe.

L1=Length of link 1=910mm So, Bending Moment (M) for link 1 is given by, M =F1 x L1 =245.25 x (910/1000 =223.17 N-m We are using MS angle over MS flat cause MS angle has comparatively high stenght in twisting & bending than MS flat. So, Selecting MS angle of (22 x 22 x 2) mm dimension.Calculating Moment of Inertia for MS angle (I),IG= (bd3/12) σpermissible= (Sut/Nf)= (650 / 2) = 325 N/mm2 IG1= (22 x 23)/12 =14.666mm4 IG2= (203 x 2)/12 =1333.33mm4 y=C.G. of the system= (A1y1+ A2y2)/(A1+ A2) y= [{(22 x 2) x 2} + {(20 x 2) x 10}] / {(20 x 2) + (22 x 2)} y= 15.76mm

Now, IP= Moment of Inertia about parallel axis.= (IG+Ah2) So, IP1= (IG1+A1 h12) = 14.666 + {44 x (21-15.76)2} =0.33 x 490.5 =161.865 N For 2 rear wheels Resultant force, FR= 2 x F1 = 2 x 161.865 = 323.73 N Torque transmitted (T), T= FR x r =323 x (300/2000) T=48.45 N-m

3.2. shaft design

Total Force acting on chassis = 981N As, power is transmitted to rear axle only the force acting on chassis is equally distributed into rear tires. RA= RB =981/2 = 490.5 N Now, considering F.B.D. of tyre,

Cross – section of shaft

Where,

μ=Frictional force = 0.33 RN= Normal Reaction. F1=μ x RN

T =Torque transmitted, N/mm2 J = Polar moment of Inertia, mm4 So, substituting values we get, (74.25 / [d/2])= ([48.45 x 103] / [πd4/32]) d3=3330.1430 d= 14.933mm So, for safety we are selecting the shaft diameter d= 20mm. As, Intermediate shaft also had to transmit same torque & also its length is smaller than that of rear shaft. We are selecting same material & Same Diameter of shaft 20mm.

Maximum Torsional shear stress (τmax): For shaft we are selecting C45 material

So, for C45 Syt=Yield strength of shaft material= 330 N/mm2, Sut=Tensile strength of shaft material= 60 N/mm2, According to A.S.M.E. code, (τmax)= 0.18 Sut= 0.18 x 600 = 108 N/mm2 OR = 0.3 Syt = 0.3 x 330 = 99 N/mm2 τmax= 99 N/mm2 (Selecting minimum value), so, τmax = 99 x 0.75 = 74.25 N/mm2 Now, (τmax / R)= (T / J) Where, τmax = maximum torsional shear stress, N/mm2

R= Radius of shaft, mm = (48.45/2) =24.225N-m Piston Rod is connected to the gear with eccentricity distance of 45mm. Let, R1=distance between C.G. of gear & eccentricity. Diameter of gear (D) =120mm R=D/2=60mm So, R1= {R – (15mm)} = (60 -15) R1 =45mm Force= (T/R1) = (24.225 x 103) / 45 =538.333N This is the force on a piston for 1 stroke. Let us , assume that standard bore diameter of

3.3 design of piston & cylinders

Diameter of gear=120mm

No. of teeth on gear =z1=60 Diameter of pinion=160mm No. of teeth on pinion =z2=30 So, module (m) = (120/60) = (60/30) =2 Torque transmitted to pinion = 48.45 N-m

As, pinion is mounted on intermediate shaft which is connected to the rear shaft with the help of sprocket & chain assembly. So, Torque transmitted to pinion = 48.45N-m Gear Reduction Ratio (G) = z1/ z2 =60/30 =2 Torque Transmitted from gear = (T/2) This is required pressure to move the vehicle initially from rest position. But, as we want to move the vehicle upto speed range of 15 -20 km/hr we Have to take pressure of 4bar inside air receiver tank. So, selecting working pressure (Pworking) = 4 bar Now, considering vehicle is moving with 15-20 km/hr where working pressure inside tank is 4 bar.so, for safety we will select the master cylinder of pressure 10 bar. cylinder be 50mm. Area of cylinder (A) = (π/4) x D2 = (π/4) x (50)2 =1963.49mm2 =1963.49 x 10-4 m2 Required pressure inside air receiver tank (Preq), Preq= (F/A) =538.333/ (1963.49 x 10-4) =2741.71 N/m2 Now considering vehicle should move upto 15 m once the air receiver tank is filled. Diameter of rear tyre (D) = 300 mm So for 1 rotation = π x D = π x 0.3 = 0.94 m So for 15 m rotation of tyre = (15 x 1) / 0.94 = 15.9 = 16 rotations As, pinion is on the intermediate shaft which is connected to rear shaft with chain sprocket, so for 16 rotations of tyre there are same rotations of pinion So rotations of pinion = 16 rotations For gear = (16 / 2) = 8 rotations For piston=16oscillations.For2 oscillations i.e. for forward & return stroke there is 1 complete rotation of gear.

So volume exhausted per stroke of piston = (π/4) x D2 x L = (π/4) x 502 x 100 = 1.963 x 10-4 m3/stroke So for 1 rotation of gear there are 2 strokes

Selecting 10 bar master cylinder with stroke length=100mm, Bore diameter=50mm. So, our initial assumption of Bore diameter of 50mm & gear diameter of 120mm is true & design is safe. As, stroke Length of piston is 100mm so we are selecting gear of diameter 120mm.so our initial assumption is also true. 3.5. **design for pressure vessel** Let, d=diameter of pipe=170mm, t=thickness of pipe=5m, L=length of cylinder=280mm. So, (d/t)=(170/5)= 34 >20 So, designing pressure vessel as a thin cylinder. Radial forces acting in thin cylinder can be neglected.	

CHAPTER-06

DESIGN OF CHASSIS AND COMPRESSED AIR

6.1 Chassis

A car chassis may refer to either the frame of a car that holds together its components or to a rolling chassis. A rolling chassis consists of the frame, engine and drive train. That is, it includes almost all components except the body. Most modern automobiles are not built with a rolling chassis, as uni body construction is more common.

It is common for People to refer to the skeletal frame of a car as the chassis, although in some cases this may not be entirely accurate. For many vehicles made in the early-to- middle 20th century, the chassis was simply the car minus the body. Antique vehicles will generally be constructed this way, making the chassis easily identifiable. Later, a technique called monocoque was developed, in which parts of the body and frame were welded together to form a single unit.

dynamic stability

When a vehicle is said to be dynamically stable it is meant that it reacts safely and predictably under various driving conditions. When designing a chassis, we can choose how the car will react when turning too fast. One of two things will always happen: either the car wheels will slip relative to the ground, or the vehicle will tip over. Obviously, slipping is the preferred outcome. Keep this in mind for the moment. If the front wheels slip first , you won't spin out and it is easier to regain control. Understeer is considered a safe dynamic response to slipping in a turn and is designed into all commercial cars. Which wheels will slip first is a function of weight distribution and weight transfer during turns.

braking

Because your weight transfers to the front when you decelerate, the front wheels on any vehicle provide the majority of your stopping power (something like 60-70%). The delta is at a disadvantage considering the weight distribution issues discussed above and the fact that it has one less front tire to brake on.

simplicity of design

Steering is definitely easier to design for the delta. No special considerations need to be taken into account to avoid lateral wheel slipping on turns, while the tadpole design has to incorporate extra linkages to approximate 'Ackermann' steering geometry to prevent wheel slippage. Front suspension design is definitely easier on the delta. The best choice is a 'telescopic fork' positioned with some degree of caster angle to ensure that the car drives straight when you let go of the wheel. The rear suspension design can be any number of options.

Aerodynamics

The tadpole design lends itself better to the aerodynamic tear drop with the correct length/width ratio more easily than the delta. The image below shows how poorly the correct shape fits the delta design. Plus, you have to encase more empty space with the delta.

Powertrain

The delta design has more disadvantages when selecting your drive wheel. If you go with front wheel drive, you have to fight against the dynamic stability disincentive of putting too much weight on the front of a delta. You also have to make sure that your steering system doesn't conflict with your method of driving that wheel. If you power a back wheel on a delta you need

to add a differential gear to the rear wheels or else risk stability issues caused by the off center driving wheel force.

working

At the beginning of the intake process, the intake valve opens immediately, and the exhaust valve stays closed while the piston moves from the top dead center (TDC) toward the bottom dead center (BDC). During this process, the incoming compressed air pushes the piston downward, producing the power stroke. The intake valve closes before the piston reaches the BDC to reduce the air consumption, and thus changing the process from a constant pressure expansion to an isentropic expansion. The downward movement of piston produces work while the compressed air feeds into the cylinder during the intake process, and even after the intake valve closes during the isentropic expansion process. At the start of the exhaust process, the exhaust valve opens immediately while the intake valve remains closed. The piston moves from the BDC toward the TDC to discharge the compressed air from inside the cylinder. The simplicity in design, durability and compact size of pneumatic systems make them well suited for mobile applications. Pneumatic control system plays very important role in industrial system owing to the advantages of low cost, easy maintenance, cleanliness, readily available, and cheap source, etc.

6.2 compressed air(fuel)

Pneumatic motors generally convert the compressed air orgasto mechanical work through either linear or rotary motion. Linear motion can come from either a diaphragm or piston actuator, while rotary motion is supplied by either a vane type air motor or piston air motor. Compressed air energy storage is a way to store energy generated at one time for use at another time using compressed air. At utility scale, energy generated during periods of low energy demand can be released to meet higher demand periods. Compressed air is air kept under a pressure that is greater than atmospheric pressure. It serves many domestic and industrial purposes. In Europe, 10 percent of all industrial electricity consumption is to produce compressed air. Compressed air has a low energy density.

In 300 bar containers, about 0.1 MJ/L and 0.1 MJ/kg is achievable, comparable to the values of electrochemical lead-acid batteries. While batteries can somewhat maintain their voltage throughout their discharge and chemical fuel tanks provide the same power densities from the first to the last litre, the pressure of compressed air tanks falls as air is drawn off. A consumer-automobile of conventional size and shape typically consumes at the drive shaft per mile of use, though unconventional sizes may perform with significantly less.

compressed air energy storage

compressed air energy storage is a way to store energy generated at one time for use at another time using compressed air. At utility scale, energy generated during periods of low energy demand can be released to meet higher demand periods. Small scale systems have long been used in such applications as propulsion of mine locomotives. Large scale applications must conserve the heat energy associated with compressing air, dissipating heat lowers the energy efficiency of the storage system.

CHAPTER-06

WORKING PRINCIPLE

The compressed air vehicle consists of the air storage tank which stores the compressed air inside the tank. Then there is a gate valve for the controlling of the compressed air into the next part of the system. This vehicle also consists of a non-return valve, pneumatic (gun) drill, shafts and chain drive and sprocket mechanism.

The compressed air stored in the tank enters the gate valve which is placed near the handle for the comfort of the driver, when the gate valve is opened the air enters the pneumatic drill (gun) for the actuation or the motion of the vehicle.

This vehicle is designed as a tri-wheeler for the better comfort and easier handling of the vehicle. The compressed air enters the air gun through a gate valve by which the shaft is driven and by the chain sprocket mechanism the power from a shaft is transmitted to the other shaft or the rear wheel shaft thus making the vehicle driven.

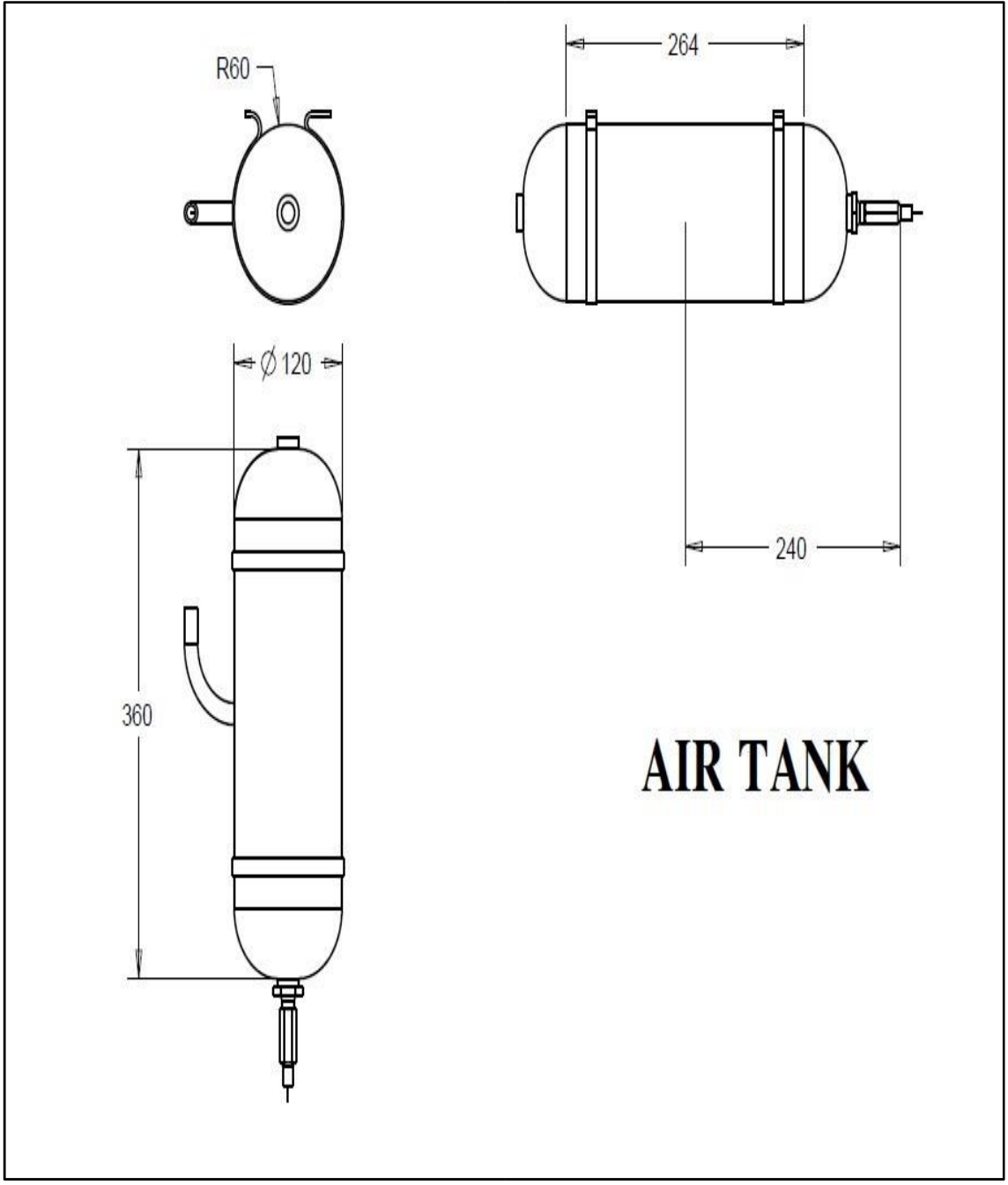


Fig 6.1 air tank

future modifications

It is always consider that every machine should perform satisfactorily but due to theoretical assumptions differ from actual practice so to overcome this drawback some modifications are needed. These modifications may be in design or may be in performance or may be in features of product. It is also not possible

To develop a model which works on ideal conditions. According to customer requirement, market value & necessity of product some changes may be done. These changes may vary according tocondition. The future modification is done for improving performance of product & increasing the life of product. For pneumatic vehicle there are lots of scopes to modify the performance, features design.

load carrying capacity

As we know the load carrying capacity of pneumatic vehicle is less. It is due to the low torque developed at low pressure. As the torque is increased the load carrying capacity is also increased this may be done by increasing the pressure in the air receiver tank. This is one of the major & very important modification can be done in the pneumatic vehicle.

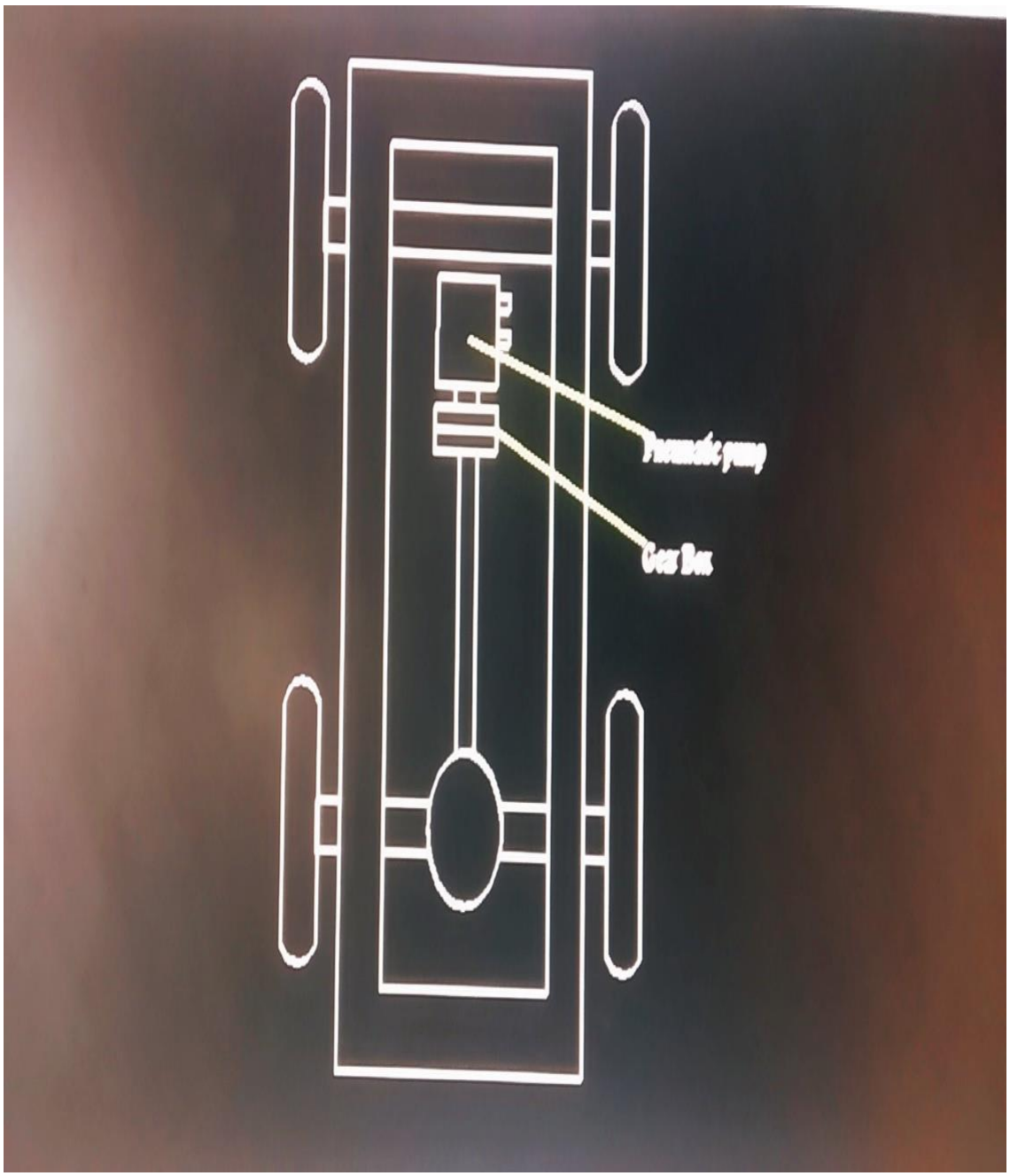
low speed of vehicle

The name itself indicates the function of vehicle but the major drawback of this; vehicle is not running continuously more than 20kmph.To overcome this drawback we can get a continuous motion with more speed by using the solenoid valve with reset timer. Using this mechanism vehicle will move continuously without stop & we can achieve the speed more than 20kmph

large storage space

As we know for working the pneumatic vehicle we require an initial compress air in air receiver tank. This tank is heavy in weight & big in size. Due to this the space as well as the cost is increase. This is not feasible. To overcome this drawback we can use the low weight metal with high tensile strength & to decrease the size with require press we can use the bio-fuel

pnumatic transmission raised car basic layout



CHAPTER-07

ADVANTAGES, DISADVANTAGES AND APPLICATIONS

advantages

- Compressed air to store the energy instead of batteries. Their potential advantages over other vehicles include:
- Reducing pollution from one source, as opposed to the millions of vehicles on the road.
- Transportation of the fuel would not be required due to drawing power off the electrical grid. This presents significant cost benefits. Pollution created during fuel transportation would be eliminated.
- Compressed air technology reduces the cost of vehicle production.
- There is no need to build a cooling system, fuel tank, Ignition Systems or silencers.
- The mechanical design of the engine is simple and robust.
- Low manufacture and maintenance costs as well as easy maintenance.
- Compressed-air tanks can be disposed of or recycled with less pollution than batteries.
- The tank may be able to be refilled more often and in less time than batteries can be recharged, with re-fueling rates comparable to liquid fuels.
- Lighter vehicles would mean less abuse on roads resulting in longer lasting roads.
- The price of fueling air powered vehicles will be significantly cheaper than current fuels.
- Refueling can be done at home using an air compressor

disadvantages

- Like the modern car and most household appliances, the principal disadvantage is the indirect use of energy.
- The temperature difference between the incoming air and the working gas is smaller. In heating the stored air, the device gets very cold and may ice up in cool, moist climates.
- Refueling the compressed air container using a home or low-end conventional air compressor may take as long time.
- Tanks get very hot when filled rapidly. It very dangers it sometime bloused.
- Only limited storage capacity of the tanks. So we not take drive on long time.

applications

- Two wheeler Application
- Four wheeler Applications

CHAPTER-08

CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between the institution and the industries.

We are proud that we have completed the work with the limited time successfully. The DESIGN AND ANALYSIS OF PNEUMATIC AIR POWERED CAR working with satisfactory conditions. We can able to understand the difficulties in maintaining the tolerances and also the 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 a “PNEUMATIC TRANSMISSION OF AIR POWERED CAR’’

CHAPTER-09

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