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Movable Pneumatic Crane

Sunil Kumar Jena
Professor,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Anandapuram, Vizag.

S.Uday Kumar
Student,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Anandapuram, Vizag.

S.Mani Shankar
Student,
Department of Mechanical Engineering,
VITS College of Engineering,
Sontyam, Anandapuram, Vizag.

INTRODUCTION TO PNEUMATIC

1.1 Introduction to Pneumatic

Pneumatic" redirects here. For the highest order of humans in Gnosticism, see Pneumatic (Gnosticism).Pneumatics is a section of technology that deals with the study and application of pressurized gas to produce mechanical motion.Pneumatic systems used extensively in industry are commonly powered by compressed air or compressed inert gases. A centrally located and electrically powered compressor powers cylinders, air motors, and other pneumatic devices. A pneumatic system controlled through manual or automatic solenoid valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors and actuators.Pneumatics also has applications in dentistry, construction, mining, and other areas.

Gases used in pneumatic systems:

Pneumatic systems in fixed installations, such as factories, use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture removed, and a small quantity of oil is added at the compressor to prevent corrosion and lubricate mechanical components.Factory-plumbed pneumatic-power users need not worry about poisonous leakage, as the gas is usually just air. Smaller or stand-alone systems can use other compressed gases that present an asphyxiation hazard, such as nitrogen—often referred to as OFN (oxygen-free nitrogen) when supplied in cylinders.Any compressed gas other than air is an asphyxiation hazard—including nitrogen, which makes up 78% of air. Compressed oxygen (approx. 21% of air) would not asphyxiate, but is not used in pneumatically-powered devices because it is a fire hazard, more expensive, and offers no performance Advantage over air .Portable pneumatic tools and small vehicles, such as Robot Wars machines and other hobbyist applications are often powered by compressed carbon dioxide, because containers designed to hold it such as Soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air requires. Carbon dioxide is an asphyxiate and can be a freezing hazard if vented improperly.

1.2 Brief History:

Pneumatics have been used for thousands of years, ever since hunters used the blow-gun to take down their prey. Using their lungs, with a capacity around 6000 cubic inches per minute, they could produce a pressure of 1 to 3 psi. The first compressors were seen around 3000 B.C. to provide small puffs of air to aid in starting a fire. These simple devices evolved into larger, more sophisticated units used in metal smelting about 1500 B.C. Around the 18th century, mechanical compressors were capable of developing almost 15 psi. And were able to do more useful work. It was not until the late 18th century that pneumatics began to take off as they were considered a serious industrial energy transfer medium. Many experiments were ran to test the power and expandability of pneumatic systems. A notable experiment, and unsuccessful one, was the attempt to power a mill with compressed air located at a Waterfall 3,000 ft. from the plant site. It was here that the experiment began to fail. Clay pipe, useful for transporting water, was used to connect the compressor to the plant. To the dismay of workers, the pressure needed wasn't enough because the clay pipe wasn't air tight and thus a leakage occurred along the way.Then came along the early 19th century. It was here that compressors were able to reach a higher capacity of 90 psi. And thus more work could be done. Pneumatics were used to power a tunneling project in Mt. Cenis, located in the Alps. If traditional drilling methods were used (manual) the project would have taken upwards of 30 years. Using pneumatic drills, operating on many miles of line, the tunnel was completed in just 14 years and it was Open to traffic in 1871.

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This project caught the attention of many government agencies and they began to talk of compressor stations for city-wide power consumption.Paris was actually the first city to try this in 1888 when a 65 horsepower (HP) rated compressor fed 4 miles of main wire with 30 miles of branch circuits delivering 90 psi. By 1891 the capacity of the motor was increased to 25,000 HP. Making this compressed air available everywhere was soon followed by pneumatic devices everywhere as well. During this time many engineers began to debate on whether compressed air or Electricity would be the main source of power throughout a city and could be expanded into the future world. A technological evolution began where both electricity and pneumatics found their right homes. Electricity would become the most convenient on large-scale energy transmission while pneumatics were used in more industrial applications including power, process, and control services.

In recent years, compressed air has been applied to control circuitry, dental drills, surgery, and many other industrial processes requiring high impacts or blows. Such devices are seen day to day as impact wrenches or pneumatic staplers because they are durable and light-weight. I will introduce you to basic principles and components found In typical industrial pneumatic systems. I will also help you understand basic pneumatic circuits that form the "muscle" in varied applications. Pneumatic systems use pressurized gases to transmit and control power. Pneumatic systems typically use air as the fluid medium because air is safe, low cost and readily available.

1.6 Overview of Pneumatic:
Gases used in pneumatic systems:

Pneumatic systems in fixed installations, such as factories, use compressed air because a sustainable supply can be made by compressing atmospheric air. The air usually has moisture removed, and a small quantity of oil is added at the compressor to prevent corrosion and lubricate mechanical components.Factory-plumbed pneumatic-power users need not worry about poisonous leakage, as the gas is usually just air. Smaller or stand-alone systems can use Other compressed gases that present an asphyxiation hazard, such as nitrogen—often referred to as OFN (oxygen-free nitrogen) when supplied in cylinders. Any compressed gas other than air is an asphyxiation hazard—including nitrogen, which makes up 78% of air.

Compressed oxygen (approx. 21% of air) would not asphyxiate, but is not used in pneumatically-powered devices Because it is a fire hazard, more expensive, and offers no performance advantage over air.Portable pneumatic tools and small vehicles, such as Robot Wars machines and other hobbyist applications are often powered by compressed carbon dioxide, because containers designed to hold it such as soda stream canisters and fire extinguishers are readily available, and the phase change between liquid and gas makes it possible to obtain a larger volume of compressed gas from a lighter container than compressed air requires. Carbon dioxide is an asphyxiate and can be a freezing hazard if vented improperly.

Comparison to hydraulics:

Both pneumatics and hydraulics are applications of fluid power. Pneumatics uses an easily compressible gas such as air or a suitable pure gas—while hydraulics uses relatively Incompressible liquid media such as oil. Most industrial pneumatic applications use pressures of about 80 to 100 pounds per square inch (550 to 690 kPa). Hydraulics applications commonly use from 1,000 to 5,000 psi (6.9 to 34.5 MPa), but specialized applications may exceed 10,000 psi (69 MPa). [Citation needed]

Advantages of pneumatics:

• Simplicity of design and control—Machines are easily designed using standard cylinders and other components, and operate via simple on-off control.

• Reliability—Pneumatic systems generally have long operating lives and require little maintenance. Because gas is compressible, equipment is less subject to shock damage. Gas absorbs excessive force, whereas fluid in hydraulics directly transfers force. Compressed gas can be stored, so machines still run for a while if electrical power is lost.

• Safety—there is a very low chance of fire compared to hydraulic oil. Newer machines are usually overload safe.

Advantages of hydraulics:

• Liquid does not absorb any of the supplied energy.

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• Capable of moving much higher loads and providing much higher forces due to the incompressibility.

The hydraulic working fluid is basically incompressible, leading to a minimum of spring action. When hydraulic fluid flow is stopped, the slightest motion of the load releases the pressure on the load; there is no need to "bleed off" pressurized air to release the pressure on the load.

Infinite availability of the source:

Air is the most important thing in the pneumatic system, and as we all know, air is available in the world around us in unlimited quantities at all times and places.

Easy channelled:

Air is a substance that is easily passed or move from one place to another through a small pipe, the long and winding.

Temperature is flexible:

Air can be used flexibly at various temperatures are required, through equipment designed for specific circumstances, even in quite extreme conditions, the air was still able to work.

Safe:

The air can be loaded more safely than it is not flammable and does not short circuit occurs or explode, so protection against both of these things pretty easily, unlike the electrical system that could lead to fires.

Clean:

The air around us are tend to clean without chemicals that are harmful, and also, it can be minimized or cleaned with some processes, so it is safe to use pneumatic systems to the pharmaceutical industry, food and beverages and textiles.

The transfer of power and the speed is very easy to set up:

Air could move at speeds that can be adjusted from low to high or vice versa. When using a pneumatic cylinder actuator, the piston speed can reach 3 m / s. For pneumatic motors can spins at 30,000 rpm, while the turbine engine systems can reach 450,000 rpm.

Can be stored:

The air can be stored through the seat tube fed excess air pressure. Moreover, it can be installed so that the pressure boundary or the safety of the system to be safe.

Easy utilized:

Easy air either directly utilized to clean surfaces such as metal and machinery, or indirectly, i.e. through pneumatic equipment to produce certain movements.

Some of other advantages are as follows:

1. Air used in pneumatic systems can be directly exhausted back in to the surrounding environment and hence the need of special reservoirs and no-leak system designs are eliminated. 2. Pneumatic systems are simple and economical.
3. Control of pneumatic systems is easier.
4. Wide availability of air.
5. Compressibility of air.
6. Easy transportability of compressed air in pressure vessels, containers and in long pipes.
7. Fire proof characteristic of the medium.
8. Simple construction of pneumatic elements and easy handling.
9. High degree of controllability of pressure, speed, and force.
10. Possibility of easy but reasonably reliable remote controlling.
11. Easier maintenance.
12. Explosion-proof characteristic of the medium.
13. Comparatively cheaper in cost than other systems.

Pneumatic logic:

Further information:Pneumatic circuit Pneumatic logic systems (sometimes called air logic control) are often used for controlling industrial processes, consisting of primary logic units like:

- And Units
- Or Units
- 'Relay or Booster' Units
- Latching Units
- 'Timer' Units
- Sorteberg relay
- Fluidics amplifiers with no moving parts other than the air itself

Pneumatic logic is a reliable and functional control method for industrial processes. In recent years, these systems have largely been replaced by electronic control systems in new installations because of the smaller size, lower cost, greater precision, and more powerful features of digital controls. Pneumatic devices are still used where upgrade cost, or safety factors dominate. MOTORS A motor is a machine which converts energy into rotating motion. The dictionary definition of motor is broader than that but when engineers and mechanics talk about motors they are almost always talking about rotating motion. There are different names for devices which convert energy into other types of motion.

A DC motor is a motor that uses direct electrical current (DC) as the source of its energy. An AC motor is a motor that uses alternating electrical current (AC) as the source of its energy. AC current is the type of electricity provided by household wall outlets. DC current is the type of electricity provided by batteries.A gear motor is a motor with an attached set of gears driving a secondary drive shaft. Practical motor designs result in motors that spin too fast for most uses. As a result, almost all gear sets are used to "gear down" the motor. The geared down drive shaft spins slower than the direct motor drive shaft. The geared down drive shaft also spins "harder". Motor speed is generally measured in revolutions per minute (RPM).

Rotating force is called Torque and for hobby motors is generally measured in inch-ounces or centimetre-grams. For now, just remember that the higher the number the harder the motor turns. Gearing down a motor reduces its RPM (speed) but increases its torque. Gears are generally contained within a housing that protects the gears from interference and which provides a bearing surface for the various gear shafts and drive shafts. The term gear box generally refers to the entire system of gears, shafts, bearings and housing.

When you apply energy to a motor it spins as fast and hard as its design allows for that energy level and output load. If you increase the energy supply it spins faster and harder. If you attach a load the motor will slow down. If you continue increasing the load it slows ever more until the motors capability to work is exceeded. When the extreme load causes the motor to stop it is said to be stalled. Reducing the load causes the motor spin faster. If you entirely remove the load the motor is said to be "free running" and operates at its maximum speed for that input energy level.Electric motors both ac and dc motors, come in many shapes and sizes. Some are standardized electric motors for general-purpose applications. Other electric motors are intended for specific tasks. In any case, electric motors should be selected to satisfy the dynamic requirements of the machines on which they are applied without exceeding rated electric motor temperature. Thus, the first and most important step in electric motor selection is determining load characteristics -- torque and speed versus time. Electric motor selection is also based on mission goals, power available, and cost. An electric motor uses electrical energy to produce mechanical energy.

The reverse process for using mechanical energy to produce Electrical energy is accomplished by a generator or dynamo. Electric motors are found in household appliances such as fans, refrigerators, washing machines, pool pumps, floor vacuums, and fan-forced ovens. They are also found in many other devices such as computer equipment, in its disk drives, printers, and fans; and in some sound and video playing and recording equipment as DVD/CD players and recorders, tape players and recorders, and record players. Electric motors are also found in several kinds of toys such as some kinds of vehicles and robotic toys.The classic division of electric motors has been that of direct current (DC) type vs. Alternating Current (AC) types. This is more a de facto convention, rather than a rigid distinction. For example, many classic DC motors run on AC power, these motors being referred to as universal

WORKING AND PROCESS MADE WELDING:

Arc welding is a type of welding that uses a welding power supply to create an electric arc between an electrode and the base material to melt the metals at the welding point.

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They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes. The welding region is usually protected by some type of shielding gas, vapour, or slag. Arc welding processes may be manual, semi-automatic, or fully automated. First developed in the late part of the 19th century, arc welding became commercially important in shipbuilding during the Second World War. Today it remains an important process for the fabrication of steel structures and vehicles.Electrode Arc welding is used for joining of the MS steel plates. The electrode will act as both electrode and filler material for the fabrication purpose.

Welding of the base plates:

The base plates are welded according to the required area as shown in figures of chapter 5, and this is chosen by us because it is the simplest method of designing the base as its low-cost and it's easy to carry the heavy loads in any situation.

WORKING OF CRANE:

We see many of the trolleys work as either as crane nor as a truck and also our modification is that the crane rotates 3600 degrees in either of the way for easy working and as shown in figures in chapter 05 and also here our vehicle works on a lead battery and it can turn to any side as ordinary vehicle.

Mechanism of 3600:

As the vehicle is running their will be some motion of the gears it helps us to rotate the crane, I had arranged a process that I fixed a motor at the one edge of the base in the centre I fixed at a certain height to fix the motor and I fixed a sprocket to it and I have used the bike chain set for rotation in 3600and opposite to it a big sprocket is assembled with the help of the bearing which is welded to it.

Working of crane:

As crane working with the help of pneumatics is a good idea but its working is to dangerous but I took it to a simple procedure for making a basic model so I have used the syringes for simple working and its procedure is tough of making it but huge loads cannot be applied so we must be careful while we are doing it in any manner.When we apply pressure on the one syringe it automatically applies pressure on the other side and make it to lift the load.

MAKING OF JOINT:

As per our availability we used a simple method of working for joints to move upward and downward so I fixed a no end screws and made it to fix at the edge of bolt with the help of the nuts which make it to work free in motion in any condition and to support the work. I have used the deal wood as a crane work because it helps me to carry high support with low weight in any conditions and also consumes less in energy.

MATERIALS USED FOR MAKING:

M.S.Plate:

We have used a MS flat plate as a base we had used a mesh plate in between them to use as fixed plate which helps us to support the work which is made in other cases.

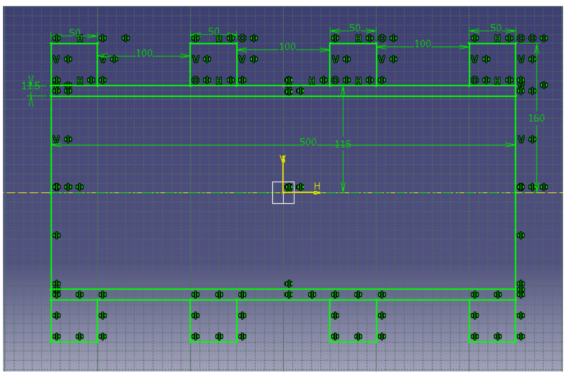
Deal wood:

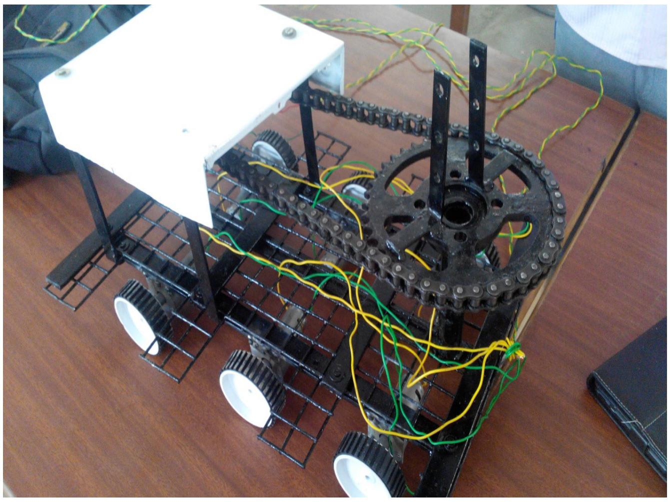
The wood is the cheap source of material and also the best source of sustaining the load but deal wood is the best source for sustaining the load in other cases than any other of material.

Wire:

I have used the silk wire for the working of the material because it helps to make free accessibility in working.

Soft copy of basic base design:





F= (Pcomp – Patm) * π/4(D^2 –d^2)

SNO	Pcomp	Patm	P=(Pcomp – Patm)	A=π/4 (D^2 – d^2)	F=P*A
1	2	1.03297	0.96703	41.3	39.931
2	3	1.03297	1.96704	41.3	81.23
3	4	1.03297	2.96704	41.3	122.53
4	5	1.03297	3.96704	41.3	163.83
5	6	1.03297	4.96704	41.3	205.13
6	7	1.03297	5.96704	41.3	246.43
7	8	1.03297	6.96704	41.3	287.73
8	9	1.03297	7.96704	41.3	329.037

ADVANTAGES:

1. Idle time of the machining is reduced

2. When compared with the mechanical vices it consumes less time for clamping and unclamping the job

3. It reduces the manual labour

4. Hence, the production rate is higher

5. In this mechanism there is no backlash

DISADVANTAGES:

1. Initial cost is high
2. May be chance of air leakage
3. Cylinder stroke length is constant

CONCLUSION:

The project is meant to produce a movable pneumatic crane as a work holding devices for machining operations like lifting, carrying, shifting... etc.We designed a pneumatic crane which costs less than that available in the market. We are very good at what we have done and had fun doing it. Our pneumatic crane is useful to lift loads of 500gms max pressure withstanding. We can do simple operations which is very useful and helpful to do small works at our college.We tested our project on holding the work pieces.

FUTURE EXTENSION:

1. Two cylinders side by side placed in the arrangement leads to hold a greater size work piece for lifting operations also for higher thickness metals.
2. Two adjustable cylinders placed in opposite side results in the holding of all sizes work piece.

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