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## Fabrication of Pneumatic Crane

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### ABSTRACT

This work applies the fabrication of Hydro pneumatic crane (HPC) which can be used for removing and installing heavy objects such as engines and transmissions from vehicles. The intention of using this project work is to gain knowledge in the field of material handling equipment. This work has dealt with the fabrication of the portable jib crane. The main principle of this project is, the hand pump present in the normal hoist crane is replaced with hydraulic cylinder. The hydraulic piston is coupled with pneumatic pistons, and the hydraulic piston is connected to the boom. The pneumatic cylinder is pumped by air compressor. By calculating rated power of HPC and compared with the existing crane we will prove that the system will work under automated condition without compromising the efficiency of the system.

Keywords: Pressure, Bench Vice, Compressor

### 1.Introduction

A crane is a load lifting device that is provided with pulleys and cables. It can be used to raise and lower the load of the semifinished or fully finished components or raw materials. It is generally used in the manufacturing of heavy equipment and in the construction industry. Cranes used in construction may be of usually temporary structures either mounted on a custom built vehicle or fixed to the ground. The cranes can be operated by a worker sitting in a cab which is integral with the crane. Workers either use a radio type controls or a push button pendant control station to control the cranes. It is mostly employed for lifting or lowering heavy products and transferring them to other locations. The device needs one or more convenient apparatus to generate high mechanical advantage and thus lifts or transfer loads beyond the normal capability of a worker. Cranes can be normally utilized in the transport application for the loading and unloading of goods, in the automobile and construction applications for the movement of materials, and in the manufacturing company for the assembling of heavy equipment. It is available various ways or forms – all are made or chosen according to specific purpose or use. The size of cranes varies from the smallest jib cranes being employed in workshops, to the largest tower cranes being employed in tall building constructions. Mini-cranes can also be utilized in tall building constructions for facilitating in doing construction works on reaching some tight locations. Bigger floating cranes can be employed to build oil rigs and salvage sunken ships. Some lifting systems like loader cranes and stacker cranes may not suit for the definition of a crane, but are normally termed as cranes. Pneumatics is also a part of engineering which uses pressurized air or gas to execute it. Pneumatic systems being employed in industry are generally driven by compressed air or inert gases. Cylinders, air motors, and other pneumatic devices are normally powered by a centrally located and electrically powered compressor. If a lower cost, more flexible, or safer alternative to electric motors and actuators are decided, a pneumatic system controlled through manual or automatic solenoid valves may be chosen. In mining, construction, dentistry and other areas, pneumatics may be applied. Hydraulic systems are a combination of hydrostatics and hydrodynamics. Hydrostatics is related to stationary fluids where power is transmitted by pressure energy. Hydrodynamics is related to moving fluids where forces are generated by

motion. Thus in practice a mixture of the two is present; for example, actuator works on a hydrostatic principle, whilst flow through the pipelines to the actuators conforms to hydrodynamic laws.

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## 2.Need for Automation

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

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

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## 3.Pneumatics

The word „pneuma“ comes from Greek and means 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 means 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 will 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 A 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 that of the air at intake conditions namely at Atmosphere pressure and normal ambient temperature. The compressibility of the air was first investigated by Robot Boyle in 1662 and that Found that the product of pressure and volumes of particular quantity of gas. The usual written as  $PV = C$  (or)  $P_1V_1 = P_2V_2$  In this equation the pressure is the absolute pressured which for free is about 14.7Psi And is of courage 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.

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## 4.Procedure

In the normal automobile crane the hydraulic is pumped by centrifugal pump. This pump can only run at high rated current. In our project we are replacing the pump with pneumatic cylinder and secondary hydraulic cylinder which are coupled to each other. The pneumatic piston is pumped by air compressor. And the hydraulic piston is connected to the primary hydraulic. When the pneumatic cylinder is forwarded, the piston arm which is connected to the

secondary hydraulic arm plunges the oil through the pipe to the primary hydraulic cylinder. The pressure is created to lift the boom with weight is suspended with it.

## 5. Working principal

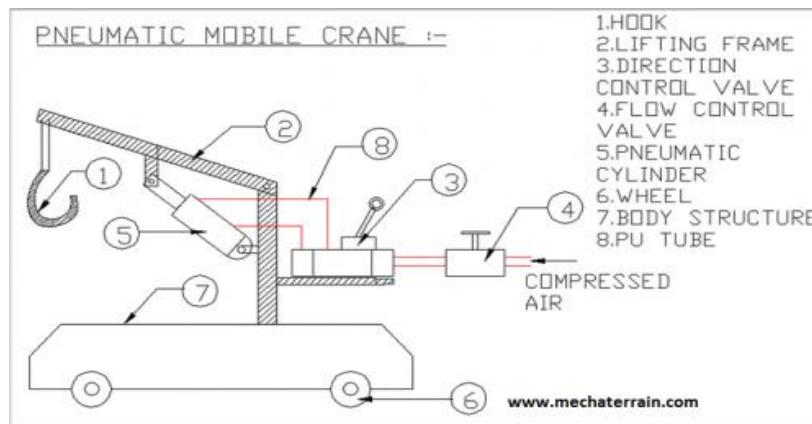
A crane is a mechanism which is commonly used to elevate goods or materials, and is therefore referred to as a lifting mechanism usually equipped with chains or wire ropes, a winder (also called a wire rope drum), and sheaves. A crane is used to carry materials both vertically and horizontally. One or more simple machines are utilized by the crane for creating mechanical advantage and thus, loads which are over the individual capacity or capability will be moved without any problem. The vehicle industries use cranes to load and unload freight; the construction industries use cranes to move materials from one place to a different, and the manufacturing industries use cranes to build heavy equipment.

Cranes are intended keeping in mind two important considerations:

1. The crane should be able to carry a load of a specified weight.
2. The crane ought to remain stable and not fall over when the load is transported to a different location.

Cranes, follow the principle of conservation of energy. Cranes accomplish the task of lifting loads by imparting force from one point to another to create mechanical benefit. The crane does so by using simple machines. Most common simple machines include the lever, the pulley, the pneumatic cylinder and the hydraulic cylinder.

Cranes exist in an enormous variety of forms – each tailored to a specific use. Sometimes sizes range from the smallest jib cranes, used inside workshops, to the tallest tower cranes, used for constructing high buildings. Mini-cranes are also used for constructing high buildings, in order to facilitate constructions by reaching tight spaces. Finally, we can find larger floating cranes, generally used to build oil rigs and salvage sunken ships.



## 6. Components used

### Compressor

An air compressor is a device that converts power (usually from an electric motor, a diesel engine or a gasoline engine) into potential energy by forcing air into a smaller volume and thus increasing its pressure. The energy in the compressed air can be stored while the air remains pressurized. The energy can be used for a variety of applications, usually by utilizing the kinetic energy of the air as it is depressurized.

### Solenoid Control Valve

A solenoid valve is an electromechanically operated valve. The valve is controlled by an electric current through a solenoid: in the case of a two-port valve the flow is switched on or off; in the case of a three-port valve, the outflow is switched between the two outlet ports. Multiple solenoid valves can be placed together on a manifold.

Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. They are found in many application areas. Solenoids offer fast and safe switching, high reliability, long service life, good medium compatibility of the materials used, low control power and compact design.

### Pneumatic cylinders

Pneumatic cylinders (sometimes known as air cylinders) are mechanical devices which use the power of compressed gas to produce a force in a reciprocating linear motion. Like hydraulic cylinders, something forces a piston to move in the desired direction. The piston is a disc or cylinder, and the piston rod transfers the force it develops to the object to be moved.

Engineers sometimes prefer to use pneumatics because they are quieter, cleaner, and do not require large amounts of space for fluid storage.

Because the operating fluid is a gas, leakage from a pneumatic cylinder will not drip out and contaminate the surroundings, making pneumatics more desirable where cleanliness is a requirement. For example, in the mechanical puppets of the Disney Tiki Room, pneumatics are used to prevent fluid from dripping onto people below the puppets.

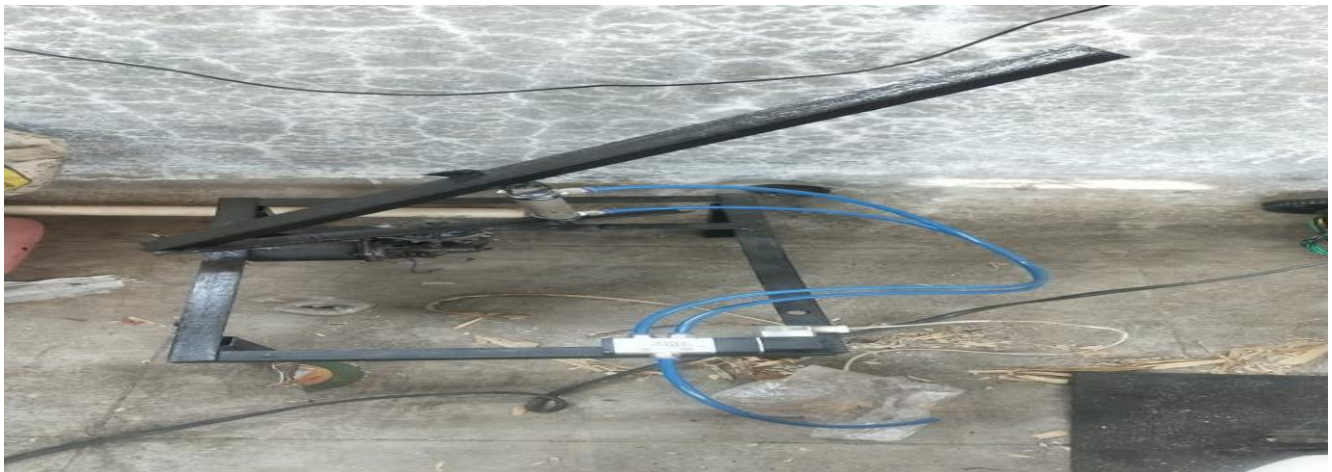
Principle: Once actuated, compressed air enters into the tube at one end of the piston and, hence, imparts force on the piston. Consequently, the piston becomes displaced (moved) by the compressed air expanding in an attempt to reach atmospheric pressure.

### **Battery**

An electric battery is a device consisting of one or more electrochemical cells that convert stored chemical energy into electrical energy. Each cell contains a positive terminal, or cathode, and a negative terminal, or anode. Electrolytes allow ions to move between the electrodes and terminals, which allows current to flow out of the battery to perform work.

Primary (single-use or "disposable") batteries are used once and discarded; the electrode materials are irreversibly changed during discharge. Common examples are the alkaline battery used for flashlights and a multitude of portable devices. Secondary (rechargeable batteries) can be discharged and recharged multiple times; the original composition of the electrodes can be restored by reverse current. Examples include the lead-acid batteries used in vehicles and lithium ion batteries used for portable electronics.

### **Pneumatic crane model**



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## **7. Advantages**

- 1) Air used in pneumatic systems can be directly exhausted back into the surrounding environment and hence the need of special reservoirs and no-leak system designs are eliminated.
- 2) Pneumatic systems are simple and economical.

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## **8. Disadvantages**

1. Pneumatic systems exhibit spongy characteristics due to compressibility of air.
2. Pneumatic pressures are quite low due to compressor design limitations.

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## **9. Conclusion**

Cranes are used to lift heavy loads such as containers, heavy automobile part. Cranes are available in various forms/ways – they are carefully made on their specific use. A size of cranes varies from the smallest jib cranes being employed in workshops to the highest tower cranes being utilized for constructing tall buildings. In this we are using smallest jib crane, in which we adding an additional system the project hydro pneumatic crane can lift greater load under minimum pressure from above justified calculation. Since it is controlled by solenoid switch, the hand pump in existing portable crane is replaced. Therefore we conclude that human force is not needed in this new crane.

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