



# Fabrication of Hydro-Pneumatic Crane for Automobiles

Nagasankar P1\*, Tamilselvi P2, Satheesh Kumar S3, Someshwar D4, Sanjay Murugan G5, Theyagarajan K6

1, 3,,4,5,6 Department of Mechanical Engineering, Vel Tech High Tech Dr.Rangarajan Dr.Sakunthala Engineering College, Chennai-62 India 2 Department of Computer science Engineering, Jeppiaar Engineering College, Chennai –119, India.

\*Corresponding author Email: [karupsshankar@yahoo.in](mailto:karupsshankar@yahoo.in)

## 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:** Cranes, Hydraulics, Pneumatic, transportation, Jib Crane

## 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 semi-finished 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.

## 2. 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 piston which is connected to the boom.

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.

### 3. Hydro pneumatic system

The hydraulic cylinder is actuated by the pneumatic cylinder to lift a loaded with weight. It works under the Pascal's law.

#### 3.1. Diagram



#### 3.1 Working Principle

The pneumatic piston coupled with hydraulic piston. The compressor compresses the air to the pneumatic cylinder to plunge the oil in hydraulic cylinder, which is carried forward to the primary hydraulic cylinder to lift the boom.

#### 3.2 Material Used

Portable jib crane (body)  
 Primary hydraulic cylinder  
 Secondary hydraulic cylinder  
 Pneumatic cylinder  
 Compressor

#### 3.3 Construction

The boom of the jib crane is mechanically connected with hydraulic piston (primary).

The compressor compresses the air to pneumatic cylinder through control valve. This valve ducts the piston to move forward and backward.

The pneumatic piston is coupled with secondary hydraulic piston. The oil flow is from the secondary hydraulic cylinder is directed to primary hydraulic cylinder through flow tube.

### 3.4 Working

When the object required lifting the control switch is switched forward. The air process into the pneumatic cylinder and moves the piston in forward direction. This pressurized the oil and equivalent force is transferred from secondary hydraulic cylinder to primary hydraulic cylinder. When required force attains at the primary hydraulic piston the boom started lifting with weight suspended with it.

### 4. Result and Discussion

The hydro pneumatic crane is tested under various loading condition. The maximum weight 15kg is suspended and reading are noted which are stated below.

These readings includes distance moved by the pneumatic piston, time, input pressure (bar), and distance moved by primary hydraulic cylinder is calculated by formula.  $L_1 = 1.44 \times L_2$ . The pressure is varied using pressure gauge, and run for 30sec with weight constant.

**Table 6.1:** result

S.No.	Pressure (bar)	Time (sec)	Weight (kg)	L2	L1
1	4	30	15	27	38.88
2	6	30	15	56	80.64
3	8	30	15	86	123.84

### 5. 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 exiting portable crane is replaced. Therefore we conclude that human force is not needed in this new crane.

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