



## RESEARCH ARTICLE

### DESIGN AND FABRICATION OF IRRIGATION PUMP OPERATED BY AIR PRESSURE

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#### ABSTRACT

Ever increasing fuel price and unreliable electricity supply hamper irrigated crop production. Pressurized Air operated pump may be one of an alternate the electric motor operated pumps for irrigated crop production in the country. In this project we tried to develop an "IRRIGATION PUMP OPERATED BY AIR PRESSURE". The main objective of this project is to develop an economical Irrigation pump which can be operated by compressed air. Generally, the reciprocating pump operated with compressed air, this project is an attempt to operate centrifugal pump with compressed air. Main advantage of compressed air pump is that no hydrocarbon fuel & electrical power supply required because of no combustion process. The farm mechanization is to carry some of goals like; Project is used to run irrigation pump operated with Air pressure. Irrigation pump is used to take the low-level water to high level with the help of compressed air. Pneumatic actuator acts as a piston and it is operated by solenoid valves. Solenoid valves are operated by electronic timer.

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## INTRODUCTION

Pump is a device that moves fluid by mechanical action this fluid may be liquid or gases. And the pump increases the pressure of a fluid to give it the driving force required for flow. The working principle is usually is that slurry enters the pump through the eye of the rotating impeller which imparts a circular motion. Compressed-air systems account for about 10% of total industrial-energy use for few selected countries as found in literatures. Compressed air is typically one of the most expensive utilities in an industrial facility. The history of Compressed Air Technology (CAT) is not new to industries. The compressed air inside the tank has large amount of energy, and this energy can be used to move the piston of an engine. The back-and-forth movement of piston inside the engine cylinder results in generation of useful work energy. By virtue of this work can operate many machines.

## MODEL CONSTRUCTION

The general operated pumps is used to lift the water from low level area to high level area. The pumps costs about 40,000 rupees but the project of ours is about 20,000 rupees. This model is prepared by to and fro motion of the pneumatic

actuator operated by compressed air. And the impeller casing is connected to the setup of air operated model to lift the water from low level to high level.

Table 1. General Specification of Project Model

Description of Item	Size
Length of the Frame	60 cm
Width of the Frame	40 cm
Height of the Frame	40 cm
Thickness of the Frame	2cm

## HARDWARE USED

**Battery:** The usage of "battery" to describe a group of electrical devices dates to Benjamin Franklin, who in 1748 described multiple Leyden jars by analogy to a battery of cannon. A battery consists of one or more electrochemical cells, which transform stored chemical energy directly into electrical energy. When an external load connects to a battery, electrons cross from the negative to the positive terminal, creating an electrical current.

**ElectronicTimer:** A timer is a specialized type of clock for measuring time intervals. Electronic timers can achieve higher precision than mechanical timers. Electronic timers have digital electronics, but may have an analog or digital display. An electronic timer is now less expensive than many mechanical and electromechanical timers.



Fig. 1. Battery

The Selec 800XC is a DIN rail mount to a socket and are powered from a large choice of AC or DC power options and it is an analog timer that measures 22.5 mm. Its framework comprises of an LED status indicator of relay and power as well as finger-safe terminals. In addition, this device has six time ranges as well as universal supply voltage of 20V AC up to 240V AC and also supply voltage of 12V DC up to 240V DC. These timers offer many different timing functions together with accurate, long-term switching reliability and high current switching contacts. The single or double pole changeover relay output contacts are isolated from the supply voltage.



Fig. 2. Electronic timer (source: directindustry.com)

**Relay:** A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operation.

**Pneumatic Actuator:** The history of the pneumatic actuation system and the hydraulic actuation system dates to around the time of World War II (1938).



Fig. 3. Relay (source:indiamart.com)

It was first created by Xhiter Anckeleman (pronounced 'Ziter') who used his knowledge of engines and brake systems to come up with a new solution to ensure that the brakes on a car exert the maximum force, with the least possible wear and tear. A pneumatic control valve actuator converts energy into mechanical motion. A Pneumatic actuator mainly consists of a piston or a diaphragm which develops the motive power. It keeps the air in the upper portion of the cylinder, allowing air pressure to force the diaphragm or piston to move the valve stem or rotate the valve control element. This pressure is transferred to the valve stem, which is connected to either the valve plug/butterfly valve etc. Larger forces are required in high pressure or high flow pipelines to allow the valve to overcome these forces, and allow it to move the valves moving parts to control the material flowing inside. A pressure transmitter will monitor the pressure in the vessel and transmit a signal from 20–100 kPa. 20 kPa means there is no pressure.



Fig.4. Pneumatic Actuator (source: ebay.com)

**Solenoid 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. Solenoid valves are the most frequently used control elements in fluidics. Their tasks are to shut off, release, dose, distribute or mix fluids. As soon as the coil is electrical energized, a magnetic field is created which pulls the plunger up towards the centre of the coil.

**Bearing:** A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts. Most bearings facilitate the desired motion by minimizing friction. Bearings



Fig. 5. Solenoid valve (source:industrybuying.com)

are classified broadly according to the type of operation, the motions allowed, or to the directions of the loads applied to the parts. A ball bearing is a type of rolling bearing element that uses balls to maintain the separation between the bearing races. The purpose of a ball bearing is to reduce rotational friction and support radial and axial loads. In most applications, one race is stationary and the other is attached to the rotating assembly (e.g., a hub or shaft). 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.



Fig. 6 . Ball Bearing (source:indiamart.com)

**Air Tank:** Air tank is a mechanical component used to store air which posses certain pressure and its own density. Compared to carbon dioxide, compressed air produces a more stable pressure that is better suited to rapid fire and cold weather.



Fig.7. Air tank

**Ball Valve:** A ball valve is a form of quarter-turn valve which uses a hollow, perforated and pivoting ball to control flow through it. It is open when the ball's hole is in line with the flow and closed when it is pivoted 90-degrees by the valve handle. The handle lies flat in alignment with the flow when open, and is perpendicular to it when closed, making for easy visual confirmation of the valve's status. Ball valves are durable, performing well after many cycles, and reliable, closing securely even after long periods of disuse. Other types of quarter-turn valves include the butterfly valve and plug valve and freeze proof ball valve.



Fig. 8. Ball valve (source:in.redelivers.com)



Fig. 9. Fabrication of Irrigation Pump Operated by Air Pressure

## CONCLUSION

- This project is an attempt of Irrigation pump operated with air pressure. The air will be compressed with the help of foot air pump. The compressed air is stored in the storage tank named as air tank. The air tank as capacity of bearing 40 bar pressure and the air tank as diameter of 25cm. General purpose of pump is to convert the low-level water to high level. But this is done with the help no of sources namely electrical power, solar energy, and petroleum products.
- The objective of this project is to develop an economical irrigation pump which can be operated by compressed air. Main advantage of compressed air pump is that no hydrocarbon fuel and electrical power supply required because of no combustion process

- The pneumatic actuator is operated with help of solenoid valves and this valves operated with the help of timer. when the inlet valve of the solenoid valve receive the air then the pneumatic actuator reciprocates in forward direction due to this crank gets rotates.

## REFERENCES

U.S. Energy Information Administration, how much carbon dioxide is produced per kilo watt hour when generating electricity with fossil fuels. Available at: <https://www.eia.gov>. W. Ryan, M. Bolinger.

Modi P.N. and S.M. Seth "Hydraulics, fluid mechanics and hydraulic machinery", 14th Edition, Standard Book House, New Delhi 2002.

Dr. Bansal R.K. "A Text book of Fluid Mechanics and Hydraulic Machines", 9th Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2010.

Rajput R.K. "A text book of Fluid Mechanics and Hydraulic Machines", 5th Edition, S.Chand & Company (Ltd) New Delhi, 2009.

Fluid mechanics by R.K.Bansal R.K.Rajput, "Engineering Thermodynamics", 3<sup>rd</sup> Edition, Laxmi Publications Pvt. Ltd., New Delhi, 2007.

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