Automatic Pneumatic Ramming Machine

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***Abstract*— Moulding is one of the important metals forming process in manufacturing components for various applications in industry. Casting of any size and shape can be made accurately. Automation in this field helps to improve the foundry environment and accuracy of the cast parts. Efficiency of moulding is affected by various parameters like permeability, collapsibility, adhesiveness etc. So it is a must to avoid defects in casting. The defects occur in sand castings post a great problem in foundry. On account of defects more than 10% castings are rejected. Even though skilled labor is employed for ramming operation, the packing of molding sand will not be even throughout the molding box. So we have selected the idea of fabricating "PNEUMATIC RAMMER". This rammer is operated pneumatically. By using this rammer moulding sand will be packed evenly throughout the box.**

Index Terms: **Moulding, Ramming, Pneumatic.**

INTRODUCTION

The pneumatic rammer is used for ramming the sand uniformly around the pattern. It can be used even in small scale industries. To operate this rammer an air compressor is needed. A butt which is attached to the bottom of the piston rod does the operation of ramming. The pressure developed inside the cylinder reciprocates the piston and hence the butt. This rammer is handled by an operator just by moving it over the moulding sand. The butt rams the sand at places moved and the sand is uniformly rammed. This rammer reduces the ramming time and labor. Due to this the cost is reduced considerably. So this machine finds application in foundries.

LITERATURE REVIEW

Sand moulding process

Casting process involving the use of sand as a moulding medium is known as sand moulding. Conventional Ramming Machine:

The cam is actuated by a user by rotating the handle, causing a cam to lift the weight and let it fall freely on the frame attached to the ram head. This produces a standard compacting action to a pre-measured amount of sand.

Variety of standard specimen for Green Sand and Silicate based (CO_2)sand are prepared using a sand rammer along with accessories The sand rammer machine can be used to measure compatibility of prepared sand by filling the specimen tube with prepared sand so that it is level with the top of the tube.

The tube is then placed under the ram head in the shallow cup and rammed three times. Compatibility in percentage is then calculated from the resultant height of the sand inside the specimen tube.

Pneumatics

The word 'pneumatic' comes from Greek and means wind. The word pneumatics is the study of air movement and its phenomena are derived from the word pneuma. Today pneumatics is mainly understood to mean the application of air as a working medium in the industry especially the driving and operating of machines and equipment.

The key part of any facility for the supply of compressed air is by means using the reciprocating compressor. A compressor is a machine that takes in air, and gas at a certain pressure and delivered the air at high pressure. Compressor capacity is the actual quantity of air compressed and delivered and the volume expressed is that of the air at intake conditions namely at atmospheric pressure and normal ambient temperature. The compressibility of the air was first investigated by Robot Boyle in 1962 and that found the product of pressure and volumes of a particular quantity of gas.

The usual written as

$PV = C$ (or) $P_iV_i = P_fV_f$ Where,

P_i =initial pressure V_i = initial volume P_f = final pressure V_f = final volume

In this equation, the pressure is the absolute pressure 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 the pneumatic system but the air is the most used system nowadays. Pneumatic systems used 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 Directional control valves is selected when it provides a lower cost, more flexible, or safer alternative to electric motors and actuators.

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.

Selection of Pneumatics

Mechanization is broadly defined as the replacement of manual effort with mechanical power. Pneumatic is an attractive medium for low-cost mechanization, particularly for sequential (or) repetitive operations. Many factories and plants already have a compressed air system, which is capable of providing the power (or) energy requirements and control system (although equally pneumatic control systems may be economic and can be advantageously applied to other forms of power). The main advantages of an all-pneumatic system are usually economic and simplicity the latter reducing maintenance to a low level. It can have outstanding advantages in terms of safety.

DESCRIPTION OF EQUIPMENT

Compressor

A compressor is an air-producing machine. They collect the air from the atmosphere and are in the running of the machine are the engine. Air compressors are utilized to raise the pressure of a volume of air. Air compressors are available in many configurations and will operate over a very wide range of flow rates and pressures. Compressed air was expelled by primitive man to give glowing embers sufficient oxygen to allow them to flare up into a fire. During the compression process, the temperature increases as the pressure increases. This is known as polytypic compression. The amount of compression power also increases as the temperature increases. Compressors are staged thereby reducing the temperature rise and improving the compression efficiency. The temperature of the air leaving each stage is cooled before entering the next stage. This cooling process is called intercooling. Volumetric efficiency also increases with multi-stage compression since the pressure ratio over the first stage will be decreased. The selection of the air compressor is only the first step in designing an efficient and reliable compressed air system. The air exiting the compressor is saturated with moisture and will have compressor lubricants (lubricated compressors only).

Double acting cylinder

A double-acting cylinder is employed in control systems with the full pneumatic cushioning and it is essential when the cylinder itself is required to retard heavy messes. This can only be done at the end positions of the piston stroke. In all intermediate positions, a separate externally mounted cushioning derives must be provided with the damping feature. The normal escape of air is out off by a cushioning piston before the end of the stroke is required. As a result, they sit in the cushioning chamber is again compressed since it cannot escape but slowly according to the setting made on reverses.

The air freely enters the cylinder and the piston strokes in the other direction at full Force and velocity. Pneumatic cylinders are mechanical devices that use the power of compressed gas to produce a force in a reciprocating linear motion. Like pneumatic 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.

Directional control valve

The directional valve is one of the important parts of a pneumatic system. Commonly known as DCV; this valve is used to control the direction of airflow in the pneumatic system. The directional valve does this by

changing the position of its internal movable parts. This valve was selected for speedy operation and to reduce the manual effort and also for the modification of the machine into an automatic machine employing using a Directional control valve. A solenoid is an electrical device that converts electrical energy into straight-line motion and force. These are also used to operate a mechanical operation which in turn operates the valve mechanism. The solenoid is one in which the plunger is pulled when the solenoid is energized. The name of the parts of the solenoid should be learned so that they can be recognized when called upon to make repairs, do service work, or install them.

Hose and Connecters

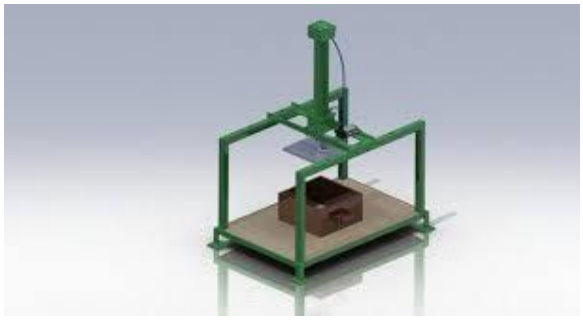
Hoses used in this pneumatic system are made up of polyurethane. This hose can stand at a maximum pressure level of 10 x105N/m2. In our system, there are two types of connectors used. One is the hose connector and the other is the reducer. Hose connectors normally comprise an adopted hose nipple and cap nut. These types of connectors are made up of brass (or) aluminum (or) hardened pneumatic steel. A hose is a flexible hollow tube designed to carry fluids from one location to another. Hoses are also sometimes called pipes or more generally tubing. The shape of a hose is usually cylindrical. Hose design is based on a combination of application and performance.

Working Principle

The compressed air goes to the flow control valve. The flow control valve is used to control the flow of air. It is adjustable one. We have to adjust the lever, so that the required pressurized air goes to the Solenoid Valve.

In our project, the solenoid valve is used as a direction control valve. This solenoid valve is controlled by the electronic control timing unit. The ramming time is varied by adjusting the timing (timer 555 IC) control of the electronic unit.

The compressed air goes to the pneumatic double acting cylinder. The ram is fixed at one end of the pneumatic cylinder. The compressed air pushes the pneumatic cylinder, so that the piston moves downward by giving air supply in one direction of pneumatic cylinder. The solenoid valve is changing the air flow in the opposite direction by the small time delay. In this time the pneumatic cylinder piston moves upward due to changing of the air flow direction. This air flow direction is controlled by the solenoid valve.



MERITS & DEMERITS

MERITS

- It requires simple maintenance.
- Checking and cleaning are easy; because the main parts are screwed.
- Handling is easy.
- Manual power not required.
- Repairing is easy.
- Replacement of parts is easy.
- Lifting cost will be less.
- Free from wear adjustment
- Less power consumption
- Installation is simplified very much

DEMERITS

- Separate air tank or compressor is required.
- Small operations will be carried.

RESULTS AND DISCUSSIONS

The rammer can be handled by an operator without feeling uneasiness. No separate skill is required to operate this rammer. The operation is quick and hence it is a time saving one. The operation is easy and consumes less cost. Due to the above reasons it finds its extensive application in manufacturing industries. It has an extensive application in both large scale and small scale industries because of its economy and easy handling. strength Uniform ramming of sand is obtained by this rammer. The time consumption for ramming is reduced greatly. Skilled labor is not required. Easy operation

It can be transported easily from one place to another since dismantling and assembling is simple. It reduces more labor for ramming operation. Maintenance is easy.

CONCLUSIONS

Uniform ramming of sand is obtained by this rammer. The time consumption for ramming is reduced considerably. It eliminates more labour for ramming operation and hence the labour cost is reduced. Skilled labour is not required to operate this machine. Transportation of this machine is easy. Maintenance is also easy, The reduction of production time and elimination of more labour for ramming operation reduce production cost, thereby the economy is greatly achieved.

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