RESEARCH ARTICLE   OPEN ACCESS

Manufacturing of Eco-Friendly and Fire Resistance Bricks

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Abstract-

An alternative use of fly ash is the manufacture of Eco-friendly and fire-resistance bricks. The goal of this work is to minimize clay extraction and fly ash reuse. Fly ash is collected as waste material in large quantities near thermal power plants, thereby causing significant environmental pollution, using fly ash as the main raw material in brick manufacturing. Fly ash will also not only provide ample opportunities such as 'proper disposal,' but will also lead to greater control of environmental pollution in the surrounding areas of power plants. Pan Mixer and molding machine are the most important part of the bricks factory. One group of brick moulds is in the pressing system. The mixture is provided by one set of moulds, then it is compressed and eventually bricks are made in one revolution of this unit.

Keywords

PLC(Programmable Logic Controller), Pneumatic cylinder, Gear Motor etc.

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INTRODUCTION

Fly ash is the by-product of coal combustion produced by the mechanical or electrostatic precipitator (ESP) until the flue gasses enter very large quantities through the chimneys of thermal power stations.The country's power requirement is growing rapidly with growth in the industrial sectors. India is dependent on thermal power as its main source (around 65 percent of the power produced is thermal power), which also increases the quantity of Ash produced. Indian coal has an average of 30 to 40 percent ash, and this is one of the prime factors that will contribute to increased ash production and, subsequently, problems with the country's use of ash.Pulverized Fuel ash commonly referred to as fly ash is a useful by-product of thermal power plants using pulverized coal as fuel and has significant pozzolonic activity.This national resource has been used for the manufacture of pulverized fuel ash-lime bricks as a supplement to common burnt clay building bricks leading to natural resource conservation and environmental quality improvement. Pulverized fuelash-lime bricks are obtained in large quantities from materials consisting of pulverized fuel ash, lime and accelerator which act as catalysts.Pulverized fuel ash-lime bricks are usually produced by mixing different raw materials into bricks and subjected to specific temperature and pressure curing cycles. Crushed bottom fuel ash or sand is also used in the composition of the raw material on occasion as and when necessary. Crushed ash or sand from bottom fuel is also used as a coarser material in the formulation to control water absorption in the end product. In the presence of humidity, pulverized fuel ash reacts with lime from a calcium hydrate which is a binder material. Thus, in the presence of moisture, pulverized fuel ash – limes form a calcium – silicate hydrate that is a binder material. A pulverized

fuel ash-lime brick is a chemically finished bricksSuch bricks are suitable for use as conventional burnt clay bricks in the construction of masonry. Manufacture of pulverized fuel ash-lime bricks has already started in the country and this quality is expected to facilitate mass production and use.This stand sets out the basic specifications of pulverized fuel ash bricks in order to achieve uniformity in manufacturing these bricks.
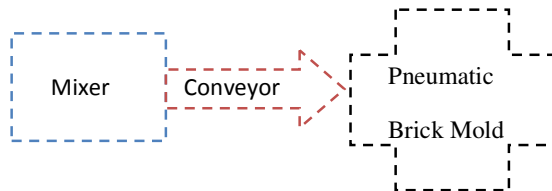

Fig -1: Basic brick making process

Basics of PLC

A programmable controller is a digital device for automating usually electro- processes. Machine control on factory assembly lines, amusement rides, or light fixtures, for instance. PLCs are designed to provide numerous analog and digital input and output arrangements, extended temperature ranges, tolerance to electrical noise, and vibration and impact resistance. Computer process control programs usually are stored in non-volatile memory.A PLC is an example of a "strong" real-time system because output results have to be generated within a limited time in response to input conditions, otherwise it will result in unintended operation.

MicroLogixTM 1200 Programmable logic controller systems are small enough to fit into tight spaces and are sufficiently powerful to serve a wide range of uses. Our controller comes in 24-point and 40-point models. Using rackless I / O modules, you can extend the I / O count. You can construct larger control systems, achieve greater versatility in the application, and extend the system at a lower cost and with reduced inventory of components.

Fig-2:- PLC Panell

Objective of the Work

The basic goal of this study is to build a completely automated fly ash machine making model. That will increased the bricks plant's communication gap and mismanagement. Less numbers of human forces are needed and thus the speed and efficiency of output is increased.

Problems Background

There is a common issue in the bricks manufacturing industry that is lack of contact and the sudden fault that occurred in the system. A loud sound created in industry when the machine is running so that some time works can't hear proper command to on or off the cause of accident. These accidents create economic difficulties.

Second issue is that manually, which is time consuming operation, is performed in conventional bricks manufacturing plant mixing and molding processes. And this operation should be automatic. That will increase the safety efficiency of plants without altering their fundamental ruin procedure.
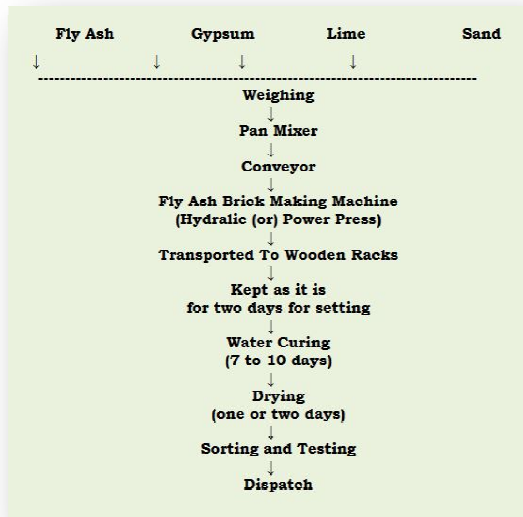
METHODOLOGY

Fig-3:- Flow Sheet Diagram

For intimate mixing, fly ash, lime, sand, and gypsum are fed manually into a pan mixer where the appropriate proportion of water is added.

The raw material ratio is usually 60-80% fly ash, 10-20% lime, 10% gypsum and 10% sand, depending on the consistency of the raw materials.The products are blended together in pan mix. Upon mixing, the mixture is transferred to the pneumatic presses via the belt conveyor. The homogenized mortar extracted from the roller mixer is placed into the mould boxes.

Depending on whether the route is lime or cement, the bricks are dried up under the sun from 24 to 48 hours; the dried up bricks are stacked and subjected to water spray curing once or twice a day;

Hardware Description

Equipment overview includes full process block diagram and circuit diagram of the various electrical connections.
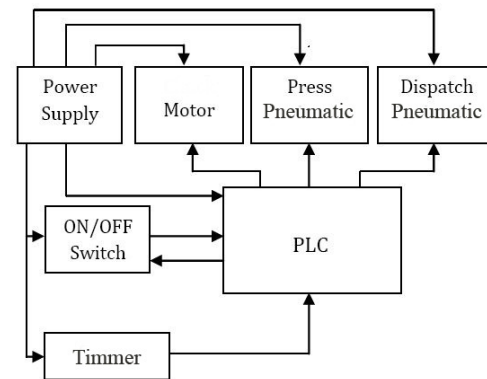

Fig -4: Block diagram of the model

The key components of the proposed model are set out below.

Main motor (DC MOTOR)

It is nothing but a motor with DC gear. A gear motor may be either an electric motor type AC (alternating current) or one type DC (direct current). A gear motor is a specific type of electric motor designed to produce high torque while maintaining low horsepower or motor efficiency at low speed.Gear motors are commonly used in things like openers, door openers for the garage, time control knobs for the washing machine and even electronic alarm clocks.

Pneumatic System

Many industrial applications involve linear movement throughout their sequence of operations. One of the easiest and most cost-effective ways to do this is by using a pneumatic actuator, also called an air cylinder. An actuator is a device which translates a static power source into useful output motion. This can also be used for exerting energy. Usually, actuators are mechanical devices that take energy and transform it into some form of motion. The motion, like blocking, clamping or ejecting, can be in any shape. Pneumatic actuators are mechanical devices that use compressed air inside a cylinder that acts on a piston to drive a charge along a linear path. The working fluid in a pneumatic actuator is actually air, as opposed to their hydraulic counterparts, so the leakage does not spill and contaminate surrounding areas.

Double-acting cylinders have an air port at each end, and push the piston back and forth by rotating the port that receives the high air pressure.
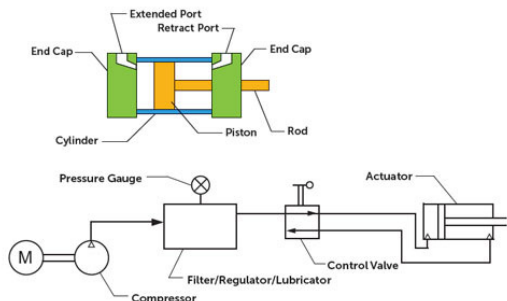
Fig-5: Pneumatic Cylinder Operation

In a typical application, the actuator body is attached to a support frame, and a system device to be moved is attached to the end of the rod. When opening the Retract port to atmosphere, an on - off control valve is used to channel compressed air into the Extended port. The difference in pressure on both sides of the piston results in a force equal to the differential pressure multiplied by the piston surface area.

If the load connected to the rod is less than the resulting force, the piston and rod will extend the machine part and push it through. The valve reversal and the compressed air flow causes the assembly to retract back to the "home" position.

Software Description

The PLC programming implements this automated operation. Ladder Programming is the programming performed in PLC. Ladder Diagrams are similar to diagrams of relay logic describing circuits of relay power. A software written in the language of Ladder Diagram is made up of rungs which are sets of graphical instructions drawn between 2 vertical possible bars. Logic controller executes the rungs sequentially.
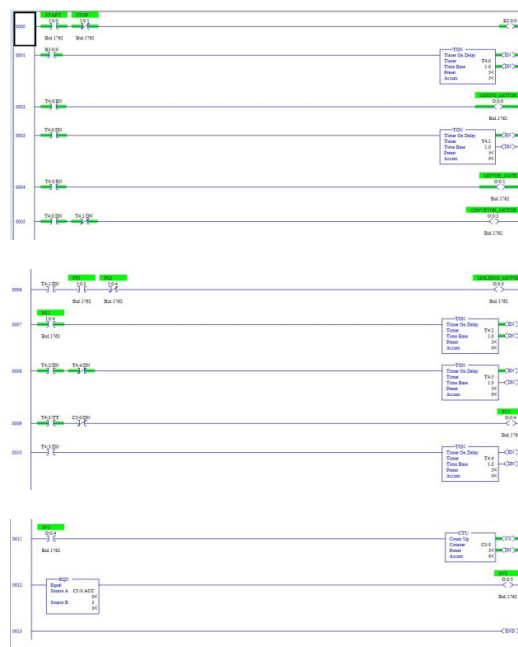
Fig-6: Ladder Program

RESULT

After connecting all brick machine components and their connection with plc the program runs properly in the result section. It shows that our hardware and software can't be difficult to run.

S. No.	Features	Proposed method	Existing method
1.	Time	Time saving (Filling Product, Pressing & ejection)	Time consuming (One step at a time)
2.	Capacity	5000-8000 Daily	1000-2000 bricks a day
3.	Manpower	Manpower reduces (2-3 person)	Manpower is needed for each process (5-8 person)
4.	Safe and faster diagnosis of fault	Safe and secure (operated PLC)	Less secure and faulty

5.	Nos. of moulds	It is possible to increased number by changing the die.(3,6,9.. as available)	Not available
6.	Cost	Installation costs are high but running costs are lower	Installation costs are lower but running costs are high
7.	Function	Automatic service, based on ladder programming	The Press is manually controlled

Table -1: Comparison with the existing method

CONCLUSIONS

Both the operation performed by automated machine but not simultaneously in the case of semi automatic factory. Time slot is given for each process and only the next process which is time consuming process can be done after that. Nonetheless, the proposed brick machine model is completely automated and operated by the programming logic controller.The pressing system has one set of moulding bricks. One collection of moulds receives the mixture, then it is compressed and eventually one brick is made of this unit in one revolution. Thus, the efficiency of this model is increased Complete by implementation. Systems are automatic. Cases of an incident also decrease.

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