

# Automation of Sand Core Drilling Process in Casting Industries

M. Dinesh Kumar

**Abstract-** Casting industries use different types of materials for making materials of complex shapes. Sand core is one of the cost effective methods for such a process. In order to get a shape a sand core is used. Core is a device used in casting and molding processes to produce materials of different shapes. Sand core is a delicate material which is highly prone to damages when handled manually. The productivity is also less due to the damages of manual handling. This paper discusses about the sand core drilling process used in industries manually and automating those processes using rack and pinion method with relay logic control mechanism.

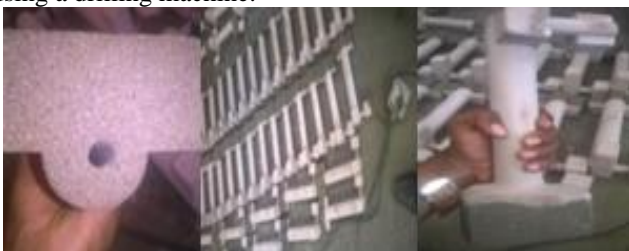
**Keywords:** Sand Core, Industries, Drilling Methods.

## I. INTRODUCTION

Nowadays company use hand drilling machine for drilling the sand core. The workers are drilling the core manually by hand. This project is about automating the process of sand core drilling in the industry [1]. This project involves relay logic for the control of machine. The designed machine will be fabricated and wired in order to drill the cores in the industry [2]. An intriguing example of the use of cores is in the casting of engine blocks [3]. For example, one of the GM V-8 engines requires 5 dry-sand cores for every casting [4]. The aim of this project is to overcome the problems faced in sand core drilling processes like vent holds cleaning in core shooter, core fixing in high pressure molding line and manual core drilling. The above mentioned problems can be overcome by automating the process of core drilling.

## II. METHODOLOGY

Usually the sand core is clamped on to a surface and workers mark the drilling holes and drill holes manually using a drilling machine.



**Fig 1: Drilled Sand Cores. Courtesy of Ammarun Foundries**

A design for automating the process was planned by having the drilling end with a fixture arrangement and moving the sand core through a rack and pinion mechanism.

The motor control of that sand core material is planned to be through relay logic and control.

Rack and pinion method is used with relay logic control. Generally they are used in steering systems of cars to convert rotary motion into linear motion. The plan is to use limit switches for the starting the drilling machine to move forward and backward. The sand core would be clamped on to the other end of the drilling machine. The steps are explained in the figure 2.



**Fig 2: Steps for Sand Core Drilling Automation**

### A. Experimental Setup:

A geared DC motor and a brushless DC motor that can operate at 24V at 25W has been selected to drive this operation. A regular drilling machine is clamped on to a steady surface. The rack and pinion assemble is connected to the motors with design to hold the sand core. A relay and switches along with other drilling accessories are used for this process.



**Fig 3: From Left Planetary geared motor, a relay in the middle and switches on the right**

### B. Design and working:

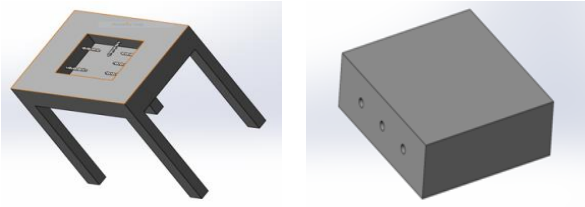
The initial step of the working methodology needs a manual loading and final steps includes a manual unloading but this project focuses on only the drilling process. The fixture that needs to be drilled is place in the drilling machine. The drill bit would sense the presence of the object and initiates the drilling process.

Manuscript published on 30 November 2018.

\*Correspondence Author(s)

M. Dinesh Kumar, Department of Mechatronics, Bannari Amman Institute of Technology, Tamil Nadu, India

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**Fig 4: Left Image of the Drilling Machine, Right Image of the Fixture**

As the drilling process is in progress there will be a limit switch to sense the depth of the drill bit movement. The moment the drill bit activates the limit switch the entire process would be reversed. The fixture would be ready for unloading. This process is repeated again and again. By using this method the wastage of fixture is reduced and productivity is increased.

### III. RESULTS AND DISCUSSIONS



**Fig 5: Image of the Automated Sand Core Drilling Machine**

The drilling machine which is designed will be fabricated and wired through relay logic wiring. The relay control makes this machine low in cost. Through the machine 5 drills can be made in 10 sec which is much lesser than the manual method which takes more than one minute to drill. The cores can be placed in the fixture and the motors are operated through the relay control. This machine can increase the efficiency of production by reducing the time a lot. Further the damages occurred due to the manual drilling can be reduced much through the machine. Since the damage is reduced the cost of quality can also be reduced. This also minimizes the time for production. With the help of this machine the production rate has increased and damages are reduced. This process can further be automated by loading and unloading of fixture being automated.

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