

Automation in Threading Machine

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Abstract - Day by day, the requirement of the finished goods is increased tremendously in the market, so that to meet the requirement of goods the industry has required adopting the automation. Automation plays a major role in the development of the nation. In this paper the conventional threading machine is modified by reducing the manual handling time by means of automation as well as reduces the consumption of coolant oil by design of radiator.

Key Words: automation, timer, contactor, thread rolling, sensor.

1. INTRODUCTION

1.1 Project Idea

Now a day in many industries production of threaded bars by using manual operated threading machines so it required more time and lower efficiency of machine. In order to reduce time and labor costs, we design circuit for automation in threading machine.

1.2 Automation

In today's competitive global economy, manufacturers are experiencing more pressure than ever to automate their production processes. As a result, designers of automation systems face many challenges during system development, some with far reaching consequences that may not initially be realized. The aim of this project is to evaluate these design decisions and present them in a general way which can be applied to other systems and applications. Specifically this project addresses the design of an automatic loading and unloading system for a thread rolling machine, used in producing threaded bars. The design of any Automation system should begin on the macro scale. Issues such as the system's role in the overall manufacturing process and material flow through the plant should be addressed before considering any specific mechanical designs.

In this specific case, it is desired to use the concept of a work cell to plan the overall process in an effort to maximize productivity and minimize costs.

2. LITERATURE SURVEY

M.Muthukkaruppan & K. Manoj, 24TH international symposium automation & robotics in construction, is arc. Low cost automation using electro pneumatic system-an online case study in multistation part transfer, drilling&

tapping machine case study & comparison of productivity of a component using real time multi-stationed automated rotary transfer line used for drilling, tapping.

Sameer chowdhary, o. Burak ozdoganlar, shiv g. Kapoor, richard e. Devor, university of illinois at urbana-champaign, urbana, il 61801, usa modeling and analysis of internal thread forming this paper presents a mechanistic model for the prediction of thrust and torque experienced by a forming tap during an internal thread forming process.

Darshith, Ramesh Babu & Manjunaths.iosr journal of mechanical and civil engineering (IOSR-JMCE) .this paper deals with the thread cutting and thread rolling process for special threads. The various methods of thread cutting and thread rolling process are discussed.

Wagner Matthew - Aerospace fastener production contains many machining and forming operations, such as heading, centerless grinding and thread rolling. Typically many of these processes have been hand fed, especially for large diameter parts. This project presents a general automation plan, based on the concept of a workcell, by which large diameter fastener production processes can be automated. Specifically, an automatic loading and unloading system for a thread rolling machine is developed and prototyped to prove the overall workcell concept.

3. PROBLEM DEFINATION AND OBJECTIVE

3.1 Problem statement

To make automation in thread rolling machine with lesser cost for minimization of worker involvement to reduce labor cost and increase the productivity.

3.2 Objective

1. Develop the automation for the easy and automatic feeding of the work piece.
2. Reduce the effort of carrying and feeding of the rod in machine by worker.
3. To reduce the labor cost by automation one can pay attention to more than one machine.
4. Saving in the time of feeding of work piece.
5. Smooth and efficient working of system.
6. Increase the productivity.

4. METHODOLOGY

4.1 Design of circuit

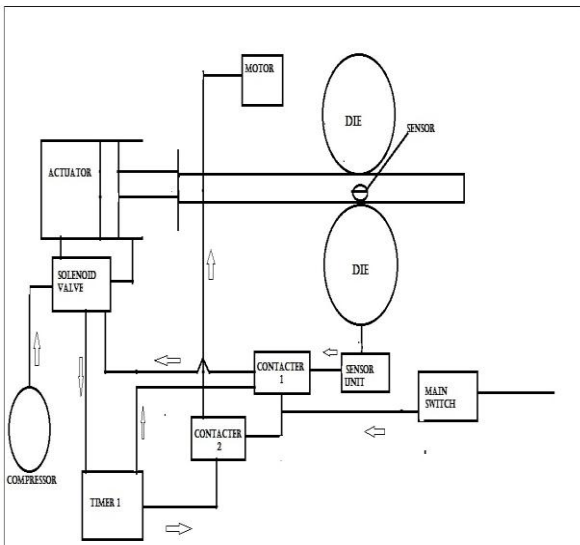


Fig. Circuit Diagram of Automation in Conventional Threading Machine.

When shaft is inserted in the dies , the proximity sensor places in dies gets signal and gives signal to a sensor unit then sensor unit gives signal to a contactor 1.the contactor unit actuated and transfer unit to main switch to solenoid valve which operated the direction control valve. Then control valves flow current from main switch to electric motor .electric motor rotates and material or rod allow air to pass from compressor to actuator which is pneumatic cylinder and reverse stroke is caused .at that time signal is goes to timer and timer gives signal to contactor 2. Contactor 2 allows from platform comes on the control line at the same time timer gives signal to contactor 1 and allows current flow towards solenoid valve and solenoid actuates and pressurized air applies force on the piston and forward stroke is occurred .again the material is passes to the dies and same process is carried out again.

4.2 Component Details Timer

Timer is a circuit breaker element which operated automatically .It's basic function is to interrupt current flow after protective relays detect a fault.



Fig -2: Typical Timer

Sensor

Physical Quantity And Convert It Into It Is The Device Which Sense The Electrical Signal .But In Our Application Proximity Sensor Is Used Which Senses The Presence Of Physical Object Without Any Physical Contact. Magnetic Sensor, Capacitive Sensor, Inductive Sensor Are the Type of Sensor.



Fig.3 Proximity Sensor

Compressor

It is the device which converts the electrical energy into useful mechanical work .the mechanical work may be pressurized fluid or air.



Fig.4 Air Compressor

Actuator

It is a cylinder piston arrangement which forces the rod in forward direction. And it gets energy from compressor.



Fig.5 Actuator

Induction Motor

A synchronous motor type of an induction motor is an ac electric motor in which the electric current in the rotor needed to produce torque is obtained by induction from the magnetic electromagnetic field of stator winding.



Fig.6 Induction motor

Solenoid Valve

A solenoid valve is an electro-mechanical device used for controlling liquid or gas flow. The solenoid valve controlled by electrical current, which is run through a coil. When the coil is energized, a magnetic field, is created causing a plunger inside the coil to move.



Fig.8 Solenoid valve

Contactors

A contactor is an electrically controlled switch used for switching an electrical power circuit, similar to a relay except with higher current ratings. A contactor is controlled by a circuit which has a much lower power level than the switched circuit.



Fig.9 Contactor

4.3 Design Calculation

As per the requirement

Output speed = 20 rpm

Load is required to lift = 150 Kg

1. Selection of motor

From the market survey. We select motor from catalogue which having,

Power = 0.55 KW

N = speed of motor = 1405 rpm

By calculating motor torque

$$P = \frac{2\pi NT}{60}$$

T = torque of motor shaft in Nm

P = power generated by motor in KW

N = speed of motor in rpm

$$0.55 = \frac{(2\pi * 1405 * T)}{60}$$

T = 373 Nm _____ (input torque)

Calculation of output torque

$$\frac{T_i}{T_o} = \frac{N_o}{N_i}$$

T_i = input torque in Nm,

T_o = output torque in Nm,

N_i = input speed in rpm,

N_o = output speed in rpm

$$\frac{3.73}{T_o} = \frac{20}{1405}$$

T_o = 262.03 Nm _____ (output torque)

Force calculation

$$\text{Torque} = F * r$$

F = force which is responsible for the torque in N,

r = distance or radius from the center at which force is acting in m

$$262.03 = (F * 0.15)$$

F = 1746.86 N

F = 178 kg

Selected motor output torque is sufficient to load up to 178

Kg

Design of shaft

Material of shaft –35C8 (medium carbon steel)

Shear yield strength = $S_{yt} = 580 \text{ N/mm}^2$

$$\tau_{all} = 0.75*(0.3*S_{yt})$$

$$\tau_{all} = 0.75*(0.3*580) \\ = 130.5 \text{ N/mm}^2$$

We have

Torque on shaft = 262.03 Nm

By Finding diameter of shaft using shear stress theory,

$$T = \frac{\pi}{16} \times \tau \times d^3$$

$$262.03 = \frac{\pi}{16} \times 130.5 \times d^3$$

$$D = 21.70 \text{ mm}$$

Design of cylinder

Load m = 250 Kg

$$W = 2452.5 \text{ N}$$

Velocity = 0.5 m/s

Swept volume = $v_s = 0.5 \text{ mm}^3$

$$v^2 - u^2 = 2as$$

$$0.1^2 - 0^2 = 2 * a * 0.5$$

$$A = 0.01 \text{ m/s}^2$$

Running force

$$F = F_a + F_s$$

$$F = \frac{W}{g} * a + \mu_s * W$$

$$F = \frac{2452.5}{9.81} * 0.01 + 0.15 * 2452.5$$

$$F = 370.375 \text{ N}$$

$$p = \frac{F}{A}$$

$$p = \frac{370.375}{0.005026}$$

$$p = 73700 \text{ Pa}$$

Pressure = P = 1 bar

$$\text{Annual area } A_a = \frac{\pi}{4} (D^2 - d^2)$$

$$= \frac{\pi}{4} (0.08^2 - d0.04^2)$$

$$\text{Annual area} = A_a = 3769 \text{ mm}^2$$

Flow requirement

Approach 50 cm = 0.5 in 5 second

$$\text{velocity of piston } v = \frac{S}{t} = \frac{0.5}{5} = 0.1 \text{ m/sec}$$

Q = area * velocity

$$= 0.005026*0.1$$

$$= 0.0005026 \text{ mm}^3/\text{sec}$$

$$= 0.5026 \text{ lit/sec}$$

Selection of actuator according to requirement

5. CONCLUSIONS

In automation on threading machine, a human work is replaced by installing automation on thread rolling machine. This entire unit along with framework is mounted adjacent to the existing thread rolling machine effectively. Designed system was tested by working of threading machine using automation to find actual productivity. The time for one job to thread is 6 min.

From results, it can be conducted that the elimination of the human work i.e. worker helps in reduction of labor cost.

Thus the system is reliable enough to produce threaded jobs by elimination of labor cost and increased productivity. However further improvement in job supporting arrangements is required to avoid jerk of the job during loading

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