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Automatic Pneumatic Pick and Place Robot

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Abstract: ***The main aim of this project is to create automation in manufacturing and assembly field. The usage of robotic arm for assembly process in industries will have more benefits. The installation of robotic arm in Salzer Industry in assembly section to quick up process and also to reduce the manual work and time consumption.***

Keywords: Project, Robotic, Salzer Industry.

I. INTRODUCTION

This is an era of automation where it is broadly defined as replacement of manual effort by mechanical power in all degrees of automation. The operation remains an essential part of the system although with changing demands on physical input as the degree of mechanization is increased. In semi automation a combination of manual effort and mechanical power is required whereas in full automation human participation is very negligible.

II. PROBLEM IDENTIFICATION

In Salzer Electronics, the current assembly system, prismatic joints are used to assemble the switch gear components. There are constraints on the plastic casting, loading and unloading the casting is done manually which is time consuming, also there is no feedback system for the conveyor movement. This is the problem identified in the assembly section. Hence the automation system is to be implemented in the switch gear assembly unit.

III. PROCESS CHART

S. No	Component Name	Material	Tool used	Machines used	Process	Instruments Used
1	Piston rod	EN 8	Turning tool	Lathe	Turning Grinding Hard chroming	Vernier Caliper
2	Bracket	EN 8	Turning tool	Lathe	Turning	Vernier Caliper
3	Tie rod	EN 251	Turning tool threading tool	Lathe	Turning Threading	Vernier Caliper Micrometer
4	Piston rod	EN 8	Turning tool, grinding tool	Lathe Grinding machine	Turning Grinding Hard chroming	Vernier Caliper Micrometer
5	Rack	MS	Turning tool disc cutter	Lathe, milling machine	Turning, Teeth cutting	Vernier Caliper Micromete
6	Pinion	MS	Turning tool teeth cutter	Lathe, milling machine	Turning, Teeth cutting	Vernier Caliper Micrometer
7	Square Block	MS	Turning tool boring bar	Lathe	Turning, boring	Vernier Caliper

IV. DESIGN CALCULATION

A. Design of Cylinders:

Horizontal, vertical, rotary cylinders & arm lifting cylinder are of same design and selected from the product catalogue (Janatics pneumatic products). Cylinders are of double acting type.

So double acting cylinders are preferred. This time interval cannot be achieved by single acting cylinders. Design of horizontal, vertical & rotary cylinders. According to the applications the forward and return stroke of the piston has to be controlled with some time interval.

Force to be exerted is 40N

Force = pressure×area

Pressure in the cylinder = 0.4×10^5 N/m^2

Area of the piston, $(\pi d^2)/4$ = Force/pressure

= 40/ 40000

= 0.001m^2

Bore diameter = 0.0356m

= 35.6 mm

From Janatics pneumatic products catalogue we have selected 40mm bore diameter cylinder

For forward stroke:

For 40mm bore diameter

Corresponding rod diameter = 16mm

Area of the piston = $(\pi d^2)/4$

= $(\pi x 40^2)/4$

=

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1256.8mm2

Force (modified) to be exerted

= pressure ×area

=0.4x10^5 x1256.8

= 50N

For return stroke:

On the return stroke, when the pressure is applied to the reverse direction, the force on the piston due to the pressure is = P ×(A-a)

Where,

P = Pressure in the cylinder (N/m^2)

A = Area of the piston (m^2)

A = Cross sectional area of the piston rod (m2)

Therefore

Area of the piston (A-a)

= {(π× d^2)/4}-{(π× d_1^2)/4}

={(π× 40^2)/4}-{π (×16^2)/4}

= 1256.6-201

= 1055mm2

Force to be converted

on the reverse direction = pressure×area

=0.4×10^5×1055

= 42.2 N

For working pressure of 0.4×10^5 N/m^2

Extending force = 50.3 N

Retracting forc = 42.2 N

B. Design of Arm Lifting Cylinder

Force to be exerted is 30 N

Force = pressure×area

Pressure in the cylinder = 0.4×10^5 N/m^2

Area of the piston = (π ×d^2)/4

= 30/0.4×10^5

= 0.75×$10^{-3}$$m^2$

= 750mm^2

Bore diameter = 27.38 mm

From Janatics pneumatic product catalogue we have selected 32mm as bore diameter of arm lifting cylinder

For forward stroke

For 32 mm bore diameter

Corresponding Rod Diameter = 12mm

Area of the Piston = (π ×d^2)/4

= (π ×12^2)/4

= 804 mm^2

Force to be Exerted = pressure×area

= 0.4×10^5 × 804

= 32.2 N

For return stroke

On the return stroke, when the pressure is applied to the reverse direction,

The force on the piston due to the pressure is

= P×(A-a)

Therefore

Actual area of the piston (A-a)

= {(π×d^2)/4}-{(π× d_1^2)/4}

= {(π×40^2)/4}-{π (×12^2)/4}

= 804-114

= 690 mm^2

Force to be exerted in the reverse direction

= Pressure× area

= 0.4 ×10^5 ×690

= 27.6 N

For working pressure of 0.4×10^5 N/m^2

Extending Force = 50.3 N

Retracting force = 42.2 N

V. ADVANTAGES

1) The pneumatic arm is more efficient in the technical field.
2) Quick response is achieved.
3) Simple in construction.
4) Easy to maintain and repair.
5) Cost of the unit is less when compared to other robotics.
6) No fire hazard problem due to over loading.
7) Comparatively the operation cost is less.
8) The operation of arm is faster because the medium used to operate is air.
9) Continuous operation is possible without stopping.

VI. CONCLUSION

Thus we have developed a "PNEUMATIC PICK AND PLACE MATERIAL HANDLING ROBO MODEL" which helps to know how to achieve low cost automation. The capacity of our material handling system is 35 N. The application of pneumatics produces smooth operation. The work volume is produced within the angle of 120º.

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