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DEVELOPMENT OF CONVENTIONAL MILLING MACHINE TO AUTOMATED MILLING MACHINE USING ELECTRO PNEUMATIC SYSTEM

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Abstract- Milling is the mechanical machining process by using the a rotary cutter tool which is having cutting teeth used for milling material According to of Main spindle position Milling machines are Horizontal and Vertical types In both forms the cutting tool i e Mill Cutter functions the rotary cutting motion Horizontal or vertical axis of rotation of cutter depending upon tool type or form Milling machine is atomized by pneumatic system After turning the Milling is most common method used in modern industry for cutting and finishing the metal parts The object of Milling operation is to achieve the best quality product or part within shorter time with lower manufacturing cost

Keywords––Milling, Electro pneumatic, cutting tool, cutter, automated.

INTRODUCTION

A plain milling machine is transformed into automated one by use of pneumatic component such as Actuators Double or Single acting Direction and Flow Control Valves Various Sensors and along with Electrical Component are used in the pneumatic circuit are such as Push button and limit switch Position transmitter Relays Proximity Sensor Reed magnetic switch and solenoid coil valves Objectives of project is to gain complete Knowledge of the pneumatic system and Pneumatic and Electrical component by which plain machine can be modified into a Semi or completely automate machine Milling is material removal process by using the multi sharp rotary cutter with specific geometry mounted on the machine tool spindle simultaneous movement of work table and Milling cutting head removes the material form the part in contact with cutter

LITERATURE SURVEY

The exact and accurate automation method to be implemented to Increase of productivity quantitative and qualitatively ,improved repeatability and accuracy. The automatic or semi-automatic controls can be electronic, electrical, elector-hydraulic, or mechanical [1].

The old imported machine tools can be thoroughly improved by the modern auto control method and renovation and new procurement cost can be greatly saved by proper design programs. [3, 4].

By means of conducting many experiments it was found in Oklahoma State University that low cost automation is achieved by means of using pneumatic devices [5].

By using micro controllers along with pneumatic devices i.e. the use of electro-pneumatic devices, low cost automation is possible with all the advantages of the automation [6].

A low cost PLC system will provide accurate, timely information to the unit operators. By getting the information of the concerned motor displayed in the control room, the operators have been able to operate the motor closer to its limits and hence getting more yields [7].

stated that simplification of engineering practice and precise control of manufacturing process outcome in remarkable cost savings.[10]

Conclusion from the Literature review:

The detailed study of various papers revealed that, this is an easy and low cost way of automating the conventional machine tool which is used for simple work. Keeping in mind the objectives of project it is come to know that any conventionally operated machines can transformed into automatic or semi automatics machines by using automation techniques. By modifying the existing old machines can transformed to semi or fully automatic machine resulting into lower procurement cost. Thus haves more opportunity in automation

GENERAL CONCEPTS ON DEVELOPMENT AND DESIGN OF PNEUMATIC SYSTEMS

3.1 Development of Pneumatic System.

There are different methods for designing pneumatic circuit by engineering and they are given below.

a) Classic method or Intuitive method
b) Cascade method
c) Step counter method
d) Karnaugh–veitch method
e) Combinational circuit design

To control problem solution is carried out according to system ,for this required comprehensive and supplementary documents which perform an important role in circuit design. [2]

Comprehensive Documents	Supplementary documentation
i) Function diagram ii) Circuit diagram iii)Summarization of the operation of the system iv) Technological input of the components.	i)Component list of all devices in the system ii) Remedies and fault-finding information iii) Spare parts list

Regardless of which ever method used to built the circuit ,the motto is to achieve proper functioning and reliably operating control with ease of least maintenance by a clear layout and documentation.

Generally more than one actuators are required in sequencing circuit, these actuators movement are sequenced as per application. To check the actuators position and to actuate final control element are achieved by using sensors

3.2 Design of Pneumatic System

Table 3.1 Components List.

Item	Component designation	Qty
1	Mill Head Unit	1
2	Air service unit (Filter regulator Assembly)	1
3	Distributor manifold	1
4	Double-acting cylinders	3
5	5/2 directional control valve Pilot operated	2
6	5/2 double solenoid directional control valve	1
7	Flow control valve, adjustable, for one direction of flow, (not dependent of viscosity and pressure differential) with by-pass check valve	4
8	Hose	1

3.3 Input and Output flow Signals

Name of Cylinder	Input Signal	Output Signal
Cylinder A	Switch(Limit) at home position a0	A +
	Switch(Limit)at home position a1	A –
Cylinder B	Switch(Limit)at home position b0	B +
	Switch(Limit)at home position b1	B –
Cylinder C	Switch(Limit)at home position c0	C +
	Switch(Limit)at home position c1	C –

(+) - Advancing (-) - Retracting

3.4 Functional Diagram (Input / Output flow Signal)

For achieving A+ motion start signal in addition to a0 signal are required

1. A+ action initiate sensor signal a1, utilized for initiate B+ motion
2. B+ action initiate sensor signal b1, utilized for initiate C+ motion
3. C+ action initiate sensor signal c1, utilized for initiate B- motion
4. B- action initiate sensor signal b0, utilized for initiate C- motion
5. C- action initiate sensor signal c0, utilized for initiate A- motion
6. A- action initiate sensor signal a0, utilized for initiate A+ motion

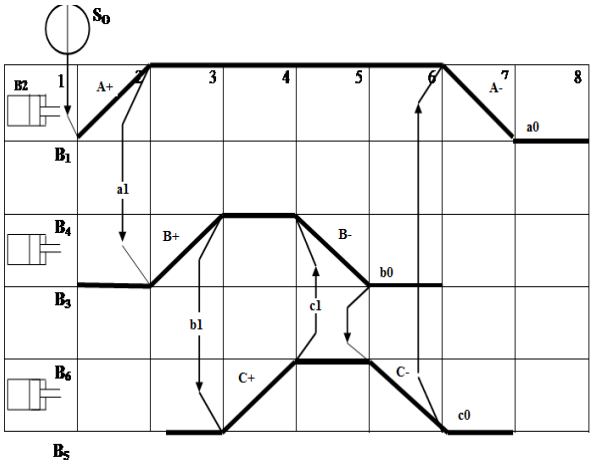
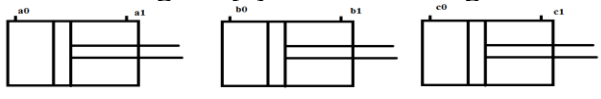


Fig. 3.4(1)Functional Diagram



Clamping Table feeding Saddle movement

Z_1 Z_2 Z_3

Fig. 3.4(2)Sequence of Operation

3.5 Sequential motion of cylinders

It is possible to have the following sequence of operation with three(A, B and C) cylinders

Name of Cylinder			Position		
A +	B	C	Clamping	Idle	Idle
A +	B +	C	Clamping	Machining	Idle
A +	B +	C+	Clamping	Idle	Saddle advancing
A +	B –	C-	Clamping	Machining	Saddle advancing
A–	B	C	De Clamping	Idle	Idle

3.6 Pneumatic Circuit Diagram of Three (03) Double Acting Cylinders [9]

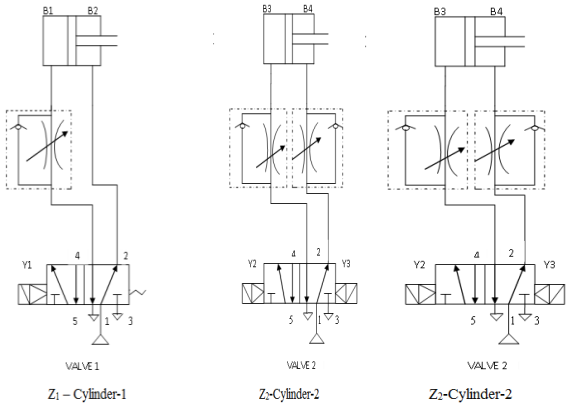


Fig.Cylinder1-Pneumatic Circuit diagram of 1st cylinder (Valve 1- Single solenoid spring return pilot operated 5/2 DCV)

Fig.Cylinder2-Pneumatic Circuit diagram of 2 nd cylinder (Valve 2 -Double solenoid 5/2 DCVs (double piloted))

Fig.Cylinder3-Pneumatic Circuit diagram of 3 rd cylinder (Valve - 3 Single solenoid spring return pilot operated 5/2 DCV)

VFCV - Variable Flow Control Valve

RS - Reset switch - Air Inlet

- Air Exhaust

Planning a flat surface on a milling machine.

The 3 Actuators (double acting) are operated with 5/2 DCV (electrical controlled) impulse valves.

Valves - Provided with visible display and manually hand operated reverse.

Valve 1 and valve 3 are single solenoid spring returned and valve 2 is double solenoid impulse valve.

Valve-1 has the single solenoid coil labeled as Y_1, Valve-2 is labeled as Y2 and Y3 and Valve-3 is labeled as Y4.

When voltage is supplied to solenoid Y1,Y2,Y4 the cylinders extends when voltage applied to Y3 and the voltage is braked to Y1 and Y4 the cylinders starts retract.

All 3 cylinders equipped with cylinder switches with visual display attached at their extent point, they are designated as B1 to B6.

The speed (extension) of the actuators can be illimitable regulated with FCV with combination of Check valve.

OPERATIONAL AND ANALYSIS

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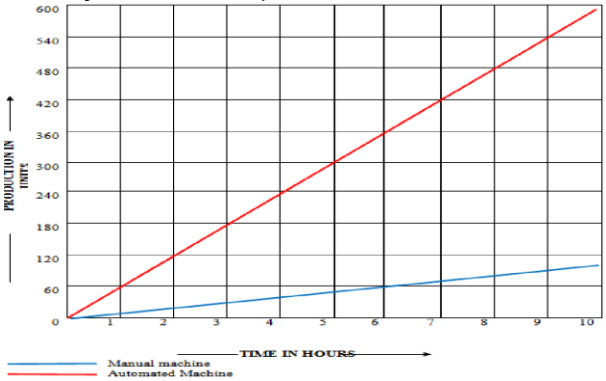
Analysis of cost of Manual controlled and Automated manufacturing machine are taken for comparison on minimum size because cost factor dependent on the size of machine and its cost for manually controlled and automatically operated milling machine are (approximate) 65000/- and 150000/- respectively

Production time Manually operated milling

Let us for a 6cm length machining in a MS material for Manually operated milling machining time 1 min. Loading and unloading time 1 min. total time for machining 2 min. Total production in 1 hour 25 jobs Total production hour in one day 6 hours 125 jobs are completed

Production time Automated Milling Let us for a 6cm length machining in a MS material for automated total time milling machining time 1 min. Total production in 1 hour 60 jobs Total production hour in one day 6 hours 360 jobs.



From the graph productivity rate of two machines understood

As seen from the graph the rate of production is very high in case of automated milling machine.

Comparison of Production Units

Type of Machine	Production In 1 Hrs	Production in 6 Hrs.
Manual	25 Units	125 Units
Automated	60 Units	360 Units

CONCLUSION

The manual operated machine is transformed into Semi automated machine by which productivity increased Also the human intervention is reduced which increase quality of product The number of skilled workers required is also reduced By which One machine operator can operate more the one machine Existing old machine can be transformed and made automated by which the to procurement cost for new automated machines may be reduced The wiring simplification and easy troubleshooting in case of fault can be fulfilled by use of PLC which results in less wiring and more save in time So there is lot of improvement opportunity in the automation filed with latest technology.

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