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EMERGING TECHNOLOGIES IN MACHINE TOOL

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ABSTRACT

Today the machine tool manufacturing industries in the world have been forced to adapt different technologies & methodologies to enhance their productivity & to sustain in the global competition. Indian industries are also in the boom of it.A file manufacturing industry located in India manufacturing various types of files e.g. flat, round, triangular etc. Various operations are performed on these files such as cutting, hardening, grinding, sand blasting, finishing etc. Different types of machines are used to perform various functions. Files are firstly hard by heating in furnace then straightening it on machine then grind it on grinding machine then goes for stamping .After stamping files goes for sand blasting to remove the black burr on it and to give it high surface finish. There is a grinding m/c which is used to grind the files operated by hydraulic power pack which is based upon German technology which is near about 100 years old. There is problem usually with feed rate of the table. As this technology is outdated its maintenance is a problem and also there is low productivity which is biggest problem. This affects the production, quality of files which affects the brand name and profit of said industry. Our aim is to design the new hydraulic power pack which will increase the feed rate of table ultimately enhancing the productivity and quality of files. The focus of writing the paper is to introduce new technology, methodology which enhances the productivity. For this we have made literature review of different concerned industries which gives different results. We have make use of this results in our paper.

Keywords: Industry, Files, Power pack, Profit, Hydraulic power jack.

INTRODUCTION

Now this is an era of developing technologies. Day by day there is development in available technologies, machineries which intensified the market in this globe. Various steps have been taken looking towards this. Everyone is now trying to associate with these changing technologies to produce good quality and quantity product to meet customer requirement and satisfy the customer. Industries began to realize that there is need to improve the productivity within the organization. A file manufacturing industry located in India manufacturing various types of files e.g. flat, round, triangular etc. File manufacturing is being started with raw material in industry. Raw material is a like a long strips of metal about 6 m in length. Depending upon the type of file being manufactured raw material is cut in different lengths. After cutting, cut material is undergoes shot blasting in order to remove the rust. Then these files are undergoes shearing operation depending upon the length of file. After that files goes for tank forging then for annealing in order to impart hardness. Grinding operation then performs on file on grinding machine then subjected to blasting and oiling. Then it is going for forming/cutting operation. Initially file length is taken in excess in order to get the file of exact length it is subjected to point cutting. There are so many operations in which file bent slightly so remove the bent file subjected to straightening. After this files are hardened in furnace and cooled in NaCl solution then files goes for ultrasonic cleaning to remove oil present on files. To sharpen the cuts form on files it is subjected to jet blasting at about 6 bar press with aluminum oxide balls. Here the manufacturing

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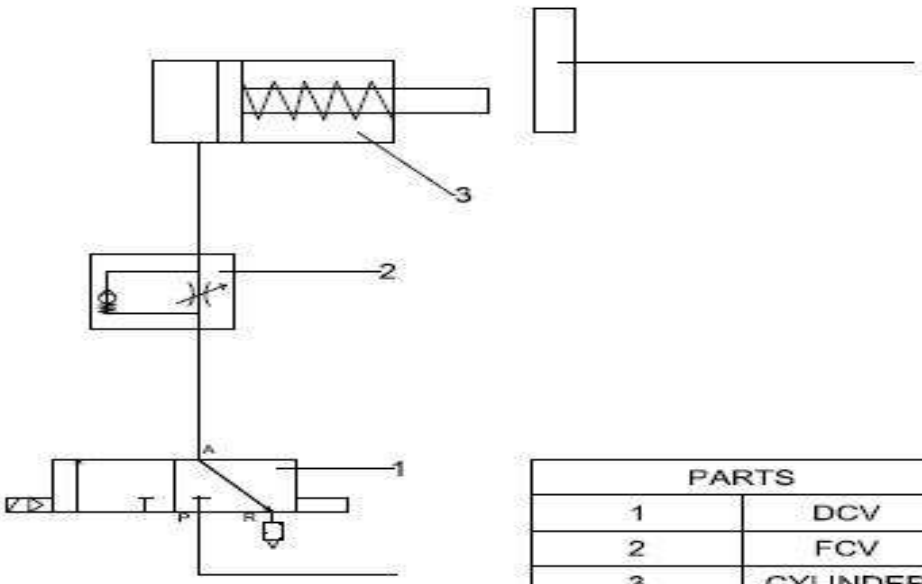
processes of file complete. Files then are inspected and go for laser marking. With this file is manufactured and ready to deliver to market.

NEED OF RESEARCH

There is a grinding m/c which is used to grind the files operated by hydraulic power pack which is based upon German technology which is near about 100 years old. There is problem usually with feed rate of the table. This grinding machine has hydraulic power pack this uses the Bosch diesel pump system with the timing adjustment for pumping the fluid. This is German technology which does not use the standard hydraulics in this system. These system carries various problem associated with its maintenance. There is fast wearing of various parts such as rotor, axial disc etc who's repairing is not done and also there is problem with availability of different spare parts of the system. If the spare parts available then they are more costly beyond the economic limit and also not match perfectly with German power pack. Hence replaceable, wearing parts have fewer life cycles. When pump is repaired its repairing cost is near about rupees 100000/- even after repairing there is problem with machine within 2-3 months. This system has high downtime and gives near about 70% of designed speed and production also up to 70%. There is daily 30% loss with production and profit of company. Hence there is need to develop a standard hydraulic power pack system which will overcome the all above stated problems, improves productivity, increase profit and quality and will be helpful for various industries to improve their status, profit etc and giving special contribution towards developing methodologies and technologies in future scope.



PARTS	
1	DCV
2	FCV
3	CYLINDER

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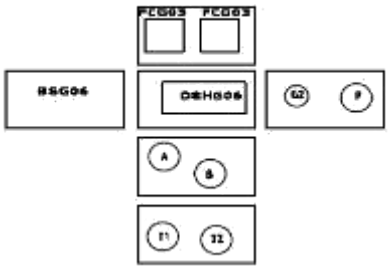
OLD HYDRAULICS SYSTEM

The hydraulic circuit diagram for old power pack is shown below and the pneumatic circuit for actuation of lever is shown below.



CONSTRUCTIONAL DETAILS

The old power pack consists of diesel pump for oil supply which was previously used in trucks for fuel injection. It consists of pneumatically operated cylinder as a directional control valve, damper in order to avoid jerk.

WORKING

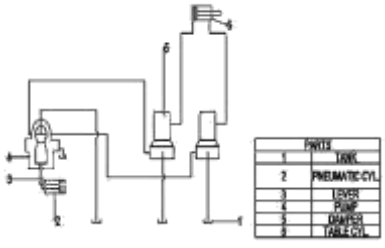
Different parts of power pack perform different functions. Initially pneumatically operated cylinder lifts the lever of pump as lever is lifted pump start supplying oil. When lever is in left position it supply the oil to damper and from damper it is supplied to piston end of cylinder and rod extends towards outside. As the rod extends table of grinding machine is also extends along with the rod. The travelling distance is fixed by the operator through PLC. When table reaches to end position limit switch sense the position and sends the signal to pneumatic cylinder. The DCV of pneumatic circuit takes the second position and air from the pneumatic cylinder is expelled to atmosphere. Cylinder comes back to its original position with due to spring force acting on it. As cylinder comes back to its original position pump lever also come back to previous position. Then pump start supplying oil through the right port to damper and from damper to table cylinder.

The oil present in the cylinder in previous stroke is returns back to the damper. Internally damper consists of piston, as fluid inside the table cylinder comes to damper it exerts force on that piston; the fluid on other side of that piston goes back to tank. This cycle is repeated no of times as per set by the operator. And thus grinding operation is performs on work piece mounted on table.

IMPROVED METHODOLOGY

Because of the no of drawbacks of old technology we have developed the simple hydraulic power pack which overcome the above stated drawbacks and improve the productivity. The block diagram of hydraulic circuit is as shown below.

The above block diagram shows various components of new hydraulic power pack. The name given in the blocks are designation of different parts. The central block is directional control valve (DSHG06), left block is pressure relief valve (BSG06), and right block shows pressure measuring devise (G2) and pump (P). The top block shows flow control valves (FCG03) and bottom block under the directional control valve shows the cylinder sides i.e. piston side (A) and rod end side (B) The block just below the cylinder block shows tank (T1 & T2) which consist of oil. This is a very simple circuit which uses the standard hydraulics and easy to maintained. The actual hydraulic circuit diagram is shown on the page



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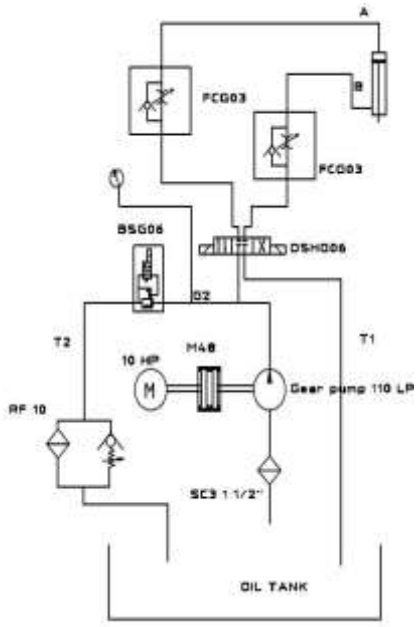

Hydraulic Circuit Diagram

CONSTRUCTIONAL DETAILS

The above circuit diagram shows various components which are used in system. This system is very simple, having low maintenance cost, easy to operate, easy to understand etc. The constructional details are shown in the diagram. It consists of oil tank, two filters i.e. one simple filter and other one with conditional check valve, gear pump which is operated by 10hp motor through the coupling, single pressure relief valve, single directional control valve and single double acting cylinder.

WORKING

Working of this system is very simple. It consists of oil reservoir through which oil is sucked by gear pump. The oil is passes through the filter. The gear pump of capacity 110 lpm is driven by motor of 10 hp through the coupling. The oil is pressurized in pump and supplied to solenoid operated 4/3 directional control valve. When the DCV is in center position, fluid is flows through the pressure relief valve back to the tank.

When DCV is operated to position-I the oil flow from pump to DCV and from DCV to FCV. The check valve in FCV not allowed the fluid to flow through it thus fluid flow through restricted path thus metered flow is given to cylinder piston side and piston is extend towards outside. The large force is required to move the piston outside and this force is given by fluid due to its pressure energy which was imparted to it in gear pump. The motion of cylinder rod is given to table of grinding machine. As the rod extends the table is also move outwards against the grinding wheel force. During this grinding operation is being performed on work piece mounted on table. The travelling distance of table is fixed by operator according to the length of file; table reaches final position and the pump is unloaded through pressure relief valve. After table travel the required distance the position of table is being sense by limit switch and signal is fed to solenoid operated DCV. After sensing the signal, DCV moved to position-II.

When DCV is in position- II, pump flow is then given to the rod end side of cylinder through the FCV. Again in FCV the check valve do not allowed the fluid to flow through it then it passes through restricted path, thus metered flow reaches to rod end side of cylinder. Rod then start to retract and thus table also move back. The fluid which was present in the cylinder piston side is then flow towards the tank through the FCV valve. Again in the flow control valve according to the property of fluid, fluid passes through less resistance path. The check valve in FCV offers low resistance to the fluid and hence fluid passes through it to the DCV. From DCV fluid goes to tank. After rod travel the set distance its position is being sensed by limit switch and signal is processed to solenoid operated DCV, and DCV again move to position-I.

This process is repeated no of times which are set by operator according to file length, surface finish required, material to be removed etc. this process is repeated within the few seconds and table moves to and fro, and grinding operation is performed on

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work piece and higher surface finish is obtained. The required amount of material is removed with lower time then with the old hydraulic circuit.

RESULT AND ANALYSIS

It is found that the after the installation of new power pack the overall productivity is increased. We have collected the different data regarding the production as shown in tables below. From the data we have drawn the different graphs with the help of data collected.

1. Production Vs Shift.

Power pack /Shift	1	2	3
Old Power Pack	830	840	850
New Power Pack	1320	1353	1493

It is clear from the data collected and a graph shows that the production of files is increased with new power pack. It increased the production of files near about by 500 files per shift. This would increases the profit of company

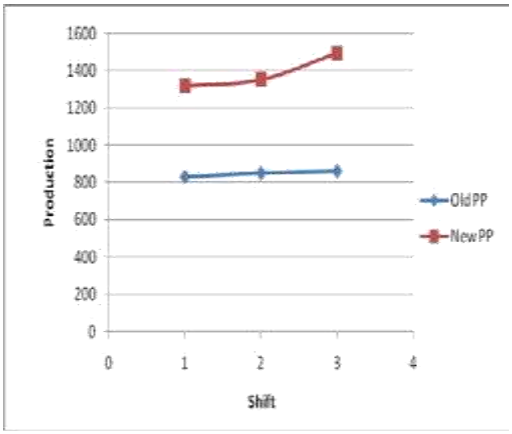
2. Time Vs Cycle.

Cycles	Time(Sec)	
	Old Power Pack	New Power Pack
10	18	11
20	35	23
30	59	35
40	65	44

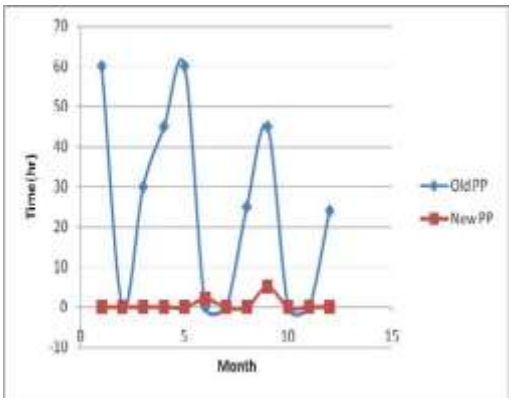
3. Downtime Vs Month

Month	Time(hr)	
	Old Power Pack	New Power Pack
January	60	0
February	0	0
March	30	0
April	45	0
May	60	0
June	0	2
July	0	0
August	25	0
September	45	5
October	0	0
November	0	0
December	24	0

Time required for no of cycles is collected and from the graph it is seen time required to complete the cycles with new power pack is much lower than the time required with old power pack.



Because of the non availability of spare parts and so many reasons the downtime with old power pack is much higher than new power pack. And it is seen that the new power pack is near about maintenance free. The installation cost of this new power pack is near about 250000/- rupees. But looking towards the production, maintenance and quality of files it becomes economical. The installation cost of power pack will recover in near about 4- 5 months and after that it becomes free for owner of power pack.



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CONCLUSION

In this work we have presented the optimum solution to our industrial problems .This new power pack is proved to be the best solution .With this new power pack we have overcomes the all problems related with the old power pack. The above all results show that the installation of new power pack is proved to be economical. The overall productivity has been increased with new power pack. This system makes the profit for industry with the very low initial cost.

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