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Implementation of Hydraulic Quick Die Clamping System

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Abstract: Hydraulic Quick die clamping system (HQDCS) mainly focuses on rapid clamping and unclamping die. It is concerned particularly with the productivity improvement by reducing the timing of die clamp-unclamping. HQDCS is a system, which is a safe, quick and simple way to clamp dies, workpieces. The organizations are facing the problem of reduction in productivity and it is due to maximum loading and unloading time of die. To achieve these objectives there is need to study the various clamping system, hydraulic system and improvement in productivity by HQDCS system. With HQDC system, only button operation is required to lock the die. Die change time would only take a few minutes. A further object of this invention is to provide a hydraulic clamp for quick die clamping of the press machine and makes the use of the already existing hydraulic system. Implementation of HQDCS improves machine efficiency, clamping time and this ultimately improves production rate.

Keywords: HQDCS, Clamping-Unclamping, Productivity, Efficiency.

1. INTRODUCTION

HQDCS (Hydraulic Quick die clamping system) is a system which clamps the die at any position along the length of the T-slot. The QDCS is mainly classified on the basis of various clamping system. The various clamping systems are Hydraulic die clamping system, Pneumatic die clamping system, Magnetic die clamping system, Mechanical die clamping system and Manual die clamping system. The hydraulic clamping system is most commonly used system due to its advantage of clamping the die at a gradual speed. Hydraulic is a system which uses pressurized hydraulic fluid to power hydraulic machinery. If the requirement is a large force and low speed, then the hydraulic system is preferred. If force requirement is less and speed is high pneumatic system is preferred. But in HQDCS system large force is required to clamp the die at a gradual speed. Because of this reason, the hydraulic system is used in HQDCS. Hydraulic system provides a consistent, repeatable force in a relatively small weight and size envelope. This means that in today's manufacturing environment, the workpiece can be secured in less time, with more accuracy and repeatability without sacrificing valuable fixture space. Hydraulic power clamping also provides the manufacturer with flexibility in holding forces and actuator functions to optimize the design for machine operations.

1.1 Problem Statement

1. Currently, most of the industries are using the manual clamping and unclamping of dies on a press machine. It has been observed that manual clamping and the unclamping process is time-consuming, and tedious and creates the fatigue to the worker.
2. According to the production team, the holding of the die is a major issue and pneumatic nut tightening machine is not a proper solution for the same. Because of the more time-consuming process, it affects the production rate.
3. After understanding this problem, the need is arising to implement the hydraulic clamping system. It may help for reducing the clamp and unclamp time and helps to increase the productivity.

1.2 Objective

1. To minimize the clamping time.
2. To analyze the effect of HQDCS for productivity improvement.

3. To improve production rate.
4. To improve machine efficiency.

2. METHODOLOGY

After considering the objectives of the organization, following methodologies are recognized. These objectives are to be implemented for the improvement of the productivity. Different components of the hydraulic system are needed to be studied, for the accurate selection of the hydraulic system. By considering the above objective, it is needed to clamp the die quickly and for that purpose hydraulic cylinder is used. Hydraulic cylinder actuates gradually and clamps the die very accurately. It requires basically four to six hydraulic cylinder as per load capacity.

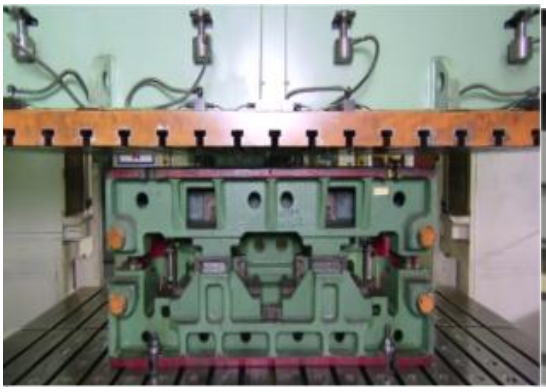

Fig. 1. Hydraulic Quick Die Clamping System

Fig. 2. Hilma Piston-cylinder die clamps [6]

HQDCS offers a reduction in die clamping time as compared to manual die clamping system. The ultimate result of achieving the objective will increase the effectiveness of the product, which results in improving productivity and maintain global competitiveness.

3. CONSTRUCTION

3.1.1 Hydraulic Cylinder

The hydraulic cylinder is a device which converts fluid power into linear mechanical force and motion. It is generally consisting of a movable element such as a piston and piston rod, plunger or ram operating within the cylinder bore.

3.1.2 Reservoir Tank

The hydraulic fluid reservoir holds excess hydraulic fluid to accommodate volume changes from cylinder extension and contraction, the temperature is driven expansion and contraction, and leaks.

3.1.3 Manifold for 6-cylinder arrangement

A hydraulic manifold is a manifold that regulates fluid flow between pumps and actuators and other components in a hydraulic system.

3.1.4 Power Unit (Pump and Power Pack)

The power unit includes a motor, a reservoir and a hydraulic pump, these units can generate a tremendous amount of power to drive most any kind of hydraulic ram.

3.1.5 Pressure reducing valve

The pressure reducing valve (PRV) is a type of valve used to control or limit the pressure in a system or vessel which can build up for a process upset, instrument or equipment failure, or fire.

3.1.6 Direction control valve

Directional control valves are one of the most fundamental parts of hydraulic machinery as well as pneumatic machinery. They allow fluid flow into different paths from one or more sources.

3.1.7 Accumulator

Accumulators are a common part of the hydraulic machinery. Their function is to store energy by using pressurized gas.

3.1.8 Hydraulic fluid which is use (oil) and oil grade detail

Hydraulic fluid, also called hydraulic liquid, are the medium by which power is transferred in hydraulic machinery. Common hydraulic fluids are based on mineral oil or water.

4. WORKING

The whole setup consists of six hydraulic cylinders, power pack unit, pressure gauge, manifold block, hoses, electric motor, and pump. When die is loaded on the machine bed, it is adjusted according to T- slot provided on the bed. After that cylinder is fitted manually on respective slots. After fixation of the die and hydraulic cylinder, the cylinder is actuated using hydraulic pressure to clamp the die. After clamping of dying particular operation or job is finalized. After completion of the operation, the cylinder is retracted and unclamps the die. After that cylinder is manually removed.

RESULTS AND DISCUSSIONS

For the productivity as well as machine efficiency analysis it is required to collect the data of actual working time of the machine, such as clamping and unclamping times and other contiguous allowances. After studying and surveying various products of the different organization following three components are chosen to be studied and analyzing the results namely door panel, bonnet, and fender.

From the day wise collection and analysis of data, it is found that in the case of Door panel as the first product has average manual production of 15859 units compare to HQDCS of 18749 units, so efficiency is increased by 18.22%. The clamping time of the manual system is 19.28 min and in HQDC system is 4.31 min, so the percentage reduction in clamping time is 77.65%. The unclamping time in the manual system is 10.76 min and in HQDC system is 1.39 min, subsequently, it is observed that percentage reduction in unclamping time is 87.09%. Also, the total productivity is increased by 2890 units in case of door panel by using hydraulic cylinder.

The second product is bonnet which has average manual production of 8070units compare to HQDCS of 10279 units, so efficiency is increased by 27.37%. The clamping time of the manual system is 20.38 min and in HQDC system is 4.26 min, so the percentage reduction in clamping time is 79.30%. The unclamping time in the manual system is 11.37 min and in HQDC system is 1.35 min, subsequently, it is observed that percentage reduction in unclamping time is 88.13%. After implementation of HQDCS, it is observed that total productivity is increased by 2209 units in case of the bonnet.

The third product is fender which average manual production of 10446units compare to HQDCS of 11929 units, so efficiency is increased by 14.19%. The clamping time of the manual system is 18.52 min and in HQDC system is 4.24 min, so the percentage reduction in clamping time is 77.11%. The unclamping time in the manual system is 10.07 min and in HQDC system is 1.35 min, subsequently, it is observed that percentage reduction in unclamping time is 86.6%. So that percentage reduction in unclamping time is 86.6% thus total productivity is increased by 1483 units in case offender. By the analysis of various products by manual as well as HQDC system, it witnessed that HQDC System is more effective.

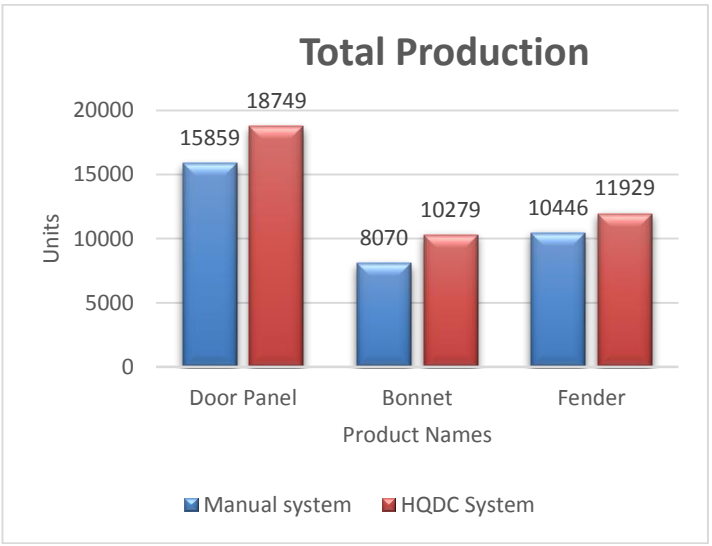

Figure No. 4.1 Total Production Graph

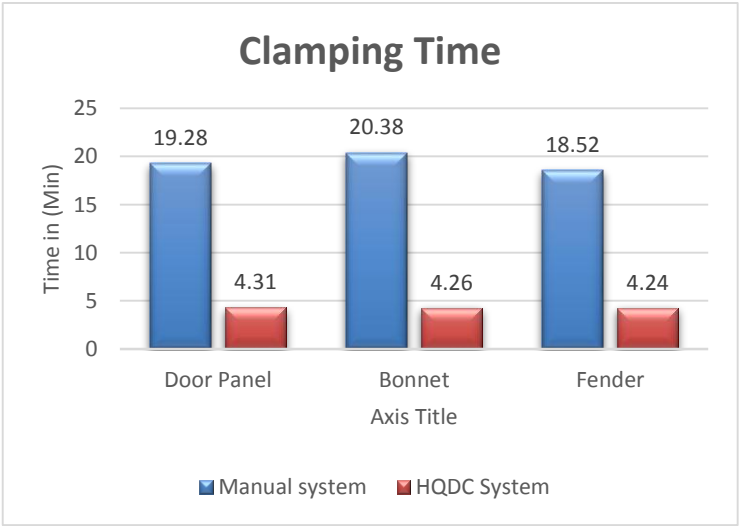

Figure No. 4.2 Clamping Time graph

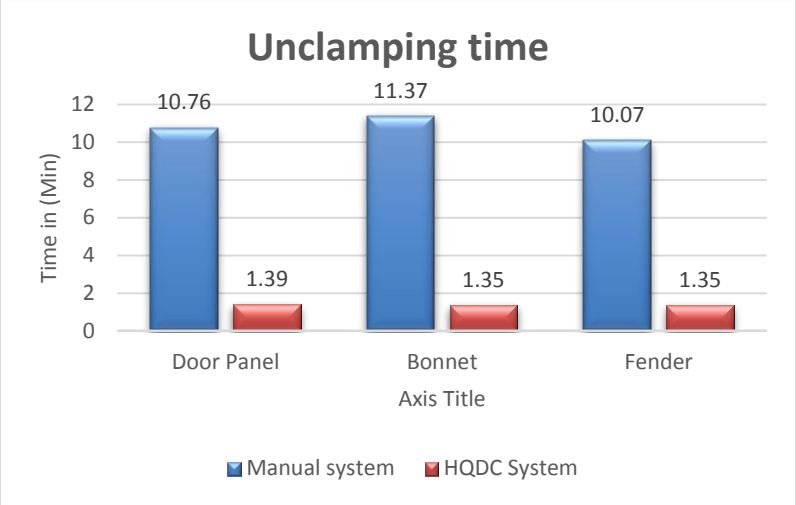

Figure No. 4.3 Unclamping time graph

CONCLUSION

It concludes that from various observations& data analysis the HQDCS is a very effective system in the world of die clamping systems which increases machine efficiency, reduces clamping time which leads to productivity improvement, also reduces the headache of tedious work.

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