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FLEXIBLE CLAMPING FIXTURE WITH REPLACEABLE JAW FOR MANUFACTURING CELL

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ABSTRACT: The modernization of technological processes is affected by the continuous efforts to reduce the production cost. One of the options how to reduce the production cost is to diminish the use of single-purpose process equipment which makes the space for universal process equipment. The use of universal process equipment will help reduce the secondary production times which highly contributes to increase the labour productivity. The paper describes flexible clamping fixture design for manufacturing cell. The main goal was to propose solutions for automatic replacement of clamping jaws depending on the type of workpieces being clamped. To prepare a design layout of replaceable jaws provides the grounds for the project of intelligent fixtures whose development is the scope of the Department of Technological Devices and Systems.

KEYWORDS: centring, clamping, jig, fixture, chuck, jaws, intelligent fixtures

❖ INTRODUCTION

The engineering production economy trend is improving manufacturing operations and eliminates undesirable effects. Productivity is of great importance in the overall production time. This can be reduced by introducing more efficient fixtures, and automating the clamping process. Increase productivity and reduce production costs can be achieved by reducing total production time. Reduce total production time can be achieved by shortening the main production time (cutting time), or secondary production time (time for clamping and positioning of workpieces). Main production time is not always possible to truncate. Therefore, we focus on reducing secondary production times. Reducing secondary production times is especially important for frequent product change in the piece and small batch production. Frequent change in workpiece type and shape requires replacement clamping fixture, or its jaws. Minimize idle time of production in this activity can be achieved by increase efficiency of clamping fixture exchange or its parts.

❖ FLEXIBLE CLAMPING FIXTURE DESIGN

The clamping of workpieces issue is necessary solve particular to manufacturing cells. The reason is product range change in manufacturing cells. For shape and dimensions similar workpieces solution is the choice of universal fixture with replaceable jaws. Replacement of the jaws is provided automatically by turning or replacing the tank. The proposed clamping fixture has two active jaws. Replacement of the jaws is performed by rotating the rotary mechanism. This mechanism is part of the clamping device. The rotation is provided a pneumatic stepper motor, which is inserted into the body of the swivel head. Clamp operates automatically without intervention from outside.

Fig.1 show a flexible fixture conceptual design. Its rotary heads have four different jaws shapes. Worktops jaws are so designed as to be able to clamp non rotating and rotating workpieces. Rotation axis of the jaws has a vertical position. Each jaw is brought into contact with the workpieces by turning on the angle.

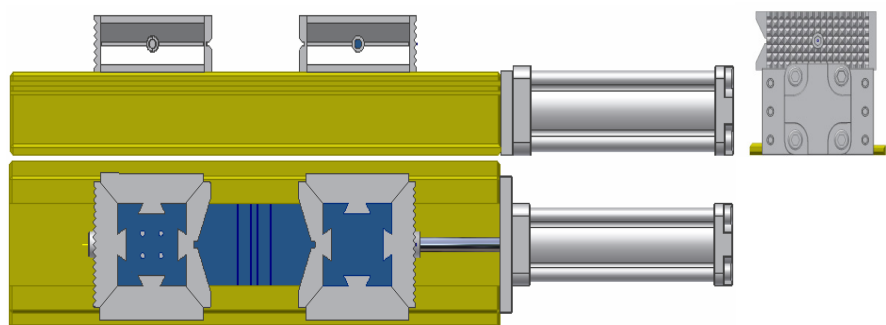


Fig. 1. Flexible clamping fixture with pneumatics actuator

❖ FLEXIBLE CLAMPING FIXTURE STRUCTURE

The clamping fixture consists of a number of structural components (subassemblies). Some of them are free (turntables, or sliding), or firmly attached to the clamping unit. The main function parts of the fixture are:

- guide plate,
- swivel head with jaws,
- jaws movement synchronization mechanism (racks, gear),
- pneumatic cylinder,
- pneumatic rotary actuator.

GUIDE PLATE. The guide plate function is to enable the smooth running rotary heads in their beds, while ensuring adequate stiffness mechanism. In the guide plate are slide assembled racks firmly associated with rotating heads. The racks ensure synchronization of movement or turning heads jaws. The guide plate is firmly attached to the pneumatic cylinder to allow movement of jaws.

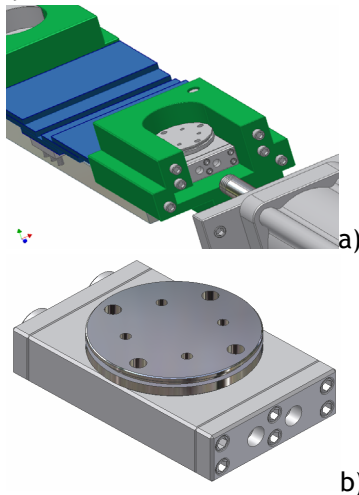


Fig.3 Flexible clamping fixture with pneumatics actuator:
a) Swivel head actuator detail, b) Pneumatic rotary actuator

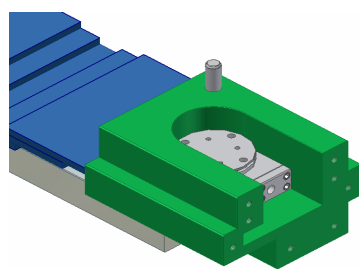


Fig.5 a) Locking pin, b) Implementation of jaw movement synchronization

Locking head swivel is secure in the desired position by locking pin (fig. 4). Locking pin has own built-in pneumatic actuator body heads. It was powered by a tiny single-acting pneumatic cylinder. Reverse cylinder movement is performance by spring. Pin is inserted into the swivel of the head after the completion of rotation.

In fixture designing important task is to synchronize the movement of rotary heads respectively jaws. Perfect centering and positioning the workpiece relative to the instrument is a function of exact positioning and clamping. Designed jaws movement synchronizing mechanism to be workpiece positioned always on one point (the middle of the fixture), while retaining sufficient stiffness and strength of the system. This mechanism uses a gear as shown in Fig. 5b. Force exerted by pneumatic cylinder Fig. 6 b) is directly transmitted to one of the rotating heads (driving).

An important requirement is to prevent the penetration of chips and other contaminants into the mechanism. To avoid penetration of chips was designed telescopic cover (fig. 6a) which is located

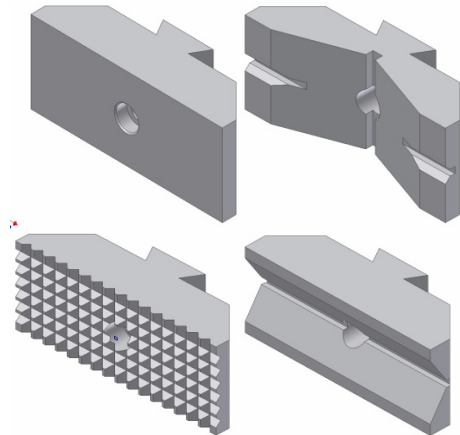


Fig.2. Designed jaws type

SWIVEL HEAD WITH JAW. Swivel head allow automatic exchange four jaw type by rotating of desired angle (90° , 180° , 270° , 360°). The jaws are mounted on the body in rotational head. There are secured with screws against a possible pulled out.

Jaws rotation is ensured by a pneumatic stepper actuator. This is inserted into the body of the swivel head and secured against movement by head plate. Swivel head part is associated with the actuator by bolted joint.

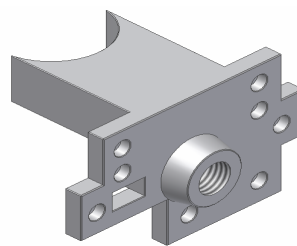


Fig. 4 a) Head plate of swivel head, b) Swivel head part

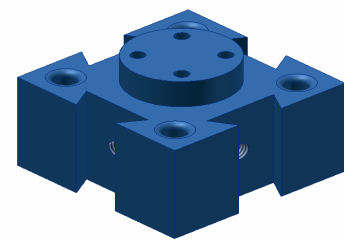


Fig.6 a) Telescopic cover, b) pneumatic actuator (cylinder)

between the swivel head. The cover does not impede movement of the jaws and allows secure and easy cleaning equipment.

❖ CONCLUSIONS

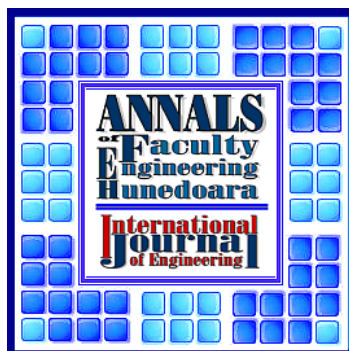
The advantage of the proposed solution with a four flexible fixture clamps is rapid exchange of the required clamping jaws and the ability to shape and dimensions of various types of workpieces. Reduction achieved interoperation times automatically change management jaws rotating around vertical axis increases productivity and work efficiency. The inclusion of this fixture is to facilitate work and reduced servicing requirements.

❖ ACKNOWLEDGEMENTS

The results and such way also the contribution came into existence in connection with MŠ SR grant support of the project VEGA 1/0163/10 – Clamping fixtures in intelligent production systems.

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