

## **CONSTRUCTIVE SOLUTIONS AT THE MODULAR FIXTURE OF THE WORKING PART AT THE FLEXIBLE MANUFACTURING CELL TMA-AL-550**

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**Keywords:** Modular fixture system solutions,

**Abstract:** The present paper work shows the main aspects of the possible constructive solutions of the modular fixture system of the working parts at the flexible manufacturing cell TMA-AL 500 from IMT Faculty laboratory.

### **1. INTRODUCTION**

Modular Fixture components are designed to be interchangeable, hold workpieces during machining and secure the workpiece in the correct orientation relative to the machine tool in industrial applications for reducing time and cost in manufacturing.

The modular system can be used in automated production, workpiece are positioned, fixed and clamped in the work area by robots. [8], [9],

With a modular fixture system workpieces can be affixed quickly, precisely and moved to the next processing step.

A modular fixture system can be actioned: mechanic, hydraulic, pneumatic or electrical.

### **2. DESCRIPTION**

A modular fixture is composed from many modular fixture elements which can be assembled into different configurations for processing a variety of workpiece and can be disassembled after processing batch. [7], [12].

Modular fixture components include items such as:

- tooling plates
- tooling blocks
- stops
- clamps
- modular risers
- work supports

The components of modular fixture system are the tooling plates, or tooling blocks, which are commonly referred to as fixture plates, grid blocks, or "tombstones" fixture [15].

The modular fixture device had the following functional characteristics:

- surface of a palette-palette settlement 300x300 mm, transverse section 250x250mm
- the pocket surface for the work piece is 225x225mm.
- number of device levels 2 on the tombstone fixture;
- number of pieces 8;



**Fig.1. Tooling pallets [10]**



**Fig.2. Four-Sided Tooling Blocks ("Tombstone" type) [10]**

Modular tooling plates contain a grid for locating holes which are used to attach clamping devices, work supports, stops, and any other components necessary for correctly position to the work piece for the application. The tooling plate's multipurpose holes provide increased flexibility for other modular components because they can be located or positioned anywhere on the grid. [10], [12], [13], [16].

This allows for many different set ups to be created on a single fixture plate:



**Fig.3. Frontal view of the detachable plate for modular fixture system [10]**



**Fig.4. Modular fixture system with 2 device level [14]**

Work piece plate is fixed with 4 pull studs placed in square arrangement in order to resist at rollover forces.

Modular fixture system functions at the TMA-AL 550 are:

- clamping piece in tombstone realized by pushing a rod by the gripper;
- releasing of the piece realized by pushed of the opposite rods with gripper at 180 degrees;
- for action or develop action realized by a piston who train in rack two lock profiles.

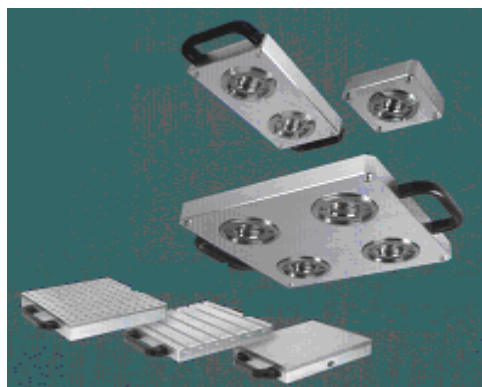
The robot will be equipped with a double swiveling arm at 180°, having two grippers.

The robot grippers are the physical interface by which the robot performs an operation. Flexible grippers come in four categories, in order of adoption: pneumatic, vacuum, hydraulic and electric each with own advantages and disadvantages that make these grippers applicable to specific application

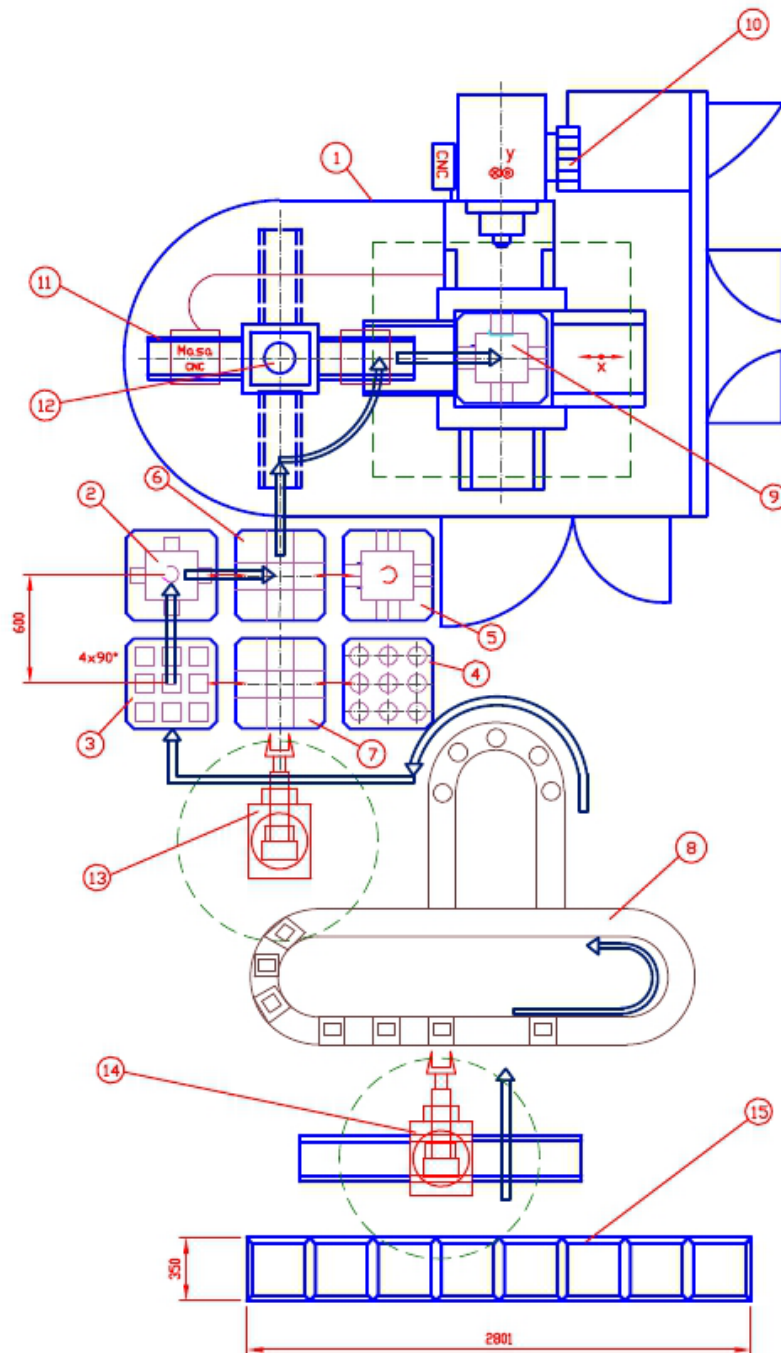


*Fig.5. Present the tree finger angular gripper for the arm of the robot [14]*

The tombstone fixture assembly pocket components the pocket for the piece fixing, which are made by pairs of standard plates male-female, where the female leave the device together the part in order to be transported by the conveyor, and the male remain un the tombstone pocket.



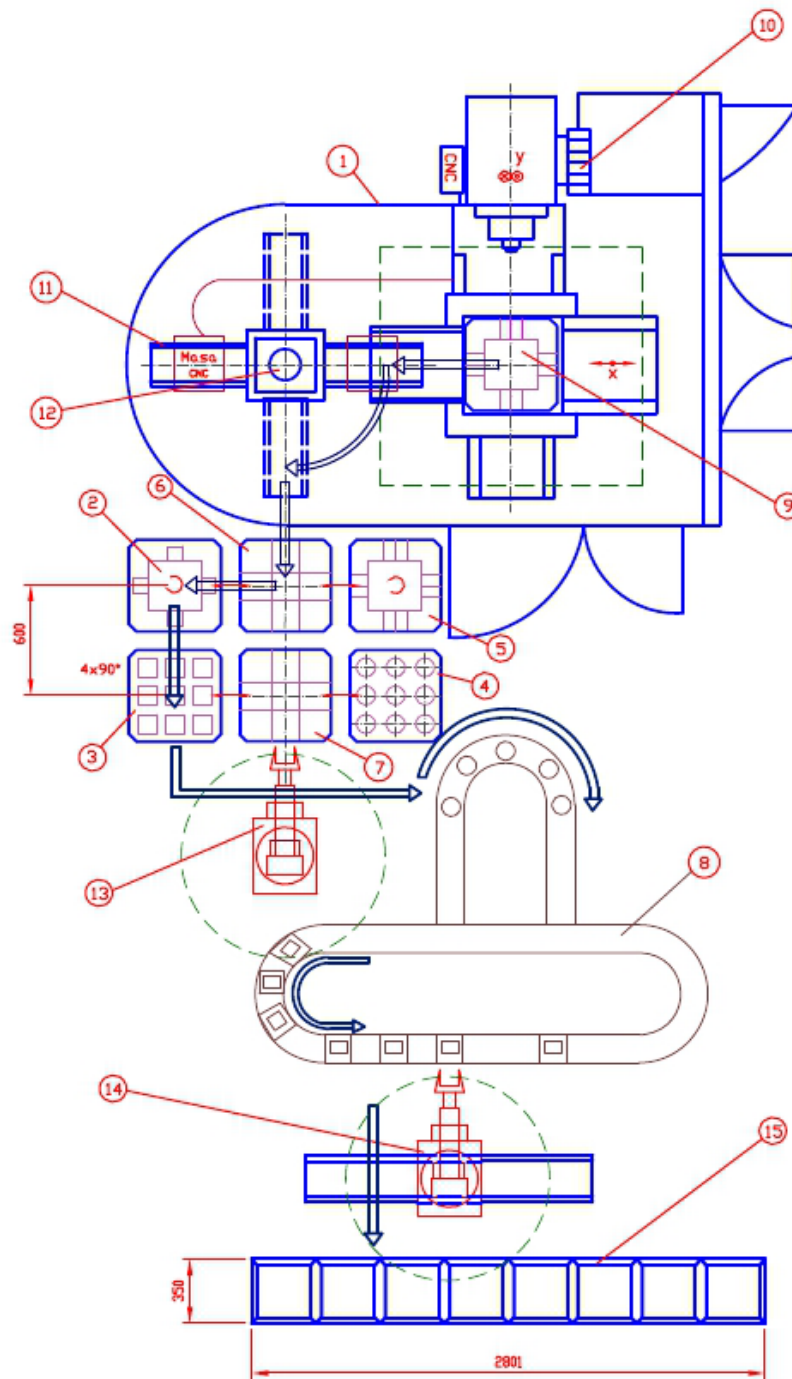
*Fig.6. The standard plate's male-female on tombstone fixture [4]*



**Legend**

- |   |   |
|---|---|
| 1-Flexible manufacturing cell TMA-AL550 | 8-Conveyor                                |
| 2-Tombstone Fixture Load station        | 9-Working table                           |
| 3-AWPC temporary magazine               | 10-Automatic tool changing                |
| 4-ATR temporary magazine                | 11-2 axes rotary table as detachable unit |
| 5-ATR Tool support Load station         | 12-Automatic pallet changing              |
| 6-Pallet Load-Unload station            | 13,14-Robot                               |
| 7-Tool offset caption station           | 15-Regal Lager                            |

**Fig.7.The working parts loading at TMA-AL 550 flexible manufacturing cell, using the modular fixture and assisted by robots**



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**Fig. 8. The working parts loading at TMA-AL 550 flexible manufacturing cell, using the modular fixture and assisted by robots**

The working parts loading flow (fig.2) from Regal lager to Flexible Manufacturing Cell is: - Regal lager (15) – Robot nr.1 (14) - conveyor (8) – robot nr.2 (13) – temporary part support (3) – tombstone fixture (2) – pallet on load station (6) – APC unit (12) – machine working table (9).

The working parts unloading flow (fig.3) from Flexible Manufacturing Cell to Regal Lager is: – machine working table (9) – APC unit (12) - pallet on load station (6) - tombstone fixture (2) - robot nr.2 (13) - conveyor (8) - Robot nr.1 (14) - Regal lager (15).

The AWPC-Automatic Work Piece Changing is the standard function, which means the load-unload of the working parts by the robots on the universal flexible device located on the board of the pallet. [1] , [2], [3] , [5] [6].

The working parts are located on the modular fixture placed in the middle of the pallet, but the part manipulation is done by the robot at the load-unload station.

This tombstone fixture (2) must be loaded-unloaded by the second robot as follow:

- the loading of the new unmachined parts, by receiving from the conveyor
- the unloading of the machined parts, by sending to the conveyor .

This detachable part support/plate leave the machine together the working part, and it is transported by the conveyor to the Regal lager, and also it is introduced into the Regal lager by the first robot, placed in the near.

The second robot take the new unmachined part from the Regal lager together the standard part support/plate in the moment of the launching in the manufacturing process.

### 3. CONCLUSIONS

The authors of the present paper works have realized the new automat part flow for the flexible cell for the prismatic part machining

The authors of the present paper works have realized the new automat part flow for the flexible manufacturing cell for the prismatic part machining based on the TMA AL 550 machines

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