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THE AUTOMATION OF A GUIDANCE AND FIXING DEVICE BY A CONTINUOUS FEEDING SYSTEM IMPLEMENTATION

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***Abstract*—**This paper is based on an applied scientific research, that is achieved by studying the implementation of a device for guiding and fixing, in a flexible manufacturing system. The design and functional optimization of a device for guiding and fixing that exists, by adding a continuous supply system elements, has as purpose to obtain by automation, a big productivity working system. These targets are achieved by the implementation of an automation and mechanization equipment that has the purpose to fill with pieces in an automatic way, a guidance and fixing device with levers that is made to move in an automatic way.

***Keywords*—** continuously feeding system Guidance and fixing device, fixing system, mechanization device, pneumatic drive, transfer system.

I. Introduction

STARTING from document the premise that the mechanization of a working device, contributes to labor productivity growth, the author of this paper aims to, present as a first paper continuation, where was presented the 3D model of a piece that was guided and fixed in the device.

In the next phase I want to present the author's conception of the design of variants of a guidance and fixing device with levers, that is automatic drive. The feeding process of the device with pieces is realized in the first phase manually by a human operator. In the second phase by adding a continuous feeding system, the same device, will have a bigger productivity.

The automatic continuous supply operation with pieces, of the guidance and fixing device, and the fastening-loosening device commands, are realized by a work program.

It provides the pneumatic actuation of some mechanisms, which will lead to the execution in a chronological order for some functions, like the extraction and the intake of the piece from the storage system, followed by the piece automatic transfer to the working device [1], [2].

II. 2D Modeling, the Working Condition of the Guidance and Fixing Device with Levers that is Mechanized Drive

Using CAD programs, I designed in 2D, a constructive version of a guidance and fixing device, which is graphic represented by two drafts in the 1st and 2nd figure According to the 2D model representation, of the guidance and fixing device assembly, this one is filled with a half-shell type piece, operation that is realized manually by a human operator. After the piece insertion in the device, the human operator commands, by a type D 4/3 pneumatic distributor , commands by the compressed air energy, the guiding and fixing operation mechanization of the piece in the device.

By a pneumatic action of the guidance and fixing device, in the first phase is realized the centering of the piece in the device, on those two cylindrical mobile pins, and in the next phase will be realized the piece fixing by acting and rotating together those two [1], [3].

The guiding and fixing operation of the half-shell part in the device, is mechanized realized by a pneumatic command. By operator's command, the mobile elements of a double action pneumatic cylinder, drive and move from down to up, a mobile guidance system and a levers fixing mechanism. The mechanism realizes by the movement of the device mobile elements, the centering of the piece on those two cylindrical mobile pins, followed immediately by the device fixing system operation that, causes, by mobile elements linear motion, the rotation of the levers, around those two joint pins, fixing the piece in the device from the sides [3].

As a result of this command, the pneumatic cylinder 26, through the mobile assembly piston and rod, realizes a continuous linear motion, which will determine by this motion, a pushing force of the superior mobile assembly, which is composed from board 10. During the motion the mobile system is guided by two guiding columns. During the linear motion, the guidance mobile system, through the body 5 will push the mobile cylindrical bolt 1, through the rod 11 and the coil 12, the milled mobile cylindrical bolt 27. Those two mobile cylindrical bolts realize the centering and the guiding of the piece on the diameters of two reaming's, ϕ40H7 and ϕ10H7. The piston and the cylinder rod by mobile board 10 – continue the motion (the guidance bolts stay unmoved, the additional motion will be taken by the compression of the coils, which are identified in the assembly drawing at the position 12, and the coil from the bolt structure 1) [1], [3], [7].

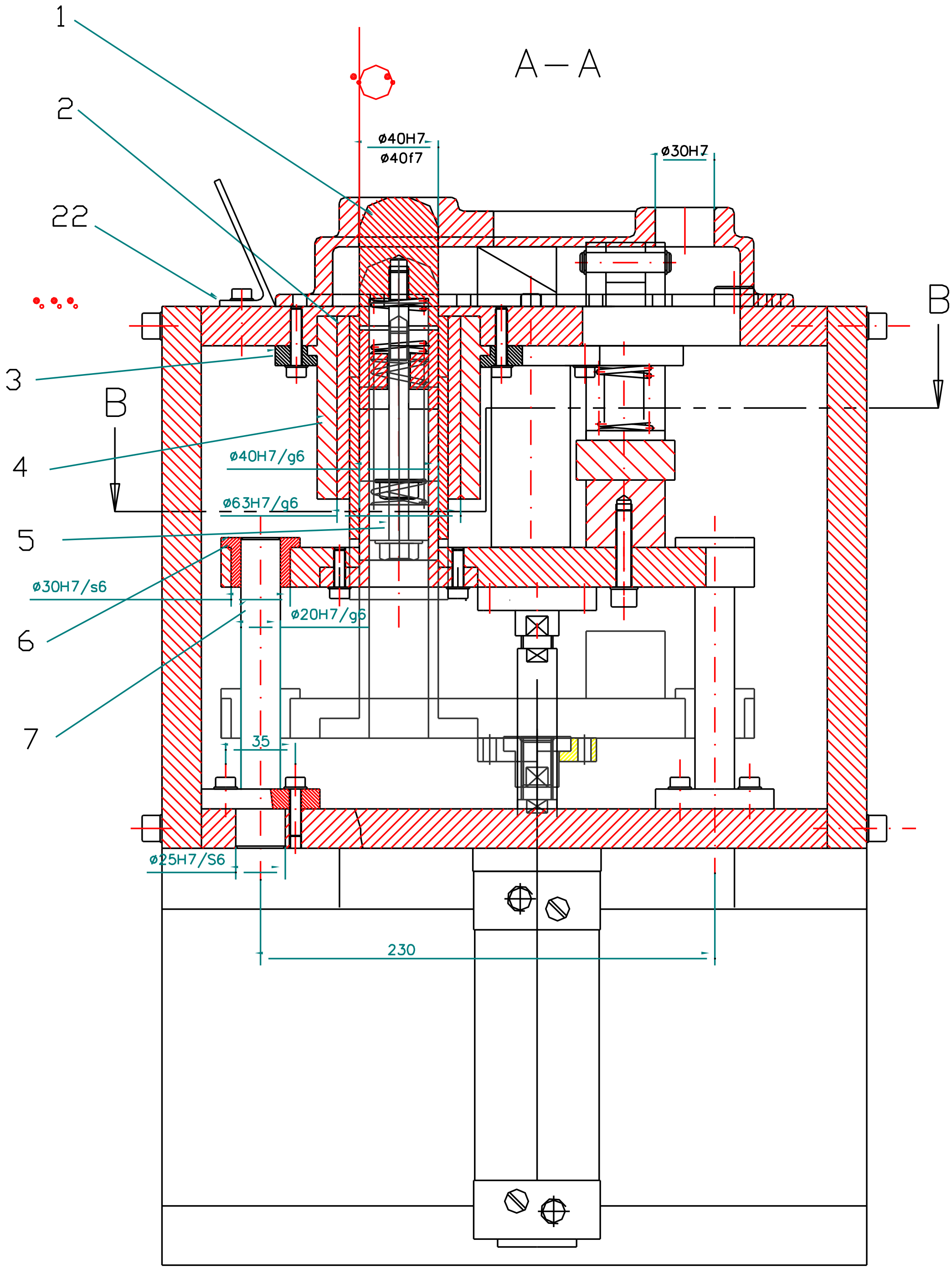


Fig. 1. 2D Model of the mechanized operated guidance and fixing device with levers assembly. A-A Section

Through the buffer 23, it is pushed the board 21, which is guiding the rods 19. The board 21, will actuate the levers 18, which will actuate the ties 16, making a symmetrical gripping force of the piece on the device setting surface. In the Fig. 2, is represented the 2D graphic model of the levers guidance and fixing device, that is represented by a B-B section, from where results the position of the piece guiding in the device. Also, from this top view , we can observe the positions of those two guiding mobile cylindrical bolts, and the position of the piece fixing system, that is composed from two pneumatic operated, levers [3], [7].

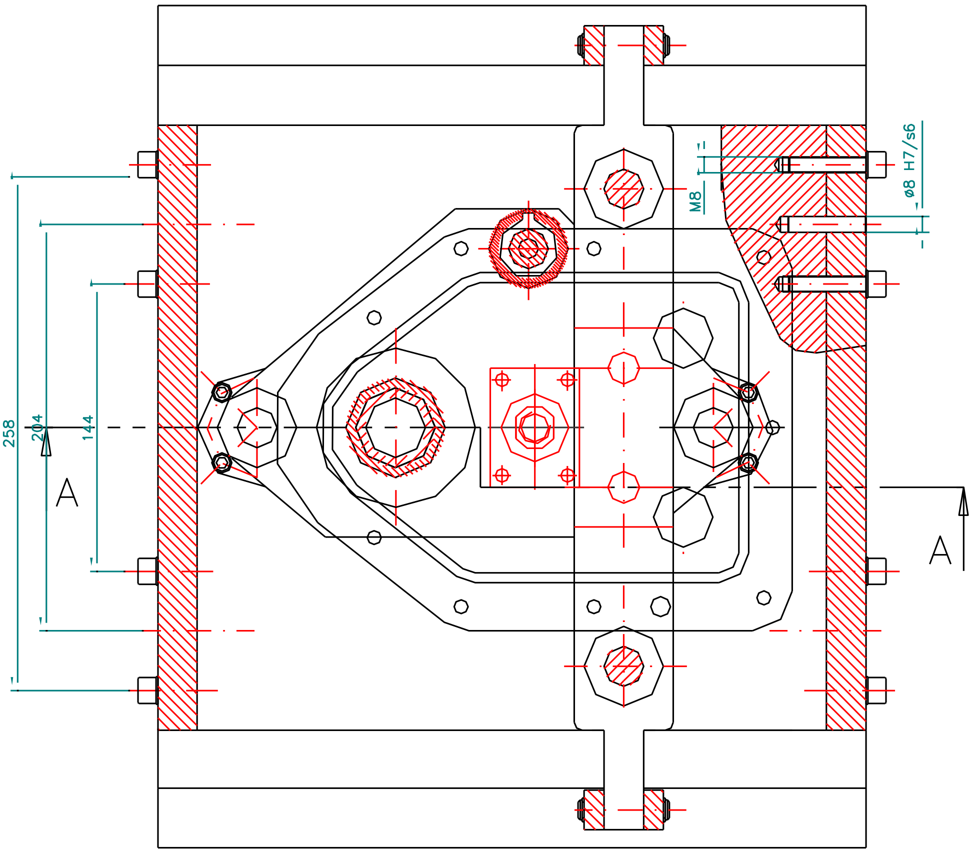


Fig. 2. 2D Model of the device guidance and fixing system. B-B Section

In the Fig. 3, by an isometric view, it is presented the 3D model of the half-shell, from the figure results the position of the piece in the fixing and guidance device at the end of the processing phase [2].

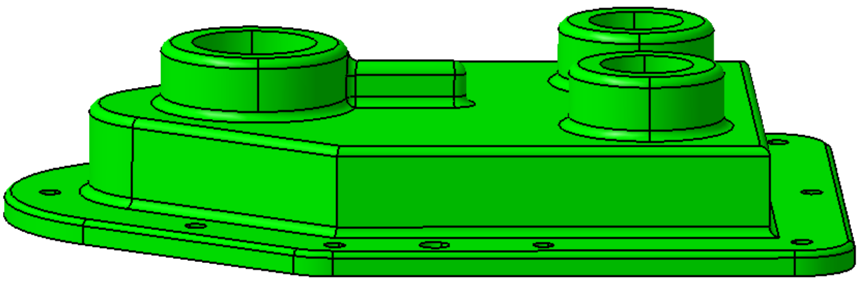


Fig. 3. 3D Model of the half-shell piece fixed and guided in the device

After the end of the simultaneously part processing of those two part reaming, by an operator command, the pneumatic cylinder rod will retract, pulling down the guiding bolts, and the coils 20, will move the mobile board 21, that will open the gripping ties , releasing the part, that in the next phase will be extracted manually by the human operator. The 2D model of the guidance and fixing device, that presents the work sequence through it realizes the loosening and fastening of the part in the device, is graphic represented in the Fig. 4, by a C-C section. Like the 2D modeled graphic representation, those two levers from the fixing system structure are opening, thanks to the cancellation of the command received from the distributor, and the mobile assembly, that by the linear motion provided the centering and the fixing of the part, are retracting to an inferior thanks to an flexible force that is applied by those two coils, notated at 20th position [3], [6], [7]. According the graphic representation from Fig. 5 a), it was modeled in 2D a compression coil that is used in the construction of the piece fixing system in the guidance and fixing device. From the figure, by 2D modeling, results the linear size of the movement, that it is necessary to operate the levers gripping mechanism, the movement is 45,5mm, the coil can realize this value from the relaxed position to the compression position. In the Fig. 5 b), it is graphic represented by a 2D modeling, the working principle of the levers fixing mechanism, in all the phases where the part is fixed and unfixed in the working device [1], [3], [7].

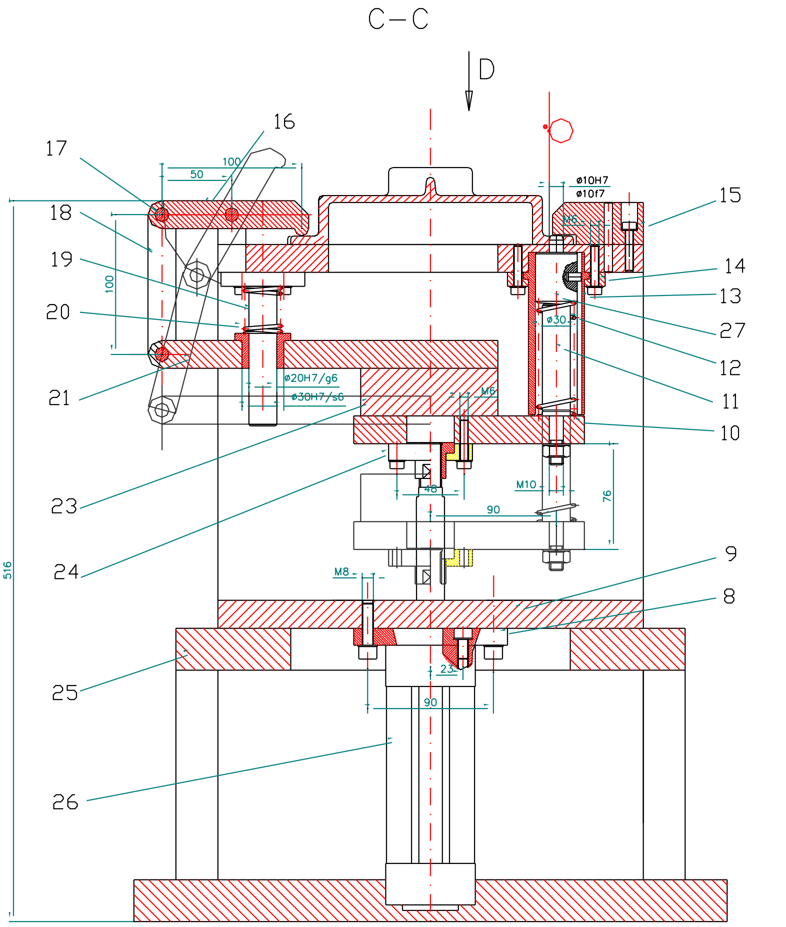
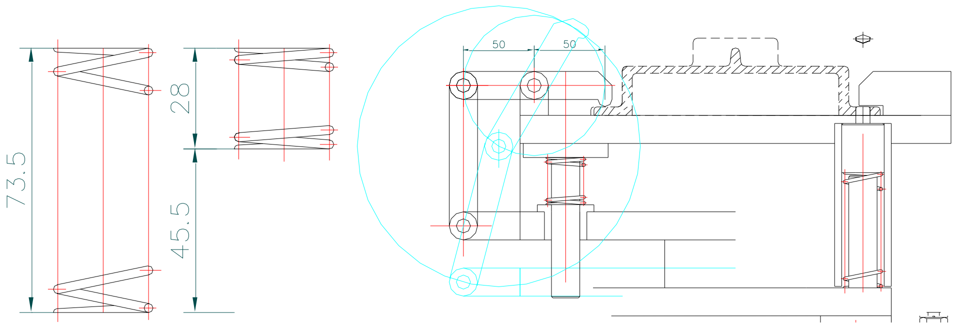


Fig. 4. 2D Model of the pneumatic operated with levers guidance and fixing device assembly. C-C Section



a) b)

Fig. 5. a), b) 2D modeling of the working phase for the levers fixing mechanism and the compression coil movement

III. THE AUTOMATION OF THE DEVICE WITH CONTINUOUS PARTS FEEDING OPERATION

In the second part of the paper, I proposed to realize an automation for the working device with automated parts feeding, by implementation a continuous feeding system.

This automatic system it's composed from an intake-extraction system that is connected to a scrapers and band transfer system, that will realize functional and constructive the automated feeding function for the half-shell part, in the fixing and guidance device. The continuous feeding system, which is presented in this paper, provides the feeding of the working device, with a piece, developing for this phase, a levers pneumatic acted intake-extraction system. The 2D model of the mechanism assembly for this system, from where results the working principle is presented in the Fig. 6 [2], [3].

After the part extraction from the cumulating system, thanks to the 37 degrees angle inclined guidance, it is realized its gravitational transfer to a transfer system, that is developed to realize a step by step transfer linear motion for the parts, that is pneumatic operated, through a click mechanism. The horizontal band transfer system, feeds with parts the work device, through the mechanism that is acted by a double action pneumatic piston. On the rubber band of the transfer system at some distance are fixed some scrapers.

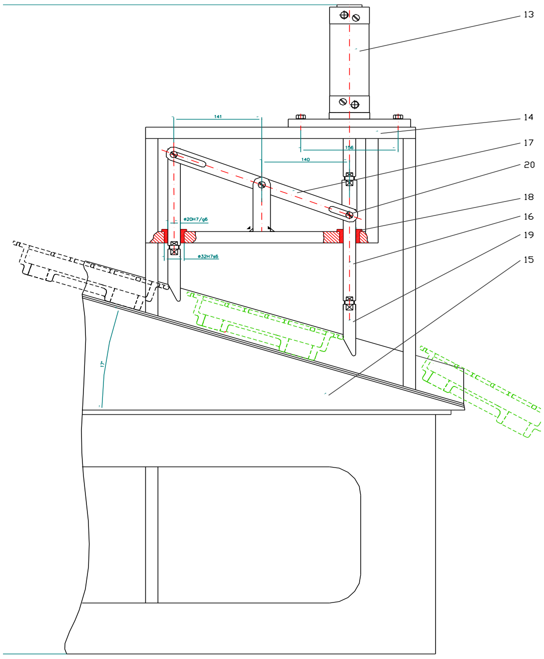


Fig. 6. The 2D model for one part intake-extraction system which provides an automatic parts filling for the transfer system.

The geometric form of these scrapers, has as a guiding and centering role, and it provides the motion with one step, for the transfer system, and the individual guidance and orientation for the half-shell part. The system, provides the transfer, based on a work program, it maintains a tact that is defined by the technological process working phases. The elements that compose the assembly of the pieces continuous feeding device, designed and modeled in 2D will be presented in the Fig. 7, this one is integrated in the automatic manufacturing system of the half-shell part, and it provides the continuous pieces feeding of the levers fixing and guidance device. The elements that compose the assembly of the continuous feeding system are ad on the 2 D models of the assembly drawings which are presented in the Fig. 6 and 7 in the following order: 1) bearing body, 2) transport band, 3) scraper, 4) fork, 5) ratchet, 6) ratchet wheel, 7) DNC-50-80-PPV. Festo pneumatic cylinder, 8) bearing stand, 9) Festo stand, 10) radial ball bearing, 11) acted reel, 12) drive reel, 13) DNC-50-125-PPV. Festo pneumatic cylinder, 14) frame, 15) inclined frame, 16) guidance, 17) lever, 18) guiding bush, 19) stopper, 20) bolt [2] - [4].

The productivity of the mechanized manufacturing line for the half-shell part which is presented in this paper is calculated with the formula:

$$Q = \frac{N}{z \cdot h \cdot s} \text{ (pieces/hour)}, \quad (1)$$

Where:

N – Planned production (includes changing parts) (pieces /year)

z – The of a year working days ≅ 252

s – one day number of shifts= 3

h – Number of the hours worked in a shift = 8

The transfer line rate and the automatic parts feed of the device will be calculated using the formula:

$$R = \frac{60 \cdot \eta_u}{Q}, \quad (2)$$

Where:

η_u – Use factor of the technological line, which ensure the time consumption to keep of possible failures and the tools adjustments, etc.

To the continuous feeding system with parts we will adopt η_u = 0,85 [5]. In the Fig. number 8 through the sequences a), b), c), d), e) 3D modeled, are represented by some isometric views, the positions of a part while the automatic feed is running. Based on the representations of these 3D modeled images, it results the crossing route of which part from the intake-extraction system, which is fixed downstream from the band transfer system, in which the half-shell part feeds the guidance and fixing device, which is located in the right side. [2], [3], [5] – [8].

IV. Conclusion

The use of the guidance and fixing device, that is presented and modeled in 2D by the author in this paper, it's characterized by a big reliability of the part fixing and guidance system mechanisms. Through the device pneumatic drive the work productivity is growing, by comparison with a fixing system that is manually acted. Another very important aspect that is realized through the device mechanization, is that the constancy of the part fixing force in the device, has the same size, and it determines a superior processing precision, by comparison with a fixing system that is manually acted. Through the introduction of the continuous feeding with parts system of the fixing and guidance device, it is providing an increased working rate, facilitating the use of this device, for a big productivity. The automatic processing system, can be used with success for processing another types of parts, designing another devices according of the technological process requirements and the claims that are asked from the client. As well the manufactured part extraction from the work device can be robotic realized. The robot equipped with a proper gripping device, with two fingers that are pneumatic acted will grab the part, forwards the robot will be programed for the extraction and for the transfer of the part from the work device, manipulating it to a control and examination stand.

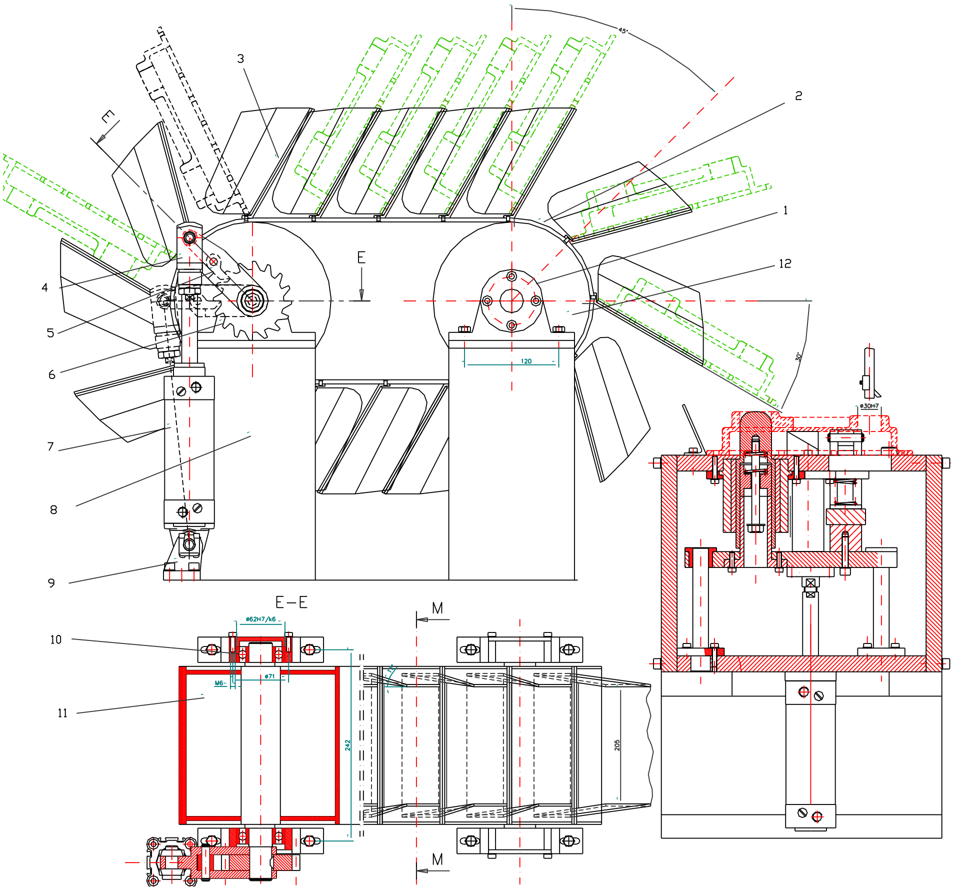


Fig. 7. The 2D assembly model of the pieces continuous feeding device which is integrated in the manufacturing mechanized system

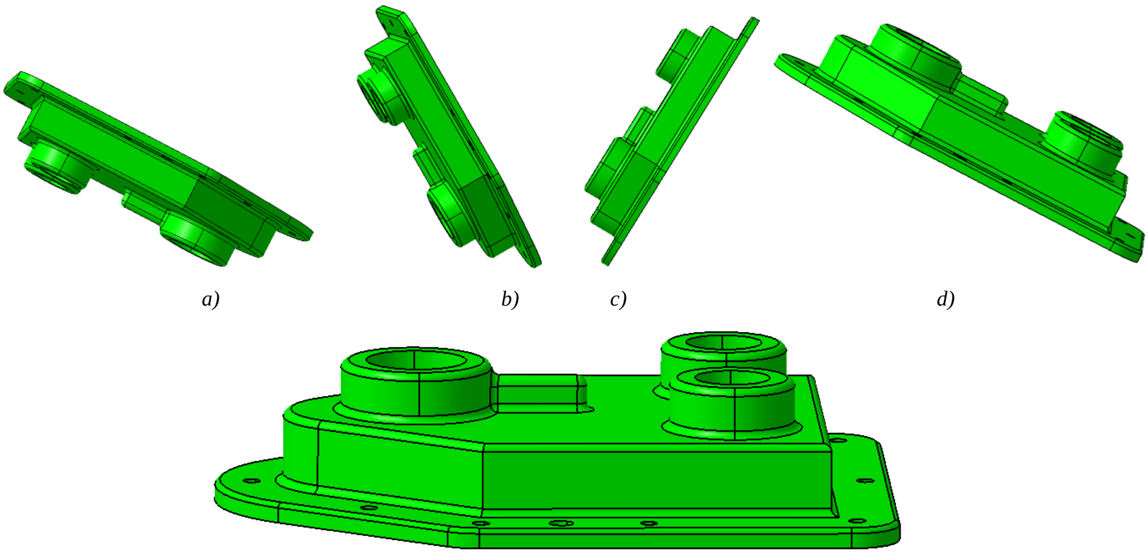


Fig. 8. a),b), c), d),e)3D modeling of the part and its space positions, during the device automatic feed

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