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CONCEPTS OF FINAL VACUUM FLEXIBLE EFFECTORS

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Abstract

The present scientific paper is based on an applied scientific research, carried out by the authors in the industry of plastics injection.

As a result of the increase in the volume of injected products of plastics, as well as of their degree of complexity, there has stemmed out as a necessity the perfecting of the prehension (gripping) operation of these in view of being handled.

1. Introduction.

The final vacuum effectors are used particularly in the case of handling relatively light objects, of small dimensions, or those presenting plain smooth surfaces as well as irregular surfaces. Of this category there take part various proucts of plastic materials obtained by injection. In order to increase the labour productivity, the injection devices are automatized, being supplimentary equippped in this respect, with handling devices or industrial robots programmed to perform, in an automatic cycle, the extraction, handling and transfer of injected objects. The final vacuum effectors are made of modulated elements, the contact with the object handled being achieved by means of port-cupping glass.

Figure 1 presents a machine of injecting plastic materials from S.C. Plastor S.A. Oradea, automatized, equipped with an electro- pneumatic handling device endowed with a final vacuum effector.

In the constructive variant presented in figure 1, the final vacuum effector is made by the assembling of several modulated elements with the help of blocking fixing bolts. The axial movement of the final effector in view of gripping the two injected handles, followed by their extraction is performed by a micro-movement module.

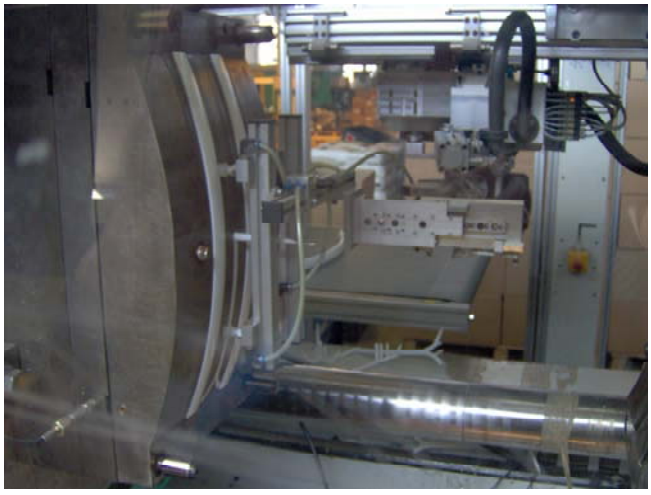


Figure 1. Automatized injection system.

The final vacuum effector presented in figure 1, comes in contact with the objects handled by means of cupping glasses fixed on props, there existing a possibility of adjusting the position of cupping glasses according to two perpendicular directions, and also according to the number and dimensions of the objects injected in the matrix from the respective lot.

In order to achieve a more efficient gripping, from a technological point of view i tis required that the prehension (gripping) surfaces of the objects to be perpendicular on the axes of the cupping glasses, in order to perform a proper contact.

In practice this is not always possible, because of the high diversity of constructive forms of the plastic products obtained by injection.

Because of this the contact cupping glasses-object is done by a non-uniform deformation of the cupping glasses, leading to an improper contact, variable gripping forces, which determines frequent detachments of objects from the gripping device during handling. The accidental detachment of the objects handled, the deteriorating in free fall at the contact with the frame of the machine is a phenomenon that can lead to the frequent interruption of the injection process, followed by the stationing time; there also existing the risk of work accidents occurrence.

2. Description of the proposed solutions.

In order to eliminate certrain disadvantages of the gripping process previously presented, the authors of the present scientific paper have set as a goal for themselves the conceiving and designing of new constructive variants of flexible final vacuum effectors, capable to perform fast as possible certain angular and axial adjustments of the cupping glasses, required by the forms of the objects handled, so that when handling an injected object of a complex form, the contact of cupping glasses to be made simulta neously, perpendicular on the tangent plane of the prehension (gripping) surfaces.

According to the geometric form of the surfaces of the object handled, the positions of the cupping glasses areadjusted angularly and axially when needed, so that the final effector to be as flexible as possible.

Figure 2, presents a model of object injected, of plastics the surfaces of which destined to gripping have curved surfaces, thing which requires supplimentary adjustments of the positions of the cupping glasses.

Figure 2. Piece (part) of injected plastic material

2.1. Final flexible vacuum effector. Variant 1.

In view of increasing the flexibility, the authors have conceived two new variants of unilateral, vacuum, flexible final effectors, made up of modulated elements, which could be used in the automatized system of prehension (gripping) handling of various objects injected of plastic material, having several complex gripping surfaces.

Figure 3 presents the ensemble 3D of the flexible final vacuum effector variant 1.

The flexible final effector is outlined by the fact that the port-cupping glass module can be adjusted by three rotations, introducing a spherical kinematic coupling (III-rd class) with the possibility of manual blocking in the adjusted position.

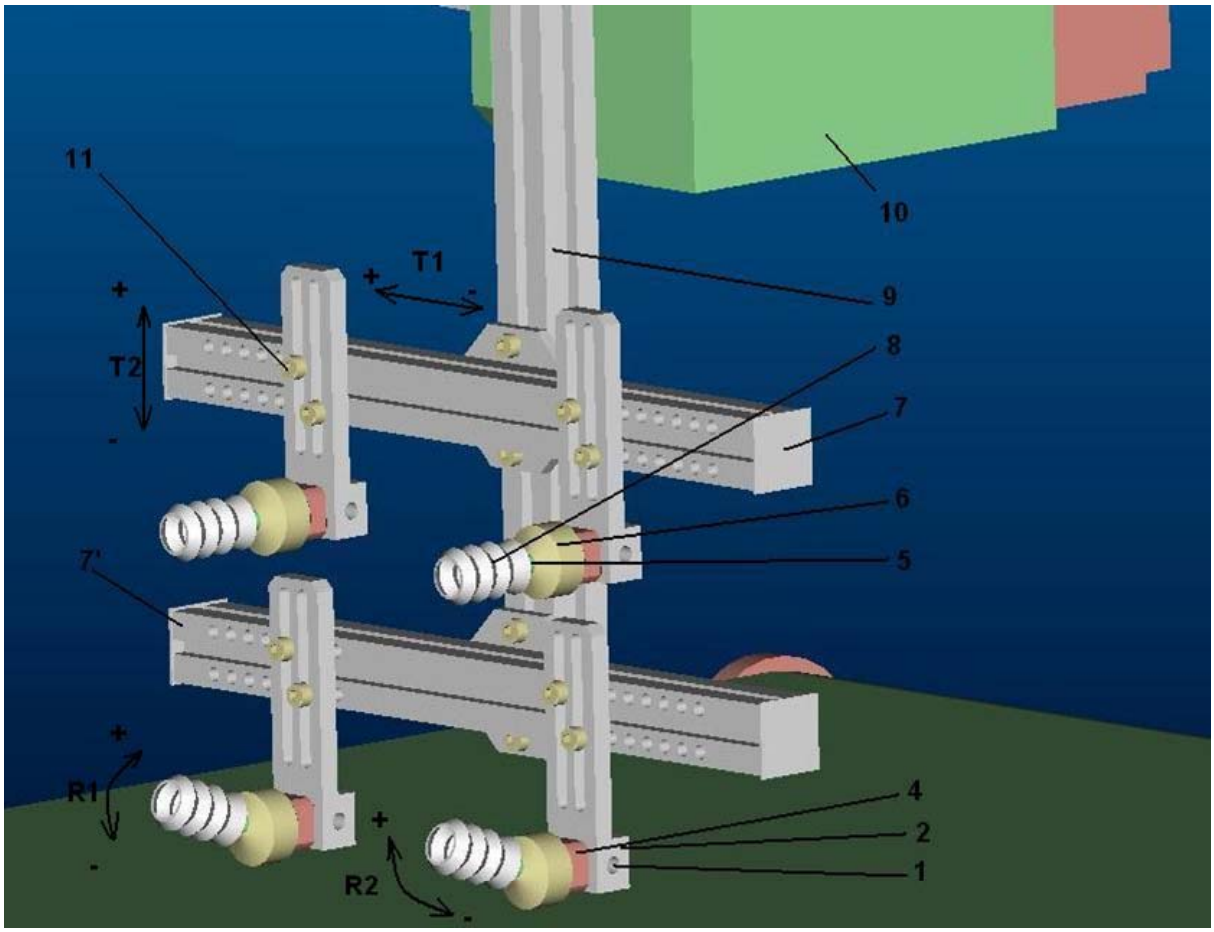


Figure 3. Flexible final vacuum effector. Variant 1.

The special flexible vacuum final effector, is composed of the following constructive elements:

(1) - screw cutting plug; (2) - translation strap; (3)- vacuum hook-up; (4) - spherical joint; (5) - cupping glass fixing ring ;(6) – blocking muff;(7,7`) - support (prop) ;(8) – cupping glasses; (9) - central support ;(10) – coupling element;(11) - fixing screws;

The device was practically manufactured and experimented at S.C. Plastor S.A. Oradea, with appropriate results, there being reduced the stationing time of the injecting machine, by reducing the accidental detachments of the objects during handling.

2. 2. The module flexible port-cupping glass. Variant 1

The element of novelty of the final effector variant 1 is represented by the flexible port-cupping-glass module, presented in figure 4, comprising the following constructive elements:
(1) – screw cutting plug; (2) – translation strap; (3) - vacuum hook-up; (4) - spherical support (prop);
(5) – spherical joint ; (6) – blocking muff; (7) – air-tight ring; (8) – cupping glass;

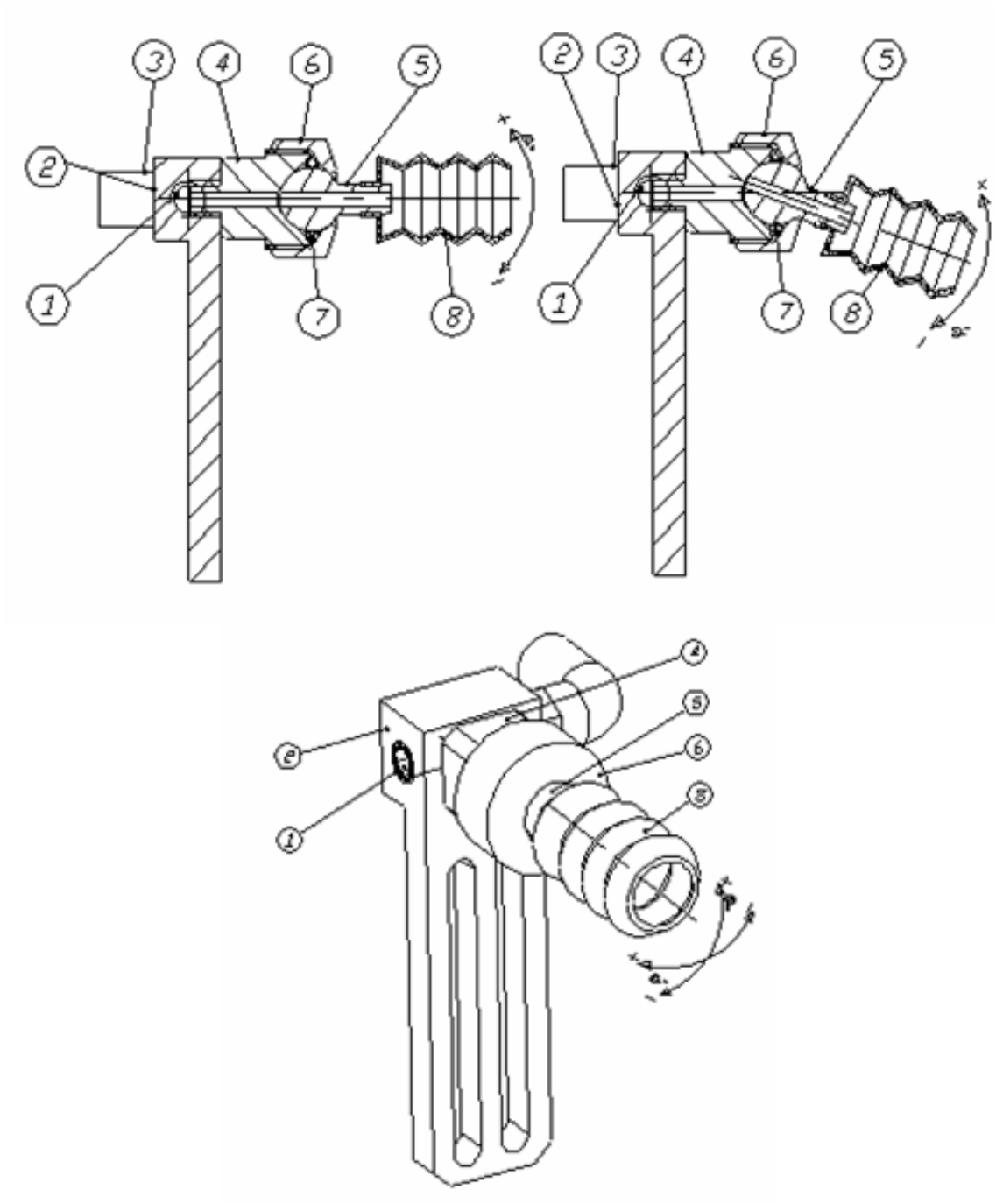
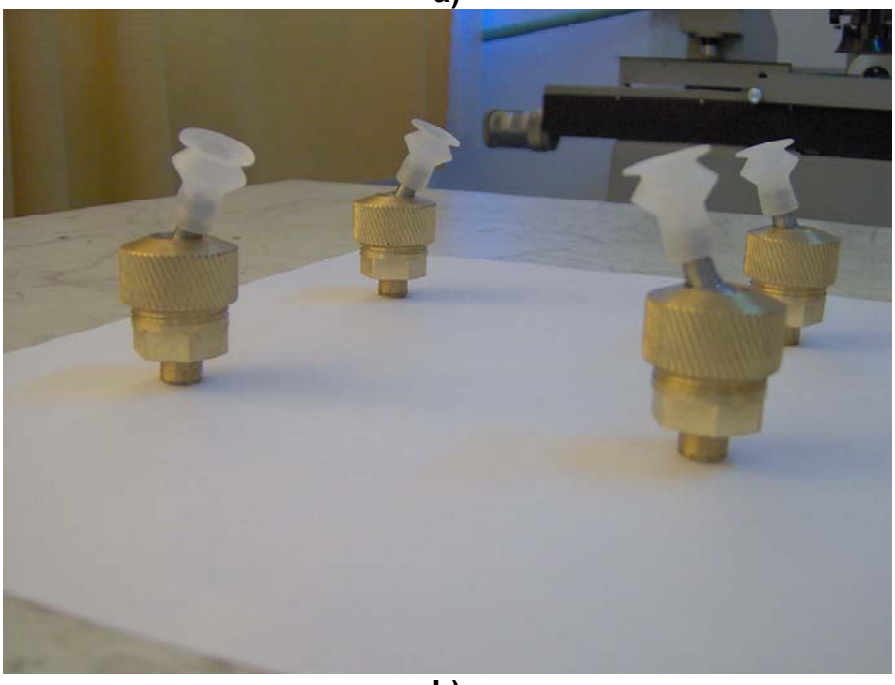


Figure. 4. Module port-cuping-glass 3 R. Variant 1 .

Figures 5 a, b present four port-cupping-glasses modules variant 1 of the flexible final vacuum effector, physically made, where one can notice the flexibility of the cupping glasses bu rotating the spherical joint in various positions.

a)



b)

Figure 5.a), b) Flexible port-cupping glasses, adjusted in various positions.

2.3. Flexible final vacuum effector. Variant 2 .

The second constructive variant of flexible final vacuum effector conceived, designed and manufactured as a result of a cooperation, finalized by a research contract concluded between the University of Oradea and S.C. Plastor S.A. Oradea, keeps to a

great extent the component elements of variant 1, having as an extra feature the possibility of adjusting the axial movement of each cupping glass. Thus, in this case, each cupping glass can finally perform six movements (3R + 3T).

The flexible final vacuum effector variant 2 can be used in an optimum condition also in the case of objects handled having curved surfaces of higher complexity.

The ensemble 3D of the flexible final vacuum effector is presented in figure 6, being comprised of the following constructive elements:

(1) - screw cutting plug; (2) – translation shoulder strap; (3) - vacuum hook-up; (4) - spherical support (prop); (5) - spherical joint with thread ; (6) – blocking muff; (7) – traverse (cross piece) ; (8) – cupping glass ; (9) – adjustable cupping glass support ; (10) - blocking screw nut; (11) - fixing screws ; (12) - central support (prop) ;(13) – coupling element;

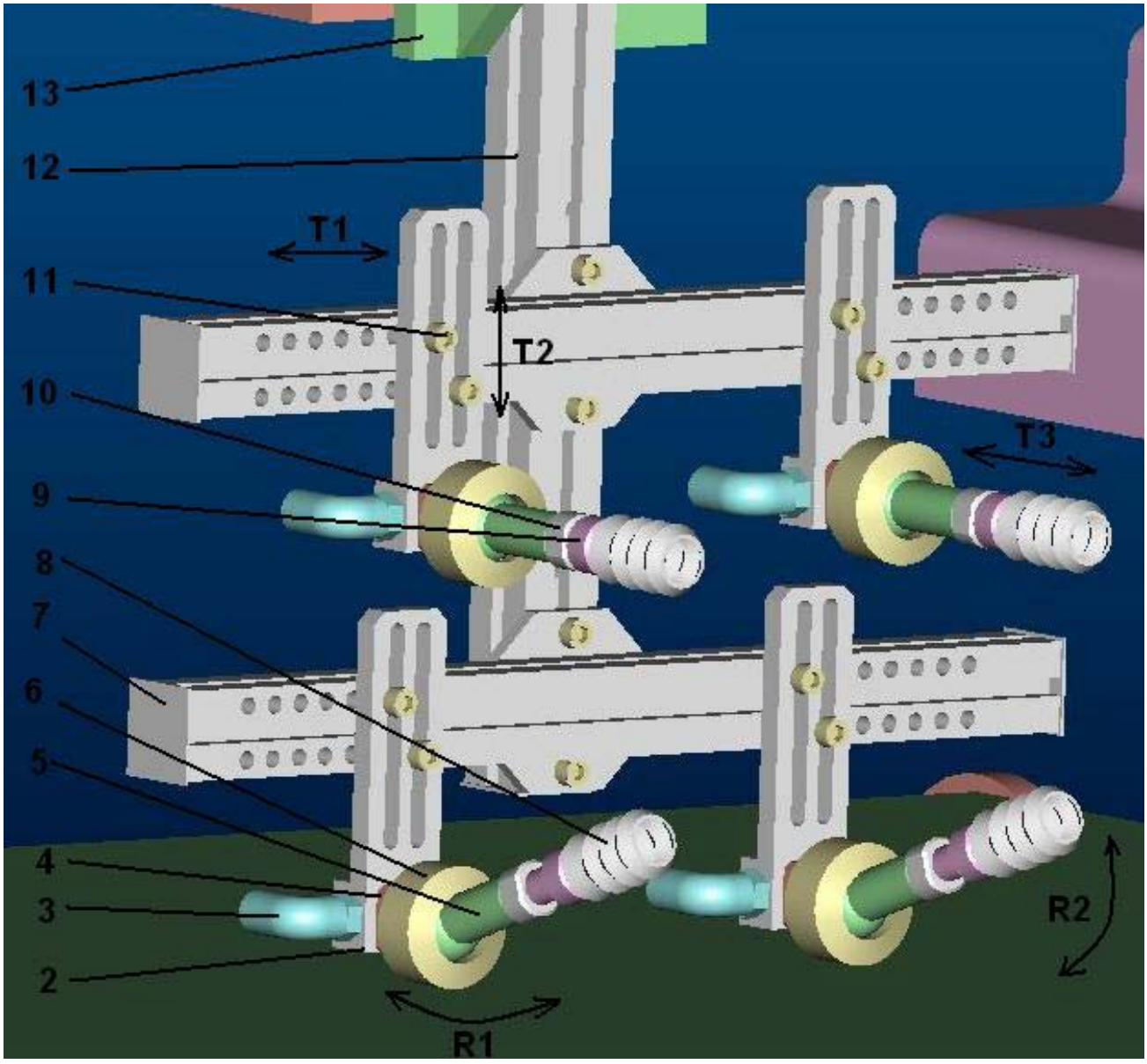


Figure 6. Flexible final vacuum effector. Variant 2.

2.4. Module flexible port-cupping glass. Variant 2.

The novelty of variant 2 consits in the conception of the module port-cupping glass.

If at variant 1 the port-cupping glass module enables the achieving of three rotation movements, in variant 2 the fourth movement was added, namely a movement of axial translation.

This movement allows for situating the cupping glasses much more proper as to the gripping areas of the objects handled

The module port-cupping glass variant 2 is presented in figure 6, having the following component parts (elements) :

(1) - screw cutting plug ;(2) - translation shoulder strap; (3) - vacuum hook-up ; (4) – spherical support (prop);

(5) - spherical joint with thread; (6) - blocking muff; (7) – garnitură de etanşare; (8) – cupping glass ; (9) – adjustable cupping glass support (prop); (10) - blocking screw nut;(11) –O air- tight rings;

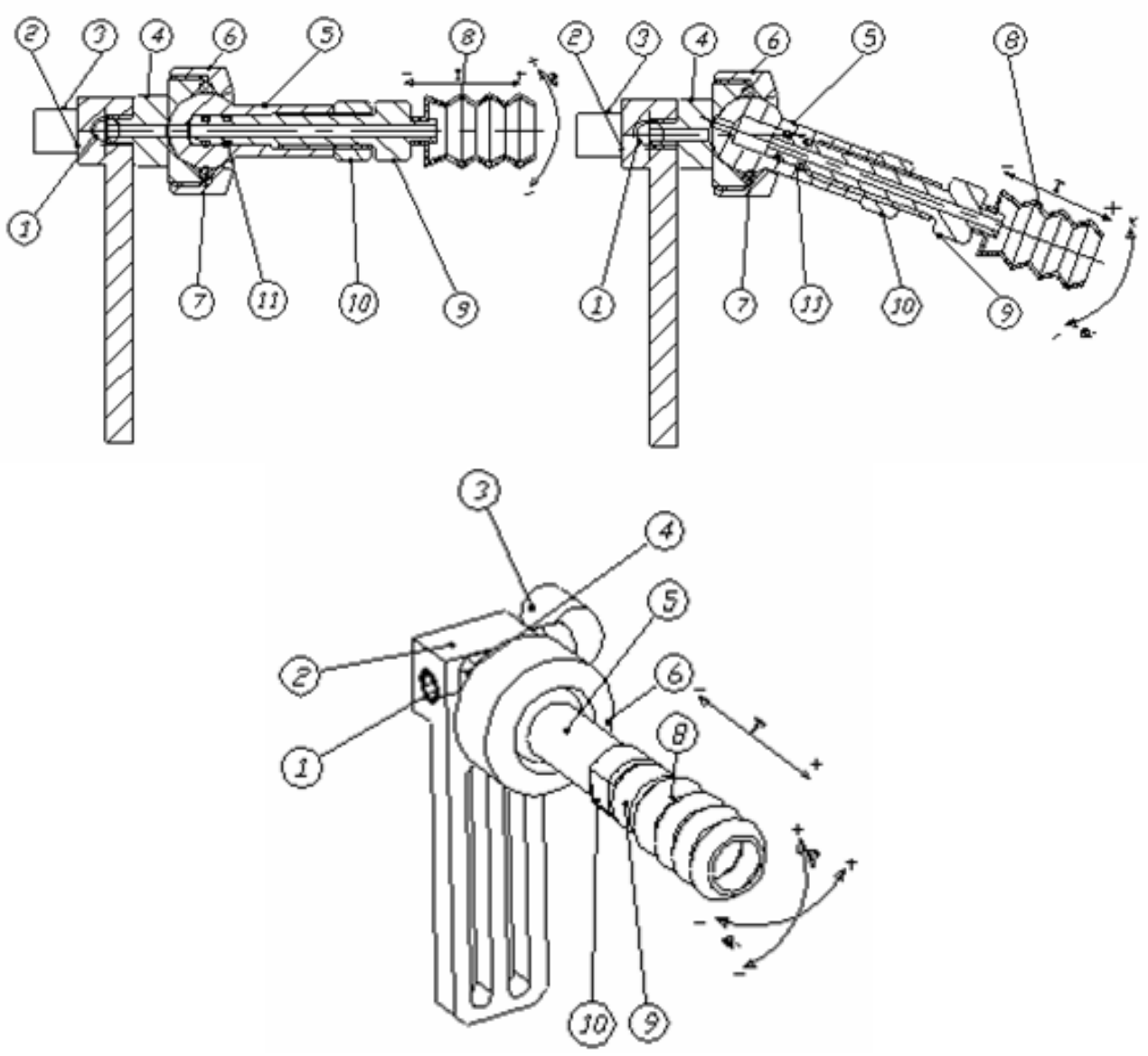


Figure 7. Module port-cupping glass 3 R and 1T. Variant 2 .

3. Conclusions.

Due to the more and more increased geometric complexity of the objects injected by a simple or bi-material method, as well as due to the use of robots and handling devices with more and more complex and more acurate movements on a wider and wider scale, there have been conceived, designed and manufactured the two new constructive variants of final vacuum effectors of modular construction, thus enhancing even more their degree of flexibility.

In the next stage, the authors aim at continuing the research of increasing the flexibility of the final vacuum effectors. Thus, there is to be conceived, designed and performed a new constructive variant of port-cupping glass module, variant no. 3. The new port-cupping glass module of special construction shall perform the angular movements of the cupping glasses by means of a mechanism of threads guided pneumatically and directed in the desired position with the help of a computer program.

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***Catalog ARBURG MULTILIFT H + Carte tehnică

***Catalog FESTO – Automatizarea cu ajutorul pneumaticii

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