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STUDIES ON THE TECHNOLOGY FOR THE EXECUTION OF A PLASTIC INJECTION MOLD

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Abstract: The mold is the mechanical subassembly that has the role of giving a certain shape to a plastic material with well-determined dimensions. The design and correct execution of injection molds conditions the achievement of high yields of injection processing. Molds for injection of thermoplastic materials are basically composed of two main parts: half mold from the injection nozzle side and half mold from the throwing side. The mold is fixed on the clamping plates of an injection machine.

The majority of molds work by injecting the plastic material through a hole with the axis perpendicular to the plane to be separated. In the case of special injections (two-color or three-color injection), the injection is made both perpendicular to the plane to be separated and in the plane to be separated.

In the construction of molds, thanks to the infusion of new technologies, optimization is constantly used. An example of this is NC milling after 5 axes. In addition to the reduced processing time of a mold, this also results in higher precision. Compared to NC milling after 3 axes, the processing after 5 axes of irregularly shaped surfaces is done with a smaller number of milling passes, with a better quality of the surfaces. The NC programs for 5 axes claim, thanks to the complex device, a large volume of calculation, at the corresponding processing speed. This can only be solved for the masses with the help of large computers. Complicated and long milling programs can be run with the help of these computers even during the night.

• Introduction

- Operation of a die
- Depending on the geometric shape of the piece, the nature and characteristics of the plastic material, of the type of injection machine, there is a wide variety of constructive injection molds. The injection mold is mounted on the clamping plates of an injection machine by means of clamping plates that are fixed with clamps or fixing screws. The centering of the mold is done with the help of centering rings that are attached to the clamping plates of the mold with the help of screws.
- The melted plastic material from the nozzle of the injection machine reaches the nozzle of the injection mold and through the injection network to the nests of the mold. The injected part is formed in the nest formed by a panson. After the hardening of the plastic material in the mold, as a result of the cooling of the mold plates, through the cooling circuit, the mold opens in the plane of separation. The injected part remains strengthened as a result of the contraction of the material on the panson. In order to remove the part from the mobile part, it is actuated by a rod on the injection machine and the throwing system that is activated causes the movement of the throwing plate used to throw the part from the mobile part.

• Material and method

- The studies for the realization of this work were carried out at the company Evopart Solutions. The machining company deals with design and industrial automation, execution of automation assemblies and subassemblies: -Design; -Execution; -CNC machining
- The most frequent projects we do are: robot arms, conveyors, sorting/cutting stations, customized components, etc.
- Evopart Solutions is a Romanian company, based in Mosnita Noua (Timisoara)
- Evopart Solutions offers computer-aided CAD/CAM design services.
- Our main activity is represented by milling/turning operations on CNC machines.
- The company currently has 6 CNC machines: 3xHAAS VF-2, 1xHAAS ST20Y, a DMC50 and a MAZAK lathe.
- Automation systems
- Design and manufacture of mechanical devices and equipment
- - Equipment for mechanical testing and simulation
- - Equipment for optical testing and parts verification
- - Clamping devices used in technical processes
- - Different assembly devices
- - Bending, shaping and cutting tools for sheet metal parts
- Design and execution of end-of-arm tools for injection and other processes
- Assembly of subassemblies and components

• Results and discussions

- The productive programs calculate along with the milling trajectory, the collision and the angle of inclination of the milling cutter. For each point of the trajectory, the necessary tipping angle is calculated, so that the angle of the milling cutter adapts to the profile of the surfaces. This certifies the fact that no point on the surface of the milling cutter collides with the surface of the press. In addition, a surface finish is removed in the milling direction.
- The component parts of the molds are removed from several processing operations by chipping: - drilling; -turning; -milling; - boring; -rectification.
- Drilling, widening, reaming and laming.
- In an injection mold, numerous holes are processed in the board package by drilling: spacer screws, centering pins, return pins, buffer pins, throwers, the tempering circuit, guide columns and bushings, etc.
- The problems related to the processing of the holes become difficult due to the fact that the construction of the mold implies at the same time high precision and great depths for the holes. If the drilling depth is approximately five times greater than the diameter of the hole, technological difficulties arise that require special tools and appropriate technology. Conventional tools easily deviate from the correct direction of the holes, due to their reduced stability, and the lightness of the faces creates difficulties, causing the tool to brake, which leads to its breakage.

• Conclusions

- For the realization of this work, the mold cavity was studied, on a milling machine with numerical control, the machine being a VF2 SS.
- For NC programming, two software licenses were used, respectively Cimatron 13 and Fusion 360. The technology was divided into several steps to make the work easier and to obtain a better quality of the processed part. After the cavity was completed, it was sent to the client to check it with a 3D measuring device and for validation.
- The plastics industry is in continuous development both internationally and nationally.
- Processing by milling on complex surfaces represents the main technological operation of mold execution. The starting point is the 3D and 2D definition of the piece, the role of the CNC programmer, using a dedicated CAM software, to establish the technological process of execution and post-processing for the machine with a dedicated numerical command.
- The main objective of this work is to present a technological innovation for the execution of a forming core for an automotive injection mold.
- As an analysis of the costs of executing a mold, we can use the following formula:
- Mold cost = Material cost + Design cost + Execution cost + Auxiliary cost (packaging, transport, tests)
- Of the actual execution cost, approximately 60% is considered the processing of functional parts and cavities.