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PLANNING OF PROGRESSIVE CONSTRUCTIONS OF ADJUSTABLE SHEET PUNCHING STAMPS

Alijonov Odiljon Isaqovich
The Department of Descriptive Geometry and
Engineering Graphics Fergana Polytechnic Institute, Republic of Uzbekistan

A B S T R A C T	***K E Y W O R D S***
Prospects for the technical improvement of sheet stamping, both in terms of increasing the productivity of pressing equipment and in terms of creating new high-performance processes, provide for a significant increase in production and widespread introduction of adjustable dies.	Progressive Stamping, Planning Constructions of Adjustable sheet punching stamps

The main advantages of adjustable dies include: the versatility of the tooling, which makes it possible to reuse it when changing production facilities; quick and easy changeover, which allows to significantly reduce the time for installation and changeover of dies; reducing the cost and labor intensity of manufacturing; high productivity when equipped with devices that automate the work of a worker, low metal consumption, as well as relatively small storage areas; ample opportunities to reduce the time to complete design work through the use of computer-aided design.

The main directions of improving the designs of adjustable dies include the creation of designs of adjustable dies of a specialized type that meet the requirements of mass production and even large-scale production, and universal ones that can provide sufficient efficiency in small-lot and individual production.

Such dies should have high performance, sufficient reliability and durability, provide convenience and safety during operation, be reversible, i.e. allow the use of basic design details when changing production facilities.

They can be based on modular dies assembled on the basis of unified units and replaceable elements: blocks, packages, universal feeding devices, blocks for removing the work piece and stamped part from the working area of the stamp, universal transport devices, etc.

In comparison with the existing adjustable die tooling in the indicated designs, the main parts of the modules (base plates, holders, strippers, columns, bushings) are made of steel 12ХН3А, 20Х, 20ХГНР, 38ХМЮА with subsequent heat treatment up to HRC 56-65, which increases the wear resistance, and the service life of the parts is increased to 10-12 years. Fixation of packages on the mirror of die blocks is provided with dowels or special installation pins; fastening of packages is carried out mechanically using pneumohydraulic systems of the block and press. Dies and punches are fixed in holders using one of the universal methods, for example, by pouring them with a plastic composition of the AST-T type, easy-hardening metal alloys. At the same time, to increase the bearing

capacity of the plastic composition with simultaneous compensation of shrinkage phenomena, the plastic is reinforced with a volumetric metal frame.

As the operating experience has shown, this method of fixing makes it possible to assemble single-operation, combined and sequential dies for stamping sheet parts with a thickness of up to 6 mm according to the 2nd-3rd class of accuracy.

In this case, in the manufacture of a stamp, only working elements (punches, matrices) have to be performed each time, which makes it possible to reduce the complexity of making bags by 40-60% compared to conventional designs.

For one universal block, depending on production conditions and serial production, from 1 -5 to 150-200 replaceable changeable packages are assigned.

Thus, the block becomes, as it were, an accessory to the press, the change of packages, due to their design, takes 2-5 minutes and is performed without removing the block from the press.

At the same time, it is necessary to preserve all the advantages of special dies (productivity, reliability, safety in operation) so that progressive designs of adjustable dies can be exploited in conditions of serial and large-scale production.

Currently, a range of universal blocks and reusable replaceable packages designed for the assembly of specialized adjustable dies (SRS) for separating sheet stamping operations has been developed and serially produced.

Specialized changeable dies are assembled from assembly units used in various dies and special parts used in only one die.

Assembly units are blocks and replaceable packages, special parts are punches, punch dies and dies.

Special parts are fastened and fixed in replaceable bags with self-hardening acrylic plastic, reinforced with a three-dimensional metal frame, or low-melting alloys with a melting temperature of 90-110°C, which, in combination with the design of the package, makes it possible to readjust the SPSH for stamping various parts by replacing only special parts.

Specialized adjustable dies in performance and reliability are not inferior to special ones, and surpass the latter in quality and manufacturing accuracy.

The material can be fed into the working area of the stamp either manually or with the use of various automatic feeds and robots.

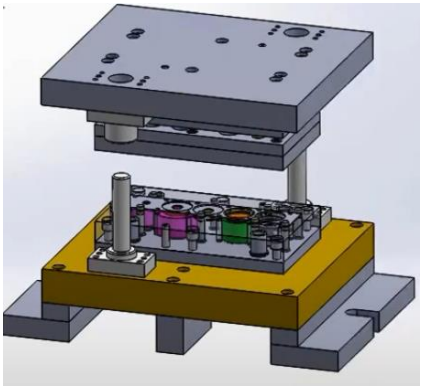

Figure 1 - Universal block

Technical specifications

Limit dimensions of stamped parts, mm:

length ……260

width ……220
thickness ……..0.2-6
Closed die height, mm ……175-325
Overall dimensions of the stamp, mm:
max ……720X500
min ……..280X240
Accuracy of stamped parts, class ……2a-7
Setup time, min ……....5-10
Nominal force of the used pressing equipment, kN ……..160-2500

In fig. 1 shows a universal block containing a shank 1, upper 2 and lower 3 plates, interconnected by guide columns 4 and bushings 5. Depending on the size and dimensions of the stamped parts, the blocks are made with two, three and four guide assemblies. The latter are fixed in slabs of blocks by filling them with epoxy compound ED-5, ED-6. As a result, high precision of block assembly is ensured, and labor intensity of their manufacture is reduced. Plates are made of steel 20X with carburizing to a depth of 0.8 ... 1.5 mm and subsequent hardening to HRC 56 ... 62.

Deviation from the parallelism of the base surfaces have allowed within 0.02 mm over a length of 200 mm. The non-perpendicularity of the guidance system relative to the surfaces of the plates does not exceed 0.02 over a length of 150 mm.

The packages have fastened in the block by clamps consisting of a clamp 6, a wedge 7 and a nut 8. When the nut rotates clockwise, the wedge interacts with the inclined plane of the clamp and secures the package, when the nut rotates counterclockwise, the wedge leaves the contact zone with the clamp and unfastens the package ... To fix the package in the block, the upper and lower plates have finger clamps 9 mounted on epoxy glue.

The accuracy and alignment of the fixation have ensured by a special device.

The movable part of the blocks is equipped with a device 10 for hard ejection of parts, and the stationary part is equipped with pushers 11 interacting with the buffer devices of the presses.

The design of the blocks provides for the installation and fastening of replaceable packages for performing dividing and shaping operations.

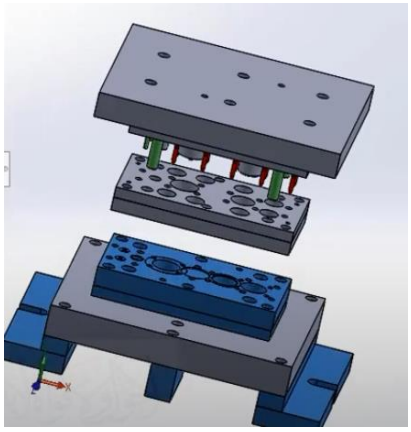

Figure 2 - Replaceable combined action package and replaceable special parts

In fig. 2 shows an exchangeable combined action punching bag and replaceable special parts. The package contains parts that are reusable in various stamps: the lower holder 1 with bushings 2 installed in it, into which columns 3 have pressed, entering the bushings 4, fixed in the upper holder 5, a stripper 6, a stripper plate 7, stops 8 for guiding the strip installed in the movable bar 11, a step stop 9.

The bushings 2 with the columns pressed into them in the lower holder and the bushings 4 in the upper holder with epoxy glue has fixed in a device that ensures the necessary accuracy and alignment of their installation.

Holders 1, 5 and a stripper have working cavities, made regardless of the location and seating dimensions of punches and punch-dies, with a slope of 15 walls, which makes it possible to remove the resulting plastic holders with special parts from them and, if necessary, re-insert them into these cavity.

The fixation of the dies in the package has made by pouring plastic into the holes A along the columns 5 and bushings 4.

The pusher 21 in order to reduce the complexity of manufacturing is made of plastic by pouring it into the working window of the matrix.

Plastic parts 18, 20, 21, 25 in all cases contain a spatial metal frame.

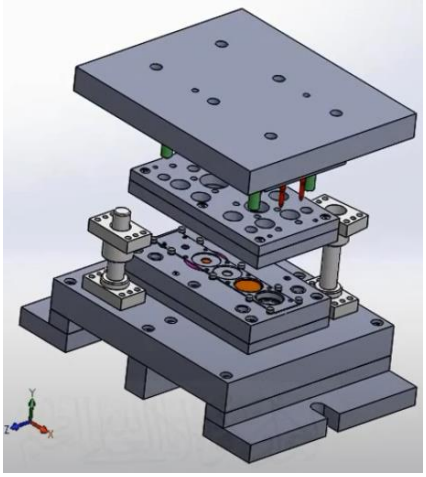

Figure 3 - Replacement bag with fixed stripper

fig. 3 shows a removable pouch with a fixed stripper for the assembly of single-stage and sequential dies.

The package contains an upper holder 1 with bushings 2 installed in it, into which the guide columns 3 have pressed, mating on a sliding fit with bushings 4 fixed in the base 5, upper 10 and lower 11 gaskets. The bushings 2 with pre-pressed columns and bushings 4 have fastened with epoxy compound.

In addition, the package includes a puller 6 with guide bushings 12, a stripper plate 7, guide strips 8 and 9 and replaceable special parts: punches 13 and 14 with a plastic plate 15, a matrix 16 with a mushroom stop 17 installed in it, a plastic puller block eighteen.

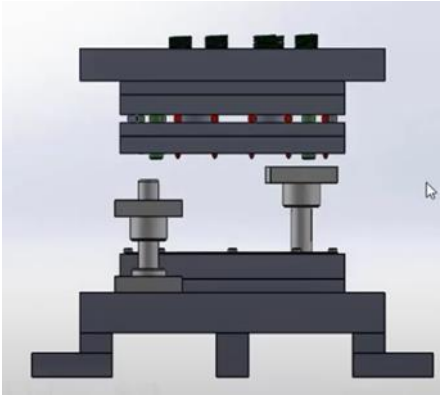

Figure 4 - Replacement bag with a movable puller

In fig. 4 shows a replaceable package with a movable stripper designed for the assembly of single-operation and sequential dies. The package contains adjustable strips, guide strips 8 and 9, movable stripper 6, fixed with screws 4 to the upper holder 1, sliding inserts 7, which are set with a gap in size between the guide strips. The base 5 and the bottom gasket 11 have made with holes for waste removal and stamped parts.

To assemble the stamp, it is necessary in each specific case to make only special parts: punches 12, 10 and matrix 2. Due to the constant direction of the punches in the plastic blocks 3, their durability increases by 15-20% (depending on the geometric dimensions of the punches).

The table shows the comparative indicators of the use of special dies and specialized re-adjustable dies.

Thus, the economic effect from the use of specialized convertible dies is created as a result of a reduction in the cycle of technological preparation of production, labor and material costs in the manufacture and design of die tooling.

Analysis of the nomenclature of parts and designed dies at a number of machine-building enterprises showed that the use of dies in batch production allows replacing up to 50%, and in conditions of individual and pilot production - up to 80% of the dies designed for sheet stamping.

The use of specialized convertible dies creates enough opportunities for organizing group stamping using technologies typical for serial and large-scale production.

Equipment type	Number of names of stamped parts	Labor intensity of manufacturing,%	Labor intensity of design,%	Number of packages assigned to a block	Metal consumption,%
Special stamps Specialized relocatable dies	1 5-20	100 8-30	100 25-30	– till 10	100 30

The technical characteristics have given in Table 1.

Table 1

Designation	Stamp type	Maximum dimensions of stamped parts	
		in plan, mm	thickness, mm
Blocks: OM 1004-4021 OM 1004-4022 OM 1004-4023 OM 1004-4025	For all types	50x50 80x80 120x120 200x200	0,5-4,0 0,5-5,0 0,5-5,0 0,5-6,0
OM 1004-4029 OM 1004-4030 OM 1004-4031	For all types	280x155 280x185 320x185	0,5-6,0 0,5-6,0 0,5-6,0
Packages: OM 1016-2001 OM 1016-2002 OM 1016-2003 OM 1016-2004 OM 1016-2005 OM 1016-2006 OM 1016-4085	For all types	32x32 48x34 67x45 95x60 120x70 150x100 200x200	0,5-2,0 0,5-3,0 0,5-4,0 0,5-4,0 0,5-6,0 0,5-6,0 0,5-6,0
OM 1016-4055 OM 1016-4056	Combined action	160x160 200x200	0,5-6,0 0,5-6,0
OM 1011-4121 OM 1011-4125	With movable puller	50x50 120x120	0,5-4,0 0,5-5,0
OM 1011-4124 OM 1011-4130	With rigid puller	80x80 200x200	0,5-5,0 0,5-6,0

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