United States Patent

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[33] **Switzerland**
[31] **7898/67**

[54] PRECISION CUTTING PUNCHING TOOL FOR PRECISION PUNCHING OF PARTS

7 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **83/124,** 83/55, 83/169, 83/454, 83/465, 83/685
[51] **Int. Cl.** **B26d 3/00**
[50] **Field of Search** 83/55, 17, 19, 169, 123, 124, 125, 126, 127, 128, 176, 453, 454, 456, 465, 684, 685, 686, 690; 72/333, 338; 76/107; 10/24, 26, 27

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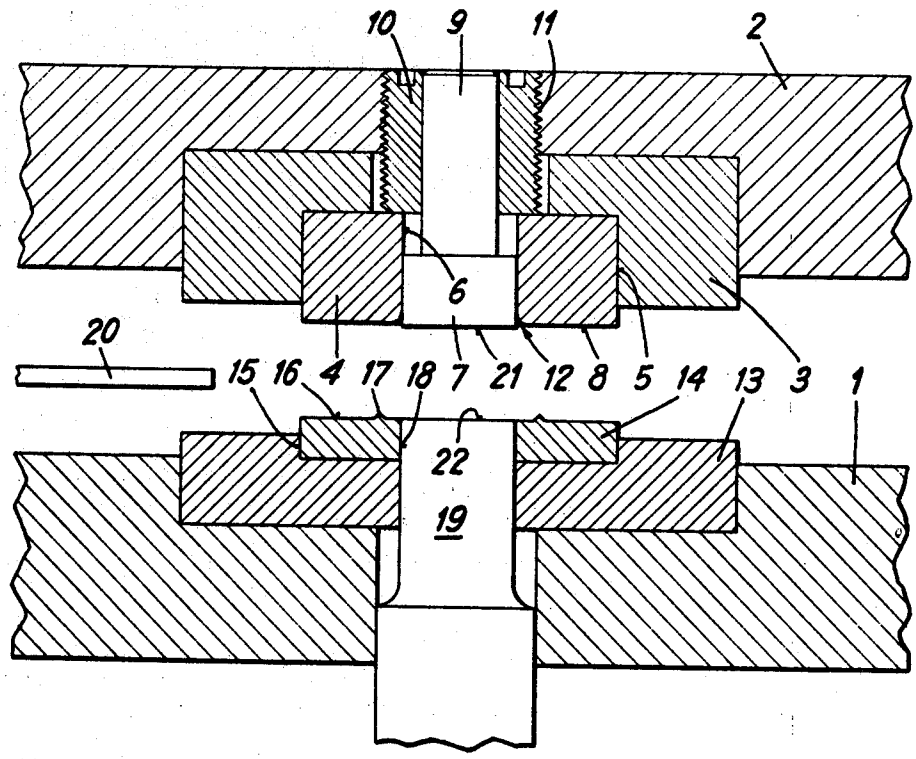
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ABSTRACT: A precision cutting punching tool incorporating a die member with a die opening and a cutting punch which can be displaced through a pressure or contact plate into the die opening. A counterpunch which counteracts the cutting punch is arranged in the die opening. The contact plate has an opening for receiving the cutting punch and this last-mentioned opening is provided at the operable side of such contact plate with protruding ring teeth or projections. The generatrices or surface lines of the die opening with the exception of the location of the cutting edge of the die member extend substantially parallel, and the cutting edge of the die member is irregular, e.g. facetlike or paraboliclike configuration and possesses a convex form.



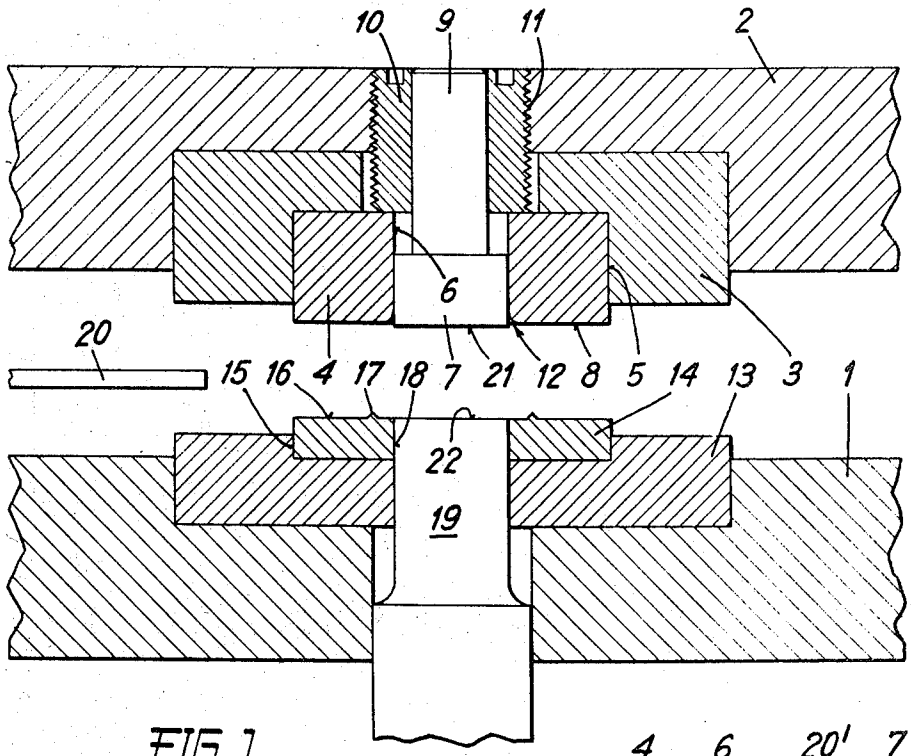


FIG. 1

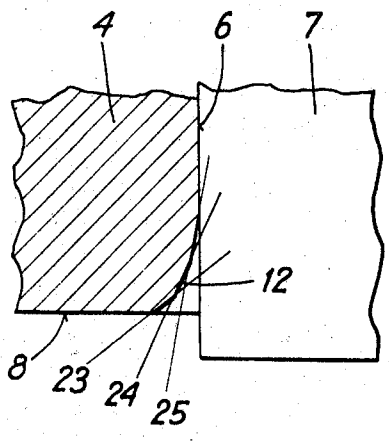


FIG. 2

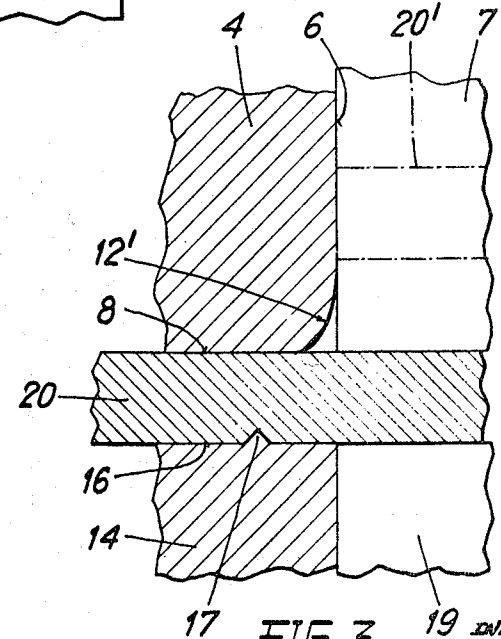


FIG. 3

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PRECISION CUTTING PUNCHING TOOL FOR PRECISION PUNCHING OF PARTS

BACKGROUND OF THE INVENTION

The present invention relates to an improved punching tool for precision cutting comprising a die member and a cutter punch penetrating through a contact or pressure plate, with the cutter punch being insertable into the die opening, and wherein a counter punch mounted within the die opening counteracts said cutter punch. Furthermore, protruding and ring-shaped teeth or projections surround the through passage opening of the contact plate and are provided at the effective or operable side of such contact plate. The invention is also concerned with an improved method of punching parts with precision.

The punching or stamping tools known heretofore to the art cannot produce perfect cut surfaces. They always leave more or less sizable groovelike depressions or elevations which extend in the direction of the punching operation. If during subsequent use these cut surfaces must comply with greater demands or requirements, these surfaces must further be worked or machined. Moreover, the prior art is familiar with the use of means which permit the production of an improved quality of the cut surfaces. For this purpose, protruding ring teeth are provided on a contact or pressure plate which presses the material or blank to be punched against the die surface. These ring teeth press the material being worked firmly against the die surface in the vicinity of the cutting edges. As a result, the material is less able to move away laterally and the cut surface therefore will be much more precise. The cut surfaces produced in this fashion suffice for punched parts which are subjected to average or medium requirements. In the event, however, that these cut surfaces will have to meet very high requirements, they must be subjected to further machining operations.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide an improved tool for precision punching which permits the production of punched parts having excellent cut surfaces which satisfy the highest requirements without the necessity of subjecting the punched parts to any special further working or machining operations.

Another noteworthy object of the present invention pertains to an improved precision punching tool which is relatively simple in construction, quite easy to operate, and capable of efficiently and reliably punching parts with a high degree of precision.

Still a further significant object of the present invention relates to an improved method of punching parts with extreme accuracy so that no further machining operations will be required even if the punched parts have extremely high demands placed upon them.

Now, in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the present invention is generally manifested by the features that, with the exception of the cutting edge of the die member, the surface lines or generatrices of the die opening extend substantially parallel and the cutting edge of the die is broken or irregular and possesses a convex configuration.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be better understood, and objects other than those set forth above, will become apparent, when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing wherein:

FIG. 1 is a cross-sectional view of a preferred embodiment of precision punching tool designed according to the teachings of the present invention;

FIG. 2 is an enlarged detail l of a portion of the precision punching tool of FIG. 1, depicting the configuration of the cutting edge with greater clarity; and

FIG. 3 is a view essentially similar to FIG. 2, but illustrating a different cutting edge configuration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawing, FIG. 1 depicts an upwardly and downwardly movable punch table 1 and stationery or rigid punch block 2 which can be mounted in a triple-acting press. A die holder 3 is embedded into the punch block 2 and secured by any suitable nonillustrated means. A die member 4 formed of hard metal, e.g., sintered or cemented carbides, is set into a recess 5 of the die holder 3. A counterpunch 7, which is movable vertically in relation to the die surface 8, is provided within a die opening 6. The cross section of this counterpunch 7 corresponds to the cross section of the die opening 6. A bolt 9 is attached to the counterpunch 7 for actuating the same.

A parallel guide piece 10 is inserted into a bore 11 provided at the punch block 2. This parallel guide piece 10 has two functions, namely that of supporting the die member 4 and, on the other hand, of being removable, if required, so that the counterpunch 7 can be pulled out upwardly of the die opening 6 in order to be able to control the cutting edges 12 of this die member 4 and, if necessary, to clean the same or further work or machine them.

A holder or mounting support 13 for a contact or pressure plate 14 is embedded into the punch table 1 and rigidly connected with the same by any suitable means, not shown. This contact or pressure plate 14 itself is mounted in a recess 15 of the holder 13, and ring teeth or projections 17 pointing toward die member 4 protrude from its surface 16 located opposite the die surface 8. Ring teeth 17 are spaced at a small distance from a through passage or penetration opening 18 for a cutter punch 19. These teeth 17 or the like serve to provide better engagement or support of a striplike or sheetlike material 20 which is being processed or worked upon, this material 20 passing between the die member 4 and the contact or pressure plate 14 as is customary in punch presses. The cross section of the cutter punch 19 and the through passage opening 18 are equal and correspond to that of the die opening 6.

The stamping or punching of a punched part occurs as follows:

The striplike material 20 is inserted between the die member 4 and the contact or pressure plate 14. The stamp block 2 is moved exactly vertically against the punch table 1, whereby the striplike material 20 is clamped or secured between such die member 4 and the contact or pressure plate 14. The counterpunch 7, which in FIG. 1 extends slightly past the die surface 8, is thereby moved into the die opening 6 to a point where its outside surface 21 together with the die surface 8 lies in one plane. At such time as the striplike material 20 is clamped, the ring teeth 17 penetrate such material, whereby it is securely retained in place and cannot be laterally displaced. The force with which the die member 4 and the contact or pressure plate 14 are pressed against each other is preferably maintained constant during the entire punching process.

By simultaneously displacing the cutter punch 19 and the counterpunch 7 into the die opening 6, the part of the striplike material 20 to be punched out is likewise moved into this die opening 6, during the course of which it is separated by the cutting edges 12 from the material 20 clamped between the die surface 8 and the operable or effective surface 16 of contact or pressure plate 14.

Inasmuch as the cutting edges 12 are broken or irregular, that is to say, they possess a substantially paraboliclike configuration when viewed in cross section, and since the part to be punched out which is between the cutter punch 19 and the counterpunch 7 is finally pushed completely into the die opening 6 by the counterpunch 7 to a point lying behind this broken cutting edge 12, a process occurs which is similar to that of drawing a wire. After the punched-out part which is secured between the punches 7, 19 has been completely separated from the striplike material 20, the punch 19 again

moves downward, whereby the blank of material is stripped off the press punch 19. The tool portions 1 and 2 open due to the movement of the press, and it is only then that the counterpunch 7 pushes or ejects the finished punched part out of the die member 4, whereupon it can be removed from the area or zone of this die member 4.

A standard or normal lubricant is fed to the die opening 6 and especially to the cutting edges 12. It is preferable to take care that the lubricating film between the die member 4 and the material to be punched out does not flow off or break down during the stamping or punching operation. Since the die member is preferably formed of a sintered carbide, it is porous. A part of the lubricant can deposit in the pores of this material and helps to ensure that the lubricating film does not break down or flow away.

The precision punching tool described above is preferably mounted at punch presses having controlled punching speed. This type of punch press reduces the punch movement of the cutter punch toward the end of the punching operation, even when the gravitational force required for separating the punched part decreases toward the end of the punching operation.

FIG. 2 depicts a section of the arrangement of FIG. 1 in an enlarged scale. The configuration of the cutting edge 12 is clearly recognizable in this FIG. The cutting edge is ground or sharpened in facetlike or bevellike fashion with the grinding movements being performed along the three straight lines 23 to 25. The counterpunch 7 is depicted in its inoperable or rest position and extends slightly past the die surface 8 in order to be able to completely eject the punched-out part from the die opening 6 after completion of the punching operation.

In FIG. 3 a die member 4 is provided with a paraboliclike cutting edge 12'. This FIG. depicts the position of the punching process at just the period of time where the striplike material 20 to be processed is clamped between the die surface 8 and the surface 16 of the contact or pressure plate 14 and between the cutter punch 19 and the counterpunch 7. The ring tooth means 17 has penetrated into the material 20 so that the same can no longer move laterally. A phantom line shows the position of the punched out part 20' immediately upon the completion of the punching operation. It can be clearly seen that it has been pushed completely into the die opening 6 behind the broken or irregular cutting edge 12'. During this operation it has had imparted to it a cut surface of excellent quality, said cut surface even surpassing a normally ground surface with respect to its degree of precision, and it can only be compared to a finely lapped surface.

Punched parts which have been produced with the above-described precision punching tool are extremely true to measurement and their cut surfaces satisfy the highest demands which may be required of them. They do not require any special further machining operations and they extend at right angles to both parallel surfaces of the punched part without exhibiting any burrs or the like.

It should be apparent from the foregoing detailed description that the objects set forth at the outset have been successfully achieved.

I claim:

1. A precision cutting punch tool means comprising a die member provided with a die opening, a contact plate having an opening for piercingly receiving a cutting punch member, a cutting punch member extending through said opening of said contact plate and into said die opening, a counterpunch located in said die opening counteracting said cutting punch member, said contact plate having an operable side which is provided at the region of said opening thereof with protruding ringlike projection means which encircle said opening, said die member being provided with cutting edge means, the surface lines of said die opening with the exception of said cutting edge means extending substantially parallel, said cutting edge means of said die member possessing an irregular convex configuration.

2. A precision cutting punching tool means as defined in claim 1, wherein said protruding ringlike projection means comprise protruding teeth means.

3. A precision cutting punching tool means as defined in claim 1, including means to lubricate the cutting edge means on said die member; wherein said die member is formed of a porous hard metal in order to be able to assist a lubricating film in carrying out its lubricating function.

4. A precision cutting punching tool means as defined in claim 3, wherein said porous hard metal is a sintered carbide.

5. A precision cutting punching tool means as defined in claim 1, wherein said cutting edge means is in the form of substantially facetlike broken cutting edges.

6. A precision cutting punching tool means as defined in claim 1, wherein said cutting edge means is in the form of substantially parabolic-shaped cutting edges, wherein the parabolic lines merge asymptotically with said surface lines.

7. A precision cutting punching tool means comprising a die member provided with a die opening, a contact plate member having an opening for piercingly receiving a cutting punch member, a cutting punch member extending through said opening of said contact plate member and into said die opening, a counterpunch located in said die opening counteracting said cutting punch member, one of said members having an operable side which is provided at the region of the associated opening thereof with protruding ringlike projection means which encircle said opening in spaced relationship therefrom, said die member being provided with cutting edge means, the surface lines of said die opening with the exception of said cutting edge means extending substantially parallel, said cutting edge means of said die member possessing an irregular convex configuration.