United States Patent [19]

Carmeli

[11] **3,878,746**

[45] **Apr. 22, 1975**

[54] **BURLESS BLANKING MACHINE AND PROCESS**

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[22] Filed: **Nov. 23, 1973**

[21] Appl. No.: **418,626**

[30] **Foreign Application Priority Data**

Dec. 22, 1972 Italy 33436/72

[52] **U.S. Cl.** **83/126**; 83/51; 83/137; 83/582; 83/616; 83/623

[51] **Int. Cl.** **B26f 1/02**

[58] **Field of Search** 83/7, 9, 50, 51, 55, 137, 83/623, 616, 389, 542, 543, 380, 582, 126

[56] **References Cited**

UNITED STATES PATENTS

3,178,975	4/1965	Georgeff	83/616 X
3,602,078	8/1971	Schindler	83/50 X
3,640,167	2/1972	Axtmann	83/623 X
3,739,669	6/1973	Seki	83/623 X

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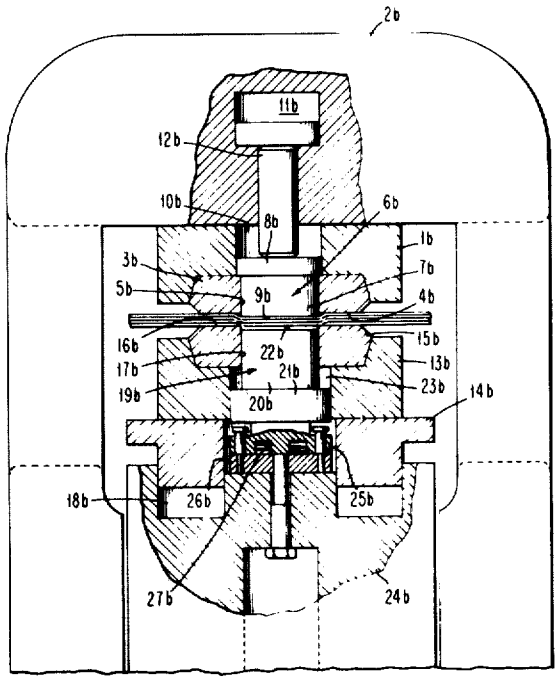
Attorney, Agent, or Firm—K. P. Johnson

[57] **ABSTRACT**

In a triple-action blanking press comprising a frame, a fixed die, a stripper, a clamping plate, a punch, a drive slide driving the punch and actuating means, the stripper can project from the die and an elastic member is interposed between the punch and the drive slide. The machine adjustment is such that during a first part of the machine cycle the stripper acts as a punch and the clamping plate as a die so that the piece is partially blanked on its punch side; during said operation the elastic member is completely compressed and the connection between the drive slide and the punch becomes rigid; then the punch acts just as a punch and forces the piece into the die until it is completely blanked. The operation provides completely burless blanked pieces.

4 Claims, 5 Drawing Figures



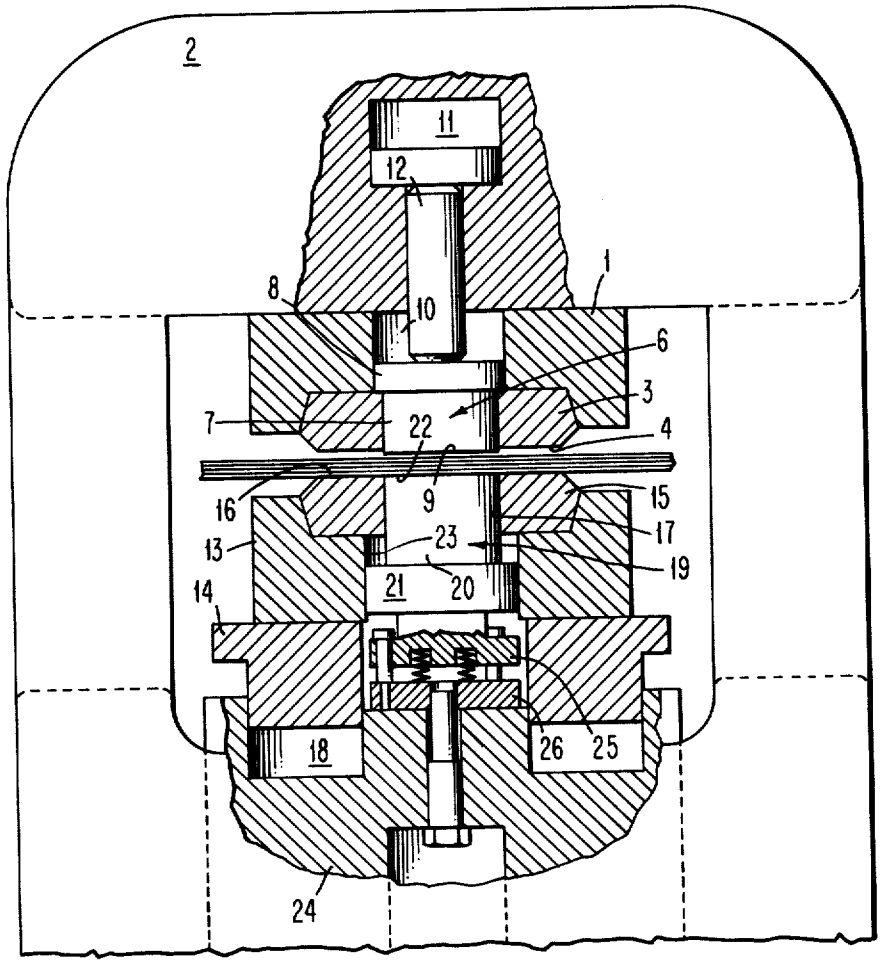

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FIG. 1

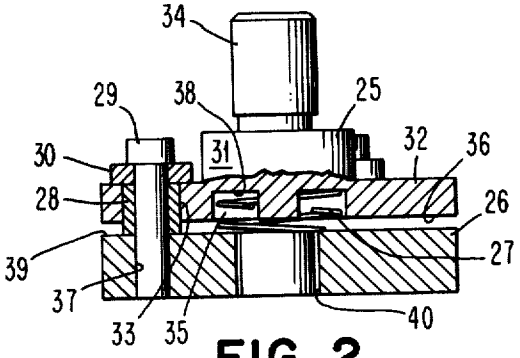
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FIG. 2

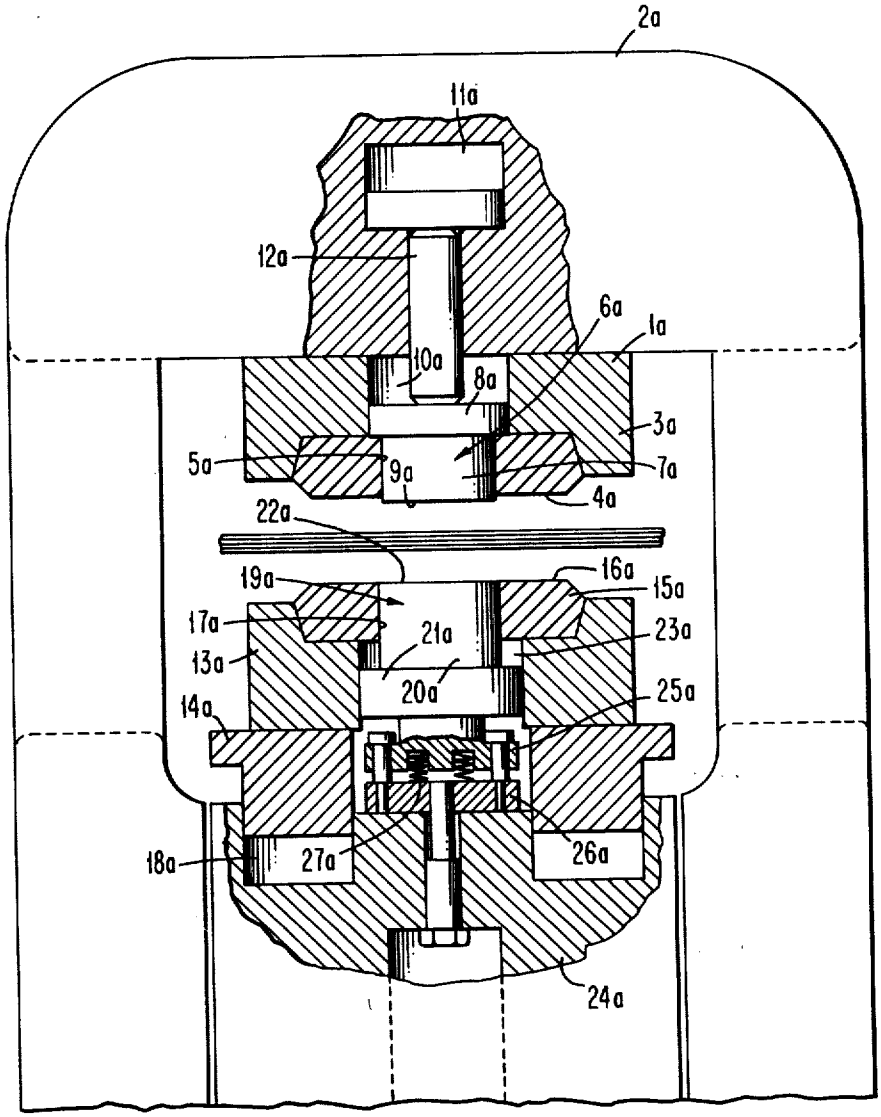
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FIG. 3

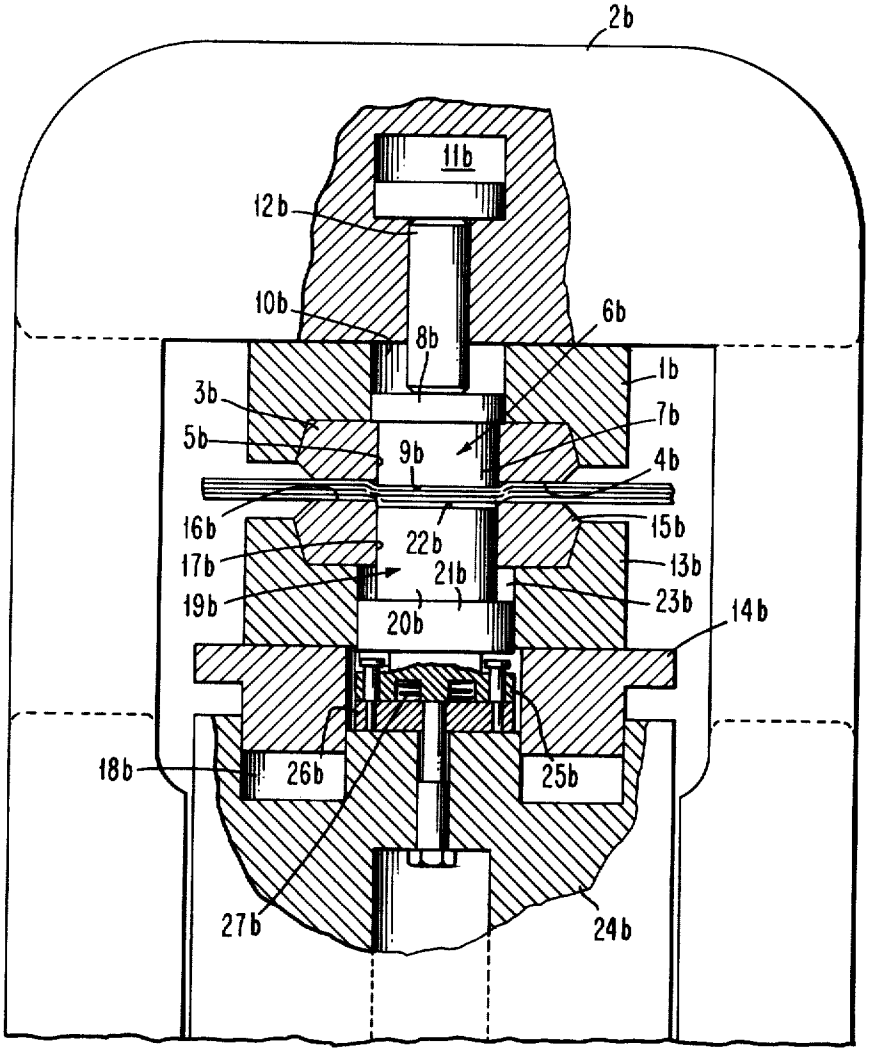
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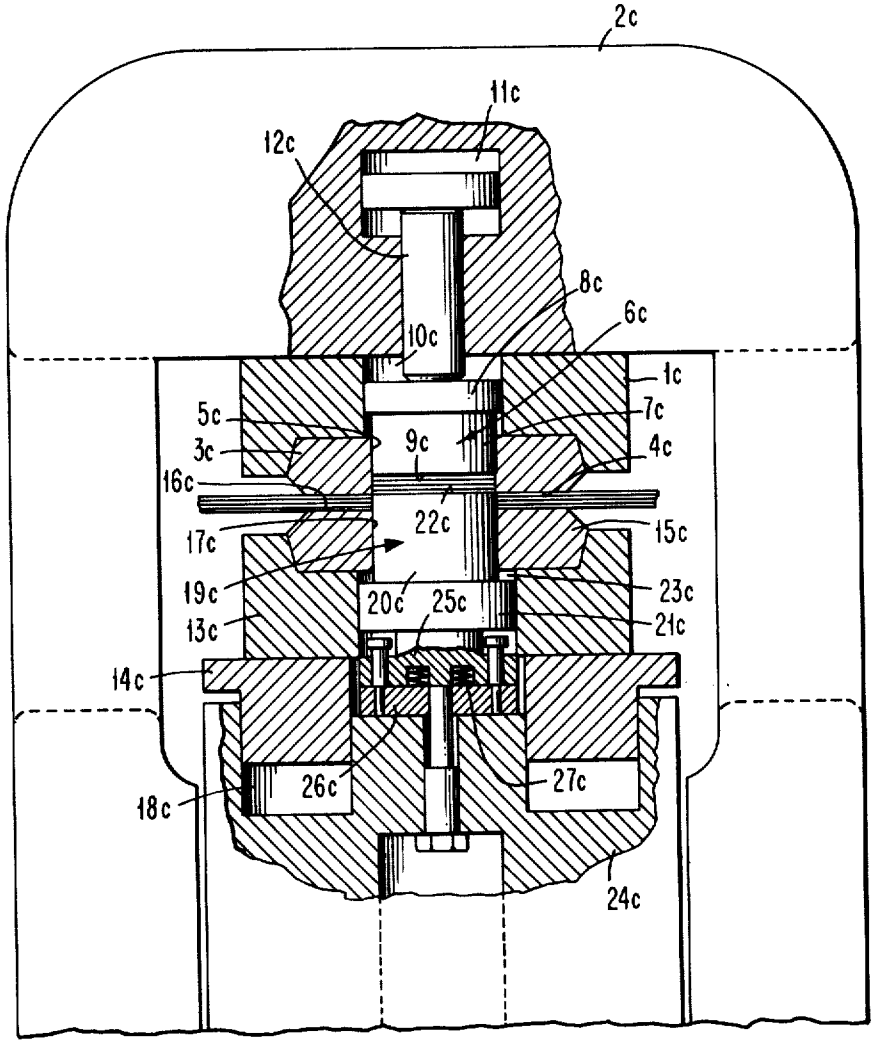
FIG. 4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26c
27c
18c
24c

FIG. 5

BURLESS BLANKING MACHINE AND PROCESS

BACKGROUND OF THE INVENTION

This invention is directed to blanking apparatus and processes, more particularly to a fine blanking apparatus and a process for blanking burless pieces with a fine blanking machine. In traditional blanking methods tool assemblies are used comprising essentially a die and a punch which are mounted on a single-action press. The pieces blanked according to said methods present major surfaces which are neither coplanar nor parallel to each other, and present lateral surfaces which are very rough and non perpendicular to the major surfaces and have cranks whose depth depends on the hardness of the material.

Said pieces, which can be suitable for coarse productions, cannot be used in fine works without undergoing several further processings. It is known in the art to obviate many of above-mentioned defects by using special tool assemblies on triple-action presses, according to a process usually known as "fine blanking."

However, even the fine blanking cannot prevent burrs from forming on the punch side of the blanked pieces and that makes necessary to deburr the blanked pieces with suitable processings (e.g. sanding, tumbling, etc.). That does not represent a great disadvantage if the thickness of the blanked pieces is such to allow the cleaning operations without warping or anyhow damaging the pieces themselves. It is however impossible to tumble or sand very thin pieces, since said pieces are unavoidably warped by said operations. An alternative to mechanical deburring consists in chemical deburring, but it is so expensive to make the operation uneconomic.

SUMMARY OF THE INVENTION

Accordingly it is a main object of the present invention to provide a blanking method for making high precision completely burless thin blanked pieces. Another object of the present invention is to provide blanked pieces which need no further cleaning operation.

A still further object of the present invention is to provide an improved triple-action press for blanking high precision smooth finish thin pieces. These and other objects will be readily perceived from the following description, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a fragmentary cross sectional view of the triple-action press in accordance with the present invention.

FIG. 2 is a cross sectional view of the elastic member to be used in the press in accordance with the present invention.

FIGS. 3, 4 and 5 show three different moments of the blanking cycle in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While the invention will be described in connection with a preferred embodiment it will be understood that the invention is not limited to that embodiment. Referring now to FIG. 1, the mount 1 is supported by the machine frame 2 and in turn supports the die 3. The die 3 has a substantially flat outer surface 4 and is provided with a die aperture 5. The number 6 generally indicates

the stripper, which consists of a stripper body 7, a flange 8 and a worksurface 9. The stripper body 7, which has a cross section complementary to the die aperture 5, is partially nested in said die aperture and is slidably guided by the walls which define it. The flange 8 is slidably guided by the walls defining the chamber 10 in the mount 1 and, since the diameter of the chamber 10 is greater than the diameter of the die aperture 5, said flange limits the downward movement of said stripper. The stripper 6 projects, in the position shown, from the outer surface 4 of the die 3. The stripper 6 is actuated by the hydraulic cylinder 11 through the ram 12.

The mount 13 of the clamping plate is supported by the base 14 and in turn supports the clamping plate 15. The clamping plate 15 has a substantially flat outer surface 16 and is provided with an aperture 17 which has the same cross section as the die aperture 5 and is aligned therewith.

The base 14, slidably guided by means not shown, is vertically movable under the action of the hydraulic cylinder 18.

The number 19 generally indicates the punch, which consists of a punch body 20, a head portion 21 and a work surface 22. The punch body 20 has a cross section complementary to the clamping plate aperture 17, in which it is partially nested, and is slidably guided by the walls defining said aperture.

The work surface 22 of the punch is, in the position shown, flush with the outer surface of the clamping plate. The head portion 21 of the punch 19 has a circular section and is slidably guided by the walls defining the chamber 23 in the mount 13. The plate 25 is fastened to the lower end of the punch head portion and engages an elastic element connecting said plate 25 to the plate 26, which in turn is secured to the drive slide 24 vertically movable under the action of the main motor (not shown).

A cross section of the elastic member connecting the punch to the drive slide is shown in FIG. 2.

Said elastic member comprises an upper plate 25 to be fastened to the punch, a lower plate 26 to be secured to the drive slide, a cup spring 27, bushes 28, screws 29 and washers 30. The upper plate 25 comprises a central body 31, a flange 32 provided with holes 33, and a member 34 disposed on the upper side of the central body 31 which is apt to engage a recess in the punch. An annular recess 35 opens in the lower surface 36 of the upper plate 25 and is coaxial with the plate itself.

The lower plate 26 is provided with threaded holes 37, in which screws 29 engage, said holes being coaxial with the holes 33 in the flange 32, and further provided with the central threaded hole 40 which is able to engage a suitable member of the drive slide 24.

The cup spring 27 is nested in the annular recess 35 and engages both the bottom surface 38 of said recess and the upper surface 39 of the lower plate 26. The bushes 28 are inserted into the holes 33 of the flange 32 and the screws 29 with the washers 30 fasten said bushes to the lower plate 26, so that the upper plate 25 is reciprocably movable with respect to the lower plate 26, said upper plate 25 being slidably guided by the bushes 28.

The maximum spacing between the lower plate and the upper plate is determined by the length of the bushes 28. The working process for making burless thin blanked pieces by a press according to the present in-

vention will be described with reference to FIGS. 3, 4 and 5.

As previously stated, the burless fine blanking process requires a triple action press. The three machine actions actuate respectively the stripper 6*a*, the clamping plate 15*a* and the punch 19*a* and their magnitude and phase must be adjusted so that the following conditions are attained:

1. The action (the force) on the stripper 6*a* must be sufficient to overcome the strain strength of the material to be blanked plus the force exerted by the cup spring 27*a*.
2. The action on the clamping plate 15*a* must be greater than the action on the stripper 6*a*.
3. The action on the punch 19*a* must be sufficient to overcome the blanking stress of the material to be blanked plus the actions on the clamping plate 15*a* and on the stripper 6*a*.

OPERATION

The machine cycle can be divided into three main subcycles which we shall name "first stroke," "second stroke" and "ejection and reset." Said three machine subcycles will be first briefly defined and then described in details. The subcycle defined first stroke begins as the machine starts; the machine is shown in its rest position in FIG. 3. During the first stroke the stripper 6*a* acts as a punch and the clamping plate 15*a* acts as a die, while the punch 19*a* acts as a blank holder (and follows closely the piece to be blanked): this is a blanking stroke opposed to the usual one and the partial blanking depth on the punch side is equal to the initial distance between the two plates 25 and 26.

The second subcycle defined second stroke begins when the punch 19*b* has compressed the spring 27*b* of the elastic member at its maximum and a rigid connection between the punch 19*b* and the drive slide 24*b* has been achieved.

Through the rigid connection the drive slide 24*b* actuates directly the punch 19*b* which penetrates into the material to be blanked overcoming the opposite actions on the stripper 6*b* and on the clamping plate 15*b*; this is the actual blanking stroke during which the material is forced to enter the die 3*b* and is completely blanked. The third subcycle, that we have defined ejection and reset, begins when the punch 19*b* and the drive slide 24*b* reverse their motion. During said subcycle the blanked piece is ejected and the machine reset.

We shall now give a detailed description of the three subcycles previously defined. The machine is shown in its rest position in FIG. 3. The punch work surface 22*a* is substantially flush with the clamping plate outer surface 16*a*. The elastic member spring 27*a* has the maximum extension compatible with the elastic member adjustment; said adjustment determines the depth of the partial blanking on the punch side. Thus the connection between the drive slide 24*a* and 19*a* is of elastic kind. The hydraulic cylinder 11*a* actuates the stripper 6*a* through the ram 12*a*. Said action is sufficient to overcome the strain strength of the material to be blanked, plus the force exerted by the spring 27*a* on the punch 19*a*. The pressure in the hydraulic cylinder 18*a* is sufficient to bear the weight of the base 14*a*, of the mount 13*a* and of the clamping plate 15*a*.

Starting the machine, the drive slide 24*a* begins moving upwards driven by the main motor through a double toggle mechanism (not shown in the figures). Since the pressure in the cylinder 18*a* is sufficient to bear the weight of the base 14*a* and of the assembly it supports, the base 14*a*, the mount 13*a* and the clamping plate 15*a* will follow the movement of the drive slide 24*a*. Likewise, since the elastic element 27*a* is able to bear the weight of the punch 19*a*, the punch 19*a* will follow the upward movement of the drive slide. As a result, the drive slide 24*a*, the clamping plate 15*a* and the punch 19*a* will move upwards, maintaining the same position with respect to one another as in the rest position. When the clamping plate outer surface 16*a* meets the material to be blanked, the action of the drive slide is transmitted to said material, which in consequence is pushed upwardly toward the outer surface 4*a* of the die 3*a* and towards the work surface 9*a* of the stripper 6*a*, which projects out of the die 3*a*. As the upper surface of the material to be blanked meets the work surface 9*a* of the stripper 6*a* the action of the hydraulic cylinder 18*a* on the base 14*a* and therefore on the clamping plate 15*a* is sufficient to overcome the action on the stripper 6*a*. The action exerted by the elastic element 27*a* on the punch 19*a* is not sufficient to overcome the action on the stripper 6*a*. As a consequence the clamping plate 15*a* continues its upward motion pushing that part of the material to be blanked which does not face the work surface 9*a* of the stripper 6*a*, while that part of the material which faces the work surface 9*a* is stopped and forced to penetrate into the aperture 17*a* of the clamping plate 15*a*. Under the action of the stripper 6*a*, which forces the material into the aperture 17*a* of the clamping plate 15*a*, the punch 19*a* recedes with respect to the clamping plate 15*a* and follows under pressure the material, while it is partially blanked, preventing the material from bending and in so doing altering the real dimensions of the perimeter so impressed. Since the drive slide 24*a* continues moving upwards and the punch 19*a* stands still, the elastic member spring 27*a* is compressed.

When the clamping plate 15*a* has clamped the material external to the figure to be blanked against the outer surface 4*a* of the die 3*a*, the first subcycle, i.e. the first stroke is completed. That part of the material which faces the work surface of the stripper has been forced into the clamping plate aperture for a depth essentially equal to the initial distance between the plates 25 and 26 of the elastic member. Since said distance is less than the thickness of the material to be blanked, the material has been partially blanked on the punch side and the edges of the partially blanked figure are rounded off. As shown in FIG. 4 the elastic member spring 27*b* is completely compressed and the plates 25*b* and 26*b* of the elastic member are in contact. The punch 19*b* and the drive slide 24*b* are now rigidly connected and the second subcycle, i.e. the second stroke begins.

Since the drive slide 24*b* continues its movement upwards, the punch 19*b* is pushed upwards and since the clamping plate stands still, the punch slides through and out the clamping plate aperture 17*b*. The action on the stripper 6*b* is not sufficient to bear the action of the drive slide 24*b*, so that the punch 19*b* pushes the partially blanked part out of the clamping plate aperture 17*b* and, against the action of the stripper 6*b*, forces it into the aperture 5*b* of the die 3*b* blanking now the piece on the die side. The machine is so preset that the piece is completely blanked before the punch 19*b* pen-

etrates into the aperture 5*b* of the die 3*b*, so that when the work surface 22*b* of the punch 19*b* is flush with the outer surface 4*b* of the die 3*b* the motions of the punch 19*b* and of the drive slide 24*b* reverse and the return stroke begins.

In order to facilitate the separation of the material from the outer surface 4*c* of the die 3*c*, the pressure in the cylinder 11*c*, acting on the stripper 6*c* and the pressure in the cylinder 18*c* acting on the clamping plate 15*c* are momentarily interrupted. The punch 19*c* moves downward and the pressure on the clamping plate 15*c* is reset, the punch 19*c* continues moving downward and comes out of the blanked material. Before the punch 19*c* reaches the return stroke end also the pressure acting on the stripper 6*c* is reset. The material is caused to advance to another work position and air blasts blow away the blanked piece. When the punch reaches the return stroke end, the machine cycle is over and an identical cycle is ready to start.

While the invention has been particularly shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A blanking press comprising:

a frame;

a die, having a die aperture, said die being rigidly secured to said frame;

a stripper disposed within said die aperture and slidably guided by said die aperture, said stripper projecting from the outer surface of said die during one predetermined period of the machine cycle;

a clamping plate opposed to said outer surface of said die for clamping the material to be blanked against said outer surface of said die, said clamping plate being provided with an aperture, said aperture having essentially the same section of and being essentially aligned with said die aperture;

a punch disposed within said aperture of said clamping plate, said punch being slidably guided by said aperture;

a drive slide;

means for connecting said punch and said drive slide, said means being able to maintain the work surface of said punch substantially flush with the work surface of said clamping plate during another predetermined period of the machine cycle, said means being further able to allow said punch to recede into said aperture of said clamping plate a predetermined distance after which said means supply a direct transmission of the motion of said drive slide to said punch;

means for actuating said stripper;

means for actuating said clamping plate; and

means for actuating said drive slide.

2. A blanking press according to claim 1, wherein said means for connecting said punch and said drive slide comprise essentially a first plate secured to said punch, a second plate secured to said drive slide and a spring at least partially nested between said plates within a suitable cavity formed in said plates, so that said punch and said drive slide can approach compressing said spring until said plates meet and form a rigid transmission of the motion from said drive slide to said punch.

3. A blanking press according to claim 1, wherein said means for actuating said stripper is hydraulic means, said means for actuating said clamping plate is hydraulic means and said means for actuating said drive slide is mechanical means.

4. A blanking press according to claim 1, wherein said stripper projects from the outer surface of said die an amount which is less than the thickness of the material to be blanked.

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