

TOOLING DEVICE

FIELD OF THE INVENTION

The present invention relates to a tooling device, especially to a tooling device used for tooling a workpiece by punching.

5 BACKGROUND OF THE INVENTION

As is well known, press is a frame used for tooling a workpiece by punching. The conventional press including a ram 11 which moves in a reciprocating manner and is used to transmit a power generated by the press. A plank is mounted on one end of the ram in order that a die set
10 is able to be secured on the ram via the plank. A bed of the press is used to mount a bolster plate thereon for placing a workpiece, and the die set is guided by the ram to punch the workpiece.

The major function of the die set is to perform a puncturing, scraping and a blanking operations for tooling the workpiece, e.g. a
15 printed circuit board or a metal board.

The conventional die set which includes a workpiece rejecting plate, a punching plate assemblage, an interface plate and a top plate, in which the interface plate is adapted to be accommodated within the top plate, and the die set is secured on the plank of the ram via the top plate.
20 Furthermore, the punching plate assemblage includes a pad plate, a punch securing plate, a shouldered punch, in addition, a workpiece rejecting pin is further included in the die set. This workpiece rejecting pin is able to pass the punching plate assemblage through a workpiece rejecting hole disposed thereon and the two ends of the workpiece
25 rejecting pin are respectively against the interface plate and the workpiece rejecting plate.

At the beginning of the tooling operation, the die set is guided by the ram and the workpiece is therefore punched by the die set as the workpiece rejecting plate contacting with the workpiece at a bottom dead center of its stroke, and the workpiece rejecting plate presses the workpiece continually and accordingly the workpiece rejecting plate which is movable moves upwardly. Therefore, the shouldered punch passes the workpiece rejecting plate through a punching hole located thereon and punches the workpiece. After the punching operation performed by the shouldered punch is completed, the ram and the die set are not going to descend anymore, and owing to the upward motion performed by the workpiece rejecting plate the workpiece rejecting pin together with the interface plate are therefore moved upward. Thereafter, the ram and the die set ascend to its up dead center of the stroke for proceeding a next tooling step.

However, the workpiece is frequently adhered to the shouldered punch and rises up together with the die set during the rising up motion of the ram and the shouldered punch. Therefore, in order to overcome this troublesome defect aforementioned, a knockout device which includes a knockout bar and a knockout stop is thus disposed on the conventional press. The knockout bar is mounted on the ram and the knockout stop is secured on a specific position of the conventional press.

Because the ram and the die set are moved in a reciprocating manner and confined in a predetermined stroke having a top dead center and a bottom dead center, therefore, during the rising up motion of the ram, the interface plate will be contacting with the knockout bar, and accordingly, when the die set is risen up to the top dead center, the knockout bar is knocked by the knockout stop, and the interface plate is

therefore descent at once, that also causes the workpiece rejecting pin to punch the workpiece rejecting plate to descend and concurrently the workpiece adhered to the shouldered punch is accordingly separated therefrom.

5 However, the shortcomings existed in the tooling procedure mentioned above as employed in the prior art tooling device are:

(1) Because the workpiece rejecting procedure performed by separating the workpiece from the die set is taken place at the top dead center of the ram's stroke, hence the workpiece is going to descend from a certain
10 height, which will induce the workpiece to be easily damaged, and a relatively higher defectiveness of the workpiece is therefore increased, and

(2) Since the workpiece is adhered to the shouldered punch and will not be separated therefrom, unless the die set reaches the top dead center
15 and is knocked by the knockout stop and the knockout bar, hence, a detested crater-like opening will be unavoidably formed at a punched hole of the workpiece. For instance, if the provided workpiece is a printed circuit board, an adhesion ability for adhering a solder thereon will be accordingly reduced.

20 SUMMARY OF THE PRESENT INVENTION

Therefore the first object of the present invention is to alter the moment for rejecting a workpiece in order to reduce the defective rate of the workpiece.

A second object of the present invention is to offer a tooling device
25 having a capability for rejecting the workpiece without forming a crater-like opening thereon.

A third object of the present invention is to enhance the rejecting force in tooling processing.

A fourth object of the present invention is to promote the quality of the punched hole of the workpiece.

5 In accordance with the present invention, a tooling device comprises:
a frame for mounting thereon a workpiece, and a resilient device
disposed on the frame for transmitting and storing a power in response
to an applied force in order that as a tooling procedure for processing the
workpiece is accomplished, the power will be instantly released for
10 speeding the tooling procedure of the workpiece.

In accordance with another aspect of the present invention, the frame is a press.

In accordance with another aspect of the present invention, the resilient device includes: a casing having a movable compressing plate,
15 and a spring disposed in the casing and compressible by the movable compressing plate.

In accordance with another aspect of the present invention, the casing has a top connected to a ram of the press and a bottom connected to a die set.

20 In accordance with another aspect of the present invention, the compressing plate is disposed at a central portion of the bottom of the casing.

In accordance with another aspect of the present invention, the central portion has an opening and a flange surrounding the opening,
25 while the compressing plate is provided with a corresponding flange for urging against the flange of the central portion.

In accordance with another aspect of the present invention, the spring is disposed between the top of the casing and the compressing plate in order that the spring will be compressed as the compressing plate is moved toward the top of the casing.

- 5 In accordance with another aspect of the present invention, the ram is moved in a reciprocating manner for transmitting the applied force to the casing.

In accordance with another aspect of the present invention, the die set is used to punch and tool the workpiece.

- 10 In accordance with another aspect of the present invention, the die set includes: a top plate engaging with the bottom of the casing of the resilient device, a punching plate assemblage engaging with the top plate, and including a punch for punching and pressing the workpiece, a workpiece rejecting plate having a punching hole through which the
15 punch passing to punch the workpiece and being moved by having a direct contact with the workpiece, an interface plate adapted to be disposed on a central portion of the top plate and contacted tightly with the compressing plate of the resilient device, and a workpiece rejecting pin passing through the punching plate assemblage in which two tips of
20 the rejecting pins respectively contacting with the rejecting plate and the interface plate.

In accordance with another aspect of the present invention, the punch is a shouldered punch.

- 25 In accordance with another aspect of the present invention, as the tooling procedure is being executed, a movement of the rejecting plate concurrently induces a motion of the rejecting pin, the interface plate

and the compressing plate, and the power generated and outputted by the tooling device is accordingly stored in the spring.

In accordance with another aspect of the present invention, the power stored in the spring is released immediately after the tooling procedure is accomplished, in order that the workpiece can be separated from the die set rapidly.

In accordance with another aspect of the present invention, the casing of the resilient device is partitioned into a first room and a second room by a partitioning plate, in which the spring and a transmitting plate are disposed in the first room, while the spring is installed between the top of the casing and the transmitting plate, and the second room is a space for accommodating the motion of the compressing plate.

In accordance with another aspect of the present invention, the resilient device further includes a transmitting pin passing through the partitioning plate, and two tips of the transmitting pin respectively urge against the interface plate and the transmitting plate, in order that the power is uniformly stored or released by the spring.

In accordance with another aspect of the present invention, the resilient device further includes at least one more spring.

In accordance with another aspect of the present invention, the resilient device includes a plurality of springs.

In accordance with another aspect of the present invention, a ram of the press is adapted to engage with a die set.

In accordance with another aspect of the present invention, the die set includes: a top plate engaging with the ram, a punching plate assemblage engaging with the top plate and including a punch for punching and pressing the workpiece, and a workpiece rejecting plate

having a punching hole through which the punch passes to punch the workpiece and being moved by having a direct contact with the workpiece.

In accordance with another aspect of the present invention, the plurality of springs are disposed between the rejecting plate and the punching plate assemblage, in order that the rejecting plate and the punching plate are respectively prepressed by the plurality of springs.

In accordance with another aspect of the present invention, the rejecting plate is moved during the tooling procedure by having a direct contact with the workpiece to thus compress the plurality of springs and accordingly store the power.

In accordance with another aspect of the present invention, the workpiece is a printed circuit board.

In accordance with another aspect of the present invention, the workpiece is a metal plate.

The present invention may best be understood through the following description with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic view showing a preferred embodiment of the tooling device according to the present invention;

Fig. 2 is a sectional view of a preferred embodiment of the resilient device according to the present invention;

Fig. 3 is a schematic view showing another preferred embodiment of the tooling device according to the present invention;

Fig. 4 is a schematic view showing a third preferred embodiment of the tooling device according to the present invention; and

Fig. 5 is a diagram showing a printed circuit board punched by using the tooling device disclosed by the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Please refer to Fig. 1, a conventional press 10 is employed by the present invention as a main frame. A resilient device 41 is disposed between the ram 11 of the press 10 and the die set 12 which includes a spring 43 and a casing 42 within which the spring 43 is accommodated. The top of the casing 42 is secured on a plank 111 mounted on the ram 11 of the press 10. Please refer to Fig. 2, an opening 51 having a flange 52 surrounded thereabout is provided at the central portion of the bottom of the casing 42 in order to accommodate therein a compressing plate 53 having a corresponding flange 54. The compressing plate 53 can be urged against the flange 52 of the opening 51 via the flange 54 thereof.

The spring 43 can be plural and be disposed between the top of the casing 42 and the compressing plate 53 for uniformly bearing an applied pressure and transmitting a power generated by the press 10.

Please refer to Fig. 1, the bottom of the casing 42 is connected with the die set 12, however, owing that the interface plate 23 of the die set 12 is thicker than the top plate 24, therefore, the interface plate 23 can be contacted tightly with the compressing plate 53, thus to make the spring 43 retain a pre-pressure therebetween. When the die set 12 is descended to the bottom dead center during the tooling process, the workpiece 14 will be punched by the shouldered punch 223, in the mean time, the rejecting plate 21, the rejecting pin 25 and the interface plate 23 will be accordingly moved upward, and the compressing plate 53 will be therefore risen up owing to the pressing performed by the interface

plate 23 to compress the plurality of springs 43. Therefore, the maximum distortion of the springs 43 will then be generated when the die set 12 is moved to the bottom dead center. As soon as the die set 12 departs away from the bottom dead center, the workpiece 14 will no longer be compressed by the rejecting plate 21, and thus the energy stored in the springs 43 will be released immediately, the interface plate 23, the rejecting pin 25 and the rejecting plate 21 will be accordingly pushed down by the compressed springs 43 during the workpiece rejecting operation, and this will results in a separation of the workpiece 14 from the shouldered punch 223. Thereafter, the die set 12 will returns to the top dead center of the stroke for another tooling operation.

Please refer to Fig. 3, for more uniformly releasing the power stored in the springs 43 during the tooling procedure, a resilient device 61 is developed according to the resilient device 41 depicted in Fig. 1. The resilient device 61 includes a casing 62, a partitioning plate 63 separating the internal of the casing 62 into a first room 621 and a second room 622, in which the first room 621 is used to accommodate the plurality of springs 43 and a transmitting plate 64. The plurality of springs 43 are disposed between the top of the casing 62 and the transmitting plate 64. The central bottom of the casing 62 has the same design with that of the compressing plate 53 shown in Fig. 2, and the second room 622 defines a space for the compressing plate 53 to move therein. A transmitting pin 65 is disposed between the compressing plate 53 and the transmitting plate 64, while the transmitting pin 65 can pass the partitioning plate 63 through a passing through hole thereon in order that two tips of the transmitting pin 65 can respectively urge against the compressing plate 53 and the transmitting plate 64.

The working theory of the resilient device 61 is identical with that of the resilient device 41 depicted in Fig. 1, and the power stored in the resilient device 61 can be uniformly released and transmitted due to the arrangement of the transmitting pin 65 and the transmitting plate 64
5 during the workpiece rejecting operation.

Please refer to Fig. 4, the plurality of springs 43 are disposed between the rejecting plate 21 of the die set 12 and the punch securing plate 222, wherein the top plate 24 of the die set 12 is directly secured on the plank 111 of the ram 11, therefore, the rejecting plate 21 can be
10 descended immediately as the die set 12 departs from the bottom dead center in order to reject the workpiece instantly.

In according with the above descriptions, it is realized that, the advantage of the instantaneous rejecting operation of the workpiece 14 is that a flat surface of the workpiece 14 is maintained after the
15 workpiece is tooled. For the reader's convenience, a printed circuit board is taken as an instance, on which a layer of copper 141 is attached thereon, as shown in Fig. 5.

When the printed circuit board 14 is punched by the shouldered punch 223, a heat is resulted from a friction taken place therebetween,
20 and accordingly, the punching hole 142 is enlarged by the instantaneous heat. Consequently, the instantaneous rejecting operation of the workpiece 14 makes the shouldered punch 223 depart rapidly from the printed circuit board 14 without touching it. Hence, the copper coating 143 around the punching hole 142 is flat and smooth, and the copper
25 coating 143-1 surrounded a circumference of the hole 144 is tightly attached thereon. The hole 142 having the copper coating circumference 144 is called a flanged hole.

The flanged hole 142 having a copper coating surrounded the circumference 144 thereon enhances the soldering ability of the solder therearound in order that an object soldered on the flanged hole 142 is capable of enduring an application of a large tension. In addition, the
5 instantaneous rejecting operation of the workpiece 14 can reduce the defective rate of the printed circuit board.

In contrast, the knockout rejecting operation used in the conventional tooling device will easily to distort the surface of the workpiece and cause the crater-like punched hole, and thus decrease the
10 quality and costs during the tooling process.

According to above description, although a printed circuit board is used as an example to introduce the working theory of the present invention, in practice, however, a similar advantage can also be achieved by utilizing the present invention to process every metal
15 workpiece. For example, by employing the present invention to work on a punching or pressing operation for tooling a steel plate, the tooled position of the workpiece can be kept flat and smooth, and distortion and warping problems can be avoided. Consequently, the present invention is to utilize a very simple construction for obtaining a high
20 quality of a punched workpiece, therefore, it is very valuable for industrial application.

CLAIMS:



1. A tooling device characterized by comprising a frame for mounting thereon a workpiece, and a resilient device disposed on the frame for transmitting and storing a power in response to an applied force in order that as a tooling procedure for processing the workpiece is accomplished, the power is released for use of the workpiece.
2. A tooling device according to Claim 1, characterized in that the frame is a press.
3. A tooling device according to Claim 2, characterized in that the resilient device includes a casing having a compressing plate, and a spring disposed in the casing, and compressible by the compressing plate.
4. A tooling device according to Claim 3, characterized in that the casing has a top connected to a ram of the press, and a bottom connected to a die set.
5. A tooling device according to any one of Claims 3 - 4, characterized in that the compressing plate is disposed on a central portion of the bottom of the casing.
6. A tooling device according to Claim 5, characterized in that the central portion has an opening and a flange surrounding the opening, and the compressing plate is provided with a corresponding flange for urging against the flange of the central portion.
7. A tooling device according to any one of the Claims 3 - 6, characterized in that the spring is disposed between the top of the casing



and the compressing plate in order that the spring is compressed as the compressing plate is moved toward the top of the casing.

8. A tooling device according to any one of Claims 3 - 7, characterized in that the ram is moved in a reciprocating manner for transmitting the applied force to the casing.

9. A tooling device according to any one of Claims 1 - 8, characterized in that the die set is used to punch and tool the workpiece.

10. A tooling device according to any on Claims 1 - 9, characterized in that the die set includes a top plate engaging with the bottom of the casing of the resilient device, a punching plate assemblage engaging with the top plate, and including a punch for punching and pressing the workpiece, a workpiece rejecting plate having a punching hole through which the punch passes to punch the workpiece for rejecting the workpiece, an interface plate adapted to be disposed on a central portion of the top plate and contacted tightly with the compressing plate of the resilient device, and a workpiece rejecting pin passing though the punching plate assemblage and two tips of the rejecting pins respectively contact with the rejecting plate and the interface plate.

11. A tooling device according to Claim 10, characterized in that the punch is a shouldered punch.

12. A tooling device according to any one of Claims 3 - 11, characterized in that as the tooling procedure is executing, a movement of the rejecting plate induces concurrently a motion of the rejecting pin, the interface plate and the compressing plate, and the power generated and outputted by the tooling device is accordingly stored in the spring.



13. A tooling device according to any one of Claims 3 - 12, characterized in that the power stored in the spring is released immediately after the tooling procedure is accomplished, in order that the workpiece is separated from the die set rapidly.

14. A tooling device according to any one of Claims 3 - 13, characterized in that the casing of the resilient device is partitioned into a first room and a second room by a partitioning plate, in which the spring and a transmitting plate are disposed in the first room, the spring is installed between the top of the casing and the transmitting plate, and the second room is a space for the motion of the compressing plate.

15. A tooling device according to any one of Claims 3 - 14, characterized in that the resilient device further includes a transmitting pin passing through the partitioning plate, and two tips for the transmitting pin respectively urge the interface plate and the transmitting plate, in order that the power is uniformly stored or released by the spring.

16. A tooling device according to any one of Claims 1- 15, characterized in that the resilient device further includes at least one more spring.

17. A tooling device according to any one of Claims 1- 15, characterized in that the resilient device includes a plurality of springs.

18. A tooling device according to any one of Claims 2 - 17, characterized in that a ram of the press is adapted to engage with a die set.



19. A tooling device according to any one of Claims 1 - 18, characterized in that the die set includes a top plate engaging with the ram, a punching plate assemblage engaging with the top plate, including a punch for punching and pressing the workpiece, and a workpiece rejecting plate having a punching hole through which the punch passes to punch the workpiece for rejecting the workpiece.
20. A tooling device according to any one of Claims 3 - 19, characterized in that the plurality of springs are disposed between the rejecting plate and the punching plate assemblage, in order that the rejecting plate and the punching plate assemblage are prepressed by the plurality of springs.
21. A tooling device according to any one of Claims 3 - 20, characterized in that the rejecting plate is moving during the tooling procedure by the workpiece to thus compress the plurality of springs and accordingly store the power.
22. A tooling device according to Claim 1, characterized in that the workpiece is printed circuit board.
23. A tooling device according to Claim 1, characterized in that the workpiece is a metal plate.