Feb. 27, 1940. D. E. STROMBERG ET AL 2,191,836

SELF-CLEANING PUNCH

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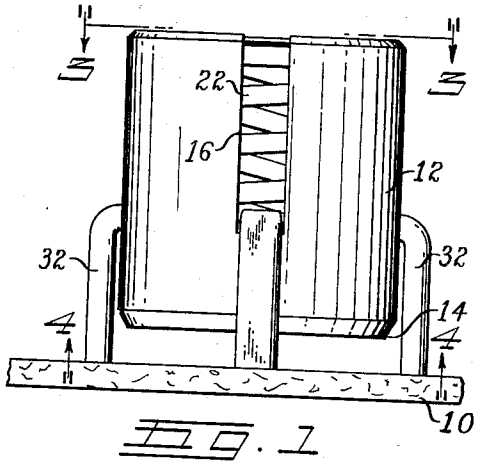


FIG. 1

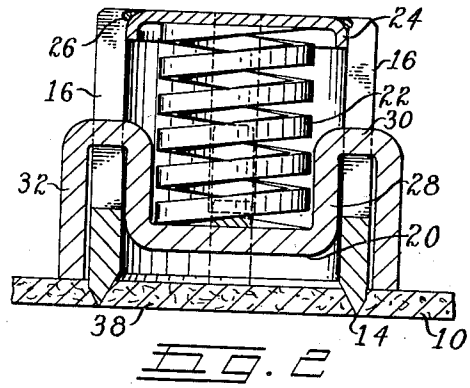


FIG. 2

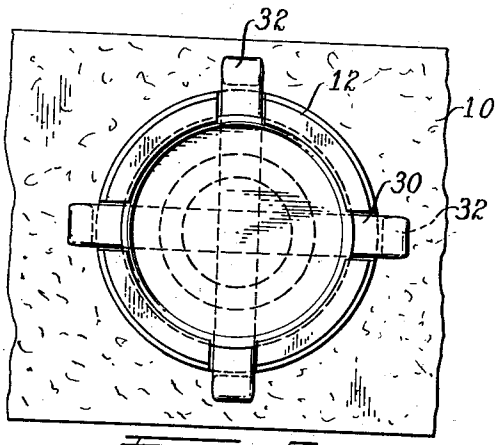


FIG. 3

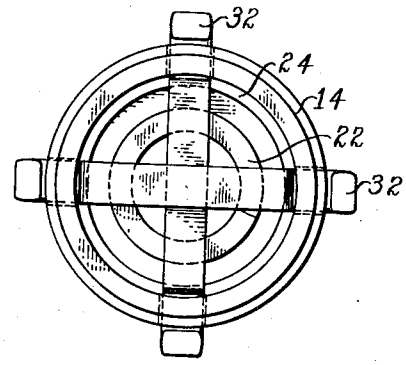


FIG. 4

FIG. 6

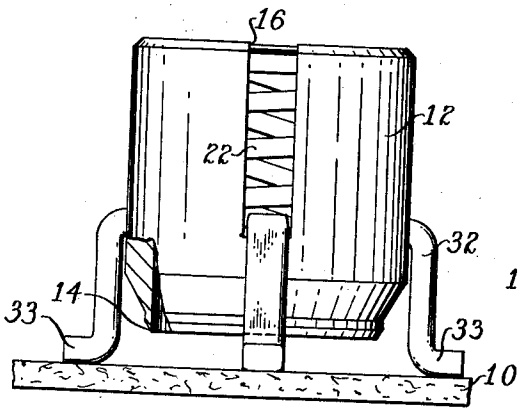
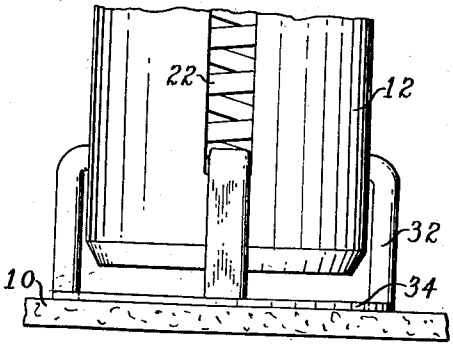


FIG. 5



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SELF-CLEANING PUNCH

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13 Claims. (Cl. 164—110)

This invention relates to an improved self-cleaning punch or die.

An object is to provide a punch which is simple, an inexpensive, which is sturdy and of rugged construction and which is entirely self-contained and self-cleaning.

This improved punch is particularly designed for the cutting of fiber board and other similar sheet material but is capable of use with sheet material of widely varying characteristics and is intended for such use wherever it may be feasible. Heretofore punches designed for this use have required additional operations for removal of the slug or cut-out cut either from the sheet of material upon which the punch operated or from the punch itself if such cut out was retained by the punch after being withdrawn by the punch from the sheet.

Punches have been provided with spring mechanism adapted to act upon that portion cut from the sheet punched to eject such cut out portion from the punch itself after the punch has lifted the cut out portion from the sheet. Such spring mechanism, however, generally functioned to act on said cut out portion to eject the same concurrently with the lifting of the punch itself from the sheet and as a result such cut out portion was ejected from the punch itself back into the aperture in the sheet. If the cut out portion could not pass directly through the aperture in the sheet or fall therefrom an additional operation was necessary for its removal.

Other types of punches have been provided wherein additional apparatus actuated by or responsive to mechanism on the press or punch operating mechanism was brought into play to eject the cut out portion which normally remained with the cutting or knife part of the punch. Such punches are not considered to be self-cleaning in that the cleaning of the punch is not accomplished by mechanism self-contained within the punch itself but by auxiliary mechanism.

This improved punch while self-cleaning is also self-contained in that the cut out portion or slug severed by the cutting edge of the punch is ejected from the punch by mechanism within the punch itself and is ejected in such a manner that the slug clears the aperture in the sheet formed by the severance of such cut out therefrom. This punch does not require additional operations or mechanism for complete removal of such cut out.

An important feature of this invention is that the ejecting mechanism is so constructed and arranged that its action is delayed so that the cut out is ejected from the punch only after the punch has been completely elevated above the sheet acted upon.

Another important feature is that this delayed action ejecting mechanism is not only self-contained within the punch itself but is self-actuating in that it responds to clean the cut out portion from the punch after the punch has been lifted a determined spaced distance above the sheet of material acted upon by the punch and without the intervention of any additional or auxiliary apparatus actuated by the press or punch operating machine but automatically when the punch attains a determined height above the sheet of material punched.

After the punch has been lifted a determined spaced distance above the sheet of material from which the cut out portion has been severed the punch cleaning or ejecting mechanism functions to eject the cut out portion from the punch clear of the aperture formed in the sheet of material punched. By delaying the ejecting action the cut out portion is withdrawn entirely from the sheet of stock material after the punch is retracted and following such complete withdrawal is then ejected from the punch.

Other objects, advantages, and meritorious features of this invention will more fully appear from the following description, appended claims, and accompanying drawing, wherein:

Figure 1 illustrates in side elevation a punch embodying this invention,

Fig. 2 illustrates in cross-section a punch embodying the invention in the position of severing a portion from a sheet of material,

Fig. 3 is a plan taken on the line 3—3 of Fig. 1,

Fig. 4 is a view looking up at the bottom of the punch on the line 4—4 of Fig. 1,

Fig. 5 is a side elevation of a punch embodying the invention and broken away showing a slightly modified form of cutting edge,

Fig. 6 is a side elevation partly broken away of a punch embodying a modified form of my invention.

The improved punch is illustrated in the drawing and positioned for operation. The invention is shown as embodied in a punch or die of circular contour. It is obvious that it might be of any desired shape. The shape shown is conventional and illustrative only. It is shown is connection with a sheet of fiber board adapted to be cut thereby. The extensive use of fiber board in the automobile industry makes a punch of this type particularly adaptable for such use though obviously it might be used with any type of ma-

terial with which the punch was capable of functioning.

The punch will be carried by the movable part of a machine which will urge the same with sufficient force against the sheet material to be cut by the punch so as to perform its intended function and such sheet material will of course be properly supported. One punch might be used or a multiplicity of punches might be mounted in a form which has moved toward and away from the sheet material to be cut thereby. This associated apparatus and machine mechanism is conventional construction and this invention relates solely to the structure of the self-contained punch itself and is not concerned with this associated mechanism.

In the drawing a sheet of material to be cut by the punch is indicated as 10. Such material may, as above stated, be composition fibrous material. The punch itself embodies a body portion 12 sharpened at one end as at 14 to provide a cutting edge at such end. This body member is here shown as circular in cross-section and of tubular construction. It is provided with slots 16 which are here shown as arranged in two opposed pairs and extending lengthwise of the body member from that end which is opposite the cut end toward the other end but the slots terminate spaced from such cutting end as shown particularly in Figs. 1, 2, 5 and 6.

The cutting end of the punch may be shaped as desired to serve its intended cutting purpose and depending upon the character of material and the character of the aperture desired to be made. In Fig. 5 a slightly different form of cutting edge is illustrated. These features have nothing to do with the invention herein claimed and it is obvious that any type of cutting bevel desired may be given to the cutting edge of the punch.

In the construction of Fig. 2 the cutting edge is beveled upon the inside as well as upon the outside while in Fig. 5 the cutting edge is straight on the inside and the bevel which is a multiple one is entirely on the outside surface.

The present invention concerns itself with such a punch provided with improved ejector or knock out mechanism adapted to knock the slug or cut out portion removed from the board by the punch out of the punch in such a manner that the punch will clear itself at all times during operation so that it may continue to function accurately and efficiently without the necessity of additional operations for its clearance and in such a manner that it will not be left in the sheet of material from which it was severed.

This ejector mechanism is here shown as formed of a pair of strap elements which extend transversely through the body of the punch being disposed within the slots 16. These strap elements cross each other within the body of the punch being disposed at right angles to one another and are so bent as to form a knock out portion 20 within the body of the punch which is cup shaped so as to receive one end of a spring 22 the opposite end of which spring bears against a spring abutment in the form of a plate 24 which plate 24 is removably held within the upper end of the punch by a snap ring 26. The spring tends to urge these ejector straps toward the cutting end of the punch so that normally they seat therein as determined by the length of the slots 16.

It will be noted that each strap is so shaped that the central knock out area 20 has end extensions which are U-shaped. Each of these U-shaped end extensions has a short leg 28 within the body of the punch and the base of the U or bridge portion 30 rides within the slot 16 and seats in the bottom of the slot under the pressure of the spring 22 as shown in Figs. 1, 5 and 6. Each U-shaped end extension has also a long outer leg 32 which extends toward the cutting end of the punch outside of the punch body as shown in Figs. 1, 2, 5 and 6 and is of such a length that when the ejector straps or clips are seated in the ends of the grooves as shown in Fig. 1 these long leg portions 32 project substantially beyond the cutting end of the punch but the short legs are of such a length that the knock out portions 20 are supported within the body and do not project beyond the cutting end of the punch. It is due to this construction that the delayed action of the knock out which is a feature of primary importance is obtained. In Figs. 1 and 2 these outer legs 32 bear directly against the sheet of material which is to be cut by the punch but in the construction of Fig. 6 these outer legs 32 have fixed to their outer ends a ring 34 of a diameter to pass the punch body 12 therethrough and which ring directly contacts the sheet of material 10 to be cut by the punch. In Fig. 5 each of the legs 32 is bent outwardly at its lower end providing a foot portion 33.

In the operation of this punch when it is forced downwardly toward the sheet of material to be cut thereby the legs 32 or the link 34 first engages such sheet and the continued downward movement of the punch body is against yielding resistance of the spring 22 as the knock out or ejector which is made up of the cross straps or clips travels upwardly against the resistance of the spring. When the cutting edge of the punch comes in contact with the board the knock out portion 20 of the ejector is elevated substantially above the board and this is true when the punch is pressed completely through the sheet of material to be cut as shown in Fig. 2.

In such figure it will be seen that a portion 38 has been severed from the board 10 and this portion forms a slug or knock out portion which, when the punch is elevated after completing its cutting operation will normally cling within the cutting end of the punch body and be lifted from the sheet of material by the punch. The knock out portion 20 of the ejector will not come into play to knock this portion 38 out of the punch body until the punch body has been lifted a sufficient distance to permit the knock out portion to move downwardly as the spring expands. It will therefore be seen that the punch body will have completely cleared the board or sheet material from which the cut out part was severed before the ejector functions to knock the slug from the punch body. It is this delayed action of the punch which clears the cut out portion in such a manner that it does not fall back within the sheet of material from which it was cut and clears it entirely by the action of the punch mechanism itself as it moves away from the sheet operated upon. The ejector mechanism is entirely automatic in its functioning. It is self-contained within the punch. It is simple and inexpensive in construction. If the spring 22 is broken the plate 24 may be removed and another spring inserted in place. Repair is easily accomplished.

What we claim is:

1. A punch comprising a tubular body having a cutting edge at one end and having slots ex-

tending lengthwise of the body terminating spaced from said cutting end, ejector mechanism having a knock out portion disposed within the body and provided with supports extending through said slots and slidable lengthwise thereof and adapted to support said knock out portion within the body when the supports are seated within the ends of the slots adjacent to the cutting end of the body, spring means acting upon said ejector mechanism to yieldingly urge said knock out supports to seat within said slots, said knock out supports having legs disposed exteriorly of the body and of a length to extend beyond the cutting end of the body when the knock out supports are seated within said slots.

2. A punch comprising a tubular body having a cutting edge at one end and a spring abutment at the opposite end and having opposed slots extending lengthwise of the body and terminating spaced from said cutting end, ejector mechanism having a knock out portion disposed within said body and provided with opposed supporting portions extending through said slots and slidable lengthwise thereof and adapted to seat within the ends of the slots adjacent to the cutting end of the body and when so seated adapted to support said knock out portion within the body, said supports provided with legs outside of the body extending lengthwise thereof and of a length to terminate spaced outwardly beyond the cutting end of the body when the knock out supports are seated within said slots, and a spring seated at one end against said spring abutment adapted to yieldingly urge said knock out toward the cutting end of the body.

3. A punch comprising a tubular body having a cutting edge at one end and a spring abutment at the opposite end and having opposed slots extending lengthwise of the body and terminating spaced from said cutting end, ejector mechanism mounted within said slots for slidable movement lengthwise therethrough and including a knock out portion disposed within said body and U-shaped leg portions extending through said slots with the base of each U-shaped leg portion slidably disposed within its slot and adapted to seat in the end thereof adjacent to the cutting end of the body, each U-shaped leg portion having a short leg within the body and a long leg outside of the body whereby the knock out portion is supported within the body when the U-shaped legs are seated within said slots and the outer long legs extend beyond the cutting end of the body, and a spring bearing at one end against said spring abutment and at the opposite end against said knock out portion to yieldingly urge said ejector toward the cutting end of the body.

4. A punch comprising a tubular body having a cutting edge at one end and a spring abutment at the opposite end and having opposed slots extending lengthwise of the body and terminating spaced from said cutting end, ejector mechanism comprising a strap having a central knock out portion disposed within the body and having U-shaped end portions extending through said slots and adapted to seat within ends of the slots adjacent to the cutting end of the body, each U-shaped end portion having a short leg within the body and a long leg outside of the body, such short leg being of such a length that the central knock out portion of the strap is supported within the body when each U-shaped leg portion is seated within its slot and said long legs being of such a length that the ends thereof project beyond the cutting end of the body when the U-shaped end portion is so seated within its slot.

5. A punch comprising a tubular body having a cutting edge at one end and a removable spring abutment at the opposite end and having two pairs of opposite slots extending from said opposite end lengthwise of the body and terminating spaced from said cutting end, a snap ring holding said abutment releasably in position, ejector mechanism comprising a strap for each pair of slots extending transversely through the body and through said slots, each strap having a central portion disposed within the body and adapted to serve as an ejector knock out, such straps crossing each other within the body, each strap having U-shaped end portions disposed within the slots for slidable movement lengthwise therethrough, each U-shaped end portion having a long leg outside of the body of a length to extend beyond the cutting end of the body when the U-shaped end portion is seated within the adjacent end of the slot and having a short leg within the body supporting the central knock out portion of the strap spaced inwardly from the ends of the outer legs, and a spring bearing at one end against said releasable spring abutment and bearing in the opposite end against the crossed central portions of said straps.

6. A punch comprising a tubular body having a cutting edge at one end, an ejector extending transversely through the body and slidable lengthwise thereof, a spring yieldingly urging said ejector toward the cutting end of the body, said body having a seat adapted to limit the movement of the ejector toward the cutting end of the body, said ejector having a knock out portion disposed within said body and having supporting legs disposed outside of the body and extending beyond its cutting end when the ejector reaches its limit of movement toward said cutting end.

7. A punch comprising a hollow body having a cutting edge at one end, an ejector extending transversely through the body and slidable lengthwise thereof, means yieldingly urging said ejector toward the cutting end of the body, means limiting the movement of the ejector toward said cutting end of the body, said ejector having a knock out portion disposed within said body and a supporting portion disposed outside of the body and extending toward the cutting end of the body substantially beyond the knock out portion of the ejector.

8. A punch for cutting a part from a sheet of material including a member within the punch yieldingly urged toward the cutting edge thereof and adapted to engage the cut out part and eject the same from the punch, said member having a part directly connected and adapted to engage the sheet of material during the cutting operation and hold the member back in its movement toward the cutting edge of the punch so that it does not engage the cut out part until after the punch has been retracted a spaced distance from the sheet of material.

9. Punch mechanism comprising a hollow punch body having a cutting end, directly connected ejector and stock stripper means having its ejector portion disposed within the punch body and having its stock stripper portion disposed externally of the punch body, and mechanism acting upon said ejector and stock stripper means jointly and as a unit to urge the same toward the cutting end of the punch body.

10. Punch mechanism comprising a hollow

punch body having a cutting end ejector and stock stripper means having its ejector portion disposed within the punch body and having its stock stripper portion disposed externally thereof, said ejector portion and stock stripper portion being directly connected by a U-shaped portion bridging a part of the punch body wall for movement as a unit toward and away from the cutting end of the punch, said stock stripper portion being in advance of the ejector portion, and means engaging said ejector and stock stripper means to urge the same as a unit toward the cutting end of the punch.

11. Punch mechanism comprising, in combination, a hollow punch body having a cutting edge, an ejector supported within the punch body for movement toward and away from the cutting edge and a stock stripper disposed outside the punch body and carried by the ejector for movement therewith, said stock stripper being disposed in advance of the ejector toward the cutting edge of the punch, and spring means yieldingly engaging the ejector to urge the ejector and stock stripper as a unit toward the cutting edge of the punch.

12. Punch mechanism comprising, in combination, a hollow punch body having a cutting edge, an ejector supported within the punch body, a stock stripper disposed outside of the punch body, a bridging portion connecting said ejector and stock stripper for movement as a unit toward and away from the cutting edge of the punch, and means operable to move said ejector and stock stripper as a unit toward said cutting edge.

13. Punch mechanism comprising, in combination, a hollow punch body having a cutting edge, an ejector supported within the punch body, a stock stripper disposed outside of the punch body, a bridging portion connecting said ejector and stock stripper for movement as a unit toward and away from the cutting edge of the punch, and spring means disposed within the punch body and acting upon said ejector operable to urge said ejector and stock stripper as a unit toward said cutting edge.

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