April 23, 1963 J. E. LEVINE 3,086,418

SHEARPROOF METAL PUNCH

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Fig. 1.

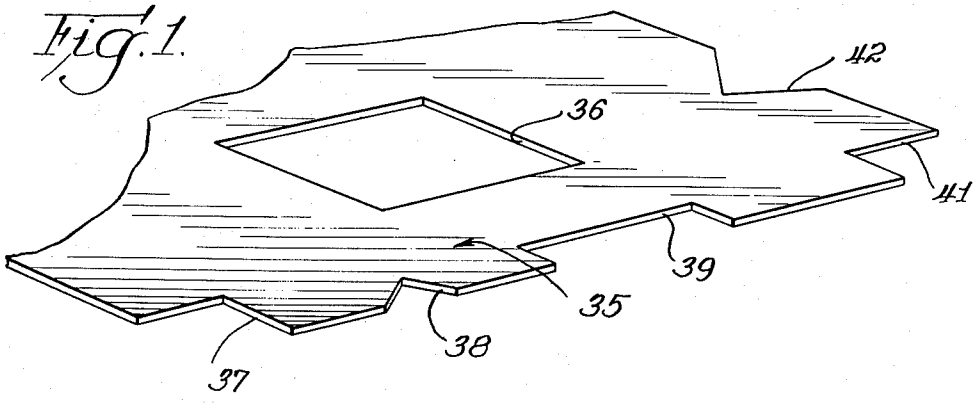
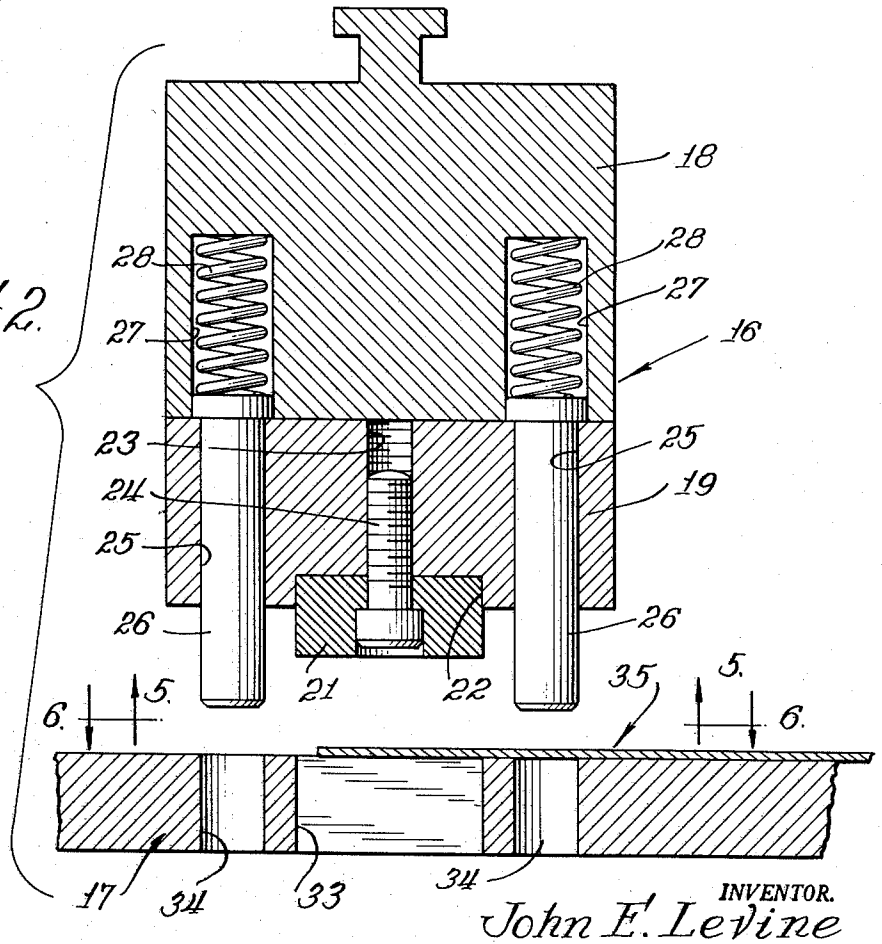


Fig. 2.



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Fig. 3

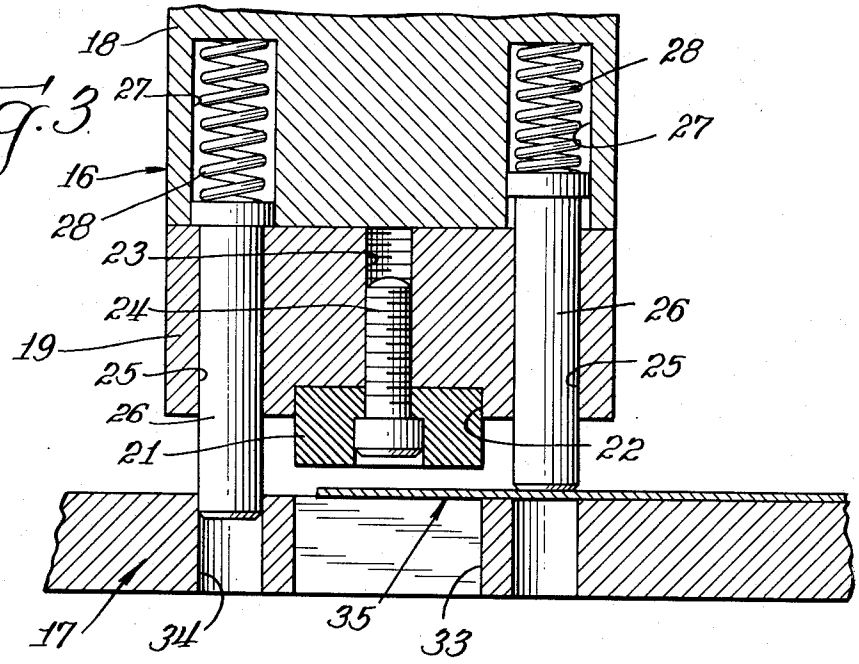
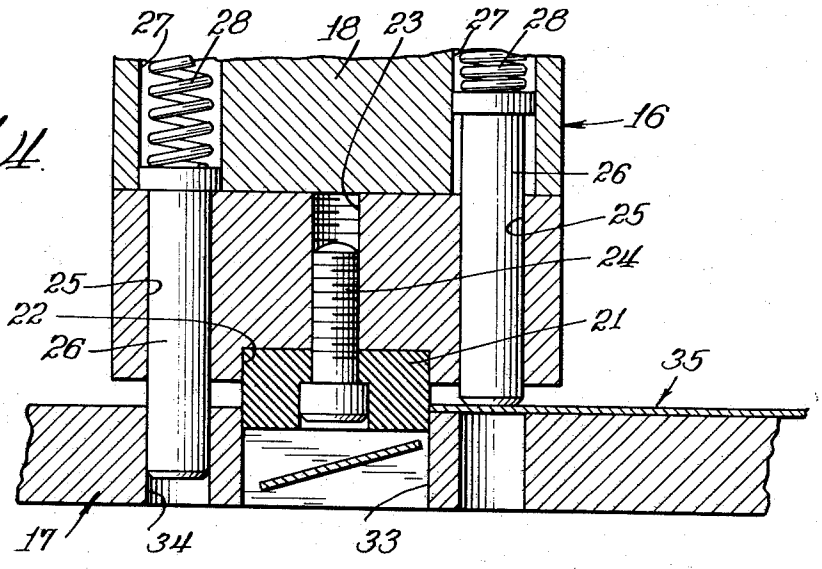


Fig. 4



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Fig. 5.

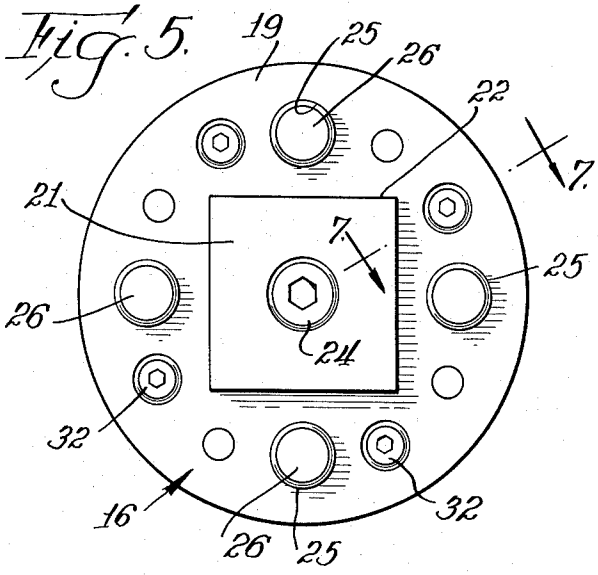


Fig. 7.

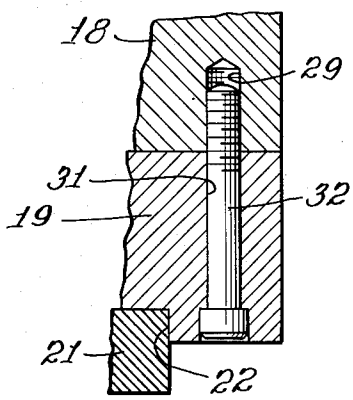
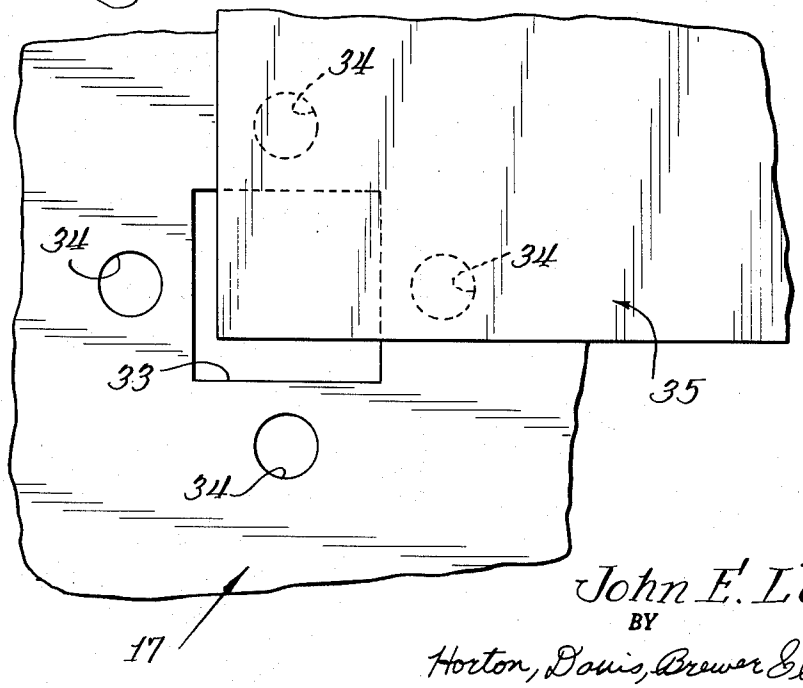


Fig. 6



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Fig. 8.

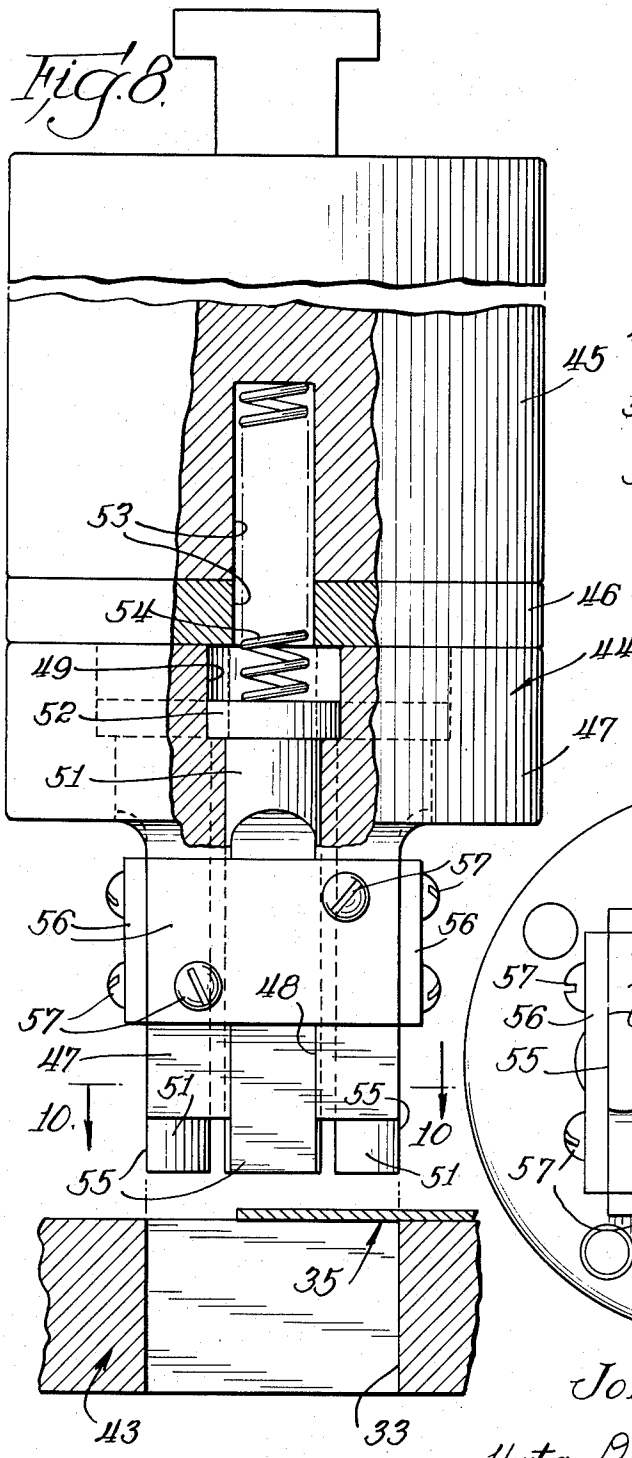


Fig. 10.

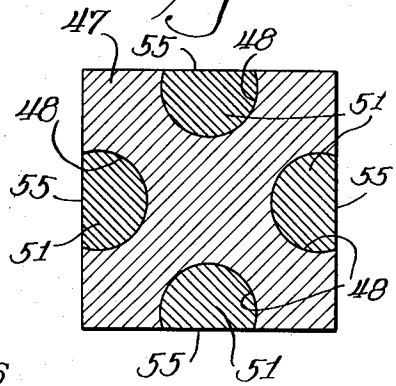
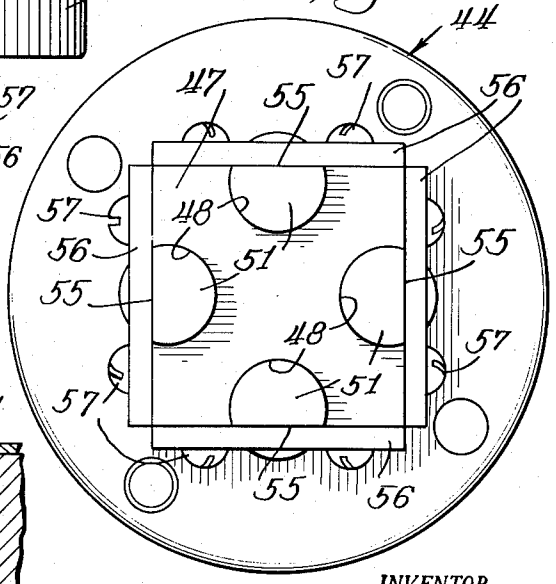


Fig. 9.



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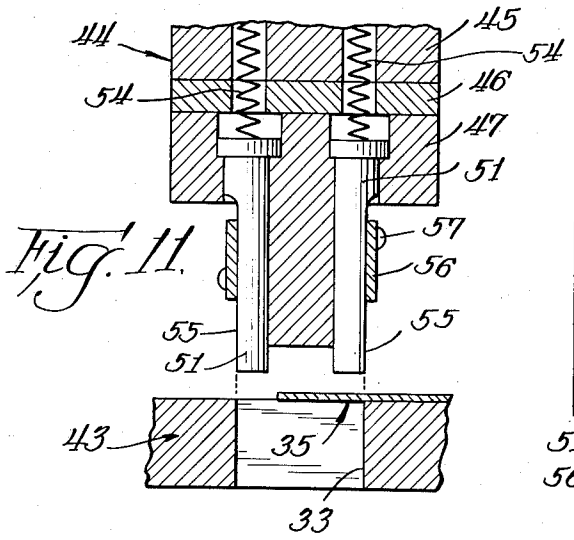


Fig. 11.

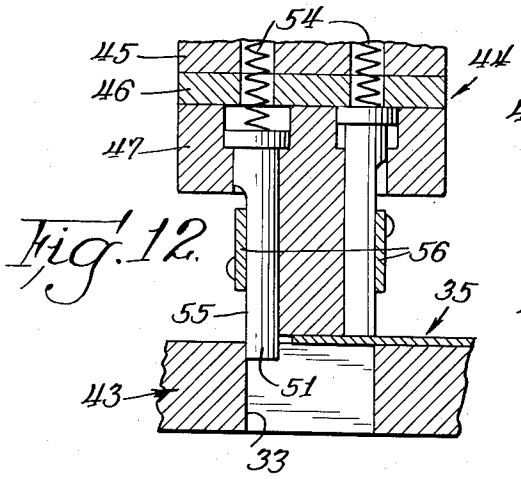


Fig. 12.

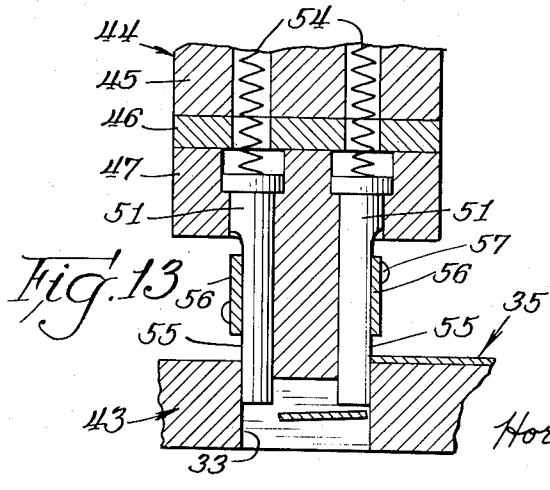


Fig. 13.

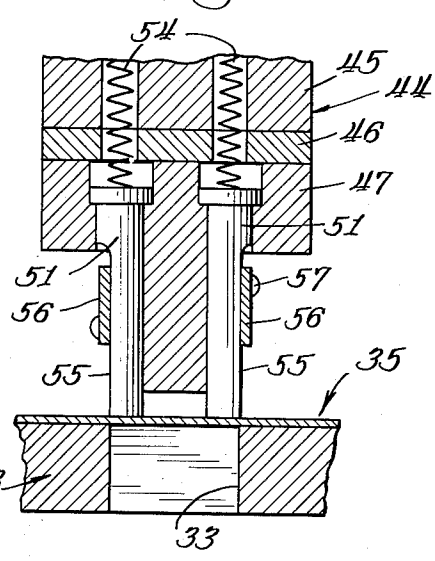


Fig. 14.

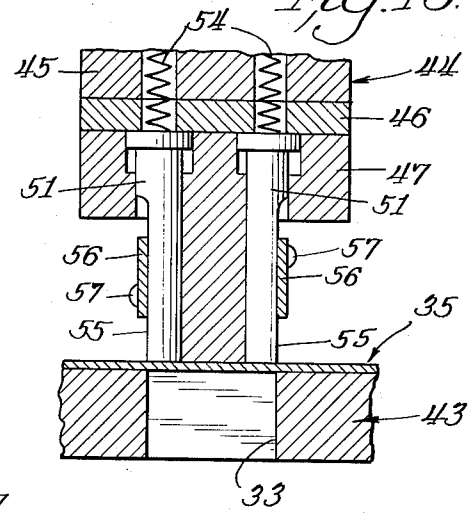


Fig. 15.

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United States Patent Office 3,086,418 Patented Apr. 23, 1963

3,086,418

SHEARPROOF METAL PUNCH

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Filed Feb. 1, 1960, Ser. No. 5,979
2 Claims. (Cl. 83—635)

When less than the total perimeter of a die is used in the conventional punching or forming of a work piece, such as when the latter is being notched, the shearing or forming action will impose forces against the punch to move it transversely of its normal punching movement against the exposed peripheral portion of the die. Both the punch and die thus will be worn and damaged.

A principal object of this invention is to prevent wear and damage of punching apparatus, particularly during notching therewith, due to contact between contiguous active edge portions of the punch and die which are not effecting a cutting, shearing or forming action. This is accomplished by mounting retractable guide pins in one of the die members and providing aperture means or mating holes in the opposing die member for receiving those pins during a punching operation before the punch contacts a work piece, if the pins are not prevented from doing so by the work piece. Thus, if one or more of the pins enters the corresponding hole or holes, shifting of the die members relative to each other will be prevented, except in the direction of the punching action.

Another object of the invention is to facilitate repair of a die structure by providing an active cutting or working portion of the punch which may readily be removed and replaced.

A further important object of the invention is to simplify the female die in such apparatus by arranging and constructing the retractable guide pins on the punch for movement into the die opening proper, when not prevented by the work piece, and as comprising or defining portions of the cutting or forming edges of the punch.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, when taken in connection with the accompanying drawings, discloses preferred embodiments thereof.

In the drawings:

FIGURE 1 is a perspective view of a portion of a work piece illustrating various types of punching operations that may be accomplished with the die means of the instant invention;

FIG. 2 is a vertical sectional view through a pair of dies comprising one embodiment of the invention;

FIG. 3 is a sectional view similar to FIG. 2 with the dies moved toward each other to the position assumed just prior to contact between the punch and a work piece interposed between the dies;

FIG. 4 is a view similar to FIGS. 2 and 3 showing the relative positions of the parts at the termination of a punching operation;

FIG. 5 is a bottom plan view of the punch-carrying male die, as seen from the line 5—5 of FIG. 2;

FIG. 6 is a top plan view of a portion of the female die and a work piece resting thereon, as seen from the line 6—6 of FIG. 2; and

FIG. 7 is a detail vertical section taken substantially on the line 7—7 of FIG. 5.

Referring more particularly to FIGS. 2–7, reference numerals 16 and 17 indicate generally a first or male die and a second or female die, respectively. The male die 16 comprises a punch head 18 of standard configuration for ready mounting in a press in well-known manner, a punch body or holder 19, and a removable punch 21 mounted on the latter. The lower surface of the punch

body 19 is provided with a machined recess 22 for receiving the punch 21 and a tapped bore 23 which preferably is axially disposed and located centrally of the recess 22. The punch 21, which is constructed of hardened steel in well-known manner, is centrally recessed to receive the enlarged head portion of a bolt 24 adapted to be screwed into the tapped bore 23 to removably secure the punch to the holder or receiving body 19 within the recess 22. To facilitate such attachment, it will be appreciated that the head of bolt 24 may be provided with a hexagonal recess, as shown in FIG. 5. With such arrangement, the punch 21 comprises the active cutting or working portion of the male die 16 and may readily be removed and replaced as dictated by wear criteria.

The punch-receiving holder 19 is provided with a plurality of vertically extending apertures 25 for slidably receiving the body portions of headed guide pins 26. As best seen in FIG. 5, these apertures and their guide pins 26 preferably are equally spaced from each other around the periphery of the punch 21. The punch head 18 is provided with a plurality of vertical apertures 27 respectively axially aligned with the apertures 25 for slidably receiving the enlarged head portions of the guide pins 26 and each housing spring means, in the form of a coil spring 28, interposed between its associated guide pin and the upper end of an aperture 27, as shown in FIG. 2, for resiliently urging the guide pin outwardly or downwardly and to enable retraction of the guide pin relative to the punch, in a manner later to be described in detail.

To facilitate assembly of the several parts of the male die 16, the punch head 18 may be provided with a plurality of tapped and verticallly extending apertures 29 (as best seen in FIG. 7) and the punch holder 19 with companion and axially aligned apertures 31 for slidably receiving bolts 32. The lower ends of the apertures 31 may be counterbored to receive the heads of the bolts 32 and, as illustrated in FIG. 5, it is preferred that such retaining means for securing the holder 19 to the punch head 18 be spaced around the periphery of the punch 21 in a somewhat similar manner to the arrangement of the guide pins 26. It will be understood that the specific construction of such retaining means and the guide pins may be modified as desired, but it is preferred that the guide pins be disposed respectively each adjacent one of the active or cutting edge portions of the punch 21. As best seen in FIG. 5, when the punch has a rectangular horizontal section, it is preferred that a guide pin 26 be disposed opposite each of the peripheral surfaces defining that horizontal punch section.

As is customary in the art, the female die 17 is provided with an aperture 33 to receive the punch 21 and, like the latter, this die aperture 33 has its periphery defined by a plurality of active edge or surface portions contiguous with those of the punch. As best seen in FIGS. 2 and 6, the female die 17 also is provided with a plurality of vertical apertures 34 comprising mating holes for slidably receiving the guide pins 26 during downward movement of the male die in a punching operation if those apertures 34 are not covered or partially covered with a work piece.

A work piece of sheet metal is shown in FIG. 1 and designated by the reference numeral 35. An aperture 36 is illustrated therein which will result from the work piece being placed on the female die 17 so as to completely cover the die aperture 33 and in response to a subsequent reciprocal punching action of the male die 16 relative thereto. It is customary to employ such die apparatus, in addition to such perforating operations, to form notches of various sizes and locations in the edge portions of a work piece. For example, the work piece 35 may be placed in its position of FIG. 6 on the female die 17 so that one corner partially overlies the die aperture

33. A subsequent operation of the press will result in notching this corner of the work piece as illustrated at **37** in FIG. 1. If the work piece is differently positioned with respect to the dies, other forms and locations of notching will be accomplished in readily understandable manner, such as those illustrated at **38**, **39**, **41** and **42** in FIG. 1.

Whenever less than the total perimeter of the active portion of the dies thus is employed, the resulting shearing or forming action will impose forces against the punch to move it transversely of its normal punching direction against the exposed peripheral portion of the female die aperture. For example and with reference to FIGS. 2–4 and 6, notching of the lower left-hand corner of the work piece **35** normally would result in forces being applied to the punch **21** to move it horizontally or transversely outwardly relative to its vertical punching direction to the left and downward, as viewed in FIG. 6. The contiguous active edge portions of the punch and die between which the work piece **35** was not disposed thus would be moved into sharp contact with each other, resulting in rapid wear and deterioration of the dies. It is the function of the guide pins **26** to eliminate such die wear. Whenever the active reciprocations of the dies relative to each other approach resulting contact of the punch with the work piece, as illustrated in FIG. 3, any of the guide pins **26** under which a portion of the work piece **35** is not disposed will enter their mating aperture **34**. This will prevent horizontal movement of the punch **21** relative to the female die **17**. Of course, in those locations in which a portion of the work piece extends over all or a part of one or more of the apertures **33**, further downward movement of the associated guide pin **26** will be arrested when the same contacts the work piece. The guide pins so arrested will merely be retracted into the male die **16** against the action of their respective springs **28**.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the forms, construction and arrangements of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the forms hereinbefore described being merely preferred embodiments thereof.

I claim:

1. In a press, relatively reciprocable male and female dies, means on one of said dies to receive fed work, a first one of said dies having a plurality of apertures spaced forwardly and rearwardly of the die in the direction of work feed with their axes extending parallel to each other in the direction of the die reciprocations, a substantially cylindrical guide pin independently slidably mounted in each of said apertures, spring means disposed in each said aperture inwardly of the guide pin therein for resiliently urging the latter outwardly toward the second said die and enabling retraction of the associated guide pin into its aperture when movement thereof with said first die is arrested by a work piece interposed between said dies, said second die having aperture means spaced complementary to said first mentioned apertures for receiving said guide pins, when the latter are not arrested by a work piece, to prevent outward movement of said dies relative to each other transversely of the direction of said reciprocations.

2. In a press, relatively reciprocable male and female dies, means on one of said dies to receive fed work, a first one of said dies having a plurality of apertures spaced forwardly and rearwardly of the die in the direction of work feed with their axes extending parallel to each other in the direction of the die reciprocations, a substantially cylindrical guide pin independently slidably mounted in each of said apertures, spring means disposed in each said aperture inwardly of the guide pin therein for resiliently urging the latter outwardly toward the second said die and enabling retraction of the associated guide pin into its aperture when movement thereof with said first die is arrested by a work piece interposed between said dies, said second die having a mating hole for receiving each of said guide pins, when the latter are not arrested by a work piece, to prevent movement of said dies relative to each other except in the direction of said reciprocations.

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