May 27, 1969 J. H. HERZOG 3,446,105

NOTCHING UNIT

Filed Jan. 24, 1967

Fig. 1

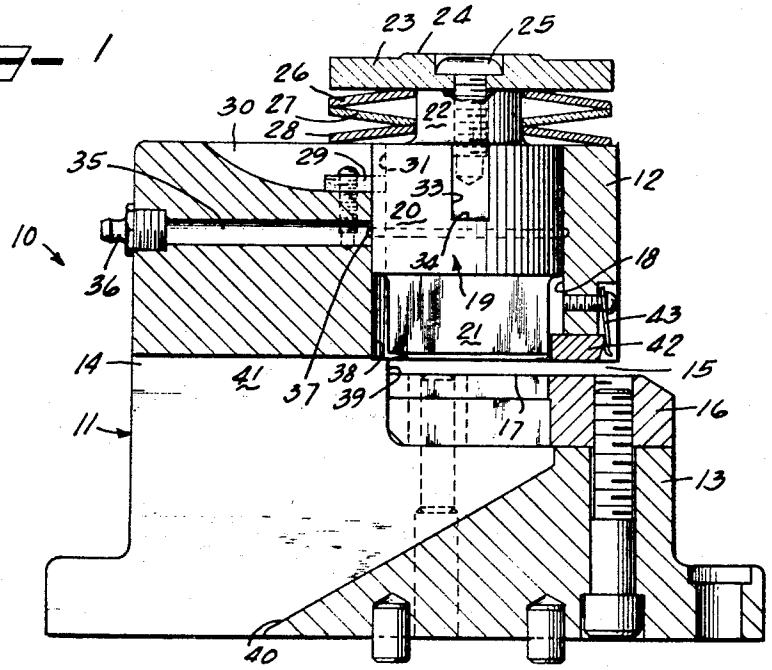
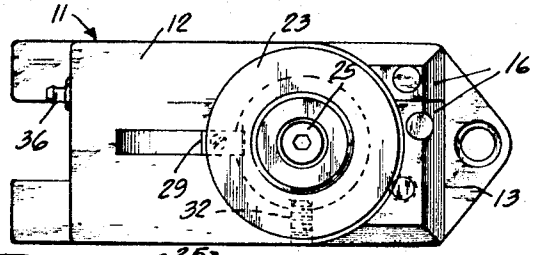


Fig. 2



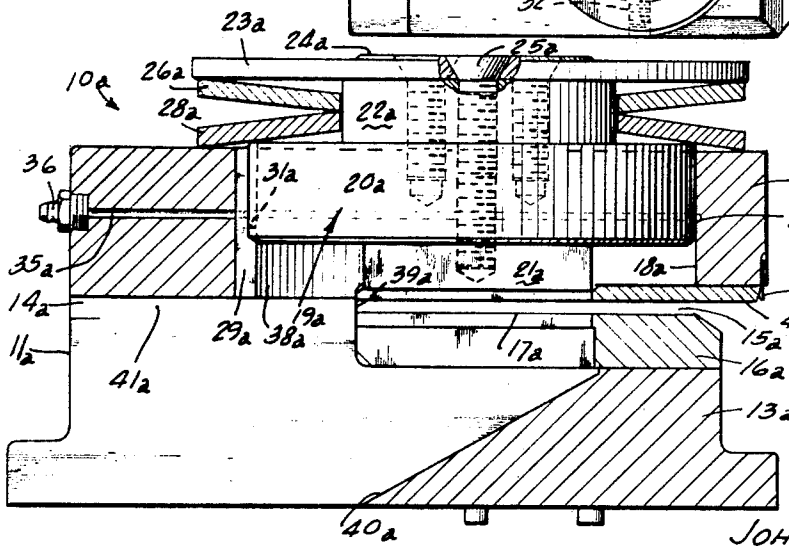


Fig. 3

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NOTCHING UNIT

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U.S. Cl. 83—146 14 Claims

ABSTRACT OF THE DISCLOSURE

A notching unit has a unitary C-shaped base with a cylindrical punch holder body guided in a cylindrical bore in the upper arm, the guided diameter being greater than the guided length of the holder body, the punch being biased away from the die with heavy duty springs which preclude holder cocking, a lubrication passage including a circular groove encircling the holder body, a U-shaped stripper plate carried under the upper arm as a snap-on element, and the base having a front-to-rear passage enabling front-to-rear feeding of an elongated workpiece.

BACKGROUND OF THE INVENTION

Field of the invention

This invention deals with a cutting or notching device which includes means to drive or to guide the reciprocable tool or punch which is constantly urged by spring means in one direction during both the cutting and the non-cutting strokes.

Prior art

The prior art device with which I am most familiar is that shown in U.S. Patent No. 3,213,741, owned by the assignee of the present invention. That device constituted an advance over the then-known art, but commercial experience with it has demonstrated certain limitations. It was conceived as an edge-notching unit primarily, but when users inserted workpieces of steel of substantial thickness utilizing only two adjacent cutting edges, the unbalanced forces thus produced tended to cause the cheek plates thereof to spread, thereby permitting or causing damage to the punch and die. Also, when particularly heavy-duty notching is performed using three cutting edges, on occasion the strength of the springs was inadequate. Further, with this construction, for various thicknesses of material, various punch and die clearances had to be employed, thus necessitating substitution of either the punch or the die. Further, lubrication difficulties were encountered, particularly on the lateral sides of the punch holder. Further, the structure shown in Patent No. 3,213,741 in certain instances tended to deform the finished blank, thereby requiring added corrective action.

SUMMARY

In accordance with the present invention, I have provided a structure which overcomes all of the problems described above. Life tests conducted to date show that the structure of this invention is particularly reliable and enduring, that greatly unbalanced reactive forces have no adverse effect on the device, that stripping forces are always adequate, that a single die clearance may be employed for a wide range of materials, that lubrication is easily accomplished, and that feeding of the workpiece may be either through the device in the conventional lateral manner, or at will at right angles thereto.

A punching or notching unit according to the present invention includes a C-shaped base which is a single element including an upper arm and a lower arm between which there is a throat for passage of the workpiece. A punch holder is provided with a cylindrical body that is slidably guided in a bore in the upper arm, the body diameter being greater than the guided length thereof. A particularly advantageous arrangement of dished circular washer springs is provided which has economic advantages and functional advantages which not only perform as expected but which prevent cocking of the holder body described. A removable snap-on stripper plate is secured to the underside of the upper arm, and the base has a passage at the rear of the throat permitting front-to-read feeding as well as lateral feeding of the workpiece.

Accordingly, it is an object of the present invention to provide a notching unit which may be employed for edge notching, corner notching, and for other punching.

A further object of the present invention is to provide a cutting unit of the type described wherein the workpiece may be fed through the device either laterally or in a front-to-rear manner.

A further object of the present invention is to provide a punching or notching unit wherein the space occupied by the unit above the workpiece has a relatively low vertical extent in relation to that normally necessary for a particular punching area.

A still further object of the present invention is to provide a punching unit which eliminates all of the problems enumerated in the discussion of prior art above.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description and the accompanying sheet of drawings in which a preferred structural embodiment incorporating the principles of the present invention is shown by way of illustrative example.

On the drawings:

FIG. 1 is a side view, drawn in vertical cross section, of a notching unit provided in accordance with the principles of the present invention;

FIG. 2 is a top view thereof in reduced scale; and

FIG. 3 is a view corresponding to FIG. 1 of a somewhat larger embodiment of this invention, drawn in reduced scale.

As shown on the drawings:

The principles of this invention are particularly useful when embodied in a punching unit of the notching type, such as is illustrated in FIG. 1, generally indicated by the numeral **10**. The device **10** includes a C-shaped base **11** which is a one-piece member including an upper arm **12**, a lower arm **13**, and a portion **14** which integrally joins the arms **12**, **13** together, thereby defining a throat **15** which is receptive of a workpiece (not shown).

The lower arm **13** has a lower surface which is adapted to be secured directly or indirectly to the bed of a press, and to that end, the lower arm **13** includes conventional fastening and guidance means, as shown. The lower arm **13** detachably supports a notching die **16** which in this embodiment has a U-shaped cutting edge **17** which extends for part of the lateral width of the base **11**, and rearwardly to the rear end of the throat **15**.

The upper arm **12** has a cylindrical bore **18** extending therethrough, and within this bore there is slidably guided a punch holder or punch holder assembly **19**. The punch holder **19** includes a cylindrical body **20** which has a diameter that is slidably guided by the bore **18**. The cylindrical body **20** has a guided length which is shorter than its diameter, and in accordance with the present invention, the diameter of the cylindrical body **20** may not only be greater than such guided length, but may be several times greater, as illustrated below in FIG. 3. The punch holder **19** includes a punch tip **21** which may be integral with the body **20** or which may be removably secured thereto as shown in FIG. 3. The punch tip **21** in this disclosure is a notching punch tip having a U-shaped cutting

edge corresponding to the die cutting edge **17** for cooperation therewith. The punch holder **19** has a coaxial stem **22** either integral therewith as shown in FIG. 1 or secured thereto as shown in FIG. 3, the stem **22** having a diameter less than that of the body **20**. The punch holder assembly **19** further includes a ram plate **23** having an upper surface **24** for being engaged by the ram of the press. The ram plate **23** is secured as by a number of screws **25** to the punch holder body **20**. The ram plate **23** has a size in a direction parallel to the diameter of the cylindrical body **20** and parallel to the diameter of the stem **22** which is of greater extent so that the ram plate projects therebeyond to engage the central portion of the uppermost one of a number of dished circular washer springs **26–28**. It is desirable that the ram plate **23** have a dimension such as a diameter which is larger than the bore **18** to enable its lower side near the outer periphery to engage the outer periphery of one of the springs **26–28** if they were arranged differently.

The spring means **26–28** act as a single spring between the upper arm **12** and the punch holder **19**, and in this instance against the ram plate **23**.

The upper arm carries a key **29** which is secured to the upper arm in a slot **30** and which projects into the bore **18** and is received within a vertical groove **31** extending through the guided length of the body **20**. A retainer screw **32** shown in FIG. 2 extends into a further slot or groove **33** in the body **20** and is engageable by an upwardly directed shoulder **34** to retain the punch holder assembly **19** within the base **11**.

The upper arm **12** includes a lubrication passage **35** which is accessible externally through a grease fitting **36** and which communicates at its inner end with a groove **37** in the cylindrical bore **18**, the groove **37** being circular and opening toward the body **20** and encircling it for conducting lubricant to it.

The rear end of the bore **18**, indicated by the numeral **38**, extends to the rear of the inner end of the throat **15**, indicated by the numeral **39**, whereby the rear **39** of the throat **15** is closer to the front of the device **10** than is the rear **38** of the bore **18**. Thus the guide surface of the cylindrical body **20** extends beyond various cutting edges of the notching die **21**.

The lower arm **13** of the base **11** is provided with a chute **40** through which slugs formed by the punch **21** and die **16** may pass. Also, the portion **14** of the base **11** which joins together the upper and lower arms **12**, **13** is provided with a passage in a front-to-rear direction, such passage being indicated by the numeral **41** and extending upwardly to substantially the top of the gap **15**. The passage **41** has a width which is substantial, thereby enabling a workpiece to be fed to or from the front of the device **10**, beneath the punch and die, and through the passage portion **41** and to or from the rear side. In the present embodiment, for convenience, the slug chute **40** has been combined with the workpiece passage **41** into a single passage in which both the workpiece and the slugs may simultaneously pass. This arrangement is particularly advantageous in that the device may be used as a cut-off tool without wasting workpiece material.

The dished circular washer springs **26–28** are heavy duty springs, and depending on their size, have a typical relatively high cost. It is therefore highly advantageous to use a minimum number of such springs. The more springs that are used, the less the stripping force will be. The more springs that are used, the greater the punch travel will be. Therefore, the ideal combination can be brought about using a minimum number of springs as described provided that the stem **22** is of reduced diameter so that the hole in the springs **26–28** may be of a minimum size. In the embodiment shown in FIG. 1 using springs that are about 2¾ inches in diameter, it would take about 1,000 pounds of force to close the notching unit to its shut height. In the embodiment of FIG. 3, it would take about 6,000 pounds of force to close it to shut height, using a travel of about ½ inch. These values are representative of the term "heavy duty" as used herein, and they are also so great that there is a correspondingly high force between the ram plate **23** and the ram of the punch press (not shown) so that even if an unbalanced force were applied to the punch tip due to corner notching, such spring force would hold the ram plate **23** squarely against the ram, thereby enabling the cylindrical body **20** to move vertically without any appreciable tendency to cock or bind.

The device **10** includes a stripper plate **42** of U-shaped configuration which extends from the rear **39** of the throat **15**, in a manner that encircles three sides of the punch tip **21**, the inner periphery of the stripper plate **42** having a profile corresponding to the punch tip **21**. The stripper plate **42** is readily removable to provide its being replaced by one having a desired clearance, or to provide for its being replaced by one having a configuration to match a different punch tip **21**. To this end, a number of spring fingers **43** are carried by the upper arm, one being shown at the front, and there being two others at the sides in an identical manner. The stripper plate **42** underlies and is thus disposed against the lower surface of the upper arm **12**, and has a beveled edge against which the spring fingers **43** act to so urge and hold it. The spring fingers **43** are also referred to herein as snap-on retainer means which have a snap fit with the stripper plate **42**.

To use the notching unit, it is mounted on the bed of a press beneath the ram and a workpiece is fed through from side to side or from front to rear, and may pass through the base **11** rearwardly if it is in the nature of an elongated strip. The punch tip in FIG. 1 has a dimension of 1½ x 1 inch, and a punch holder can be provided which has any punching configuration falling within that area, and with which a corresponding die is utilized. The punching pattern thus may comprise edge-notching, corner-notching, hole punching, cut-off, or the like. The key **29** aligns the punch **21** with the die **16** and also precludes rotation thereof during cut-off use or during corner notching at one side of center. The structure of FIG. 1 can be provided with .002 die clearance to enable it to handle workpieces as thin as shim stock and as thick as .134 inch. The structure is particularly advantageous in that any set taken by one of the springs **26**, **28** does not disturb alignment, and the Belleville springs are further advantageous in that they provide inherently absolutely uniform reaction to downwardly guided movement before the workpiece is engaged.

According to what one might expect who is not familiar with my teaching, one might believe that the use of a punch holder body diameter which is greater than its guided length is either impossible, impractical or a poor feature. However, my experimentation has shown that the device of this invention operates properly on much less and on much more than the theoretically necessary stripping force, thereby demonstrating an unobvious advantage.

The device of FIG. 3 corresponds in all important aspects to the device of FIG. 1 except that it is larger. It is thus economically advantageous to use only two Belleville springs, to use several screws, and to use a separate stem and punch tip, all as described above. For this reason, similar numerals have been affixed to the elements of FIG. 3 accompanied by the suffix letter *a*. The space underlying the punch tip **21***a* is three inches wide and five inches long.

Although various minor modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon, all such embodiments as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A device for use between the bed and ram of a press, comprising in combination:

(a) a C-shaped base having an upper arm and a lower arm, said lower arm being adapted to be secured to the press bed and adapted to detachably support a die;

(b) a punch holder slidably disposed in a bore in said upper arm, and adapted at one end to support a punch tip and to guide it in registration with the die, and to be engaged by the press ram at the other end; and

(c) spring means acting between said upper arm and said punch holder for biasing said punch holder away from the die;

(d) said arms being spaced to define a throat which permits a workpiece to pass through said base between the punch and die from one lateral side through the other, and said base having a passage through the portion thereof which joins said arms, said passage extending to the height of said throat to permit a workpiece to pass through said base from the front side through the rear side.

2. A device according to claim 1, in which said base has a slug chute through the lower portion of which slugs can pass, and the upper portion of which is said passage through which the workpiece can simultaneously pass.

3. A device according to claim 1, in which said base including both of said arms comprises a one-piece member.

4. A device for use between the bed and ram of a press, comprising in combination:

(a) a C-shaped base having an upper arm and a lower arm, said lower arm being adapted to be secured to the press bed and adapted to detachably support a notching die;

(b) a punch holder slidably disposed in a bore in said upper arm, and adapted at one end to support a notching punch tip and to guide it in registration with the die, and to be engaged by the press ram at the other end;

(c) spring means acting between said upper arm and said punch holder for biasing said punch holder away from the die; and

(d) a generally U-shaped stripper plate underlying and supported against the lower surface of said upper arm and having an inner edge corresponding to the cutting edges of the punch tip for being spaced slightly therefrom.

5. A device according to claim 4, in which means are carried by the front and lateral sides of said upper arm for removably supporting said stripper plate thereon with a snap fit.

6. A device according to claim 1, in which there is a generally U-shaped stripper plate underlying and supported against the lower surface of said upper arm, which plate has an inner edge corresponding to the cutting edges of a punch tip for being spaced slightly therefrom.

7. A device for use between the bed and ram of a press, comprising in combination:

(a) a C-shaped base having an upper arm and a lower arm, said lower arm being adapted to be secured to the press bed and adapted to detachably support a die;

(b) a punch holder having a cylindrical body slidably disposed in and directly guided by a cylindrical bore in said upper arm, and adapted at its lower end to support a punch tip and to guide it in registration with the die, said cylindrical body having a diameter greater than its guided length;

(c) a stem rigidly secured to the upper end of said punch holder and disposed coaxially therewith, said stem having a dimension parallel to and somewhat smaller than said body diameter;

(d) a ram plate, having a dimension parallel to and somewhat greater than said dimension of said stem, for being engaged by the press ram, and being rigidly secured to said stem; and

(e) a plurality of dished circular washer springs with a hole diameter smaller than said body diameter and encircling said stem and acting between said upper arm and said ram plate, and biasing said ram plate against the ram during punching with such biasing force as to hold the upper surface of said ram plate flatly against the ram, thereby to preclude any cocking of said punch holder body in said bore when an unbalanced reactive force is applied to the punch tip by the workpiece.

8. A device according to claim 7, in which said arms are spaced to define a throat through which a workpiece can pass between the punch and die from one lateral side of said base through the other, said base having a passage through the portion which joins said arms communicating with said throat and enabling a workpiece to pass from the front side through the rear side of said base.

9. A device according to claim 7, in which there is a generally U-shaped stripper plate underlying and supported against the lower surface of said upper arm, which plate has an inner edge corresponding to the cutting edges of a punch tip for being spaced slightly therefrom.

10. A device for use between the bed and ram of a press comprising in combination:

(a) a C-shaped base having an upper arm and a lower arm, said lower arm being adapted to be secured to the press bed and adapted to detachably support a die;

(b) a punch holder having a cylindrical body slidably disposed in and directly guided by a cylindrical bore in said upper arm, and adapted at its lower end to support a punch tip and to guide it in registration with the die, said cylindrical body having a diameter greater than its guided length, the rear surface of said cylindrical body and said cylindrical bore being farther from the front of said base than is the rear end of the throat between said arms, the upper end of said punch holder being disposed to be engaged by the press ram; and

(c) heavy duty spring means acting between said upper arm and said punch holder, and biasing said holder against the ram during punching with such biasing force as to hold the upper surface of said punch holder flatly against the ram, thereby to preclude any cocking of said punch holder body in said bore when an unbalanced reactive force is applied to the punch tip by the workpiece.

11. A device according to claim 7,

(a) said base, including both of said arms, being a one-piece member, said arms being spaced to define a throat through which a workpiece can pass between the punch and die from one lateral side of said base through the other, said base having a chute in said lower arm and extending through the portion which joins said arms and extending upwardly to the top of said throat, whereby slugs can pass through the lower part of the chute and a workpiece can simultaneously pass through the base from the front side through the upper part of said chute and through the rear side;

(b) the rear end of said throat being closer to the front of said base than is the rear end of said cylindrical bore;

(c) there being a generally U-shaped stripper plate underlying and supported against the lower surface of said upper arm, which plate has an inner edge corresponding to the cutting edges of a notching punch tip for being spaced slightly therefrom; and

(d) there being means carried by the front and lateral sides of said upper arm for removably supporting said stripper plate thereon with a snap fit.

12. A device according to claim **7**, said cylindrical body having a diameter more than twice as great as its guided length and providing the sole sliding guidance for the punch tip.

13. A device according to claim **9**, in which means are carried by the front and lateral sides and said upper arm for removably supporting said stripper plate thereon with a snap fit.

14. A device according to claim **7**, in which the rear end of the throat between said arms is closer to the front of said base than is the rear end of said cylindrical bore.

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U.S. Cl. X.R.

83—165, 588, 635, 693, 917