Jan. 10, 1967 J. S. KILLALY 3,296,905

COMPRESSIVE STRIPPING UNIT AND INDEXING TYPE NIBBLING PUNCH FOR TURRET PUNCH PRESSES AND THE LIKE

Filed Jan. 8, 1965 3 Sheets-Sheet 1

FIG. 1

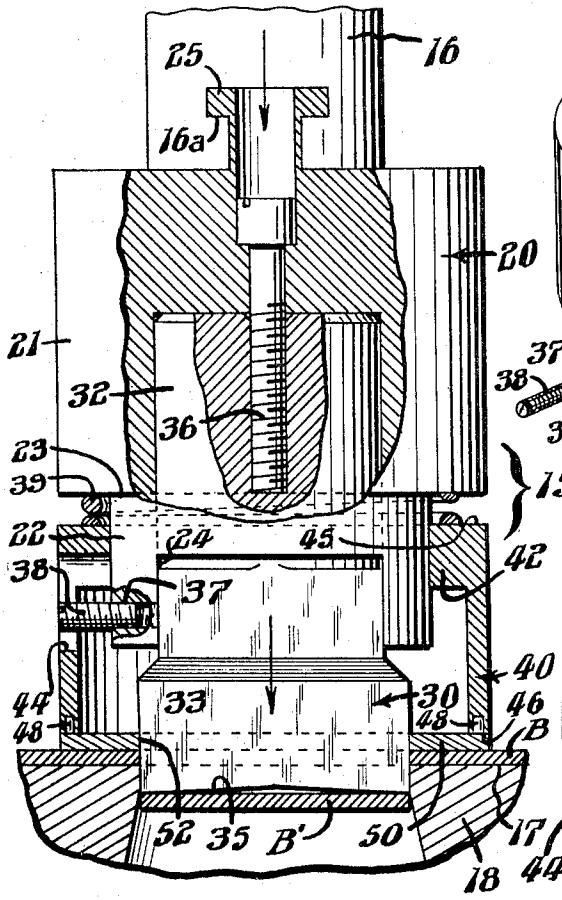

FIG. 4

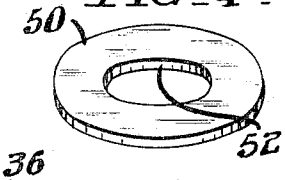

FIG. 5

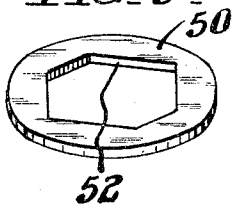

FIG. 3

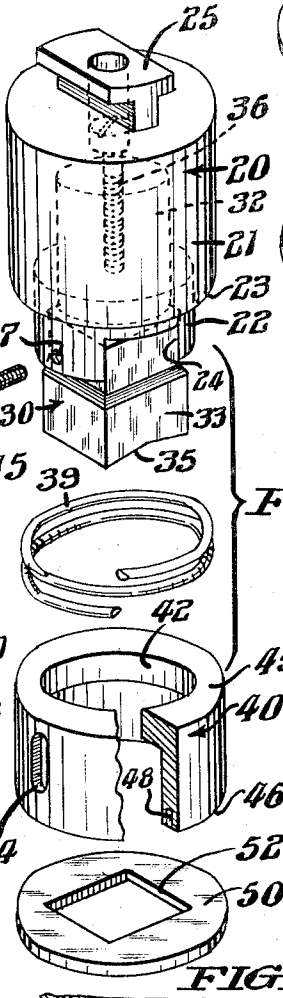

FIG. 3a

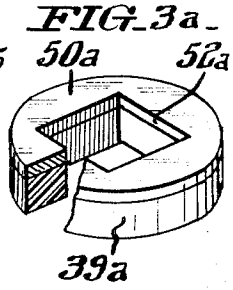

FIG. 2

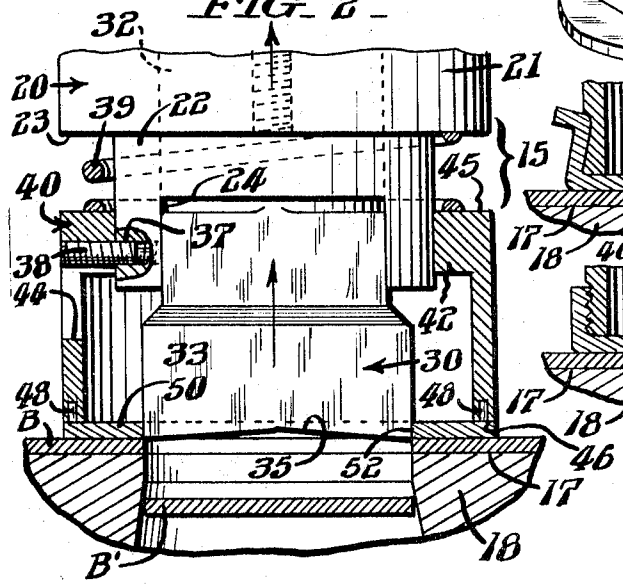

FIG. 6

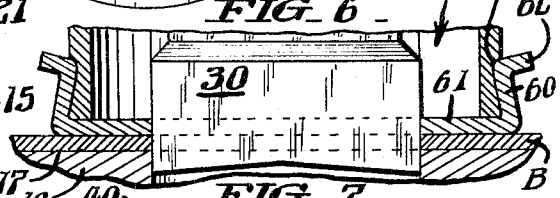

FIG. 7

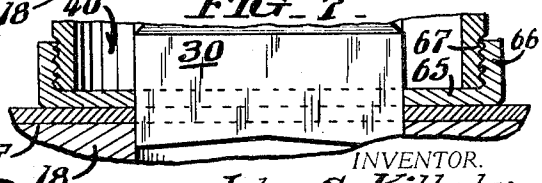

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FIG. 8

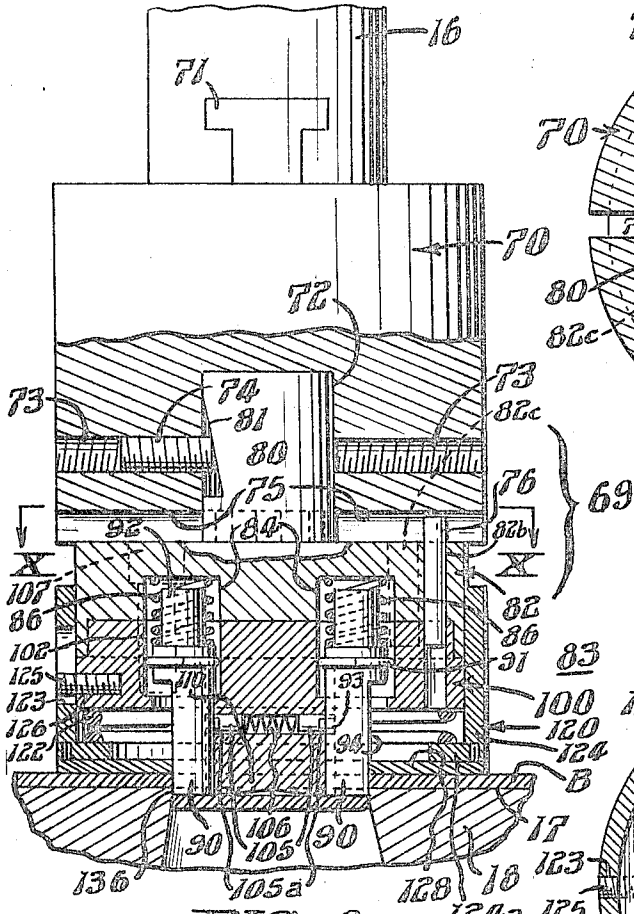


FIG. 10

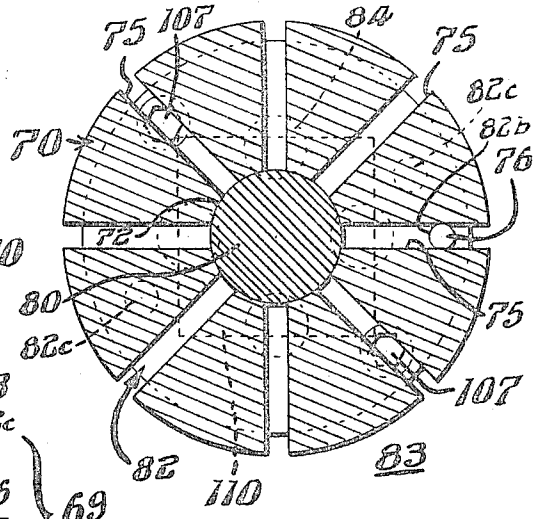


FIG. 11

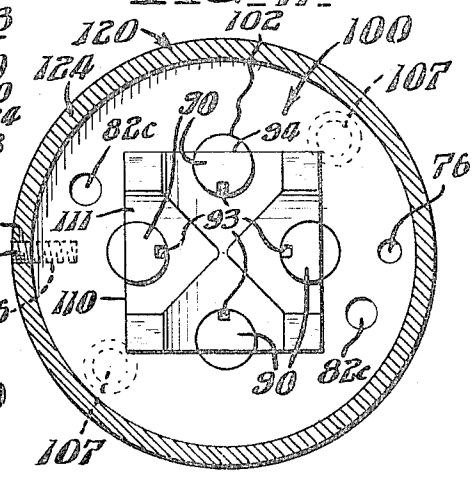
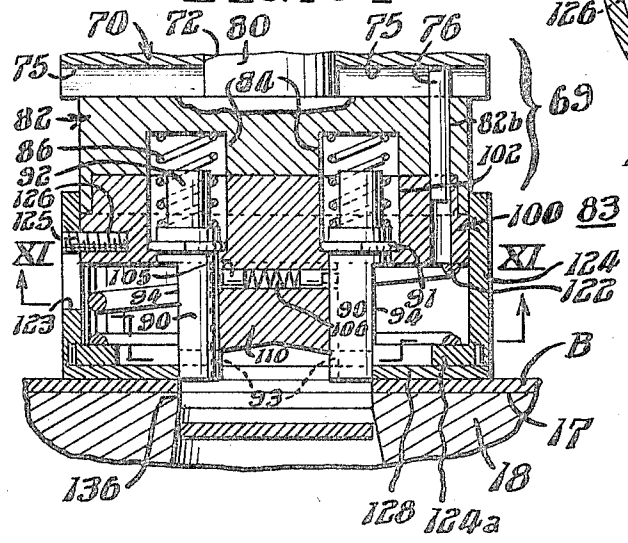


FIG. 9



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COMPRESSIVE STRIPPING UNIT AND INDEXING TYPE NIBBLING PUNCH FOR TURRET PUNCH PRESSES AND THE LIKE

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FIG_12_

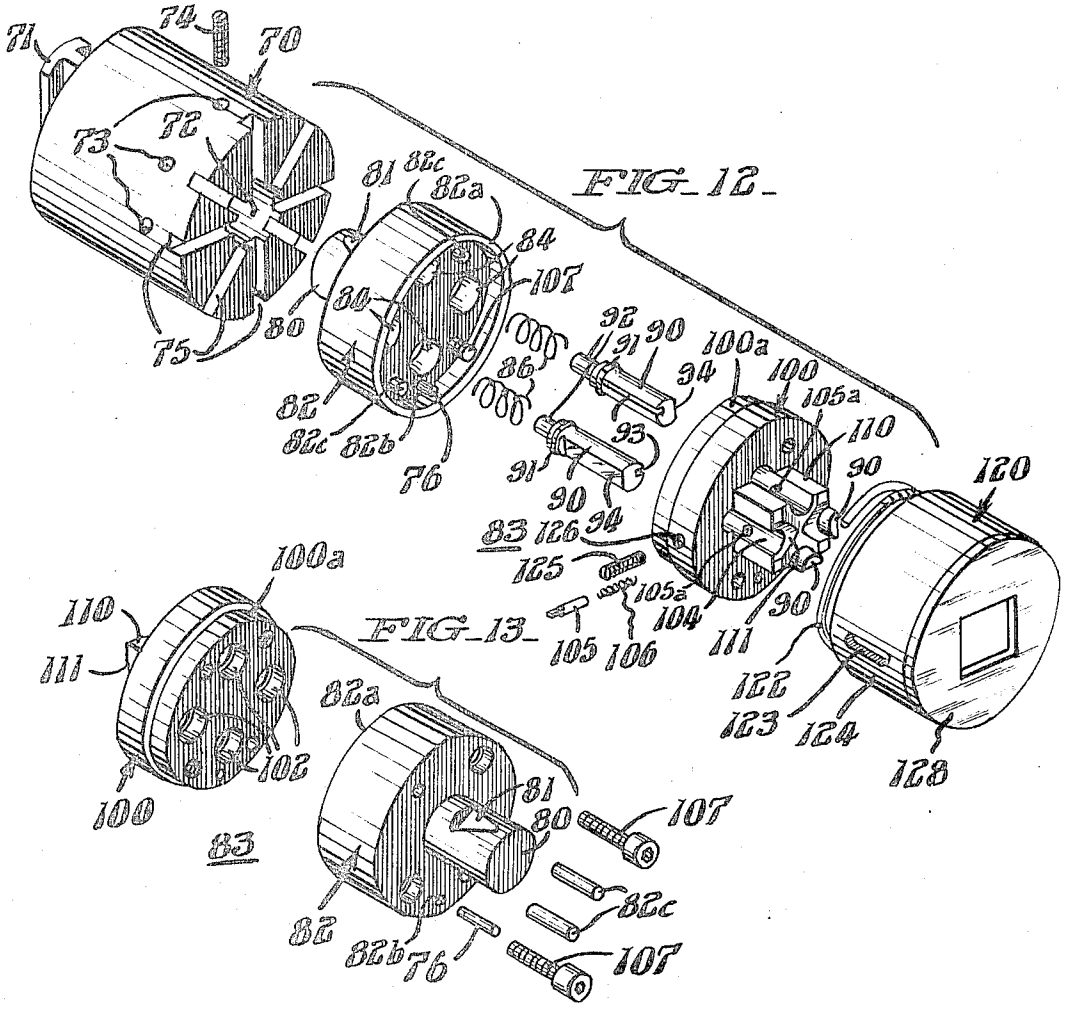
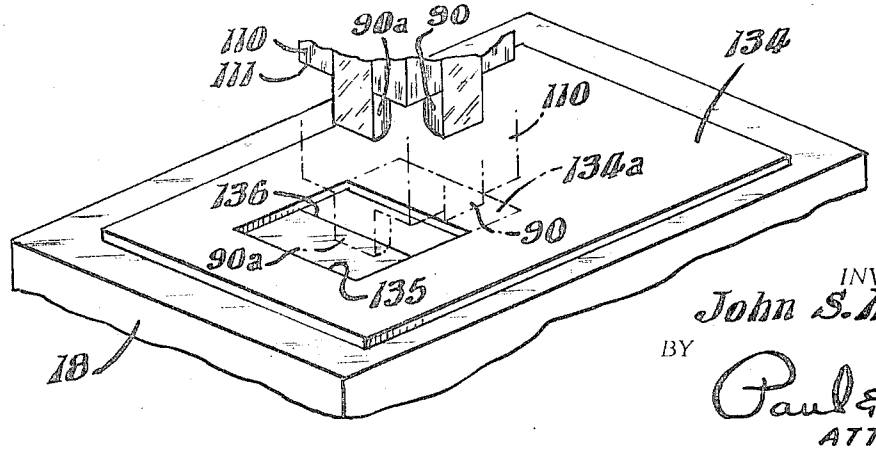


FIG_13_

FIG_14_



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3,296,905

COMPRESSIVE STRIPPING UNIT AND INDEXING TYPE NIBBLING PUNCH FOR TURRET PUNCH PRESSES AND THE LIKE

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Filed Jan. 8, 1965, Ser. No. 424,230
10 Claims. (Cl. 83—140)

This invention relates to certain improvements adapted for turret punch presses or for single station presses used mainly for low production work. In this type of press activity, the blank is placed in a pantograph or a duplicator type press or a numerically controlled type press, whether it be a turret punch press or a single station punch press. Each stroke of the punch or ram produces only one hole, notch or nibble in the blank. The blank is clamped in work holders or is manipulated manually underneath the punch station until the entire hole pattern is punched.

The above-described type of press activity differs basically from that inherent with presses set up for high production work wherein multiple punches are mounted in the press and a single stroke produces a number of holes and cut-outs or completely finishes the work.

The design and construction of the low production type of punch press differs in many important respects from that of the high production machines. Considering the stripper or apparatus which presses the blank off the punch on the withdrawal stroke, in the low production presses the stripper must be confined within a certain limited diameter punch holder. Movement of the stripper must be limited within a certain vertical distance and, most important, the top half of the press must not be connected to the bottom half in any way which restricts movement of the work piece in the press.

The prior art teaches a positive stripper adapted for the low production type of press mounted usually on the lower face of the upper turret and, on a single station press, mounted on the press frame. The disadvantages of these types of construction are that the blank is not positively held against the working surface or die and tends to "hang up" on the punch during withdrawal and becomes distorted while traveling the distance required to contact the bottom of the positive stripper. The blank sometimes sticks to the punch and slides off to one side thereby causing "double slugging" when the ram trips again. These movements of the blank are injurious to the punch and die as well as the blank. Also, the prior art type of positive stripper actually "forms" the blank when there are several holes to be punched close together in light gauge material requiring the removal and straightening of the piece before the remaining holes can be punched. Further, the constant banking of the blank up against the positive stripper creates a peening action which causes inaccuracies in locating subsequent holes and results in rejections of close tolerance parts.

Thus, it is the primary advantage of the compressive stripping unit of this invention that the blank material is held stationary on the die surface during punching and stripping movement of the punch. Therefore, it is not possible for the slug to stick to the punch and double slugging as well as damage to the tools and blanks is avoided. The compressive stripper holds the blank perfectly flat, insures accuraces unavailable to the positive stripper even on light gauge material.

In addition to the compressive stripping unit adapted for the turret punch type of press, this invention teaches a novel construction nibbling punch which is adapted for and within the price range of those engaging in the low production type of punch press activity. Similar to the compressive stripper, the nibbling punch of this invention

is confined within a certain diameter punch holder and within certain up and down dimensions. This nibbling punch can be indexed as desired around its vertical axis to produce angular notches and nibbles as well as angular sheer cuts. The nibbling punch can punch out round, square, rectangular, oval, and odd-shaped openings which far exceed the tonnage capacity and other physical capabilities of the press being used.

It is the further advantage of the improvements of this invention that they are relatively simple in design, in expensive to manufacture and use, and readily and easily substitutable in the well-known turret or single station type of press. These features are particularly important, as indicated above, when, in those instances, the press is designed for use in low production type of work.

These and other advantages of this invention will become more apparent from the description set forth hereinbelow and from the drawings, wherein:

FIG. 1 is a view partly in side elevation and partly in section, with a cut-away portion, of the preferred form of the compressive stripping unit of this invention;

FIG. 2 is a partial view similar to that of FIG. 1 showing the press in the upward or withdrawal stroke;

FIG. 3 is an exploded perspective view of the stripping unit shown otherwise in FIGS. 1 and 2.

FIG. 3*a* is a perspective view partly cut away of an alternate type of stripper;

FIGS. 4 and 5 are perspective view of strippers for use with a punch having a different shaped cutting surface;

FIGS. 6 and 7 are sectional views of alternate types of strippers;

FIG. 8 is a view partly in side elevation and partly in section, with a cut-away portion, of the preferred form of indexing type nibbling punch equipped with a compressive stripper;

FIG. 9 is a partial view of the punch shown in FIG. 8 during the withdrawal movement of the punch;

FIG. 10 is a sectional view of the punch support taken along the lines and arrows X—X of FIG. 8;

FIG. 11 is a sectional view taken along the lines and arrows XI—XI of the stripper and punch as shown in FIG. 9;

FIG. 12 is an exploded perspective view of the indexing type nibbling punch shown in FIG. 8;

FIG. 13 is a reversed exploded perspective view of the shank and punch half members forming part of punch as shown in FIG. 12; and

FIG. 14 is a partial perspective view of the nibbling punch, blank and die.

The following description is directed to the specific forms of the invention illustrated in the drawings and is not intended to limit the scope of the invention itself which may be practiced in a variety of forms and arrangements.

In the drawings and written description set forth herein, only general reference is made to the well-known features of the standard turret or single station type press and the like and this disclosure is largely directed to the novel structure in the form of improvements which are designed for incorporation in said standard type presses. Referring to FIG. 1 of the drawings, the punch and compressive stripping unit of this invention are designated generally by the numeral 15 and said components are supported at the top by a press member 16 which also includes a working surface 17 along the top of the female die 18. Components 15 move in a vertical direction under control of the operator in relation to the stationary and horizontal die 18. The unit 15 includes, basically, three components: a punch support 20, a pnuch 30 and a sleeve 40.

Referring now to FIG. 3, the components of the stripping unit **15** are shown in exploded perspective view. A generally cylindrical punch support **20** has a main body portion **21** of a first diameter and a second body portion **22** located therebeneath of a lesser diameter thereby defining an annular, downwardly-directed shoulder **23**. A top supporting T-shaped flange **25** fits within a correspondingly shaped groove **16***a* in the press member **16**. Punch support second body portion **22** is recessed at **24** and a cylindrical hole is formed in support **20** so as to accept a punch **30** which has a top cylindrical portion **32** (shown in dotted lines) and a generally cubical punch block portion **33** with an inwardly tapered cutting surface **35**. The punch **30** is held within support **20** by a bolt **36** shown in dotted lines. Punch support second body portion **22** has a threaded hole **37** to accommodate a stud or pin **38** for reasons described below. It should be understood that, during operations, the support **20** and punch **30** move as a single unit, on the downward stroke to punch a hole in a blank mounted on the die and then upwardly and clearing so that the blank can be repositioned.

A compression spring **39** is provided of such diameter to fit around the punch support second body portion **22** and is of less diameter than that of the support main body portion **21**.

A generally cylindrical stripper sleeve **40** having a top inwardly directed flange **42** of a minor diameter slightly larger than that of portion **22** and an outside diameter similar to that of portion **21** is located on portion **21** for partial independent movements in relation thereto. An axial directed slot **44** is provided in the wall of sleeve **40**. Sleeve **40** has a downwardly directed bottom annular surface **46** which is located approximately level with the cutting surface **35** of the punch when the punch and sleeve are lifted clear of a blank. Sleeve flange **42** forms an upwardly-directed annular surface **45**.

A flat, round disk **50** serves as a stripper or stripper plate in this embodiment and said stripper has an outside diameter similar to that of the sleeve **40**. Stripper **50** may originally be provided with an opening **52** which corresponds very closely to the outside diameter of the punch **30** or said disk may be solid when installed and thereafter punched out on the first stroke of the punch.

The components are assembled as shown in FIGS. 1 and 2 wherein the spring is placed on portion **21** followed by sleeve **40** and stud **38** is placed within slot **44** and threaded in hole **37**. Spring **39** then acts against shoulder **23** and surface **45** to urge the sleeve downwardly until stud **38** engages the top limit of slot **44**. This is substantially the position shown in FIG. 2. The metal stripper plate **50** is attached to the bottom surface **46** of sleeve **44**, in this instance, by a plurality of small magnets which are mounted in the surface **46** and these are sufficient to hold the stripper in position during operation of the press.

Operation of this preferred form of compressive stripping unit is substantially as follows:

The punch support **20** and punch **30**, together with sleeve **40** and stripper **50**, are raised sufficiently clear of the working surface **17** of the die **18** to allow a blank or slug material B to be placed on surface **17** and positioned as desired beneath the punch. As the press begins its downward movement, the stripper **50** contacts and presses downwardly on the blank B slightly before or at the same time as the punch cutting surface **35** contacts the blank. The blank is thereby held stationary on die surface during the entire downward movement as the punch passes through the blank knocking out piece B'. As shown in FIG. 1, spring **40** is thereby compressed and it is evident that the pressure exerted by the stripper and sleeve on the blank may be varied by substituting different compression strengths springs. As the press begins to move upwardly, as shown in FIG. 2, the spring continues to press the stripper against blank B holding the blank on the die while the punch passes back through and finally out of the blank. This continuous compressive action of the stripper

prevents the blank from sticking to the punch and prevents double slugging upon the return downward stroke of the punch. By holding the blank on the die, the compressive stripper insures accuracy of the punching and prevents peening action in light gauge blanks.

The compressive stripping unit shown in FIG. 3 may be modified by substituting for stripper **50** the stripper shown in FIG. 3*a* which, in this form, has a top metal disk **50***a* and a similarly shaped compressible material **39***a*, such as plastic, rubber or neoprene, attached to the bottom thereof. In a stripping unit incorporating the stripper of FIG. 3*a*, the sleeve **40** is fixedly attached to support body portion **22** and spring **39** is dispensed with as the compressible stripping material **39***a* presses against the blank B and flattens out to absorb the downward movement of sleeve **40** during the punching stroke. During withdrawal of the punch, the stripper material **39***a* presses with sufficient force to hold the blank B in position on the die **18**.

Of course, it should be understood that the shape and size of the punch **30** and particularly the cutting surface **35** may be varied from the square shape shown in FIGS. 1 to 3 to a round and hexagonal shape as indicated by the strippers shown in FIGS. 4 and 5.

Modifications of the means for attaching the stripper to the sleeve are shown in FIGS. 6 and 7. Stripper **60**, shown in FIG. 6, has a flat disk portion **61** and flexible side portions **62** which may be snapped over the lower surface of sleeve **40** into an annular groove **63** formed in the sleeve. In FIG. 7, the stripper **65** formed from metal, rubber or plastic has threads formed on flanges **66** which correspond to threads **67** formed along the bottom edge of the sleeve **40**.

Indexing type nibbling punch

The preferred form of indexing type nibbling punch, equipped with a compressive stripper, of this invention as designed for a turret type punch press and the like is shown assembled in FIG. 8 and identified generally by the numeral **69**. The punch **69** is supported at the top by the press member **16** and moves up and down relative to the stationary, horizontal work surface **17** and female die **18**.

Referring to the exploded perspective view of the punch **69** shown in FIG. 12, a generally cylindrical punch support **70** is provided with an upwardly-extending, T-shaped flange **71** which fits within a correspondingly shaped groove in member **16** and, at its base, support **70** has a cylindrical hole **72** and a series of threaded holes **73** extending inwardly to the hole **72**. A threaded stud **74** is provided to thread in any one of the holes **73** to engage a whistle groove **81** formed in shank **80** of the shank half member **82** thereby preventing shank **80** from being removed from hole **72** as described further below. The bottom or downwardly directed surface of punch support **70** is provided with a series of radially directed continuous grooves **75** which are of such size as to receive an indexing pin **76** therein otherwise mounted in the shank half member **82** for adjustment of shank half member **82** in a number of positions around its vertical axis in relation to punch suport **70**, as described further hereinbelow.

Generally cylindrical half member **83** having an outside diameter slightly less than that of the punch support **70** is composed of an upper shank half member **82** and lower punch half member **100** which are held together by a pair of bolts **107** (FIG.13), the member **82** having a flange **82***a* positioned within recess **100***a* of member **100**. Shank member **82** is provided with, in addition to shank **80**, four uniform diameter equally spaced holes **84** extending upwardly from the bottom surface. Four nibbling heels **90** having a small diameter neck **92**, an axial slot **93**, a flat axial surface **94** and a snap ring **91** are mounted for limited axial or up and down movement in holes **84**, being spring biased downwardly by springs **86**. Shank half member **82** also has at least one bore **82***b* in

which the indexing pin 76 is located extending therefrom into punch support 70 and aligning pins 82c.

Punch half member 100 has a generally cubical punch 110 with cutting surface 111 fixedly attached to said member and has four holes or bores 102 (FIG. 13) of the same size and location as holes 84 in shank half member 82, said holes 102 being continued to grooves 104 in the side surfaces of punch 110. The heels 90 are mounted in half member 100 (FIG. 8) so that the springs 86 are concentric to heel necks 92 and the snap rings 91 prevent the escape of the heels out of punch half member 100. Each heel 90 is prevented from rotating in its groove 104 in punch 110 by pins 105 and springs 106 mounted in horizontal bores 105a, said pins 105 being spring biased into longitudinal or axial slots 93 in the heels 90 thus allowing axial movement of the heels but not rotary movement. The heels 90 are mounted in punch 110 so that their flat sides 94 form part of the side surface of the punch 110 as shown in FIGS. 11 and 12. These flat sides, specifically, as well as the remaining surface of the punch are of such dimension to fit tightly within the opening 136 formed in the female die 18 when the punch descends as shown in FIGS. 8 and 9.

The compressive stripper apparatus 120, modified for the nibbling punch, comprises a conical spring 122 of a diameter slightly larger than the punch 110, a cylindrical sleeve 124 with an inner diameter only slightly larger than the half member 100 and having an inwardly-directed shoulder 124a formed on the bottom end thereof (FIG. 9), and a flat disk stripper 128. Sleeve 124 has an axial slot 123 and a pin 125 is provided to thread within hole 126 in punch member 100 to hold the sleeve within certain limits within an axial or upward and down movement. As shown in FIG. 9, sleeve 124 is mounted on member 83 and spring 122 surrounds punch 110 and is mounted between the flat downwardly-directed surface 108 of punch half member 100 and the annular upward facing surface 124a of the sleeve, thereby continually urging stripper 128 into contact with the blank B when the punch begins to descend.

The operation of the preferred form of the indexing nibbling type punch press is substantially as follows. The press is raised sufficiently high to allow a blank to be inserted therebeneath and positioned on the die 18. As described above, the nibbling punch is particularly designed for punching out a piece of material which is smaller in size than the total area of the punch cutting surface or face. As shown in FIG. 14, the blank 134 has a pre-punched hole 135 and is positioned on the die 18 so that a piece 134a shown in dot and dash lines will be cut out in the following stroke. As the press descends, all of the heels 90 are spring biased downwardly in advance of the bottom cutting surface of the punch. When a heel contacts the blank it is forced upwardly until it bottoms in hole 84 in member 82 and the bottom cutting surface of that heel assumes a position level with the remaining cutting surface of the punch and perfoms like any other part thereof. The important work is achieved by those heels which do not contact the blank, for instance heel 90a in FIG. 14, as this heel then precedes the punch and passes directly through the hole 135 in the blank and into and against the side of the die 18 as shown in dotted lines. Because this heel 90a is within the die before or at the time the remaining surface of the punch contacts the blank, the punch is prevented from moving sideways or shearing the blank. Of course, secondary movement of the blank is also prevented and an accurate, clean cut is produced.

The nibbling punch of this invention can punch out round, square, rectangular, oval and odd-shaped openings which far exceed the tonnage capacity and other physical capabilities of the punch used. By substituting a quadrant punch for the nibbling punch shown, much larger holes can be produced in material which, otherwise, would far exceed the capacity of the press used.

By means of the indexing grooves 75 formed in the bottom of support 70, the indexing pin 76 mounted in member 82 and the removable stud 74, the shank and punch half members may be separated from support 70 and rotated so as to position pin 76 in a different groove. This causes the punch 110 to assume a new position relative to the work blank with a minimum of time and effort.

The punch indexing apparatus as shown in FIG. 8 can be modified by providing a series of radially directed holes in shank 80 of such size as to accept stud 74 therein and a vertically positioned supporting bolt extending through support 70 and into shank 80 as shown in the apparatus of FIG. 1. Radially directed grooves 75 formed in the bottom of support 70 can be dispensed with along with indexing pin 76 and its complementary hole formed in member 82. The shank and punch half members may be indexed or rotated a portion of a revolution by loosening the vertical bolt and retracting stud 74 from its first hole. When the half members and punch are positioned as desired, the stud is threaded into a second aligned hole in the shank and the supporting bolt tightened.

The compressive stripper 120 functions with the nibbling punch as with the ordinary punch shown in FIGS. 1 and 2. As indicated in FIGS. 8 and 9, the stripper 128 extends beyond the punch and heels and contacts the blank slightly before or at the same time the heels come into contact. The work piece is thereby held stationary on the die while the punch continues to descend and then on the withdrawal stroke until the punch is clear of the blank as shown in FIG. 9.

Although this invention has been disclosed with reference to specific forms and embodiments thereof, it will be appreciated that a great number of variations may be made without departing from the spirit or scope of this invention. For example, parts may be reversed, equivalent elements may be substituted for those specifically disclosed, and certain features of the invention may be used independently of other features, all without departing from the spirit and scope of this invention as defined in the appended claims.

I claim:

1. A turret type press punch or the like having a punch mounted for vertical movement relative to a work surface, a compressive type stripping unit mounted for partial movement with the punch comprising

a sleeve surrounding the punch having a downwardly directed surface adjacent the punch cutting surface and having means for attaching a sleeve to the punch so that the sleeve moves partially with the punch but is free to move within defined limits in vertical directions relative to the punch,

compression spring means for continually urging the sleeve in the direction of the work surface, said spring means being mounted concentric to one portion of the press and bearing on an upwardly directed surface of the sleeve,

a stripper comprising a flat metal disk supported by the sleeve on its downwardly directed surface by a plurality of magnets located within the downwardly directed surface of the sleeve, said stripper forming a surface contiguous to and in the same plane as the punch cutting surface when said surface is not in contact with the blank whereby upon positioning of the blank and lowering of the punch proximate the blank the stripper contacts and presses the blank against the work surface while the punch passes through the blank and as it is withdrawn,

an axial directed slot formed in the sleeve and a stub mounted in the punch and extending through said slot, whereby movement of the sleeve independent of the punch is determined by the limits of the slot.

2. The punch press as defined in claim 1 further including

a punch support having a main portion supported at the top by the press and a second portion at the

bottom of the main portion having a lesser diameter, the two portions of the punch support forming therebetween a downwardly directed annular shoulder, the punch support holding the punch partly within and partly extending from the bottom end thereof, and the annular shoulder forming the upper supporting surface for the compression spring.

3. In a turret type punch press or the like, a nibbling punch comprising

a punch and support member mounted for vertical movement relative to a stationary female die, said punch having a plurality of uniform diameter grooves extending therethrough from the cutting surface and extending into the support member as holes, said grooves being located contiguous the vertical sides of the punch so that the flat side surfaces of the punch truncate the grooves causing their perimeter to be less than 360°,

a plurality of generally cylindrical heels equal in number to the number of grooves, each of said heels having an axially directed flat surface which forms part of the vertical side surface of the punch when in assembled condition, said heels mounted in the grooves and holes for vertical movement independent of the punch and punch support within certain limits,

means for preventing the heels from rotating,

means for continually urging the heels in the direction of the die so that the heels extend beyond the downwardly directed cutting surface of the punch when not forced upwardly by the blank upon downward movement of the punch, whereby following positioning of the blank on the die and lowering the punch, each heel which does not contact the blank moves into the die before or at the same time as the punch contacts the blank thereby preventing lateral movement of the punch when only a portion of the punch cutting surface contacts the blank, a punch support located above and supporting the punch and support member for vertical movement, said punch support having a plurality of indexing openings located within its downwardly directed bottom surface,

said support member having at least one indexing pin mounted vertically within and protruding from said member, said pin being of such size as to fit within one of said indexing openings in the punch support,

means for detachably connecting the punch support and supporting member so that upon detaching said means the support member may be rotated around its vertical axis to a selected position until said pin fits within a selected hole whereby the position of the punch around its vertical axis may be varied.

4. The nibbling punch defined in claim 3 further including

a stripper sleeve mounted for independent axial movement on the supporting member having a downwardly directed surface located adjacent the punch cutting surface when not contacting the blank and having means for attaching the sleeve to the punch so that the sleeve moves partially with the punch but is free to move independently within defined limits in a vertical direction relative to the punch,

means for continually urging the sleeve in the direction of the die, and

a stripper supported by the sleeve on its downwardly-directed surface and forming a surface contiguous to and in the same plane as the downwardly-directed surface of the punch heels when not contacting the blank whereby following positioning of the blank and lowering of the punch proximate the blank, the stripper contacts and presses the blank against the die during the time the punch passes through the blank and is withdrawn.

5. The nibbling punch as defined in claim 4 wherein the means for continually urging the sleeve in the direction of the work surface comprises

a compressing spring surrounding the punch and located between the downwardly-directed surface of the punch support and an upwardly-directed flange surface of the sleeve.

6. In a turret punch press of the type producing a single cut for each stroke; a punch assembly comprising; a cylindrical upper guide portion adapted to slide in the bore of the turret; a cylindrical intermediate portion of reduced outside diameter relative to that of said upper portion; a generally cubical lower punch portion, the under surface of which is provided with cutting edges; a sleeve encompassing said cylindrical intermediate portion and in sliding engagement with the outer surface thereof, said sleeve also surrounding said punch portion, the outside diameter of said sleeve being equal to that of said cylindrical upper guide portion; an initially solid stripper plate having an outside diameter substantially equal to that of said sleeve secured to the under side of said sleeve and adapted to be pierced by said punch portion to form a stripper plate closely surrounding the cutting edges of said cubical punch portion; and compression spring means urging said sleeve and stripper plate downwardly toward the work to be punched.

7. Apparatus as claimed in claim 6 characterized in that said compression spring means is wrapped around the outer surface of said cylindrical intermediate portion between said upper portion and said sleeve.

8. Apparatus as claimed in claim 6 characterized in that the under surface of said upper cylindrical guide portion is provided with a plurality of radially extending indexing grooves and in that said intermediate portion is provided with an off-center indexing pin which projects upwardly from said intermediate portion and is received in one of said indexing grooves, thereby to control the angular position of said punch.

9. Apparatus as claimed in claim 6 characterized in that said intermediate portion comprises an upper half and a lower half; further characterized in that said generally cubical punch portion has arcuate cutouts in the side walls thereof forming axially extending truncated cylindrical grooves; further characterized in that nibbling heels are provided in said grooves, said heels having resiliently supported upper portions and truncated cylindrical lower portions fitting into the truncated cylindrical grooves in the side walls of the punch portion, each of said heels having an axially extending slot in the outer surface of the cylindrical portion opposite the flat surface thereof; and resilient means extending transversely through the punch from the slot of one heel to the slot of an opposite heel for preventing angular movement of the heels.

10. Apparatus as claimed in claim 9 further characterized in that the under surface of said upper cylindrical guide portion is provided with a plurality of radially extending indexing grooves and in that said intermediate portion is provided with an off-center indexing pin which projects upwardly from said intermediate portion and is received in one of said indexing grooves, thereby to control the angular position of said punch.

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