Nov. 15, 1966 L. E. SAUER 3,285,642

SPLIT ROTARY ANVIL, HEAD, AND THE LIKE

Filed Sept. 17, 1962 4 Sheets-Sheet 1

Fig. 1.

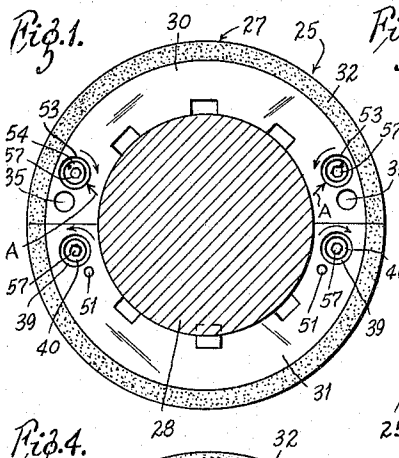


Fig. 2.

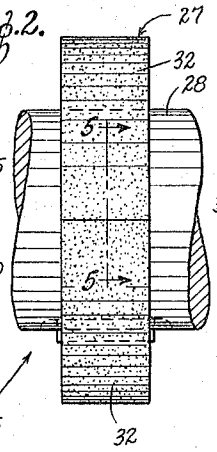


Fig. 3.

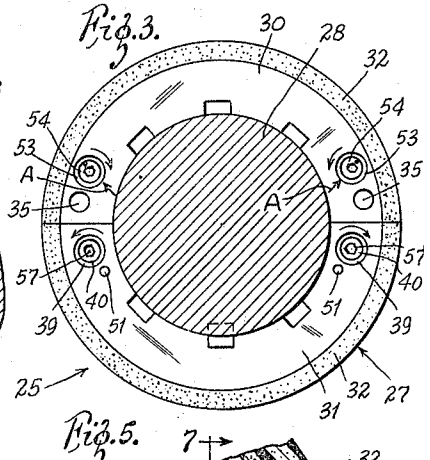


Fig. 4.

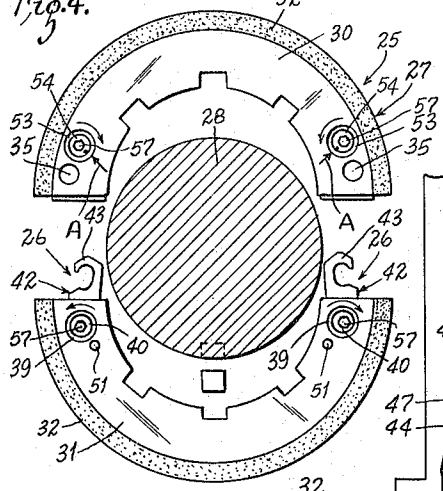


Fig. 8.

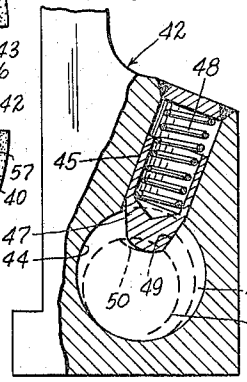


Fig. 5.

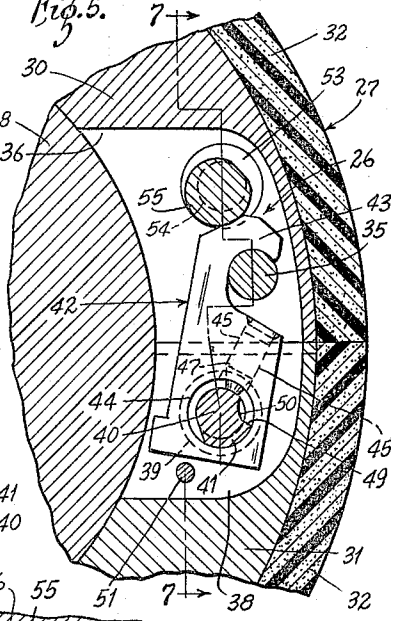
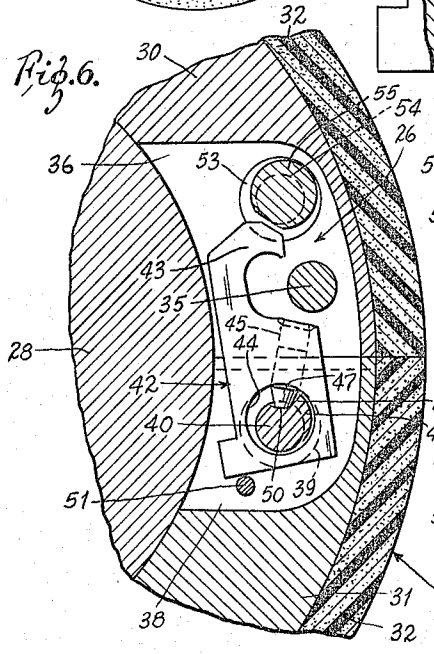


Fig. 6.



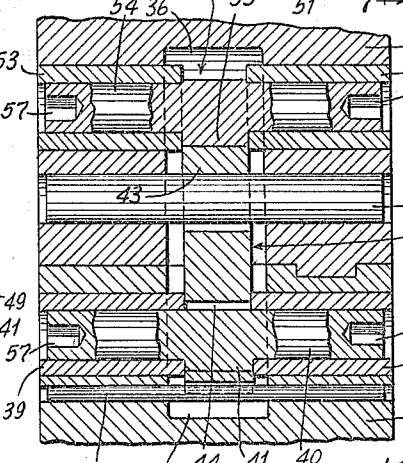


Fig. 7.

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Nov. 15, 1966 L. E. SAUER 3,285,642

SPLIT ROTARY ANVIL, HEAD, AND THE LIKE

Filed Sept. 17, 1962 4 Sheets-Sheet 2

Fig. 9. PRIOR ART

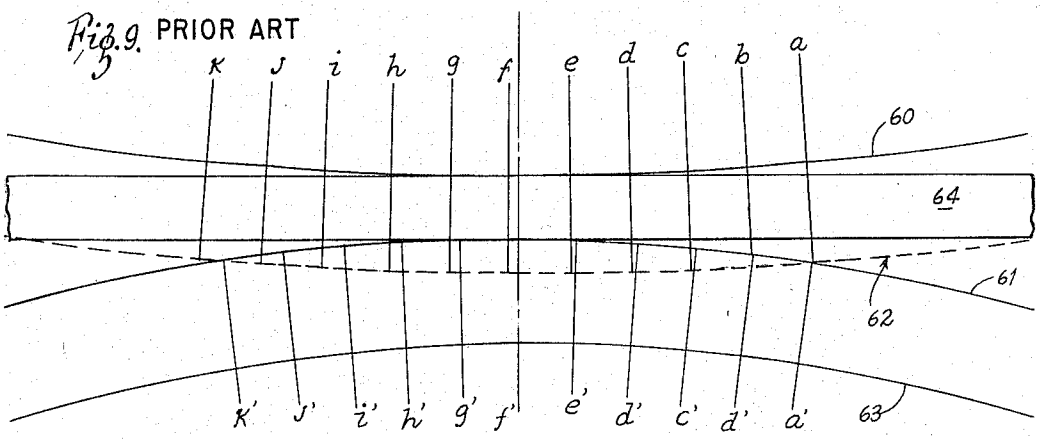


Fig. 10.

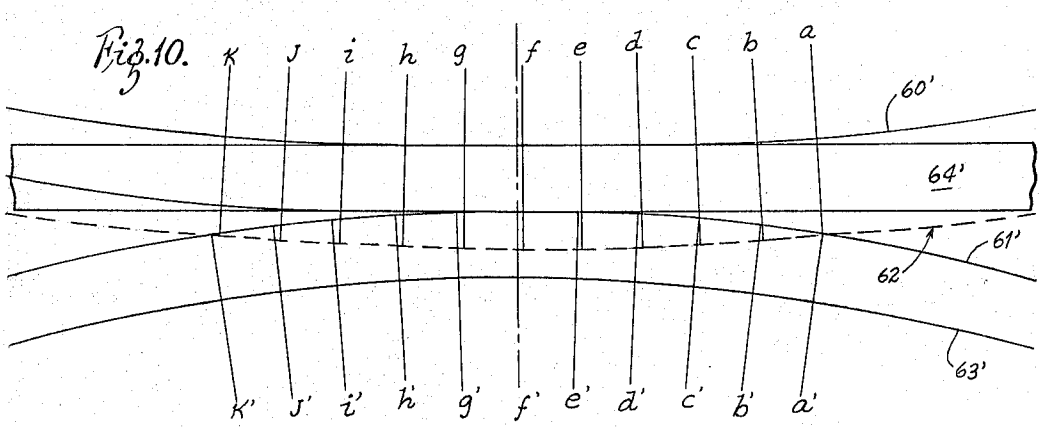
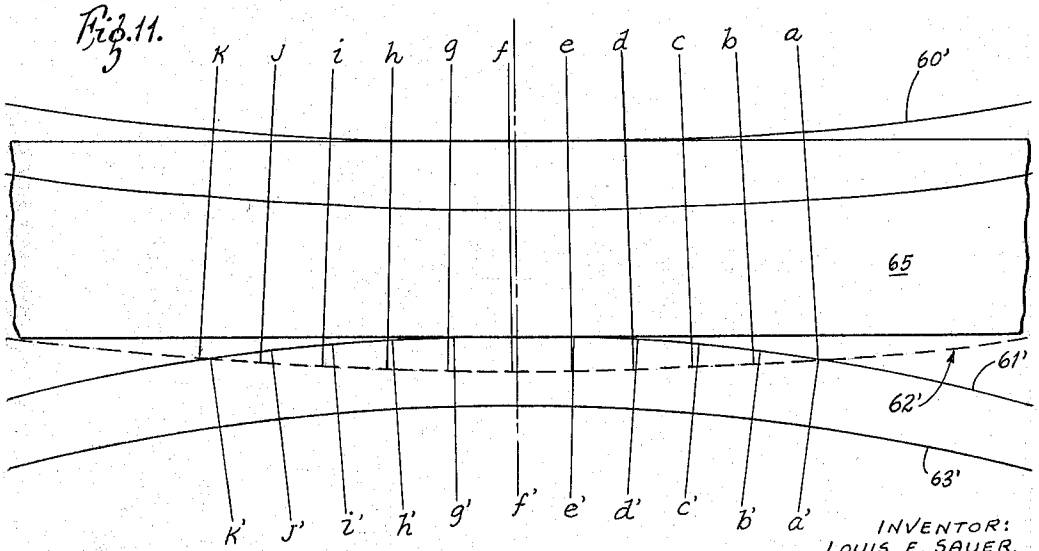


Fig. 11.



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Nov. 15, 1966 L. E. SAUER 3,285,642

SPLIT ROTARY ANVIL, HEAD, AND THE LIKE

Filed Sept. 17, 1962 4 Sheets-Sheet 3

Fig. 12.

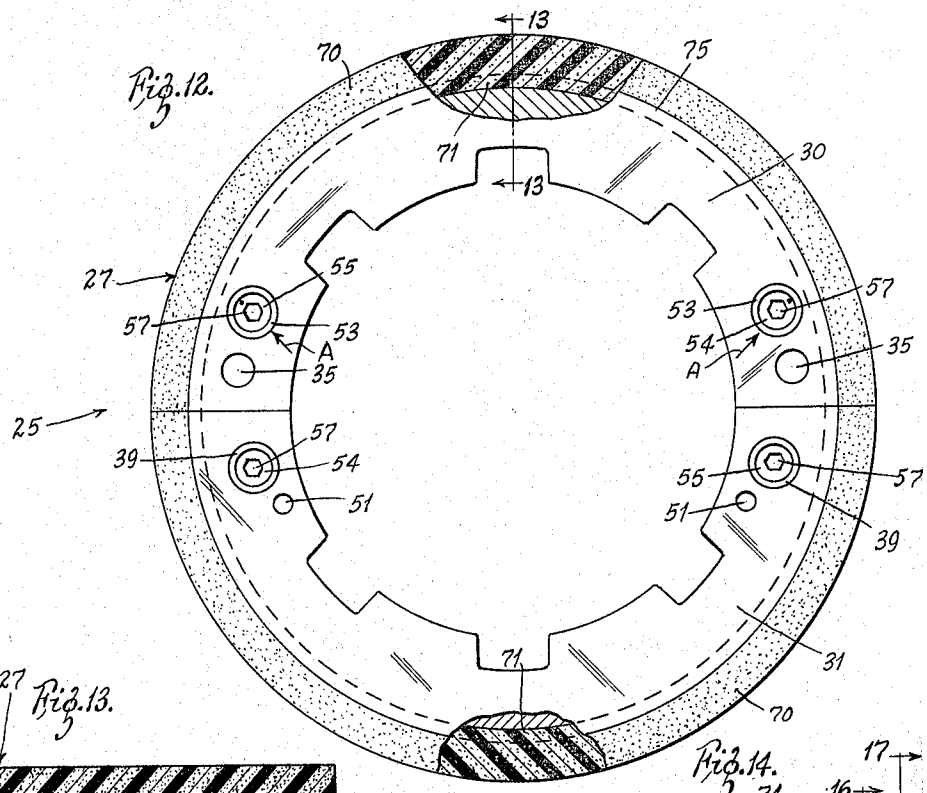


Fig. 13.

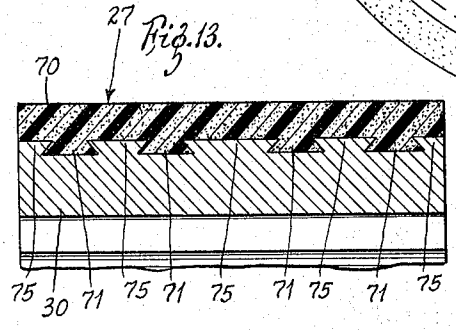


Fig. 14.

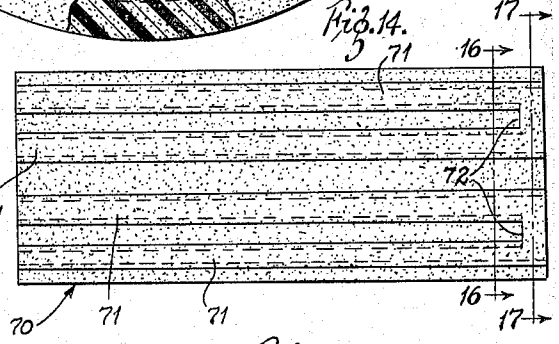


Fig. 16.

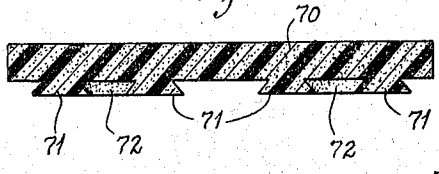


Fig. 15.

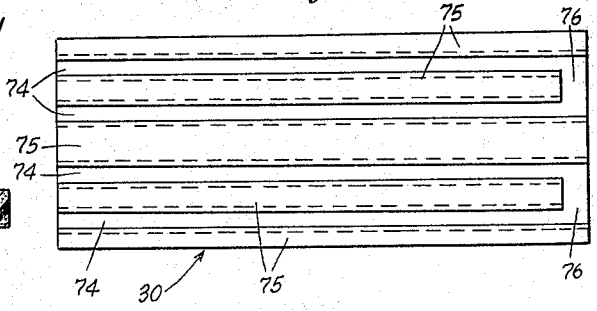
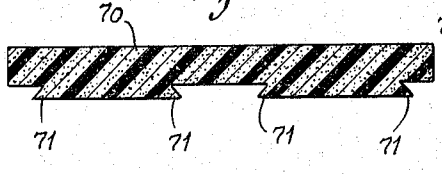


Fig. 17.



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Nov. 15, 1966 L. E. SAUER 3,285,642

SPLIT ROTARY ANVIL, HEAD, AND THE LIKE

Filed Sept. 17, 1962 4 Sheets-Sheet 4

Fig. 19.

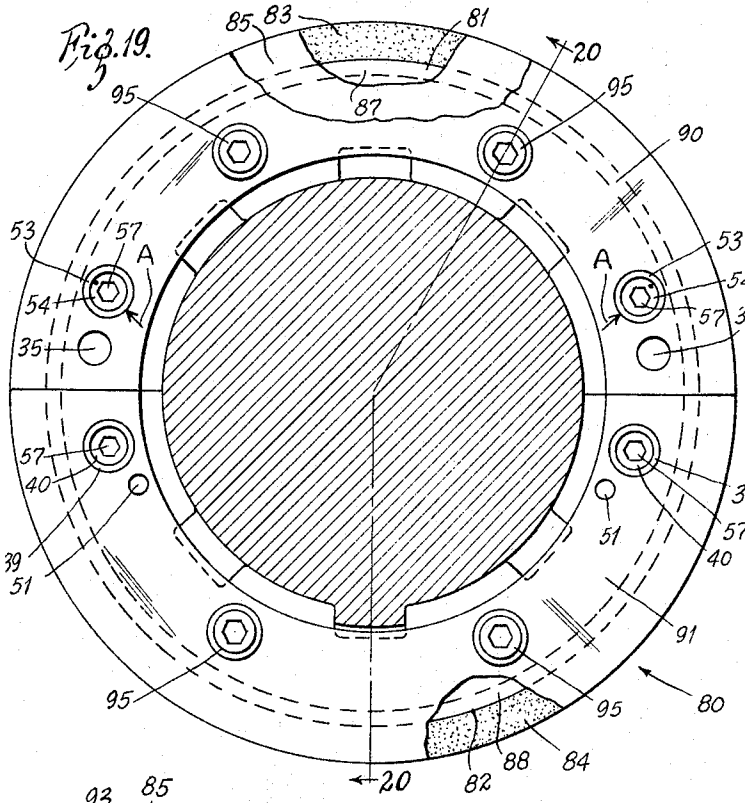
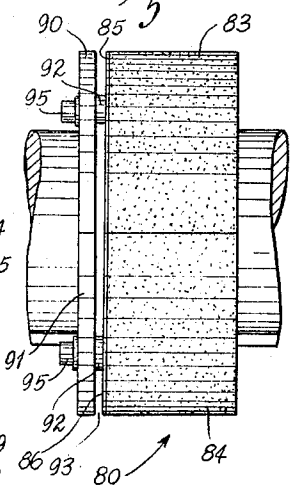


Fig. 18.



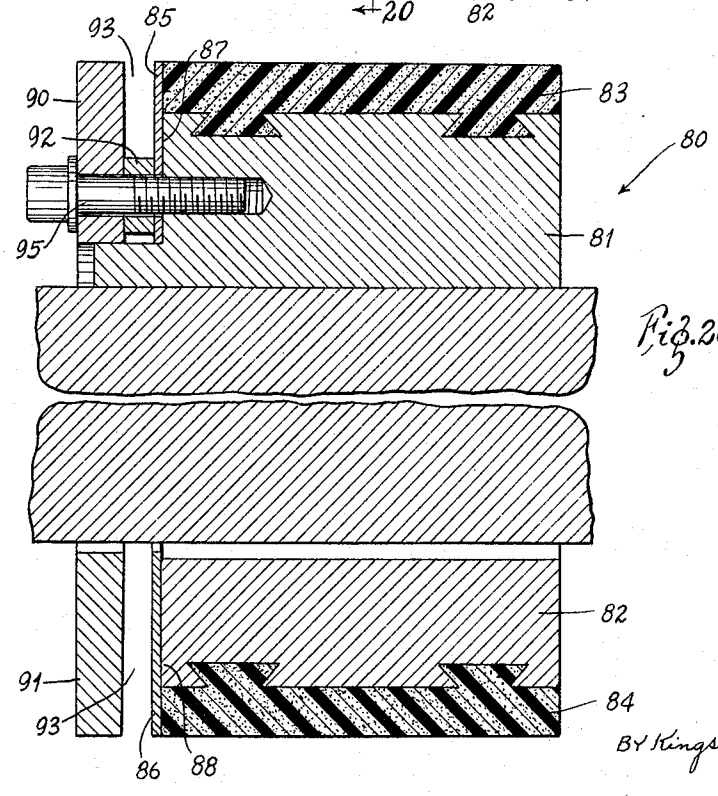


Fig. 20.

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United States Patent Office 3,285,642 Patented Nov. 15, 1966

3,285,642

SPLIT ROTARY ANVIL, HEAD, AND THE LIKE

Louis E. Sauer, St. Louis, Mo., assignor to L. E. Sauer Machine Company, St. Louis, Mo., a corporation of Missouri

Filed Sept. 17, 1962, Ser. No. 224,003
10 Claims. (Cl. 287—189.36)

The present invention relates generally to rotary die cutting, as rotary anvils, heads, and the like. It is more particularly concerned with novel split anvils, split heads, and the like incorporating novel locking construction, with novel replaceable resilient cover construction for anvils, with maximum efficiency of operation of knife carrying head and opposed resiliently covered anvil through reduction of damage to the latter, and with a slotting anvil including construction reducing pounding to a minimum.

There has long existed in rotary die cutting the need for heads and anvils which can be installed securely on a shaft, loosened for movement longitudinally on the shaft, or removed therefrom in a matter of seconds rather than in the extended time which has heretofore been required for adjustments and changes. This need has included the requirement that the locking and unlocking arrangement be firm against movement while the anvil is in place, yet include means for quickly engaging and disengaging the lock. Die cutting has also long felt the want of long lasting anvil covers and quickly replaceable anvil covers which remain firmly in position while the anvil is in use, yet can be quickly replaced. Damage by cutting knives to anvil covers has heretofore been excessive, requiring undue down time and expensive replacement of elements. Lower slotting steel anvils have long caused undue pounding of equipment with resulting damage to anvils and concerned machinery in general.

Therefore, an object of the present invention is to provide novel heads and anvils for rotary die cutting which fulfill and satisfy the foregoing long existing needs.

In brief, the present novel structure incorporates a quick action locking and unlocking arrangement for rotary die cutting split heads and anvils which includes the combination of frictional engagement of parts and cam action which securely maintain a clamping link in locking engagement with a fixed shaft. In addition, a notable locking cam is provided as an extra measure to insure maintenance of the clamping link in locked position. Both the locking cam and a clamping shaft and cam supporting the clamping link are quickly and effectively rotated by means of a simple Allen wrench. Each half of the split anvil is provided with a replaceable cover of polyurethane which is anchored in place by inter-engaging grooves and corresponding linear projections. Each cover incorporates a stop at the end to limit movement of the cover in respect to the anvil half.

For stitch lap cutting, the solid tool steel roller heretofore employed is replaced by a rotary anvil incorporating a polyurethane cover and a thin tool steel blade of ring form at one side adjacent and defining the inner wall of the annular groove against which the blade strikes, thereby substantially eliminating the pounding heretofore necessarily a part of stitch lap cutting. Blunting of blade points is also eliminated. Accurate cutting is assured.

Hence, another object is to provide a novel quick acting efficient locking construction for split anvils and heads.

Another object is to provide a novel quick acting lock for split anvils and heads which is securely engaged when in operative position yet can be quickly released for adjustment on the shaft or removal, thereby insuring safety of operation yet reducing down time to a minimum when

it becomes necessary to remove the anvil or head such as for changing the set up from one style box to another, or for replacement or repair.

Another object is to provide a novel relationship of rolls in rotary die cutting which reduces to a minimum the amount of damage inflicted by the cutter upon the cover of the anvil.

Another object is to provide a novel split anvil incorporating a removable novel cover of wear resisting material.

Another object is to provide a novel anvil incorporating a polyurethane cover.

Another object is to provide a novel rotary anvil incorporating a removable resilient cover.

Another object is to provide a novel split rotary anvil incorporating a readily and quickly removable resilient cover for each anvil part, each of which may be slipped into and removed from operative position, each being provided with means preventing relative peripheral sliding.

Another object is to provide a novel slotting anvil formed for highly effective cutting and slotting in which pounding of metal on metal is substantially eliminated with resultant benefit to anvil and associated machinery.

Another object is to provide a novel slotting anvil incorporating a resilient main working periphery and a thin inner blade of steel.

Another object is to provide anvil structures of the nature heretofore set forth which are highly efficient, long wearing and very effective for the intended purposes, readily employed with minimum instruction, and otherwise an improvement on existing structures.

The foregoing and other objects and advantages are apparent from the following description taken with the accompanying drawings, in which:

FIGURE 1 is an end elevational view of a split rotary die cutting anvil incorporating teachings of the present invention locked upon a shaft in cross section;

FIGURE 2 is a view of the anvil of FIGURE 1 looking at the periphery thereof, the shaft being broken away on both sides of the anvil;

FIGURE 3 is a view similar to FIGURE 1, looking at the other side of the anvil;

FIGURE 4 is a view similar to FIGURE 1 but with the separable parts of the anvil exploded from the shaft;

FIGURE 5 is an enlarged transverse cross-sectional view taken substantially on the line 5—5 of FIGURE 2, the several parts being in locked positions;

FIGURE 6 is a view similar to FIGURE 5, but with the several parts in unlocked positions;

FIGURE 7 is a longitudinal cross-sectional view taken on substantially the line 7—7 of FIGURE 5;

FIGURE 8 is an enlarged cross-sectional view illustrating the thimble shaped member and its relation to the cam with which it is associated;

FIGURE 9 is a diagrammatic view illustrating the standard cutting action of a knife mounted on a rotary head of standard diameter cutting through paperboard of a thickness of one-eighth of an inch and working against a resiliently covered anvil of one-half the diameter of the head;

FIGURE 10 is a diagrammatic view illustrating the knife cutting action of a knife mounted upon a head of diameter predetermined in accordance with the present invention cutting through the paperboard of one-eighth inch thickness and working against a resiliently covered rotary anvil of predetermined diameter;

FIGURE 11 is a diagrammatic view similar to FIGURE 9 illustrating the present invention as applied to cardboard of a thickness of .364 inch;

FIGURE 12 is an enlarged end elevational view of a

split rotary anvil similar to the one illustrated in FIGURE 1, parts being broken away for illustration of details;

FIGURE 13 is a further enlarged longitudinal cross-sectional view taken on substantially the radial line 13—13 of FIGURE 12;

FIGURE 14 is a bottom view of a cover member for one-half of the rotary anvil of FIGURE 12 flattened for purposes of comparison with the surface on which it is located when in use;

FIGURE 15 is a view of one-half of the metal base of the rotary anvil of FIGURE 12 schematically flattened as FIGURE 14 for comparison of the inner engaging portions of the cover of FIGURE 14 with the surface of FIGURE 15;

FIGURE 16 is an enlarged cross-sectional view taken on substantially the line 16—16 of FIGURE 14;

FIGURE 17 is an enlarged cross-sectional view taken on substantially the line 17—17 of FIGURE 14;

FIGURE 18 is a view of the periphery of a stitch lap lower slotting anvil incorporating the teachings of the present invention mounted upon a shaft which is broken away, as shown, for conservation of space;

FIGURE 19 is an enlarged side elevational view of the rotary anvil of FIGURE 18, looking toward the left of FIGURE 18; and

FIGURE 20 is a further enlarged cross-sectional view taken on substantially the line 20—20 of FIGURE 19, the central portion of the shaft being broken away for conservation of space.

Referring to the drawings more particularly by reference numerals, 25 indicates generally a split rotary anvil incorporating teachings of the present invention including locking construction generally indicated by the reference numeral 26, and cover construction generally indicated by the reference numeral 27. The rotary anvil 25 is illustrated as keyed to a shaft 28 and as including two opposed arcuate metal bases or halves 30 and 31 and a cover 32 removably mounted on each half 30 and 31.

Particularly considering the locking construction 26, extending through the metal half 30 adjacent each end is a fixed shaft or pin 35. Also adjacent each end of the metal half 30 is a recess 36 which is open both radially inwardly and circumferentially at the free end, as is clear from FIGURE 5. A recess 38 is disposed adjacent each end of the metal half 31, opening in similar manner to the recesses 36. Rotatably mounted in each end of the metal half 31 by spaced bearing sleeves 39 is a shaft 40 having an integral cam 41 of the configuration shown thereon disposed within the respective recess 38. Disposed about each cam 41 is a thick clamping link 42 of the configuration shown in FIGURE 5, each clamping link 42 having a hook portion 43, an annular opening 44 surrounding the cam 41, and a well 45 opening into the annular opening 44. Within the well 45 is a thimble shaped member 47 biased outwardly therefrom by a compression spring 48 (FIGURE 8), the nose of which engages an indentation 50 in the cam 41 in one position of movement. The side of the nose of the member 47 is engaged positively by a shoulder 49 of the cam 41 in unlocking rotation of the shaft 40. Mounted adjacent the heel of each clamping link 42 is a pin 51 which is engaged by the former to prevent swinging thereof out of the area of the joining recesses 36 and 38 (FIGURE 6). Rotatably mounted adjacent to but inwardly of each fixed shaft 35 in bearing sleeves 53 is a locking shaft 54 having an integral locking cam 55 of the configuration shown disposed within the recess 36. The ends of the shafts 40 and 54 are formed to include hexagonal recesses 57 to receive an Allen wrench for ease of rotation (FIGURE 7). The shafts 54 are marked at each end for indexing with an arrow A to indicate the unlocked positions of the cams 55 to avoid blocking the movement of the clamping links 42 into locking positions.

It will be noted that the operative arcuate surface of the cam 41 is on the same radius as the radius of the opening 44 of the clamping link 42. The cam 41 extends for an arc of about 90°, hence, the clamping link 42 floats about said cam 41 and is bodily displaced in the locking and unlocking movements.

With the locking cam 55 in substantially the position of FIGURE 6, the clamping link 42 can be rotated from its free position in FIGURE 6 to its locked position in FIGURE 5 through rotation of the shaft 40 clockwise by use of an Allen wrench. The spring pressed thimble shaped member 47 engaging in the indentation 50 is effective to insure this movement of the clamping link 42 until the inner surface of the hook portion 43 of the clamping link 42 strikes the fixed shaft 35. Thereafter, as the shaft 40 is continued to be rotated, the nose of the member 47 will ride out of the indentation 50 and the clamping link 42 will move bodily downward in relation to the fixed shaft 35 and the rotatable shaft 40 under the influence of the cam 41. The clamping link 42 reaches and thereafter is maintained firmly in the position of FIGURE 5 in which the relationship of the engagement of the cam 41 with the surface of the opening 44 of the link 42 to the fixed shaft 35 is short of overcenter, both by frictional engagement of the substantially ninety degrees of the surface of cam 41 with the wall of the opening 44 and the camming effect of this relationship with the engagement of the hook portion 43 with the fixed shaft 35. It will be noted that the clamping link 42 is free to rotate a limited amount about the center of the fixed shaft 35, thus maintaining full surface contact with the wall of opening 44 for the substantially ninety degrees of the cam 41.

However, as extra security the locking cam 55 is rotated into camming engagement with the outer planar surface of the hook portion 43 to lock the clamping link 42 in its clamping position. In addition while the locking cam 55 remains fixed, the rotatable shaft 40 can be reversed without the clamping link 42 disengaging from the fixed shaft 35. This releases the clamping pressure holding the anvil 25 to the shaft 28 so it can be moved to a new position therealong without fear of its falling off the shaft 28.

To release the clamping links 42 for separation of the metal halves 30 and 31, the obvious reverse procedure is followed.

As heretofore indicated, positive release is effected by the shoulder 49 of the cam 41 positively engaging with the side of the nose of the thimble shaped member 47 to move the clamping link 42 counterclockwise out of engagement with the fixed shaft 35.

It has been determined that the effectiveness of the frictional engagement between the cam 41 and the wall of the opening 44 is increased by making the wall of the opening 44 and the surface of the cam 41 slightly scalloped or wavy in the manner of a sine-cosine curve, the opposed surfaces interengaging, in effect, in a locked as well as frictional relation. This is possible, since there is some give even in the sturdy fixed shaft 35 and thick link 42.

FIGURES 9, 10 and 11 diagrammatically illustrate the relationship of a cutting knife mounted upon a rotary head to an opposed rotary anvil having a resilient cover. FIGURE 9 illustrates standard construction heretofore employed, whereas FIGURES 10 and 11 show the novel relationship of head, knife and anvil in accordance with the concepts of the present invention.

With reference to FIGURE 9, the reference numeral 60 indicates the periphery of a rotary head of the standard diameter of 15.923 inches, reference numeral 61 indicates the periphery of a standard resiliently covered rotary anvil of a diameter of 7.962 inches, one-half that of the rotary head 60, the reference numeral 62 indicates the path of the tip of a knife mounted upon the rotary head periphery 60 and having a penetration of .065 inch in the resilient rotary anvil periphery 61, and 63 indicates the perimeter of the metal base of the anvil. A paperboard 64 of the thickness of one-eighth inch is shown between

the rotary head periphery **60** and the rotary anvil periphery **61**. It will be understood, of course, that the surfaces of the rotary head and the rotary anvil are driven at the same speed, through suitable gearing.

The letters *a* through *k* are equi-spaced and indicate the path of a selected knife point of the knife mounted on the rotary head periphery **60** as it moves from initial engagement with the resilient periphery **61** through its maximum penetration and exit therefrom. The reference letters *a'* through *k'* mark the initial point of impact on the resilient periphery **61** of the knife and the subsequent equi-spaced positions thereof until the knife exits from the periphery **61**. It will be observed that the point *k* is well in advance of the point *k'* in FIGURE 9. This demonstrates the gouging action of the knife as it is rotated along its path from *a* to *k*, since it gradually bodily moves forward in the resilient cover. This destructive forging ahead is caused by the fact that the point of the knife moves in a path of greater diameter than the periphery **60** of the rotary head.

In FIGURE **10**, the reference numerals are primed, the same reference numerals designating similar elements. However, in accordance with the present invention, the periphery **60'** is that of a rotary head having a diameter of 15.675 inches, the resilient periphery **61'** is that of a rotary anvil having a diameter of 8.212 inches, and the path of the knife point designated **62'** continues to be that of a knife having a penetration of .065 inch. The paperboard **64'** has the same thickness of one-eighth inch. The gearing remains the same as that heretofore used and mentioned above.

The letters *a* through *k* indicate the path of the knife point in equal increments as it meets, penetrates and leaves the resilient periphery **61** of the rotary anvil. It will be noted that the knife point at *k* has dropped slightly behind the point *k'* on the rotary anvil perimeter **61'**, thereby eliminating or reducing any gouging effect to a minimum, since in this position the knife point will in effect withdraw in a previously cut slit without bodily removing material from the periphery **61'**. The slight difference in opposed speeds of peripheries **60'** and **61'** has no noticeable effect on work processed.

FIGURE 11 is similar to FIGURE 10 and effects the same solution to paperboard of a thickness of .364 inch indicated by the reference numeral **65**. The periphery **60'** is that of a rotary head having a diameter of 15.675 inches and the periphery **61'** is that of a resiliently covered rotary anvil having a diameter of 8.212 inches. It will be noted that the indicated points *a–k* in the path **62'** of the knife tip mounted on the rotary head differ a little from those of FIGURE 10 in that the point *k* is a little in advance of the point *k'*. Since the distance between the points *k* and *k'* is quite small, the gouging effect is reduced to a minimum.

Thus, substantially equalizing the paths of the knife tip and the periphery of the rotary anvil eliminates or reduces to a minimum the gouging of the resilient surface of the rotary anvil. The present improvement adds substantially to the life of the resilient cover of a rotary anvil.

Referring to FIGURES 12–17, there is illustrated in detail the cover construction **27**, heretofore referred to, which includes a polyurethane cover member **70** removably mounted on each metal half **30** and **31**. The member **70** includes a plurality of continuous undercut projections **71**, four being illustrated. At one end of the member **70** an integral stop **72** is formed between adjacent projections **71**, as is clear from FIGURE 14, in which the inner side of a flattened member **70** is illustrated. The peripheries of the metal halves **30** and **31** are formed with annular grooves **74** and annular undercut projections **75**, the two outside projections **75** being undercut on the inner wall only. The intermediate projections **75** terminate short of the full half circle at one end to provide end spaces **76** which receive the integral stops **72** of the cover member **70**.

It will be apparent from the foregoing that the cover member **70** slips onto the metal half **30** or **31** simply by engaging the left end of the cover member **70**, considering FIGURE 14, with the right end of the metal half **30**, considering FIGURE 15, the projections **71** of the cover member **70** entering the grooves **74** of the periphery of the metal half **30**. The cover member **70** is slipped along the periphery of the metal half **30** until the stops **72** engage the ends of the intermediate projections **75** of the metal half **30**. The cover member **70** will remain firmly in place and will not slide around since the stops **72** and engaged projection ends on the cover members **70** and metal halves **30** and **31**, respectively, will prevent this when the rotary anvil **25** is assembled, as in FIGURE 12. However, the cover members **70** can be readily removed when necessary for repair, or other purpose, and is readily either replaced or a substitute cover **70** installed. Both down time and equipment expense are reduced to a minimum. In addition, the polyurethane cover **70** is of far longer wearing life than rubber and other resilient materials heretofore employed.

Referring to FIGURES 18–20, a lower slotting anvil **80** incorporating concepts of the present invention is disclosed. The slotting anvil **80** includes two metal halves **81** and **82**, resilient cover members **83** and **84** which extend across the major portion of the periphery of the anvil **80** and which are similar in construction and application to the cover members—heretofore described, an annular narrow tool steel blade comprising ring halves **85** and **86** mounted against shoulders **87** and **88** formed at one side of the metal halves **81** and **82**, respectively, as is clearly illustrated in FIGURE 20, an annular wide tool steel blade comprising ring halves **90** and **91** spaced from the ring halves **85** and **86**, respectively, by spacers **92** thereby forming an annular channel **93**, said ring halves **90**, **91** and **85**, **86** being secured in operative position against the shoulders **87**, **88** by suitable bolts or cap screws **95**.

In one embodiment of the novel slotting anvil **80**, the blade halves **85** and **86** are $\frac{3}{32}$ of an inch. Hence, in use, all except $\frac{3}{32}$ of the cross cut is made by the cutting rule or blade into the resilient cover members **83** and **84**, thereby reducing the pounding of metal upon metal to a minimum and preventing blunting of the cutting rule or blade which rapidly occurs when it strikes against a metal surfaced anvil heretofore used.

The present novel lower slotting anvil is highly effective for all types of work, including cutting of the quad lock type of box. It is a distinct improvement over existing structures.

It is manifest that the disclosed structures fulfill the objects and advantages sought.

It is to be understood that the foregoing description and the accompanying drawings have been given by way of illustration and example. It is also to be understood that changes in form of the elements or steps, rearrangement of parts or steps, and substitution of equivalent elements or steps, which will be obvious to those skilled in the art, are contemplated as within the scope of the present invention which is limited only by the claims which follow.

What is claimed is:

1. Locking mechanism for a split rotary anvil including two separable parts, or the like, comprising in combination a fixed member mounted on one part, a movable member mounted on the other part having a portion for engaging said fixed member and having an annular surface, and means for moving said movable member into engagement with said fixed member, said means including a substantial camming surface of substantially the same radius as that of said annular surface movable into frictional-camming locking position short of overcenter with said annular surface to maintain said engagement to draw said parts into locked relation, said movable member being in floating relation with said camming sur-

face and having the annular surface thereof disposed about said camming surface of said moving means.

2. In combination with two separable members, locking mechanism for releasably securing the two separable members together comprising a fixed member secured to one member, a shaft rotatably mounted in the other member including a cam rotatable therewith and including a camming surface formed as the substantial arc of a circle, a latching link including a circular opening surrounding said cam having at least a portion of substantially the same radius as that of said camming surface and a hook portion adapted to engage and pivot about said fixed member, said link being in floating relation with said cam, means for effecting rotation of said latching link with said rotatably mounted shaft and cam, and means for rotating said rotatable shaft to move said latching link into engagement with said fixed member and said cam into frictional-camming engagement with said opening to effect a locking relationship between said cam and said surface of said opening which is short of over-center.

3. The combination of claim 2 in which said latching link is movable bodily in respect to said movable shaft and cam in reaching a locked position in respect to said fixed member and said movable shaft and cam.

4. The combination of claim 3 in which said latching link and said cam frictionally interengage in locked position over a substantial portion of each.

5. In combination, two separable members, locking mechanism for releasably securing the two separable members together comprising a fixed member mounted in one separable member, a shaft rotatably mounted in the other separable member and a cam rotatable therewith, a latch member having a circular opening disposed about said cam and shaft and having a portion engageable with said fixed member in one position of movement thereof, said latch member being in floating relation with said cam, said cam having an arcuate camming surface of substantially the same radius as the radius of said latch member opening, and means for moving said camming surface into firm engagement with the surface of said opening and said engageable portion of the latch member into engagement with said fixed member in a relationship short of overcenter to secure said separable members against separation.

6. The combination of claim 5 in which said latch member is bodily movable radially of said cam and shaft, thereby permitting secure camming engagement between the complementary arcuate surfaces thereof and therethrough locking of the engageable portion with said fixed member.

7. The combination of claim 5 in which said arcuate camming portion is of a substantial number of degrees providing a substantial area of frictional engagement firmly resisting disengagement thereof.

8. The combination of claim 5 in which said moving means includes an indentation in said camming surface and supporting shaft and a plunger member mounted in said latch member spring biased towards said shaft, said indentation being formed to permit said latch to ride out one side, but to engage a shoulder at the other side for movement of the latch member with said rotatable shaft.

9. In combination, a split rotary member including two separable members, locking mechanism for releasably securing the two separable members together comprising a fixed member mounted in one separable member, a shaft rotatably mounted in the other separable member and a cam rotatable therewith, a latch member having a circular opening disposed about said cam and shaft and having a portion engageable with said fixed member in one position of movement thereof, said cam having an arcuate camming surface of substantially the same radius as the radius of said latch member opening, means for moving said camming surface into firm engagement with the surface of said opening and said engageable portion of the latch member into engagement with said fixed member to secure said separable members against separation, and means for releasing the engagement of said camming surface and opening surface without releasing said engageable portion from said fixed member to permit movement of said separable members axially along a shaft, said latch member being bodily movable radially of said cam and shaft, thereby permitting secure camming engagement between the complementary arcuate surfaces thereof and therethrough locking of the engageable portion with said fixed member, said arcuate camming portion being of a substantial number of degrees providing a substantial area of frictional engagement firmly resisting disengagement thereof, said moving means including an indentation in said camming surface and supporting shaft and a plunger member mounted in said latch member spring-biased towards said shaft, said indentation being formed to permit said latch to ride out one side, but to engage a shoulder at the other side for movement of the latch member with said rotatable shaft, said releasing means including a rotatable shaft mounted in said one separable member adjacent to said fixed member having a cam engageable with the engageable portion of said latch member to prevent its disengagement with said fixed member, said cam including a flat side movable into position to permit disengagement of said engageable portion.

10. In combination, two separable members adapted to be mounted on a shaft for axial movement when unlocked, locking mechanism for releasably securing the two separable members together comprising a fixed member mounted in one separable member, a shaft rotatably mounted in the other separable member and a cam rotatable therewith, a latch member having a circular opening disposed about said cam and shaft and having a portion engageable with said fixed member in one position of movement thereof, said cam having an arcuate camming surface of substantially the same radius as the radius of said latch member opening, means for moving said camming surface into firm engagement with the surface of said opening and said engageable portion of the latch member into engagement with said fixed member to secure said separable members against separation, and means for releasing the engagement of said camming surface and opening surface without releasing said engageable portion from said fixed member to permit movement of said separable members axially along a shaft.

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