Aug. 25, 1964 C. J. BOGNAR 3,145,462

METHOD OF SEVERING TUBES AND REFORMING DEFORMED PORTION CAUSED BY SEVERING ACTION

Filed May 1, 1961 3 Sheets-Sheet 1

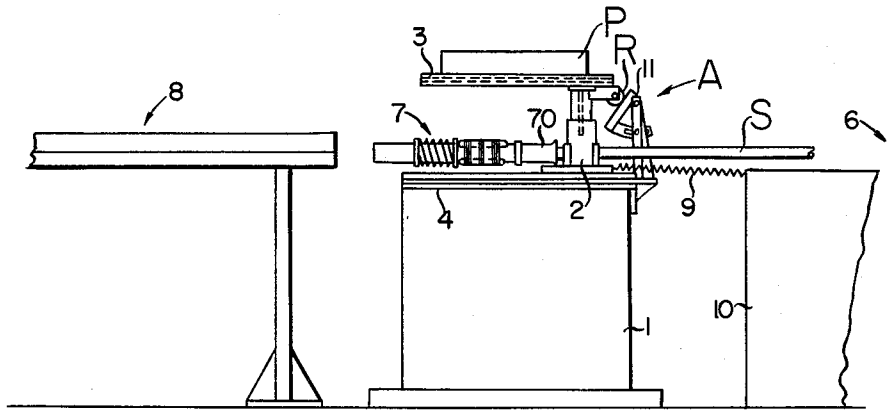


FIG 1

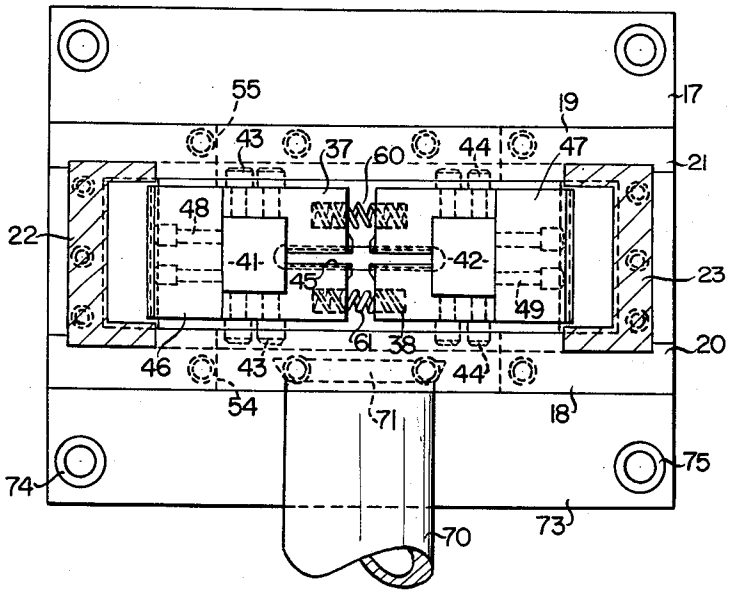


FIG 2

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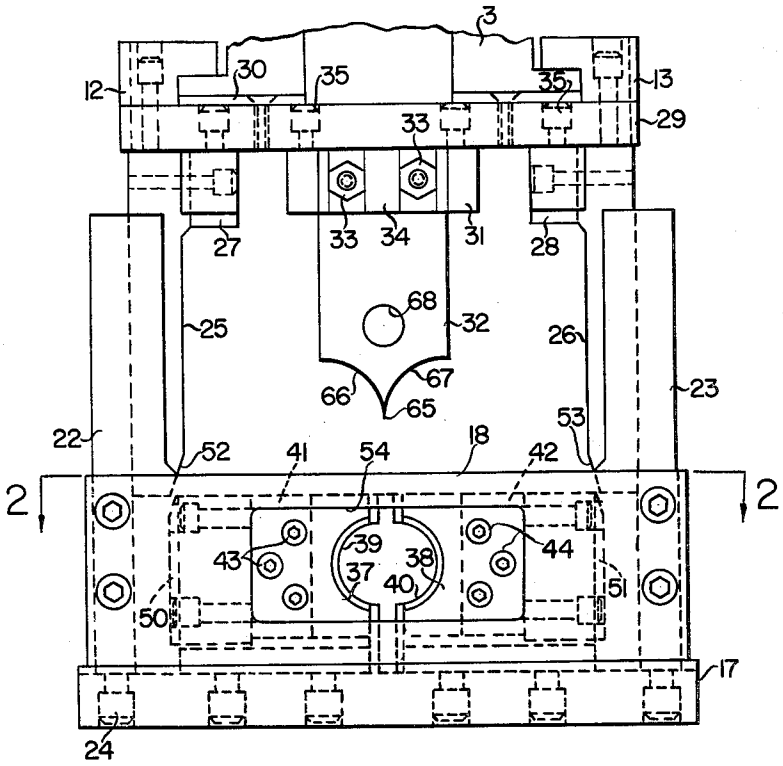


FIG 3

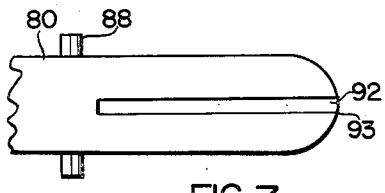


FIG 7

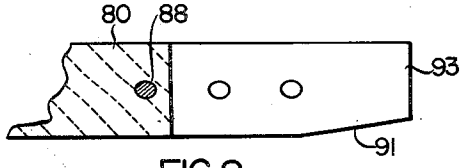


FIG 8

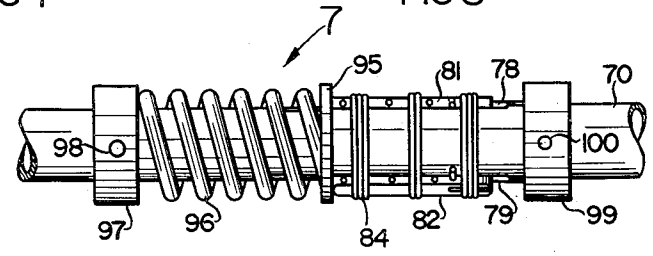


FIG 9

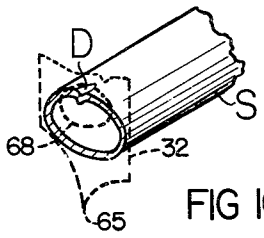


FIG 10

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METHOD OF SEVERING TUBES AND REFORMING DEFORMED PORTION CAUSED BY SEVERING ACTION

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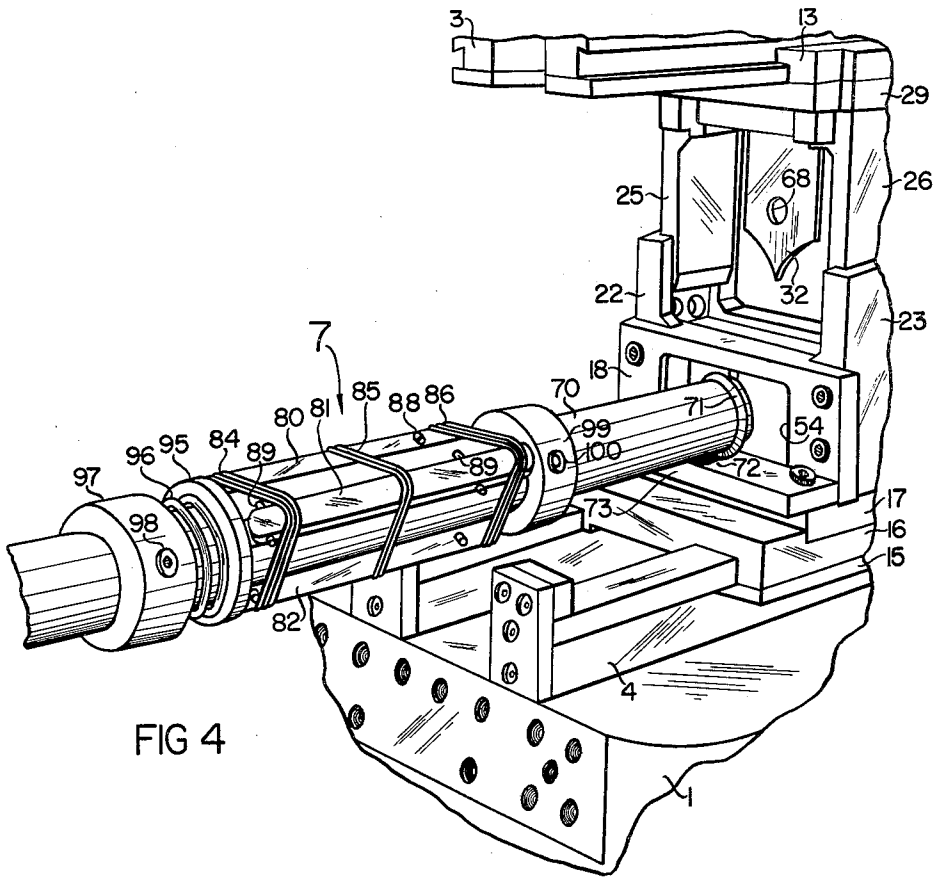


FIG 4

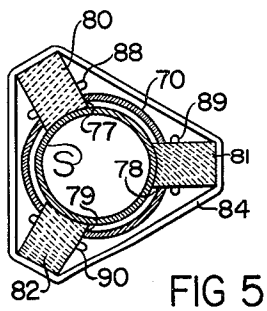


FIG 5

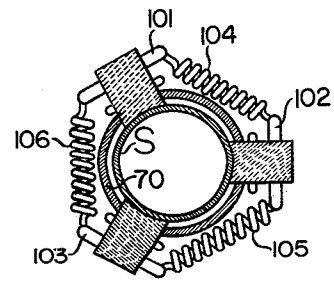


FIG 6

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3,145,462
METHOD OF SEVERING TUBES AND REFORMING DEFORMED PORTION CAUSED BY SEVERING ACTION

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Filed May 1, 1961, Ser. No. 106,857
15 Claims. (Cl. 29—417)

This invention relates generally, as indicated, to a tube cut-off mechanism and more particularly to an improved form of punch-type cut-off.

In a conventional press type cut-off machine employing a punch and die, the tube is clamped or confined in die blocks actuated by downward movement of the press and, as the press continues to close, the pointed punch enters the tube. However, as it enters the tube, it normally depresses a small portion of the tube wall causing a dimple therein. Thus, the end surface of the tube severed in a conventional press type cut-off will not be completely circular but will have a dimple or depressed portion which indicates the point at which the pointed punch entered the tube to make the cut.

In the past, such dimples have been removed from the ends of the cut-off lengths in a separate operation, as by using an end expanding tool or the like. Such methods are obviously inconvenient and expensive and also fail to eliminate the slight protuberance normally resulting projecting longitudinally of the tube and when the dimple has been straightened.

It is accordingly a principal object of the present invention to provide a cut-off mechanism for tubes or the like which will produce a more perfectly circular tube end face.

It is a further object to provide a punch-type cut-off press which will automatically remove the dimple produced in the stock by a pointed punch.

It is another object to provide an improved form of punch-type cut-off which will produce more accurate cutting faces in work.

It is still another object to provide an improved cut-off blade and tube retarding device which can readily be adapted to conventional press-type cut-offs to produce improved severing of tubes and the like.

Yet another object is to utilize the normal reciprocation of the punch to achieve removal of the dimple and any protuberance extending beyond the tube end.

Other objects and advantages of the present invention will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

In said annexed drawings:

FIG. 1 is a somewhat schematic fragmentary side elevational view of a flying shear or press type cut-off in accordance with the present invention;

FIG. 2 is a fragmentary horizontal section of the press taken substantially on the line 2—2 of FIG. 3;

FIG. 3 is an end elevation of such press with the tube retarding device removed for clarity of illustration;

FIG. 4 is an enlarged perspective view of the press and tube retarding device mounted thereon;

FIG. 5 is a transverse section of the tube retarding device shown in FIG. 4;

FIG. 6 is an alternative form of tube retarding device that may be employed with the present invention;

FIG. 7 is a fragmentary top plan view of the leading end of a tube retarding shoe;

FIG. 8 is a fragmentary longitudinal section of such leading end of the tube retarding shoe of FIG. 7;

FIG. 9 is a fragmentary elevation of the tube retarding device; and

FIG. 10 is a perspective view showing the dimpled tube and the manner of dimple removal in the cut-off of the present invention.

Referring now to the drawing and more particularly to FIG. 1 thereof, there is shown a cut-off press for tubes and the like in accordance with the present invention comprising a base 1 having mounted therein a cut-off press 2 for horizontal sliding movement on ways 3 and 4. The tube or stock S enters from a forming mill to the right of FIG. 1 as shown generally at 6, passes through the cut-off dies, and extends through a tube retarding mechanism shown generally at 7 and onto a run-out table 8. It will, of course, be understood that a mechanical or electrical flag means normally will be employed on the run-out table to actuate the cycle of the cut-off mechanism in the conventional manner. It is noted that the cut-off press 2 will slide to the left as shown in FIG. 1 as the result of the action of the accelerator A. Downward movement of the platen P causes the roller R to engage the angularly adjustably mounted cam bar 11 so that the stationary inertia of the press is overcome prior to any positive engagement between the punch and moving tube stock S. The punch is then moved along the slides by the positive engagement of the punch blade and tube stock. After the severing operation is complete and the punch blade is withdrawn, springs 9 extending between the press and the last stand 10 of the forming mechanism will be employed to return the press to its original position. Reference may be had to U.S. Patent No. 2,630,177 for an accelerator and cut-off that may be employed with the present invention.

Referring now more particularly to FIGS. 2, 3 and 4, and more especially to FIG. 3, it will be seen that the press cut-off of the present invention is comprised of top gibs 12 and 13 which cooperate with the top rails 3 and bottom gibs 14 and 15 which cooperate with the bottom rails 4. The gibs 14 and 15 are mounted on the underside of a bronze die slide plate 16 which forms the base for the cut-off dies and punch guides. Mounted on top of the bronze die slide plate 16 is a bottom die shoe plate 17 upon which the side guides 18 and 19 are mounted for the dies and die actuators. As indicated in FIG. 2, each of the side guides has inturned or flanged ends 20 and 21 at each end thereof and vertically extending cam guides 22 and 23 positioned between the side guides 18 and 19 are fastened to the bottom die shoe 17 as are the side guides 18 and 19 by screws 24 more clearly seen in FIG. 3.

The cam guides 22 and 23 extend vertically above the side guides 18 and 19 and provide vertically extending U-shape guideways for die operating cams 25 and 26. These cams are mounted on cam holders 27 and 28 which are in turn mounted on the top slide plate 29. The gibs 12 and 13 are mounted on the top slide plate 29 which guide the top slide for movement along the rails 3 with wear plates 30 being interposed between the rails 3 and the top slide plate 29. The cams 25 and 26 and the guides 22 and 23 then act to hold the top slide plate 29 and the bottom die shoe 17 which is in turn mounted on the bottom slide plate 16 for reciprocation of the press as a unit along the pair of rails 3 and 4.

Also mounted on the top slide plate 29 is a punch holder 31 which secures the vertically extending punch 32 to the top slide plate 29. The punch 32 may be clamped to the holder 31 by nut and bolt assemblies 33 cooperating with a punch holding plate 34. The punch

holder 31, like the cam holders 27 and 28, will be secured to the top slide plate 29 by means of suitable screws 35 or the like.

The vertical movement of the cams 25 and 26 serves to move horizontally toward each other a pair of dies 37 and 38, each provided with semi-circular tube confining portions 39 and 40. The semi-circular tube confining portions may preferably be .003 to .005 inch larger than the upper size tolerance of the manufactured tube stock S. Each pair of dies 37 and 38 is secured respectively to die block holders 41 and 42 by means of screws 43 and 44. As seen more clearly in FIG. 2, each die is generally L-shape and the legs thereof are secured to the holders 41 and 42 respectively by means of the screws 43 and 44. The pairs of dies 37 and 38 are dimensioned to provide a transverse elongated slot 45 for reception of the punch blade 32 therein. The die block holders 41 and 42 are fastened to cam blocks 46 and 47 by means of screws 48 and 49.

The cam blocks 46 and 47 are provided with outside wear or cam surfaces 50 and 51 respectively which are engaged by the beveled cam surfaces 52 and 53 of the cams 25 and 26 respectively, so that vertical movement of the cams 25 and 26 will cause horizontal movement of the dies into stock confining position. The side guides 18 and 19 are provided with windows 54 and 55 respectively through which the tube stock S will pass to be confined by the horizontally reciprocable pair of dies 37 and 38.

The upper pair of rails 3 will, of course, be driven for vertical movement with respect to the lower pair of rails 4 and the base 1 of the cut-off. It will be seen that as the rails 3 move downwardly, the top slide plate 27 will also move downwardly, as will the cams 25 and 26 as well as the punch blade 32. Movement of the cams will cause the dies to confine the tube and further vertical movement of the cut-off press downwardly will cause the blade 32 to enter the slot 45 between the dies, severing a section of tube. It will be understood that the confining of the tube by the dies and the insertion of the punch blade will cause the punch to move to the left as seen in FIG. 1 sliding along the rails 3 and 4 at the same speed as the tube or stock S.

As seen in FIG. 2, springs 60 and 61 extending between the opposed pairs of clamping dies 37 and 38 will be employed to move apart or release the confining dies when the cams 25 and 26 are withdrawn upwardly and the punch 32 is withdrawn from the severed tube.

To describe one cycle of operation, the tube enters from the right as seen in FIG. 1 and passes through the cut-off 2 and onto the standard run-out table 8. Positioned in the path of the tube on the run-out table there will be provided a flag, either mechanical or electrical, triggering the cut-off device. Tube S trips the flag switch on run-out table 8 and a switch actuates through relays the solenoid operated air valve which supplies air to the press clutch. Upon clutch engagement, the platen P carrying the punch holder starts downward. The cams 25 and 26 close the die block jaws which insure proper tube confinement for the cutting stroke. The die accelerator cam following roller R (see FIG. 1) attached to the punch holder traveling downward on the inclined cam surface 11 produces a motion of the punch holder in the direction of travel of the tube. The die accelerator A accelerates the cut-off die to a velocity equal to the velocity and direction of the tube at the instant the punch begins to pierce the tube. After the punch blade has pierced the tube and throughout the cutting stroke, the motion and velocity of the tube is imparted to the cut-off die by the input end of the tube pressing against the punch blade.

The hereinabove described cut-off press is generally conventional and serves merely as a typical example of the mechansm with which the cut-off improvements of the present invention may be incorporated.

The improvements of the present invention which enable a conventional press-type cut-off to sever elongated stock such as tubing without leaving a dimple in the wall thereof comprise a specially shaped cutting punch or blade 32 and a tube retarding device secured to the cut-off 2 for movement therewith as indicated generally at 7. As shown in FIG. 10, as the blade 32 moves down through the tube, severing the same, there is a dimple D produced in the tube wall as the result of the point 65 of the blade deforming the tube initially as such point enters the tube wall. The particular blade illustrated is shown as provided with arcuate cutting edges 66 and 67 which facilitates the severing of the tube. It will, however, be understood that any appropriate punch or blade may be modified in accordance with the present invention as explained below.

In order to remove the formed depression or dimple in the tube wall, the punch is provided with a central aperture 68 located directly above point 65. The aperture is so positioned that it will enter the top portion of the severed tube while the punch is cutting through the bottom. As the punch progresses toward the bottom of the cut, and the aforesaid hole or aperture enters the tube, the aperture passes the dimple on its downward travel and the edge of the dimple will then protrude into the hole due to the natural resiliency of the tube material. When the punch reverses direction and begins to move out of the tube, the dimple is caught by the lower edge of the hole in the blade and is raised up thereby with the tube still being held by the die confining blocks. As the punch continues to withdraw it removes the dimple from the cut ends of the tube and at the same time may sever a crescent of excess metal due to elongation of the metal in the region of the dimple. Such lower edge of the hole constitutes a shearing edge. The edges of the aperture 68 will ordinarily be at least at right angles to the face of the blade to effect with the cooperation of the dies such shearing action.

The movement of the stock is sufficient firmly to hold the leading end of the following tube against the blade in order to have the dimple removed therefrom by the lower edge of the aperture. However, firmly to hold the trailing end of the severed section of tubing against the blade and thus also to force the dimple on the trailing end of the severed section into the aperture, there is provided the tube retarding device 7.

As shown more clearly in FIGS. 4 and 9, the tube retarding device 7 is comprised of a stock guide tube 70 which has its leading end flared as shown at 71 and welded as shown at 72 to a transverse supporting plate 73. The tube retarding device can then be mounted on the standard cut-off press by adding two tapped holes to the bottom die shoe 17 and fastening the transverse plate 73 thereto by screws 74 and 75 or the like. As seen in FIG. 5, the guide tube 70 is provided with three elongated longitudinal slots 77, 78 and 79 which receive Micarta, or other suitable heat and wear resistant drag shoes 80, 81 and 82 respectively. These shoes are provided with arcuate inner tube-engaging contact surfaces and elastic annular garter springs 84, 85 and 86 may be trained about such shoes continually to exert a radially inwardly directed pressure. Pairs of guide pins 88, 89 and 90 may be positioned transversely through such Micarta drag shoes to keep the shoes from moving too far into the guide tube when not inwardly supported by the tube or stock S. As seen in FIGS. 7 and 8, the leading inner edges of the drag shoes are beveled as at 91 and the leading end is provided with a vertically extending wear plate 92 held in slot 93 by pins or the like. It will now be seen that the tube S moving through the guide 70 will contact the beveled edges 91 of the drag shoes, forcing the same radially outwardly against the contracting pressure of the springs 84, 85 and 86 and thereby obtaining a braking action on the tube. This braking action causes the drag shoes to move to the left as seen in FIGS. 4 and 9 so that the trailing end of the drag shoes

will abut against a slidable collar **95** compressing spring **96** held between the collar **95** and the fixed collar **97**. A set screw or the like **98** may be employed adjustably to fix the collar **97** on the tubular guide **70**. It will be understood that in place of the single spring **96** illustrated, a plurality of springs in compression series may be employed to give the resilience desired between the slidable collar **95** and the fixed collar **97**. An adjustable collar **99** held by set screw **100** may be provided at the opposite end of the slots **77**, **78** and **79** to provide control of the extent of movement of the shoes **80**, **81** and **82** within the respective slots.

An alternative form of tube retarding device may be employed, as shown in FIG. 6. Each of the shoes **80**, **81** and **82** is here provided with transverse pins **101**, **102** and **103** to support coil springs **104**, **105** and **106**. In this manner, coil tension springs may be employed in place of the annular rubber or elastic garter springs shown in FIG. 5.

It will now be seen that as the tube passes between the separated dies into the tube guide **70**, the leading edge will engage the beveled undersurfaces of the drag shoes **80**, **81** and **82** to move the same radially outwardly against the springs **84**, **85** and **86**. The friction between the shoes and tube will not be sufficient, however, to impair the efficiency of the forming mill from which the advance of the tube is obtained nor will such friction be sufficient to cause the moving tube to elongate springs **9** prematurely to move the press **2** along the rails **3** or **4**. The leading end of the tube will then move onto the run-out table **8** to strike the flag to commence the cycle of operation of the cut-off press. After the blade **32** has severed the tube S, it will be seen that the spring **96** will exert a back pressure on the severed length of tube actively to hold the trailing end of such length against the face of the blade **32**, thereby to ensure engagement of the depressed or dimpled portion of the tube within the aperture **68**. When the punch blade is withdrawn from the tube, the dimpled portion on the severed end will then also be removed as will the dimpled portion on the leading edge of the unsevered end. Whereas the aperture **68** is illustrated as circular, it will be understood that any type of aperture may be employed so long as the dimpled portion of the severed tube can be held firmly against the blade to enter the aperture so that the dimpled end of the tube can be straightened and any projecting portion be severed by withdrawal of the blade.

As an example of a specific blade, when severing tube of 1¾ inches O.D., a blade width of approximately 3 inches is suitable. The blade may have an overall length of 5¾ inches from the root to the tip **65**. The arcuate edges **66** and **67** may be struck on a 2½ inch radius so that the blade length from the edge of the arcuate portion to the root may be 4⅜ inches. The bottom edge of the aperture **68** may then be positioned approximately 1 13/16 inches from the tip **65** and the aperture may be ¾ inch in diameter. The arcuate severing edges **66** and **67** will be spaced approximately ⅛ of an inch from the wall of the severed tube in the maximum down position of the punch blade. In this position, the top edge of the aperture **68** will be just slightly above the top of the severed tube.

It will now be understood that after the punch blade has pierced the tube and throughout the downward cutting stroke and upward de-dimpling stroke, the punch blade will be held against the input end of the tube stock S by the springs **9**. This pressure de-dimples the entering end of the tube while the tube retarding device supplies the back pressure on the exit end of the tube for the de-dimpling thereof.

The spring or natural resilience in the tube material is a factor in the cut-off and de-dimpling action, but it will readily be understood that such is not a limiting factor which would make it impossible to de-dimple dead soft or low resilient materials. Accordingly, the punch blade of the present invention can be used with such materials to achieve the desired effects.

Other modes of applying the principles of the invention may be employed, change being made as regards the details described, provided the features stated in any of the following claims or the equivalent of such be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. A flying shear for elongated moving stock and the like comprising a horizontally movable punch and die, means thus to move said punch and die with such stock, means to move said punch transversely of such stock to sever such stock while thus horizontally moved, said punch having a pointed end which deforms such stock on movement thereof transversely of such stock, said punch including transverse opening means operative to reform such stock after completion of the severing stroke thereof, and means operative to urge the severed section of such tube against such opening.

2. In a flying shear, a reciprocable punch having a downwardly projecting pointed end adapted to sever elongated stock and the like, said punch having a transverse opening having a cutting edge aligned with such point adapted to engage such stock upon completion of the severing stroke of said punch to remove any deformations in such stock during the return stroke of said punch.

3. A tube severing device comprising a movable pointed punch blade, a transverse opening in said punch blade aligned with said point in the direction of movement thereof, such opening being spaced from said point to receive one edge of such tube as the pointed end severs the opposite edge of such tube and straighten any deformations in such one edge of such tube caused by the pointed edge of said punch entering such tube.

4. A tube severing device comprising a vertically reciprocable tube severing blade having a lower end having a projecting point, an aperture in said blade spaced from said pointed end to engage the top edge of such tube at the maximum low position of said blade, and means operative resiliently to hold the severed end of such tube against said blade to force any deformed portion thereof into such aperture to be straightened upon removal of said blade from such tube.

5. In a cut-off press for elongated traveling tube having a reciprocating cut-off blade, a tube retarding device comprising an elongated guide tube, a plurality of longitudinally extending slots in said guide tube, drag shoes positioned in said slots, and means operative to force said drag shoes resiliently radially inwardly adapting said shoes frictionally to engage a tube or the like within said guide tube, spring means engaging one end of said shoes to force said shoes longitudinally against the normal direction of travel of such tube temporarily to maintain the severed end of a severed length of such tube against said cut-off blade.

6. A cut-off press as set forth in claim 5, wherein said means operative resiliently radially inwardly to force such shoes comprises a plurality of garter springs surrounding said shoes.

7. A cut-off press as set forth in claim 5, wherein said means operative radially inwardly to force said drag shoes comprises a plurality of tension springs interconnecting said drag shoes.

8. A cut-off press as set forth in claim 5, including guide pins transversely extending through said drag shoes adapted to control the maximum radial inward position of said shoes.

9. A cut-off press as set forth in claim 5, including an adjustable collar on said tubular guide, a freely movable collar engaging the ends of said drag shoes, and a compression spring interposed between said adjustable collar and said movable collar adapted to exert a back-pressure on said drag shoes and thus such tube in said tubular guide.

10. The method of forming circular end faces on

severed tube and the like comprising the steps of severing lengths of tube with a punch having a projecting point, and thereby placing a dimple or deformation in a peripheral wall portion thereof, forcibly holding the severed end of such tube against such blade and then removing such deformed portion by return reciprocation of such blade.

11. In tube cut-off mechanism for elongated traveling tube including a blade operative to sever a length from a continuous supply of such tube while producing a dimple in the end wall of such severed length, means operative actively to urge such dimpled end of such severed length against said blade after completion of the cut, means on said blade adapted to engage and remove such dimple upon return movement of said blade, and means operative thus to return said blade.

12. The mechanism of claim 11, wherein said means on said blade is operative both to engage and straighten such dimple and also to remove any minor longitudinal protuberance in the dimpled region.

13. In a cut-off press having a cut-off blade, a tube retarding device comprising an elongated guide tube, a plurality of longitudinally extending slots in said guide tube, drag shoes positioned in said slots, and means operative to force said drag shoes resiliently radially inwardly adapting said shoes frictionally to engage a tube or the like within said guide tube, spring means engaging one end of said shoes to force said shoes longitudinally against the normal direction of travel of such tube temporarily to maintain the severed end of a severed length of such tube against said cut-off blade, said cut-off blade including an opening aligned with the cutting portion thereof in the direction of movement of said blade, said tube retarding device holding said severed tube section against said blade to maintain any deformed portion of the end face of such tube in such opening to remove such deformation as the blade is returned from the tube.

14. In tube cut-off mechanism operative to sever lengths from a continuous traveling supply of such tube, a cut-off blade having a cutting edge with a projecting point producing a dimple in the end wall of each such severed length when driven into such tube, means operative resiliently to urge each such severed length against said blade after completion of the cut, transverse opening means in said blade aligned with said point in the direction of movement thereof operative to engage and remove such dimple upon return movement of said blade, and means operative thus to return said blade.

15. The mechanism set forth in claim 14 including drag shoes operative resiliently frictionally to engage each such severed length, means actively urging said shoes into such engagement, and spring means acting on said shoes thus to urge each such severed length against said blade.

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