

Sept. 20, 1966

W. A. EHLERT

3,273,372

COMBINED DRAWING AND CUT-OFF APPARATUS

Filed Feb. 24, 1964

4 Sheets-Sheet 1

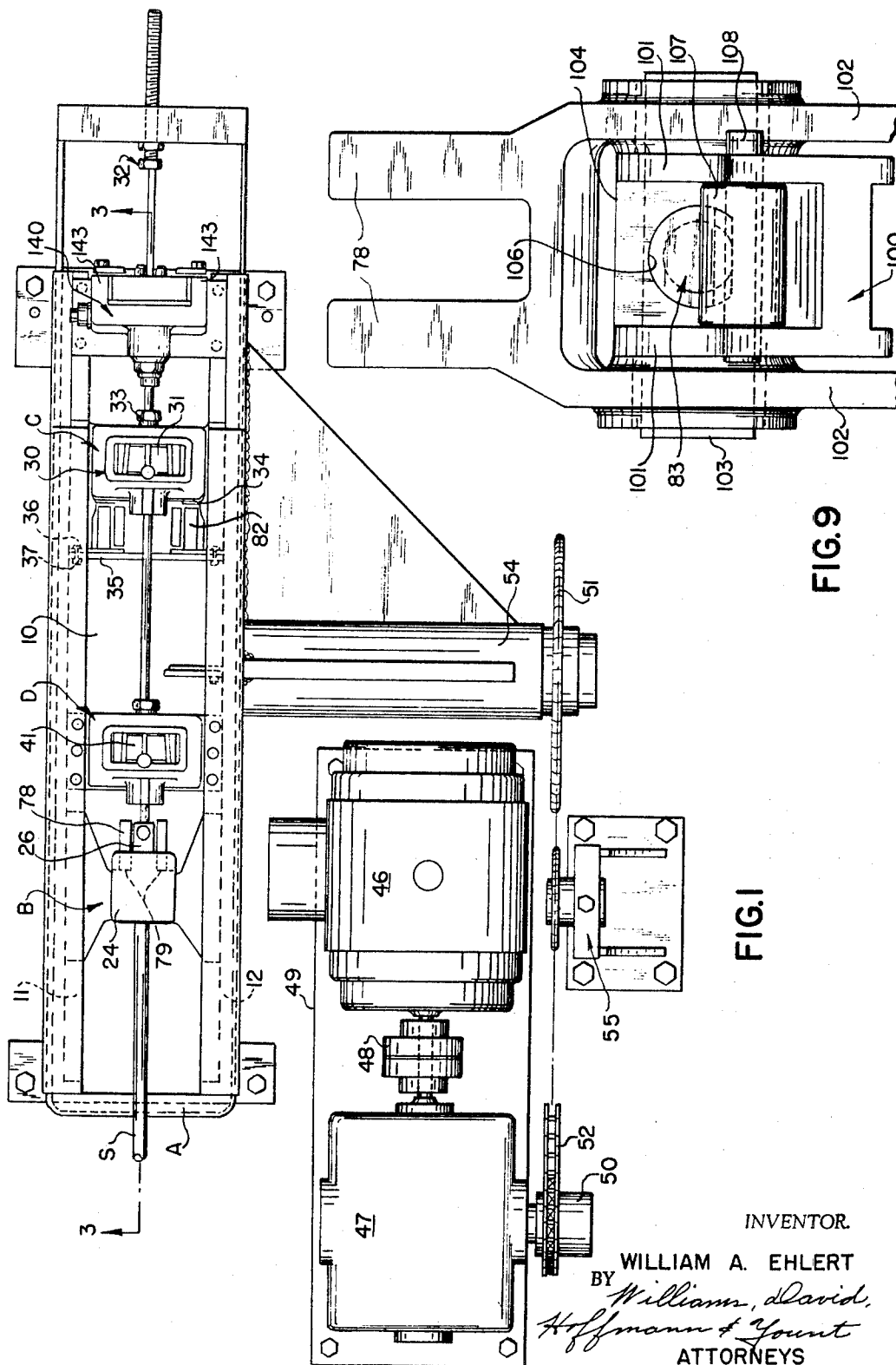


FIG. 1

FIG. 9

INVENTOR.

WILLIAM A. EHLERT

BY

William, David,
Hoffmann & Yount
ATTORNEYS

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W. A. EHLERT

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4 Sheets-Sheet 2

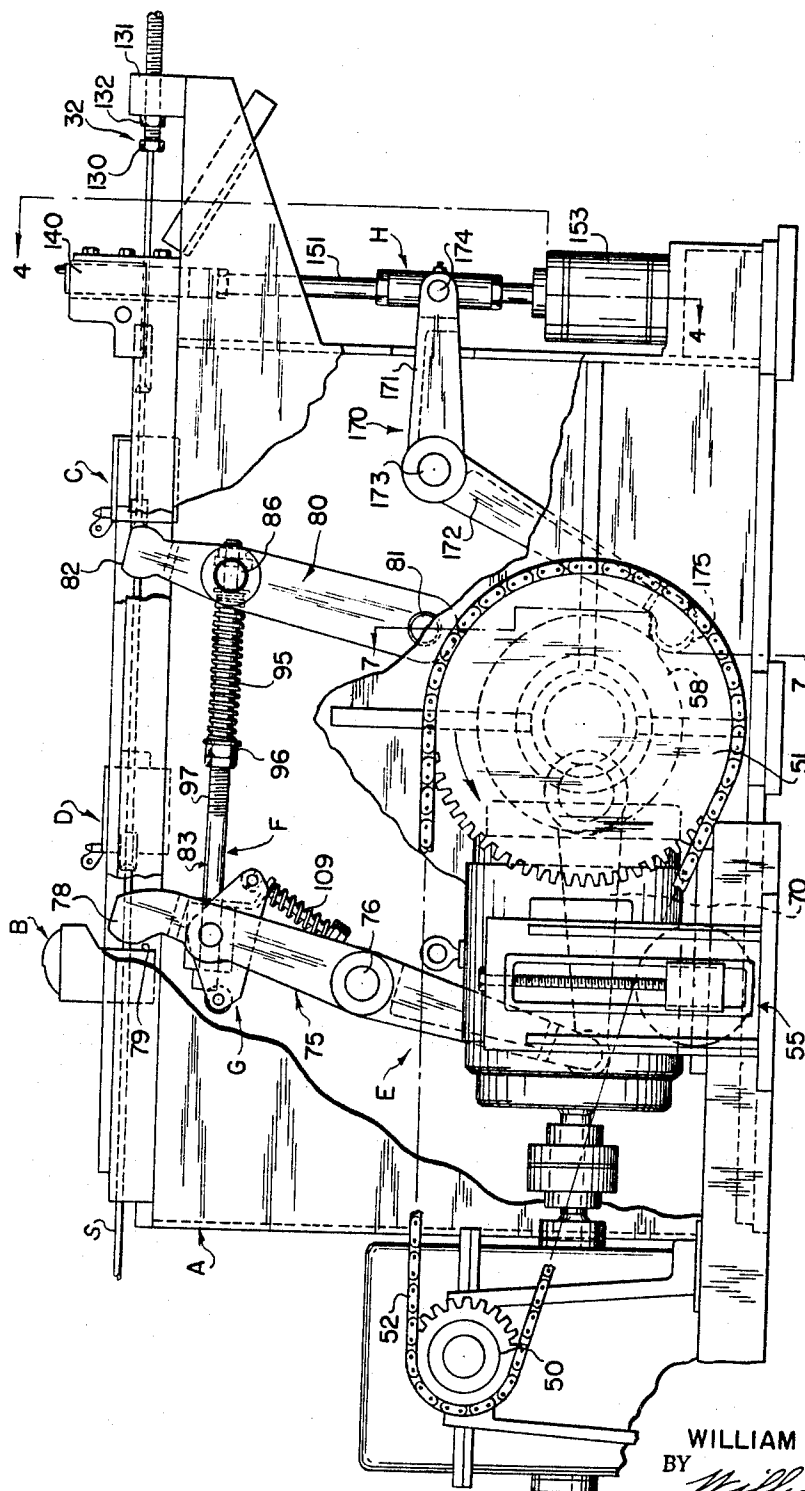


FIG. 2

INVENTOR.

WILLIAM A. EHLERT

BY

William, David,
Hoffmann & Gunt
ATTORNEYS

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W. A. EHLERT

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4 Sheets-Sheet 3

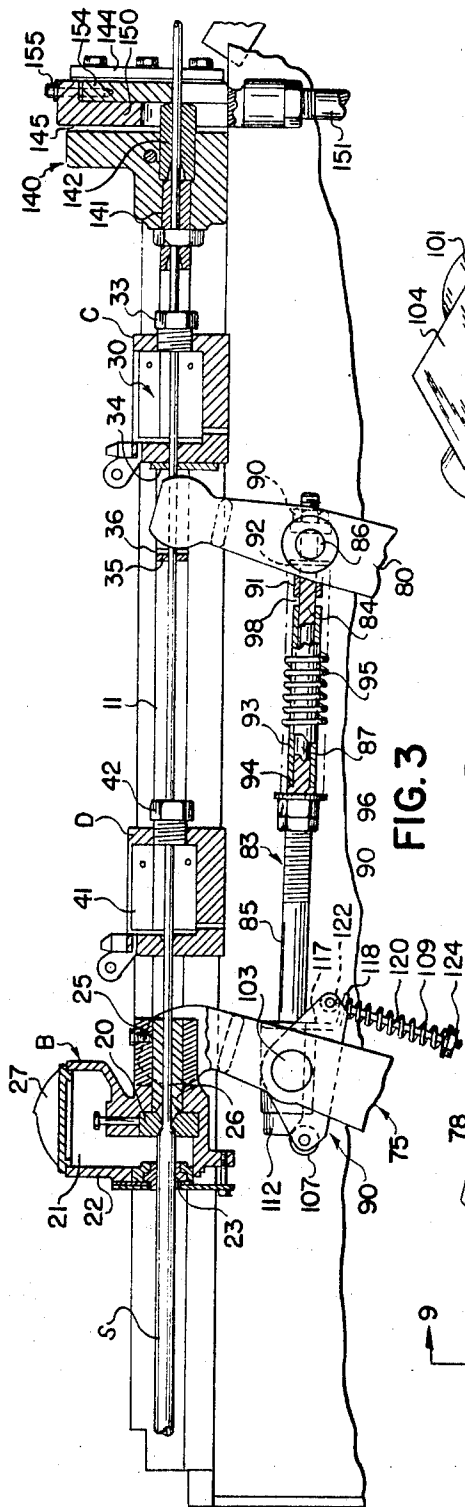


FIG. 3

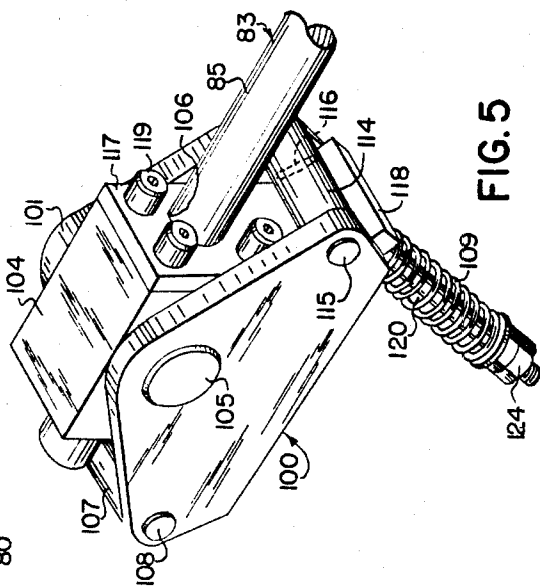


FIG. 5

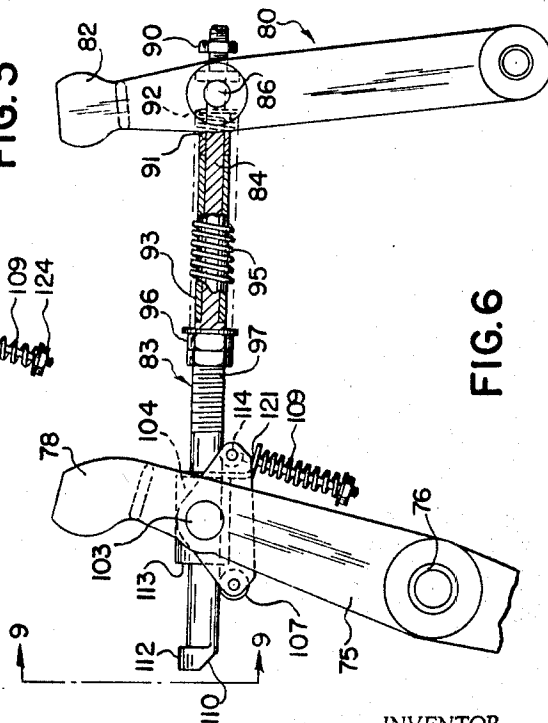


FIG. 6

INVENTOR

WILLIAM A. EHLERT

BY

William A. Ehlert
Hoffmann & Gount
ATTORNEYS

Sept. 20, 1966

W. A. EHLERT

3,273,372

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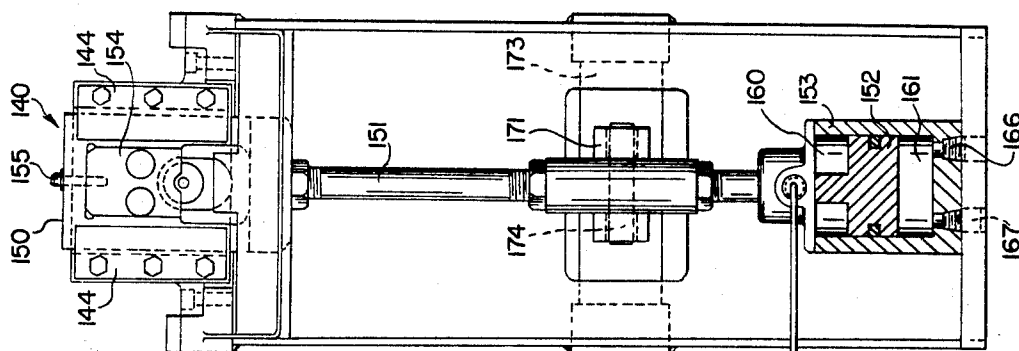
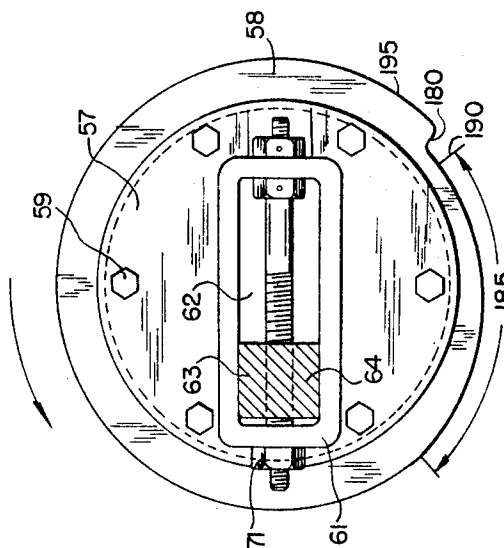


FIG. 8

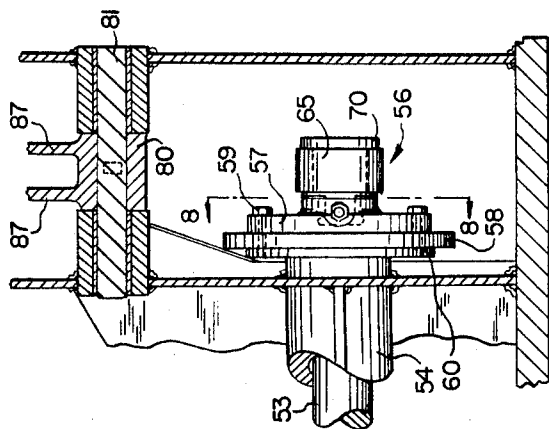


FIG. 7

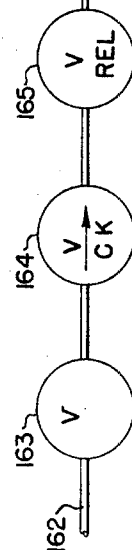


FIG. 4

INVENTOR.

WILLIAM A. EHLERT

BY

Williams, David,
Hoffmann & Young
ATTORNEYS

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3,273,372

COMBINED DRAWING AND CUT-OFF APPARATUS

William A. Ehlert, South Euclid, Ohio, assignor to The Ajax Manufacturing Company, Euclid, Ohio, a corporation of Ohio

Filed Feb. 24, 1964, Ser. No. 346,626
15 Claims. (Cl. 72-275)

The present invention relates to an apparatus for cutting linear stock, such as bar, rod and wire stock, collectively referred to herein as wire to predetermined lengths, and more particularly to a combined wire drawing and cut-off apparatus in which the wire drawing mechanism is of the reciprocating type and in which the cut-off mechanism is operated in timed relation to the operation of the wire drawing mechanism.

One of the problems encountered in the design and construction of the apparatus of the character referred to for producing relatively long blanks of wire is that the operating mechanism therefor must be capable of moving through long strokes and preferably has some means incorporated therein that will prevent damage to the apparatus in the event that the wire being operated upon fails to feed due to some malfunctioning of the apparatus. As a result, apparatus or machines having relatively cumbersome operating mechanisms have heretofore been used. In contrast, the present invention provides an apparatus of the character referred to including a relatively simple and compact operating mechanism having an overload re-engageable release mechanism incorporated therein which will release and allow the drive portion of the operating mechanism to overtravel and prevent damage to the apparatus in the event the wire fails to feed due to some malfunctioning of the apparatus.

The principal object of the invention is the provision of a new and improved combined wire drawing and cut-off apparatus in which the wire drawing mechanism therefor is of the reciprocating type and which apparatus is simple and compact in connection, reliable in operation, capable of producing relatively long accurately sized wire blanks and incorporating a mechanism that will prevent damage to the apparatus in the event that the wire being operated upon fails to feed due to some malfunctioning of the apparatus.

Another object of the invention is the provision of a new and improved wire drawing mechanism of the reciprocating type having a feed slide reciprocable through relatively long feed and return strokes and operatively connected to a die slide or to a member of the drive therefor by means including an overload re-engageable release for releasing or disengaging the operating connection to the feed slide upon the feed slide encountering resistance to its movement in a feeding direction exceeding a predetermined amount.

Another object of the invention is the provision of a new and improved wire cut-off apparatus for producing relatively long lengths of wire from wire stock and having a reciprocating feed slide operatively connected to a power actuated oscillatable or reciprocating member by means including an overload re-engageable release for releasing or disengaging the operative connection therebetween upon the feed slide encountering resistance to its

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movement in a feeding direction exceeding a predetermined amount and for re-engaging the operative connection therebetween upon the power actuated oscillatable or reciprocating member moving through a full cycle.

A further object of the invention is the provision of a new and improved cut-off apparatus of the character referred to, preferably including a wire drawing mechanism, wherein the driven mechanism for reciprocating the feed slide has a yieldable means embodied therein to allow overtravel of the drive mechanism during the latter portion of the feed stroke in order to hold the wire being fed firmly against a fixed gauge during the operation of the cut-off apparatus to insure the cutting of the wire blanks to accurate lengths.

A still further object of the invention is the provision of a new and improved cut-off apparatus of the character referred to, preferably including wire drawing mechanism, wherein the cut-off mechanism is actuated in timed relationship with the wire drawing mechanism and wherein the cutter is carried by a slide actuated in the cutting direction by fluid pressure to rapidly shear the wire.

Yet another and more specific object of the invention is to provide a new and improved wire drawing mechanism of the character referred to having a power actuated oscillatable drive lever and an oscillatable feed lever which is operatively connected to the drive lever by an overload-re-engageable release mechanism and wherein the distance between the two levers can be substantially the same as the length of the operating stroke of the drive lever to thereby provide a wire drawing mechanism which is compactly arranged and yet capable of feeding relatively long lengths of wire.

The present invention resides in certain constructions, combinations and arrangements of parts and further objects and advantages will be apparent to those skilled in the art to which it relates from the following description of the preferred embodiments described with reference to the accompanying drawings forming a part of this specification, in which:

FIG. 1 is a top plan view of a wire drawing and cut-off apparatus embodying the invention;

FIG. 2 is a side elevational view of the wire drawing and cut-off apparatus shown in FIG. 1 with portions cut away;

FIG. 3 is an enlarged fragmentary longitudinal sectional view of the top portion of the wire drawing and cut-off apparatus approximately on the line 3-3 of FIG. 1 with parts thereof shown in elevation;

FIG. 4 is an end elevational view of the cut-off apparatus approximately on the line 4-4 of FIG. 2 with parts thereof shown in section;

FIG. 5 is a detached perspective view of a portion of the feed mechanism;

FIG. 6 is a fragmentary view of a portion of FIG. 2 with parts of the wire drawing mechanism in different positions;

FIG. 7 is a partial vertical section taken substantially along line 7-7 of FIG. 2;

FIG. 8 is a vertical section taken along line 8-8 of FIG. 7; and

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FIG. 9 is an enlarged fragmentary end view of part of the wire drawing mechanism taken along line 9—9 of FIG. 6.

Referring to the drawings, the machine or apparatus shown therein is a combined wire drawing and cut-off apparatus or machine of the reciprocating type which is adapted to alternately feed and draw wire stock. The machine comprises, in general, a frame A, die and feed slides or components B and C, respectively, slidably supported for linear movement on the upper portion of the frame A, a stationary uni-directional gripping device or box D disposed between the die and feed slides and rigidly secured to the upper portion of the frame and adapted to grip the wire during the drawing stroke of the machine, power actuated drive means E including a member for engaging the die slide B to move the die slide during the drawing stroke, a feed mechanism F operatively connected to the aforesaid member of the drive means E and to the feed slide C for reciprocating the latter in timed relation with the movement of said member and incorporating an overload re-engageable release mechanism or means G for releasing or disengaging the drive to the feed slide C when the feed slide fails to feed the wire as intended, and a cut-off mechanism H secured to the frame and operable in timed relationship with the other operations of the apparatus for cutting wire blanks of accurate length.

The frame A is of a generally box like construction having an elongated opening 10 at its top side. A pair of linear guides or ways 11 and 12 are provided adjacent the opening in the top side of the frame A for slidably supporting the die and feed slides B and C, respectively. The frame forms an enclosure in which various operating mechanisms are suitably housed.

The die slide B carries a drawing die 20 through which the wire stock extends and which draws or sizes the stock as the die is pushed thereover or towards the left, as viewed in the drawings to perform a drawing stroke. The die slide is provided with a chamber or pocket 21 in front of or to the left of the die 20 which contains a quantity of lubricant powder for lubricating the drawing die. The front wall 22 of the pocket may have a guide bushing 23 therein through which the stock moves to the drawing die 22. The rear of the die contains a boss portion 25 and may have a bushing 26 therein through which the stock is guided after leaving the die 20. A suitable cover 27 is provided for closing the chamber or pocket 21.

The feed slide C carries a conventional uni-directional stock gripping device 30 which may be of any suitable type or construction and may include a pair of cooperating grippings elements or blocks 31 arranged to automatically grip the wire S and feed the same toward a stock gauge 32 when the feed slide is shifted toward the right, as seen in the drawings. These gripping blocks 31 are arranged so that when the feed slide is shifted in the opposite direction, that is, toward the left, they will automatically release the wire and permit the slide to be shifted relative to the wire which at this time is held against backward movement by the stationary gripping device D. The feed slide may contain a bushing 33 disposed within the rear wall thereof for guiding the wire as it leaves the gripping device 30. The feed slide C also contains a thrust surface or plate 34 which is suitably secured to the front portion thereof. A forwardly spaced plate member 35 having an associated thrust surface 36 is secured to the foremost portion of the feed slide by bolts 37. The purpose of these spaced thrust surfaces will appear hereinafter.

The gripping device or box D is securely fastened to the frame A and includes cooperating gripping elements or blocks 41 arranged to automatically permit the wire S to move freely therethrough while it is being fed towards the right, as viewed in the drawings, but grip the wire and firmly hold the same against backward movement, that is, movement in the opposite direction during the working or drawing stroke of the die slide or whenever there is a tendency for the wire to shift toward the left.

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The power actuated drive means E comprises an electric motor 46 which is drivingly connected to a speed change transmission means 47 via a coupling means 48. The motor and transmission means may be suitably secured to the frame A or, as illustrated, mounted on a separate base member 49 adjacent to the frame. The output or driving shaft of the transmission means 47 is provided with a sprocket wheel 50 which in turn drives a larger sprocket wheel 51 via a sprocket chain 52. The sprocket wheel 51 is secured to a shaft 53 rotatably journaled within a hollow member 54 rigidly secured to and forming a part of the frame A. An adjustable idler assembly 55 is provided for maintaining the sprocket chain 52 taut. In the illustrated embodiment, the idler assembly 55 is mounted on the floor adjacent to the base member 49, but any suitable arrangement may be employed for maintaining the sprocket chain under desired tension.

The shaft 53 constitutes the main drive shaft for the machine and from the sprocket wheel 51 projects through the hollow member 54 into the interior of the frame where an eccentric device or crank assembly 56 is mounted or secured thereon. The eccentric device or crank assembly 56 transfers the rotary motion of the shaft 53 to reciprocating motion and includes a disk member 57 to which an annular cam plate means 58 is adjustably clamped via bolts 59 extending therethrough and threadably secured to a clamping plate 60. The disk member 57 has a raised rectangular boss portion 61 thereon provided with a generally rectangularly shaped groove 62 within which a generally square shaped portion 63 of slide block 64 is slidably disposed. The slide block 64 has a projecting circular portion or crank pin 65 to which one end of a crank arm 70 is pivotally connected. The guide block 64 is retained within groove 62 by being threadably secured to a bolt 71 extending through the two opposite end walls of the boss portion 64. The other end of the crank arm 70 is pivotally connected to the lower end of a bifurcated drive or draw lever 75 which is pivotally connected intermediate its ends to the frame A by a pivot pin or shaft 76 fixed in the frame and extending transversely of the length thereof. The other end of the draw lever is formed with a pair of heads 78 which engage thrust surfaces 79 located on the die slide when the drive lever is oscillated in a counter-clockwise direction to move the die slide through its drawing stroke, that is, to the left, as viewed in the drawings. The eccentricity of the eccentric device 56 can be adjusted to vary the stroke of the drive or draw lever 75 by rotating the bolt 71 to thereby reposition the slide 64 within groove 62.

The feed mechanism F contains a bifurcated feed arm or lever 80 which is pivotally connected to one end to the frame A by a pivot pin or shaft 81 fixed in the frame A and extending transversely thereof. The other end of said feed arm is formed with a pair of heads 82 which are disposed between and engage the thrust surfaces 34 and 36 of the feed slide C for reciprocating the feed slide upon oscillation of the arm 80. The lever 80 is connected to and oscillated by the draw lever 75 by the feed mechanism F through the resettable release mechanism G. The feed mechanism F includes a feed rod 83 having two portions or parts 84, 85 of different diameter. The smaller right hand end part 84 is slidably supported in a transverse aperture in a short shaft or pin 86 pivotally mounted in and extending between the two parts 87 of the feed arm 80. The other end of feed rod 83 is adapted to be releasably connected to the drive or draw lever 75 by the release mechanism G.

A nut 90 on the threaded end of the reduced diameter portion 84 of the rod 83 to the right of the pin 86 limits movement of the feed rod within the pin 86 toward the left, as viewed in the drawings. The reduced diameter portion 84 carries a slidable bushing or sleeve 91 having a flange 92 on its right hand end adapted to engage the left side of the pin 86, and a sleeve means 93 interposed between the sleeve 91 and the shoulder 94 formed at

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the junction of the two different diameter portions of the feed rod.

A compression spring 95 is disposed in surrounding relationship with the feed rod with its ends bearing against the flange 92 of bushing 91 and lock nuts 96 threaded on a threaded portion 97 of the portion 85 of feed rod 83. The compressive stress imposed on spring 95 may be varied by merely loosening and repositioning lock nuts 96. When the spring 95 is in position, the length of the rod 83 between the flange 92 of the bushing 91 and the shoulder 94 is greater than the combined lengths of the sleeve 93 and the bushing 91 and thus, a space or gap 98 is provided between the adjacent ends of the sleeve and bushing. The provision of gap 98 enables relative sliding movement between the rod 83 and feed lever 80 to take place to the extent of the gap when spring 95 is compressed. When the adjacent ends of the sleeve 93 and bushing 91 abut, a solid connection is formed between the drive lever and the feed lever 80. The spring 95 is strong enough to transmit the force normally required to effect a feeding operation and the function of the gap 98 is to allow a slight sliding movement of the end 84 of the feed rod 83 within the pin 86 upon the wire being fed engaging the stop 32. When this occurs the force of the spring 95 holds the end of the wire in engagement with the stop during operation of the cutting mechanism H.

The larger left hand end of feed rod 83 is connected to the drive lever 75 by the overload release mechanism or means G. The release mechanism G comprises a generally U-shaped saddle member 100 having a pair of upwardly extending sides 101 which are disposed between and pivotally connected to the two parts 102 of the bifurcated drive lever 75 by pivot pin means 103. Disposed between the sides of the saddle member 100 is a guide block 104 having a transverse hole 105 therethrough through which the pivot pin 103 extends. The pivot pin 103 has a transverse hole (not shown) therethrough and the guide block 104 also has a longitudinal hole 106 therethrough, said holes being aligned and adapted to slidably receive the left hand end of feed rod 83.

A roller 107 rotatably mounted between the sides 101 of the saddle member 100 and to the left of guide block 104 by pivot pin 108 is normally biased by compression spring 109 to engage a notch or sloping portion 110 on the larger left hand end of rod 83. The rod 83 has a raised flange portion 112 which during normal operation engages thrust surface 113 on the front of the guide block 104. A spacer means 114 is disposed and secured between the sides 101 of the saddle member 100 and to the right of guide block 104 by pivot pin 115. A spring pin 116 is employed to rigidly connect the spacer means 114 to pivot pin 115.

A vertically disposed plate member 117 having a flanged portion 118 which extends beneath but spaced from the spacer 114 is attached to the rear of the guide block 104 by bolts 119. A rod 120, which is threaded at both ends, extends through an aperture 121 in the flange 118 of plate member 117 and is threadably secured within a threaded opening 122 in spacer means 114. The compression spring 109 is disposed around the rod 120 and between the bottom surface of the flange 118 and a pair of lock nuts 124 threadably secured to the other end of the rod. The compressive stress imposed of the spring 109 can be adjusted by loosening and repositioning the lock nuts 124. The compression spring 109 will pivot the saddle member 100 clockwise about the pivot pin 103 to urge the roller means 107 into engagement with the notched portion 110. The flange 112 will prevent the roller 107 from pushing the feed rod 83 to the right through the member 104.

The adjustable stock gauge or stop 32 against which the wire S abuts during the latter portion of the feed stroke is mounted on the right hand portion of the frame A, to the right of the cut-off mechanism H as viewed in

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the drawings, and comprises a bolt 130 threadably secured within a block 131 mounted on the frame. A lock nut 132 is provided to prevent rotation of the bolt 130 after it is positioned within the block.

In normal operation of the wire drawing mechanism, the power drive means E will oscillate drive arm or lever 75. In the drawing stroke, that is, when lever 75 is oscillated in a counterclockwise direction as viewed in the drawings, the head portion 78 thereof will engage thrust surface 79 of the die slide B and move the die slide to the left to perform the drawing operation. The gripping means 41 of the gripper device D will grip the wire and prevent any movement of the wire to the left. Movement of the drive lever 75 in the counterclockwise direction imparts similar movement to the feed arm or lever 80 via the thrust surface 113 of the guide block 104 engaging the flange 112 of the feed rod 83 and the nut 90 at the other end of the feed rod engaging the pin 86 carried by the feed arm. The feed lever 80 in turn will move feed slide C to the left via the heads 82 thereof engaging thrust surface 36 of the feed slide.

After the drawing stroke is completed, the power drive means E will oscillate lever 75 in a clockwise direction, as viewed in the drawings, which in turn will push feed rod 83 to the right due to spring means 109 biasing the roller 107 of the release mechanism G into engagement with the notched portion 110 of the feed rod 83. The feed rod is prevented from being pushed by the roller 107 through the guide block 104 by flange 112 which engages the thrust surface 113 of the guide block. Movement of feed rod 83 to the right produces movement of spring 95 to the right which in turn bears against flange 92 of the bushing or sleeve 91 to move feed arm 80 to the right. The spring 95 is of a sufficient strength that it is capable of transmitting the necessary force required to perform the feeding stroke without compressing. The feed arm transmits its movement to the feed slide C by the heads 82 thereof engaging the thrust plate 34. As the feed stroke commences, the gripping means 30 on the feed slide C will grip the wire and move the same to the right while the stationary gripping device D will release the wire to allow the wire to move therethrough. The die slide will move with the feed slide to the right due to the enlarged undrawn portion of the wire to the left of the die 20 engaging the die.

Stock gauge 32 is adjusted or positioned so that during the latter portion of the feed stroke the wire S will be in engagement therewith, that is, before the drive lever 75 has been oscillated all the way to the right, as shown in the drawings. This will cause spring means 95 to compress slightly and thus, permit a slight overtravel of the drive lever 75. This insures that the wire will be held tightly against the gauge during the cut-off operation and thereby assure the cutting of accurate wire blanks. The rod 83, while the spring 95 is compressing, will slide through pivot pin 86, a distance equal to the linear distance of overtravel of the drive lever at the end of the feed stroke. The distance of overtravel permitted is less than the distance of the space or gap 98 and thus, no solid connection between the two levers takes place.

By permitting overtravel of the drive arm 75 during the latter portion of the feed stroke, heads 78 of the drive lever will move to the right of thrust surface 79 of the die slide B so that when the draw stroke is commenced and the lever is oscillated in a counterclockwise direction, as viewed in the drawings, the heads 78 will not engage the thrust surface 79 of the die slide immediately, but must travel a small distance before engaging the thrust surface. This delayed engagement provides sufficient time to insure that the gripping means of the feed slide C has released the wire and the gripping device D has gripped the wire before the actual drawing operation commences.

If the feed slide encounters a predetermined resistance during the feeding stroke because of the wire snagging, jamming, etc., due to some malfunctioning of the appara-

tus, such as failure of the cutting mechanism, the overload release mechanism G will disengage the driving connection between the drive lever 75 and feed lever 80. As stated before, when the drive lever is oscillated in a clockwise direction, the feed rod 83 normally moves to the right. If, however, the feed slide cannot move, the feed lever 80 will remain stationary, the spring means 95, which normally moves feed lever 80 to the right, compresses and the feed rod 85 slides through pin 86. As the spring 95 compresses, the space or gap 98 between sleeve 93 and bushing 91 disappears and the adjacent ends thereof abut to form a solid connection between the shoulder 94 of feed rod 83 and feed lever 80. This solid connection transfers the resisting force encountered by the feed slide to the feed rod which will tend to push roller means 107 downwardly. If the resisting force is sufficient to overcome the bias force of spring 109, the roller 107 will be pushed downwardly and the saddle member 100 will pivot counterclockwise about the pivot pin 103. The roller 107 will thereafter merely roll along the underside of feed rod 83 as the drive lever continues its movement to the right. As the drive lever 75 oscillates through the draw stroke the roller 107 rolls off the end of the feed rod 83 and is in position to re-engage the sloping surface 110, either at the beginning of the clockwise movement of the drive lever 75 or after it has travelled through that portion of the previous feed stroke which occurred before disengagement or release took place. In other words the drive arm will oscillate through or complete a full cycle before the release mechanism G re-engages. If the difficulty encountered during the feeding movement continues after the first disengaged cycle, the cycle will be repeated until the operator shuts down the machine and corrects the cause of the malfunction. The resistance that is necessary to be encountered by the feed slide before the overload release mechanism G will release or disengage can be varied by varying the stress of spring 109 by re-positioning lock nuts 124.

The cut-off mechanism H comprises a cutter housing 140 rigidly attached to the top portion of the frame A to the right of feed slide C, as viewed in the drawings. The housing contains a pair of horizontally extending bushings 141 and 142 for guiding the stock as it is delivered from the feed slide C and a pair of spaced apart, projections 143 to which plate members 144 are bolted to form generally vertically extending linear guideways 145. A rectangularly shaped cutter holder means 150 is slidably disposed within the cutter housing for linear movement within the guideways 145. The holder means is rigidly connected to a rod means 151 which in turn is connected to a piston 152 which is reciprocally movable within a cylinder 153 mounted on the frame A. A cutter means 154 is releasably secured to the holder means 150 by a bolt 155.

Both ends of the cylinder 153 are closed and the piston 152 divides the cylinder into an upper chamber 160 and a lower chamber 161. The upper chamber 160 of the cylinder is connected to a high pressure air supply line 162 or other suitable high pressure air source. Connected in series within the air supply line is an air regulator valve 163 for regulating the pressure of the air supplied to chamber 160, a check valve 164 and a pressure release valve 165. The closed bottom end of the cylinder 153 has connected thereto a plug having a vent hole 166 there-through and also a check valve 167.

A bifurcated bell crank lever or follower member 170 having a pair of arms 171 and 172 which form an obtuse angle therebetween is pivotally connected transversely to the frame A by a pivot pin 173 at the juncture of the arms. Arm 171 is pivotally connected at its end to the rod 151 by pivot pin 174. Arm 172 at its end has pivotally connected thereto a roller 175, which is adapted to ride on the cam surface 58.

The cam periphery has an abrupt drop portion 180, during which the cutting stroke takes place, a rise portion 185, which covers approximately 90 degrees of the

cam periphery and during which the return stroke of the cutter takes place, and a dwell portion which covers approximately 270° of the cam periphery and during which the cutter 154 remains stationary.

The cut-off mechanism H has an operating cycle comprising a rapid cutting stroke and a gradual return stroke and is operated in a selected timed relationship with the wire drawing and feed cycles of the apparatus by positioning the adjustable cam 58 with respect to the eccentric plate 57 before securing it thereto. The adjustment is normally such that the roller 175 will drop off the high portion of the cam at or shortly after the end of the feed stroke. The rotation of the cam 58 is counterclockwise, as indicated by the arrows in FIGS. 2 and 8.

Assuming that a cutting stroke has just been completed and that the draw stroke has just been commenced, the follower roller 175 will be engaged with low point 190 of the cam periphery and the piston 152 and cutter 154 will be in their lowermost positions, as viewed in the drawings. The follower roller 175 is continuously urged against the cam periphery by the pressure air in chamber 160 which pushes piston 152 and rod 151 in a downward direction, which in turn urges the arms 171 and 172 clockwise about their pivot point 173 and holds the roller 175 in engagement with the cam periphery. In its lowermost position the piston will be spaced slightly from the bottom wall of the cylinder 153 by the engagement of the cam follower roller with the cam periphery.

As the cam is rotated, the follower roller 175 will travel over the rise portion 185 of the cam periphery which will move arms 171 and 172 counterclockwise about the pivot point 173 and move rod 151 and cutter means 154 upwardly. As the rod moves upwardly, piston 152 will compress the high pressure air contained in chamber 160 to a higher pressure since the air therein is prevented from flowing back through the supply line 162 by check valve 164. A pressure relief valve 165 is provided to allow some of the compressed air to escape to the atmosphere in the event it is compressed beyond a predetermined safe pressure. Air at this time is admitted to the bottom chamber 161 from the atmosphere through the vent in the plug 166 and the check valve 167. At the end of the rise portion the cutter has completed its return stroke and is positioned in its uppermost position. The cutter 154 remains in its up position while the cam is rotated through its dwell portion and when the feed stroke is nearing completion, the cam follower 150 will be approaching the point 195 on the dwell portion of the cam, which point is adjacent the abrupt drop portion 180. At the completion of the feed stroke or shortly thereafter, the follower roller will drop off the end 195 of the high portion of the cam and thus, allow arms 171 and 172 to move about their pivot point 173 in a clockwise direction. Since the arms are allowed to pivot, the compressed air in chamber 160 will force the piston 152 and the cutter means 154, which is operatively connected thereto, downwardly at a rate which is initially rapid to cut or shear the wire blank. The air contained in chamber 161 is compressed when the piston moves downwardly and is allowed to escape therefrom at a slow rate by the vent in the plug 166. The air contained in chamber 161 as it is compressed and emitted on the downward movement will act as a cushion between the piston 152 and bottom wall of cylinder 153. If desired the vent can be adjustable as by providing the same with a needle valve. At the completion of the cutting stroke the follower roller 175 will be in engagement with the low point 190 of the cam periphery.

While the preferred embodiment discloses the overload release mechanism G operatively associated with the draw arm or lever 75 and the yieldable spring means 95 operatively associated with the feed arm or lever 80, it would be obvious to one skilled in the art that their operative associations could be reversed, i.e., the release mechanism could be operatively associated with the feed lever

and the spring means operatively associated with the draw lever.

While the drive means for reciprocating the die slide of the preferred embodiment has been illustrated as a mechanical means, it could, of course, comprise other suitable means capable of producing a reciprocating movement, such as, for example, a hydraulic means suitably mounted on the frame and operatively connected to the die slide.

A conventional inching device may be provided and mounted on the frame A to the left of the die slide, as viewed in the drawings, for the purpose of initially starting the wire S through the die means 20. Since the inching device forms no part of the present invention, it is not illustrated and described herein.

From the foregoing it will be apparent that the present invention provides a combined wire drawing and cut-off apparatus which is simple and compact in construction, reliable in operation, and capable of producing relatively long lengths of wire stock and which comprises an operating mechanism for the feed slide having a yieldable means embodied therein for holding the wire against a gauge during the cut-off operation and an overload release means operable to prevent damage to the apparatus in the event that the wire cannot be fed due to some malfunctioning of the apparatus. It will also be apparent that a novel cut-off apparatus is provided which is fluid pressure actuated in timed relationship to the wire drawing apparatus and which is effective to rapidly shear or cut off accurate lengths of wire blanks.

Although one embodiment of the invention has been illustrated and described herein to somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope but includes all changes and modifications coming within the terms of the claims hereof.

What I claim is:

1. In a mechanism for drawing linear stock, a frame, a die slide carried by said frame for reciprocation through draw and return strokes, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock, a reciprocable feed slide carried by said frame, uni-directional stock gripping means carried by said feed slide and adapted to perform a feeding operation on said stock, first means operatively connected to said die slide for moving the latter through its drawing stroke, second means interconnecting said first means and said feed slide and reciprocating the latter, and third means in said second means releasable upon said feed slide encountering a predetermined resistance to its movement during the feeding operation.

2. In a mechanism for drawing linear stock, a frame having guideways, reciprocable die and feed slides carried by said guideways, a drawing die carried by said die slide and adapted to produce a drawing operation on the stock upon movement of said die slide in one direction, uni-directional wire gripping means carried by said feed slide and adapted to grip and advance the stock upon movement of said feed slide in the direction opposite to said one direction, a drive member movably mounted in said frame and engageable with said die slide to move the same in said one direction, first means for moving said drive member in opposite directions, second means connecting said feed slide with the drive member, said second means having a release therein operable when said feed slide encounters a pre-determined resistance to its movement in the direction opposite to said one direction.

3. In a mechanism for drawing linear stock, a frame, draw and feed slides carried by said frame and reciprocably movable in the same directions, a drawing die carried by said draw slide and adapted to produce a drawing operation on the stock during reciprocation of the die slide in one direction, a uni-directional stock gripping means carried by said feed slide and adapted to grip and feed the stock during reciprocation of the feed slide in the

other direction, a drive lever pivotally connected to said frame and engaging said die slide at a point spaced from said pivotal connection, a feed lever pivotally connected to the frame and engaging said feed slide at a point spaced from said pivotal connection, first means for reciprocating said drive lever, second means operatively interconnecting said levers to reciprocate said feed lever with and in the same direction as said drive lever, said second means including a release means for releasing said operative connection between the levers upon said feed slide encountering a pre-determined resistance and allowing said drive lever to reciprocate through a full cycle while said feed lever remains stationary.

4. The mechanism according to claim 3 wherein said first means for reciprocating said drive lever includes an adjustable eccentric means for varying the length of the stroke of the drive lever.

5. In a mechanism for drawing linear stock, a frame, draw and feed slides carried by said frame and reciprocably movable in the same directions, a drawing die carried by said draw slide and adapted to produce a drawing operation on the stock during reciprocation of the die slide in one direction, uni-directional stock gripping means carried by said feed slide and adapted to grip and feed the stock during reciprocation of the feed slide in the other direction, a drive lever pivotally connected to said frame and engaging said die slide at a point spaced from said pivotal connection, a feed lever pivotally connected to said frame and engaging said feed slide at a point spaced from said pivotal connection, first means for reciprocating said drive lever, second means operatively connected to one of said levers, means slidably connecting said second means to the other of said levers, a release means having a member pivotally secured to said other of said levers and a yieldable means for normally biasing said member into operative engagement with said second means to drivingly interconnect said levers, said member being disengageable from said second means upon said feed slide encountering a pre-determined resistive force which is greater than the bias force of said yieldable means and allowing said drive lever to reciprocate through a full cycle while said feed lever remains stationary.

6. In a mechanism for drawing linear stock, a frame having guideways, draw and feed slides reciprocably movable in the same directions along said guideways, a drawing die carried by said draw slide and adapted to produce a drawing operation on the stock during reciprocation of the die slide in one direction, stock gripping means carried by said feed slide and adapted to grip and feed the stock during reciprocation of the feed slide in the other direction, a drive lever pivotally connected to the frame and engaging said die slide at a point spaced from the pivotal connection, a feed lever pivotally connected to the frame and engaging said feed slide at a point spaced from the pivotal connection, means for reciprocating said drive lever, a rod having one end pivotally connected to said feed lever and the other end pivotally and slidably connected to said drive lever, a release means having a member pivotally secured to said drive lever and a yieldable means for normally biasing said member into engagement with the other end of said rod, said rod and release means cooperating to drivingly connect said feed lever with the drive lever, said member being disengageable from said other end of said rod when a resistive force is encountered by said feed slide which is greater than the bias force exerted by the yieldable means.

7. In combined linear stock drawing and cut-off apparatus, a frame, a stock gauge, a cut-off mechanism, a reciprocable die slide carried by said frame, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock during movement of said die slide away from said gauge, a reciprocable feed slide carried by said frame, a stock gripping means carried by said feed slide and adapted to grip and advance the stock during movement of the feed slide toward said gauge, a

drive lever pivoted to said frame and engaging said die slide, a feed lever pivoted to said frame and engaging said feed slide, means for reciprocating said drive arm, a rod having one end pivotally connected to said drive lever and the other end slidably and pivotally connected to said feed lever, spring means encircling said rod and having one end bearing against the feed lever and the other secured to said rod, said spring means compressing to permit overtravel of said drive lever during the latter portion of the movement of the feed slide toward said stock gauge for holding said wire stock against said gauge during actuation of said cut-off mechanism.

8. In combined stock drawing and cut-off apparatus, a frame, a cut-off mechanism, a reciprocable die slide carried by said frame, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock during movement of said die slide away from said cut-off mechanism, a reciprocable feed slide carried by said frame, a stock gripping means carried by said feed slide and adapted to grip and advance the stock during movement of the feed slide toward said cut-off mechanism, first means operatively engaging said die slide for moving said die slide during the drawing operation, second means operatively interconnecting said first means with said feed slide and reciprocating the latter with the former, third means for actuating said cut-off mechanism to shear said stock at the end of said movement of said feed slide toward said cut-off mechanism, fourth means in said second means releasable upon said feed slide encountering a pre-determined resistance during movement of said feed slide toward said cut-off mechanism.

9. In combined linear stock drawing and cut-off apparatus, a frame, a stock gauge, a cut-off mechanism, a reciprocable die slide carried by said frame, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock during movement of said die slide away from said gauge, a reciprocable feed slide carried by said frame, a stock gripping means carried by said feed slide and adapted to grip and advance the stock during movement of the feed slide toward said gauge, a drive lever pivoted to said frame and engaging said die slide, a feed lever pivoted to said frame and engaging said feed slide, first means for reciprocating said drive lever, second means interconnecting said drive and feed levers, yieldable means embodied within said second means to permit overtravel of said drive lever during the latter portion of the movement of said feed slide toward said stock gauge for holding said stock against said stock gauge during actuation of said cut-off mechanism, said second means having a release means therein for releasing said second means from the drive lever upon said feed slide encountering a pre-determined resistance during movement of said feed slide toward said stock gauge.

10. In combined linear stock drawing and cut-off apparatus, a frame, a stock gauge, a cut-off mechanism, a reciprocable die slide carried by said frame, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock during movement of said die slide away from said gauge, a reciprocable feed slide carried by said frame, a stock gripping means carried by said feed slide and adapted to grip and advance the stock during movement of the feed slide toward said gauge, first means operatively engaging said die slide, second means operatively connected to said first means for reciprocating the latter and moving said die slide during the drawing operation, third means operatively interconnecting said first means with said feed slide and reciprocating the latter with the former, yieldable means embodied within said third means to permit overtravel of said first means during the latter portion of the movement of said feed slide toward said stock gauge during actuation of said cut-off mechanism and fourth means in said third means for releasing said third means from said first means upon said feed slide encountering a

pre-determined resistance during movement of said feed slide toward said stock gauge.

11. In combined linear stock drawing and cut-off apparatus, a frame, a stock gauge, a cut-off mechanism, a reciprocable die slide carried by said frame, a drawing die carried by said die slide and adapted to perform a drawing operation on said stock during movement of said die slide away from said gauge, a reciprocable feed slide carried by said frame, a stock gripping means carried by said feed slide and adapted to grip and advance the stock during movement of the feed slide toward said gauge, a drive lever pivoted to said frame and engaging said die slide, a feed lever pivoted to said frame and engaging said feed slide, means for reciprocating said drive lever, a rod having one end pivotally and slidably connected to said drive lever and the other end slidably and pivotally connected to said feed lever, spring means encircling said rod and having one end bearing against said feed lever and the other end secured to said rod, a release means having a member pivotally secured to said drive lever and a yieldable means, which is stressed to greater extent than said spring means, biasing said member into engagement with the other end of said rod, said rod and release means cooperating to normally drivingly connect said feed lever with the drive lever, said spring means compressing to permit slight overtravel of said drive lever during the latter portion of the movement of the feed slide toward said stock gauge for holding said wire stock against said gauge during actuation of said cut-off mechanism, said member being releasable from said other end of said rod when a resistive force is encountered by said feed slide which is greater than the bias force of the yieldable means.

12. In cut-off apparatus for linear stock, a frame having a stock feed passage, a cutter means for severing said stock, said cutter means having an operating cycle comprising a cutting stroke and a return stroke, a rotary cam having a drop portion and a rise portion, a cam follower in engagement with the cam, a cylinder having a piston reciprocably movable therein, said piston dividing said cylinder into two chambers, means operatively connecting said piston to said cutter means, said follower being operatively connected to said last named means, one of said chambers being closed and connected to a source of pressure fluid, said follower moving said piston and cutter means through the return stroke and compressing the fluid in said one chamber when engaged with the rise portion of said cam, said compressed fluid moving said piston and cutter means through the cutting stroke when said follower engages the drop portion of said cam.

13. In cut-off apparatus according to claim 12 wherein said follower comprises a member pivotally connected to the frame at an intermediate portion thereof and with one end in engagement with the cam and the other end pivotally connected to said last named means.

14. In cut-off device apparatus according to claim 12 wherein the other chamber is in communication with the atmosphere and wherein the atmospheric air contained therein acts as a cushion between the cylinder and piston when the piston is moved thereagainst during the cutting stroke.

15. In a combined wire drawing and cut-off apparatus for linear stock, a frame, a die slide carried by said frame and having a drawing die thereon and a feed slide carried by said frame and having a gripping means thereon, said slides being operatively interconnected and reciprocably movable through advance and return strokes by a drive means to alternately feed and draw the stock, a housing having a guideway, cutter means for severing stock advanced by said gripping means and being movable within said guideway, said cutter means having an operating cycle comprising a cutting stroke and a return stroke, a stock gauge spaced from said cutter means and being engageable by said wire stock at the end of said feed stroke, a rotary cam having a drop portion and a rise portion, said cam being rotated in timed relationship with said drive means, a cam follower in engagement with

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the cam, a cylinder secured to the frame and having a piston reciprocably movable therein, said piston dividing said cylinder into two chambers, means operatively connecting said piston to said cutter means, said follower being operatively connected to said last named means, one of said chambers being closed and connected to a source of pressure fluid, said follower moving said piston and cutter means through the return stroke and compressing the fluid in said one chamber when it is engaged with the rise portion of said cam, said compressed fluid moving said piston and cutter means through the cutting stroke when said follower engages the drop portion of said cam.

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References Cited by the Examiner

UNITED STATES PATENTS

15,705	9/1856	Noette	72—275
774,287	11/1904	Taylor	83—639
1,239,451	9/1917	Belz	72—275
2,226,400	12/1940	Gaines	72—274
2,269,914	1/1942	Parker	83—639
2,797,799	7/1957	Ehlert	72—274

10 CHARLES W. LANHAM, *Primary Examiner*.H. D. HOINKES, *Assistant Examiner*.