

June 19, 1962

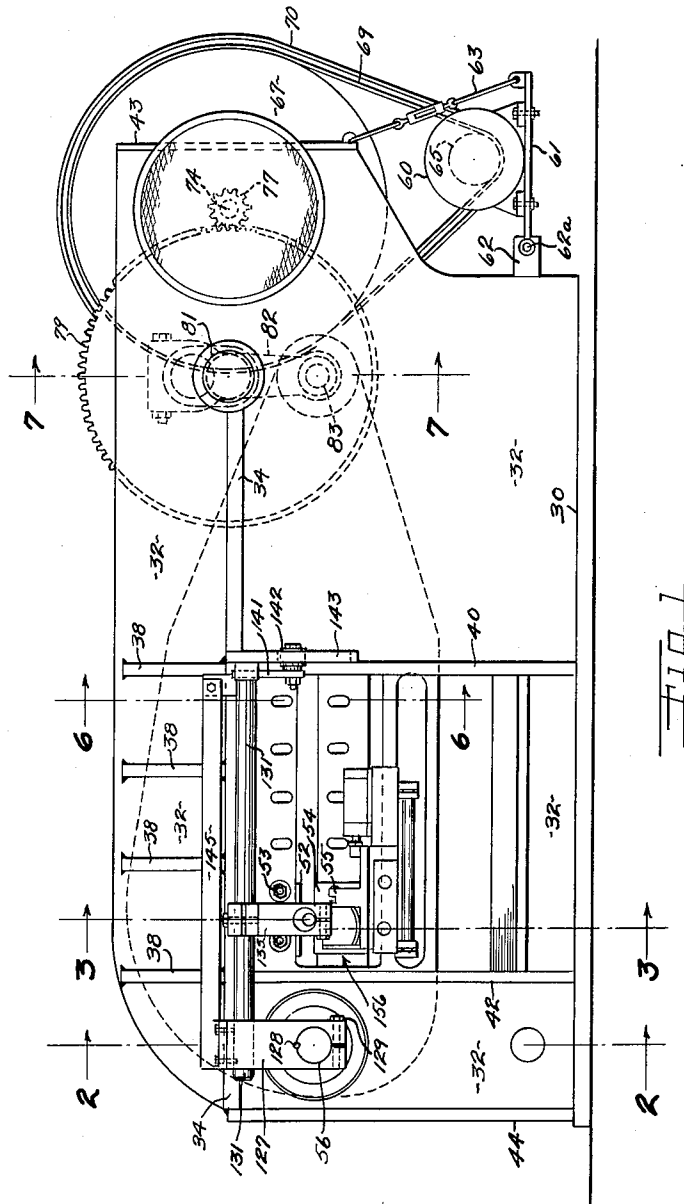
L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 1



INVENTOR.

LAD L. HERCIK

BY

Hyde, Meyer, Baldwin & Doran

ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 2

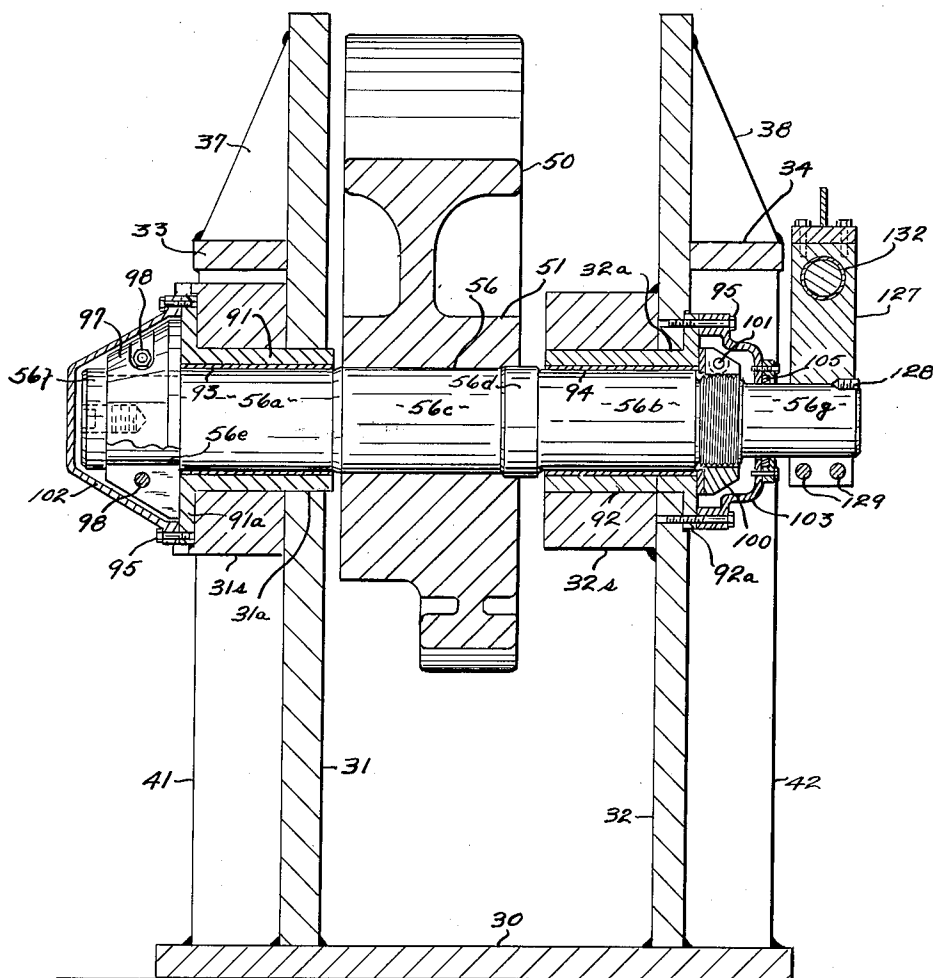


Fig. 2

INVENTOR.

LAD L. HERCIK

BY

Hyde, Meyer, Baldwin & Doran

ATTORNEYS

June 19, 1962

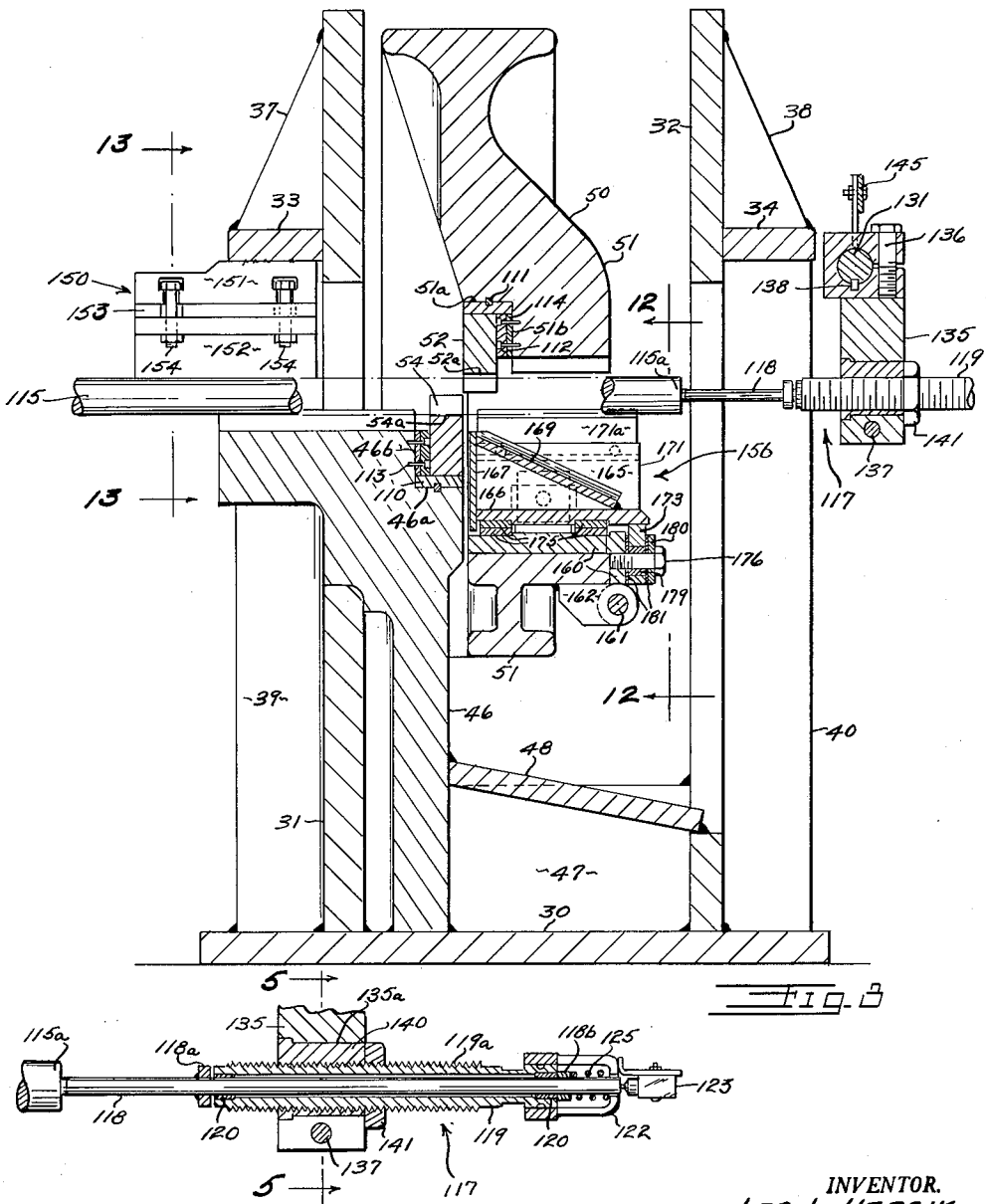
L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 3



INVENTOR.
LAD L. HERCIK

BY
Nyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

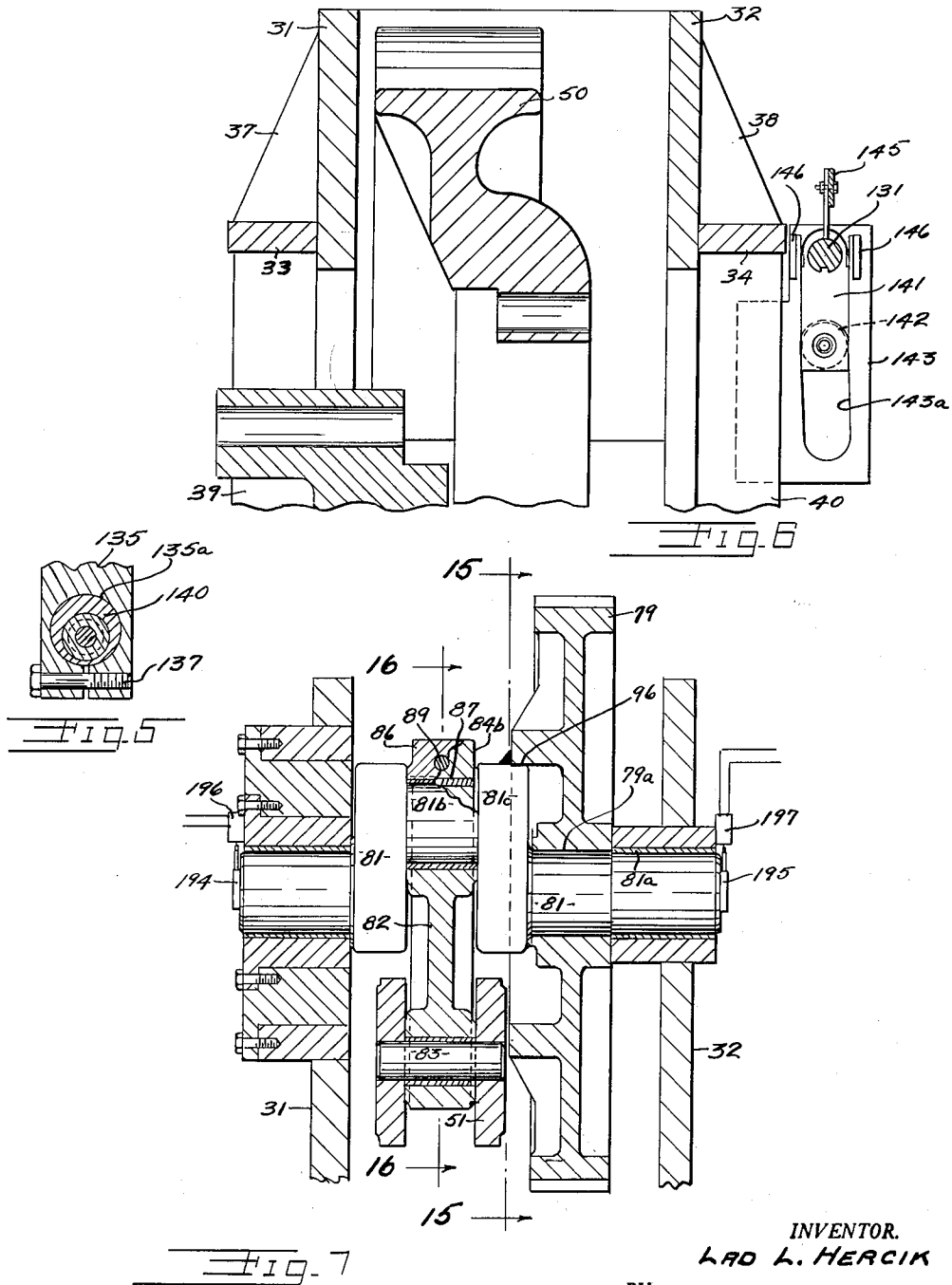
L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 4



INVENTOR.
LAD L. HERCIK

BY

Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 5

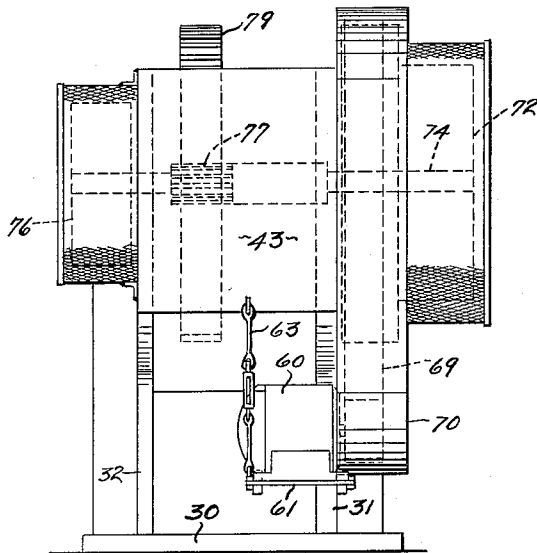


FIG. 5

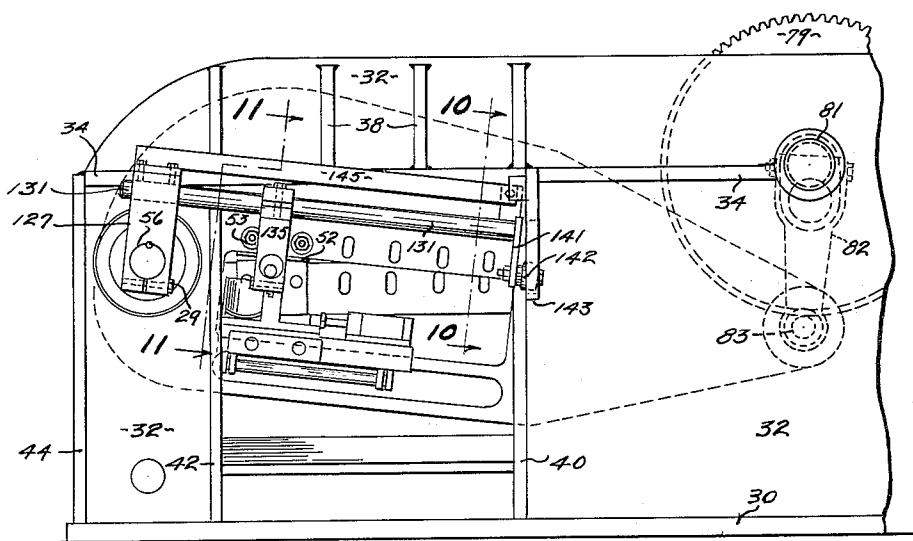


FIG. 6

INVENTOR.
LAD L. HERCIK

BY
Hyde, Myers, Baldwin & Doran
ATTORNEYS

June 19, 1962

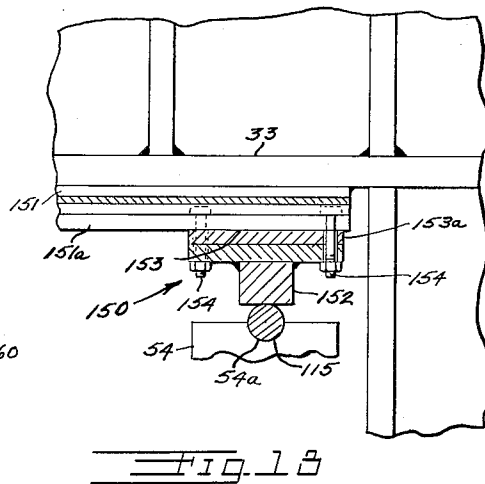
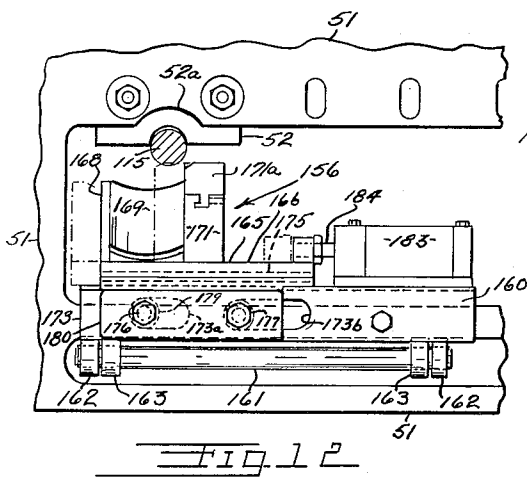
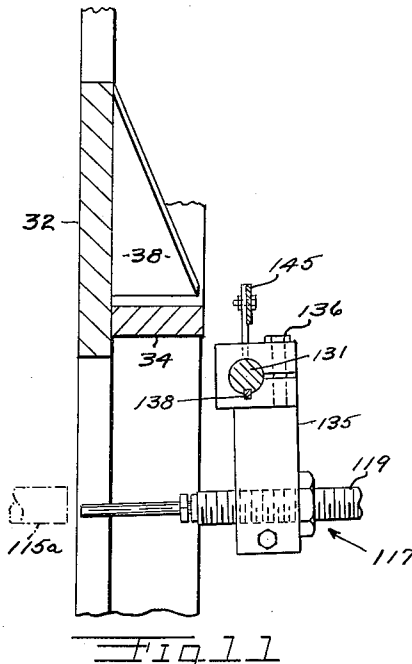
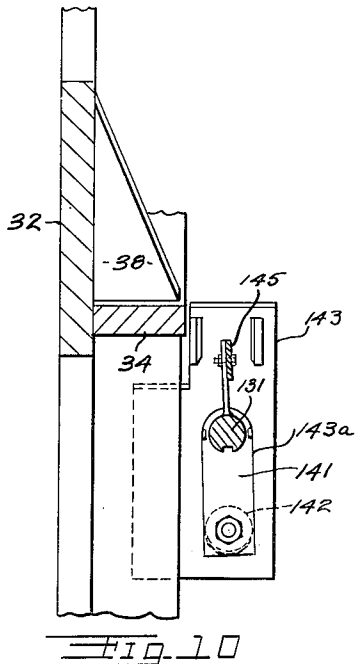
L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 6



INVENTOR.
LAD L. HERCIK

BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 7

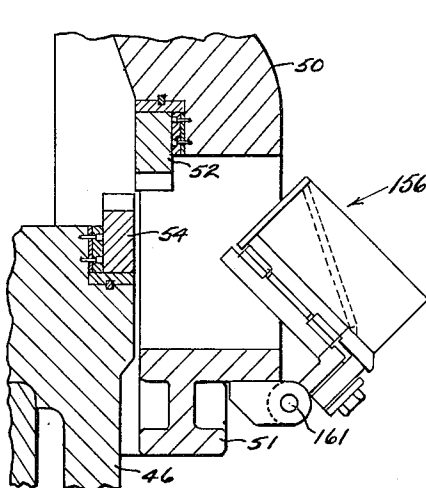


Fig. 14

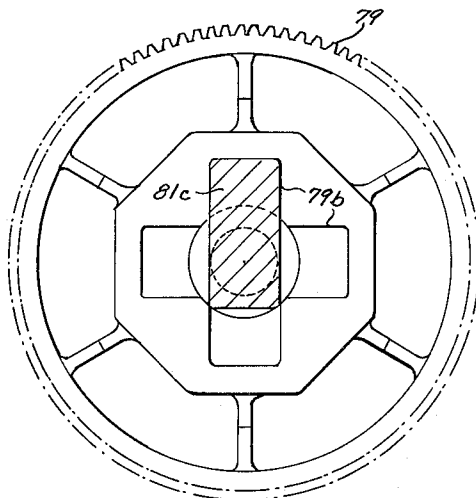


Fig. 15

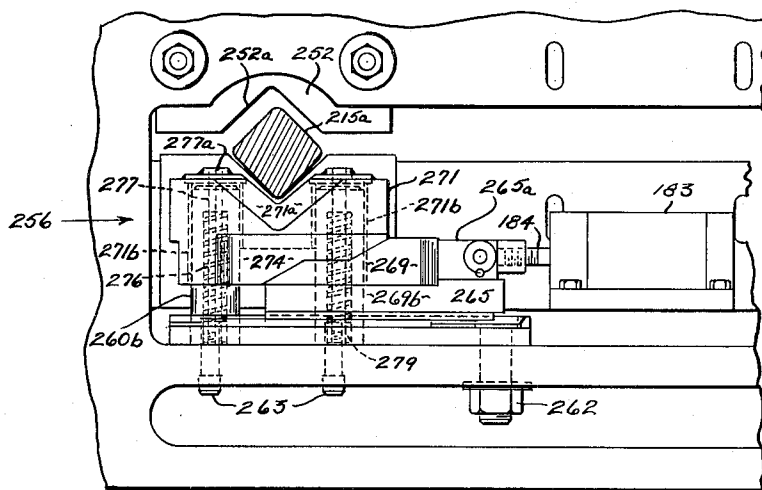


Fig. 18

INVENTOR.
LAD L. HERCIK

BY

Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 8

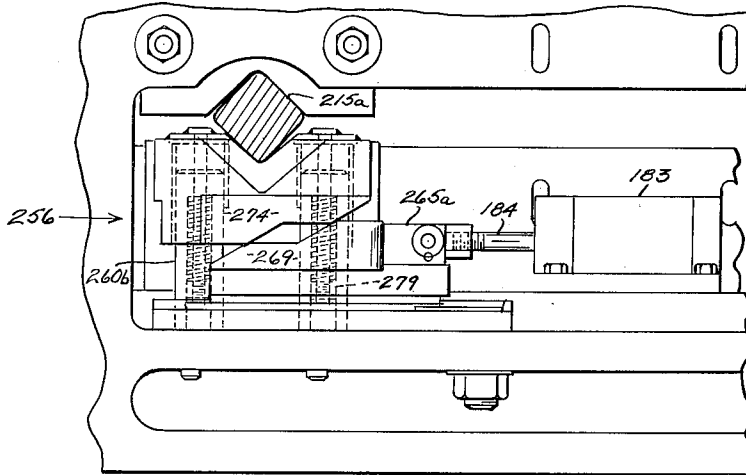


Fig. 20

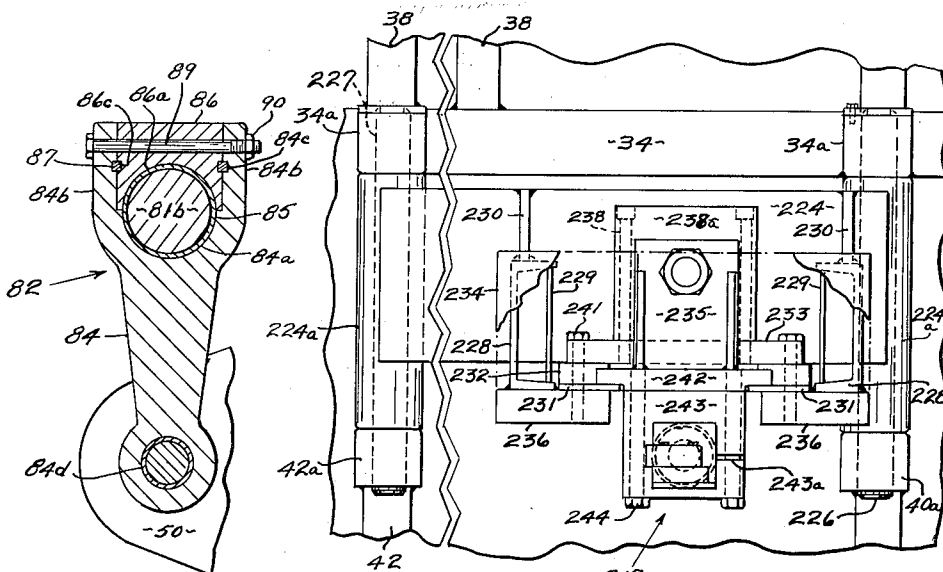


Fig. 22

Fig. 16

INVENTOR.
LAD L. HERCIK

BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

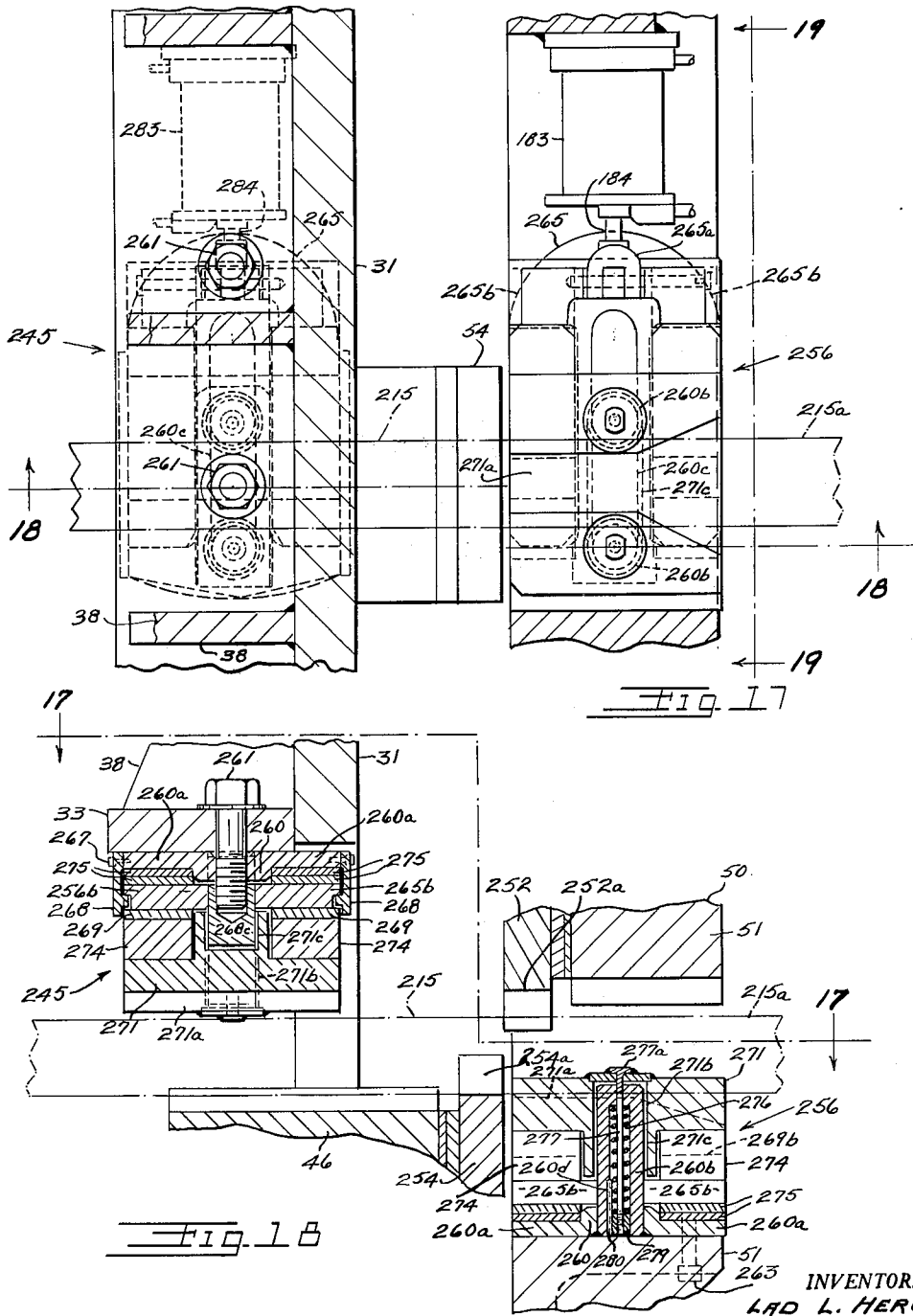
L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 9



INVENTOR.
LAD L. HERCIK

BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 10

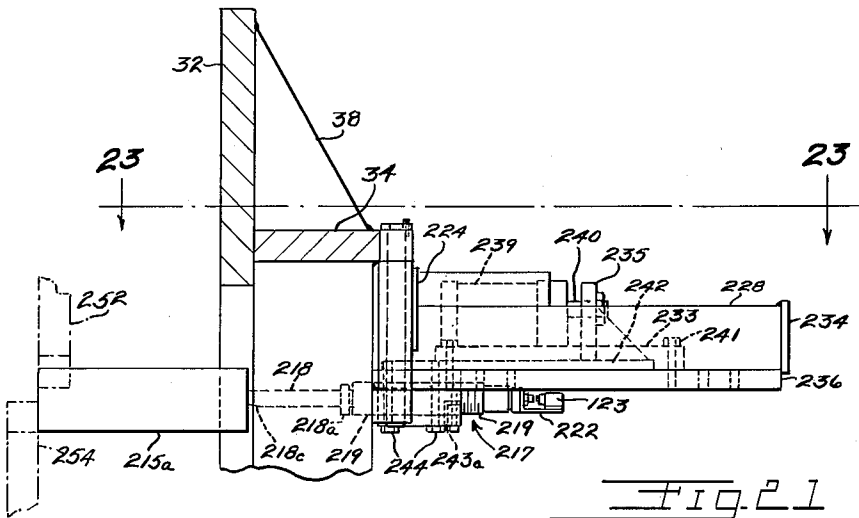


Fig. 21

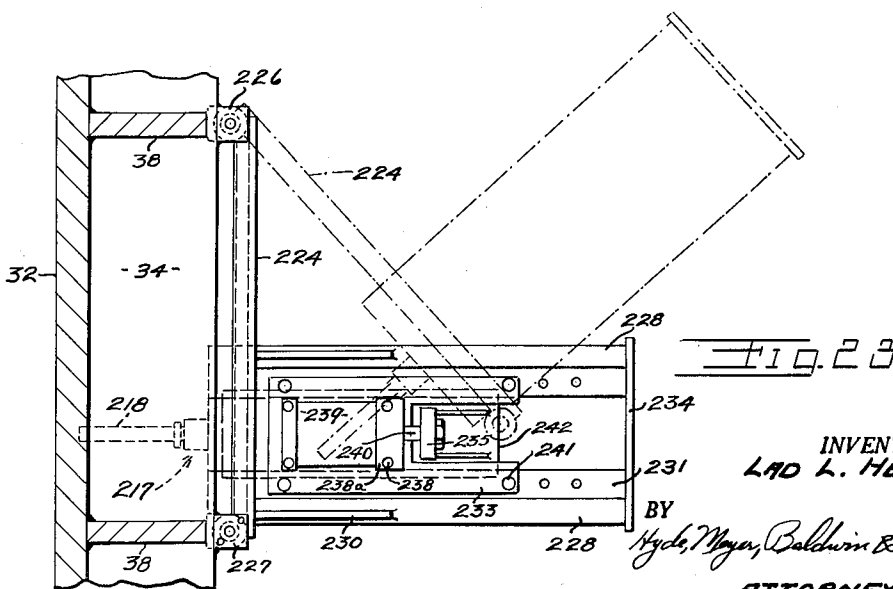


Fig. 23

INVENTOR.
LAD L. HERCIK

BY
Hyde, Meyer, Baldwin & Doran
ATTORNEYS

June 19, 1962

L. L. HERCIK

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Filed Aug. 24, 1956

11 Sheets-Sheet 11

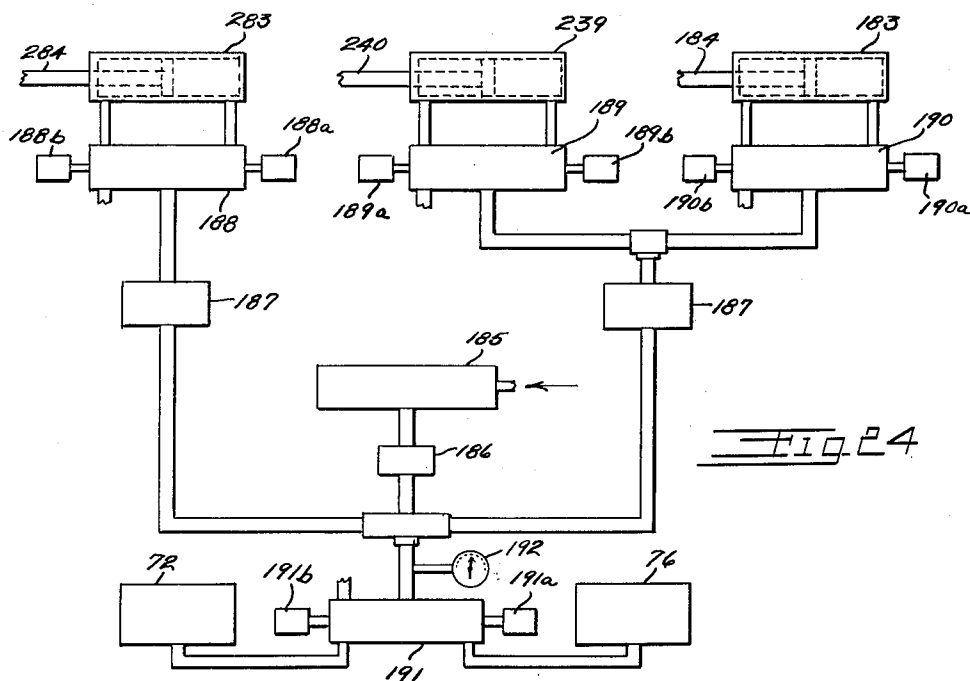


FIG. 24

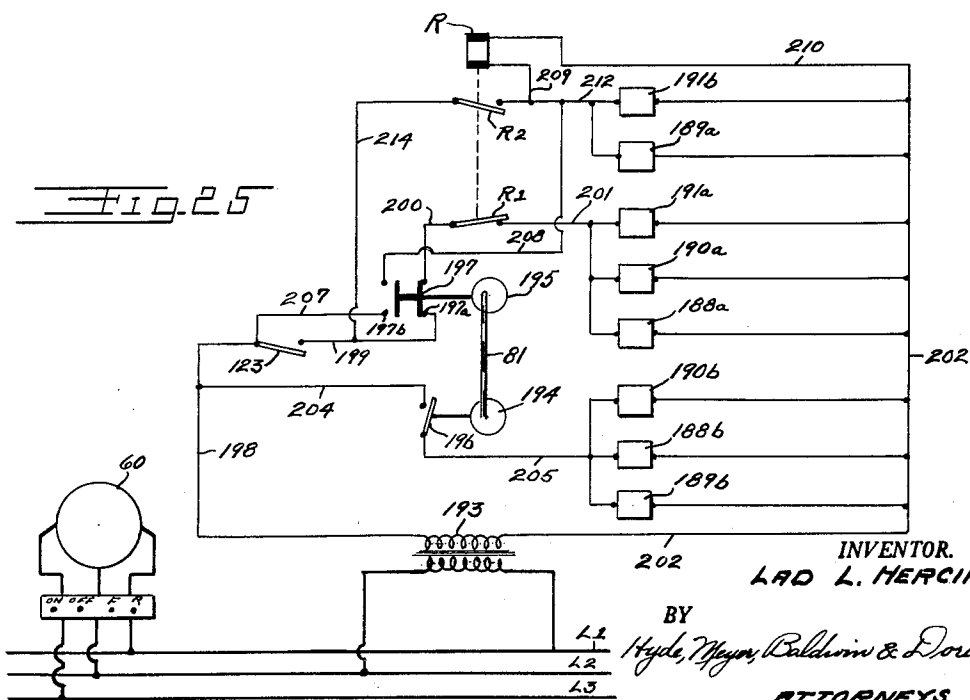


FIG. 25

INVENTOR.
LAD L. HERCIK

BY

Hyde, Meyer, Baldwin & Doran

ATTORNEYS

1

3,039,344

STOCK SHEAR HAVING STOCK STOP AND CLAMPING MEANS

Lad L. Hercik, Lakewood, Ohio (% The Hill Acme Co.,
1201 W. 65th St., Cleveland, Ohio)
Filed Aug. 24, 1956, Ser. No. 606,154
20 Claims. (Cl. 83-165)

This invention relates to improvements in a shear and more particularly to a lever type shear for bar or billet stock.

One of the objects of the present invention is to provide a connecting rod or pitman subjected to a large tensile force, such as the weight of a heavy shear arm supported thereby, with a bearing cap detachably connected to the remainder thereof so that the bearing bore formed thereby will not be substantially enlarged by this tensile force.

A further object of the present invention is to provide a king pin in a lever type shear adapted to absorb the axial separating load between the shear blades caused by the shearing action.

A further object of the present invention is a gear and crank drive construction for providing an oscillating movement in a mechanism, such as in a lever type shear, wherein the radial arm or cheek of the crank is recessed into the face of the gear with means securing it therein, whereby the axial distance between the gear and crank pin is minimized and the torsional wind-up of the mechanism is also minimized.

A further object of the present invention is to provide a shear blade mounting having hardened and replaceable surfaces separate from the blade supporting members and permitting adjustability of the blade after grinding thereof.

A further object of the present invention is to provide a stock stop carried by a movable shear arm or by the machine base.

A further object of the present invention is to provide a stock stop or stock length gauge automatically movable away from the leading end of the stock during the cut-off stroke.

A further object of the present invention is to provide a stock stop carried by a king pin secured to and providing a pivot for the movable shear arm of a lever shear with means provided for camming the stock stop away from the leading end of the stock in response to the arm movement during the cut-off stroke.

A further object of the present invention is to provide a stock stop gauge movable away from the leading end of the stock during the cut-off stroke by a fluid pressure actuated cylinder and piston unit.

A further object of the present invention is to provide a shear having its cut-off stroke initiated by stock engagement with a stock stop gauge.

A further object of the present invention is to provide a stock clamping assembly on a stock shear with this clamping assembly including a hold-down clamping means and an outboard support clamping means for respectively clamping the stock down against the stationary cutter member and upwardly against the bottom of a movable cutter member during the cut-off stroke.

A further object of the present invention is to provide a shear having means for moving one of the aforesaid clamping means from its unclamping to clamping position in response to stock engagement with the stock stop gauge.

A further object of the present invention is to provide a means for moving at least the outboard support clamping means from clamping to unclamping position at the end of the stock cut-off to permit drop of the cut-off stock therefrom.

A further object of the present invention is to provide a quick disconnect coupling means between at least one

2

of said clamping means, both of said clamping means and/or the aforesaid stock stop gauge and their associated carrying members to permit a shear operator to reach and service the shear blades.

A further object of the present invention is to provide a bar or billet shear characterized by its structural simplicity of design, low maintenance expense, strong and sturdy nature, economy of operation, ease of assembly of its component parts, compactness of design, multiplicity of functions performed by each component part wherever possible, and ease of operation during bar or billet shearing.

Other features of this invention reside in the arrangement and design of the parts for carrying out their appropriate functions.

Other objects and advantages of this invention will be apparent from the accompanying drawings and description and the essential features will be set forth in the appended claims.

In the drawings;

FIG. 1 is a side elevational view of a bar or billet shear with its shear arm or cutter member in its raised position positioned to start downward movement through its shearing or cut-off stroke;

FIG. 2 is a vertical sectional view taken along the line 2-2 of FIG. 1 longitudinally through the king pin of the shear;

FIG. 3 is a vertical sectional view taken transversely through the shear along the line 3-3 of FIG. 1 longitudinally through the stock, such as a bar or billet, to be sheared by the machine;

FIG. 4 is an enlarged longitudinal sectional view through the stock stop shown at the right-hand side of FIG. 3;

FIG. 5 is a transverse sectional view taken along the line 5-5 of FIG. 4 through the stock stop;

FIG. 6 is a vertical sectional view taken along the line 6-6 of FIG. 1 through a portion of the means for moving the stock away from the leading end of the stock during the cut-off stroke;

FIG. 7 is a vertical sectional view taken along the line 7-7 of FIG. 1 through the drive gear, crank and connecting rod or pitman in the oscillation drive for the movable shear arm;

FIG. 8 is an end view of the right end of the shear in FIG. 1 looking from the right toward the left at the shear;

FIG. 9 is an enlarged partial view of FIG. 1 with the movable shear arm in its lowest position at the end of its cut-off stroke prior to the start of its return stroke;

FIG. 10 is a sectional view taken along the line 10-10 of FIG. 9 with the parts of FIG. 6 shown in a different position;

FIG. 11 is a sectional view taken along the line 11-11 of FIG. 9 with the stock stop swung away from the leading end of the stock which it contacted in FIG. 3 and with the leading end of the stock shown in the dot-dash line position it takes prior to cut-off even though the stock stop is shown in the position it takes after cut-off;

FIG. 12 is a sectional view taken along the line 12-12 of FIG. 3 with the outboard support clamping means shown in its unclamping and clamping positions respectively by the solid line and dot-dash line position of the parts;

FIG. 13 is a vertical sectional view taken along the line 13-13 of FIG. 3 through the hold-down clamping means;

FIG. 14 is an enlarged sectional view of a portion of FIG. 3 with the outboard support clamping means swung toward a clearance position to permit servicing the shear blades with said clamping means being connected to the movable shear member or arm by a pivot pin;

FIG. 15 is a vertical sectional view taken along the

line 15—15 of FIG. 7 showing the embedded construction of the crank in the drive gear;

FIG. 16 is a sectional view taken along the line 16—16 of FIG. 7 through the connecting rod or pitman of the shear arm oscillating mechanism;

FIG. 17 is a top view taken generally along the line 17—17 of FIG. 18 of another form of stock clamping assembly;

FIG. 18 is a vertical sectional view taken through this last mentioned clamping assembly along the line 18—18 of FIG. 17;

FIG. 19 is a side elevational view of the outboard support clamping means in the unclamping position taken along the line 19—19 of FIG. 17;

FIG. 20 is a side elevational view similar to FIG. 19 with the outboard support clamping means in the clamping position;

FIG. 21 is a sectional view, similar to the right side of FIG. 3, of another form of stock stop and its mounting construction;

FIG. 22 is an end view of the stock stop in FIG. 21 looking from the right toward the left at the right end of the stock stop;

FIG. 23 is a sectional view taken along the line 23—23 of FIG. 21 showing the stock stop in its solid line position to perform its normal stock gauging operation and in its dot-dash line position swung partially out of the way to permit servicing of the shear blades;

FIG. 24 is a schematic lay-out of the fluid pressure flow and its fluid actuated device for this shear; while

FIG. 25 is a simplified electrical diagram of the electrical control for the shear.

Before the lever-type bar and billet shear here illustrated is specifically described, it is to be understood that the invention here involved is not limited to the structural details of arrangement of parts here shown since mechanisms embodying the present invention may take various forms. It also is to be understood that the phraseology or terminology herein employed is for purposes of description and not of limitation since the scope of the present invention is denoted by the appended claims.

While the present invention may be adapted to various types of machines, it has been chosen to show the same as applied to a lever-type shear for bar or billet stock.

There are two different shear forms disclosed hereinafter differing in the shape of the stock receiving recesses in the shear blades, stock clamping means and stock stop structures. First, the common structure to both shear forms will be disclosed and then the specific structure for each form, adapted to be used with the common structure, will be disclosed.

The frame of the shear includes a base plate 30 having welded thereto two vertical frame plates 31 and 32 in FIG. 2 extending parallel to each other and at right angles with respect to the base plate 30. The vertical plates 31 and 32 extend substantially throughout the length of the machine with the outward sides of each having generally the same reinforcing ribs, rails or frame plate structure secured thereto. This structure includes for these respective vertical plates horizontal reinforcing ribs or rails 33 and 34 and fourteen ribs or rails 37, 39 and 41, and 38, 40 and 42. Vertical frame plates 31 and 32 are connected at opposite ends by end plates 43 and 44 in FIG. 1, a blade or knife seat block 46 in FIG. 3 secured to frame plate 31 and base 30 with suitable spacers 47 and a connecting plate 48 secured at opposite ends to block 46 and vertical frame plate 32. All of these plates, rails, ribs, spacers and blocks are secured together to make a rigid frame in any suitable manner with the preferred securing means being welds, as illustrated in the drawings.

The shear includes two cutter members carrying co-acting blades with the cutter members taking the form of a stationary cutter member including the machine

frame and block 46 in FIG. 3 and a movable cutter member taking the form of shear arm 50. The movable cutter member or shear arm 50 includes an arm frame part 51 having an upper blade or knife 52 detachably secured thereto by a plurality of nut and bolt units 53 in FIG. 1 spaced along the length of the blade. The stationary cutter member includes in addition to the machine frame and block 46 a lower knife or blade 54 detachably secured to block 46 by another series of nut and bolt units 55 spaced along the length thereof. The cutter members are operatively connected together for relative movement with this operative connection taking the form of a pivot or king pin 56 in FIGS. 1 and 2. The king pin pivotally connects arm frame 51 and frame plates 31 and 32 to permit oscillation of this shear arm 50 in opposite directions with the shear arm movable clockwise during the cut-off stroke from the raised position in FIG. 1 to the lowered position in FIG. 9 for moving the blades 52 and 54 relative to each other in a shear plane. Also, the shear arm 50 is swingable counter-clockwise in a return stroke from the lower position in FIG. 9 back to the raised position in FIG. 1.

A suitable drive is provided for oscillating this shear arm 50 through its shear or cut-off stroke and return stroke. Electric motor 60 in FIGS. 1 and 8 is mounted on a platform base 61 secured to frame plate 31 by a bracket 62 with a pivot 62a provided between bracket 62 and base 61. Supporting link 63 is secured at opposite ends to eyes in base 61 and frame end plate 43. Link 63 has a turnbuckle construction intermediate its ends for adjusting the belt tension of driving belt 69. A drive pulley 65 on motor 60 drives driven pulley and fly wheel 67 by belt 69 covered by belt guard 70. Driven pulley 67 drives a drive shaft 74 through an air actuated clutch 72 with the shaft adapted to be stopped by an air actuated brake 76 at an appropriate time when the drive from the motor is deenergized by moving the clutch 72 to its unclutching position. The sequence and mode of operation on the clutching and braking will be set forth in detail hereinafter. Drive shaft 74 has a driving gear 77 secured thereto for driving driven gear 79 with a gear driven crank, oscillation producing mechanism. Gear 79 is keyed to crank shaft 81 in FIG. 7 with said crank shaft rotatably mounted at opposite ends in frame side plates 31 and 32 with this crank shaft driving a connecting rod 82 rotatably secured at its lower end by a pin and bearing unit 83 to the distal end of the arm frame part 51 of shear arm 50. This connecting rod 82 supports and moves in opposite directions the shear arm 50 at a point farther than blade 52 in FIG. 1 from king pin 56 so as to provide substantial mechanical advantage in performing the shearing cut so that the shear may easily cut large size bars or billets.

In a shear for cutting large size bars and billets, shear arm 50 has substantial weight with its weight in some machines being over six tons. This large weight, the large inertia of the moving parts in the shear, the large forces exerted on the component parts, and the resistance of the stock to the shearing action causes many problems in shear design. Hereinafter is disclosed specific structures for solving some of these problems with these structures including the connection between crank shaft 81 and driven gear 79, the specific construction of the connecting rod or pitman 82 for effectively resisting the large tensile force exerted endwise thereon by heavy shear arm 50, the construction of king pin 56 and its mounting in frame plates 31 and 32, and the mounting of shear blades 52 and 54 in their supporting frame parts.

Crank shaft 81 and its drive gear 79 are rigidly connected together to drive as a unit. Drive gear 79 in FIG. 7 has a central bore 79a telescoped over and keyed to a shaft portion 81a of crank shaft 81. Crank shaft 81 has a crank pin portion 81b radially offset from the rotational axis of the shaft portion 81a and rotatably mounted in one end bore of the connecting rod or pitman

5

82 with this radial offset causing the oscillation movement of the shear. Crank pin arm 81c connects shaft portion 81a and crank pin portion 81b and is welded into a radially extending recess 79b radially extending in one face of the gears 79, as shown in FIGS. 7 and 15. This construction minimizes the axial distance between gear 79 and crank pin portion 81b in FIG. 7 for any given gear strength so that they will act as a single drive unit, will provide a strong drive component, and will reduce the torsional wind-up in the mechanism during movement of the heavy, movable shear arm 50 in contrast with the construction wherein crank pin arm or cheek 81c is not imbedded in the face of gear 79. Two or more recesses or pockets 79b, such as the four in FIG. 15, may be provided in the face of gear 79 to permit repositioning of the crank arm 81c so as to distribute the wear on the teeth of gear 79 produced by a large force periodically exerted thereon at the same circumferential point.

Connecting rod 82 has a construction especially adapted to resist the large tensile force exerted endwise thereon by the heavy shear arm 50. Connecting rod 82 in FIGS. 7 and 16 includes an elongated connecting rod member 84 having a semi-circular recess 84a at one end straddled by outwardly projecting U-shaped arms 84b, 84b and having a bore 84d at the opposite end for receiving the pin and bearing assembly 83. The connecting rod 82 also includes a cap 86 located between arms 84b, 84b and having a mating semi-circular recess 86a forming a circular bore with recess 84a spaced from and parallel to bore 84d for receiving a sleeve bearing 85 which rotatably carries crank pin portion 81b. Suitable keying means is provided for detachably locking cap 86 to connecting rod member 84 with this keying means including two pairs of keyways straddling cap 86 with one pair on each side of the cap. Each pair of keyways includes a keyway 86c in cap 86 and a keyway 84c in arm 84b. A key 87 is located in each pair of keyways with its long dimension in FIG. 7 extending generally parallel to the axis of the bore formed by recesses 84a and 86a so as to minimize separation between these recesses by the tensile force on the connecting rod 82. These keys 87 accurately hold cap 86 in proper relationship with respect to member 84, even though a large separating force is exerted upon the component parts of the connecting rod 82, because the keys present a large shear area to resist the separation. In contrast, through bolts or studs extending in the lengthwise direction of arms 84b, generally used to hold the cap of a connecting rod in place, tend to be stretched and elongated by a large tensile force so that the sleeve bearing for the crank pin portion 81b has a very short wear life. In contrast, the construction in FIG. 16 has a very long wear life even though it supports a heavy shear arm 50 weighing many tons.

Suitable fastening means are provided to permit disassembly of cap 86 from member 84 but to normally prevent their disassembly along the axis of crank pin portion 81b during the operation of the shear. Here, a detachable cylindrical fastener, specifically shown as a bolt 89 having a nut 90, extends through arms 84b and cap 86 generally perpendicular to the axis of this bore to lock member 84 and cap 86 together.

King pin 56 and its supporting parts are constructed (1) to resist axial separating force between blades 52 and 54 by the shear cut and (2) so that king pin 56 and shear arm 50 are secured together and move as a unit.

The shearing action produces a severe side thrust tending to separate the shear blades 52 and 54 in FIG. 3 and move them generally apart in a horizontal direction. This separating thrust, transmitted to shear arm 50 and the frame plate 31, is counteracted by king pin 56 and its supporting construction especially designed to prevent excessive wear resulting from this thrust. King pin 56 in FIG. 2 has two journalled portions 56a and 56b straddling central portion 56c of larger diameter and

6

having an annular shoulder 56d at the right end thereof. Shear arm 50 has a bore extending through its arm frame part 51 secured to central portion 56c, preferably by being shrunk thereon, and backstopping against the left face of collar 56d so that the blade separating force caused by the shearing action will move lever arm 50 in the right-hand direction in FIG. 2 relative to king pin 56. The left-hand end of king pin 56 in FIG. 2 has a relatively wide groove 56e having straddling shoulders with the diameter of its end cap terminal portion 56f greater than the neck of the groove but smaller in diameter than journalled portion 56a.

King pin 56 is rotatably mounted in the shear frame. Sleeves 31s and 32s are welded respectively to frame plates 31 and 32 with common bores 31a and 32a provided through each unit. In bores 31a and 32a are removable sleeves or bushings 91 and 92 having formed on their outwardly extending ends radially extending flanges 91a and 92a. Bearing liners 93 and 94 of anti-friction material are telescoped within the sleeves to serve as bearings for king pin journal portions 56a and 56b. Flanges 91a and 92a, are secured respectively to sleeve 31s and frame plate 32 by means of a plurality of screws 95.

In the king pin groove 56e at the left in FIG. 2 is located a split thrust collar 97 formed of two halves secured together by bolt and nut units 98 with the axial length of this collar being substantially identical with that of groove 56e and with its bore forming a clamping fit on the neck of groove 56e with its inner face providing a smooth, machined seat for engagement with the outer face of flange 91a. Hence, the separating thrust exerted on frame plate 31 and shear arm 50 by the shearing action will be resisted by the engagement between split collar 97 and the outer face of flange 91a.

Suitable means is provided for taking up any slack or axial loose play existing during assembly of the shear or resulting from wear. A lost motion take-up, split nut 100, screwed onto the right end of king pin 56 in FIG. 2, may be adjusted axially by rotation so that it engages the outer face of flange 92a to the desired tightness. Then, it may be clamped in position by tightening threaded bolt 101 to pull the split sections of take-up nut 100 together. Note that clearance still exists in FIG. 2 between collar 56d and sleeve 32s so that relative rotation may take place.

Long, trouble-free wear life is assured by providing component parts of adequate size and providing adequate lubrication. The area of contact between thrust collar 97 and the outer face of flange 91a is large enough so that thrust pressure is small enough to assure long life. Continuous and effective lubrication of all wear parts is provided. Caps 102 and 103 are provided at opposite ends to retain the lubricant and to keep out foreign elements, such as dirt, etc. Each end cap has a circular flange secured by the screws 95 to the shear bed frame and may be provided with an opening for lubricant normally closed by a detachable plug (not illustrated). Other lubricant reservoirs may be provided by radially extending holes through sleeves 31s and 32s to king pin journal portions 56a and 56b, if so desired. Since outwardly projecting extension 56g at the right end of king pin 56 must extend outwardly beyond cover cap 103 in the FIG. 2 shear form, lubricant seal ring 105 is provided in an annular housing secured to the outer end of cap 103.

A mounting is provided for blades 52 and 54 in FIG. 3 with this mounting having many advantages. Knife seat block 46 and shear arm frame part 51 have machined blade seats therein comprising respectively horizontal faces 46a, 51a and vertical faces 46b, 51b. Vertical faces 46b and 51b extend parallel to the shear plane and the direction of movement of shear arm 50 during the cut-off stroke. These faces are located in this manner to absorb

the two components of the shearing force acting upon each blade with horizontal faces *46a* and *51a* absorbing the vertical forces acting in the shearing plane while vertical faces *46b* and *51b* resist the forces tending to separate the blade in the horizontal direction. Blades *52* and *54* are secured respectively in place to arm frame part *51* and block *46* by a plurality of nut and bolt units *53* and *55* in FIG. 1 having countersunk heads in the shear plane common to the blades. These shear blades *52* and *54* may be successively reversed and inverted when the edges become dull so that longer cutting life may be obtained from them.

It has been found that the machined blade seats have a substantially longer life if hardened blade back-up plates or another suitable member is located between the blade *52* or *54* and its associated frame part *51* or *46* for resisting the force exerted between each blade and its associated frame part in the aforesaid horizontal and vertical directions. It is also desirable to permit adjustment in spacing between each blade and the vertical face *46b* or *51b* of its supporting frame part. This adjustment permits the horizontal distance between the adjacent vertical faces of blades *52* and *54* to be accurately maintained even though the distance between shear arm *50* and block *46* is maintained at a fixed dimension by king pin collar *56d* and split collar *97*, even though wear should occur on the collar *97*, or even though the horizontal width of one or both of these blades is reduced as a result of grinding. Hardened and replaceable back-up plates *110* and *112* are provided for each blade seat and are of similar construction. Plate *110*, located between a blade and its horizontal seat face, such as between blade *54* and face *46a*, is keyed to its associated frame part by a key *111* while the other plate *112*, located between the blade and its vertical seat face, such as *46b*, abuts against the flat surface on plate *110* opposite the key *111* to keep the plate *110* firmly keyed in place. Screws *113* detachably secure plate *112* to its associated frame part, such as block *46*. Hence, the blade supporting surface of plate *112* extends generally parallel to the shear cut plane so as to serve with king pin *56* in FIG. 2 for resisting separation movement of the blades *52* and *54*. The horizontal distance between the adjacent vertical faces of blades *52* and *54* in FIG. 3 is easily maintained by detaching screws *113* and inserting one or more shims *114* of the desired thickness to increase the distance perpendicular to the shear plane between any one blade and its supporting vertical seat face.

First Form of Stock Stop and Clamping Assembly

The shear includes a stock stop or length gauge *117* and its supporting structure, best shown in FIGS. 1, 2, 3, 4, 5, 6, 9, 10, and 11, for accurately gauging the length of stock to be cut off from the end of a bar or billet, to maintain the stock in proper position during the shearing cut, and then to move away so as to allow cut-off stock length *115a* to fall freely from the shear. The bar or billet stock *115* in FIG. 3 is fed toward the right by hand or by a power driven feed conveyor through the semi-circular recesses *54a* and *52a* in blades *54* and *52* respectively until the right-hand end thereof engages against stock stop *117* so that an accurately gauged length of stock *115a* may be sheared by blades *52* and *54* during the cut-off stroke.

Stock stop *117* in FIG. 4 includes a stock engagement rod *118* having outwardly directed flanges *118a* and *118b* welded or otherwise secured thereto and straddling sleeve *119* within which rod *118* is telescoped. Sleeve *119* has external cylindrical threads *119a* and bearings *120*, *120* carried by the internal bore for supporting rod *118* for axial movement. A switch bracket *122* is secured to the right end of sleeve *119* for supporting an electric switch *123* actuated by axial travel of the stock engagement rod *118*. A helical compression spring *125* normally biases the rod *118* to the left into the illustrated

position with flange *118b* engaging against sleeve *119*. This construction permits accurate stock gauging by flange engagement with sleeve *119* while providing sufficient lost motion in the axial direction for actuation of switch *123*.

Stock stop *117* is carried by and movable with the movable cutter member or shear arm *50* so that minimum relative movement occurs between stock *115* and stock stop *117*. King pin *56* in FIG. 2, secured against relative axial and rotational movement with respect to shear arm *50*, has a vertical bracket *127* rigidly secured to its right end by the split construction of the bracket in FIG. 1 with bolt *129* pulling the split portions together and a set screw *128* serving as a key. An elongated cylindrical bar element or traveling beam *131* in FIG. 1 is rotatably supported at one point in a bearing sleeve *132* in FIG. 2 carried by bracket *127*. Bracket *135* is provided in FIGS. 1 and 3 for securing stock stop *117* to element *131* spaced axially along the element from bracket *127*. At opposite ends, bracket *135* in FIGS. 3 and 5 has a bore with a radially split wall adapted to be pulled together by a clamp bolt *136* or *137* for securely clamping the bracket, element and stock stop together. Key *138* in FIG. 3 prevents rotation of the bracket relative to element *131*. The lower end of bracket *135* is secured around an eccentric bushing *140* in FIGS. 4 and 5 eccentrically carrying stop *117* with respect to and rotatably mounted in bracket bore *135a* with the axis of this bore extending in the same direction as the feed of the stock *115*. Lock nut *141* in FIG. 4 secures any given eccentric position. With this mounting, the stock stop *117* in FIG. 3 is carried by shear arm or cutter member *50* and is located closer thereto than to the stationary blade *54* carried by the stationary block *46*.

Camming means is provided for operatively connecting element *131* at its right end in FIG. 1, the point spaced along its length from the support bracket *127*, to the stationary shear bed plate *40* for causing movement of stock stop *117* away from the leading end of stock *115* when relative movement between cutter blades *52* and *54* takes place during the cut-off stroke. The right end of traveling beam or element *131* in FIG. 1 is welded or otherwise secured to an actuating arm *141* in FIG. 6 having a roller *142* carried by its distal end with this roller traveling in a cam slot *143a* in a stationary plate *143* carried by base plate *40*. A torque or torsion bar *145* extends along the length of element or traveling beam *131* in FIG. 1 and is rigidly secured at opposite ends to bracket *127* and to beam *131* adjacent to actuating arm *141*.

The movement of the stock stop *117* relative to the leading end of stock *115* now should be clearly apparent. When the shear arm *50* is in its upper position shown in FIGS. 1, 3 and 6 prior to the beginning of the cut-off stroke, stock stop *117* is accurately located to accurately gauge the length of the stock length *115a* to be cut off. The left end of element *131* in FIG. 1 is secured against axial movement with respect to the shear bed and the shear arm *50* by bracket *127* secured to king pin *56*. However, the righthand end of element *131* in FIG. 1 is somewhat free to move toward and away from shear arm *50* but is accurately located in a fixed position by having arm *141* in FIG. 6 sandwiched between parallel bearing brackets *146* secured to cam plate *143* to accurately position stock stop *117* in the proper locating position for the leading end of the stock for gauging. After stock length *115a* in FIG. 3 has been accurately gauged, shear arm *50* moves downwardly in its cut-off stroke with the stock stop or gauge *117* moving with the shear arm to constantly contain the stock length *115a* while it is being sheared. After the stock length *115a* is cut, stock stop *117* moves away from the end of the stock from the FIG. 3 to the FIG. 11 position so that the stock length *115a* may fall freely from the shear. This oscillation movement is caused by the roller follower *142* swinging the arm *141* and turning the element *131* through a small arc around

9

its longitudinal central axis in bearing 132 of FIG. 2 as the roller follower 142 moves from the FIG. 6 to the FIG. 10 position. Hence, stock stop 117 moves generally endwise away from its locating position in FIG. 3 for the leading end of the stock when relative movement between cutter blades 52 and 54 occurs during the cut-off stroke. During this outward swing of the stock stop, torsion bar 145 is twisted slightly about its longitudinal axis so that when shear arm 50 completes its return stroke and again returns to its raised position in FIG. 1, torsion bar 145 will return stock stop 117 to the FIG. 3 locating position. This torsion bar 145 also accurately locates cylindrical element 131 axially relative to the bracket 127 in FIG. 1; it is secured to both, so that stock stop 117 and roller 142 will be accurately located.

During the cut-off stroke, it is desirable to clamp the stock 15 on the left of the shear plane in FIG. 3 down against stationary blade 54 and into its semi-circular recess 54a in FIG. 13 by a hold down clamping means 150 and to clamp the stock piece 115a to be cut off at the right of the shear plane in FIG. 3 against the movable blade 52 and into its semi-circular recess 52a by an outboard support clamping means 156 with these two clamping means taking the form of a clamping assembly. This clamping action prevents any tendency of the stock to cock during the shearing cut. This clamping assembly is especially desirable for use in shearing round bar or billet stock and is best illustrated in FIGS. 1, 3, 9, 12, 13, and 14.

The hold-down clamping means 150 of this assembly is best shown in FIGS. 3 and 13 and is carried by stationary bed rail 33. This hold-down clamp 150 includes a base plate 151 welded along its upper surface to bed rail 33 and having two parallel T-slots 151a along its lower surface for receiving the bolt heads of bolt and nut assemblies 154. T-shaped clamping member 152 has a top plate generally rectangular in horizontal section with the bolt and nut assemblies 154 being two in number and located at diagonally opposite corners so that one or more spacer plates 153 may be easily swung into the assembled position of FIG. 13 or removed therefrom without disassembling the nut and bolt units 154 because they have recesses 153a cut in diagonally opposite corners. This permits a fast set-up of the machine after choosing the proper number of spacers to place between clamping member 152 and base plate 151 to achieve the illustrated position in FIGS. 3 and 13. It is apparent that the hold-down clamping means is readily adjustable for different stock diameters and the clamping member 152 is able to be moved along its base 151 by sliding the bolt heads along the T-slots so as to center the clamping means in FIG. 13 directly over the stock 115 after it has been placed FIG. 13 directly over the stock 115 after it has been placed in the recesses 52a and 54a in shear blades 52 and 54.

The outboard support clamping means 156 of this assembly is best shown in FIGS. 1, 3, 9, 12 and 14. This clamping means is carried by the movable cut-off arm 50 and is located below the stock length 115a for clamping it upwardly against cut-off blade 52. It clamps the stock against the blade during cut-off by movement between stock unclamping and clamping positions by a suitable power means to be described hereinafter. The structure includes a platform 160 in FIGS. 3 and 12 hinged by a pivot pin 161 to shear arm frame 51 by hinge eye lugs 162, 162 and 163, 163 secured respectively to arm frame 51 and platform 160. Clamping slide 165 is adapted to travel along platform 160 in a direction transverse to the longitudinal axis of the bar stock 115 (in the plane of the drawing in FIG. 12). Slide 165 comprises welded together a floor plate 166, an end plate 167 in FIG. 3, another end plate 168 in FIG. 12, a curved discharge chute plate 169 for guiding the discharge of the cut-off stock length 115a, a stock clamp jaw base 171 and a jaw insert 171a bolted thereto, and a downwardly extending guide lug 173. Four wear and guide strips 175 are pro-

10

vided between platform 160 and slide 165 to permit relative movement of the latter over the platform. Two bolts 176 and 177 are screwed into the depending wall of the platform 160 with each having a guide sleeve 179 telescoped thereover and located respectively in elongated slots 173a and 173b of guide lug 173 for guiding the travel of slide 165. The bolts hold a cap plate 180 firmly in position to prevent lateral movement of slide 165 with wear plates 181, 181 straddling guide lug 173.

Power means for moving this outboard support clamp between clamping and unclamping positions includes a double acting, fluid pressure actuated cylinder 183 welded or otherwise secured to platform 160 and having a fluid pressure driven piston stem 184 screwed into an upwardly extending bracket from floor plate 166 of slide 165 and locked thereto by a suitable lock nut. The operation of this outboard support clamping means 156 will now be apparent. When fluid pressure is supplied to the right-hand side of the double acting cylinder 183 in FIG. 12, piston rod 184 moves the clamping jaw 171a generally parallel to blade 52 from the solid line unclamping position to the dot-dash line clamping position with the clamping action being provided by the wedge-shaped leading upper left edge of jaw 171a for wedging the stock 115 upwardly into the stock receiving recess 52a in the blade 52. Supplying pressure fluid to the left end of cylinder 183 in FIG. 12 will, of course, return the jaw to the unclamping position. Guide sleeve 179 on bolt 176 serves as an end stop for these two positions by abutting against opposite ends of elongated slot 173a.

FIGS. 24 and 25 disclose control apparatus for performing in the desired sequence the different functions of the shear with FIG. 24 being a fluid flow diagram and FIG. 25 being an electrical diagram for controlling said fluid flow diagram. The actuating fluid may be any suitable fluid, but is here shown as air delivered in the direction of the arrow under pressure from an air supply to an air accumulator 185 in FIG. 24 from which it travels through a filter 186 and then either through lubricators 187 to solenoid operated four-way air valves 188, 189 and 190 or directly to four-way air valve 191 past pressure gauge 192. Each of these valves is solenoid actuated but only valves 190 and 191 will be discussed in detail at this point because valves 188 and 189 are used only with the second shear form to be described in detail hereinafter.

This fluid flow diagram in FIG. 24 is controlled by the electrical circuit in FIG. 25. Three-phase power is supplied through power lines L1, L2 and L3. Motor 60 is driven continuously by this three-phase power while the circuit is supplied with power through step-down transformer 193 from lines L1 and L2. Switches 196 and 197 are mounted respectively on shear frame base plates 31 and 32 in FIG. 7 and are actuated by cams 194 and 195 respectively carried by crank shaft 81. These cam-actuated switches 196 and 197 as well as the length gauge or stock stop switch 123 of FIG. 4 are shown in their normal position with shear arm 50 in its elevated position of FIG. 1 prior to the beginning of the cut-off stroke and before the leading end of stock 115 engages the stock stop rod 118.

As the bar or billet stock 115 in FIG. 3 is fed toward the right against the stock stop and engages the stock stop 117, rod 118 in FIG. 4 moves axially toward the right against the bias of spring 125 to take up the lost motion in the connection until its flange 118a engages sleeve 119 and the rod closes switch 123 in FIG. 25. This establishes a circuit from the secondary of transformer 193 through line 198, closed switch 123, line 199, closed switch contacts 197a, line 200, normally closed relay switch R1, line 201, valve operated solenoids 190a and 191a and return line 202. Solenoid 191a causes valve 191 to disengage brake 76 and to engage clutch 72 in FIGS. 8 and 24 so that motor 60 will start to drive shear arm 50 downwardly in a clockwise direction from

the FIG. 1 to the FIG. 9 position through the shear or cut-off stroke. Simultaneously, valve actuating solenoid 190a causes fluid under pressure to flow into the right end of cylinder 183 in FIGS. 12 and 24 to move the outboard support stock clamping jaw 171a from the solid line to the dot-dash line position in FIG. 12 to wedge the stock upwardly into the recess 52a in blade 52. During the cut-off stroke, movement of the cut-off arm and its appurtenant structure from the FIG. 1 and 6 position to the FIGS. 9 and 10 position causes the stock stop 117 to swing outwardly from the FIG. 3 to the FIG. 11 position. It will be noted that this construction permits sufficient time delay after the stock engages the stock stop so that the shear completes the stock gauging operation before the clamp jaw 171a wedges the stock into its clamped position and before the stock stop moves away from the end of the stock. Hence, stock engagement with the stock stop not only moves clamp jaw 171a from unclamping to clamping positions but also causes downward movement of shear arm 50 through its cut-off stroke.

During the cut-off stroke, clamp jaw 171a is returned from its dot-dash line clamping position back to its solid line unclamping position after stock cut-off to permit dropping the cut-off stock length 115a in FIG. 3 from the shear. A circuit is formed in FIG. 25 from the secondary of the step-down transformer 193 through line 198, line 204, outboard support control switch 196 now closed by cam 194 at a predetermined point during the cut-off stroke in the rotation of crank shaft 81 in FIGS. 7 and 25, line 205, solenoid 190b and return line 202. Energized solenoid 190b reverses the flow through valve 190 to admit pressure fluid to the left end of cylinder 183 in FIGS. 12 and 24 to retract the clamping jaw to the unclamping position.

After shear arm 50 has completed its shear or cut-off stroke, has reached the FIG. 9 position, and then is swinging counterclockwise back toward the FIG. 1 position in the return stroke, brake 76 is engaged and clutch 72 is disengaged automatically. An electrical circuit is formed from the secondary of the transformer 193 through line 198; line 207; switch contacts 197b now closed by cam 195; line 208; one parallel path through line 209, relay coil R and line 210; another parallel path through line 212 and solenoid 191b; and return line 202. Solenoid 191b in FIG. 24 reverses valve 191 to disengage clutch 72 and engage brake 76. Hence, the movement of the shear arm 50 is stopped at the end of one complete cycle of operation. As the shear arm 50 reaches the FIG. 1 position, cam 195 will open switch contacts 197b and close switch contacts 197a to prepare the circuit for the next cut-off stroke. Openings switch contacts 197b normally deenergizes relay coil R by breaking its aforesaid energizing circuit. However, if switch 123 remains closed while contacts 197b are closed instead of opening as stock stop 117 separates from stock length 115a, relay coil R will prevent the shear from going through another cycle until switch 123 is open and again closed. Then, relay coil R will be locked in by a maintaining circuit from transformer 193 through line 198, closed switch 123, line 199, line 214, relay contact R2 now closed, line 209, relay coil R, line 210 and return line 202. Energized relay coil R will keep its switch R1 open to prevent engagement of clutch 72 by valve actuating solenoid 191a as long as switch 123 remains closed.

Modifications of this simplified electrical circuit in FIG. 25 readily suggest themselves to one skilled in the art. The circuit illustrated is for a one cycle shear with its operation initiated by stock stop engagement. Alternatively, the cycle may be initiated by a foot switch instead of or in addition to switch 123 by either substituting the foot actuated switch for switch 123 or mounting it in parallel therewith. Motor 60 may be provided with forward, reverse, jog, start, and stop controls. The circuit may provide power for conveyers for feeding the stock 150 axially toward the right in FIG. 3 toward the

stock stop 117 at the appropriate time and for conveying the cut-off stock lengths 115a after cut-off has been completed.

After cut-off, the stock length 115a will drop by gravity down the curved discharge chute plate 169 in FIG. 12 automatically located below the cut-off stock after the clamping jaw 171a in FIG. 12 has moved from the clamping position to the unclamping position with the latter position shown in solid lines in FIG. 12. The curved shape of the discharge chute will cause the cut-off stock length 115a to rock laterally so as to be positively dispensed from the machine.

Stock stop 117 may be adjusted to meet various conditions. It may be adjusted along the length of element 131 for proper alignment with the stock recesses 52a and 54a in the cut-off blades 52 and 54 by loosening bolt 136, moving the stock stop to the desired position and then tighten the bolt again. Stock stop 117 is adjustable in and out along the axial direction of the bar or billet stock 115 by loosening lock nut 141 and rotating sleeve 119 to screw it in or out in bushing 140 until the desired position is reached and the lock nut 141 is again tightened.

Eccentric bushing 140 in FIGS. 4 and 5 may be rotated in bore 135a, after clamping bolt 137 has been released, to change the lateral relationship between the stock stop rod 118 and the leading end of the bar stop 115 to meet various conditions. First, when extremely short lengths 115a are to be cut off, the distal end of stock stop 117 extends far to the left in FIG. 3 and closer to blade 52. This long overhang provides a considerable arcuate swing for the distal end of the stock stop so that as it swings to the FIG. 11 position, there is always danger that it will interfere or strike against a portion of the outboard support clamping means in FIGS. 3 or 12. The eccentric bushing 140 permits the stock stop rod 118 to be adjusted as high as possible to be engaged against only the top edge of the stock 115 so that it will not swing downwardly far enough to strike against the surfaces on this combined outboard support clamping means and stock discharge chute. Hence, good stock stop action is provided for any stock size without interference with the clamping means during the shearing operation. Second, when large diameter bar stock is cut off in pieces 115a of substantial length, it may be desirable to again mount the stock trip rod 118 high relative to the stock because the stock stop 117 swings only through a small arcuate length and the top edge of the large diameter bar will swing a substantial distance toward the stock stop as it drops downwardly. Third, under normal conditions, the eccentric bushing 140 permits the stock stop rod 118 to be centrally located with respect to the cross section of bar stock 115 for any given diameter bar, whether the diameter be large or small, to provide the preferred stock stop action under normal conditions.

Second Form of Stock Stop and Clamping Assembly

Another form of shear is disclosed in FIGS. 17-23. FIGS. 21, 22 and 23 disclose another form of stock stop, actuating mechanism therefor and supporting structure thereof easily substituted for stock stop 117 in FIG. 3 and its corresponding mechanism and supporting structure. FIGS. 17-20 disclose another form of clamping assembly easily substituted for the hold-down clamping means 150 in FIGS. 3 and 13 and the outboard support clamping means 156 in FIGS. 3 and 12 with the actuating mechanism therefor and supporting construction therefor. Also, blades 252 and 254, identical to blades 52 and 54 except that they have V-shaped recesses 252a and 254a for receiving stock 215 instead of semi-circular ones, are used.

Stock stop 217 in FIGS. 21-23 is similar in construction and operates basically the same as stock stop 117 in FIG. 4. It has many similar parts performing corresponding functions including a stock engagement rod

218 having a flange 218a, a supporting sleeve 219, electric switch bracket 222, and an electric switch 123 corresponding respectively to stock engagement rod 118 having flange 118a, supporting sleeve 119, electric switch bracket 122 and electric switch 123 in FIG. 4. The front end of the rod 218 is chamfered at 218c in FIG. 21 to provide clearance for drop away of the cut-off length 215a of stock 215 without interference with the stock stop rod 218.

Stock stop 217 is carried by the stationary cutter member, namely the stationary machine frame and stationary shear blade 254 instead of by the movable shear arm 50 as in the construction in FIG. 3. Also, stock stop 217 is located closer to the blade 252 of the movable member than to the stationary blade 254.

Means is provided for operatively connecting stock stop 217 to the stationary frame members as to be carried thereby. This structure includes a platform plate 224 secured at opposite ends to the stationary bed of the shear in FIG. 22 by hinge eye lugs 40a, 42a, 34a and 224a welded respectively to rail plate 40, rail plate 42, rail plate 34 and platform plate 224 with pins 226 and 227 telescopically associated within the eyes. Platform plate 224 has welded thereto and extending outwardly therefrom parallel channels 228 and 228, reinforcement plates 229 and 229, and rib plates 230 and 230 with the three members in each of these parallel groups welded together. An end plate 234 is welded to channels 228 and reinforcement plates 229 to complete the rigid supporting frame along with parallel support plates 236, 236 secured to the bottom of the channel 228. Wear plates 231, 231 are carried by the upper surfaces of support plates 236. A base plate 233, adapted to be bolted to supporting plates 236 by bolts 241 or slid along wear plates 231 to a new point for securement, carries with it spacers 232, 232 and a clamp bracket 238a of a fluid pressure cylinder 239 adapted to be secured by bolts 238 to base 233. A cylinder piston rod 240 has secured thereto a stock stop carrying head including a vertical plate 235, a horizontal slide plate 242 and a depending bracket 243 secured to plate 242 by bolts 244. The external threads on stock stop sleeve 219 are screwed into a threaded bore in bracket 243 with one wall of this bracket split at 243a so that tightening one of the bolts 244 will securely clamp this threaded connection. Hence, the fluid pressure actuated cylinder and piston unit operatively connects the stock stop and shear bed member to provide relative movement between said stop and member.

The location of stock engagement rod 218 may be easily adjusted axially to provide proper gauging for different length stock sections to be cut off. Small adjustments may be made by loosening one of the bolts 244, screwing stock stop sleeve 219 in the axial direction and then tightening the bolt again. Major adjustments may be made by loosening bolts 241 so as to slide cylinder base plate 233 and spacers 232 along the wear plates 231 until alignment with another pair of holes in plates 236 in FIG. 23 is reached.

FIGS. 17, 18, 19 and 20 disclose a clamping assembly especially adapted for the use in shearing bar stock of square or other non-circular cross section with this clamping assembly easily substituted for the clamping assembly disclosed in FIG. 3 in the first shear form. The clamping assembly clamps the square bar stock 215, including the length 215a to be cut off, against the blades 252 and 254 and into the recesses 252a and 254a thereof during the cut-off stroke by movement between stock unclamping and clamping positions. The clamping assembly in FIGS. 17 and 18 includes a hold-down clamping means 245 carried by the stationary bed member of the shear and an outboard support clamping means 256 carried by the movable shear arm 50 and located below the stock length 215a for clamping purposes. Each clamping means has a power means, including a fluid pressure actuated cylinder and piston unit, for moving its associated clamping means from unclamping to clamping posi-

tion and in the reverse direction in the same manner as in the outboard support clamping means in FIG. 12.

Both clamping means 245 and 256 are substantially identical but are secured respectively to frame rail 33 and to shear arm part 51 with one clamping means being inverted with respect to the other. Each includes a support plate 260 secured by bolts 261 to frame rail 33 or by bolts 263 and bolt and nut units 262 in FIGS. 18 and 19 to shear arm part 51. Each support plate 260 includes two parallel support rails 260a, 260a and include tubular columns 260b, 260b spaced apart in a plane perpendicular to the axis of the stock 215 and connected together by a connecting wall 260c welded to the plate forming rails 260a and to the columns 260b. A slide 265, U-shaped in FIG. 17, is adapted to move up and down in the plane of the drawing in FIG. 17 with a pair of liners or wear plates 275 located between each arm of the U-shape of slide 265 and each support rail 260a with each slide arm and each support rail having secured thereto by screws (not shown) one of the wear plates 275. In the hold-down clamping means 245 in FIG. 18, suitable support brackets 268 are secured to the outer surfaces of support rails 260a by screws 267 to slidably support slide 265. Each slide 265 includes an upstanding bracket 265a in FIG. 19 connecting the two arms of the U-shape formed by the slide portions 265b, 265b. Two drive wedges 269 are secured one to each slide portion 265b by screws (not shown). A block 271 is mounted for vertical reciprocating movement in the plane of the drawing in FIG. 18 with the block having secured thereto two driven wedges 274 by screws (not shown) vertically associated with and coacting with the drive wedges 269.

The block 271 has a V-jaw 271a mounted for vertical movement between the FIG. 19 and 20 positions generally perpendicular to the blades. Block 271 also has two bores 271b, 271b spaced apart in the plane of the drawings in FIG. 19 and telescoping over tubular columns 260b, 260b on the base or supporting plate 260, as shown in FIG. 18, while a connecting slot 271c between these bores telescopes over the connecting wall 260c. In each of these tubular columns 260b is located a compression spring 276 adapted to pull the jaw 271a downwardly in FIG. 19 to the unclamping position. In the lower right-hand portion of FIG. 18, a stud 277 extends through the bore and has its head 277a on its upper end welded to the top face of block 271 and a thread formed at its lower end. The upper end of spring 276 in FIGS. 18, 19 and 20 is backstopped against a shoulder in the bore of tubular column 260b while the lower end abuts against a threaded bore sleeve 279 screwed onto stud 277 with a pin 280 inserted into an axial notch in the periphery of sleeve 279 and into a longitudinal slot 260d in the bore wall of tubular column 260b so as to prevent rotation of sleeve 279 on stud 277 while permitting sleeve 279 to travel axially along pin 280 and within the bore of column 260b between the FIG. 19 and 20 positions. Hence, each spring 276 exerts a force downwardly in FIGS. 19 and 20 upon its associated sleeve 279 to pull V-jaw 271a downwardly in FIG. 19 to its unclamping position.

The power means, which actuates each clamping means by moving its slide 265 and drive wedge 269 between clamping and unclamping positions, includes cylinders 183 and 283 respectively for outboard support and hold down clamping means 256 and 245 secured to the same part of the shear as base plate 260, and fluid pressure driven pistons therein driving piston rods 184 and 284 connected to slide brackets 265a in a suitable manner. As the fluid pressure is admitted to the right end of the cylinder 183 in FIG. 19, for example, slide 265 and drive wedge 269 will move toward the left so as to drive the driven wedge 274 and V-jaw 271a upwardly against the bias of spring 276 to the clamped position in FIG. 20. When the fluid flow under pressure in the cylinder 183

is reversed, the reversed motion will take place so that springs 276 will pull the V-jaw 271a downwardly from the FIG. 20 to the FIG. 19 unclamping position. The flow to cylinders 283 and 183 is so designed that hold-down clamping means 245 and outboard support clamping means 256 will be in their clamping positions during the shearing stroke and then will move to the unclamping positions to permit drop of the cut-off stock section 215a from the shear and to permit further feed of the stock 215 against the stock stop 217.

Hold-down and outboard support clamping means 245 and 256 are especially adapted for clamping bar or billet stock of square or other non-circular cross section. Since this type of stock is generally not perfectly straight and the cross section thereof may be twisted in a slight helix, this construction with both jaws movable, instead of one being a permanent hold-down clamping means of the type shown in FIG. 3, provides adequate compensation for any helical twist.

The same hydraulic and electrical circuit illustrated in FIGS. 24 and 25 is used with this second form of the invention disclosed in FIGS. 17-23 except that the solenoids, valves and piston-cylinder units not described heretofore but shown in FIGS. 24 and 25 are also used at this time. When shear arm 50 is in its elevated position of FIG. 1 prior to the beginning of the cut-off stroke, cam actuated switches 195 and 197, as well as the stock stop switch 123 in FIG. 21, are shown in their normal position in FIG. 25 and stock stop rod 218 is in its left-most position in FIG. 21 for stock gauging.

As the bar or billet stock 215 in FIG. 21 is fed toward the right against stock stop 217 to form length 215a to be cut-off, rod 218 moves axially toward the right to take up the lost motion and closes switch 123 in FIG. 25. This establishes a circuit from the secondary of transformer 193 through line 198, closed switch 123, line 199, closed switch contacts 197a, line 200, normally closed relay switch R1, line 201, valve operating solenoids 188a and 190a and 191a, and return line 202. Solenoid 191a causes valve 191 to disengage brake 76 and to engage clutch 72 in FIGS. 8 and 24 so that motor 60 will start to drive shear arm 50 in a clockwise direction from the FIG. 1 to the FIG. 9 position through a shear or cut-off stroke. Simultaneously, valve actuating solenoid 190a causes fluid under pressure to flow into the right end of outboard support cylinder 183 to move its clamping jaw 271a from the FIG. 19 unclamping to the FIG. 20 clamping position. Also, valve actuating solenoid 188a causes similar movement of valve 188 to supply fluid to the right end of cylinder 283 in FIG. 24 (upper end in FIG. 17) to move the hold-down clamping jaw 271a in FIG. 18 downwardly to the stock clamping position. It will be noted that this construction permits sufficient time delay after the stock engages the stock stop 217 so as to complete the stock gauging operation before the stock clamp jaws 271a, 271a wedge the stock into its clamped position and, as will be brought out in the next paragraph, before the stock stop 217 is moved away from the end of the stock 215 by energization of solenoid 189b in the manner to be brought out hereinafter. Hence, stock engagement with the stock stop not only moves both clamping jaws 271a from unclamping to clamping positions, but also causes downward movement of shear arm 50 through its cut-off stroke.

Both clamping jaws 271a are moved to their unclamping position and stock stop rod 218 is moved toward the right in FIG. 21 to permit drop of the cut-off stock length 215a from the shear after stock cut-off. This is performed by a circuit formed by the secondary of the step-down transformer 193 through line 198, line 204, switch 196 now closed by cam 194 at a predetermined point in the cut-off stroke of rotation of crank shaft 81 in FIG. 7, line 205, solenoids 188b and 189b and 190b, and return line 202. Solenoids 188b and 190b reverse the flow to valves 188 and 190 to admit pressure fluid

to the left ends of the cylinders 283 and 183 in FIG. 24 (lower ends in FIG. 17) to retract the clamping jaws to the unclamping position. Solenoid 189b reverses the flow of valve 189 to cylinder 239 to move stock stop rod 218 outwardly away from the leading end of the stock (toward the right in FIG. 21). After shear arm 50 has completed its shear or cut-off stroke, has reached the FIG. 9 position, and then is swinging counterclockwise back toward the FIG. 1 position in the return stroke, brake 76 is engaged, clutch 72 is disengaged and stock stop rod 218 is moved toward the left in FIG. 21 to its inward or locating position for stock stop action. This is performed by an electrical circuit formed from the secondary of transformer 193 through line 198, line 207, switch contacts 197b now closed by cam 195, line 208, solenoids 189a and 191b, and return line 202. Solenoid 189a reverses the flow in valve 189 and cylinder 239 to move stock stop rod 218 toward the left in FIG. 21 while solenoid 191b reverses the flow in valve 191 to disengage clutch 72 and engage brake 76.

As set forth heretofore, one cut relay coil R in FIG. 25 limits the machine to one cycle operation, and the other suitable modifications set forth heretofore for this circuit may be made for this modification of the invention as well.

Quick disconnect coupling means is provided for operatively connecting stock stops 117 and 217 and operatively connecting clamping means 150, 156, 245 and 256 to their supporting members, whether the supporting member is the shear arm 50 or the stationary shear base. These quick disconnect coupling means permit access to the blades 52 and 54 or 252 and 254 for servicing, such as changing the shear set-up, sharpening or replacing the blades, etc. In each form of coupling means, relative movement is provided between the stock stop or clamping means and its supporting member to permit swinging it free of an obstructing position with respect to the blades while providing support for the stock stop or clamping means. In FIG. 3, for example, stock stop 117 may be telescoped longitudinally along element 131 after clamp bolt 136 is loosened. In FIG. 23, stock stop 217 and platform plate 224 may be swung outwardly about the vertical hinge axis provided by pin 226 after pin 227 has been removed by telescoping it upwardly out of eye lugs 34a, 42a and 224a in FIG. 22. Then, stock stop 217 can be swung outwardly from the solid line position in FIG. 23 through the dot-dash line position to a clearance position to permit servicing of the shear blades. The hold-down clamping means 150 in FIGS. 3 and 13 may be moved out of alignment with the blade by loosening nut and bolt units 154 and sliding them along the T-slots 151a. Outboard support clamping means 156 may be swung outwardly on hinge pin 161 about a horizontal axis from the FIG. 3 position through and past the FIG. 14 position to service the shear blade. Clamping means 245 and 256 in FIG. 18 are swung to a clearance position by removing all but one of the bolts 261 and 263 or bolt and nut unit 262 in each means while loosening the remaining one in each before the clamp means are swung to a clearance position. Although only one specific form of quick disconnect coupling means is shown for each, it should be clearly apparent that hinge pins permitting swinging about a horizontal or vertical axis may be used or a slideway connection may be used for straight line movement of the particular clamping means or stock stop.

It should also be clear that the complete machine need not be made in one of the two forms illustrated but may be a composite of both forms. For example, the fluid pressure actuated stock stop in FIG. 21 may be substituted for the stock stop 117 in FIG. 3 for use with the clamping means illustrated in FIG. 3. Also, either or both clamping means 245 and 256 in FIG. 18 may be substituted respectively for either or both clamping means

shown in FIG. 3 so that they may be used with stock stop 117.

Various changes in details and arrangement of parts may be made by one skilled in the art without departing from either the spirit of this invention or the scope of the appended claims.

What I claim is:

1. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, driving means for relatively moving said members through said cutoff stroke, a stock stop carried by one of said members, and means operable independently of said driving means and responsive to relative movement of said members for moving said stock stop away from the leading end of the stock during said cutoff stroke; said last-mentioned means including cam and follower means operatively connecting said stock stop and the other member for causing movement of said stock stop away from the leading end of said stock by relative movement between said members and between said cam and follower means during the cutoff stroke.

2. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, a stock stop carried by one of said members, means for moving said stock stop generally endwise away from a locating position for the leading end of the stock during said cutoff stroke, and a resilient torsion bar operatively connecting said stock stop and said one member so that said stock stop is returned to said locating position during said return stroke by the resiliency of said torsion bar.

3. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, a stock stop carried by one of said members, means responsive to relative movement of said members for moving said stock stop away from the leading end of the stock during said cutoff stroke; said last-mentioned means including an elongated element, means operatively connecting said element at one point to said one member, means operatively connecting said element at another point along its length to the other member for causing movement of said stock stop away from the leading end of said stock by relative movement between said members during the cutoff stroke, and means securing said stock stop to said element spaced from said one point, whereby relative movement between said stock stop and one member occurs during relative movement between said members.

4. In a stock shear, two cutter members, a pivot pin operatively connecting said cutter members for relative oscillation movement in opposite directions in cutoff and return strokes respectively, a stock stop carried by one of said members, means responsive to relative movement of said members for moving said stock stop generally endwise away from a locating position for the leading end of the stock during said cutoff stroke; said last-mentioned means including an elongated element, means preventing relative movement between said one member and said pin, means operatively connecting said element at one point to said pin to move with said one member, camming means operatively connecting said element at another point along its length and the other member for causing movement of said stock stop away from the leading end of said stock by relative movement between said members during the cutoff stroke, and means securing said stock stop to said element spaced from said one point, whereby relative movement between said stock stop and one member occurs during relative movement between said members; and a torsion bar operatively connecting said element and said pivot pin for returning said stock stop to said locating position during said return stroke.

5. In a stock shear, two cutter members carrying coacting blades, a pivot pin operatively connecting said cutter members for relative oscillation movement in opposite directions in cutoff and return strokes respectively, a stock stop carried by one of said members, means responsive to relative movement of said members for moving said stock stop generally endwise away from a locating position for the leading end of the stock during said cutoff stroke, said last-mentioned means including a fluid pressure actuated cylinder and piston unit operatively connected to said stock stop and said one member, an intermediate member operatively connecting said stock stop and said one member, a fine stock stop adjustment connection between said stock stop and intermediate member, and quick disconnect coupling means operatively connecting said stock stop through said intermediate member to said one member for relative movement therebetween while providing support for said stock stop to permit access to the blades for servicing, said coupling means including a telescopic connection in said intermediate member providing said relative movement, support and access and including locking means for detachably locking said intermediate member and one member in position with the stock stop aligned with said stock.

6. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, means for clamping said stock against one of said members during cutoff by movement between stock unclamping and clamping positions, and power means for moving said clamping means from unclamping to clamping positions, said cutter members carrying coacting blades, said clamping means including a stock clamp jaw operatively connected to said power means and mounted on said one member for movement generally parallel to the blade on said one member between clamping and unclamping positions, said jaw having a wedge shaped leading edge for wedging the stock against said last mentioned blade.

7. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, means for clamping said stock against one of said members during cutoff by movement between stock unclamping and clamping positions, a stock stop carried by one of said members, and means responsive to stock engagement with said stock stop for moving said clamping means from unclamping to clamping positions; said last mentioned means including a power means for moving said clamping means from unclamping to clamping positions, a lost motion connection between said stock stop and said one member and means for energizing said power means in response to take-up of said lost motion.

8. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, and a combined discharge chute and clamping means located below said stock for clamping as an outboard support said stock against one of said members during cutoff by movement at right angles to said direction between stock unclamping and clamping positions, said combined discharge chute and clamping means having a discharge chute located below the cutoff stock upon movement of said outboard support clamping means to said unclamping position, said chute and clamping means being spaced apart along a direction generally perpendicular to a central axis of said stock.

9. In a stock shear, two cutter members carrying coacting blades, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, means carried by one of said members for clamping said stock against

one of said blades during cutoff, and quick disconnect coupling means operatively connecting said clamping means to said one member for relative movement therebetween while providing support for said stock to permit access to the blades for servicing, said quick disconnect coupling means being a hinge connection between said aforementioned clamping means and member with the axis being generally vertical.

10. In a stock shear, two cutter members carrying co-acting blades, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, means carried by one of said members for clamping said stock against one of said blades during cutoff, and quick disconnect coupling means operatively connecting said clamping means to said one member for relative movement therebetween while providing support for said stock to permit access to the blades for servicing, said quick disconnect coupling means being a hinge connection between said aforementioned clamping means and member with the axis being generally horizontal.

11. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, clamping means for clamping said stock against one of said members during cutoff by movement between stock unclamping and clamping positions, a stock stop carried by one of said members, control means responsive to stock engagement with said stock stop for moving said clamping means from unclamping to clamping positions and for causing relative movement of said members through said cutoff stroke, control means responsive to relative movement of said members for moving said stock stop away from the leading end of the stock during said cutoff stroke, and control means responsive to relative movement of said members for moving said clamping means from clamping to unclamping positions at the end of stock cutoff to permit drop of cutoff stock therefrom.

12. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, a stock stop, and means operatively connecting said stock stop to one of said members for movement therewith relative to the other member, said connecting means including a bushing eccentrically carrying said stock stop and rotatable in a bore carried by said one member with the axis of said bore extending in the same direction as the feed of said stock.

13. In a stock shear, two cutter members, means operatively connecting said cutter members for relative movement in opposite directions in cutoff and return strokes respectively, means for clamping said stock against one of said members during cutoff by movement between stock unclamping and clamping positions, a stock stop located closer to said one member than the blade carrying portion of the other member, means operatively connecting said stock stop to said one member for movement therewith relative to the other member, said connecting means including a bushing eccentrically carrying said stock stop and rotatable in a bore carried by said one member with the axis of said bore extending in the same direction as the feed of said stock, whereby said stock stop may be eccentrically adjusted in said bore to provide good stock stop action for any stock size without interference with said clamping means during shear operation, means responsive to stock engagement with said stock stop for moving said clamping means from unclamping to clamping positions, and means responsive to relative movement of said members for moving said stock stop away from the leading end of the stock during said cutoff stroke.

14. In a stock shear, two cutter members carrying co-acting blades with one of said members being stationary and the other movable, a pivot pin operatively connecting said cutter members for movement of said movable cut-

ter member in opposite directions in cutoff and return strokes respectively, a clamping means as an outboard support carried by said movable member below said stock for clamping said stock against the blade on said movable member during cutoff by movement between stock unclamping and clamping positions, quick disconnect coupling means operatively connecting said clamping means to said movable member for relative movement therebetween while providing support for said stock stop to permit access to the blades for servicing, said quick disconnect coupling means being a hinge connection between said clamping means and said movable member, a stock stop carried by one of said members and located closer to said movable member than to the blade carrying portion of said stationary member, means responsive to stock engagement with said stock stop for moving said clamping means from unclamping to clamping positions and for causing relative movement of said members through said cutoff stroke, said last mentioned means including power means carried by said movable member for moving said clamping means from unclamping to clamping positions and a lost motion connection between said stock stop and said one member and means for energizing said power means in response to take-up of said lost motion, means responsive to relative movement of said members for moving said clamping means from clamping to unclamping positions at the end of stock cutoff to permit drop of cutoff stock therefrom, and means responsive to relative movement of said members for moving said stock stop generally endwise away from a locating position for the leading end of the stock during said cutoff stroke.

15. The combination of claim 14 with said last-mentioned means including an elongated element, means preventing relative movement between said movable member and said pin, means operatively connecting said element at one point to said pin to move with said movable member, camming means operatively connecting said element at another point along its length and the stationary member for causing movement of said stock stop away from the leading end of said stock by relative movement between said members during the cutoff stroke, and means securing said stock stop to said element spaced from said one point, whereby relative movement between said stock stop and movable member occurs during relative movement between said members; and a torsion bar operatively connecting said element and said pivot pin for returning said stock stop to said locating position during said return stroke, said securing means between said element and stock stop including a bushing eccentrically carrying said stock stop and rotatable in a bore carried by said element with the axis of said bore extending in the same direction as the feed of said stock, whereby said stock stop may be eccentrically adjusted in said bore to provide good stock stop action for any stock size without interference with said clamping means during shear operation, said clamping means having a discharge chute located below the cutoff stock upon movement of said clamping means to said unclamping position, said one member being said movable cutter member, said clamping means including a stock clamp jaw operatively connected to said power means and mounted on said movable member for movement generally parallel to the blade on said movable member between clamping and unclamping positions, said jaw having a wedge shaped leading edge for wedging the stock against said last-mentioned blade.

16. The combination of claim 14 with said last-mentioned means including a fluid pressure actuated cylinder and piston unit operatively connected to said stock stop and said one member, and quick disconnect coupling means operatively connecting said stock stop to said one member for relative movement therebetween while providing support for said stock stop to permit access to the blades for servicing, said one member being said stationary cutter member, said clamping means including a stock clamp jaw operatively connected to said power means and

21

mounted on said movable member for movement generally perpendicular to the blade on said movable member between clamping and unclamping positions.

17. The combination of claim 14 with a hold down stock clamping means carried by said stationary member for clamping said stock against the blade on said stationary member during cutoff by movement between stock unclamping and clamping positions, means responsive to stock engagement with said stock stop for moving said hold down clamping means from unclamping to clamping positions, said last mentioned means including power means carried by said stationary member for moving said clamping means from unclamping to clamping positions, and means responsive to relative movement of said members for moving said hold down clamping means from clamping to unclamping positions at the end of stock cutoff to permit stock feed after cutoff.

18. In a stock shear, fixed and movable cutter members relatively movable in opposite directions in cutoff and return strokes respectively, means for clamping said stock against one of said members between the ends of said one member during cutoff by movement between stock unclamping and clamping positions, clamping power means for moving said clamping means from unclamping to clamping position, means pivotally connecting said two cutter members together at one end on a pivot axis at right angles to the plane of shear cut, and shear power means operatively connected between said cutter members at the other end for causing relative approach and separation movement between said cutter members for cutoff and return strokes respectively, said clamping power means being rigidly secured to said movable cutter member between said ends.

19. In a stock shear, fixed and movable cutter members relatively movable in opposite directions in cutoff and return strokes respectively, means for clamping said stock against one of said members between the ends of said one member during cutoff by movement between stock unclamping and clamping positions, clamping power means for moving said clamping means from unclamping to clamping positions, one of said cutter members being a rigid frame having a cutting blade rigidly secured thereto and a way spaced from said blade and rigid with said frame, means pivotally connecting said two cutter members together at one end on a pivot axis at right angles to the plane of shear cut, power means operatively connected between said cutter members at

22

the other end for causing relative approach and separation movement between said cutter members, and said clamping means including a stock clamp jaw operatively connected to said clamping power means and mounted on said way between the ends of said movable cutting member for movement generally at right angles to said pivot axis between stock clamping and unclamping positions, whereby said stock clamp jaw is fixed relative to said movable cutting blade and is carried thereby during a stock cutting operation.

20. In a stock shear, fixed and movable cutter members, a base member, a pivot pin extending through all of said members operatively connecting said movable cutter member between said base member and said fixed cutter member for relative oscillation movement in opposite directions in cutoff and return strokes respectively, a stock stop, means preventing relative movement between said movable cutter member and said pin, and said pin connecting said stock stop and said movable cutter member on opposite sides of said base member, there being means connecting said pin with said stock stop for movement of the latter with said movable cutter member.

References Cited in the file of this patent

UNITED STATES PATENTS

891,626	Loss	June 23, 1908
1,189,031	Andrews	June 27, 1916
1,407,712	Stevens et al.	Feb. 28, 1922
1,767,763	Johnson	June 24, 1930
1,932,875	Addison	Oct. 31, 1933
2,047,322	Hazelton	July 14, 1936
2,165,614	Cork et al.	July 11, 1939
2,247,766	Boerger	July 1, 1941
2,254,316	Rider	Sept. 2, 1941
2,287,833	Ridgway	June 30, 1942
2,370,311	Hercik	Feb. 27, 1945
2,404,901	Cibs	July 20, 1946
2,440,799	Hercik	May 9, 1948
2,446,146	Tucker	July 27, 1948
2,507,453	Moore	May 9, 1950
2,520,495	Dehn	Aug. 29, 1950
2,593,144	Hercik	Apr. 15, 1952
2,603,291	Williams	July 15, 1952
2,658,574	Slettengren	Nov. 10, 1953
2,837,157	Gunther	June 3, 1958