July 29, 1941. F. HAFECOST 2,250,530

FEED MECHANISM

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FIG. 1.

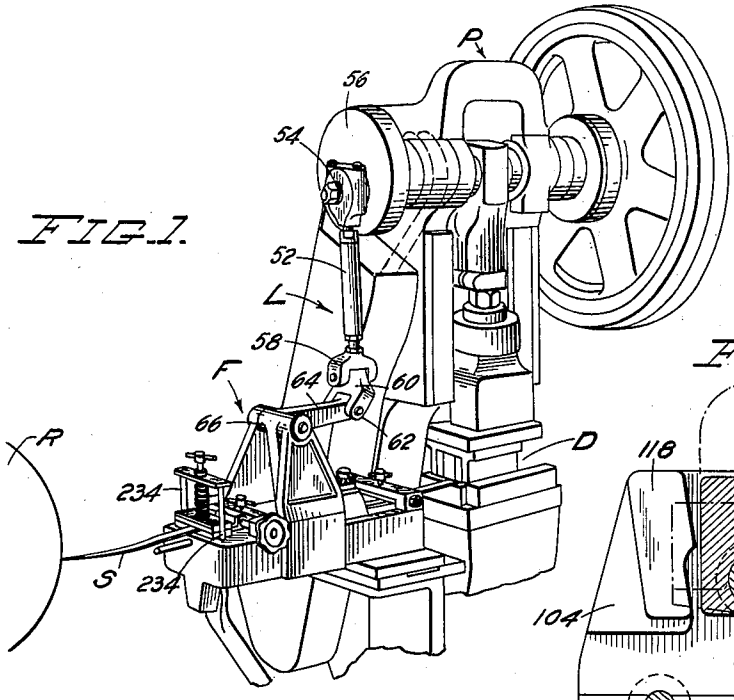


FIG. 8.

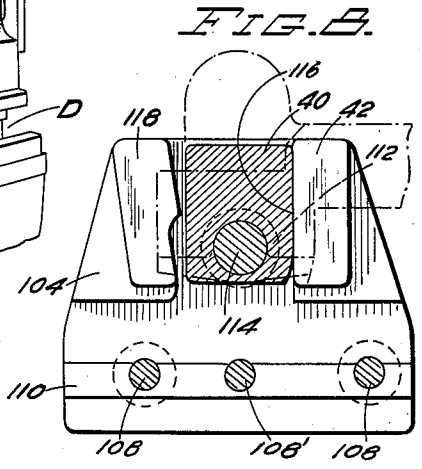


FIG. 6.

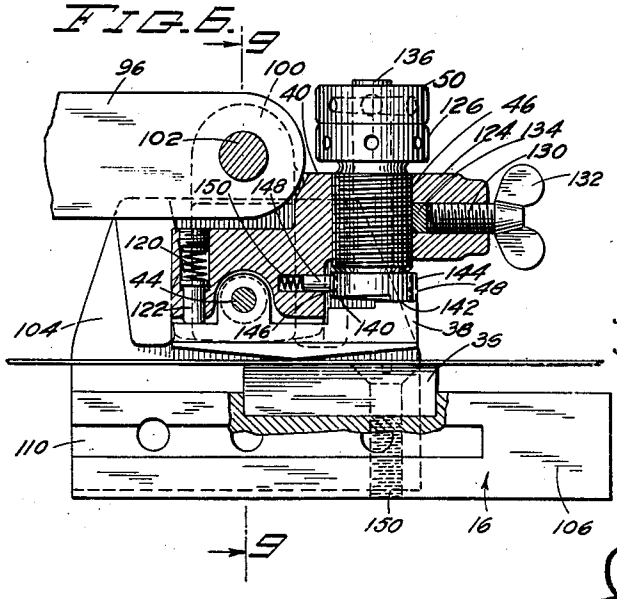
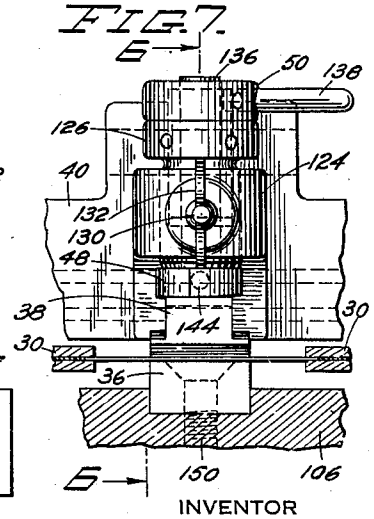


FIG. 7.



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FIG. 2.

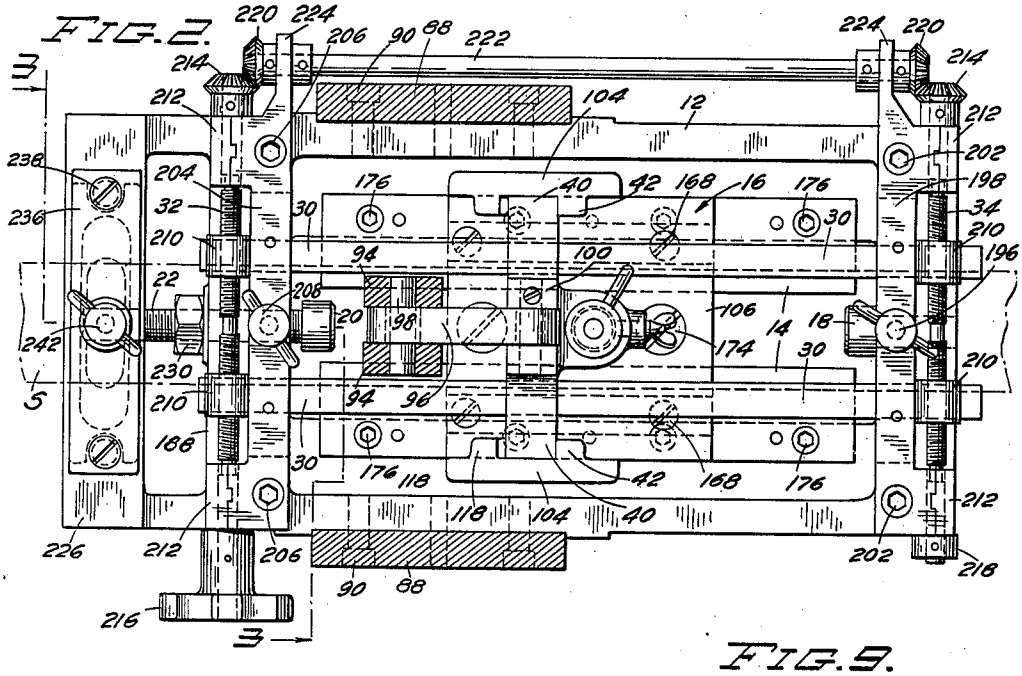


FIG. 3.

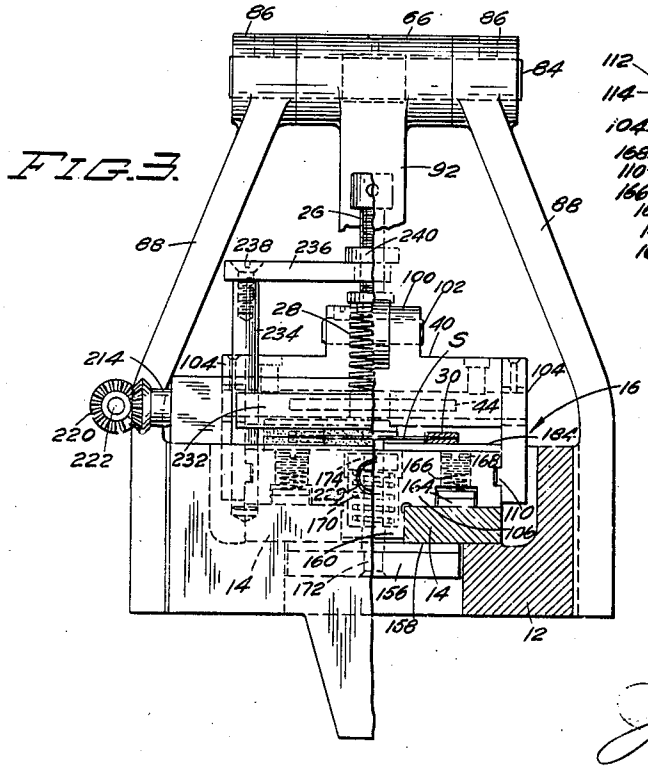


FIG. 9.

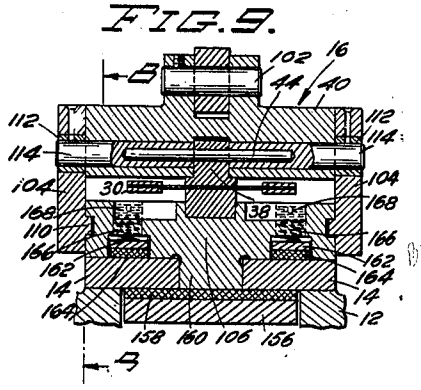
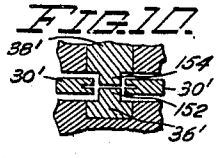


FIG. 10.



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FIG. 5.

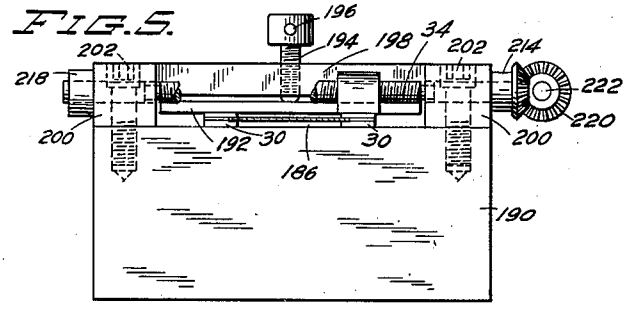
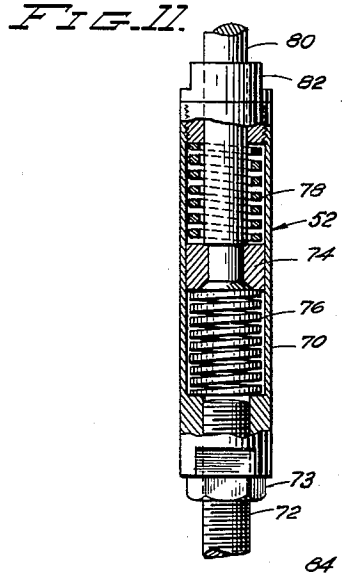


FIG. 11.



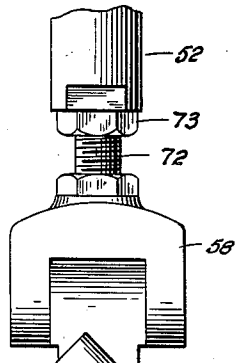


FIG. 12.

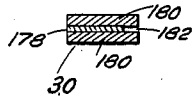


FIG. 4.

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Patented July 29, 1941 2,250,530

UNITED STATES PATENT OFFICE

2,250,530

FEED MECHANISM

Frederick Hafecost, Hopatcong, N. J., assignor to The Fred Goat Co., Inc., Brooklyn, N. Y., a corporation of New York

Application April 21, 1938, Serial No. 203,313

16 Claims. (Cl. 271—2.5)

This invention relates to feed mechanisms for intermittently feeding stock to be worked upon, as for example, in a punch press.

The primary object of my invention is to generally improve feed mechanisms. A more particular object resides in the provision of a feed mechanism which will feed the stock with extreme accuracy, such accuracy in fact, as will make it possible to dispense with the use of conventional pilots even when working on the stock in a complex die involving a large number of successive operations or stages. Considered in a still more specific aspect, the invention concerns itself with, although it is not limited to, the feed of exceedingly thin stock, for example a strip of metal having a thickness of only $\frac{5}{1000}$ of an inch. A common example of the use of such material is for the manufacture of parts of vacuum tubes for radio receivers. When dealing with thin metal of this character, it is impossible to rely upon the use of pilots for proper registration of the stock, for the pilot will readily punch through the thin metal and will break away the edge of a pilot hole too readily to successfully register the stock. In accordance with my invention, the feed mechanism is a precision device and feeds the stock with such accuracy that the pilots may be eliminated. This feature is a desirable one even when working with thicker stock, because it is an expensive matter to provide a multiple station die with the necessary pilots, and in some cases, the saving in the expense of the pilots alone may be sufficient to make up for the entire cost of the feed mechanism of the present invention.

The feed mechanism is of the grip feed type, and when applied to a punch press, is actuated by a single force obtained through linkage connected to the crank shaft of the press. This force functions first to clamp the gripper jaws on the stock, and then to move the gripper jaws bodily with the stock. The gripper jaws are mounted on a slide which is reciprocable on rails and which is frictionally related to the rails, as by the use of spring pressed brake shoes. The resistance to movement of the slide insures tight closure of the jaws before the jaws move in the feed direction. In accordance with a feature and object of the present invention, the travel of the slide is accurately determined by the use of adjustable stops for limiting the motion of the slide. The linkage for actuating the feed mechanism is given an excess movement greater than the desired feed, and a part of the linkage is made yieldable to accommodate this excess movement when the slide is positively stopped by the motion-limiting stops. This yieldable connection may be obtained by frictional slippage or by the use of an hydraulic dashpot arrangement, but in the present case it is obtained by means of oppositely disposed compression springs acting on a piston within a tubular connecting rod.

As has already been mentioned, the stock worked on may be very thin, and in some cases it may be made of a comparatively soft metal. The bite of the gripper jaws may indent or mutilate the stock, particularly when the slide is mounted on the rails with substantial friction for precision operation. A further object of the present invention is to prevent the gripper jaws from being closed with excessive force, and to definitely limit the bite of the jaws to a desired amount. With this object in view, the slide is provided with a stationary jaw and a rocker carrying a movable jaw, and I additionally provide motion-limiting means to positively limit the motion of the rocker. This in effect limits the motion of the jaw. The limit is, of course, preferably made adjustable, and for this purpose the movable jaw is itself oscillatably mounted on the rocker and an accurately adjustable screw is provided between the rocker and the gripper jaw in order to adjust the position of the jaw when the rocker has been moved to its limit of motion. In this way the pressure exerted by the jaws may be definitely limited, and as a rough working rule, I have found it satisfactory to set the jaws for a spacing $\frac{1}{1000}$ of an inch less than the thickness of the stock being handled. For example, in handling a strip having a thickness of $\frac{5}{1000}$ of an inch, the gripper jaw may be adjusted while inserting a gauge having a thickness of $\frac{4}{1000}$ of an inch between the jaws. It is desirable to afford a substantial release movement of the gripper jaws at times, as for example, when inserting the starting end of a new reel of stock, and in accordance with a further feature and object of the present invention, a quick release means is provided for temporarily releasing the jaw without, however, changing or losing the previously established adjustment of the screw which determines the bite of the jaws.

Still further objects of the invention concern the centering of the stock with respect to the jaws. I provide guides on opposite sides of the feed mechanism. These may be simultaneously equally moved toward or away from one another while maintaining the same in strict parallelism, this being done by means of threaded rods ex-

tending transversely of the guides at the ends thereof, said rods being provided with right and left-hand threads for moving the rods. The rods are appropriately geared together for simultaneous equal movement. The guides are relatively thin in vertical dimension and are thereby adapted to pass freely between the rocker and the slide so that they may be moved close to the gripper jaws for handling narrow strips. The guides are so long that the right and left-hand screw mechanism for adjusting the same does not interfere with the maximum desired reciprocation or stroke of the slide. The disposition of the parts is such that there is also no interference with the adjustable stops which determine the motion or feed of the slide.

To the accomplishment of the foregoing and other objects which will hereinafter appear, my invention consists in the feed elements and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be defined in the claims. The specification is accompanied by drawings in which:

Fig. 1 is a perspective view showing the application of the feed mechanism of the present invention to a punch press;

Fig. 2 is a partially sectioned plan view of the feed mechanism and is taken in the plane of the line 2—2 of Fig. 4;

Fig. 3 is a partially sectioned transverse elevation of the input end of the feed mechanism, taken in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a partially sectioned side elevation of the feed mechanism;

Fig. 5 is an end elevation of the discharge end of the feed mechanism;

Fig. 6 is a partially sectioned side elevation to enlarged scale showing the jaw and rocker arrangement on the slide;

Fig. 7 is a side elevation of the mechanism shown in Fig. 6;

Fig. 8 is explanatory of the manner in which the movement of the rocker is limited by the slide, it being a section taken approximately in the plane of the line 8—8 of Fig. 9;

Fig. 9 is a transverse section through the slide and rocker mechanism taken in the plane of the line 9—9 of Fig. 6;

Fig. 10 is a modification adapted for use with narrow stock;

Fig. 11 is a section through a spring connecting rod constituting the yieldable part of the linkage actuating the feed mechanism; and

Fig. 12 is a section through one of the centering guides.

Referring to the drawings, and more particularly to Fig. 1, the feed mechanism is shown at F and is mounted at the side of a punch press generally designated P. The mechanism F is shown feeding a ribbon-like strip of stock S from a reel R to the die D mounted in the punch press. The feed mechanism is driven from the crank shaft of the press through appropriate preferably yieldable linkage generally designated L.

Referring now to Figs. 2, 3 and 4 of the drawings, the feed mechanism comprises a frame 12 carrying rails 14. A slide generally designated 16 is slidable on the rails. The movement of the slide is positively limited by stops 18 and 20, the distance between which is adjustable, as by means of screw 22 carrying stop 20. It will be evident that the permitted stroke or feed is equal to the amount by which the distance between stops 18 and 20 exceeds the length of the slide 16. The movement sought to be applied to the slide by the linkage L exceeds the desired feed movement, and the slide is therefore moved snugly against the motion-limiting stops at each end of the feed stroke.

The stock S preliminarily passes through a friction brake 24 the pressure of which is adjustable by means of the screw 26 working on the compression spring 28. The stock then is received between long centering guides 30. These are channeled on their inner faces to receive the edges of the stock, and are adjustable toward or away from one another by means of threaded rods 32 and 34. The rods are geared for simultaneous movement, thus keeping the guides 30 parallel, and the threads on the rods are opposite in direction, so that the guides are moved toward or away from one another by equal amounts, thus keeping the stock centered with respect to the feed mechanism.

The gripper jaws are best shown in Figs. 6 through 9. The stock is gripped between a lower jaw 36 which is stationarily mounted on slide 16, and an upper jaw 38 which is movable toward or away from lower jaw 36. The upper jaw is carried by a rocker 40 pivoted on the slide 16. The movement of the rocker 40 is positively limited as by means of the stop 42 best shown in Fig. 8. No adjustment is provided for this stop, and instead, the upper jaw 38 is itself movably mounted on rocker 40, as by means of the pivot 44 best shown in Fig. 6. The position of jaw 38 relative to the rocker is determined by means of a screw 46 the lower end 48 of which bears against the jaw. For quick release of the jaw, the end 48 is preferably made in the form of a cam which may be turned by means of a capstan 50, without losing or changing the desired adjustment of screw 46.

Considering the feed mechanism in greater detail, the linkage L (Fig. 1) includes a connecting rod 52, the upper bearing of which is received on a crank pin 54 mounted on crank disc 56 at the end of the main crank shaft of the press. The throw or radius of crank 54 is made somewhat greater than is needed for the maximum feed anticipated. The lower end of connecting rod 52 is provided with a bearing yoke 58 pivotally connected to a block 60 having a bearing yoke 62 which receives one arm 64 of an angle lever 66. It will be understood that the bearing connections at 58 and 62 form a universal joint for connection between the connecting rod and the angle lever.

In the present construction the yieldable part of the linkage is the connecting rod 52, and this may be described in greater detail with reference to Fig. 11, in which it will be seen that the connecting rod comprises a tubular sleeve 70 the lower end of which receives the threaded stud 72 of the bottom bearing of the connecting rod. A piston 74 is slidable in sleeve 70. It is yieldably held in mid-position by opposed compression springs 76 and 78. Piston 74 carries a piston rod 80 which projects through a plug 82 closing the upper end of the sleeve. The piston rod 80 carries the upper bearing of the connecting rod. Springs 76 and 78 need not be under substantial compression. In fact, theoretically, no compression at all is needed, but in practice the parts are so designed that the springs are placed under a slight compression in order to guard against lost motion in the connecting rod. In operation, when the slide of the feed mechanism reaches its limit of motion in one direction, the continued

throw of the crank pin 54 of the press is accommodated by compression of one of the springs, and similarly, when the slide reaches its limit of motion in the other direction, the excess movement is absorbed by compression of the other spring. The hollow sleeve 70 of the connecting rod may be packed with grease, and the lubricant being sealed at all points except the top, there is no loss of lubricant.

Referring now to Figs. 3 and 4, angle lever 66 is carried by a pin 84 the ends of which are received in bearings 86 formed at the upper ends of bearing plates 88 the lower ends of which are bolted to the sides of frame 12, as by means of screws 90. Angle lever 66 has a depending arm 92 the lower end of which is bifurcated at 94 to receive one end of a short approximately horizontal link 96. The parts are pivotally connected together by a pin 98. The forward end of link 96 is received between upstanding bearing ears 100 on rocker 40. These parts are connected by pin 102, and it will be seen that oscillation of the angle lever 66 produces an oscillation and reciprocation of rocker 40 through connecting link 96.

Rocker 40 extends transversely between side plates 104 which in turn are secured to the main top plate 106 of the slide by means of screws 108 and dowel 108' (Fig. 8) and tongue and groove connection 110. Side plates 104 act as bearings for the rocker, and for this purpose are provided with bushings 112 which receive the outer ends of bearing pins 114, the inner ends of said pins being received in the rocker 40, as is best shown in Fig. 9. The side plates 104 are provided with the motion limiting stop 42 (Fig. 8) previously referred to, thus cooperating with the forward face 116 of rocker 40 to positively limit forward movement of the rocker. The side plates are also preferably provided with motion limiting stops 118 to limit the rearward or opening movement of the rocker, but these are not as important as the stops 42.

The upper gripper jaw 38 is pivotally mounted on a pin 44. This pin is preferably concentric with the pins 114, and as is shown in Fig. 9, it is received within pins 114. The jaw 38 is received on pin 44 between pins 114, and is normally urged in the opening direction by means of a small compression spring 120 (Fig. 6) which bears against a plunger 122 resting on the rear end of the gripper jaw.

Referring now to Figs. 6 and 7, the rocker 40 is provided with a forward projection 124 which threadedly receives adjusting screw 46. The upper end of this screw is provided with a capstan head 126 having capstan holes into which a pin may be inserted when adjusting the position of the screw. After the proper adjustment has been made, the screw may be locked in position by means of a screw 130 having a winged head 132. A soft metal plug 134 may be inserted between the end of screw 130 and the adjusting screw 46 in order not to injure the threads of the adjusting screw.

Screw 46 is hollow, and is concentrically arranged with a spindle 136 which carries the release cam 48 at its lower end. The lower end of screw 46 bears on the top surface of release cam 48. The upper end of spindle 136 has secured thereto a capstan head 50 provided with a projecting pin or handle 138. This is swung through an arc of 180 degrees in order to change cam 48 from the working position shown in Fig. 6 to its released position, at which time the spirally cut-away cam surface indicated at 140 comes above the bearing surface 142 of jaw 38. Appropriate detent means is provided to hold the quick release cam in proper position. For this purpose, the front and rear edges of the cam are recessed at 144 and 146 for cooperation with a spring-pressed finger 148. This finger is slidable in a hole formed in rocker 40 and is urged forwardly by a small compression spring 150. In Fig. 6 the end of detent finger 148 is received in recess 146, and thus holds the cam in working position. When the upper capstan head is swung around through an arc of 180 degrees to the release position, the detent finger 148 engages recess 144. Vertical adjustment of adjusting screw 46 does not change the relation between the detent finger and the cam because the recesses 144 and 146 are vertical channels which extend all the way from the top to the bottom of the cam.

The upper jaw 38 cooperates with the lower jaw 36, and said lower jaw is received in a mating recess in the top surface of the main plate 106 of the slide. It is held in position by a countersunk screw 150.

With reference to Figs. 7 and 9, it may be mentioned that the upper jaw 38 projects downwardly from the bottom of rocker 40, and the lower jaw 36 projects upwardly from the top of slide plate 106. The projection of the jaws exceeds the thickness or vertical dimension of the centering guides 30 so that the centering guides may be moved close to the jaws in order to accommodate stock of narrow width. The guides do not interfere with movement of the slide, and are purposely made so long that the cross supports for the guides are disposed outside the range of useful movement of the slide.

On this point reference may also be made to Fig. 10, illustrating the manner in which stock of small width may be accommodated. For this purpose the jaws 36 and 38 are removed and replaced by jaws 36' and 38' having narrowed jaw surfaces 152 and 154. The guides 30 may be moved close to the narrow jaws 152, 154, thus effectively handling stock much smaller than that intended to be handled by the jaws shown in Figs. 7 and 9.

Slide 16 rides on stationary rails 14, and the slide is preferably provided with main and auxiliary friction brakes to introduce a substantial amount of frictional resistance to movement of the slide. A bottom plate 156 (Fig. 9) is disposed beneath rails 14, and the upper surface of bottom plate 156 is provided with a layer of brake lining 158, this constituting the main brake. The top plate 106 has a downwardly projecting center ridge or guide 160 which fits accurately between rails 14, as is most clearly shown in Fig. 9. This guides the slide with respect to sideward movement. The bottom surface of top wall 106 is provided with auxiliary brakes 162 bearing on brake linings 164, said brakes being urged downwardly by auxiliary compression springs 166. These provide an extra spring brake pressure which, however, is preferably made inadequate to lift top plate 106 from direct engagement with the rails 14. The auxiliary brake pressure may be adjusted by means of screws 168 bearing on springs 166. The main braking springs are shown in Figs. 3 and 4 at 170. These surround the upper ends of pins 172 which project upwardly from bottom plate 156 through the top plate 106. The center thick part of the top plate is recessed to receive the springs 170. The lower ends of the springs bear against plate 106, and the upper

ends bear against nuts **174** which are threaded on screws **172** and thereby provide for adjustment of the braking pressure exerted at the bottom of rails **14**. The braking pressure applied at the top of the rails is to be considered an auxiliary braking pressure and is not essential to operation of the device. The rails **14** are preferably provided with a special wearing surface such as a layer of Stellite welded to the rail so that it will wear indefinitely. After long use, it may become necessary to replace the brake linings **158** and **164**, but this is readily done. The rails **14** are preferably formed separately from the cast frame **12**, and are secured in place on the frame by means of screws **176**.

The centering guides **30** are preferably made up of laminations, as is indicated in Fig. 12. Each guide consists of a strip of hardened steel **178** sandwiched between strips of metal **180** which may be of softer stock, for example, cold rolled steel. The strips **180** are wider than the strip **178**, thus forming a channel **182** in which the edge of the strip being fed through the machine is received. The thickness of centering strip **178** is, of course, made substantially greater than that of the stock received in the guides. The separate strip **178** of hardened material is preferably used in order to avoid sideward wear, for the primary function of the centering guide is to properly locate the strip in a side to side direction. Any wear at the top or bottom of the channel **182** is of little consequence because the position of the strip in a vertical direction is primarily determined by the gripping jaws. Although the guide is preferably made up of laminations as described, it may, of course, be made of a single solid strip, and in Fig. 10 the guides **30'** are made in that manner.

The guides **30** rest on horizontal support surfaces **184** and **186** at the supply and discharge ends of the frame, respectively, the surface **184** being best shown in Fig. 3, and the surface **186** being best shown in Fig. 5. These surfaces are formed on the top of cross connections **188** and **190** of the cast frame **12**. When the guides have been properly adjusted, they may be locked in position by clamping cross-strips **192** thereagainst. One of these cross-strips is clearly shown in Fig. 5, and it will be seen that it rests directly on the guides **30** and may be clamped downwardly by turning the clamping screw **194** by means of the head **196**. Screw **194** is threadedly received in a cross bar **198** the ends of which are enlarged at **200** and screwed to the top of cast frame **12** by means of screws **202**. The construction will be understood from inspection of Fig. 5, and also the right-hand end of Fig. 2. The construction at the opposite end of the feed mechanism is similar, there being a clamping bar disposed directly beneath the cross-bar **204**, said cross-bar being secured on top of casting **12** by means of screws **206**. The clamping bar may be pressed downwardly to lock the guides in position by means of clamping screw **208**.

The ends of guides **30** have upward projections **210** secured thereto. These ride just outside the cross bars **198** and **204**, as is best shown in Figs. 2 and 4, and this prevents longitudinal movement of the guides. They are threaded to receive the right and left-hand screws of rods **32** and **34**. These rods are received in bearings formed at the ends of the cross bars **198** and **204**, the said bearings being split bearings closed by cover plates **212**, said cover plates being held against the sides of the cross bars by horizontal assembly screws which have been omitted from the drawings in order not to unnecessarily complicate the same. The threaded rods are held against axial movement by mitre gears **214** at one end and a handle **216** and collar **218** at the other end. Mitre gears **214** mesh with mitre gears **220** secured to the opposite ends of a shaft **222** which is journalled in bearings **224** (Fig. 2) formed at the ends of cross bars **198** and **204**. On reflection, it will be evident that rotation of handle **216** rotates rod **32**, and this is accompanied by a simultaneous equal movement of rod **34**. With the particular gear set-up shown, the rods turn in opposite directions, but this is of no consequence so long as the choice of thread direction is properly made. This choice is such that both ends of the guide move in the same direction, thus keeping the guides parallel, and the two guides move in opposite direction, thus keeping the stock being fed through the machine in center position with respect to the jaws.

The motion limiting stops **18** and **20** may each be adjustably mounted, but it is sufficient for practical purposes if one of the stops is made adjustable. In the present case the stop **18** is not adjustable, it being threadedly received in the end **190** of frame **12**. The stop **20** is adjustable, it being formed on the end of screw **22**, which is threadedly received in the cross bridge or web **188** extending between the side walls of casting **12**. The end wall **226** of the casting is bored or cut away at **228** for free passage of screw **22** in order not to interfere with adjustment of the stop, and in order that a long screw may be used for a big range of adjustment. The adjusted position of stop **20** may be locked by means of lock nut **230**. With only one stop adjustable it is desirable to change the linkage to center the movement relative to the stops, i. e., to produce equal compression of the springs **76** and **78** in the connecting rod **52** (Fig. 11). In the present case this is done by means of the long threaded connection **72**, the adjustment of which is locked by nut **73**.

The gripper jaws open at the beginning of the return movement of the slide. No gripping pressure is exerted on the stock at this time. Nevertheless, it is desirable to prevent possible return movement of the stock with the slide, and for this reason and other reasons, it is desirable to pass the stock through friction brake **24** previously referred to. This is mounted directly over the end wall **226** of the frame. The lower piece of brake lining is mounted directly on top of the end wall **226**. The upper piece of brake lining is carried on the bottom of a brake **232**, which is vertically slidable between vertical support rods **234** (Figs. 1 and 3). Rods **234** carry a stationary top bar **236** at their upper ends, this being held in place by screws **238** (Figs. 2 and 3). The adjusting screw **26** is threadedly received in a suitable bushing **240** secured to top bar **236**. The screw may be rotated by means of head **242**. The lower end of the screw carries a collar **224** which bears against the brake spring **28**. In this way the brake pressure is readily adjusted.

It is believed that the construction and operation, as well as the many advantages of my improved feed mechanism, will be apparent from the foregoing detailed description thereof. The feed is capable of handling stock in the form of strips which are thin or narrow or both, and which may be made of comparatively soft metal. It feeds these strips with extraordinary accuracy,

making it possible to use the material in dies having numerous stations, say, six or seven stations, to form intricate parts, all without the use of pilots or pilot holes. The slide assembly is massive and carried on rails of generous dimension, and is secured to those rails with large brake surfaces. In this way the movement of the slide is under close control, and is devoid of lost motion, side play, or the like. Moreover, the frictional resistance to movement of the slide ensures gripping of the stock with any desired pressure before movement of the slide and stock can take place. However, indentation or mutilation of the stock is effectually prevented by positively limiting the gripping pressure of the jaws, this being done by means of a precision adjusting screw between the rocker and the jaw itself. The adjustment of this screw may be locked and left undisturbed, while affording substantial release of the jaws, as when adjusting the stock in relation to the die, or when introducing a new reel of stock. The feed or travel of the slide is positively determined between end stops, the distance between which may be adjusted to fix the extent of feed. Full travel between these stops is assured by giving the linkage an input motion greater than that desired, a part of said linkage being yieldable to absorb the excess movement. The stock is accurately guided and is centered by centering guides which extend the full length of the feed mechanism, and which are readily adjustable by means of oppositely threaded rods geared together for simultaneous equal movement.

It will be apparent that while I have shown and described my invention in a preferred form, many changes and modifications may be made in the structure disclosed, without departing from the spirit of the invention defined in the following claims.

I claim:

1. Feed mechanism, comprising a slide assembly with gripper jaws, a single linkage connected to the gripper jaws for first moving the gripper jaws and then reciprocating said slide assembly and gripper jaws in order to feed the stock, and positive stop means on opposite sides of the slide assembly for positively limiting the motion of the slide assembly and consequently the extent of feed, said linkage including excess motion absorbing means whereby the motion applied to the linkage exceeds that needed to produce the desired feed determined by the aforesaid stops.

2. Feed mechanism for accurately feeding continuous stock, said mechanism comprising rails, a slide assembly movable on said rails, gripper jaws forming a part of said slide assembly, a single linkage connected to the gripper jaws for reciprocating said slide assembly and gripper jaws in order to feed the stock, and adjustable positive stop means adjacent said rails on opposite sides of the slide assembly for positively limiting the motion of the slide assembly and consequently the extent of feed, said linkage including a yieldable connection such that the input motion applied to the linkage may exceed that needed to produce the desired feed distance as limited by the aforesaid stops.

3. Feed mechanism, comprising a slide assembly with gripper jaws, linkage for reciprocating said slide assembly in order to feed the stock, positive stop means on opposite sides of the slide assembly for positively limiting the motion of the slide assembly and consequently the extent of feed, said linkage including a connecting rod comprising a tubular sleeve connected to a bearing at one end, a piston-like member slidable in said sleeve, and a piston rod extending from said piston to a bearing at the opposite end of the connecting rod.

4. Feed mechanism for accurately feeding continuous stock, said mechanism comprising rails, a slide assembly movable on said rails, gripper jaws forming a part of said slide assembly, linkage for reciprocating said slide assembly and gripper jaws in order to feed the stock, and adjustable positive stop means on opposite sides of the slide assembly for positively limiting the motion of the slide assemby and consequently the extent of feed, said linkage including a connecting rod comprising a tubular sleeve connected to a bearing at one end, a piston-like member slidable in said sleeve, compression springs disposed in said sleeve on opposite sides of said piston, and a piston rod extending from said piston to a bearing at the opposite end of the connecting rod.

5. Feed mechanism, comprising rails, a slide reciprocable thereon, an oscillatable gripper jaw oscillatably mounted on said slide, accurately adjustable means to positively limit the motion of said gripper jaw for precision adjustment of the bite of the jaw, and linkage connected to said gripper jaw for first moving the gripper jaw and then bodily moving the slide and gripper jaw assembly in order to feed the stock.

6. Feed mechanism comprising rails, a slide reciprocable thereon, friction brakes yieldably pressed against said rails to frictionally resist movement of the slide on the rails, a gripper jaw oscillatably mounted on said slide, accurately adjustable means to positively limit the motion of said gripper jaw for precision adjustment of the bite of the jaw, and linkage for moving said jaw and then said slide.

7. Feed mechanism comprising rails, a slide reciprocable thereon, a gripper jaw oscillatably mounted on said slide, accurately adjustable means to positively limit the motion of said jaw for precision adjustment of the bite of the jaw, a quick release means for releasing said jaw without changing the adjustment of the aforesaid adjustable means, and linkage connected to said gripper jaw for first moving the gripper jaw and then bodily moving the slide and gripper jaw assembly in order to feed the stock.

8. Feed mechanism comprising rails, a slide reciprocable thereon, a rocker oscillatable on said slide, means on said slide to positively limit the motion of said rocker, a gripper jaw mounted on said rocker, an adjusting screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion.

9. Feed mechanism, comprising rails, a slide reciprocable thereon, friction brakes yieldably pressed against said rails to frictionally resist movement of the slide on the rails, a rocker oscillatable on said slide, means on said slide to positively limit the motion of said rocker, a gripper jaw oscillatably mounted on said rocker, and an adjustable screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion.

10. Feed mechanism for feeding stock without indenting or damaging the stock, said feed mechanism comprising rails, a slide reciprocable thereon, friction brakes yieldably pressed against said rails to frictionally resist movement of the slide on the rails, a rocker oscillatable on said slide, means on said slide to positively limit the motion

of said rocker, a gripper jaw oscillatably mounted on said rocker, an adjustable screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion, and a quick release means for temporarily releasing said jaw without changing the adjustment of the aforesaid screw.

11. Feed mechanism, comprising rails, a slide reciprocable thereon, a gripper jaw oscillatably mounted on said slide, accurately adjustable means to positively limit the motion of said gripper jaw for precision adjustment of the bite of the jaw, positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said gripper jaw for first moving said jaw and then the slide, said linkage including yieldable means whereby the input motion applied to the linkage exceeds the desired feed distance determined by the aforesaid stops.

12. Feed mechanism, comprising rails, a slide reciprocable thereon, a gripper jaw oscillatably mounted on said slide, accurately adjustable means to positively limit the motion of said gripper jaw for precision adjustment of the bite of the jaw, quick release means for releasing said jaw without changing the adjustment of the aforesaid means, adjustable positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said gripper jaw for first moving said jaw and then the slide, said linkage including yieldable means whereby the input motion applied to the linkage exceeds the desired feed distance determined by the aforesaid stops.

13. Feed mechanism, comprising rails, a slide reciprocable thereon, a rocker oscillatable on said slide, means on said slide to positively limit the motion of said rocker, a gripper jaw mounted on said rocker, an adjustable screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion, positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said rocker for reciprocating the rocker and the slide, said linkage including a connecting rod comprising a tubular sleeve connected to a bearing at one end, a piston-like member slidable in said sleeve, and a piston rod extending from said piston to a bearing at the opposite end of the connecting rod.

14. Feed mechanism for accurately feeding stock without indenting or damaging the stock, said feed mechanism comprising rails, a slide reciprocable thereon with substantial frictional resistance, a gripper jaw oscillatably mounted on said slide, adjustable means to positively limit the motion of said gripper jaw for precision adjustment of the bite of the jaw, positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said slide for reciprocating the slide, said linkage including a connecting rod comprising a tubular sleeve connected to a bearing at one end, a piston-like member slidable in said sleeve, compression springs disposed in said sleeve on opposite sides of said piston, and a piston rod extending from said piston to a bearing at the opposite end of the connecting rod.

15. Feed mechanism for accurately feeding stock without indenting or damaging the stock, said feed mechanism comprising rails, a slide reciprocable thereon, friction brakes yieldably pressed against said rails to frictionally resist movement of the slide on the rails, a rocker oscillatable on said slide, means on said slide to positively limit the motion of said rocker, a gripper jaw oscillatably mounted on said rocker, an adjustable screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion, quick release means for releasing said jaw without changing the adjustment of the aforesaid screw, adjustable positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said rocker for reciprocating the rocker and the slide, said linkage including yieldable means whereby the input motion applied to the linkage exceeds the desired feed distance determined by the aforesaid stops.

16. Feed mechanism for accurately feeding thin, ribbon-like strip stock without indenting or damaging the stock, said feed mechanism comprising rails, a slide reciprocable thereon, friction brakes yieldably pressed against said rails to frictionally resist movement of the slide on the rails, a rocker oscillatable on said slide, means on said slide to positively limit the motion of said rocker, a gripper jaw oscillatably mounted on said rocker, an adjustable screw between said rocker and gripper jaw for precision adjustment of the bite of the jaw when the rocker has been moved to its limit of motion, quick release means for temporarily releasing said jaw without changing the adjustment of the aforesaid screw, adjustable positive stop means on opposite sides of the slide for positively limiting the motion of the slide and consequently the extent of feed, linkage connected to said rocker for reciprocating the rocker and the slide, said linkage including a connecting rod comprising a tubular sleeve connected to a bearing at one end, a piston-like member slidable in said sleeve, compression springs disposed in said sleeve on opposite sides of said piston, and a piston rod extending from said piston to a bearing at the opposite end of the connecting rod.

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