Nov. 12, 1968 G. V. ROCH 3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 1

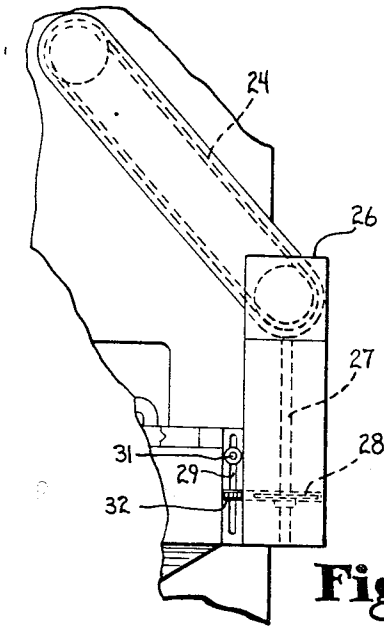


Fig. 2.

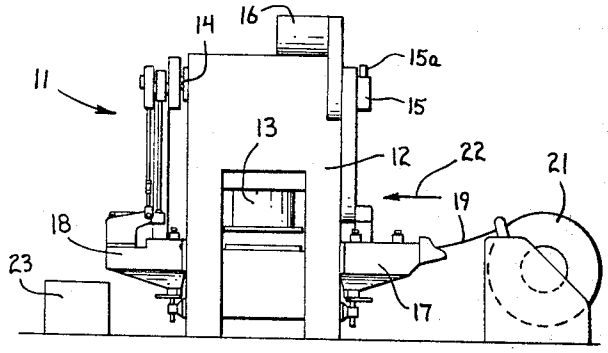


Fig. 1.

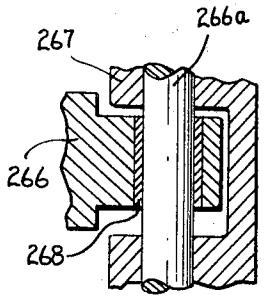


Fig. 16.

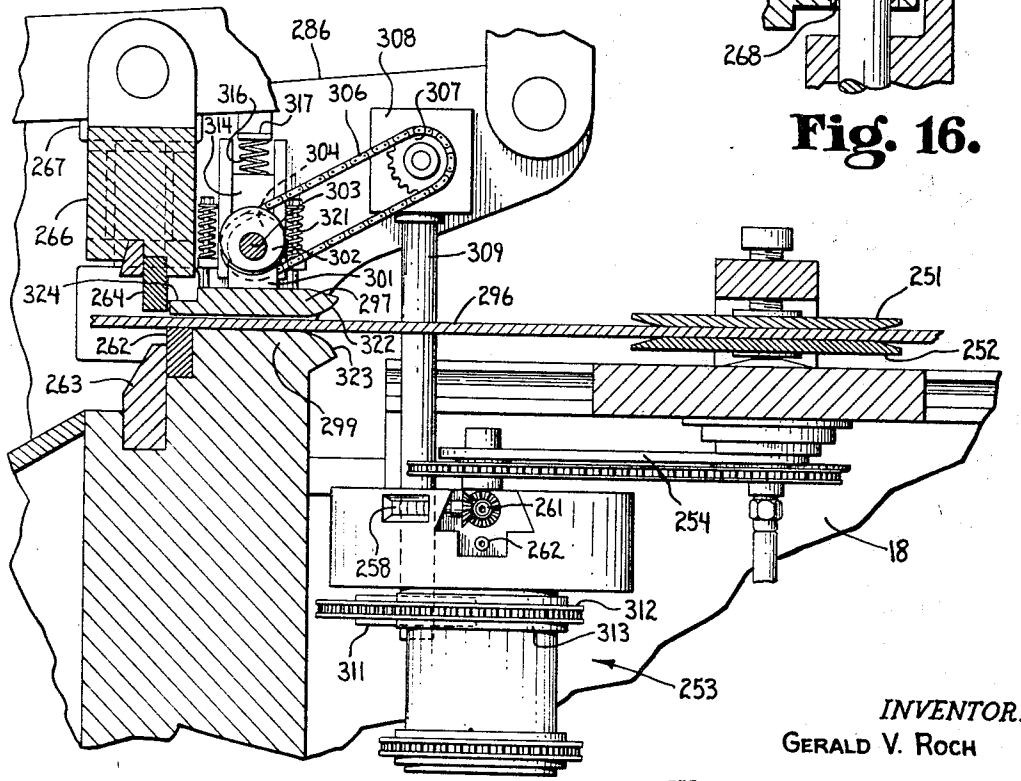


Fig. 15.

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Nov. 12, 1968 G. V. ROCH 3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 2

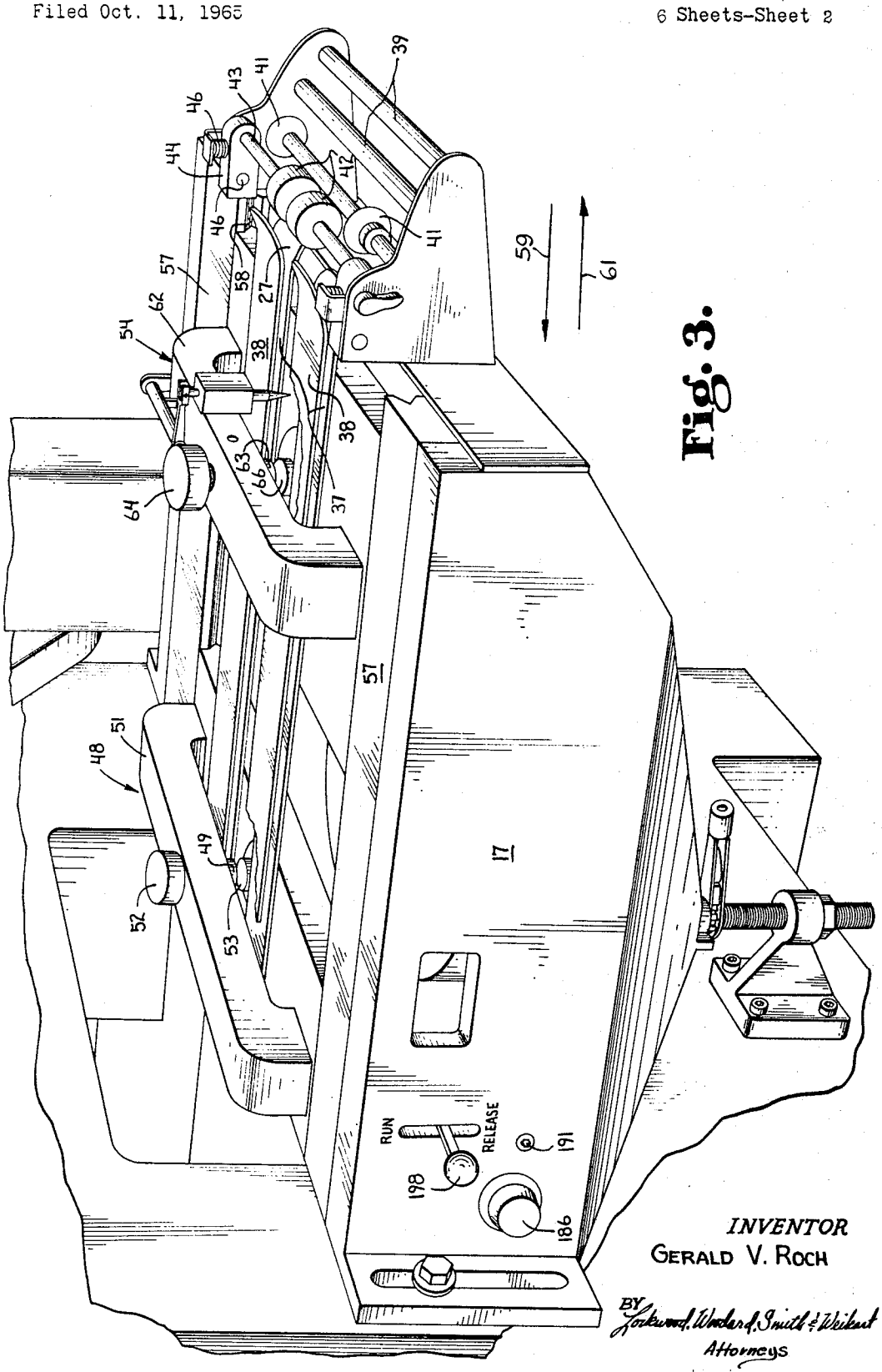


Fig. 3.

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STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 3

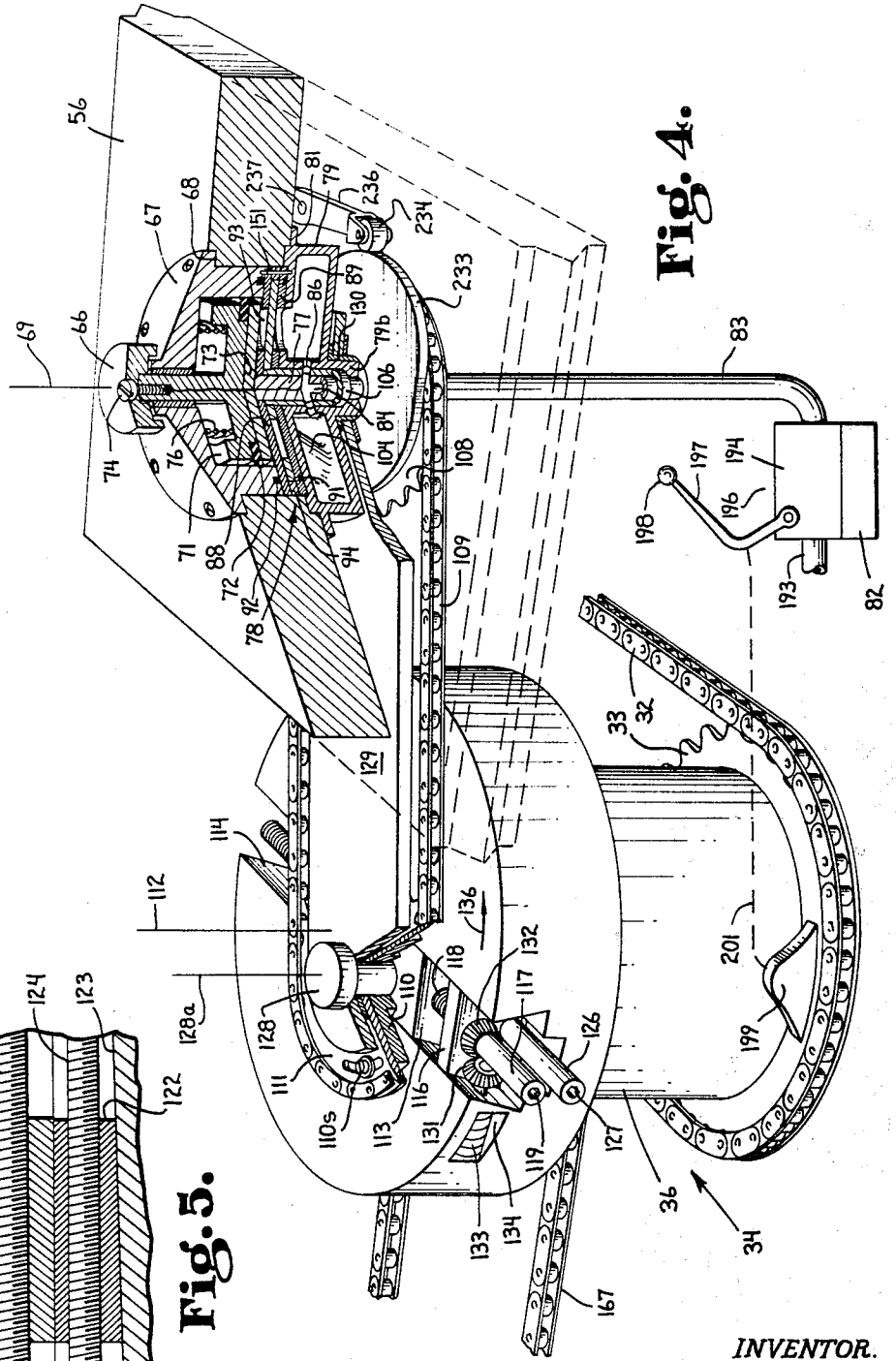


Fig. 4.

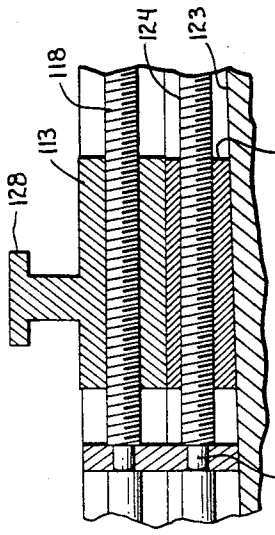


Fig. 5.

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Nov. 12, 1968 G. V. ROCH 3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 4

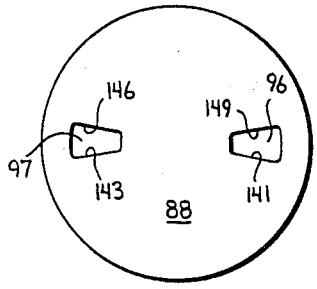


Fig. 6.

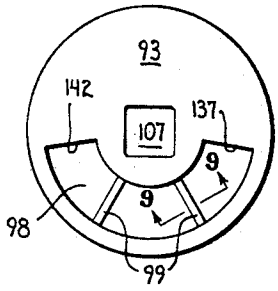


Fig. 7.

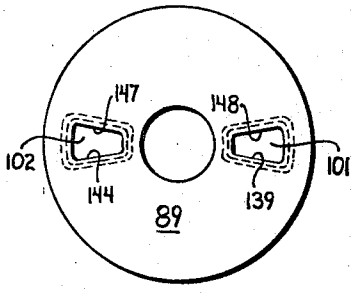


Fig. 8.

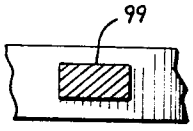


Fig. 9.

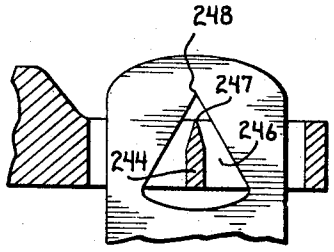


Fig. 11.

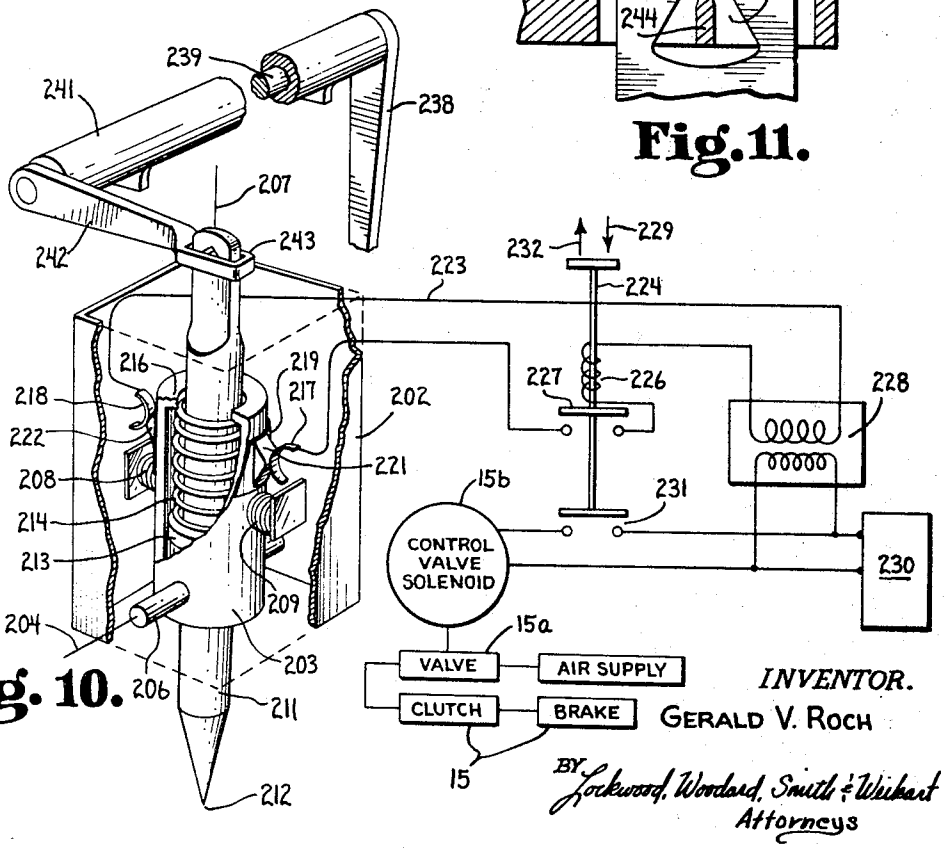


Fig. 10.

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Nov. 12, 1968 G. V. ROCH 3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 5

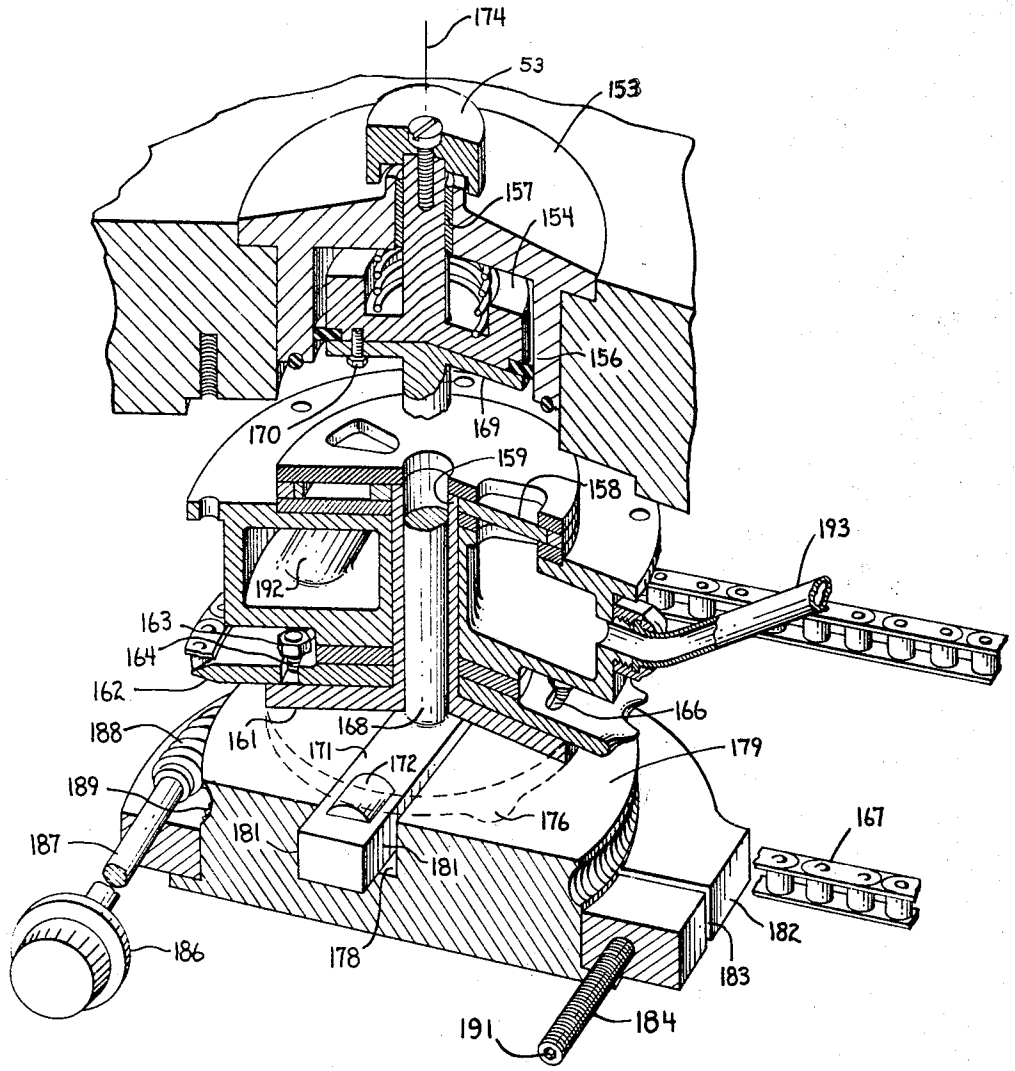


Fig. 12.

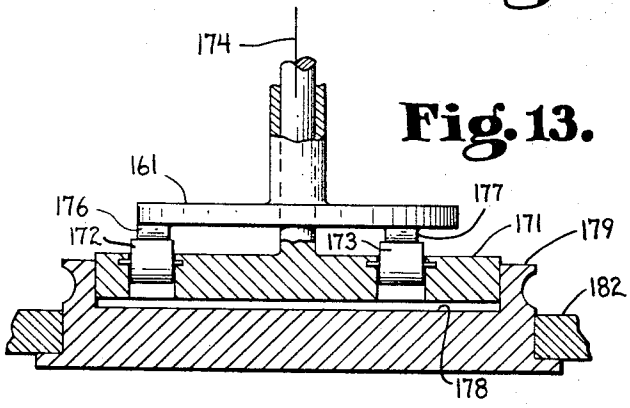


Fig. 13.

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Nov. 12, 1968 G. V. ROCH 3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Filed Oct. 11, 1965 6 Sheets-Sheet 6

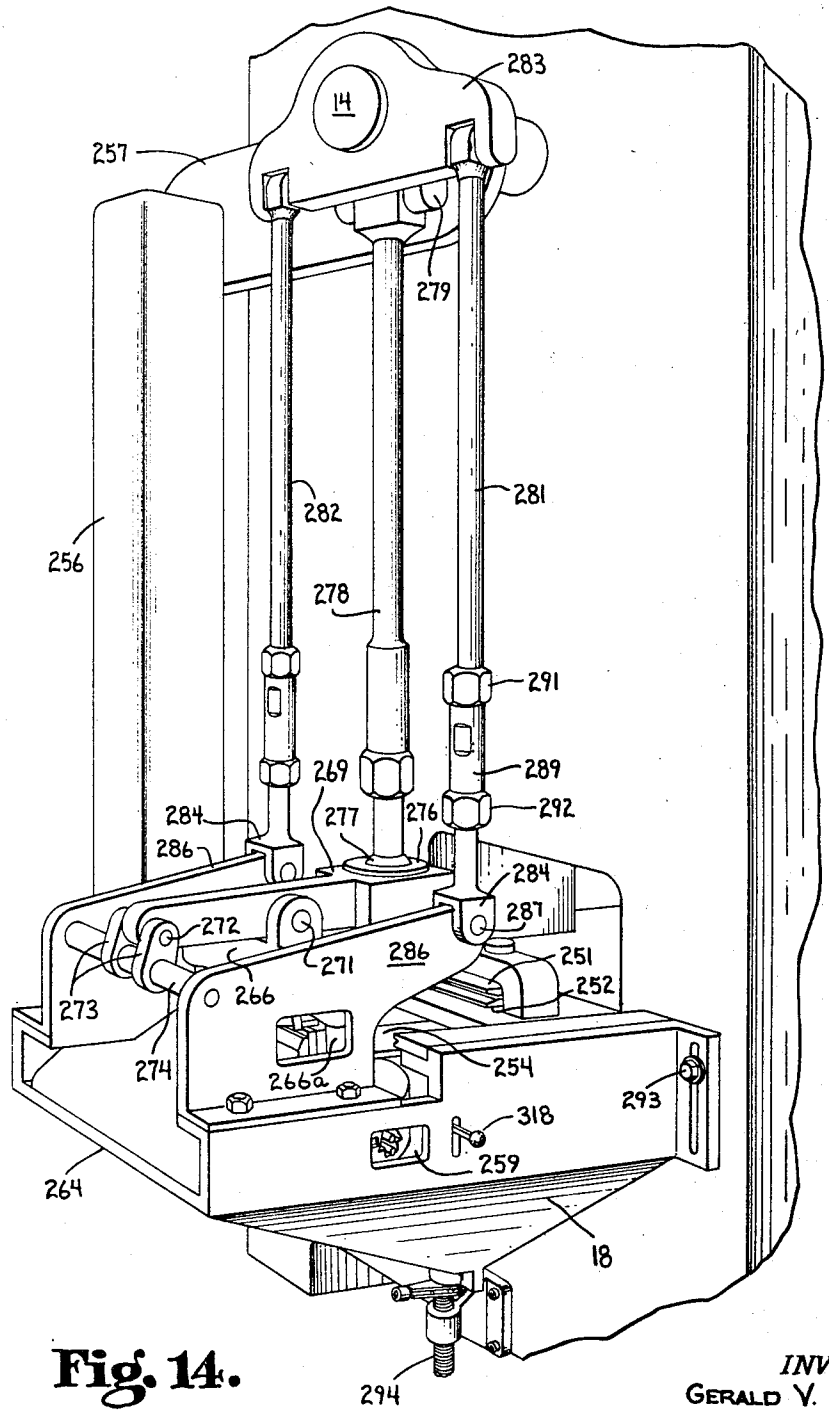


Fig. 14.

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United States Patent Office 3,410,161 Patented Nov. 12, 1968

3,410,161

STOCK FEEDING APPARATUS FOR PUNCH PRESSES AND THE LIKE

Gerald V. Roch, New Augusta, Ind., assignor to E. L. Humston Co., Inc., Indianapolis, Ind., a corporation of Indiana

Filed Oct. 11, 1965, Ser. No. 495,453
18 Claims. (Cl. 83—67)

ABSTRACT OF THE DISCLOSURE

Press apparatus having stock feed means including pneumatically operated grippers and retainers, the gripper being on a slide linked to an eccentric mechanically driven by the press crank shaft, with mechanically driven rotary valves mounted on the gripper and retainer directly for control thereof. An override or retainer release mechanically driven and readily adjustable by an external control knob for synchronization with die pilot pins. A misfeed detector including a carbide tipped vertically disposed plunger tiltable upon detection of misfeed to operate contactors in a press stopping circuit in the event of a press feed error. A scrap feed and chopper including a pneumatically actuated gripper on a slide linked to an eccentric which is mechanically driven by the press crankshaft, and a mechanically driven scrap retainer including a spring-biased cam-operated retainer shoe accommodating variations in stock thickness resulting from punch operation, and a scrap chopper including a shear blade following the scrap retainer and having a drive rod driven from the press crankshaft by an eccentric on the crankshaft, the lower end of the drive rod being received in a ball bearing box, and a pair of tension rods mounted in suitable bearings between the press crankshaft and the scrap feed and chopper bracket to prevent dislodging of the bracket by the scrap chopper action.

Background of the invention

This invention relates generally to stock handling equipment for metal working machines, and more particularly to metal stock feeding and scrap cutting apparatus employed in press operations.

In press operations, it is common practice to employ stock feeding apparatus at the input end of the press and at the scrap output end of the press for chopping the scrap strip into acceptable lengths and depositing in scrap bins. Some equipment presently available is incapable of handling heavy strip stock, is highly sensitive to variations in stock thickness and straightness, is incapable of reliably detecting feed errors, responds too slowly to detection of feed errors to avoid damage, applies excessive loads to scrap cutter brackets, is inconvenient to adjust for proper relationship to the press operating cycle or for feed length, or has other disadvantages. In addition to general inconvenience caused by such shortcomings, expensive machine and die damage and "down time" can result.

It is therefore a general object of the present invention to improve stock feeding and scrap cutting functions in press operations.

A further object is to provide reliable and easily adjustable coil stock feeding for presses.

A further object is to provide reliable and fast-acting detection of any errors in feeding, and machine shutdown in the event of error detection.

A further object is to provide high capacity scrap cutting apparatus without providing direct floor support therefor.

A further object is to provide equipment achieving

the foregoing objects and facilitating the starting of stock from new coils without feed length errors.

A further object is to provide apparatus achieving the foregoing objects and wherein accurate timing of stock release to permit die pilots to precisely position the stock, is easily and readily achieved.

A further object is to provide press feed apparatus which can feed with precision at high speeds to enable achievement of maximum production rates from high speed presses.

Described briefly, a typical embodiment of the present invention employs input and output feed apparatus at opposite ends of the press, the input feed apparatus serving to feed stock to the press, and the output feed apparatus serving to feed scrap from the press to the scrap cutter for the cutting thereof and deposit in a scrap container. The input feed includes a gripper mechanism and a retainer mechanism, both of which are mounted on a bracket secured to the press frame. Both of these mechanisms employ gripping members operable, when actuated, to engage the metal stock adjacent thereto and force it against an anvil. Each of these gripping members is driven by an air operated piston which is controlled by a rotary valve. The gripper mechanism is mounted on a slide which is reciprocable on the bracket toward and away from the press frame by a positive mechanical drive which is so connected to the press crankshaft as to avoid any backlash or slippage. The same mechanical drive is used to control operation of the valves for the gripper mechanism and retainer mechanism.

Easily adjustable feed length adjustment and retainer release timing means are provided on the input feed apparatus. A selector lever is also provided to release pressure in both the feed gripper and retainer supplies, but an automatically operating cam is operable to override the feed selector for replenishing the gripper and retainer air supplies in timely fashion when a new strip of stop is started through the machine, thus providing an automatic starting gage.

On the output feed, a gripper like that at the input feed is provided. The retainer at the output feed includes an active shoe member, mechanically driven by a cam which is mechanically driven by the output feed gripper drive, and a lower shoe serving as an anvil, with the stock being gripped between the shoes at the proper time. The cam and upper shoe are arranged to accommodate variations in thickness as well as burrs and bends in the scrap stock issuing from the press. The upper shoe also serves as a stripper for the scrap cutter which is positioned immediately behind the output retainer.

The scrap cutter itself is driven directly from an eccentric on the press crankshaft but tension rods are provided on the press crankshaft so that the load applied to the cutter from the cutter drive rod is taken largely in the tension rods, to minimize shear loads on the scrap feed and cutter support bracket.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

FIG. 1 is a schematic elevational view in reduced scale, illustrating a press with stock supply and feeding apparatus and scarp feeding, chopping and disposal apparatus.

FIG. 2 is a fragmentary elevational view showing the vertical shaft drive from the press and permitting height adjustment.

FIG. 3 is a perspective view of the stock input feeder.

FIG. 4 is a perspective view, partially in section, of the gripper slide and rotary valve mechanism therefor and drive therefor.

FIG. 5 is an enlarged fragmentary section through the

feed length adjustment and locking apparatus of FIG. 4.

FIG. 6 is an enlarged top plan view of the upper porting plate of the rotary valve.

FIG. 7 is an enlarged top plan view of the rotary plate thereof.

FIG. 8 is an enlarged top plan view of the lower plate thereof.

FIG. 9 is a section taken at line 9—9 in FIG. 7 and viewed in the direction of the arrows.

FIG. 10 is an enlarged perspective view, partially in section, of a feed length detector, and showing schematically one example of circuitry which may be incorporated therewith.

FIG. 11 is a much enlarged fragmentary sectional view of the plunger lifting arm connection to the plunger.

FIG. 12 is a perspective view, partially in section, of the retainer portion of the press input feed apparatus, including the control valve and mechanical release therefor.

FIG. 13 is a fragmentary section therethrough illustrating the retainer release T bar and cam followers therefor.

FIG. 14 is a perspective view of the press output feed and scrap chopper apparatus.

FIG. 15 is a fragmentary side elevational view of the scrap stock gripper and retainer and drive therefor.

FIG. 16 is an enlarged fragmentary elevational view showing the chopper guide mounting.

Referring now to the drawings in detail, the press **11** includes a frame **12**, a ram **13** which is vertically reciprocable in the frame by rotation of the crankshaft **14** which is driven by the motor **16**. In the illustrated embodiment, the crankshaft is driven by the motor through a combination clutch and brake unit **15**, the clutch portion of which is pneumatically engaged by air pressure applied through a solenoid valve **15***a* and, upon disengagement thereof, the brake is automatically applied to stop the press crankshaft. Such units are well known in the art. A press feed bracket **17** is mounted to the frame at one end thereof and is vertically adjustable thereon. An output feed and scrap cutter support bracket **18** is mounted to the press frame at the opposite end thereof and is also vertically adjustable.

Metal stock in the form of a strip **19** is supplied from a coil or roll **21** and is fed through the press in the direction of the arrow **22**. As the press operates, the parts produced thereby may be discharged from one or the other side thereof through the bottom and the punched out strip of stock, which is now scrap, is cut in to desired lengths and deposited in the scrap bin **23**.

To drive the feed apparatus according to the present invention, positive drive means are employed. Accordingly there is no slip between the crankshaft and the stock gripper of the present invention, as will presently become apparent. To achieve this result in the illustrated embodiment, a chain drive **24** is provided from the crankshaft to a right angle drive box **26** mounted to the press frame **12**. The right angle drive box has a vertical output shaft **27** having a drive sprocket **28** splined thereto, the sprocket **28** being mounted to the press feed support bracket **17**. Accordingly, when vertical adjustment of the press support bracket is required to obtain different feed line heights, as made possible by the vertical slots **29** and bolts **31** connected to the press frame, the sprocket **28** can move up and down as required with respect to the drive shaft **27**.

The sprocket **28** is connected by the roller chain **32** to the sprocket **33** secured to the lower end of a main press feed drive assembly **34**. Sprocket **33** has arcuate slots therein receiving circularly spaced bolts secured in the bottom of the main press feed drive drum **36** which is mounted for rotation in the press feed support bracket, this rotation being on a stationary vertical axis therein. Accordingly, rotation of the press crankshaft causes rotation of the main press feed drive drum **36**, and one turn of the crankshaft causes one turn of the drum **36**.

The press feed support bracket includes a pair of lower stock guides **37** and a pair of upper stock guides **38**, the upper stock guides being disposed immediately above the lower stock guides. The stock enters these guides over the slack loop support rolls **39**, between the edge guides **41** and under the antibackup rolls **42**. The antibackup rolls are mounted to a shaft **43** whose outer ends are connected to arms **44** which are pinned at **46** to the press feed support bracket **17**. Springs **47** hold the antibackup rolls down on the stock to prevent the slack loop from pulling the stock away from the press at any time.

According to the present invention, retainer assembly **48** is provided on the feed support bracket **17** and includes a feed stock retainer anvil **49** affixed to the bridge **51** but vertically adjustable by the use of the knob **52**. While this anvil **49** is passive, being stationary, an active retainer anvil **53** is provided directly below it and below the level of the top surface of the lower stock guides **37**.

In order to move the stock from the slack loop to the retainer, the gripper assembly **54** is provided. This includes a gripper slide **56** which is received in and supported by the gibs **57** having inwardly facing ways **58** which happen to be V-shaped in the illustrated example. The slide is movable in these ways toward the press in the direction of the arrow **59** and away from the press in the direction of the arrow **61**. Movement from the "home" position toward the press is accomplished during a feed stroke and the return stroke is in the direction of the arrow **61**.

A bridge **62** is affixed to the press feed gripper slide **56** and has an anvil **63** affixed thereto above the stock fed into the press but adjustable vertically by means of the knob **64**. Immediately below this anvil **63** is an active gripper anvil or gripper member **66**, which is disposed at nominally the same elevation as the retainer member **53**, below the level of the upper surface of the lower stock guides **37**.

The gripper member is actuated by an air piston which forces it upwardly to grip the stock between the gripper member and the gripper anvil above the stock. The retainer member is operated in essentially the same way, but has a mechanical override feature also. Referring first, therefore, to the gripper member actuating means, a downwardly opening air cylinder **67** has a flange supported in and bolted to the recess **68** in the gripper slide **56**. This cylinder is symmetrical with respect to a vertical axis **69** which, for convenience, can be considered centered horizontally between the ways or gibs **57**. A piston **71** is received in this cylinder and sealed to the wall thereof by a sliding seal ring **72** and has an upwardly extending shaft to which the gripper member **66** is secured by a screw **74**. The piston is biased downwardly normally by the return spring **76** and has a retainer plate **73** secured to the lower end thereof and rests against a stop which may be provided, for one example, in the form of an apertured plate member **88** of a rotary valve which will now be described.

According to another feature of the invention, air pressure is applied to this piston by means of a rotary valve assembly **78**. This valve assembly is supported by a surge chamber member **79** having a flange **81** thereon by which it is bolted to the underside of the gripper slide **56**. Air is supplied from a source **82** which may be located anywhere, through the flexible pipe **83** and up through the hollow center passageway **84** of the shaft **77** and out through horizontal ports **86** to the surge tank. A comparatively large quantity of air is thereby provided under pressure in the surge chamber **87**.

The rotary valve includes upper and lower stationary porting plates **88** and **89**, respectively, the lower plate being sealed to the upper surface of the surge tank by an O-ring seal **91**, and the upper surface of the upper valve plate being sealed to the air cylinder by the O-ring seal **92**. A rotary plate **93** is disposed between these plates and a sealing fit is provided between the upper

surface of the rotary plate and the lower surface of the upper plate, and between the lower surface of the rotary plate and the upper surface of the lower plate. Appropriate spacing for achieving this sealing relationship and yet allowing freedom of rotation of the valve is provided by the spacer ring **94** between the plates and surrounding the rotary plate.

As shown in the top plan views of these plates, the upper plate **88** has two apertures **96** and **97** therein, spaced approximately 180 degrees apart. The rotary plate **93** has an arcuate aperture **98** therein which extends approximately 180 degrees, suitable support for the outer portion of the plate adjacent this port being provided by the spokes **99** which are not as thick as the plate and therefore do not impede passage of air therearound from one portion to the next adjacent portion of the port **98**. The lower plate **89** has the ports **101** and **102** therein which are located approximately 180 degrees apart. There may be an O-ring seal in a groove **103** on the lower face of the lower plate around the port **102**, for sealing to the upper surface of the surge tank where an exhaust or vent pipe **104** opens into the top surface of the surge tank. This vent pipe **104** passes through the surge tank and is open at its outer end to atmosphere. The operation of the rotary valve will best be understood if the means for providing the drive therefor, are first described.

The rotary plate drive shaft **77** passes upwardly through the stationary bushing **106** and therefore, through the surge tank, and is received in a central aperture **107** of the rotary seal plate **93**, the fit between the upper end of this drive shaft and the seal plate being sufficiently loose to avoid any binding between the rotary and stationary seal plates. The drive shaft is connected to a sprocket **108** pinned thereto and which is driven by a roller chain **109** which is, in turn, driven by a sprocket **111**.

The main press feed drive drum **36** is mounted in the press feed support bracket **17** for rotation on a stationary vertical axis **112**. Again, for purpose of convenience, this axis should be considered located mid-way between the gibs **57**, so that it is coplanar with the axis **69** in a plane parallel to the ways **58**. This drum **36** is used to provide an eccentric drive by means of a drive block **113** received in a dove-tail channel **114** extending horizontally diametrically through the center of the drum. A bearing block **116** is fixed in the drum and receives and supports a feed length adjustment screw shaft **117** having the screw **118** thereon which is threadedly received in the eccentric drive block **113**. This adjustment screw has an outwardly opening tool receiving socket **119** therein which is at the outer surface **121** of the drum and facilitates insertion of an allen wrench or other suitable tool therein for rotating the screw. By rotating this screw, the position of the drive block **113** radially with respect to the axis **112** can be varied to the extent desired. To lock the block in any desired position, a wedge **122** is provided thereunder having its lower surface on the upwardly sloping surface **123** in the drum and having a wedge advancing screw **124** threadedly received therein. This wedge advancing or fixing screw has a shaft **126** extending through and longitudinally located by the bearing block **116**. It has a tool receiving socket **127** in the outer end thereof opening at the surface **121** of the drum to permit insertion of an allen wrench or other tool for securing the wedge tightly under the drive block once the block has been located as desired.

The drive block has an upwardly extending spindle **128** therein to which is keyed or splined the sprocket mounting disc **110**. Sprocket **111** is mounted on disc **110** and may have circularly spaced arcuate slots therein through which the shanks of screws **110S** extend, these screws being threadedly received in disc **110** and securing the sprocket **111** thereto. One end of a slide operating link **129** is also connected to the spindle **128** but is neither splined nor keyed thereto, being freely pivotally attached thereto. The other end of this link is received on the stationary cylindrical bushing **130** surrounding the downwardly projecting cylindrical boss **79*b*** at the bottom of the surge chamber, but is neither splined nor keyed thereto and is, in effect, only pinned thereto. Accordingly, as the drum **36** is rotated, if the spindle **128** is not concentric with the axis **112**, it can serve to reciprocate the slide **56**. The amount of reciprocation, and therefore the feed length, is determined by the radial distance between the axis **128*a*** of the spindle and the feed drive drum axis **112**. A precise adjustment of this can be accomplished by the feed length adjustment screw **117** which has a gear **131** thereon geared to four digit drum register or counter assembly **133**, numerals of which can be viewed through the window **134** in the drum surface **121**.

A mentioned previously, the positive drive from the press crankshaft to the main press feed drive drum **36** is such that there is one revolution of the drum **36** per one revolution of the crankshaft. The result is that for each revolution of the press crankshaft, the press feed gripper slide **56** is moved from home position toward the press for a feed stroke and is then moved back to home position to complete a feed cycle. During this one revolution, there is to be one revolution of the rotary valve plate. This is achieved according to the illustrated embodiment of the present invention by making the sprocket **108** on the rotary plate drive shaft **77** the same size as sprocket **111** on the drive spindle **128**. Therefore, assuming that the drum **36** rotates in the direction of the arrow **136**, which is counterclockwise, the rotary valve plate **93** rotates in the same direction. When the link **129** has returned the slide to near home position, so that longitudinal motion has reduced to a minimum, the leading edge **137** of the port **98** uncovers the edge **139** of the port **101** in the lower plate and the edge **141** of the aperture **96** in the upper plate. Air from the surge tank immediately passes through the ports **101**, **98**, and **96** in succession and fills the area immediately under the gripper piston **71** and starts forcing the piston upwardly. The gripper member **66** engages the stock and forces it against the gripper anvil **63** to tightly grip the stock. The clamping force thus achieved on the stock by the gripper can be established at any desired value, but a dimensioning of parts to achieve 6300 pounds force at 100 pounds per square inch pressure under the gripper piston is considered satisfactory for many applications. As the leading edge **137** of the rotary plate meets the leading edge **141** of the upper stationary plate, the trailing edge **142** of port **98** has already passed the trailing edge **143** of the upper plate and the trailing edge **144** of the lower plate, so that there is no chance of venting either the air from the surge chamber or air from underneath the piston.

At the end of the feed stroke, the leading edge **137** of the rotary plate meets the leading edge **146** of the vent port **97** of the upper plate and also meets the leading edge **147** of the vent port in the lower plate, to begin venting air from the area below the piston. It is vented through the pipe **104** to atmosphere, this pipe being isolated from the surge tank although it passes through the same for convenience. Immediately prior to the beginning of the venting function, the trailing edge **142** of the port **98** in the rotary plate has passed the trailing edge **148** of port **101** in the lower stationary plate and the trailing edge **149** of the port **96** in the upper stationary plate, so that there is no loss of air from the surge chamber to the atmosphere when venting begins. Also the dissipation of pressure under the gripper piston is accomplished rapidly for a positive release of the gripper member from the stock.

In order to be sure that the timing of the sequence of valve events corresponds properly with the timing of the feed and return strokes, it is necessary that the stationary plates be secure from rotation and this can be accomplished by a dowel pin **151** into the surge tank or piston cylinder. Also the fit between the aperture **107** and the

drive key upper end of the rotary plate drive shaft **77** must be accurate enough to avoid rotational backlash and yet loose enough to avoid binding. Finally, to change value timing with respect to the slide movement, the screws **110S** may be loosened to permit sprocket **111** to rotate with respect to its drive spindle **128** to the extent permitted by the arcuate slots in the sprocket. The screws can then be tightened. Other means could also be employed, but facility for adjustment is desirable.

The press input feed retainer member **53** is actuated in much the same manner as is the press input feed gripper member. There is included the cylinder **153** affixed to the input feed support bracket and receiving the retainer actuator piston **154** therein, with the ring seal **156** being provided therebetween. The rotary valve construction is the same including lower and upper stationary plates which may be similar to those for the gripper control valve and a rotary valve plate which may also be similar. It may be desirable, however, to provide a lower clamping force for the retainer, such as 1900 pounds at 100 pounds per square inch in the surge chamber, for example. Accordingly, diameters of the piston seal and cylinder would be less than that for the gripper piston. For conservation of space, therefore, the valve plates can be smaller than those provided for the gripper. As is the case with the gripper, the piston rod is received in and supported by an oil containing bushing **157** mounted in the air cylinder.

The rotary valve plate **158** for the retainer control valve is driven by a sleeve **159** affixed to or a part of a disk **161**. The upper end of the sleeve may be rectangular or some other configuration fittingly received in a matching central aperture in the rotary plate **158**, similar to that for the gripper control valve, to enable the sleeve to drive the plate. The drive for the disk **161** is provided by a sprocket **162** mounted to the disk and affixed thereto by the nuts **163** received on upstanding studs **164** in the disk **161**, there being the arcuate slots **166** in the sprocket to accommodate rotational adjustment for timing the valve event sequence with respect to the operation of the drum **36**, and therefore with respect to the operation of the gripper feed slide. This timing is arranged so that as the roller chain **167** driven by the drum **36** drives the rotary valve for the retainer, and the slide is moved by the crank link **129**, pressure is applied under the piston in the retainer immediately before release of pressure from the piston in the gripper so that for a short interval the stock is clamped by both the gripper and the retainer. Thereafter, the pressure remains under the piston in the retainer until the slide has again returned home and clamping pressure has again been applied to the gripper piston. Thereupon the retainer control valve releases pressure from under the retainer piston allowing it to unclamp due to the action of the piston return spring therefor.

One important feature of the construction of the retainer according to the present invention is the retainer override or release means employed to permit the proper functioning of the die pilot pins commonly used in die sets to precisely locate stock in the press during the actual forming operation. In the retainer assembly, the shaft **168** passing up through the center of the valve drive sleeve **159** serves as the retainer release shaft. The disk **169** at the upper end thereof is secured to the retainer piston **154** by bolts **170**, for example, so that the release shaft and piston are operable in unison. In other words, if the piston rises, so does the release shaft and if the release shaft is held downwardly, so is the piston held downwardly.

At the lower end of the retainer release shaft there is a horizontal bar **171**. This bar has two cam follower rollers **172** and **173** therein, follower **172** being disposed at a different radius with respect to the axis **174** than is the follower **173**. Both of these followers are disposed below the disk **161** on the valve drive sleeve lower end, and the disk **161** has two retainer release cams **176** and **177** thereon. Cam **176** is a downwardly projecting cam and is disposed at a radius from the axis **174** such as to enable engagement with the follower roller **172**. The cam **177** is closer to the center of the disk **161** and 180 degrees away from the cam **176** and is engageable with the follower roller **173**.

The spacing of the upper surfaces of the cam follower rollers **172** and **173** with respect to the lower face of the disk **161** is such that when there is no pressure applied under the retainer piston **154**, there is no contact between the disk **161** or the cams **176** and **177** thereon, and the follower rollers. In contrast, however, when the air pressure is applied under the piston **154** to move it up so that it can grip stock between the gripper member and the gripper anvil, the follower rollers are engageable by the cams, roller **172** being engageable by cam **176** and roller **173** being engageable by cam **177**. Accordingly, as the disk **161** is rotated by the sprocket **162**, and also rotates the control valve rotary plate, the retainer release bar **171** is driven downwardly once per revolution by the cams **176** and **177** to overcome the air pressure applied to the retainer piston and drive it, and therefore the retainer member, downwardly to release the stock. This is done so that once the press die pilot pins have entered locating holes in the stock, they can precisely locate the stock in the press and the retainer member interferes in no way with this precise locating function. The provisions of two cams and followers is to rather evenly distribute the load downwardly on the shaft so as to avoid undue cocking forces. The two followers and two cams are located on different radii to avoid releasing the retainer twice per revolution, rather than the one time desired per revolution.

The pilot release timing with respect to the press crankshaft is made adjustable by mounting the T-bar **171** in a channel **178** in a gear wheel **179** mounted in the feed support bracket **17** for rotation on the axis **174**. The channel **178**, which extends diametrically across the gear wheel in the upper surface thereof fits the bar **171** so that upon rotation of the gear wheel **179**, the bar is rotated also, without any backlash. Although there is a close fit between the sides **181** of the bar and the sides of the channel **178**, the bar can still move up and down in the channel to permit retainer release by the release cams. The gear wheel **179** is normally clamped in a desired rotational position by the encircling split clamp **182** which is split at **183** and has a tightening screw **184** therein to affix the gear wheel at any desired rotational position. To facilitate rotation of the gear wheel, a release timing adjustment knob **186** is provided on the shaft **187** on which is mounted the worm **188** engaging the gear **189** on the gear wheel. This knob **186** extends out from the front of the feed support bracket for easy access, and the gear wheel clamping screw may have a tool receiving socket **191** therein also exposed at the outside of the mounting bracket **17**, adjacent the knob. Therefore, to adjust the timing of the release, with respect to the crankshaft position, it is necessary only to release the clamp by means of the screw therefor and adjust the knob **186** appropriately.

Further with reference to the retainer, a vent pipe **192** is provided which passes through the surge tank and discharges to atmosphere at the bottom of the surge tank. However the air supply does not come through the central shaft as it does in the gripper, but rather is provided by the conduit **193** entering the wall of the surge tank. This conduit is also connected to the air supply source **82**. However the connection from the air supply source **82** to the conduit **193** for the retainer and the conduit **83** for the gripper, is provided by means of a manual valve **194**. This valve, which may be a conventional valve, has at least two positions. In one of these positions it connected the conduits **83** and **193** to the supply source **82** and in the other position closes off the supply source

82 and vents the conduits 193 and 83 to atmosphere as at the vent port 196. A sequence selector lever 197 having a knob 198 at the outer end thereof and outside the feed support bracket, is shown schematically connected to the manual valve. When this selector lever is in the up position it applies pressure from the source to the two conduits 83 and 193. When it is in the down position it vents the supply conduits and shuts off the connection to the source. An automatic starting gage is provided in connection with this sequence selector. The automatic starting gage includes a cam 199 which, for convenience, is shown mounted to the sprocket 33 and is engageable with a linkage designated by the dotted line 201 which when actuated by the cam serves to move the selector lever 197 from the release position to the run position.

In the use of the sequence selector, once the supply of stock from the supply roll 21 has been exhausted at the feed side of the machine, the sequence selector can be pushed downwardly to the release position on that which ever of the gripper or retainer pistons is pressurized will be depressurized, so that neither the gripper nor retainer is tending to grip stock. This sequence selector is left in the release position, but the cam 199 is located so that after the gripper slide has moved toward the press to its inmost point and the control valve for the gripper member has moved to a point where it closes off the supply to the gripper piston, the cam 199 moves the sequence selector to the upper or "run" position so that the manual valve 196 no longer vents the air supply conduits and air is again supplied from the source 82 to the gripper and retainer surge chambers. Accordingly the gripper is enabled to grip a new strip of stock for the next feed stroke.

To avoid damage which could possibly occur if the stock slipped in the gripper during a feed stroke, a feed length or misfeed detector is employed according to another feature of the present invention. This includes a housing affixed to the bridge 62 on the press feed gripper slide. A plunger guide cylinder 203 is pivotally mounted on a horizontal axis 204 by means of the trunnion pivot pins 206 received in opposite faces of the housing 202. Accordingly, the guide cylinder 203 can pivot toward and away from the bridge, the axis 204 being perpendicular to the direction of travel of the gripper slide. The cylinder has a cylindrical axis 207 which is normally maintained in a vertical position by the snubber or centering springs 208 and 209 disposed between opposite end walls of the housing and the wall of the guide cylinder at diametrically opposed points.

A reference plunger 211 is guidingly received in the guide cylinder 203 and has a carbide tipped pointed lower end 212. The plunger has the annular flange 213 therein against which the plunger actuating spring 214 is seated at its lower end, the upper end of the spring being seated on the inwardly turned flange 216 at the upper end of the guide cylinder. Accordingly the plunger is normally biased downwardly and the spring and plunger tip are usually selected so that a very slight penetration of the stock being used can be obtained if the plunger is allowed to rest against the stock with the force applied to the plunger by the spring 214.

From the foregoing description, it should be understood that if the plunger is allowed to rest on the stock being gripped by the gripper member, there will be no tipping of the plunger during the feed stroke and the axis 207 will remain vertical, unless there is some longitudinal slippage or movement of the stock with respect to the gripper. If the stock slips in the gripper, so that less than the proper amount of stock is fed into the press during the feed stroke, the lower point of the plunger resting in the dent it made in the stock will move away from the gripper bridge, slightly tipping the upper end toward the bridge. This tipping effect is utilized immediately to stop the press. This is accomplished by providing a pair of fixed electrical contactors 217 and 218 mounted to the detector housing 202 and insulated therefrom. An electrically conductive strip 219 may be placed around the cylinder 203 and secured thereto but electrically insulated therefrom and provided with contactors 221 and 222 at opposite ends thereof. It will be apparent, therefore, that if the plunger guide cylinder tips in response to tipping of the plunger, these contactors 221 and 222 will move toward or away from the gripper slide bridge. In so doing, contact of one of these contactors will be broken with the fixed, housing-mounted contactor which is normally electrically contacting it. Accordingly the press stop circuit 223 is broken. This stop circuit can be any one of a variety of constructions but for purposes of illustration it may be considered the holding coil circuit for a relay armature 224, the stop circuit including the holding coil 226, the contactors 227 and the transformer 228. If the relay armature is moved in the direction of the arrow 229, either manually or by solenoid action, the coil 226 is effective to hold the armature in position keeping the contact points 227 closed to complete the stop circuit. At the same time, the switch 231 from the electrical supply 230 to the solenoid 15*b* for clutch supply valve 15*a* is closed. Two lines from the electrical supply 230 are used to supply the primary winding of transformer 228. Accordingly, if the plunger tips, it will break the stop circuit and allow the spring loaded main line relay armature 224 to move in the direction of the arrow 232 and open the line switch 231 and the crankshaft drive clutch (FIG. 1) will be disengaged and the crankshaft brake applied to stop the press.

In order to raise the plunger at the proper time and permit descent thereof at the proper time, a detector control cam 233 is provided which is secured to or part of the sprocket 108 and therefore driven by the gripper slide valve drive chain 109. This cam is followed by a detector control cam follower assembly including a roller 234 mounted on the lever 236 pivoted to the gripper slide at 237. The other end of this lever engages the crank arm 238 connected to the shaft 239 received in the bushing sleeve 241 affixed to the gripper slide bridge. At the other end of the shaft 239 the crank 242 is secured and is provided with a yoke 243 at its distal end and receiving the upper end of the plunger therein. A knife edge bar 244 extends across the yoke through an aperture 246 in the upper end of the plunger. This bar has a knife edge 247 at the upper margin thereof which is directly aligned with the vertex 248 of the downwardly opening notch of the aperture in the plunger. The length of the plunger aperture measured in a direction perpendicular to the plunger axis and tangent a circle concentric with the plunger guide pivot axis 204 is great enough to permit the plunger to tip either toward or away from the slider bridge, which is therefore a tipping in the direction of the feedstroke or directly opposite the feed stroke, without interference from the knife edge bar. At least no interference occurs until the tipping is sufficient to break the press stop circuit. This relationship can be achieved readily.

The detector control cam is located to lift the plunger at the end of the feed stroke, and then permit its descent to penetrate the stock again immediately before the next subsequent feed stroke. Accordingly the timing of this particular cam can be essentially the same as the timing for the application and venting of pressure at the gripper piston. The plunger guide and plunger assembly is arranged so that at all times the center of gravity thereof is located very near the pivotal axis 204 so that tipping which might otherwise result from inertia effect is avoided, and there will be no false stops of the machine either during the feed stroke or return stroke of the gripper slide.

The press scrap output and chopper feed apparatus is very much like the press input feed apparatus, so far as the gripper and drive therefor are concerned. However the scrap feed gripper assembly employs an upper

shoe 251 instead of a circular button type anvil employed in the press feed gripper, and also a lower shoe 252 instead of the small circular button type of gripper member. These shoes extend across the scrap stock issuing from the press and are able to properly grip the scrap even though there may be very little available area for gripping because of the absence of material which has been punched out of the stock by the press. Just as with the press feed gripper slide, the chopper feed gripper slide is driven by a chopper feed drive drum assembly 253 and crank link 254, the drum assembly being driven by positive drive means including a drive chain and right angle drive means or shafting in the housing 257 from a sprocket on the crankshaft 14. A feed length indicating register 258 like register 134 is provided in the drum assembly 253 and is visible through the opening 259 in the front face of the scrap feed and chopper support bracket 18. The scrap feed length adjusting screw 261 and eccentric block clamping screw 262 are also visible and accessible through the opening for adjustment, just as in the case of the press feed drive drum assembly.

The scrap chopper includes some components of conventional construction and others which are new in and of themselves or are disposed in a new arrangement. A lower shear blade 262 is secured in position by the lower blade holder plate 263 and is disposed adjacent the "bow tie" type of upper shear blade 264 mounted in the upper blade holder or ram 266. Whereas conventional upper blade holders are guidingly received on a pair of guide pins 266*a* which are only secured to the output bracket at their bottoms, it is a feature of the present invention to also affix these guide pins to the bracket at the tops as shown at the bosses 267 mounted on the bracket 18. Bending of these guide pins is thereby avoided and the force which can be used for shearing heavy stock is increased substantially. Each of the upper blade holder guide pins fittingly receives guide bushings 268 affixed in the upper blade holder. Accordingly the holder is vertically reciprocable with precision for cutting the scrap where the upper and lower shear blades meet during the downstroke.

To operate the blade holder, a driving member 269 is employed which is pinned at 271 to the blade holder and at one end by a shear pin 272 to the links 273 which are mounted on the shaft 274 mounted on the output bracket. A conventional ball-box and sea assembly is provided at 276 which is at the opposite end of the blade driving member and receives the lower end ball 277 of the blade drive rod 278, the upper end of the drive rod being connected to a collar 279 eccentrically mounted on the crankshaft whereby the drive rod is moved up and down once for each revolution of the crankshaft of the press.

According to one feature of the invention, the pin 272 is a shear pin so that if the resistance of the scrap to cutting is excessive, which could result from a dull blade, for example, no damage will be done other than the shearing of this particular pin. However it is desirable to be able to cut very heavy stock for long periods of time. It is also desirable to be able to vertically adjust the output support bracket 18 to accommodate different feed line heights. For this purpose the mounting is much like that illustrated for the input bracket. Such mountings have in the past, however, severely limited the capacity of the chopper and instances have occurred where the scrap cutter bracket has actually been pushed downwardly on the machine out of position to properly receive the scrap stock therefrom, a situation which can result in substantial damage. Accordingly it is another feature of the present invention to avoid this result, and this is accomplished by employing a pair of tension rods 281 and 282 which are pinned at their upper end to a hanger 283 having a bearing therein by which it is precisely received on the crankshaft 14 and supported thereby. The lower ends of these rods are provided with yokes 284 pinned to the side plates 286 of the bracket 18 by pins 287. The yoke portions have upwardly extending threaded stud portions 288 threadedly received in the connectors 289 which are threadedly received on the lower ends of the upper rod portions, with the lock nuts 291 and 292 being also provided. In this manner the length of each of the tension rods can be precisely adjusted to accommodate the feed line height desired and yet actually serve to support the output bracket, the pins 287 having their axes substantially coplanar in a vertical plane with the center point of contact between the lower ball 277 of the drive rod and the ball bearing box assembly 276. Therefore the downward force exerted by the drive rod is not taken by the bracket mounting bolts or studs 293, but rather by the tension rods 281 and 282 according to one of the features of the present invention. A jack screw 294 threadedly received in a boss 296 affixed to the press frame and having an upper end in a conventional adjusting screw stud cap mounted to the output feed bracket 18 may be employed to facilitate raising and lowering the bracket to obtain various feed line heights. Of course the tension rod lengths and drive rod lengths must be changed at the same time.

The scrap retainer differs from the feed stock retainer and includes an upper shoe 297 above the top surface of the stock 298, the lower surface of which runs on the support member 299 which is part of the bracket and to which the lower shear blade 262 is mounted. This upper shoe has a follower member 301 on the upper surface thereof engaged by the retainer drive cam 302 mounted on shaft 303 driven by a sprocket 304. Sprocket 304 is driven by a drive chain 306 which is in turn driven by the sprocket 307 connected to the output shaft of a right angle drive box 308 whose input shaft 309 is driven by sprocket 311 driven by a chain 312 from sprocket 313 connected to the output and scrap chopper feed drive assembly. This cam 302 is operable to drive the retainer shoe 397 into engagement with the scrap stock 296 issuing from the press and hold it clamped against the member 299 during the desired retainer period once for each revolution of the press crankshaft. Although the cam shaft 303 is supported in bearings 314 at its opposite ends which are, in turn, supported in the side plates 286 on the output support bracket 18, it is desirable to accommodate some very limited vertical action of the cam shaft 303. For this purpose high load coil springs 316 are provided between the cam shaft bearing blocks and the upper abutments 317 connected to the side plates. This allows some limited vertical action of the cam shaft 303 which results in precision retainer action and yet accommodates some variation in the scrap stock which will naturally result from burring and bending which occurs during the press work on the stock.

Timing of this retainer to the press operation may be readily accomplished by providing arcuate slots in any one of the many drive sprockets therefor, or by other suitable means.

A sequence selector knob 318 is provided for the output feed just as it is for the input feed, but it only effects the output gripper in the same way as does the input sequence selector affect the input gripper. It has no effect on the output and scrap chopper feed retainer.

Because of the location of the shoe 297 of the output retainer, it also serves as a stripper for the upper shear blade, being located immediately adjacent thereto and immediately above the scrap stock issuing from the machine. It will be observed that a portion of this retainer shoe actually extends above the top surface of the lower shear blade 262. The retainer shoe has the coil springs 321 which are return springs and normally biased upwardly. The upper shoe 297 of the cutter feed retainer is spring biased upwardly by the springs 321 and the inner edge thereof is curved upwardly at 322 and the receiving edge of the bracket member 299 is curved downwardly at 323 to facilitate receipt of the stock therein and passage therethrough. By having the portion 324 of the shoe 297 disposed immediately adjacent the upper shear blade, it

not only serves as a stripper for the blade, but prevents the scrap front edges from abutting against the upper shear blade as the scrap is moved through the chopper after each down stroke of the upper shear blade.

It was mentioned previously, that the input gripper may be conveniently set to apply force of 6300 pounds at 100 pounds per square inch air pressure. This pressure may also be used for the output gripper and the same load may also be used. However it is more likely that a load in the neighborhood of 1900 pounds would be employed in most cases at the output gripper. A typical air consumption for 300 press strokes per minute and 100 pounds per square inch is 3 cubic feet per minute. These loads, pressures, and speeds, and volumes, are given merely as examples. Many others will be found useful in practice.

From the foregoing description, it is believed that the present invention can be understood and then it will be seen that the present invention is well able to achieve the objects set forth herein.

While the invention has been disclosed and described in some detail in the drawings and foregoing description, they are to be considered as illustrative and not restrictive in character, as other modifications may readily suggest themselves to persons skilled in this art and within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In press apparatus the combination comprising:
(A) a press frame having therein,
(1) a press ram,
(2) a powered crankshaft connected to said ram for driving said ram in reciprocating manner, one complete rotation of the crankshaft providing a press cycle,
(B) press feed apparatus including,
(1) a press feed support bracket mounted to said press frame,
(2) a main press feed drive member rotatable on a stationary first vertical axis in said bracket,
(3) positive drive means connected between said main drive member and said crankshaft for driving said main drive member in synchronism with said crankshaft without slippage therebetween,
(4) a reciprocable gripper slide movable on said bracket toward and away from the press frame,
(5) retainer apparatus on said bracket between said slide and said press frame,
(6) a slide drive link pivotally attached to said slide and eccentrically mounted to said main drive member and operable during one revolution of said drive member to reciprocate said slide from a home position toward said press frame and back to home position to provide one press feed cycle,
(7) a press feed gripper mounted to said slide and including an anvil above the stock and a gripper member below the stock with the gripper member having a fluid operated gripper clamping piston connected thereto and a rotary control valve therefor,
(8) second positive drive means connected to said main drive member and to said gripper control valve and operable during a feed cycle to drive said gripper control valve through one complete sequence of valve events to move the gripper member toward the gripper anvil and clamp the stock therebetween and then move said stock toward said press frame as said main drive member moves said slide toward said press frame, thus performing a press feed stroke, and then permit said gripper member to move away from said gripper anvil and release said stock prior to return of said slide to its home position to complete a press feed cycle.

2. In press apparatus, the combination comprising:
(A) a press ram,
(1) a press ram,
(2) a powered crankshaft connected to said ram for driving said ram in reciprocating manner, one complete rotation of the crankshaft providing a press cycle,
(B) press feed apparatus including,
(1) a press feed support bracket mounted to said press frame,
(2) a main press feed drive member,
(3) positive drive means connected between said main drive member and said crankshaft for driving said main drive member in synchronism with said crankshaft without slippage therebetween,
(4) a reciprocable gripper slide movable on said bracket toward and away from the press frame,
(5) slide drive means attached to said slide and to said main drive member and operable during one revolution of said drive member to reciprocate said slide from a home position toward said press frame and back to home position to provide one press feed cycle,
(6) a press feed gripper mounted to said slide and including an anvil and a gripper member with the stock disposed therebetween, the gripper member having a fluid operated gripper clamping piston and a control valve for said piston, and
(7) a press feed stock retainer having an anvil affixed to said bracket above the stock and a retainer member below said retainer anvil, said retainer member having a retainer clamping piston thereunder with a retainer rotary control valve and surge chamber under said retainer clamping piston,
(8) second positive drive means connected to said main drive member and to said gripper control valve and operable during a feed cycle to drive said gripper control valve through one complete sequence of valve events to move the gripper member toward the gripper anvil and clamp the stock therebetween and then move said stock toward said press frame as said main drive member moves said slide toward said press frame, thus performing a press feed stroke, and then permit said gripper member to move away from said gripper anvil and release said stock prior to return of said slide to its home position to complete a press feed cycle.

3. In press apparatus, the combination comprising:
(A) a press frame having therein,
(1) a press ram,
(2) a powered crankshaft connected to said ram for driving said ram in reciprocating manner, one complete rotation of the crankshaft providing a press cycle,
(B) press feed apparatus including,
(1) a press feed support bracket mounted to said press frame,
(2) a main press feed drive member,
(3) positive drive means connected between said main drive member and said crankshaft for driving said main drive member in synchronism with said crankshaft without slippage therebetween,
(4) a press feed stock retainer having an anvil and a retainer member with the feed stock disposed therebetween, said retainer member having a retainer clamping piston connected thereto and a retainer rotary control valve therefor,
(5) another positive drive means connected to said main drive member and to said retainer control valve and operable during a press cycle

to drive said retainer control valve through one complete sequence of valve events to cause said retainer clamping piston to move said retainer member to clamp the stock at the beginning of a pause in the feeding thereof and tend to keep said stock clamped by said retainer member during the pause, and

(6) retainer release means including a retainer release cam driven by said another positive drive means, and a cam follower connected to said retainer member and operable by said release cam in opposition to the force applicable to said retainer member by said retainer piston to move said retainer member away from said retainer anvil and release the stock to accommodate precise positioning of stock in the press by die pilots therein, said retainer release cam being operable once during each press cycle to thereby permit die pilots to precisely position the stock in the press frame immediately prior to stock forming action by said press ram, and said retainer release means including adjustable release timing means incorporating a follower receiver positioning the release cam follower and externally adjustable whereby the index of the release cam follower with respect to the press crankshaft is easily adjustable to properly time the release of said retainer member with the action of the pilots.

4. In press apparatus, the combination comprising:

(A) a press frame having therein,

(1) a press ram,

(2) a powered crankshaft connected to said ram for driving said ram in reciprocating manner, one complete rotation of the crankshaft providing a press cycle,

(B) press feed apparatus including,

(1) a press feed support bracket mounted to said press frame,

(2) a main press feed drive member,

(3) positive drive means connected between said main drive member and said crankshaft for driving said main drive member in synchronism with said crankshaft without slippage therebetween,

(4) a press feed stock retainer having an anvil and a retainer member with the feed stock disposed therebetween, said retainer member having a retainer clamping piston connected thereto and a retainer control valve therefor,

(5) another positive drive means connected to said main drive member and to said retainer control valve and operable during a press cycle to drive said retainer control valve through one complete sequence of valve events to cause said retainer clamping piston to move said retainer member to clamp the stock at the beginning of a pause in the feeding thereof and tend to keep said stock clamped by said retainer member during the pause, and

(6) retainer release means including a retainer release cam driven by said another positive drive means, and a cam follower connected to said retainer member and operable by said release cam in opposition to the force applicable to said retainer member by said retainer piston to move said retainer member away from said retainer anvil and release the stock to accommodate precise positioning of stock in the press by die pilots therein, said retainer release cam being operable once during each press cycle to thereby permit die pilots to precisely position the stock in the press frame immediately prior to stock forming action by said press ram, and said retainer release means being adjustable to properly time the release of said retainer member with the action of the pilots.

5. Press feed apparatus comprising:

(1) a press feed support bracket mountable to a press frame;

(2) a press feed drive member rotatable on an axis in said bracket;

(3) means on said press feed drive member adapted to operation by a press crankshaft for driving said press feed drive member in synchronism with the crankshaft;

(4) a reciprocable gripper slide movable on said bracket;

(5) retainer apparatus on said bracket;

(6) a slide drive link pivotally attached to said slide and to an eccentrically mounted radially adjustable block in said press feed drive member and operable during one revolution of said drive member to reciprocate said slide from a home position a selectable distance for a feed stroke and then back to home position to provide a press feed cycle;

(7) a press feed gripper mounted to said silde and including an anvil and a gripper member spaced apart to accommodate receipt of press feed stock therebetween, with the gripper member having a fluid operated gripper clamping piston connected thereto and a rotary control valve connected to said piston and to a pressurized fluid containing chamber to control operation of said gripper clamping piston;

(8) a drive sprocket affixed to said press feed drive member and a driven sprocket connected to said gripper control valve, with a chain connecting said sprockets for power transmission therebetween, both sprockets being of the same size whereby said press feed drive member is operable during a feed cycle drive said gripper control valve through one complete sequence of valve events to move the gripper member toward the gripper anvil and clamp the stock therebetween and then move away from said home position, thus performing a press feed stroke, and then permits said gripper member to move away from said gripper anvil and release the stock prior to return of the slide to its home posion to complete a press feed cycle;

(9) said retainer apparatus including a retainer anvil and a retainer member spaced apart to accommodate press feed stock therebetween, with the retainer member having a fluid operated retainer clamping piston connected thereto and a retainer control valve connected to said retainer clamping piston and to a pressurized fluid chamber, and a third sprocket connected to said press feed drive member and a fourth sprocket connected to said retainer control valve with a second chain connecting said third and fourth sprockets, said third and fourth sprockets being of the same size whereby said main drive member is operable during a feed cycle to drive said retainer control valve through one complete sequence of valve events to move said retainer member to clamp the stock when movement of the slide away from said home position has terminated and tend to keep said stock clamped by said retainer member until said slide starts away again from home position;

(10) retainer release means mounted in said press feed support bracket and including a retainer release cam driven by said second chain and a cam follower connected to said retainer member and operable by said retainer release cam in opposition to the force applicable to said retainer member by said retainer piston, to move said retainer member away from said retainer anvil and release the stock, to thereby permit precise positioning of stock in a press by die pilots in the press.

6. Machine feed appartus comprising:
(1) a machine feed support bracket mountable to a machine frame;
(2) a machine feed drive member rotatable in said bracket;
(3) means on said machine feed drive member adapted to operation by a machine crankshaft for driving said drive member in synchronism with the machine crankshaft;
(4) a reciprocable gripper slide movable on said bracket;
(5) a slide drive link pivotally attached to said slide and to an eccentrically located point on said drive member and operable during one revolution of said drive member to reciprocate said slide from a home position to a point for a feed stroke and then back to home position, to provide a machine feed cycle;
(6) a machine feed gripper mounted to said slide and including anvil means and gripper means spaced apart to accommodate receipt of machine feed stock therebetween, with the gripper means having a fluid operated gripper clamping piston connected thereto and a rotary control valve connected to said piston and to a pressurized fluid source to control operation of said gripper clamping piston;
(7) a first drive sprocket affixed to said drive member and a driven sprocket connected to said gripper control valve, with a chain connecting said sprockets for power transmission therebetween, both sprockets being of the same size whereby said main drive member is operable during a feed cycle to drive said gripper control valve through one complete sequence of valve events to move said gripper means toward said gripper anvil means and clamp the stock therebetween and then move away from said home position, thus performing a machine feed stroke, and then permits said gripper means to move away from gripper anvil means and release the stock prior to return of the slide to its home position to complete a machine feed cycle.

7. Machine feed apparatus comprising:
(1) a machine feed support bracket mountable to a machine frame;
(2) a machine feed drive member rotable in said bracket;
(3) means on said machine feed drive member adapted to operation by a machine drive means for driving said drive member in synchronism with the machine drive means;
(4) a reciprocable gripper slide movable on said bracket;
(5) a slide drive shaft eccentrically mounted to said drive member and connected to said slide and operable during one revolution of said drive member to reciprocate said slide from a home position to a point and then back to home position to provide a machine feed cycle;
(6) a machine feed gripper mounted to said slide and including anvil means and gripper means spaced apart to accommodate receipt of machine feed stock therebetween, with the gripper means having a fluid operated gripper clamping piston connected thereto and a control valve connected to said piston and to a pressurized fluid source to control operation of said gripper clamping position;
(7) and valve drive means connected to said drive member and driven thereby whereby said drive member is operable during a feed cycle to drive said gripper control valve through a sequence of valve events to move said gripper means toward said gripper anvil means and clamp the stock therebetween and then move away from said home position, thus performing a machine feed stroke, and then permits said gripper means to move away from said gripper anvil means and release the stock prior to return of the slide to its home position to complete a machine feed cycle.

8. A device set forth in claim 7 and further comprising:
(1) a stock engaging detector member biased toward engagement with stock gripped in said gripper, said detector member being mounted to said slide for movement with respect thereto upon relative movement between said stock and said slide when said stock is engaged by said engaging member;
(2) machine control means including a portion operatively associated with said stock engaging member and operable upon relative movement between said engaging member and said slide caused by relative movement between said slide and the stock when the engaging member engages the stock, to enable termination of machine operation;
(3) and release means driven by said drive member and connected to said engaging member to release said engaging member when the stock is released by said gripper means to accommodate return of said slide to home position without activation of said machine control means.

9. In a machine feeding apparatus, a retainer comprising:
(1) a retainer anvil and a retainer member spaced apart to accommodate machine feed stock therebetween;
(2) a fluid operated retainer clamping piston connected to said retainer member;
(3) a rotary retainer control valve, and a pressurized fluid chamber under said control valve, said valve and said chamber being disposed under said clamping piston, and said valve being operable to connect said chamber to said piston at certain times to permit passage of pressurized fluid from said chamber to said piston for operating said piston and thereby operating said gripper member to clamp stock against said anvil;
(4) a drive member connectable to machine drive means for operation in synchronism therewith;
(5) a first sprocket connected to said drive member and a second sprocket connected to said rotary valve and a drive chain connecting said sprockets and driving said valve to control the admission of pressurized fluid to said piston and the venting of pressurized fluid from said piston to atmosphere, to cause said retainer clamping piston to first move said retainer member to clamp stock at the beginning of a pause in the feeding of the stock and tend to keep the stock clamped by said retainer member during the pause, and then relieve pressure from said clamping piston to allow the retainer member to unclamp the stock;
(6) retainer release means including a retainer release cam driven by said second sprocket, an inverted T-bar having the central shaft thereof extending centrally up through said chamber and said valve and connected to said retainer member, said T-bar having cam follower rollers therein operable by said release cam in opposition to the force applicable to said retainer member by said retainer piston, to move said retainer member away from said retainer anvil and release the stock to accommodate precise positioning of stock in a machine by positioning means in the machine during a portion of a machine cycle, said retainer release cam being operable once during a portion of a machine cycle to thereby permit positioning means to precisely position the stock, and said retainer release means including adjustable release timing means incorporating a gear wheel having a channel therein receiving the transverse arms of the T-bar and establishing an index position thereof, said gear wheel being connected through a worm to a release timing adjustment knob manually operable whereby the index of the release cam follower T-bar

with respect to the machine drive means is easily adjustable to properly time the release of said retainer member with the action of the positioning means.

10. Machine feed stock retainer apparatus comprising:
(1) a retainer anvil and retainer member spaced apart to accommodate feed stock therebetween;
(2) a fluid operated retainer clamping piston connected to said retainer member;
(3) a retainer control valve connected to said retainer claimping piston and to a pressurized fluid chamber;
(4) a main drive member having means thereon connectable to a machine disposed to receive feed stock from said retainer member for operation in sychronism with the machine;
(5) positive drive means connecting said retainer control valve to said main drive member whereby said main drive member is operable to drive said retainer control valve through a sequence of valve events to move said retainer member to clamp the stock during a predetermined period with respect to operation of a machine to which the stock is fed, and tend to keep said stock clamped during said predetermined period;
(6) and retainer release means including a release cam driven by said positive drive means, a cam follower connected to said retainer member and operable by said retainer release member and operaoperable by said retainer release cam in opposition to the force applicable to said retainer member by said retainer clamping piston, to move said retainer member away from said retainer anvil and release the stock during a predetermined portion of said period to permit location of stock in the machine independent of said retainer member.

11. The retainer apparatus as set forth in claim 10 wherein:
(1) said control valve is a rotary valve disposed under said retainer clamping piston;
(2) said cam follower includes a shaft extending centrally through said control valve and connected to said piston and having a transverse arm at a lower end therof with a follower roller mounted thereon and engageable by said release cam.

12. In apparatus intermittently feeding stock to a machine, a misfeed detector comprising:
(1) a reciprocable member having stock feeding clamp means thereon;
(2) a stock engaging detector member biased toward engagement with feed stock clamped by said clamping means, said detector member being mounted to said reciprocable member for movement simultaneously and equidistantly therewith upon absence of relative movement between the gripped stock and the reciprocavle member, said detector member being mounted to said reciprocable member for relative movement with respect thereto upon relative movement between the gripped stock and the reciprocable member when said stock is engaged by said detector member;
(3) machine control means including a portion operatively associated with said stock engaging detector member and operable upon relative movement between said detector member and said reciprocable member caused by relative movement between said reciprocable member and the stock when the detector member engages the stock, to activate said control means and enable termination of machine operation;
(4) and release means driven by drive means driving said reciprocable member and connected to said detector member to release said detector member from engagement with the stock when the stock is released by the clamping means to accommodate a return stroke of the reciprocable member without activation of said machine control means.

13. A detector as set forth in claim 12 wherein:
(1) said detector member is a pointed plunger received in a guide cylinder pivotally mounted to said reciprocable member, the pivotal axis being perpendicular to the direction of reciprocation of said member, and the axis of said plunger being also perpendicular to the direction of reciprocation of said reciprocable member, and
(2) said control means portion includes electrical circuit contactors mounted on said reciprocable member and on said cylinder and cooperable to activate said control means, the relative movement of said detector member with respect to said reciprocable member being manifested as pivotal action of said guide cylinder operable to change the relationship of said contactors, and
(3) said release include a cam and linkage, the linkage being driven by the cam to move said plunger away from the stock.

14. Machine feed apparatus comprising:
(1) a machine feed support bracket mountable to a machine frame;
(2) a machine feed drive member rotatable on said bracket;
(3) a reciprocable gripper slide movement on said bracket;
(4) slide drive means including a shaft eccentrically mounted to said drive member and connected to said slide and operable during a revolution of said drive member to reciprocate said slide from a home position to a point for a feed stroke and then back to home position, to provide a machine feed cycle;
(5) a machine feed gripper mounted to said slide and including first anvil means and gripper means spaced apart to accommodate receipt of machine feed stock therebetween, with the gripper means having a fluid operated gripper clamping means connected thereto and a gripper control valve associated with said clamping means and with a pressurized fluid source to control operation of said clamping means.

15. The apparatus of claim 14 and further comprising:
valve operator means coupled to said valve and operable by said drive member to effect movement of said gripper means toward said anvil means and clamping of stock therebetween immediately before said feed stroke, and permit movement of said gripper means away from said anvil means and release of stock prior to return of said slide to said home position to complete a machine feed cycle.

16. The apparatus of claim 14 and further comprising:
a retainer anvil and retainer member spaced apart to accommodate feed stock therebetween;
fluid operated retainer clamping means connected to said retainer member;
and a retainer control valve associated with said retainer clamping means and with a pressurized fluid source to control operation of said retainer clamping means.

17. The apparatus of claim 16 and further comprising:
first valve operator means coupled to said gripper control valve and to said drive member and operable by said drive means to effect movement of said gripper means toward said anvil member and clamping of stock therebetween immediately before said feed stroke, and permit movement of said gripper means away from said anvil means and release of stock prior to return of said slide to said home position to complete a machine feed cycle;
second valve operator means coupled to said retainer control valve and to said drive member and operable by said drive member to effect clamping of stock be-

tween said retainer anvil and retainer member during said movement of said gripper means away from said first anvil means and until a subsequent feed stroke.

18. The apparatus of claim **14** wherein:

said gripper clamping means, said gripper control valve, and said pressurized fluid source are mounted on said reciprocal gripper slide, said pressurized fluid source including a pressurized fluid chamber.

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