Dec. 1, 1931. C. G. LILJEBERG 1,834,216

FEED MECHANISM FOR PUNCH PRESSES

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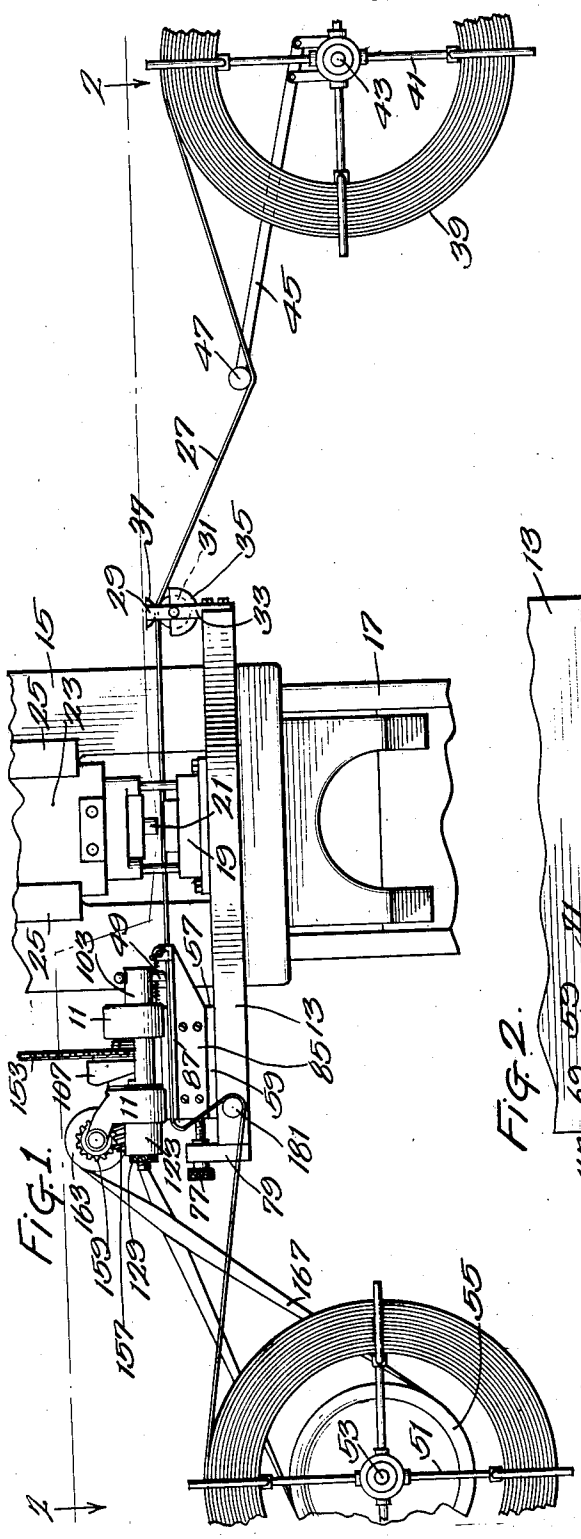


Fig. 1.

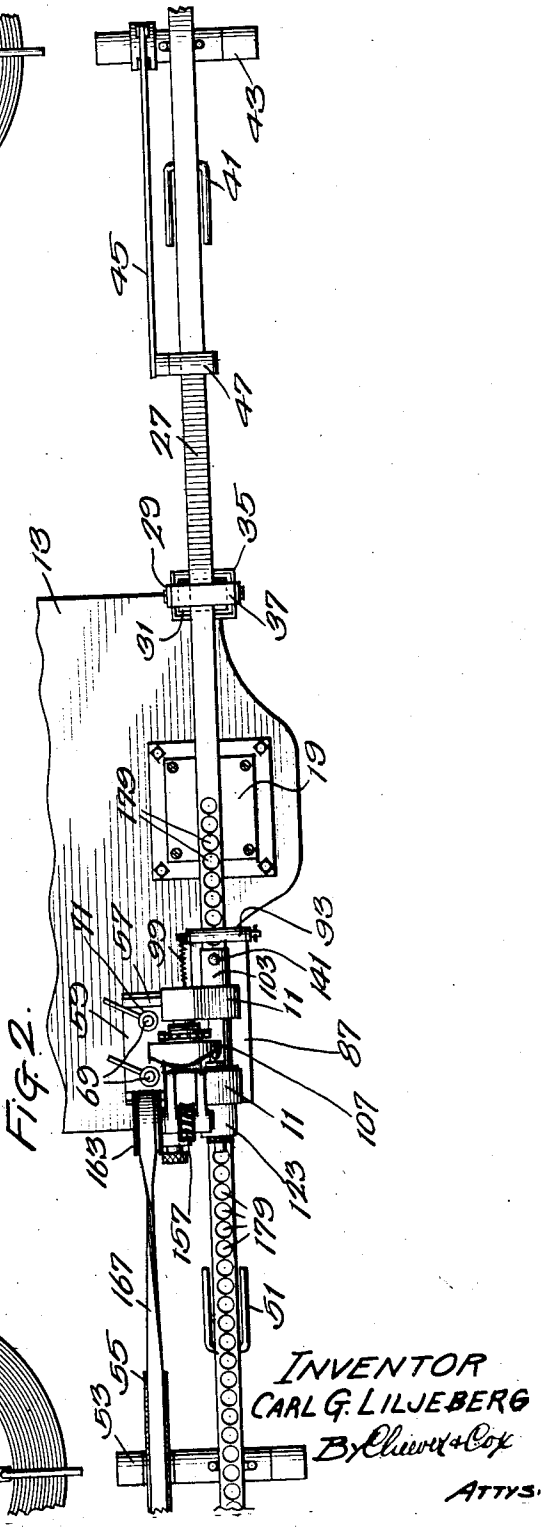


Fig. 2.

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FIG. 3.

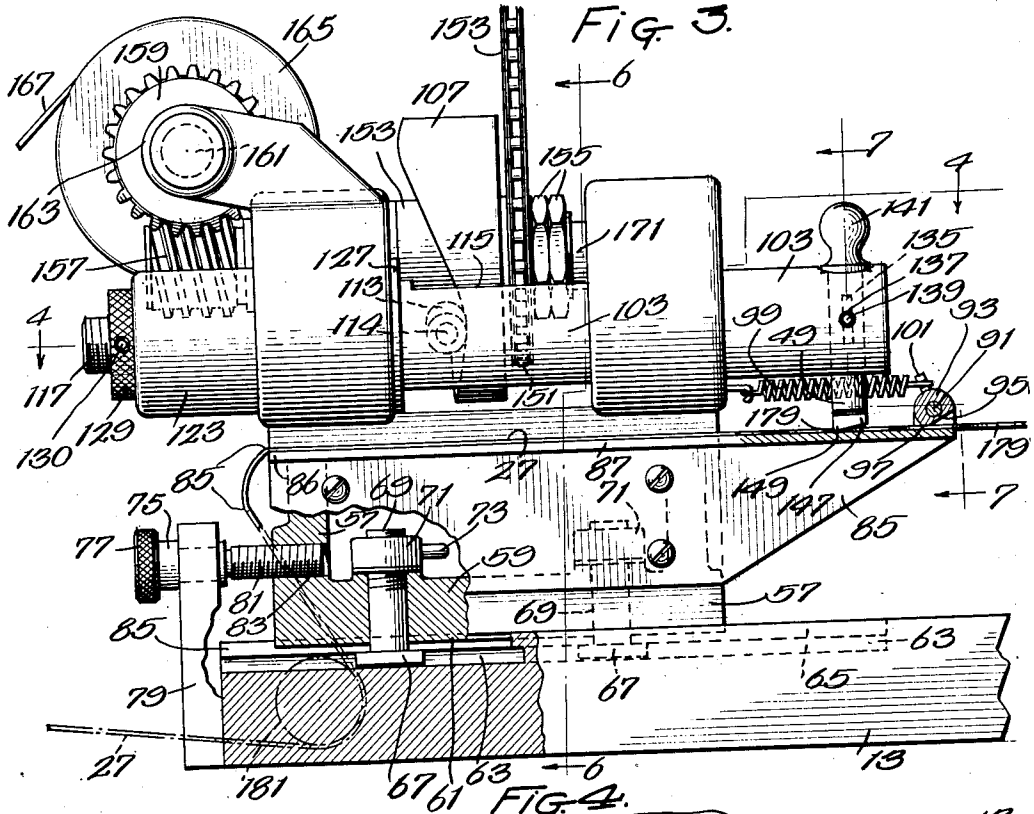
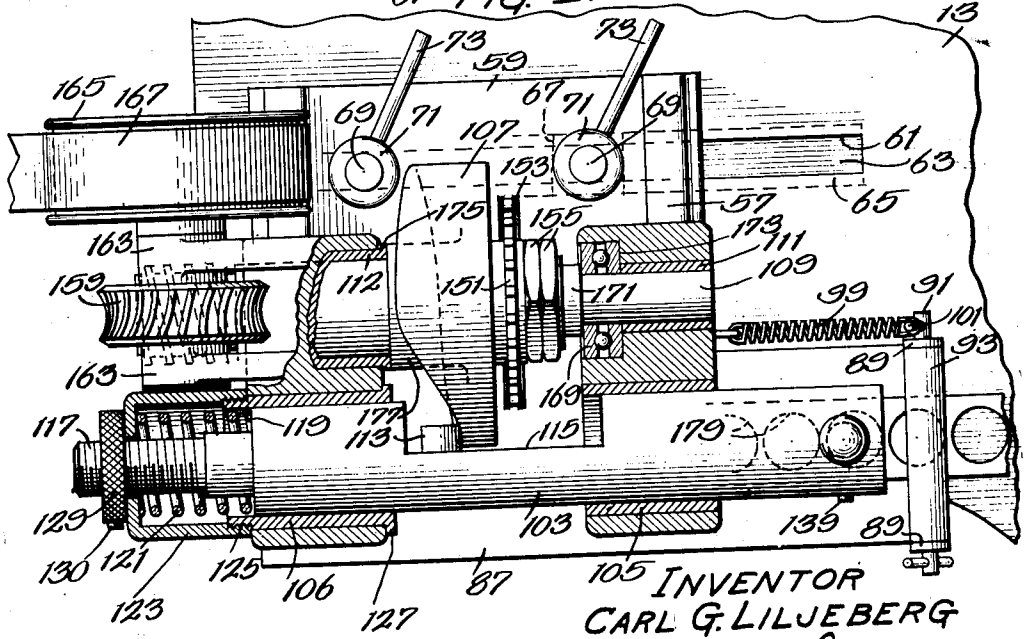


FIG. 4.



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FIG. 5.

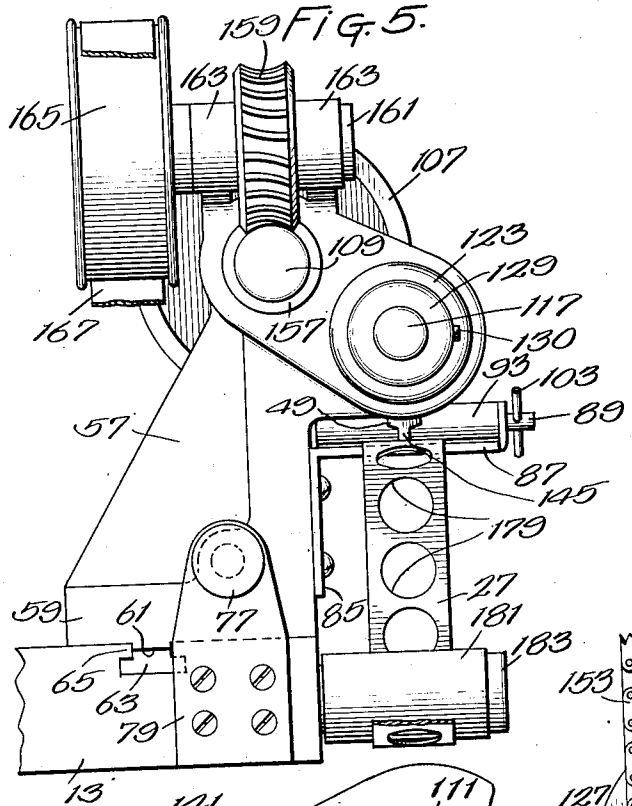


FIG. 6.

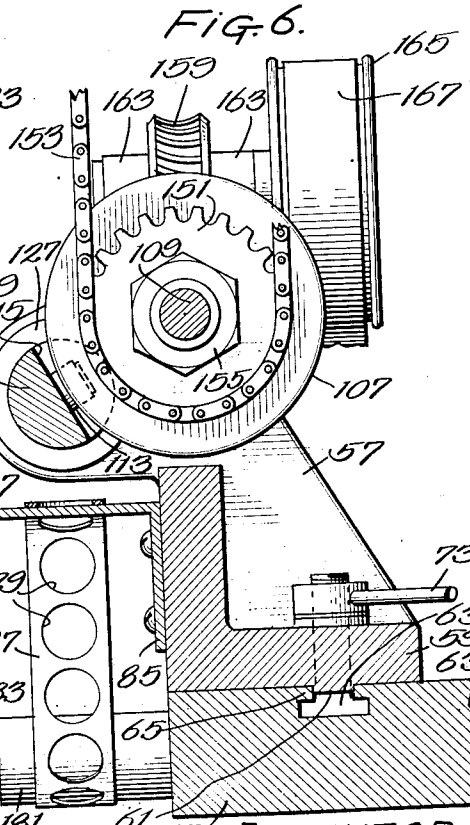
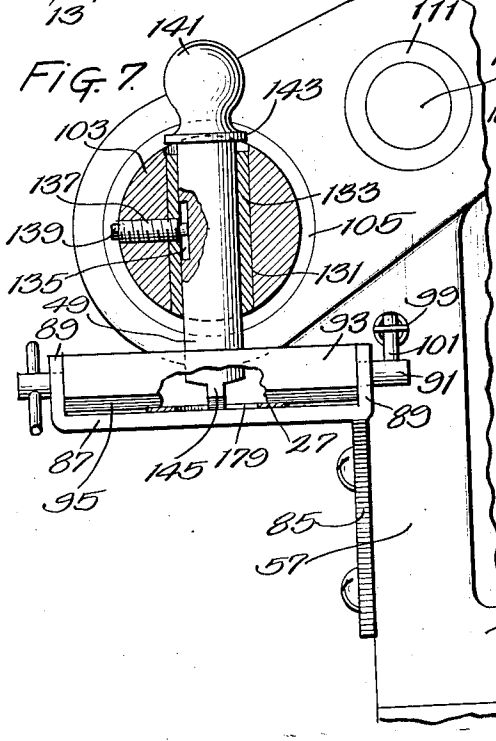


FIG. 7.



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UNITED STATES PATENT OFFICE

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FEED MECHANISM FOR PUNCH PRESSES

Application filed November 14, 1927. Serial No. 233,003.

This invention relates in general to a feeding mechanism for punch presses and has more particular reference to an improved device whereby a metal work strip may be fed positively and rapidly between the dies of a punch press for high speed production.

In punch press operation wherein a work strip of metal stock is moved across the dies which operate to strike out metal punchings or form indentations at closely spaced intervals along the work strip, it is desirable to provide a feeding means whereby the strip may be progressively advanced, by exactly similar amounts past the dies while the latter are inoperative, that is to say, in raised position, in order that the punchings or indentations may be made in the work strip as closely together as possible without overlapping. In the past, feeding devices used in connection with punch presses have been of the non-positive type comprising co-operating rollers engaging opposite sides of the work strip and rotated to draw the strip through the punch press. In such devices, there is an indeterminate amount of slip between the work strip and the rollers which causes overlapping and the consequent production of imperfect indentations, the dies striking the strip over an area including a portion of the indentation formed in the strip by the preceding punching operation. In such devices it is therefore necessary to adjust the mechanisms so that the indentations are made at widely spaced intervals in the work strip in order to reduce the number of imperfect punchings produced by the slippage of the work strip at the feeding device. This is a wasteful procedure for where a great number of punchings are made, the infinitesimal increase in the spacing between adjacent punchings greatly increases the total amount of scrap material formed from a given length of work strip, that is to say, fewer punchings are obtained per unit length of the work strip and the efficiency of production is decreased.

Positive feeding of the work strip is also desirable when the feeding device is used in a punch press having progressive dies, that is to say, a punch press in which the indentations are made progressively, the stock strip being moved successively between different dies. In such a machine it is obvious that precision feeding is an absolute necessity in the production of perfect work.

The principal object of my invention is the provision of a positive feed mechanism for punch presses which will feed the work strip rapidly and accurately through the dies of the punch press and promote high speed production by eliminating the care formerly needed in adjusting the non-positive feeding devices to operate in a satisfactory manner.

Another important object of the invention is the provision of an adjustable feeding mechanism for a punch press which will space the work accurately and thereby protect the dies from injury and thus prolonging their life by preventing the operation of the dies on a punched out portion of the work strip.

Another important object of the invention is the provision of a feeding mechanism, which may be adjusted to feed different lengths of a work strip to a punch press.

Another object of the invention is the provision of a snubbing device, used in connection with the automatic feeding mechanism of a punch press, and a take-up reel for winding up the work strip after it has passed through the feeding mechanism, for preventing the tension, imparted to the strip by the take-up reel, from interfering with the operation of the feeding device.

Another object of the invention is the provision of a means for automatically oiling the work strip as it passes to the dies of the punch press; and still another object is the provision of means for rewinding the strip tightly upon a take-up reel after the indentations have been made therein.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment of the devices of the invention.

Referring to the drawings:

Figure 1 is a side elevation showing the working portion of a punch press, including

the dies, and feeding devices embodying my invention;

Figure 2 is a plan view comprising a horizontal cross section taken substantially along line 2—2 of Figure 1;

Figure 3 is an enlarged view of a part of the feeding devices of my invention shown in Figure 1;

Figure 4 is a horizontal cross section taken substantially along line 4—4 in Figure 3;

Figure 5 is an end view of the feeding mechanism of my invention taken from the left in Figure 3;

Figure 6 is a vertical cross section taken substantially along line 6—6 in Figure 3; and

Figure 7 is a vertical cross section taken substantially along line 7—7 of Figure 3.

To illustrate my invention I have shown on the drawings, the operating portion of a punch press 15 including a horizontal work table or bolster plate 13 supported on a pedestal 17 and carrying a die 19, a feeding device 11 and an oiling device 29. The frame of the punch press 15 extends upwardly from the table 13 and carries a vertically reciprocating member 23 slidably mounted in guide ways 25 formed in the frame of the punch press. The reciprocating member 23 carries a punch member 21 at its lower end above the die 19, and is connected with devices (not shown) for imparting a reciprocating movement to the member 23 in such a manner that the punching member 21 periodically engages the die 19 to punch out a portion or otherwise deform or indent a work strip 27 positioned therebetween. The reciprocating mechanism (not shown) may be of any suitable type and includes a shaft rotating at the rate of 1 revolution per operating cycle of the punch carrying member 23. The work strip 27 is arranged in the form of a roll 39 carried upon a reel 41 adjacent the punch press and is unwound and fed to the punch press through the oiling device 29 which comprises a roller 31 rotatably mounted in support brackets 33 suitably secured to the edge of table 13. The roller 31 is partially immersed in an oil bath carried in a semi-cylindrical container 35 which is supported between the brackets 33. Contact between the strip 27 and the roller 31 is maintained by a holding block 37 secured between the brackets 33.

The reel 41 is rotatably mounted upon a shaft 43 which carries a tension device 45 having a roller 47 at its free end. This roller engages the strip 27 after it has been unwound from the roll 39 and allows the strip 27 to be fed intermittently to the punch press without imparting the intermittent movement to the roll 39. Where the intermittent movements of the strip 27 take place rapidly, it is desirable that the roll 39 unwind at a constant rate in order that the inertia of the reel may not interfere with the intermittent feeding movement of the strip 27.

The feeding device 11 engages the strip 27 after it has passed between the punching member 21 and the die 19 of the punch press which remove a portion of the strip during the punching operation and form apertures 179 successively in the work strip. In the illustrated embodiment, I have shown my device in connection with a punch press adapted to remove circular portions from the work strip, but it will be apparent that my feeding device is equally adapted to operate where portions of any desired configuration are removed, or where the work strip is merely indented by the dies or by a suitable marking device, no part of the strip being entirely removed. The feeding device includes a pawl member 49 adapted to engage the work strip being receivable in the apertures 179. The pawl 49 is reciprocated along path of the work strip by suitable mechanisms and is adapted to engage and move the work strip only when traveling away from the punch press, being formed to ride idly over the strip and leave it stationary when traveling in the reverse direction.

After leaving the pawl, the work strip passes along a table 87 on which it is supported and is delivered to a take-up reel 51 after passing sharply around the rear edge of the table 87 and a guide roller 181. The reel 51 is similar to the reel 41 and is mounted upon a rotatable shaft 53 which also carries a belt pulley 55. The take-up reel 51 is rotated, as hereinafter described, through a belt drive from the main drive shaft of the punch press at a speed sufficient to impart a continuous tension in the end of the work strip in order to wind it tightly on the take-up reel. The guide roller 181 is mounted upon a pin 183 secured in the edge of the table 13 and is arranged to deflect the work strip around the rear edge 86 of the table 87. This arrangement creates a snubbing action upon the strip and prevents any tension imparted to the strip by the take-up reel from prematurely moving the portions of the strip behind the edge 85, that is to say, in the feeding device 11, and hence prevents the tension of the take-up reel from effecting the precise operation of the feeding pawl, the snubbing being accomplished by the bending of the strip 27 at 85 and by slippage of the belt drive of the take-up reel.

The mechanism for reciprocating the pawl 49 is mounted upon a supporting frame 57 which has a base 59 arranged for sliding movement along the top of the table 13 in the direction of the path of the work strip 27. A longitudinal ridge 61 is formed along the base 59 and is adapted to engage a groove 63 formed in the top of the table 13 to guide the movement of the supporting base 57. The bottom of the slot 63 is enlarged to receive

the head 67 of clamping bolts and to form shoulders 65 for securing the heads of the clamping bolts in the slot, the shanks 69 of the bolts extending upwardly through apertures formed in the base 59 and having upper ends threaded for engagement with clamping bolts 61 provided with operating handles 73 by which to secure the supporting frame 57 upon the table 13. The supporting frame 57 may be adjusted relative to the table 13 by means of a set screw 75 having a knurled operating handle 77 and rotatably mounted in a bracket 79 which is in turn suitably secured to the end of the table 13. This set screw has a threaded shank 81 which engages a threaded aperture formed in the supporting frame 57 and upon rotation of the knurled head 77 adjustment of the position of the supporting frame is accomplished. At one side of the supporting frame 57, I provide a bracket, having a portion extending in a horizontal plane and providing the strip supporting table 87 over which the stock strip 27 is adapted to move. Two integral ears 89 extend upwardly from each side of the supporting table 87 adjacent the forward end thereof. These ears support a shaft 91 which carries a cylindrical roll 93 having a flattened side 95. The roll is supported parallel to and spaced from the table 87 and the stock strip passes across the table beneath the roll. The shaft is normally urged in a counter-clockwise direction in Figure 3 by means of a spring 99 secured to the supporting frame 57 and to a spring pin 101 secured in the end of the shaft 91 so that the shoulder 97 formed by the intersection of the flattened side 95 with the surface of the roll 93 engages the work strip and secures it against the supporting table 87. It is apparent that the work strip 27 may pass beneath the roll 93 in one direction only, that is, toward the left in Figure 3 of the drawings and that reversal of the movement of the work strip will result in the rotation of the roll 93 in a counter-clockwise direction in Figure 3 and a consequent clamping of the strip between the edge 97 and the table 87. The roll 93 in the present instance acts as a toggle member, the shoulder 97 being spring urged toward the table 87 and upon reversal of the direction of the work strip to clamp it with increasing force between the shoulder and the table, which acts as an abutment against which the toggle reacts.

The pawl 49 is mounted in the forward end of a reciprocating shaft 103 which is slidably supported in spaced bushings 105 and 106 arranged in the frame 57. Axial motion is imparted to the shaft 103 by means of a cam 107 mounted on a cam shaft 109 which is arranged parallel to the shaft 103 and which is journalled adjacent its ends in bushings 111 and 112 suitably supported in the frame 57. The cam 107 co-operates with a cam following roller 113 mounted upon a pin 114 secured in a cut-out portion 115 of the shaft 103. By forming the reciprocating shaft 103 with a cut-out portion, in which the cam follower is arranged, the engagement of the cam and the cam follower takes place at a point substantially on the axis of the shaft 103. The reciprocating force is thus applied axially to the shaft 103 so that wear at the bearings 105 and 106, caused by the application of an off center reciprocating force, is eliminated. The cutting out of the shaft 103 as described reduces the distance between the cam shaft 103 and allows the device to be assembled more compactly. At the rear of the shaft 103 I form an axial stud 117 of reduced diameter, having a threaded shank and providing a shoulder 119 at the end of the shaft 103 against which a spring 121 is engaged. This spring is threaded upon the stud and is secured in place by means of a spring housing 123 comprising a cup shaped member having threaded engagement with the rearward end 125 of the bushing 106 the forward edge of the bushing being provided with a peripheral flange 127 to prevent lateral displacement of the bushing from its support. The threaded end of the stud 117 projects through an aperture in the spring housing 123 and engages an adjusting nut 129 which has a locking element 130 for securing it in adjusted position upon the threaded stud 117. The throw of the reciprocating rod 103 may be adjusted by means of the nut 129 which limits the forward travel of the shaft by engaging behind the end of the spring housing.

The cam member is rotated once per operating cycle of the punch press and moves the shaft 103 axially away from the dies of the punch press, that is, to the left in Figures 3 and 4, against the tension of the spring 121 once during each rotation by the engagement of the raised portion of the cam behind the cam follower. By tightening the nut 129 on the stud 117, the throw of the rod 103 may be reduced from a maximum limited only by the throw of the cam member 107 to zero, the cam follower being raised from engagement with the lower parts of the cam member and engaging only the raised portion of the cam 107 as the throw of the shaft is decreased. The cam member 107 is arranged to retract the shaft 103 away from the dies during substantially one-quarter of its period of rotation, to allow the shaft to return under the influence of the spring 121 during substantially another quarter of its period and to allow the shaft to remain stationary in fully extended position for substantially one-half of its period. The punching operation of the die is arranged to occur during the interval while the shaft is stationary.

The pawl member 49 is formed from a cylindrical rod and is slidably mounted in a diametrical aperture 131 formed vertically through the forward end of the shaft 103. A bushing 133 is arranged in the aperture 131 to reduce the wear caused by the operating axial movement of the pawl member in the aperture. The body of the pawl is provided with a longitudinal slot 135 adapted to receive the end of a threaded pin 137 arranged through the bushing 133 and the shaft 103 at right angles to the pawl member and having an operating head 139. This pin is adapted to prevent rotation of the pawl member in the aperture 131. The pawl member may be removed from the aperture 131 for replacement by first removing the pin 137 and then withdrawing the pawl member by means of a handle 141 provided at its upper end. A pawl tooth 145 is arranged at the lower end of the pawl member 49. The pawl tooth 145 has a bottom surface comprising an inclined plane and providing a raised heel 147 and a depressed toe 149 adapted to engage the rear-most edge of aperture 179 formed in the strip upon rearward movement of the shaft 103 and to move the work strip through a distance equal to the throw of the shaft. During the return travel of the shaft 103, the heel 147 followed by the inclined plane of the pawl, rides over the surface of the work strip and the toe 149 is received by the succeeding aperture 179 in position to move the strip.

The cam shaft 109 is rotated by a sprocket 151 secured thereon by means of lock nuts 155. The sprocket is driven by a chain 153 which in turn is driven by a similar sprocket (not shown) mounted on the main drive shaft of the punch press, so that the cam shaft 109 is rotated once during each operating cycle of the punch press. The cam shaft 109 carries a worm gear 157 which has driving engagement with a worm wheel 159 mounted on a shaft 161 rotatably mounted in bearings 163 suitably arranged in the supporting frame 57. The shaft 161 carries a belt pulley 165 over which a belt 167 is arranged. The belt 167 engages the pulley 55 on the shaft carrying the take up reel 51 which is thus driven from the main drive shaft of the punch press, the parts being arranged to drive the take-up reel at a speed to exert tension continuously upon the free ends of the punched work strip delivered thereto from the punch press and feeding device slippage of the belt upon the pulley 55 accommodating the increase in diameter of the take-up reel as it becomes loaded with the work strip.

The end thrust of the cam shaft 109 due to operation of the cam member is taken by an end thrust roller bearing 169, arranged in a socket 173 formed in the supporting frame 57 adjacent the rearward end of the cam shaft bearing 111, and which engages a shoulder 171 formed on the cam shaft 109. End thrust on the cam shaft in the opposite direction caused by the operation of the worm 157 and worm wheel 159 is absorbed by a step bearing engagement between a shoulder 177 formed on the cam shaft 109 and a peripheral flange 175 formed at the forward end of the rearward cam shaft bearing 112.

It is thought that the advantages of the herein described feeding device will be readily apparent. The reciprocating strip engaging and moving pawl provides a means for drawing an exact length of the work strip through the dies of the press at the completion of each punching cycle, the one way toggle clamp prevents the strip from reversing its movement and from sliding backwardly into the dies while the pawl is moving forward to reengage the strip, the take-up reel winds up the punched strip tightly and neatly and the checking clamp exerts a snubbing action which prevents the tension imparted to the strip by the take-up reel from drawing the strip prematurely through the punch press.

It will be apparent that numerous changes may be made in the form and construction of the devices without departing from the spirit and scope of the invention.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. In a device of the class described, a take up device for receiving a work strip under tension, a member operating on the work strip, and checking means having a member disposed adjacent the path of said strip around which the strip may be deflected to prevent said take up means from effecting movement of the strip past said operating member.

2. In a device of the class described wherein there is a feeding element and a take up device for receiving, under tension, a work strip discharged from said feeding element, and a checking device comprising a member having a member arranged along the path of said discharged strip and around which the strip may be deflected, to prevent the tension imparted to said strip by the take up device from effecting movement of said strip at the feeding device.

3. In a device of the class described, a device for feeding a work strip, a take up device for receiving the work strip under tension, and a snubber for preventing the take up device from advancing the work strip past the feeding device, the snubber comprising a member, and the take up device being in position to draw the work strip around said member to enable said member to exert a snubbing action.

In witness whereof, I have hereunto subscribed my name.

CARL G. LILJEBERG.