Dec. 4, 1951 E. LAXO 2,577,084

RECIPROCATING STRIP FEEDING MECHANISM

Filed June 1, 1948 7 Sheets-Sheet 1

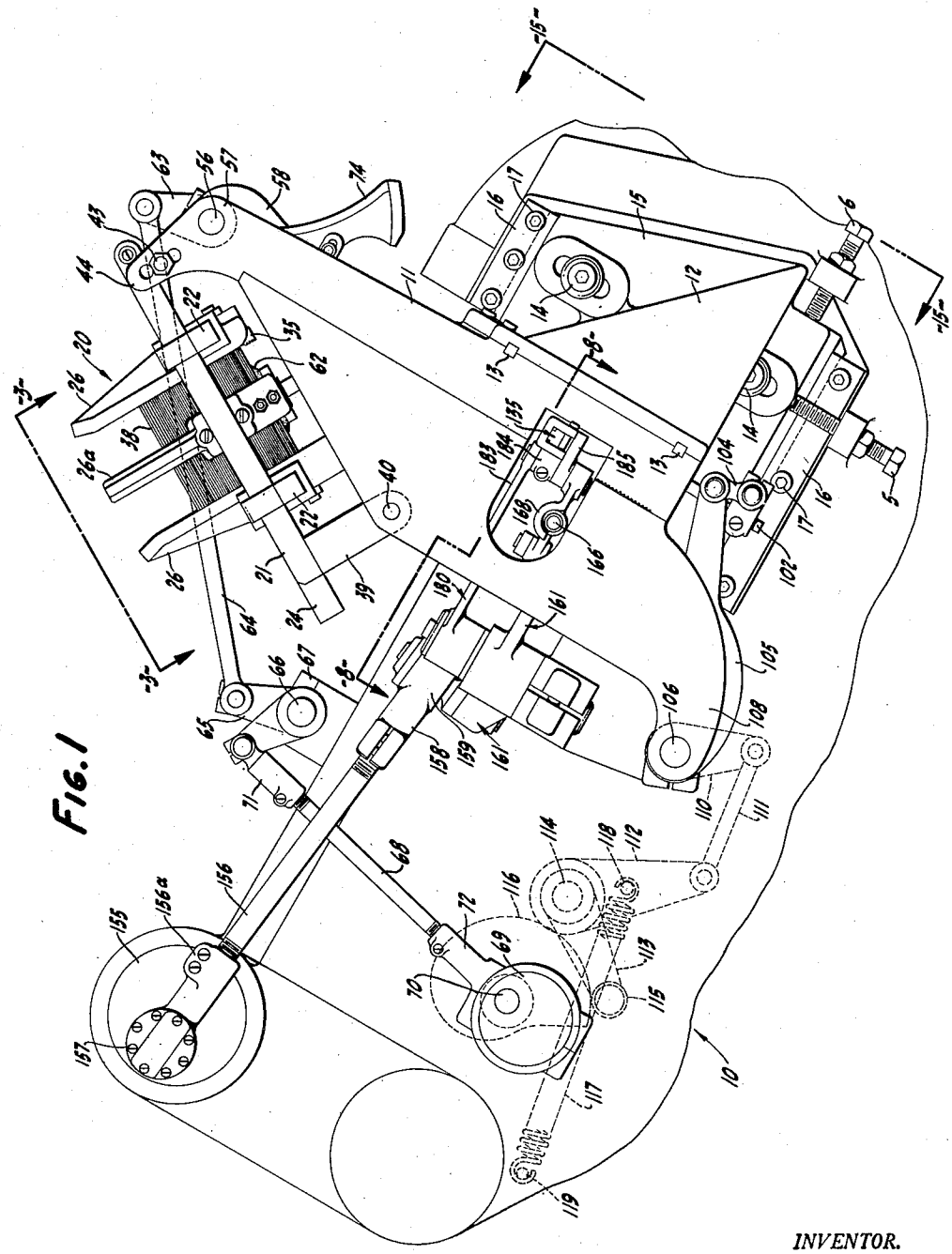


FIG. 1

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RECIPROCATING STRIP FEEDING MECHANISM

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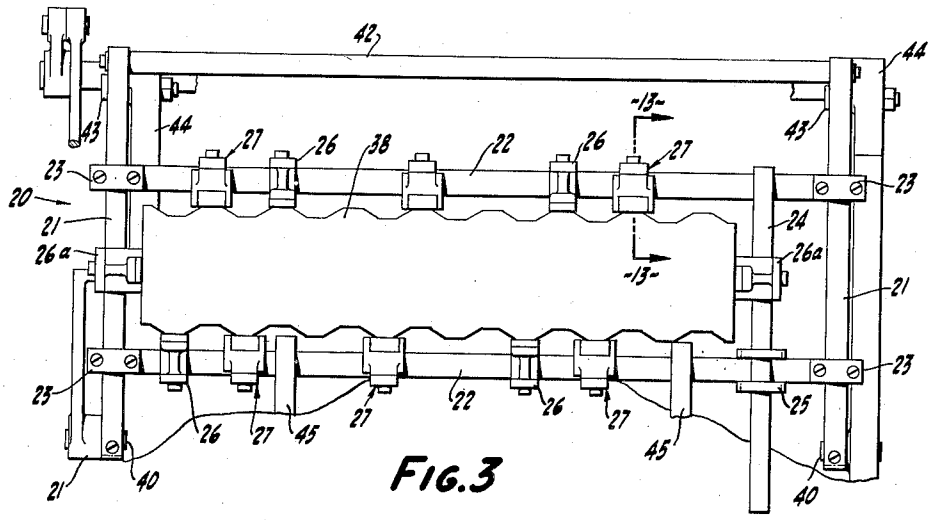


FIG. 3

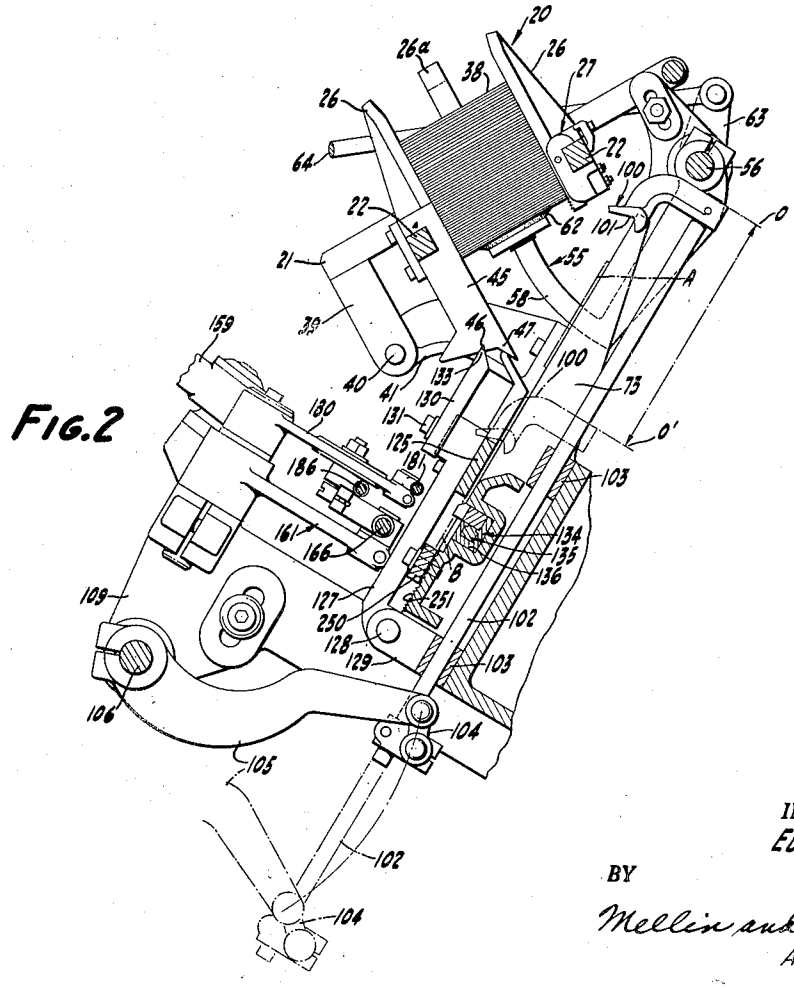


FIG. 2

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RECIPROCATING STRIP FEEDING MECHANISM

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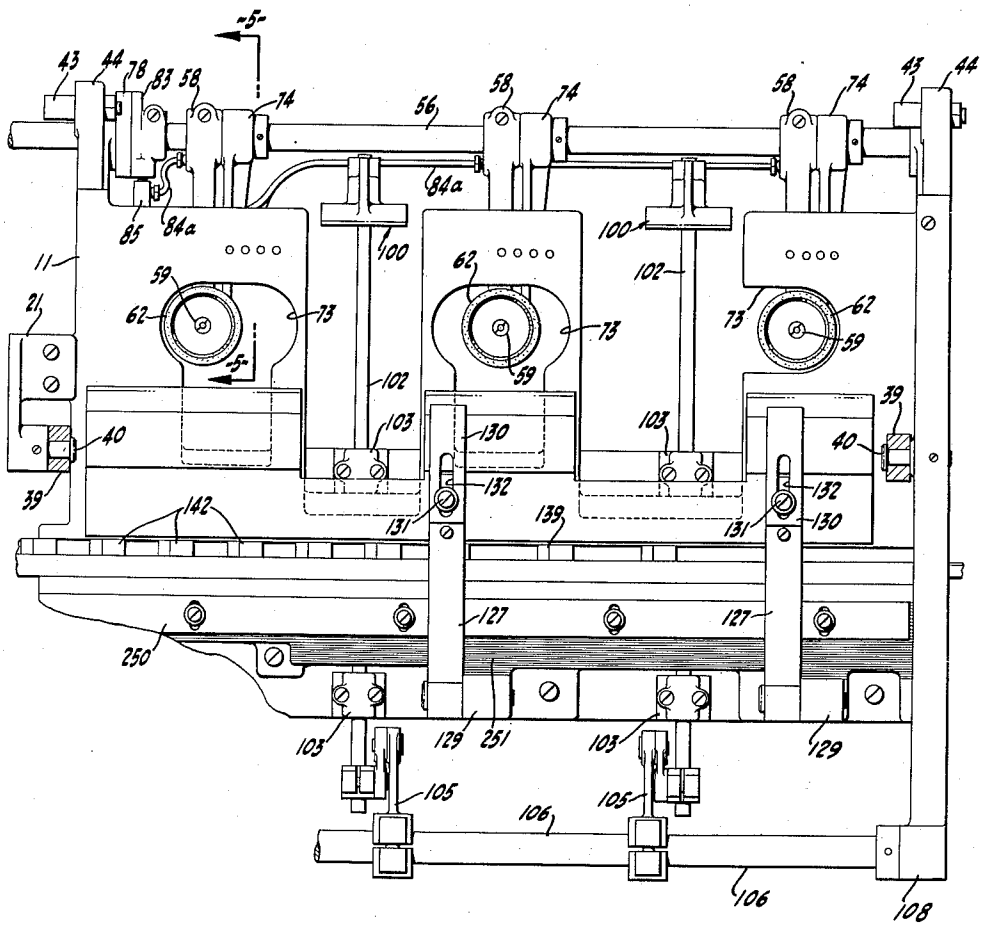


FIG. 4

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RECIPROCATING STRIP FEEDING MECHANISM

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FIG. 5

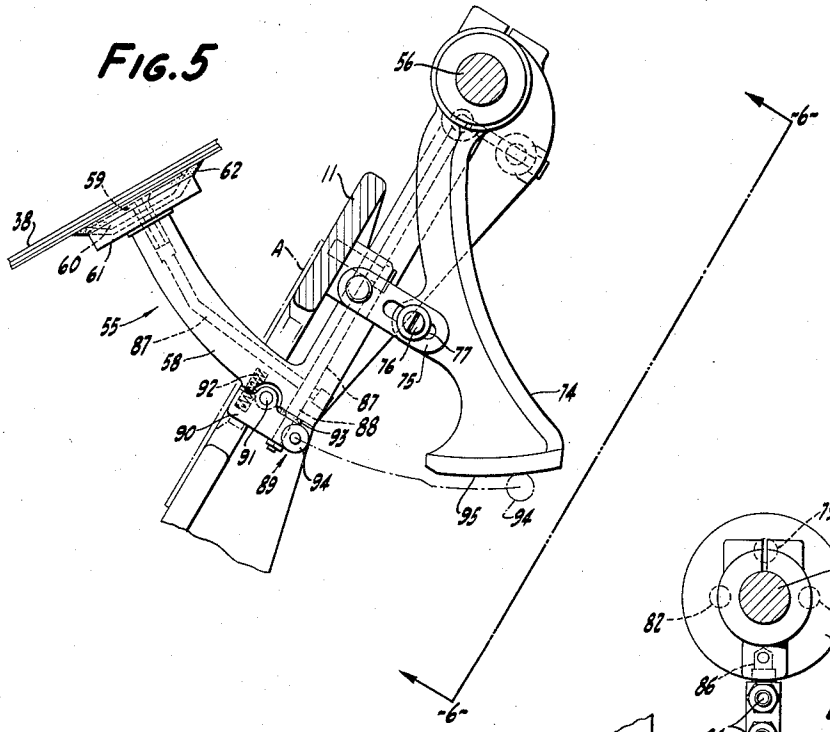
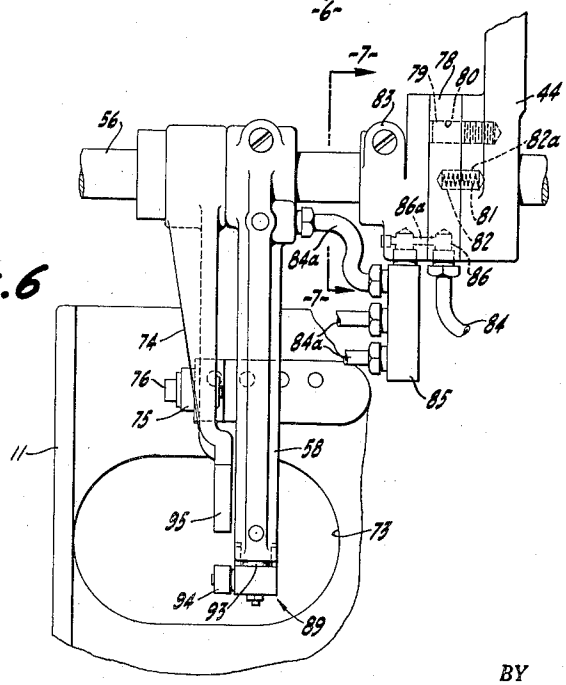


FIG. 7

FIG. 6



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RECIPROCATING STRIP FEEDING MECHANISM

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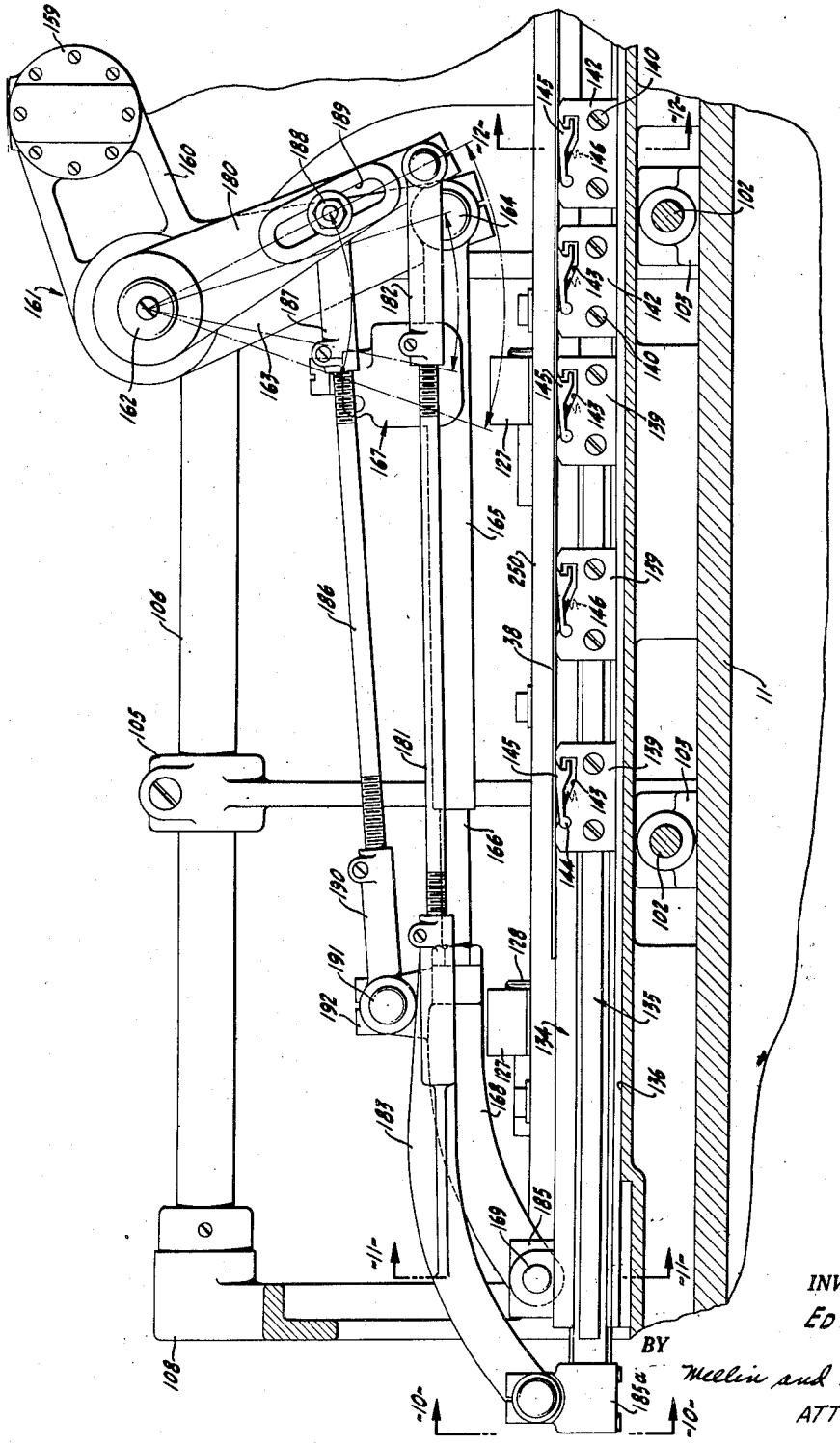


FIG. 8

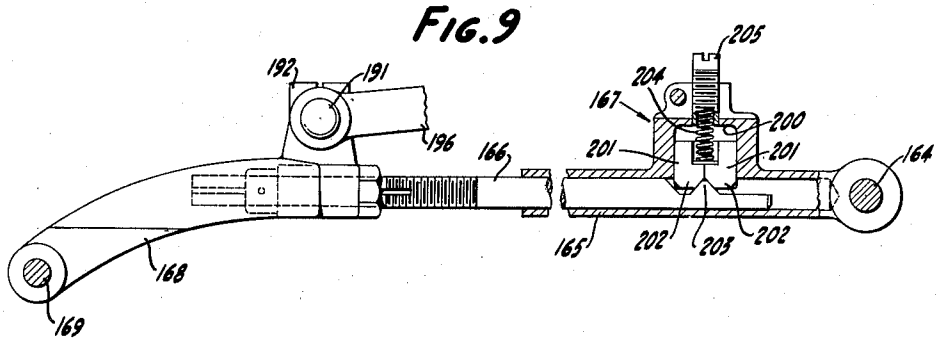
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RECIPROCATING STRIP FEEDING MECHANISM

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FIG. 9



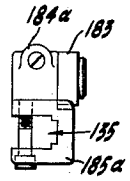


FIG. 10

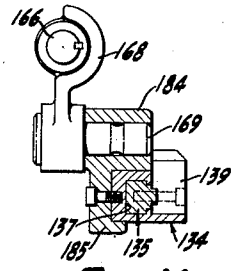


FIG. 11

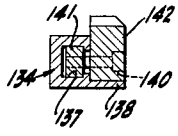


FIG. 12

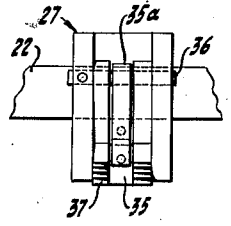


FIG. 14

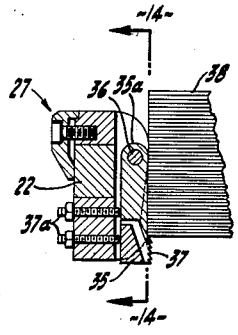


FIG. 13

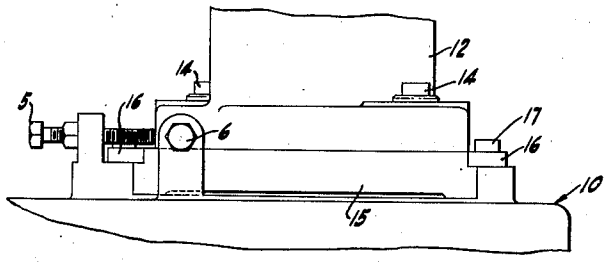


FIG. 15

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Dec. 4, 1951 E. LAXO 2,577,084

RECIPROCATING STRIP FEEDING MECHANISM

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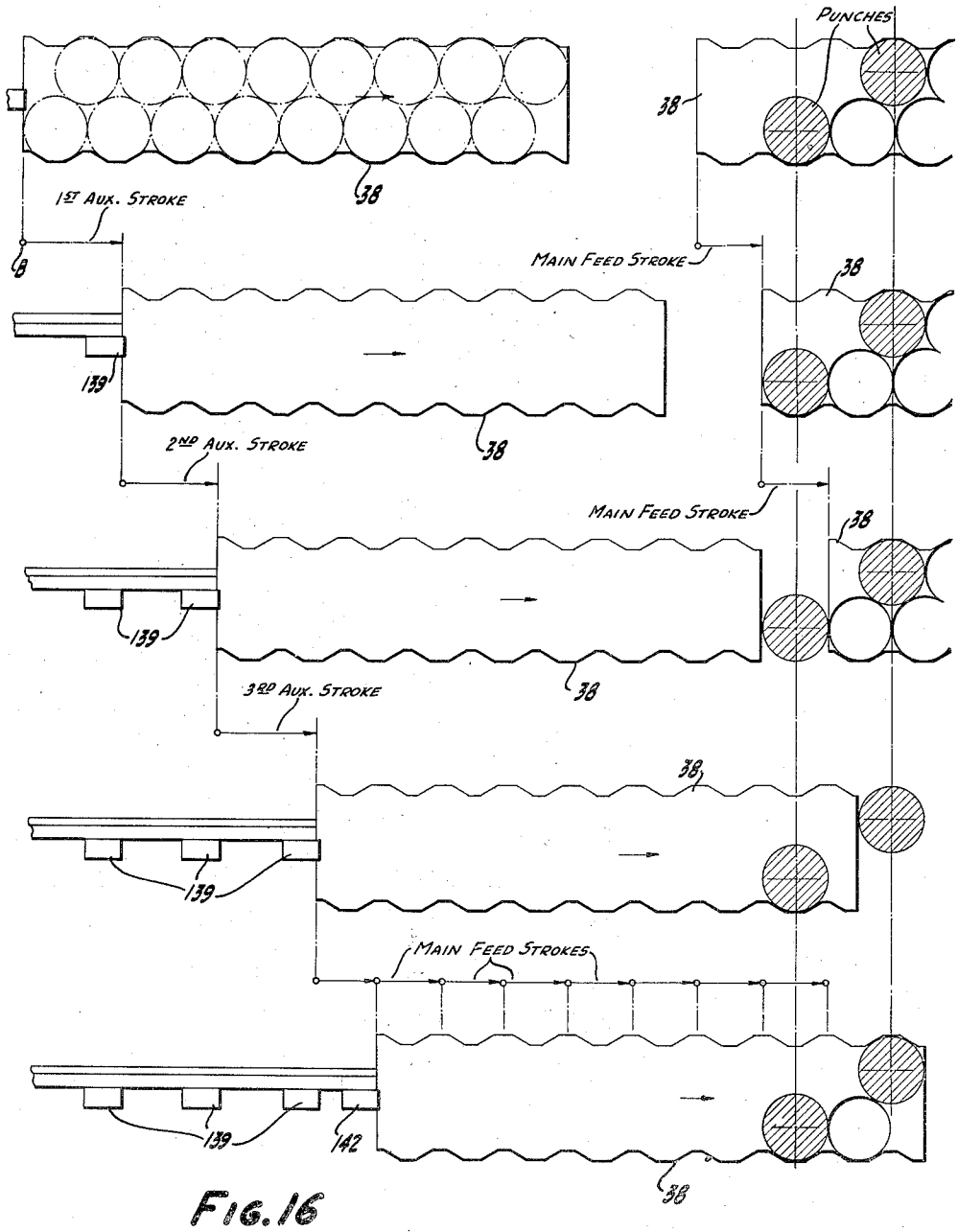


FIG. 16

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Patented Dec. 4, 1951 2,577,084

UNITED STATES PATENT OFFICE

2,577,084

RECIPROCATING STRIP FEEDING MECHANISM

Ed Laxo, Oakland, Calif., assignor to Atlas Imperial Diesel Engine Co., Oakland, Calif., a corporation of Delaware

Application June 1, 1948, Serial No. 30,243

1 Claim. (Cl. 271—54)

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This invention relates to a feeding mechanism. More particularly, it relates to a mechanism for feeding metal blanks, such as strips of tin plate, to a punch press for punching out the ends of cans. The mechanism is, however, applicable to intermittent feeding of various objects to a second mechanism for cutting, punching, stamping or other operations.

In a punch press of the type used to punch the ends of cans from metal strips, two punches are provided which are staggered or disposed diagonally to one another in relation to the line of travel of the metal strips. The punches operate in unison, punching out two, diagonally spaced ends on each punching stroke. Two parallel rows of staggered holes are thus punched in each strip.

In feeding strips to a punch press of this type, each strip must be advanced from an initial position on a feed table to align one end thereof for the first punching operation, and thereafter it must be advanced by uniform increments equal to the center-to-center distance between adjacent holes or ends punched in each row. The second feeding operation will be hereinafter referred to as the main feed and the first feeding operation as the auxiliary feed.

In feeding mechanisms for the purpose described, high speed, dependable and accurate feeding and compactness are of prime importance. It is important that individual strips be rapidly and synchronously extracted from a supply of the same. It is also important that the main feed and auxiliary feed be such as to allow uniform, rapid reciprocation of the punches and to insure that a blank is properly aligned for punching on each punching stroke. It is further desirable that, in the event of jamming of the feed table by a strip, the feeding be brought to an immediate halt to prevent damage to costly elements of the apparatus.

Feeding mechanisms as heretofore designed leave much to be desired in these and other respects. Thus, the means in use to extract strips from a stack of the same, and to position each strip on the feed table in proper timed relationship to the feeding movements of the preceding strip, have been unduly complicated, bulky, and of not too rugged construction. Also, the auxiliary feeding means has been of awkward design, being top heavy and resulting in a large degree of vibration.

It is an object of the present invention to provide an improved apparatus for feeding metal strips or the like to a punch press or the like.

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It is a further object to provide a feeding apparatus of the character described having improved means of extracting metal strips from a supply of the same and positioning each strip in proper timed relationship on a feed table.

It is a still further object to provide a sheet feeding apparatus having improved feeding means for feeding the individual strips to and registering them with reciprocating punches.

It is yet a further object of the invention to provide means for interrupting the feeding of metal strips in an apparatus of the character described, in the event of jamming of a strip.

These and other objects of the invention will be apparent from the ensuing description and the appended claim.

One form which the invention may assume is exemplified in the following description and illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is an end view of the feeding mechanism as viewed from the end farthest from the punches, and showing fragmentarily a part of the punch press frame.

Fig. 2 is a transverse section, being a view in the same direction as in Fig. 1, and showing certain details of the feed hopper and feed table.

Fig. 3 is a plan view of the feed hopper taken along the line 3—3 of Fig. 1.

Fig. 4 is a plan view of the feed table with the feed hopper removed.

Fig. 5 is a section taken along the line 5—5 of Fig. 4, showing details of the suction mechanism used for extracting metal strips from the hopper.

Fig. 6 is another view of the suction mechanism, taken along the line 6—6 of Fig. 5.

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 6, showing certain details of the suction mechanism.

Fig. 8 is a longitudinal sectional view taken along the line 8—8 of Fig. 1, showing the main and auxiliary feed mechanism.

Fig. 9 is an elevational view, partly broken away, showing the safety device employed to interrupt the feed mechanism in the event of jamming of a strip.

Fig. 10 is an end view, taken along the line 10—10 of Fig. 8, and Figs. 11 and 12 are transverse cross-sections taken along the lines 11—11 and 12—12, respectively, of Fig. 8, all showing details of the feed bar structures.

Fig. 13 is a section taken along the line 13—13 of Fig. 3, showing certain details of the feed hopper construction.

Fig. 14 is a view elevation taken along the line 14—14 of Fig. 13.

Fig. 15 is an end view, taken along the line 15—15 of Fig. 1, showing the adjustable mounting of the feed table.

Fig. 16 is a schematic illustration of the progress of a strip through the feeding mechanism and punch press.

Referring now to the drawings, and more particularly to Figs. 1, 2 and 3, the numeral 10 indicates one side of the main frame of a punch press including a punching element (not shown). A feed table 11 is secured to a supporting bracket 12 and is aligned therewith by means of keys 13. The supporting bracket 12 is bolted at 14 to an intermediate bracket 15 which is carried in gibs 16 bolted to side 10 of the press frame by bolts 17. As shown more clearly in Fig. 14, the feed table is adjustable in either of two mutually perpendicular directions, by loosening bolts 14 or 17 and turning screw 5 or 6.

As shown, the feed table 11 is set at a steep angle, and thereabove is a feed hopper generally designated as 20, which comprises end bars 21 and side bars 22, the latter being adjustably clamped to the end bars at 23 to allow variable spacing of the side bars to accommodate strips of different widths. To accommodate strips of different length, an auxiliary end bar 24 is provided which is adjustably clamped to a side bar at 25, as shown. Adjustably clamped to the side bars 22 are posts 26 and retainers 27, and to the left hand end bar (as viewed in Fig. 3) and auxiliary bar 24 are adjustably clamped combination posts and retainers 26*a*. Each retainer 27, as shown more clearly in Figs. 13 and 14, is provided with claws 35 pivotally supported at 36 and having serrations or teeth 37 at its lower end. An auxiliary member 35*a* pivotally supported between the arms of the retainer, as shown, serves to guide and align the strips, and adjustable stop screws 37*a* position the claws 35 and auxiliary members 35*a* to properly retain the strips. The claws 35 and auxiliary members 35*a* serve to retain a stack of strips 38 in the hopper until a suction mechanism hereinafter described operates to extract the lowermost strip from the stack of strips. The members 26*a* are similarly provided with claws to function as combined posts and retainers.

As shown, the end bars 21 extend both outwardly and inwardly of the hopper frame, and at their inner ends they are hingedly connected at 40 by brackets 39 to supporting brackets 41, which are bolted to the feed table. The outer ends of the end bars 21 are connected by a handle 42, by means of which the feed hopper may be pivoted about its hinged connection 40. Normally, with the feed hopper 20 in operative position, the end bars 21 rest upon adjustable stops or lugs 43 carried by brackets 44 integral with the feed table. Also, clamped to and depending from the inner side bar 22, is a block 45 provided with a notch 46 and a finger 47 at its lower end for the purpose hereinafter described.

Referring more particularly to Figs. 2 and 5 to 7, the strips 38 are withdrawn one at a time from the bottom of the hopper 20, by a plurality of suction means generally designated as 55, each of which is secured to a shaft 56 extending between and journaled in the upper ends of the feed table at 57 (see Fig. 1). Each suction means 55 comprises a generally L-shaped arm 58 clamped to the shaft 56. Secured to the free end of each arm by a screw 59 and washer 60, are a holder

61 and a rubber suction cup 62. The suction arms 58 are actuated, and are caused to swing through an arc between the plane of the bottom of the feed hopper and the plane of the feed table, by means (see Fig. 1) comprising a lever 63 clamped to the shaft 56, a connecting rod 64, a bell crank 65 (which is mounted on a stub shaft 66 carried by a bearing block 67 secured to the press frame 10), a second connecting rod 68, and an eccentric 69 secured to the outer end of a shaft 70 extending through and outwardly of the press frame 10. The shaft 70 is rotated, through a suitable driving connection (not shown) by the press crankshaft (not shown). The linkage shown as operatively connecting the eccentric 69 and the lever 63 is employed to clear certain parts of the machine, and the connecting rod 68 is threaded into rod ends 71 and 72 to allow adjustment of the arc through which the arms 58 oscillate.

It will thus be seen that, as the shaft 70 rotates, each of the suction arms 58 will swing upwardly into the position shown in Figs. 1 and 2 adjacent the bottom-most strip in the feed hopper, and will then swing downwardly to deposit the extracted strip at a position on the feed table 11 indicated as A in Fig. 2, openings 73 being provided in the feed table (see Fig. 4) to accommodate the suction arms and cups.

Suction is applied to extract the bottom strip from the hopper, and the suction is broken after the strip has been deposited on the feed table at A, by the following means. With particular reference to Figs. 5 to 7, an arm 74 carried on the shaft 56 adjacent each suction arm 58 is secured against rotation by a slotted bracket 75 secured to and depending from the feed table 11. The angularity of the arm 74 is adjustable by means of a screw 76 and slot 77 formed in the bracket 75. A sealing collar 78 is also carried on the shaft and is secured against rotation but is free to slide axially of the shaft by reason of a pin 79 lying within a socket 80 formed in the sealing collar 78 and in threaded engagement with the left hand bracket 44 (as viewed in Fig. 4). A pair of coil springs 81 received within sockets 82 and 82*a* formed in the same members serve to force the collar 78 against a fixed sealing member 83 clamped to the shaft 56. A main suction conduit 84 and branch suction conduits 84*a* are interconnected by a manifold 85 and aligned passageways 86 and 86*a* formed in the sealing collar 78 and sealing member 83; the main suction conduit leading to any suitable suction means (not shown). It will be seen that, as the shaft 56 and the arms 58 oscillate, the suction passages 86 and 86*a* will align and disalign periodically, and that merely by turning the fixed sealing member 83 and clamping it in the desired position, the pulling of a vacuum through these passageways can be made to occur at the proper time in the sequence of operations; i. e., when the suction cup 62 is in contact with the bottom strip 38.

An air passage 87 is formed in each arm 58, communicating the branch conduits 84*a* with their respective suction cups. Each passage 87 is also drilled completely through at 88, and a suction release valve generally designated as 89 is provided. The valve 89 comprises a body 90 pivotally secured to the arm at 91, a coil spring 92, a valve stem and head 93 and a roller 94. It will be seen that the spring 92 normally seats the valve head 93 in the open end of the passage 87 (which is appropriately cored out to re-

ceive the valve head), and that, on the downstroke of the arm 58, the valve is opened by engagement of the roller 94 with a cam surface 95 formed on the arm 74 as is shown in broken lines in Fig. 5. By adjustment of the angularity of the arm 74, the valve 89 is opened, and the suction is released, at the proper moment; i. e., when the extracted strip 38 has been deposited on the feed table 11. Further, by means of the adjustable link 66 referred to hereinabove (see Fig. 1) in the mechanism actuating the shaft 56 and suction arms 58, the latter are caused to swing sufficiently below the plane of the feed table to clear the feed fingers (described hereinafter) which perform the next feeding operation.

Referring now more particularly to Figs. 1, 2 and 4, each strip, after being deposited upon the feed table at the position A, is next moved across the feed table to a position indicated as B in alignment with the punches of the press. This transverse feeding movement is accomplished by means of fingers or inserters 100, each of which is notched at 101 and is so positioned as to align the apex of the notch with the plane of the feed table. Each inserter 100 is secured to the upper end of a rod 102, which is carried under the feed table in bearing blocks 103 secured to the feed table supporting framework. Each rod 102 is reciprocated by means comprising a drag link 104 clamped to the lower end of the rod, an operating arm 105 secured to the other end of the drag link and clamped at its opposite end to a shaft 106. One end of the shaft 106 is journaled in a bearing bracket 108 bolted to the feed table, and the opposite end of the shaft is journaled in an extension 109 of the feed table supporting framework. The shaft 106 extends through the extension 109 and through and inwardly of the press frame 10, which is suitably cored out to clear it. Within the press frame, as shown in broken lines in Fig. 1, an arm 110 is clamped to the end of the shaft 106 and is connected by a link 111 to a second arm 112. The arm 112 is clamped to the hub of a cam follower lever 113 carried on a shouldered stud 114 secured in the press frame, and the lever 113 carries a roller 115 engaging a cam 116 secured to the above-mentioned shaft 70, the follower 115 being held in engagement with the cam by means of a coil spring 117 secured at 118 to the arm 112 and at 119 to the press frame.

The cam 116 is so contoured that the inserters 100 descend with a relatively rapid motion, dwell for a short period until the strip is properly started forward as described hereinafter, and then rise to inserting position with a slower movement. It is further to be noted that both the eccentric 69 actuating the suction arms 58 and the cam 116 actuating the inserters 100, are secured to the same shaft. It is thus possible, merely by rotating either of these elements about the shaft 70, to change their relative angularity and provide proper and accurate timing of the strip extracting and inserting movements.

As stated, each strip 38 is moved by the inserters 100 from the position indicated as A in Fig. 2 to the position indicated as B, in which latter position it is in alignment with the punches of the press. For the purpose of holding each strip flat upon the feed table as it is being advanced toward the press punches, there is provided a guide 125 which is carried by supports 127 pivotally secured at 128 to blocks 129 secured to the lowermost edge of the feed table. To

secure the guides in position, and also to effect proper alignment of the feed hopper 20, there are provided keeper blocks 130 adjustably bolted to the guide assembly by means of bolts 131 passing through ovate slots 132 formed in the keeper blocks. The upper end of each keeper block is tapered to provide an angular corner or edge 133, which is complemental to the above-mentioned notch 46 formed in the mating blocks 45 secured to the feed hopper 20. As shown in Fig. 2, when the feed hopper 20 and the guide assembly 125 are in their normal operative position, the notches in the blocks 45 engage the tapered edges of the keeper blocks 130 and rest thereon. By adjustment of the keeper blocks forwardly or rearwardly, it is possible to compensate for discrepancies in the assembly of other parts of the machine. Also, by reason of the hinged connections 40 and 128, it is possible to lift the hopper 20 and guide 125 clear of the feed table to allow access to the latter for repairs, removing damaged strips, etc. A guide key 250 bolted to and running the length of the feed table, and engaging a grooved section 251, is also provided as a bottom support and guide for the strips as they are fed toward the punches.

Referring now more particularly to Fig. 8, to provide feeding movement of the strips 38 longitudinally of the feed table and toward the press punches, there are provided a main feed bar 134 and an auxiliary feed bar 135, which are in alignment and are received within and are reciprocable within a slot 136 formed along the length of the feed table (see Fig. 2).

As shown more clearly in the cross-sectional views of Figs. 10, 11 and 12, the main feed bar 134 is in the form of a channel having a stepped recess 137 and a lateral extension 138, and the auxiliary feed bar 135 is in the form of a solid bar complemental to the recess 137 of the main feed bar. The auxiliary feed bar 135 lies generally within, and is reciprocable in the recess 137.

Bolted to the auxiliary feed bar 135 are a plurality of blocks 139, and adjustably clamped to the main feed bar, to the right of the auxiliary feed bar, by means of bolts 140 and blocks 141, are a plurality of blocks 142 similar to the blocks 139 bolted to the auxiliary bar. Each of the blocks 139 and 142 is recessed at 143 (see Fig. 8), and hingedly secured at 144 within each recess is a feed finger 145 urged upwardly to extend slightly above the feed table by a coil spring 146. The blocks 142, hence the feed fingers 145, thus secured to the main feed bar are equal in number to the ends to be punched in a single row from a strip 38, and they are spaced apart a distance equal to the center-to-center spacing of the ends thus to be punched. The blocks 139 and feed fingers 145 bolted to the auxiliary feed bar 135 may be fewer in number and their spacing is such as to feed each strip from its initial position B on the feed table (as deposited by the inserters 100) to a second position in proper alignment for punching the first end.

The mechanism for actuating the main and auxiliary feed bars is described hereinafter. At this point, and with reference to Fig. 16, the objects of the differential feeding of the feed bars 134 and 135 will be explained.

Referring now to Fig. 16, there is shown at the top and to the left a strip 38 from which two staggered rows of ends are to be punched, eight to a row, as shown in broken lines. The left hand strip is shown at its initial position B on the feed table, and to the right thereof is shown a

second strip 38 in alignment with the punches and from which several ends have been punched and from which two more ends (shown in shading) are about to be punched. As the latter ends are being punched, the left hand strip 38 is fed forwardly by the first auxiliary stroke and then by the second and third auxiliary strokes, at which time it is in position for punching the first end therefrom. From thence forward, the strip is fed forwardly in eight successive increments corresponding to the center-to-center spacing of can ends.

Turning now to the means for actuating the main and auxiliary feed bars, the main feed bar 134 is reciprocated by rotation of a crank disc 155 (see Fig. 1) mounted on one end of the press crankshaft (not shown). A connecting rod 156 is threaded at one end into a rod holder 156a connected eccentrically and adjustably to the crank disc 155 by a ball-and-socket connection 157. The other end of the connecting rod 156 is threaded into a second rod holder 158, which is connected by means of a ball-and-socket connection 159 (more clearly shown in Fig. 8) to an arm 160 of a rocker 161 mounted on a post 162 secured to the feed table supporting framework. the other arm 163 of the rocker 161 is secured at 164 to a sleeve or hollow stem 165 which is keyed to a connecting rod 166 by a safety device generally designated as 167 and described in detail hereinafter. The other end of the connecting rod 166 is threaded into a driving yoke 168. The opposite end of the yoke 168 is pivotally connected at 169 to the main feed bar 134.

The auxiliary feed bar 135 is reciprocated by the same rocker 161 which actuates the main feed bar. A lever 180 pivotally supported upon the same post 162 on which the rocker pivots, and overlying the rocker, is connected at its outer end through a connecting rod 181, a rod holder 182, and a driving yoke 183 to the auxiliary feed bar 135. As shown more clearly in Figs. 10 and 11, the main and auxiliary driving yokes are pivotally secured to their respective feed bars by means of bearings 184 and 184a and clamps 185 and 185a, respectively.

The lever 180 is actuated by the main driving yoke 168 by means of a connecting rod 186 threaded at one end into a rod holder 187, which is adjustably connected to the lever 180 by a nut and bolt 188 engaging a longitudinal slot 189 formed in the lever, and threaded at its other end into a second rod holder 190 pivotally secured at 191 to a lug 192 projecting from an integral with the main driving yoke 168. It will thus be seen that, as the main driving yoke 168 and main feed bar 134 are reciprocated, the auxiliary driving yoke 183 and auxiliary feed bar 135 will also be reciprocated in synchronism with the main feed bar, and that the stroke of the auxiliary feed bar can be adjusted relatively to that of the main feed bar by means of the adjustable connection of the rod holder 187 and the slotted lever 180.

As is apparent, the feed strokes of the auxiliary feed bar 135 are longer than the feed strokes of the main feed bar 134. This result is accomplished by the means described for driving the auxiliary feed bar. The latter is driven by the rod 186 connected by the rod end 187 to the lever 180 at 188, and by the rod 181 connected to the lever 180 at a point farther from its fulcrum than the point 188. Thus, as shown by the angles shown in broken lines, the amplitude of reciprocation of the rod 181, hence of the auxiliary feed bar 135, is greater than the amplitude of the rod 166 and main feed bar 134.

Reverting now to the safety device 167 serving to connect the sleeve 165 and connecting rod 166 of the main feed bar actuating mechanism, as shown more clearly in Fig. 9, a chamber 200 is provided, which is integral with the sleeve 165, and within the chamber 200 are disposed two blocks 201, each having a wedge-shaped portion 202 normally seated on a complemental wedge 203 formed in the connecting rod 166 and held in engagement therewith by a coil spring 204 maintained under any desired compression by means of an adjusting screw 205. The connection thus formed between the sleeve 165 and rod 166 serves to drive the rod, hence the main and auxiliary feed bars, during normal operations, but should a strip become jammed, the blocks 201 will be forced out of engagement with the wedge 203 and further reciprocation of the sleeve 165 will merely result in the sleeve sliding back and forth without reciprocating the rod 166.

It will thus be seen that a machine has been provided which rapidly extracts strips of metal or the like from a supply of the same, in accurately timed relationship to subsequent steps in the cycle of operation; which accurately and rapidly deposits and orients each strip on a feed table in alignment with press punches; which rapidly and accurately advances each strip to a position for the initial punching operation and thereafter feeds the strip in uniform increments through the press; which provides an automatic safety element to stop the feeding movements in the event of jamming of a strip; and which embodies such desirable features as compactness and ruggedness of design, the mounting of parts in relation to each other so as to minimize vibration, etc.

While I have shown the preferred form of my invention, it is to be understood that various changes may be made in its construction by those skilled in the art without departing from the spirit of the invention as defined in the appended claim.

Having thus described my invention, what I claim and desire to obtain by Letters Patent is:

A strip feeding device adapted to feed strips to a punch press, comprising a feed table having a groove formed therein and auxiliary feed member adapted to reciprocate and, on one or more feed strokes, to feed a strip along said table and align the leading edge thereof for a first punching operation, a main feed member slidably received in the groove and adapted to reciprocate and, on successive strokes, to align said strip for successive punching operations, said main feed member being channel shaped and slidably receiving within the channel thereof said auxiliary feed member, a first oscillatable member, means for oscillating said oscillating member, a rigid reciprocating element interconnecting said first oscillatable member and said main feed member for reciprocating said main feed member upon oscillation of said first oscillatable member, a second oscillatable member mounted for oscillating movement about the axis of oscillation of said first oscillatable member, a second rigid reciprocating element interconnecting said second oscillatable member and said auxiliary feed member for reciprocating said auxiliary feed member upon oscillation of said second oscillatable member, and a third rigid reciprocating element connected at one end to said

first reciprocating element and connected at its opposite end to said second oscillatable member for radial adjustment thereof whereby the length of travel of the auxiliary feed member can be increased or decreased by suitable radial adjustment of said opposite end of said third rigid element along said second oscillatable member.

ED LAXO.

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