

[54] FEEDING APPARATUS USING RACK
AND PINION MECHANISM HAVING
DWELL PERIODS

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[51] Int. Cl. B65h 17/22
[58] Field of Search.....226/137, 138, 139, 142, 156

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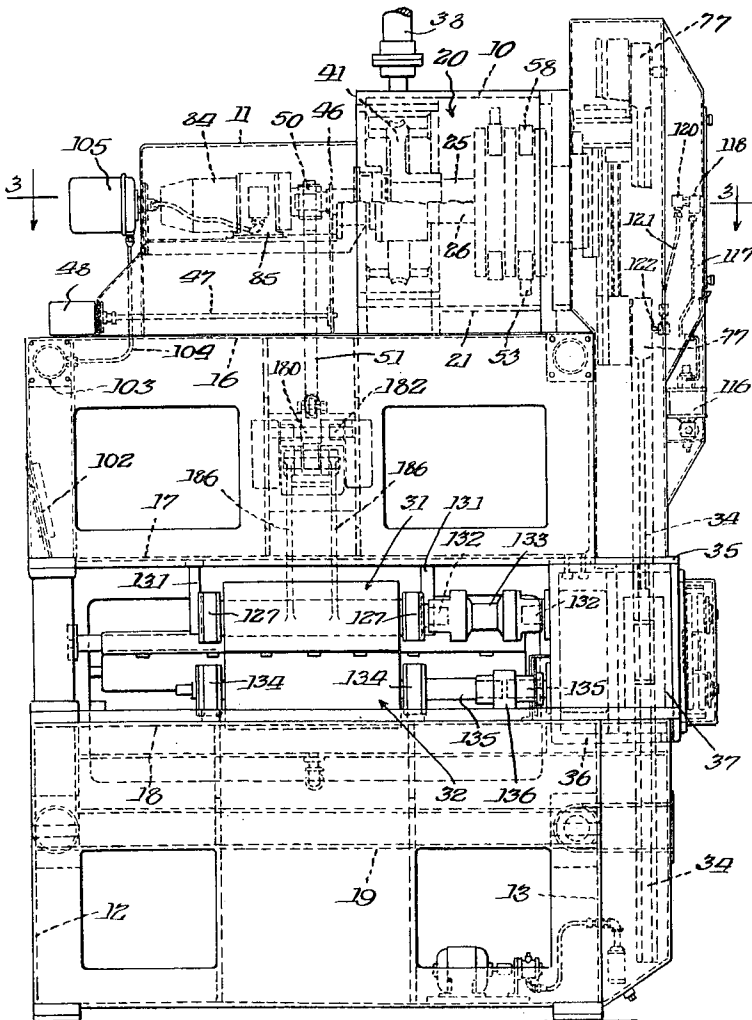
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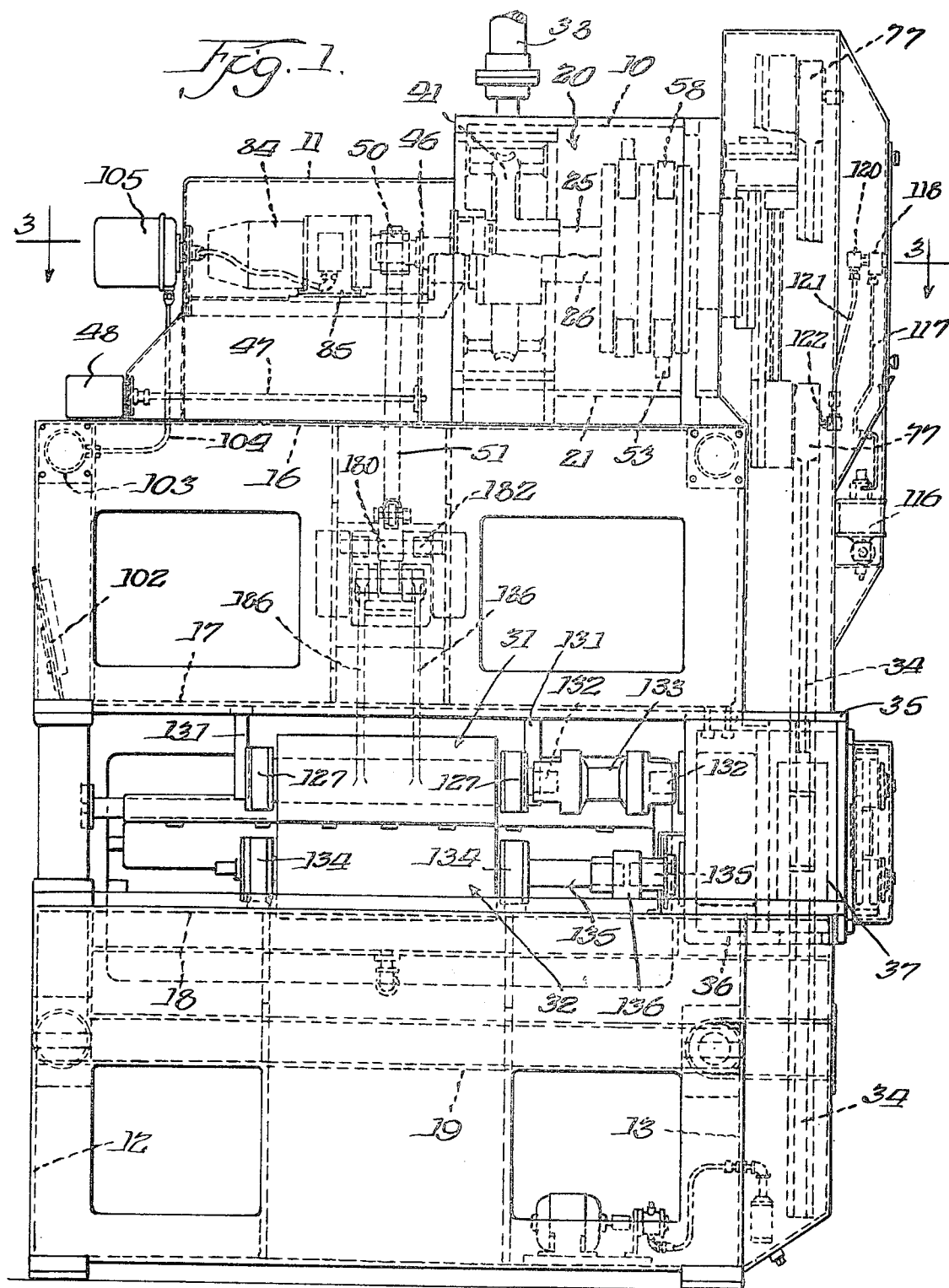
[57] ABSTRACT

For intermittently feeding strip material the invention provides rack and pinion mechanism, the rack operating on the pinion as the rack is caused to reciprocate by crank arm structure including a trunnion member carried in an adjustable manner on a rotating faceplate by means of a threaded shaft journaled for rotation within the faceplate. The threaded shaft can be rotated during operation of the apparatus to vary the position of the trunnion member on the faceplate for obtaining the desired feed lengths. A constantly rotating camshaft carrying conjugate cams produces intermittent rotation of the cam follower shaft which carries the faceplate, the said intermittent rotation being characterized by a dwell period at the end of each reciprocating stroke. The pinion is part of clutch structure which is duplicated for the lower and upper feed rolls. Each reciprocation of the rack produces a power stroke since on the downstroke one clutch structure is rendered operative and on the upstroke the other clutch structure is made operative.

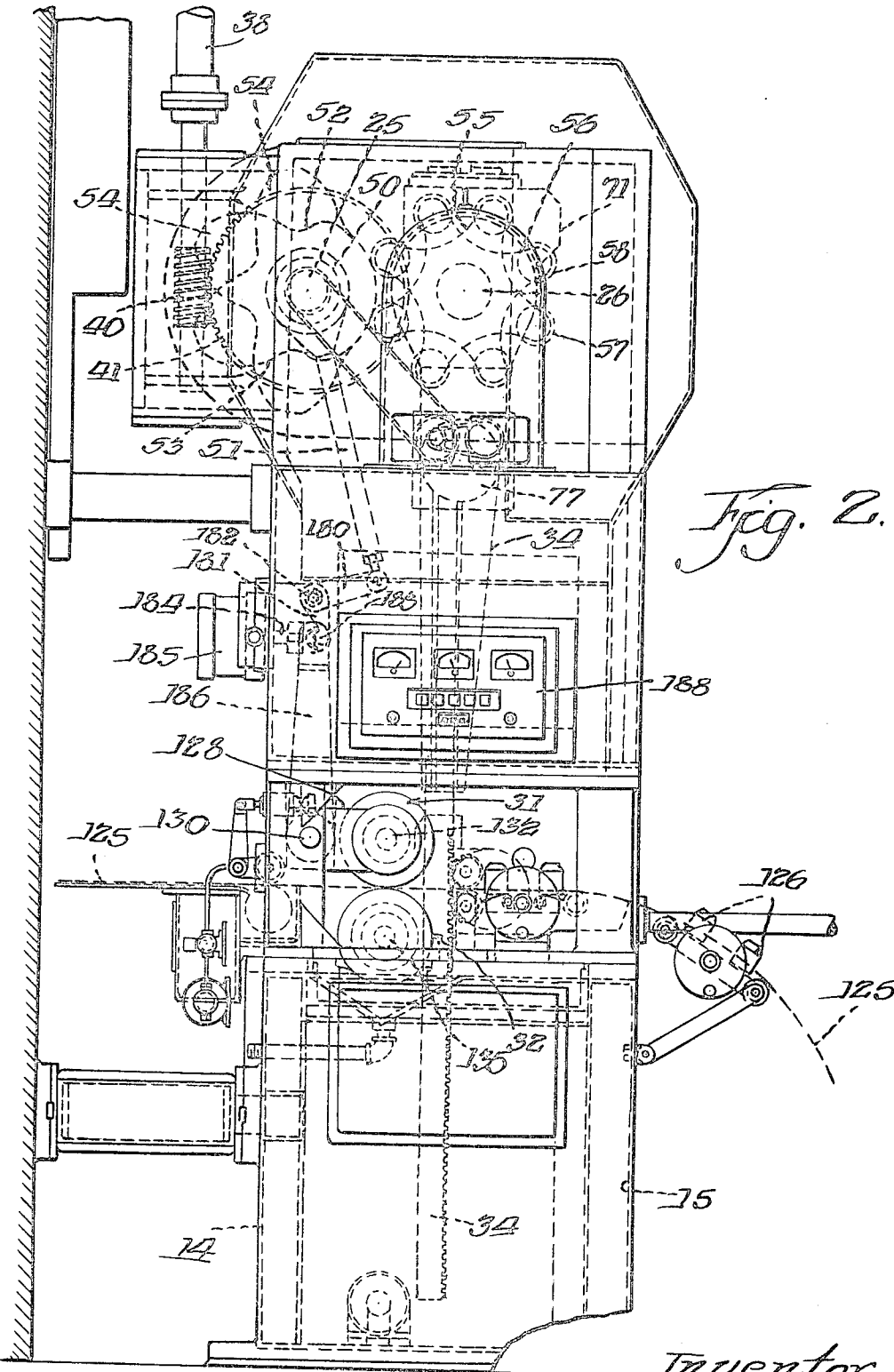
In operation of the present apparatus, the strip material is fed or advanced by the rotating upper and lower feed rolls for a predetermined feed length on each up and down reciprocating power stroke of the rack. During the dwell periods, the feed rolls and also the strip material remain at rest.

20 Claims, 11 Drawing Figures





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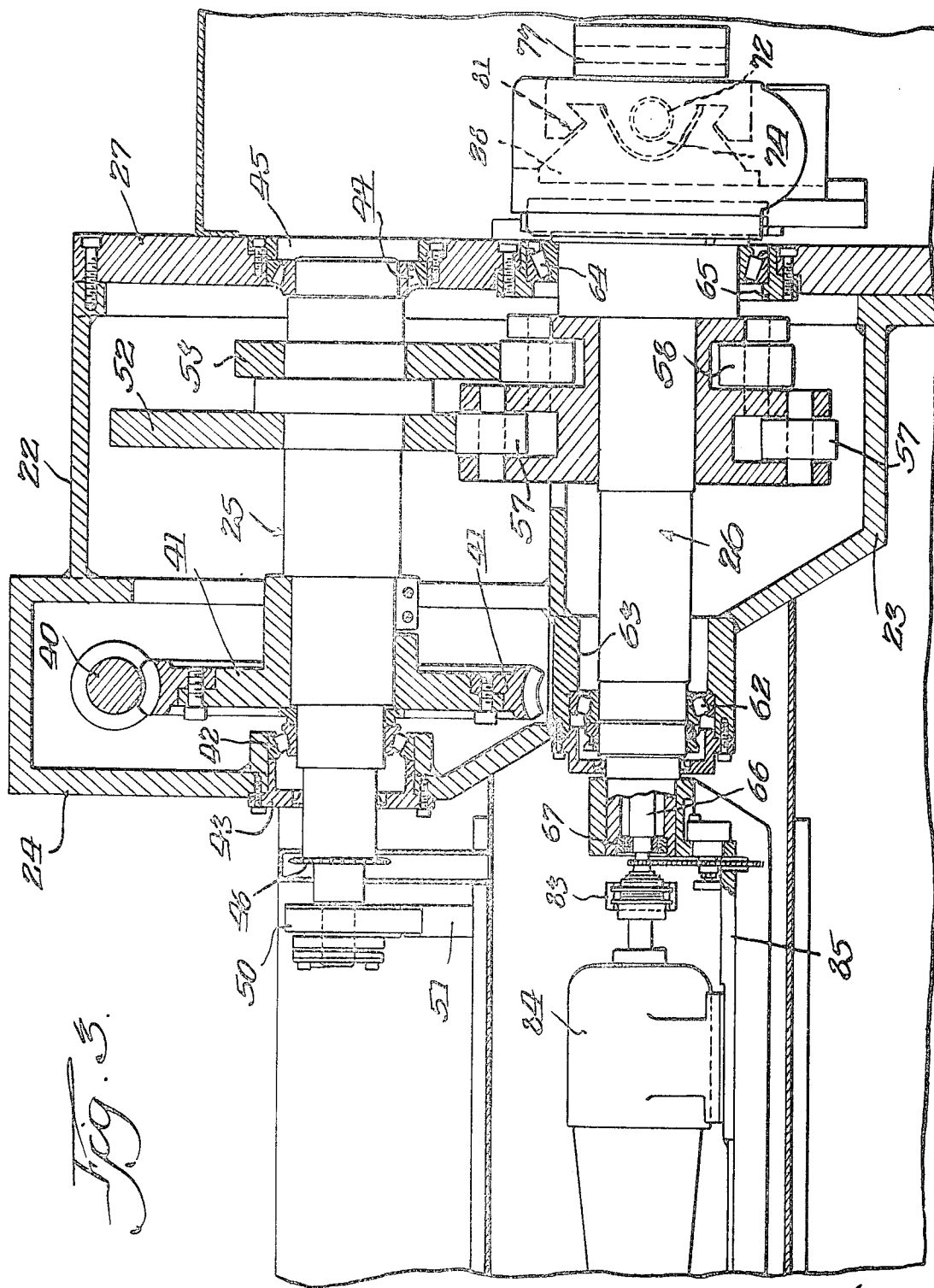
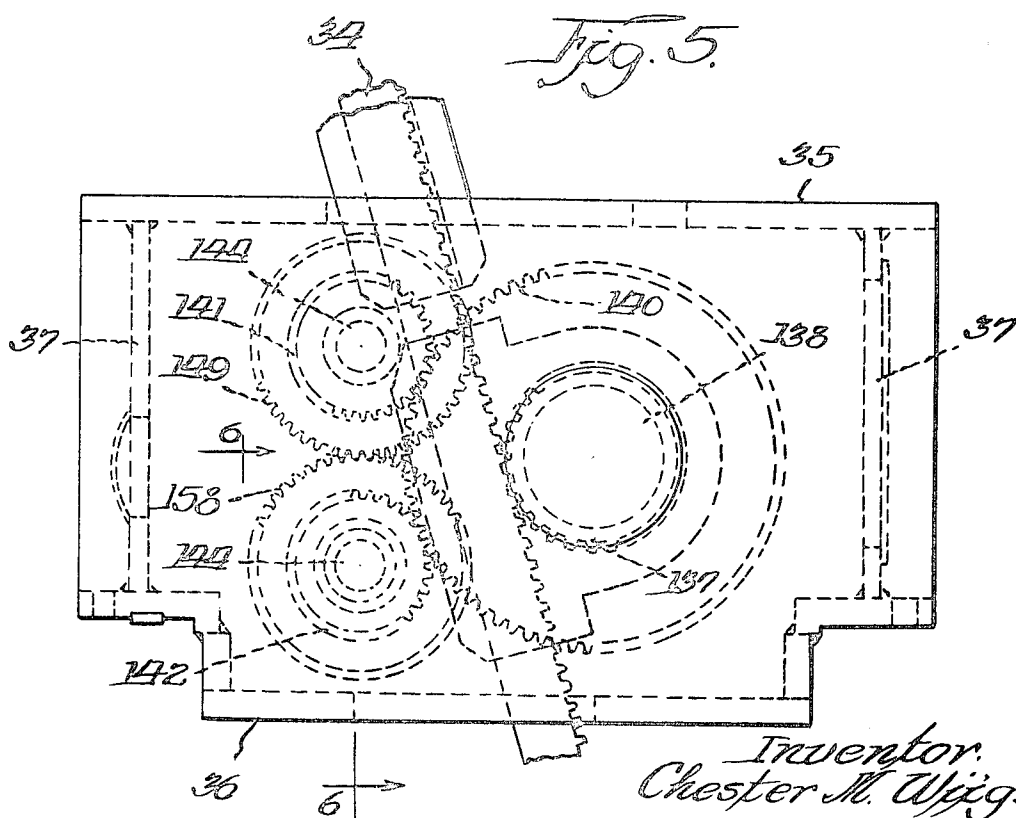
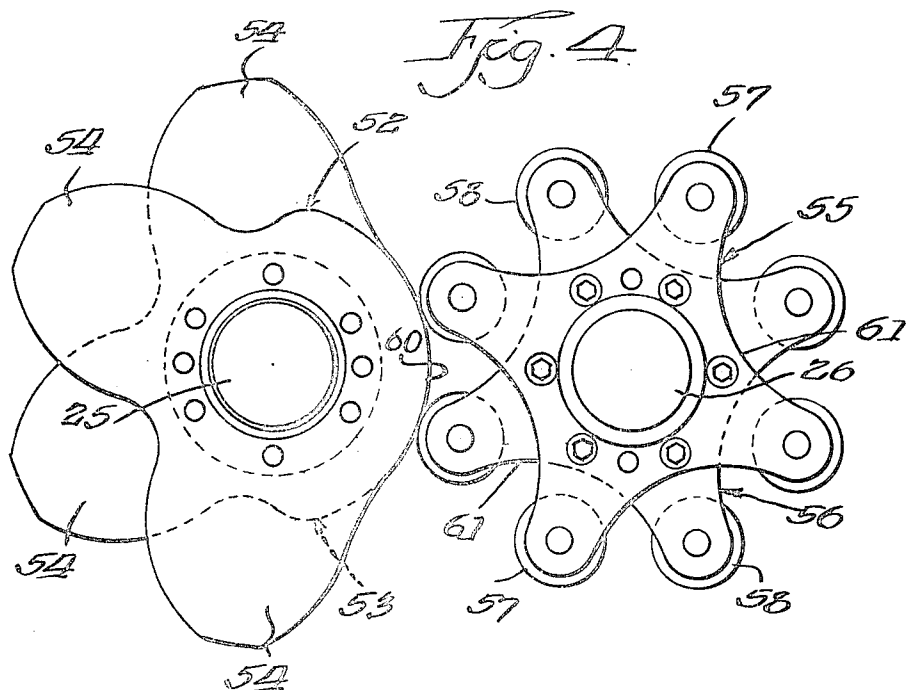
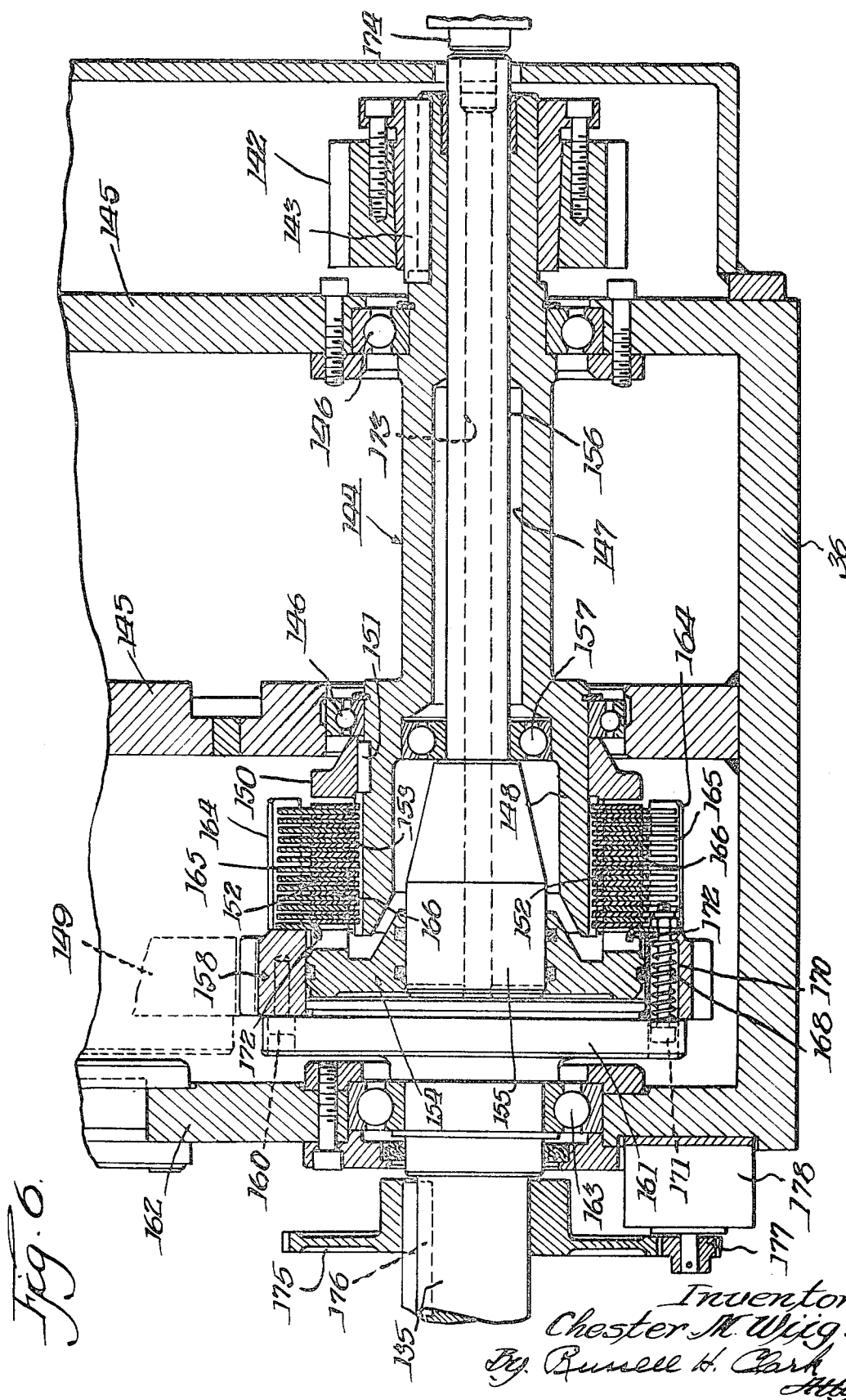


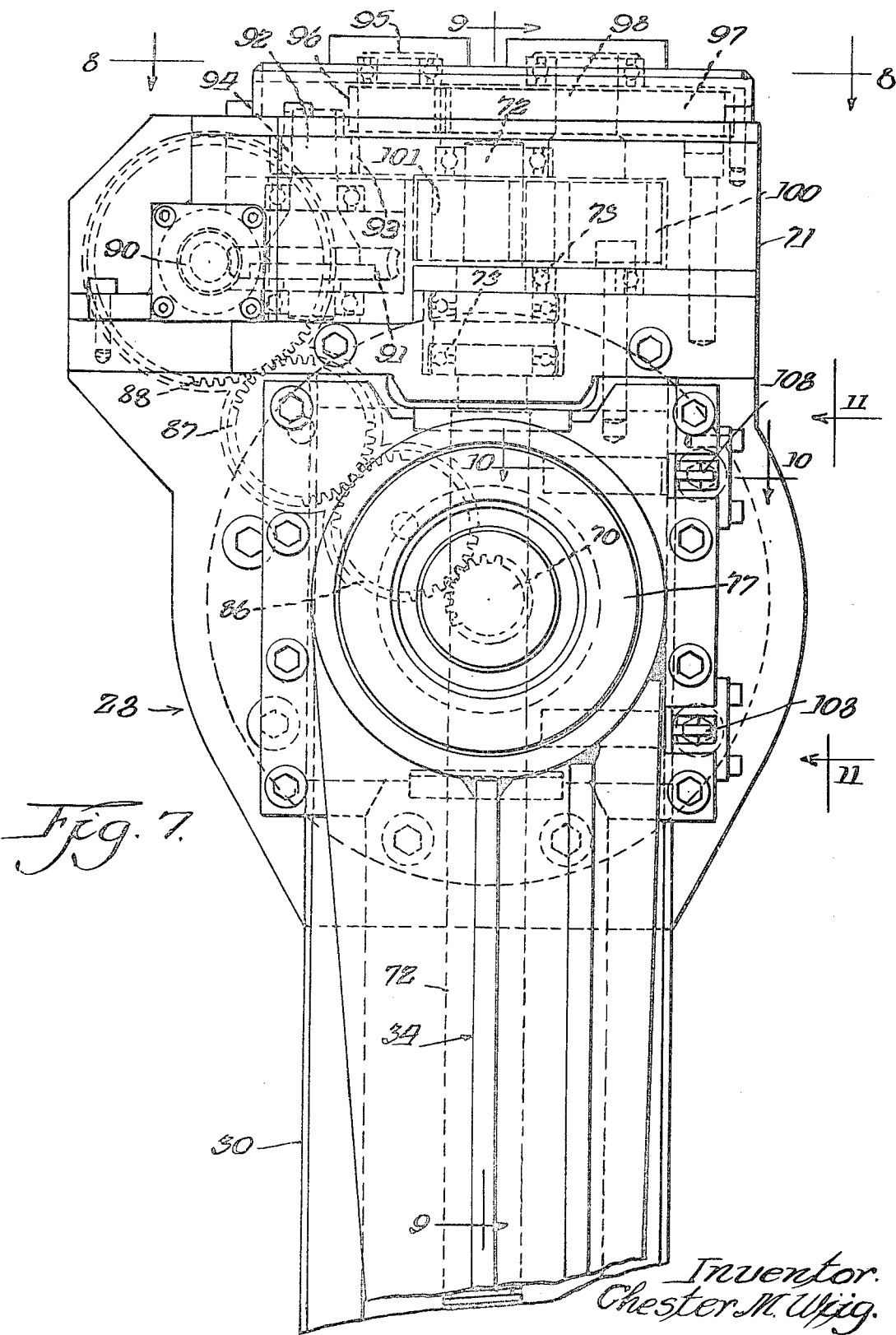
Fig. 3.

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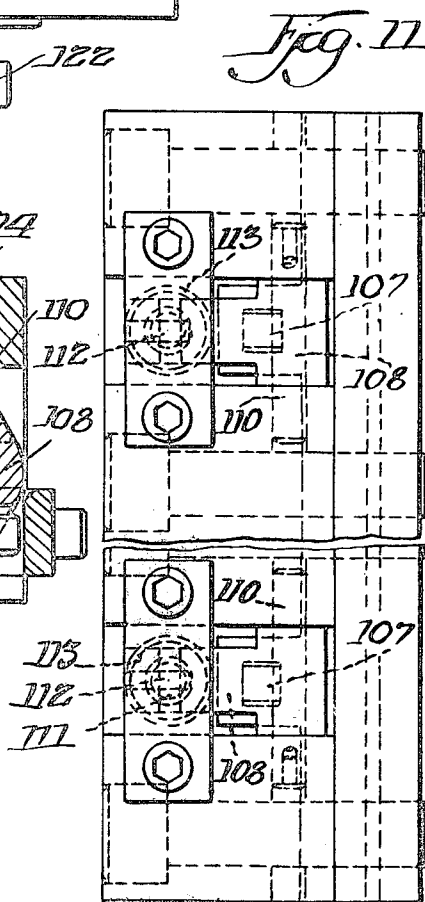
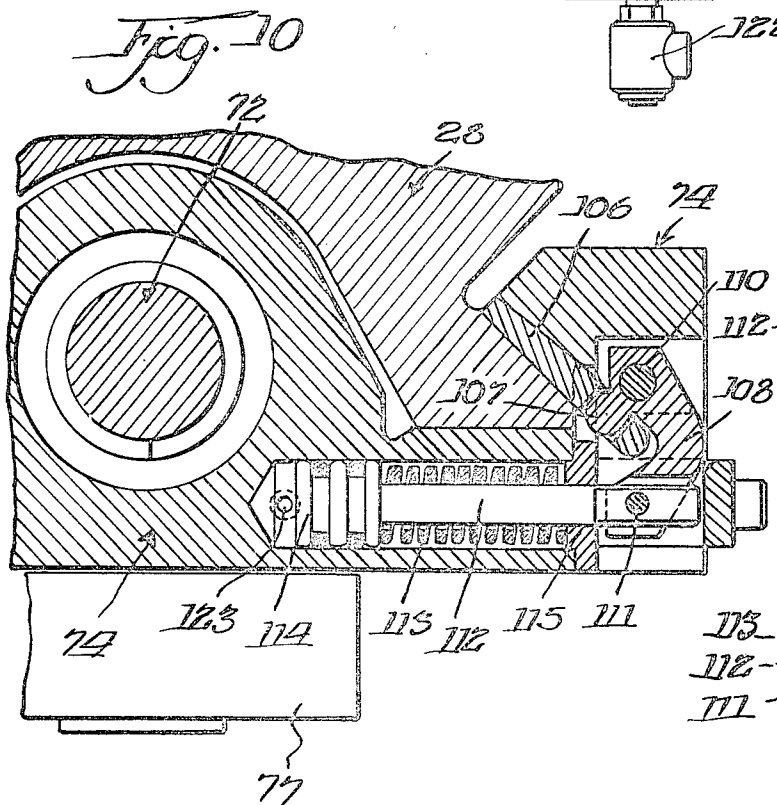
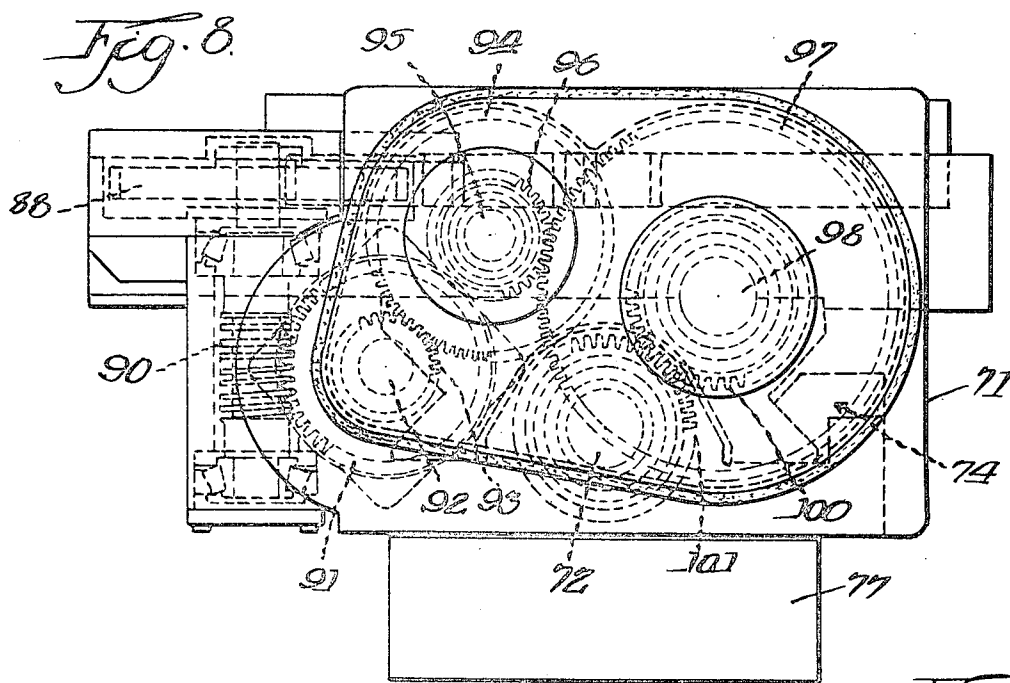


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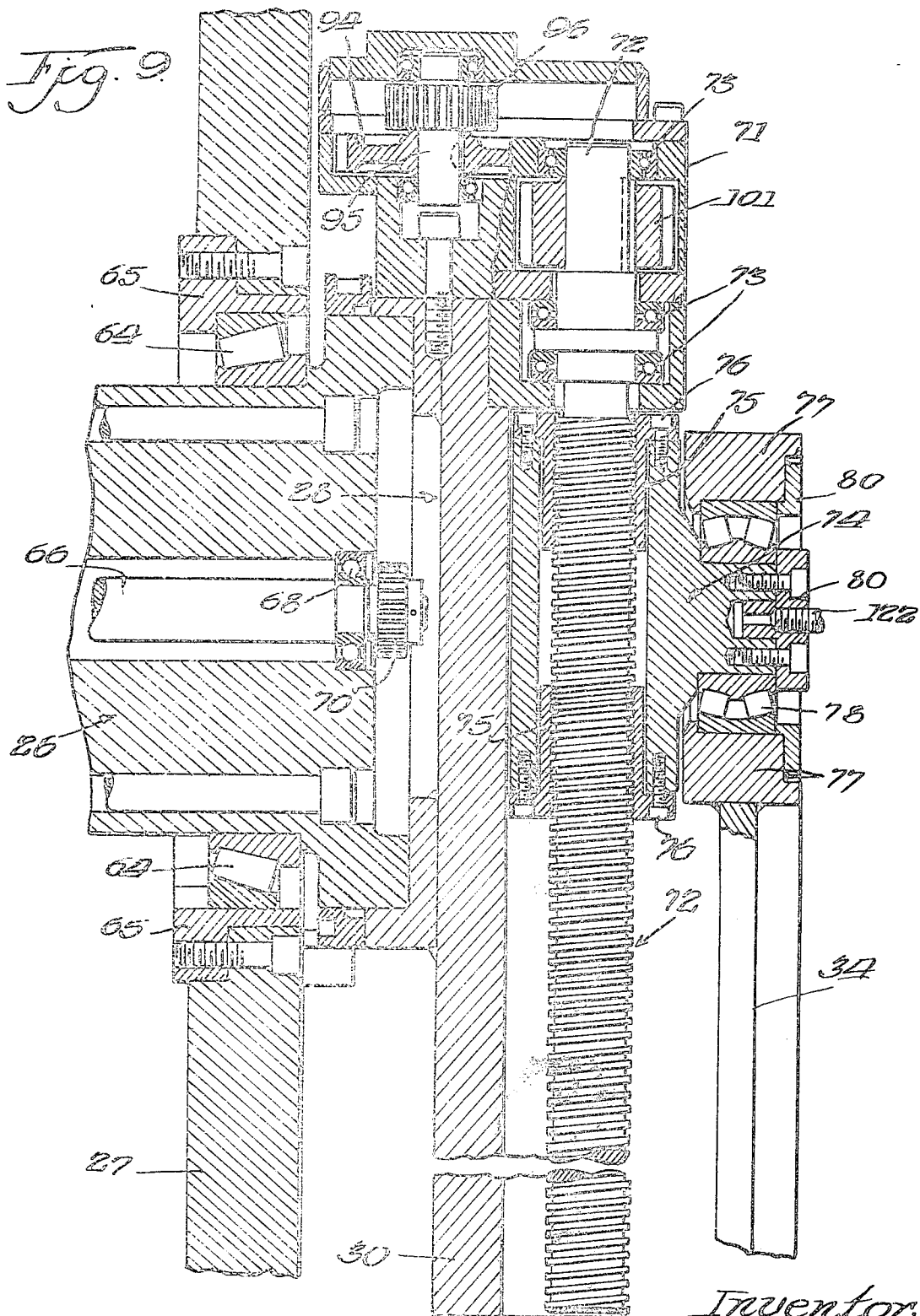




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FEEDING APPARATUS USING RACK AND PINION MECHANISM HAVING DWELL PERIODS

The invention relates to improved feeding means for feeding strip material intermittently and in desired lengths within the limits of the apparatus. More particularly the invention is directed to improvements in strip-feeding apparatus of the rack and pinion type wherein the rack at the end of each reciprocating power stroke will have a dwell period.

It is old and well known to provide apparatus having feeding rolls which are intermittently rotated for feeding strip material to punch presses and similar metalworking machines. It is also well known to provide such feeding apparatus with a rotating faceplate on which a trunnion member is adjustably mounted for journaling the hub of the rack, the structure thus forming an adjustable crank arm and which produces up and down reciprocating movements of the rack. However in these prior devices the rack operated through an overrunning clutch and therefore had an operative stroke in one direction and an inoperative stroke in the reverse direction.

The basic objective of the present invention is to provide new and improved apparatus for feeding strip material intermittently, the apparatus incorporating adjustable crank arm mechanism for reciprocating a rack which will have operation through alternately energized clutch structures for rotating the feed rolls in the same direction on both its up and downstrokes and wherein a dwell occurs at the end of each power stroke to enable one clutch device to be rendered inoperative and the other clutch device to be rendered operative.

Another object of the invention is to provide novel-strip-feeding apparatus which will employ conjugate driving cams having constant rotation to cause intermittent rotation of a cam follower device having rollers which the cams contact, the mechanism being so constructed and arranged as to cause the cam follower to rotate approximately 180° for approximately 240° of rotation of the conjugate cams and then the cam follower has a dwell period while the conjugate cams continue to rotate, the said operation taking place for each complete revolution of the conjugate cams.

A further object of the invention is to provide feeding apparatus of the rack and pinion type, wherein the rack will drive the feed rolls through clutch devices associated with each roll, and wherein hydraulic or pneumatic pressures are employed for energizing the clutch devices to render them operative in an alternate manner with the energizing and deenergizing action taking place during the dwell periods of the reciprocating rack.

Since the speed of the feeding apparatus and the gripping action of the rolls are variable, it becomes necessary at times to make adjustments in the feeding extent of the rolls in order to obtain the desired feeding accuracy. Thus another object is to provide mechanism for adjusting the crank arm trunnion member and thus the magnitude of the reciprocating strokes of the rack and wherein gear structure is carried by the rotatable face plate for effecting microadjustments of the said trunnion member at any time and even while the apparatus is running.

Another and more specific object is to provide lockup means between the faceplate and the trunnion member which journals the hub of the reciprocating rack, the said lockup means being hydraulically or pneumatically released by the operator when it is desired to effect initial positioning of the trunnion member on the faceplate and also when it is desired to effect microadjustments for obtaining the required accuracy in the feeding lengths of the strip material.

With these and other objects in view, the invention may consist of certain novel features of construction and operation as will be more fully described and particularly pointed out in the specification, drawings and claims appended thereto.

In the drawings which illustrate an embodiment of the device and wherein like reference characters are used to designate like parts:

FIG. 1 is a side elevational view of a rack and pinion intermittent feeding apparatus embodying the improvements of the invention, the said elevational view showing the right-hand side of the apparatus when viewed as in FIG. 2;

FIG. 2 is a front elevational view of the rack and pinion intermittent feeding apparatus of the invention, the view showing the apparatus as viewed by the operator, with the strip material entering the feed rolls from the right-hand side and leaving the apparatus on the left;

FIG. 3 is a partial sectional view taken substantially on line 3—3 of FIG. 1 and showing the intermittent cam and roller follower drive for rotating the faceplate which carries the reciprocating rack and also showing the motor drive to the microadjusting mechanism for varying the feed length;

FIG. 4 is an elevational view showing the driving cams and the roller follower driven means which has operation to intermittently rotate the faceplate and thus reciprocate the rack;

FIG. 5 is a fragmentary side elevational view showing the gear structure associated with the reciprocating rack;

FIG. 6 is a fragmentary sectional view taken substantially along line 6—6 of FIG. 5 and which shows the lower feed roller drive and clutch structure;

FIG. 7 is a front elevational view of the faceplate of the present strip-feeding apparatus showing the extension integral therewith, the reciprocating rack with its journaled hub portion and the gear structure for microadjustments shown in dotted lines;

FIG. 8 is a top plan view of the rotating face plate and journaled rack taken substantially along line 8—8 of FIG. 7;

FIG. 9 is a longitudinal sectional view taken vertically substantially on line 9—9 of FIG. 7 and showing the rotatable threaded member for microadjustments and the journaling means for the hub of the reciprocating rack;

FIG. 10 is a fragmentary sectional view taken substantially along line 10—10 of FIG. 7; and

FIG. 11 is a side elevational view showing the structure of FIG. 10 and taken substantially along line 11—11 of FIG. 7.

The frame of the present strip-feeding apparatus includes structural members 10 and 11, FIG. 1, forming a top wall, members 12, 13, 14 and 15 providing front, rear and side walls and the partition walls 16, 17, 18 and 19 which are positioned horizontally and which connect with the front, rear and side walls. The conjugate cams and roller follower mechanism indicated in its entirety by numeral 20, FIG. 1, is located between the top wall 10 and the intermediate bottom wall 21, and as seen in FIG. 3 between the sidewalls 22 and 23. A front wall 24 provides journaling means for the shafts of the mechanism namely 25 and 26 and the rear wall 27 likewise retains bearings for journaling the opposite ends of said shafts. The intermittently rotating faceplate 28 with the extension 30 as best shown in FIG. 9 is associated with the rear wall 27 and the feed rolls 31 and 32 are located between the horizontal partition walls 17 and 18. The reciprocating rack 34 FIGS. 1 and 5, is located adjacent the rear wall 13 and the gear structure of FIG. 5, which is actuated by the rack, is located within a housing including the top and bottom walls 35 and 36 and the sidewalls 37.

The rack is reciprocated intermittently by novel cam and roller follower mechanism as shown in FIG. 3 and which is driven by any suitable external power means by the shaft 38 which has the worm gear 40 fixed thereto, the worm gear in turn meshing with and driving the worm wheel 41 fixed on the camshaft 25. The camshaft at its left end is journaled by bearings 42 retained by ring member 43 mounted in the wall 24 and at its opposite end the shaft is journaled in wall 27 by the bearings 44 retained in the wall by the part 45. The left extending end of the shaft 25 carries the sprocket wheel 46 which is operatively connected by a chain or the like with a sprocket wheel on the shaft 47, FIG. 1, supported on wall 16 for rotation and which in turn drives the rotary drum switch 48. The left end of the shaft 25 also carries an eccentric 50 which operates the lifter rod 51 for purposes which will be presently described.

FIGS. 3 and 4 show the shaft 25 as carrying a pair of cams 52 and 53 which are fixed to the shaft in special angular relation as regards the lobes 54 of cam 52 with respect to the lobes 54 of cam 53. This special angular relation provides the dwell in the rotation of the cam follower and thus a dwell in the rotation of shaft 26. The cam follower is of the roller type and consists of a pair of plates 55 and 56 mounted on shaft 26, each plate carrying four rollers such as rollers 57 for plate 55 and rollers 58 for plate 56. Plate 56 is aligned with cam 53 whereas plate 55 is aligned with cam 52. Each cam has a spherical portion 60 which provides for continued rotation of the cams while the cam follower remains stationary, being held in a particular indexed position since a roller of each plate is in engagement with the spherical portion of its cam. Also each plate has a concave portion 61 located between rollers and which receives a lobe of one of the cams, the interaction of the parts effecting rotation of the driven shaft 26. However the driven shaft 26 and thus the faceplate 28 will have intermittent rotation whereas the conjugate cams rotate continuously. More particularly the cam and follower device will produce 180° of rotation of the shaft 26 for approximately 240° of rotation of the conjugate cams. During the remaining 120° of rotation of the cams for each complete revolution, the cam follower remains stationary and this gives the dwell period at the end of each reciprocating power stroke of the rack.

In operation of the cam and follower device, it will be understood that the shaft 25 rotates continuously during operation of the apparatus and that a lobe of cam 52 will enter a concave portion 61 of the cam follower plate 55 and thus the cam follower will be rotated to a certain extent. The rotation of the follower is continued since a lobe of cam 53 will next enter a concave portion on the cam follower plate 56 and so on until the spherical portion 60 of the cams is in contact with rollers 57 and 58 of the respective plates of the follower. The shaft 26 has now been rotated for 180°. The driving cams continue to rotate but the driven cam follower remains stationary and thus the reciprocating rack 34 has a dwell period at the end of each reciprocating stroke.

FIGS. 3 and 9 show the journaling means for the cam follower shaft 26 and which consists of roller 62 mounted in the tubular part 63 of wall 24 and roller bearings 64 mounted in wall 27 and retained by the ring 65. The cam follower shaft 26 is tubular as best seen in FIG. 9 and a motor-driven shaft 66 extends axially of the same being journaled for rotation by the bearings 67 at its left end and by the bearings 68 at its right-hand end. On said right-hand end beyond the bearing a pinion gear 70 is mounted on the motor-driven shaft for driving the gear train, shown in FIGS. 7 and 8, for effecting microadjustments of the reciprocating rack and which gear train will be presently described.

The faceplate 28 with the extension 30 is suitably fixed to the cam follower shaft 26, FIG. 9, so as to rotate therewith and the said faceplate is provided with a housing part 71 which houses the gear train above referred to and said part also journals the screw-threaded shaft 72 by means of the ball bearings 73. A trunnion member 74 has a passage extending through the same and through which the threaded shaft 72 extends and the trunnion member is threaded on the shaft by means of the end caps 75 secured to the trunnion member by the screws 76. Said trunnion member provides an outwardly projecting stud shaft portion on which the hub 77 of the reciprocating rack 34 is journaled. The journaling is effected by the spherical bearing members 78 retained in place by the parts 80. As seen in FIG. 3, the trunnion member is mounted on the rotating faceplate 28 with extension 30 by means of the keystone formation 81 whereby it will be understood that as the threaded shaft 72 is rotated, the trunnion member 74 will slide on the combination faceplate and extension part to move the hub 77 thus providing a larger or smaller crank arm for the reciprocating rack 34.

The shaft 66 has previously been referred to as a motor-driven shaft and FIG. 3 shows the shaft as connected by coupling 83 to an electric motor 84. The driven shaft of said

motor is axially aligned with shaft 66 and the said motor is fixedly supported on the platform 85 which is fixed to and thus rotates with the outer concentric shaft 26. This structure is provided so that the threaded shaft 72 can be rotated even when the apparatus is operating for effecting movement of the trunnion member on the faceplate for varying the throw of the crank arm. The pinion gear 70 on shaft 66, FIG. 9, is part of a gear train best shown in FIGS. 7 and 8 and which operatively connects the shaft 66 with the threaded shaft 72. The gear train is such that a considerable reduction in turn ratio is made possible whereby the motor 84 can be pulsed once or twice and a microadjustment of the crank arm throw of the reciprocating rack is effected.

FIG. 7 shows the pinion gear 70 as located on the longitudinal centerline of the threaded shaft 72 and on the hub portion's transverse centerline when the rack 34 is in zero crank arm position. It is only necessary to rotate the threaded shaft 72 in the proper direction to move the trunnion member down and the rack will thus have a crank arm throw and will accordingly reciprocate. From the zero position of FIG. 7 the trunnion member can be moved down to its maximum position on the threaded shaft 72 and as a result the rack will have full reciprocating strokes of approximately 50 inches. The pinion 70 meshes with and drives the gear 86 which in turn meshes with and drives the gear 87. The gear 87 drives the larger gear 88 having the worm pinion 90 on its axis shaft, FIG. 8. Said pinion 90 meshes with and drives the worm gear 91 fixed to the journaled shaft 92 which carries the pinion 93. From the pinion 93 the gear 94 continues the gear chain since it meshes with the pinion 93 and said gear is fixed to the journaled shaft 95. A second gear 96 is fixed to said shaft 95 above gear 94 and gear 96 meshes with and drives the large gear 97 on the journaled shaft 98. The lower end of shaft 98 carries the pinion 100 and the same meshes with and drives the pinion 101 on the end of the threaded shaft 72 journaled by the bearings 73 as previously described.

Prior to the start of a feeding operation, the motor 84 is energized to rotate the shaft 66 and to thus drive the shaft 72 through the gear chain. The trunnion member 74 is thereby positioned on the combined faceplate and extension so as to effect the required reciprocating strokes of the rack 34 for obtaining the desired feeding lengths. During operation it frequently happens that the feed length requires correction being either too long or too short by a mere fraction of an inch. Without stopping the apparatus the operator can pulse the motor 84 from the control panel 102 at the front of the apparatus. The electric pulses are generated by the pulser 178 having electric connection with supply terminals in 103 and wherein the pulses are delivered through the wiring in conduit 104 to the slipping structure 105. An accuracy on the order of several thousandths of an inch can be obtained. The pulses can be calibrated so that they will read infeed lengths in inches.

It will be understood that the trunnion member 74 is locked to the faceplate 28 during operation of the apparatus. This is necessary since the stresses developed during the working strokes of the rack must be transmitted to the faceplate. The locking means is shown in FIG. 10 and the same includes one or more tapered surfaces formed on the faceplate 28 and on the trunnion member 74 respectively. The ball end 107 of lever 108 is in pivotal engagement with the bar 106 and said lever, which is pivoted to the trunnion member at 110, is connected at 111 to the end of a piston rod 112. The coil spring 113 is confined between the head 114 of the piston and the end stop 115 so that the tension exerted by the spring is in a direction to maintain the bar 106 in locking contact with its parts. Thus the trunnion member is normally locked by the bars or plates 106 to the faceplate 28. However the invention contemplates that a medium under high pressure will be delivered to the bodily rotating trunnion member 74 so that the operator can release the said member for adjustment purposes. Numeral 116, FIG. 1, indicates a reservoir for the high-pressure medium, generally oil underpressure, and which is

delivered from the reservoir by the pipe 117 to the stationary coupling 118 having the rotating part 120. From the rotating part 120 the tube or conduit 121 connects with a similar rotating part 122. Said part 122 has a mounting in the hub portion 77 and through the hub a connection is made with trunnion 74. As a result of the rotary couplings, the high-pressure medium can be supplied during operation to the passage 123 of the trunnion as shown in FIG. 10, and thus the pressure medium is admitted to the left of the piston head 114.

When it is desired to release the trunnion from its locked-up relation with the face plate, the high-pressure oil is supplied to the piston chamber to the left of the piston head and the piston is moved to the right against the tension exerted by the coil spring 113. Movement of the piston rod 112 to the right will cause the lever 108 to pivot counterclockwise and withdraw the locking bars or plates 106. Trunnion member 74 is now released and rotation of the threaded shaft 72 can take place for adjusting the position of the said member for obtaining the desired feed lengths.

The strip material identified in FIG. 2 by 125 is supplied to the feeding apparatus from the right, the material passing over and being guided by roller and guide member 126. After passing between the feed rolls 31 and 32, which feed the strip material intermittently in measured lengths, the strip material is discharged from the apparatus at the left-hand side. Intermittent rotation of the feed rolls is obtained by alternate energization of clutch structure such as shown in FIG. 6 and which is actuated by the rack 34 by its reciprocating strokes all as shown in FIG. 5. The top feed roll 31 is journaled at its respective ends for rotation by the journaling members 127, FIG. 1, which are part of respective crank arms 128, FIG. 2, having oscillation for lifting the top feed roll 31 in timed relation to the feeding action. The crank arms are in turn mounted for oscillating movement by the pivot rod 130 mounted in the supports 131 which depend from partition wall 17. Since the top feed roll has bodily movement in up and down directions, the shaft 132 of said top roll includes the universal joint 133 and beyond the joint the shaft extends into the housing which contains the clutch structure of FIG. 6. The bottom feed roll 32 is journaled at its respective ends by the members 134 which are in turn mounted on the partition wall 18. The shaft 135 of said bottom feed roll includes the coupling 136 and then the shaft extends into the clutch housing being located below the shaft 132.

The rack 34 passes through openings in the top and bottom walls 35 and 36 of the housing as will be seen in FIG. 5, and within the housing the rack has meshing engagement with the pinion gear 137 on shaft 138 and which is suitably journaled since the shaft will have rotation first in a clockwise direction and then in a counterclockwise direction. The relatively large gear wheel 140 also fixed to the shaft 138 will likewise rotate the same as the gear 137 and it will be seen that this large wheel 140 has meshing relation so as to drive the pinion gears 141 and 142. Pinion gear 141 is associated with clutch mechanism for the feed roll shaft 132 whereas the pinion gear 142 is associated with clutch mechanism for the feed roll shaft 135. Since the clutch mechanism is the same for both said shafts it will be only necessary to describe one and for this purpose the bottom feed roll 32 having shaft 135 has been selected.

On the downstroke of the rack 34, the gearwheel 140 will be rotated in a counterclockwise direction and thus the gearwheel will drive the pinion gears 141 and 142 in a clockwise direction. Since the feed of the strip material is from right to left, it will be seen that the upper feed roll shaft 132 will have to be operative. On the upstroke of the rack a reverse situation takes place. The gearwheel 140 will be rotated in a clockwise direction and thus the pinion gears 141 and 142 will be driven in counterclockwise directions. Therefore to continue the feeding from a right to a left direction it will be necessary for the lower feed roll shaft 135 to be operative. When the clutch structure associated with the pinion gear 141 is operative the clutch structure for pinion gear 142 is inoperative and vice versa.

Referring again to pinion gear 142, the same is shown in FIG. 6 as located within the gear housing and as having a keyed relation at 143 on the clutch-driving shaft 144, the said clutch-driving shaft being journaled in partition walls 145 by the ball bearing assemblies 146. The shaft 144 is tubular for its entire length having the passage 146 extending through the same and at its left-hand end the shaft has the enlarged cylindrical clutch disc portion 148. The bearings 146 are associated with the clutch disc portion 148 being located to the right of the collar 150 is suitably keyed at 151 to the clutch disc portion and which acts as a stop for the clutch discs 152. Said clutch discs have cutout portions which form a plurality of tongues 153 and these tongues fit into axial grooves on the clutch disc portion so that the discs 152 are carried thereby and must rotate with the clutch disc portion 148.

The actuating means for compressing the clutch discs to render the clutch device operative includes the piston 154, FIG. 6, mounted on the enlarged cylindrical part 155 of the inner shaft 156, the said inner shaft extending axially within the passage 147 of the clutch-driving shaft 144 and being journaled by the ball bearing assembly 157. The piston 154 has slidable movement on the part 155 and is provided with one or more O-rings for sealing purposes. The piston is located within the gear ring 158 which is secured at angularly spaced locations by the bolts 160 to the faceplate 161 formed integral with the shaft 135 of the lower feed roll 32. The shaft 135 is journaled at this end in wall 162 of the clutch housing by the ball bearing assembly 163 and said shaft, the faceplate 161 and the ring gear 158 form an integral rotating unit being driven by the shaft 144 when the clutch device is operative. Of course the piston 154 is slidable within the ring 158 and has one or more O-rings of sealing purposes. At spaced locations angularly around the ring gear on its right-hand side there are located a number of outwardly extending finger members 164 which retain the tongues 165 of the clutch discs 166. The discs 166 are concentric with the portion 148 and said discs alternate with the discs 152. By reason of the fingers 164 and the tongues 165, the said clutch discs 166 are part of and they rotate with the ring gear 158.

The piston 154 is yieldingly maintained in a left-hand or released position by the coil spring 168 which are located in recesses 170 formed in the ring gear alternately with the bolts 160. The coil springs 168 are confined between the bottom of recess receiving it and head of bolt 171 which extends centrally through the coil spring and through the bottom of its recess to project beyond. At the left projecting end of each bolt 171 it passes through an adjacent disc 166 having bent inner peripheral tabs 172 which extend toward the piston 154 and the piston is caused to apply pressure against the discs 166 when moved toward the right for compressing the disc structure to render the clutch device operative. Tension exerted by coil springs 168 is such as to retract and maintain the discs 166 in a left-hand released position. This has the result of freeing any compressing action on the alternating clutch discs 152 and 166 so that the clutch device under normal conditions is inoperative and any rotation of the clutch-driving shaft 144 is not transmitted to the lower feed roll shaft 135.

The axial shaft 156, which extends through the clutch-driving shaft 144, is cored for its entire length as indicated by numeral 173 and at its right-hand end the shaft has a rotatable connection with 174 which supplies the cored passage with a medium such as oil under high pressure. At the left end of the shaft 156, the cored passage communicates with the chamber between the piston 154 and the faceplate 161. When such a high-pressure medium is admitted to the chamber in front of the piston it functions as a source of power to move the piston to the right and thus the piston is caused to contact and to move to the right and to compress the alternate clutch discs 152 and 166. The face of the collar 150 acts as a stop and eventually the discs will so contact each other as to comprise a unit with all the said discs rotating together, being driven by the driving shaft 144 and transmitting the said rotation of shaft 144 to the ring gear 158, to the faceplate 161 and to the lower feed roll shaft 135. Accordingly it will be understood that

when the clutch device of FIG. 6 is made operative the shaft 135 will be rotated by shaft 144. In the operation of the present feeding device this occurs during the upstroke of the rack 34 and the feed roll 32 is rotated a predetermined extent for a feeding operation. The clutch discs are preferably conditioned on each side for their function as a clutch disc. Upon release of the high-pressure medium, the piston 154 is retracted by the coil springs 168 and thus the clutch device becomes inoperative again.

A large wheel gear 175 is mounted on shaft 135 being keyed at 176 and this gear drives a pinion 177 on the shaft of the pulse-generating unit 178. Said pulse-generating unit produces the electric pulses for the motor 84, as previously described and explained for obtaining the desired feed lengths.

The ring gear 158 has meshing relation with the ring gear 149 of the clutch device for the shaft 132 of the top feed roll 31. See FIGS. 5 and 6. The two gears 149 and 158 are the same size and one is fixed on shaft 132 whereas the other one is fixed on shaft 135. When the clutch structure of FIG. 6 is operative on the upstroke of the rack as herein described, the gear 158 will drive gear 149 and accordingly both feed rolls 31 and 32 will be rotated for a feeding operation. Likewise when the clutch device for shaft 132 is operative on the downstroke of the rack the gear wheel 149 will then drive gear 158 for a feeding operation in the same direction.

The cam-driving shaft 25 has been described as having an eccentric 50 suitably mounted thereon and which reciprocates the lifter rod 51. This action of the lifting rod operates in an automatic manner to lift the top feed roll 31 so as to momentarily release and free the strip material 125 immediately in advance of the stamping or blanking operations of the machine. It is not only desirable but necessary to release the grip of the feed rolls on the strip material in advance of a cutting or stamping operation in order that the material may be accurately positioned in the die. This is accomplished by mechanism which is basically disclosed and claimed in my copending application Ser. No. 33,193 filed Apr. 30, 1970 and entitled Feeding Apparatus For Strip Material.

The lifter rod 51, FIGS. 1 and 2, extends downwardly from the eccentric 50 and has a connection at its lower end with the lever 180 of a crank arm having a second lever 181 and which is pivotally mounted at 182 for oscillation. The end of lever 181 has contact at 183 with the end of a piston rod 184 for the power cylinder 185. The crank arm 186 is also in contact with end 183 of lever 181 and also with the end of piston rod 184. Crank arm 186 is supported for oscillating movement by the pivot rod 130 which is in turn supported from wall 17 by the depending supports 131. The arm 186 is part of the crank arm structure which includes the arm 128 and the journaling members 127 for the upper feed roll 31. The power cylinder 185 is maintained in an energized condition by a pressure medium which is admitted to the cylinder and which forces the piston rod 184 to the right. This maintains the arm 186 substantially vertical and the arm 128 substantially horizontal to yieldingly hold with pressure the top roll 31 against the strip material 125 passing between the feed rolls. However the shaft 25 has rotation to drive the cam follower roller structure including the plates 55 and 56 having rollers 57 and 58. Thus as the rack 34 is reciprocated with dwell periods at the end of each reciprocating stroke, the rotation of shaft 25 and the eccentric 50 will be timed so as to move the lifter rod 51 down at the beginning of a dwell period and thus immediately in advance of a cutting or stamping operation on the strip material. Down movement of rod 51 will rock the crank arm device including the levers 180 and 181 in a clockwise direction and against the pressure exerted by the power cylinder 185. The arm 186 will also be rocked sufficiently to lift the feed roll 31 from the strip material thus freeing and releasing the material but only momentarily since continued rotation of shaft 25 and eccentric 50 will lift the rod 51 and the pressure exerted by the power cylinder 185 will again yieldingly force the top feed roll into contact with the strip material.

The control for the present feeding apparatus is indicated by the numeral 188 and the same is located on the front of the machine as shown in FIG. 2. The said control includes push-buttons for starting and stopping the feeding action of the apparatus and for energizing the motor 84 for a desired number of pulses. The control also contains the timing mechanism for energizing and deenergizing the clutch structures for the top and bottom feed roll shafts 132 and 135 in an alternate manner. Clutch device for shaft 132 is energized during the downstroke of the rack and the clutch structure for shaft 135 remains deenergized. During the following dwell period the clutch device for shaft 132 is deenergized and the clutch device for shaft 135 is energized. Following the upstroke and during the dwell period a reverse operation takes place with the clutch device for 132 being energized and 135 being deenergized. The unique cam and cam follower apparatus as shown in FIG. 4 drives the shaft 26 in an intermittent manner from the constantly rotating shaft 25. As a result of the lobes on the cams 52 and 53, which engage and rotate the cam follower plates 55 and 56, the rack is caused to reciprocate for up and downstrokes with a dwell period at the end of each stroke. The electrical pulses applied to the bodily rotating motor 84 will rotate the threaded shaft 72 and this will position the trunnion member 74 for the desired feeding action of the feed rolls 31 and 32.

What is claimed is:

1. In feeding apparatus for intermittently feeding strip material in predetermined measured lengths, in combination, a pair of feeding rolls journaled for rotation for feeding the strip material passing between the rolls, a reciprocating rack for rotating the feed rolls, means for effecting reciprocating strokes or the rack including a camshaft adapted to be constantly rotated during operation of the apparatus, a pair of cams on the camshaft, a cam follower shaft having mounted thereon a pair of cam follower plates and which are respectively engaged by said cams during rotation of the camshaft to cause intermittent rotation of the cam follower shaft, a faceplate fixed to the cam follower shaft so as to rotate therewith, a trunnion member carried by the faceplate, and means provided by the trunnion member for journaling the crank end of the rack, said trunnion member having a position on the faceplate spaced from the axial center of the cam follower shaft, where by the trunnion member provides crank arm structure to cause up and down reciprocating strokes of the rack.

2. Feeding apparatus as defined by claim 1, wherein a dwell period follows each reciprocating stroke of the rack.

3. Feeding apparatus as defined by claim 1, wherein the cams are conjugate cams each having approximately the same shape with at least two lobes which enter concavities in the cam follower plates during rotation of the cams to thereby effect said intermittent rotation of the plates and the cam follower shaft.

4. Feeding apparatus as defined by claim 1, wherein the cams rotate approximately 240° on each revolution to cause the cam follower shaft to rotate approximately 180° and then while the cams continue to rotate for the remaining 120° the cam follower shaft remains at rest.

5. Feeding apparatus as defined by claim 1, wherein for each revolution of the camshaft the cams cause the cam follower plates to rotate approximately 180° and then to dwell while the cams continue to rotate for approximately 120°, and wherein means are provided for adjusting the position of the trunnion member on the faceplate even while the cam follower shaft and faceplate are rotating.

6. In feeding apparatus for intermittently feeding strip material in predetermined measured lengths, the combination with a pair of feeding rolls journaled for rotation for feeding the strip material passing between the rolls, of a reciprocating rack for rotating the feed rolls, means for effecting reciprocating strokes of the rack including a camshaft adapted to be constantly rotated during operation of the apparatus, a pair of cams on the camshaft, a cam follower shaft having mounted

thereon a pair of cam follower plates and which are respectively engaged by said cams during rotation of the camshaft to cause intermittent rotation of the cam follower shaft, a faceplate fixed to the cam follower shaft so as to rotate therewith, a screw-threaded shaft extending diametrically within the faceplate and being journaled thereby for rotation, a trunnion member mounted on the faceplate for sliding movement and having threaded relation with the threaded shaft, and means provided by the trunnion member for journaling the crank end of the rack, said trunnion member being spaced from the axial center of the cam follower shaft, whereby the trunnion member provides crank arm structure to cause up and down reciprocating strokes of the rack.

7. Feeding apparatus as defined by claim 6, additionally including means extending axially through the cam follower shaft operatively connecting with the threaded shaft for rotating the shaft to adjust the position of the trunnion member on the faceplate.

8. Feeding apparatus as defined by claim 6, additionally including an electric motor supported by and bodily rotating with the cam follower shaft, the drive shaft of the motor having axial alignment with the cam follower shaft, and means extending through the cam follower shaft and operatively connecting the electric motor with the threaded shaft, whereby operation of the motor will rotate the threaded shaft to vary the position of the trunnion member on the faceplate and increase or decrease the magnitude of the reciprocating strokes of the rack.

9. Feeding apparatus as defined by claim 6, additionally including a motor-driven shaft extending axially through the cam follower shaft, a train of gears housed and journaled by the faceplate and operatively connecting the motor-driven shaft with the screw-threaded shaft, whereby rotation of the motor-driven shaft will rotate the threaded shaft to vary the position of the trunnion member on the faceplate and increase or decrease the magnitude of the reciprocating strokes of the rack.

10. Feeding apparatus as defined by claim 9, wherein the motor-driven shaft can be rotated even while the cam follower shaft and the faceplate are rotating.

11. Feeding apparatus as defined by claim 9, wherein the train of gears is so constructed and arranged as to effect a considerable reduction in the turn ratio between the motor-driven shaft and the screw-threaded shaft.

12. Feeding apparatus as defined by claim 6, additionally including a locking plate for locking the trunnion member in a desired adjusted position on the faceplate so that the stresses produced by the reciprocating strokes of the rack are transmitted to the faceplate.

13. Feeding apparatus as defined by claim 12, additionally including resilient means for yieldingly maintaining the locking plate in contact with tapered surfaces of the trunnion member and faceplate whereby to lock the parts to each other, and piston means adapted to be actuated by a pressure medium for withdrawing the plate from said locking contact with said parts.

14. In feeding apparatus for intermittently feeding strip material in predetermined lengths, in combination, a pair of coacting feed rolls including an upper feed roll and a lower feed roll both journaled for rotation for feeding the strip material passing between the rolls, a driving member including a camshaft adapted to be constantly rotated during operation of the apparatus a pair of cams on the camshaft, a cam follower shaft having mounted thereon a pair of cam follower plates and which are respectively engaged by said cams during rotation of the cam shaft to cause intermittent rotation of the

cam follower shaft, a faceplate fixed to the cam follower shaft so as to rotate therewith, a trunnion member carried by the faceplate, a reciprocating rack for rotating the feed rolls, means provided by the trunnion member for journaling the crank end of the rack, said trunnion member having a position on the faceplate spaced from the axial center of the cam follower shaft, whereby the trunnion member provides crank arm structure to cause up and down reciprocating strokes of the rack, clutch structure for the upper feed roll including a clutch-driving shaft, similar clutch structure for the lower feed roll including a second clutch-driving shaft, means operatively connecting the end of the rack with both said clutch-driving shafts whereby said shafts rotate in one direction on a downstroke of the rack and rotate in a reverse direction on an upstroke of the rack, and means rendering the clutch structures operative in an alternate manner in timed relation with the strokes of the rack for intermittently rotating the feed rolls to cause intermittent feeding of the strip material in the same direction.

15. Feeding apparatus as defined by claim 14, wherein the clutch structure for the upper feed roll is rendered operative to drive the upper feed roll when its clutch-driving shaft is rotated in one direction and wherein the clutch structure for the lower feed roll is rendered operative when its clutch-driving shaft is rotated in a reverse direction.

16. Feeding apparatus as defined by claim 14, additionally including a first journaled shaft for the upper feed roll, a second journaled shaft for the lower feed roll, the clutch structure for the upper feed roll including clutch discs fixed to the first journaled shaft and which alternate with clutch discs fixed to the clutch-driving shaft for the upper feed roll, the clutch structure for the lower feed roll also including clutch discs fixed to the second journaled shaft and which alternate with clutch discs fixed to its clutch-driving shaft, and means for applying pressure respectively to each set of clutch discs and in an alternate manner to compact the discs causing them to contact each other for first rendering the clutch device for the upper feed roll operative and then for the lower feed roll.

17. Feeding apparatus as defined by claim 16, wherein the means for applying pressure to compact the discs of the respective sets includes piston means for each set and wherein the piston means of each set is actuated by a fluid under pressure.

18. Feeding apparatus as defined by claim 16, additionally including a gear on the first journaled shaft for the upper feed roll and which has meshing relation with a similar gear on the second journaled shaft for the lower feed roll, whereby the upper and lower feed rolls are geared to rotate together.

19. Feeding apparatus as defined by claim 18, wherein the means for applying pressure to compact the discs of the respective sets includes piston means for each set, wherein the piston means of each set is actuated by a fluid under pressure, and wherein the gear on the first and second journaled shafts are respectively recessed for receiving the said piston means for its set of discs.

20. Feeding apparatus as defined by claim 18, wherein the means for applying pressure to compact the discs of the respective sets includes piston means for each set, wherein the piston means of each set is actuated by a fluid under pressure, wherein the gear on the first and second journaled shafts are each recessed for receiving the said piston means for its set of discs, and additionally including a shaft extending concentrically of each clutch-driving shaft and being journaled thereby and on which the piston means for its set of clutch discs is mounted for sliding movement.

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