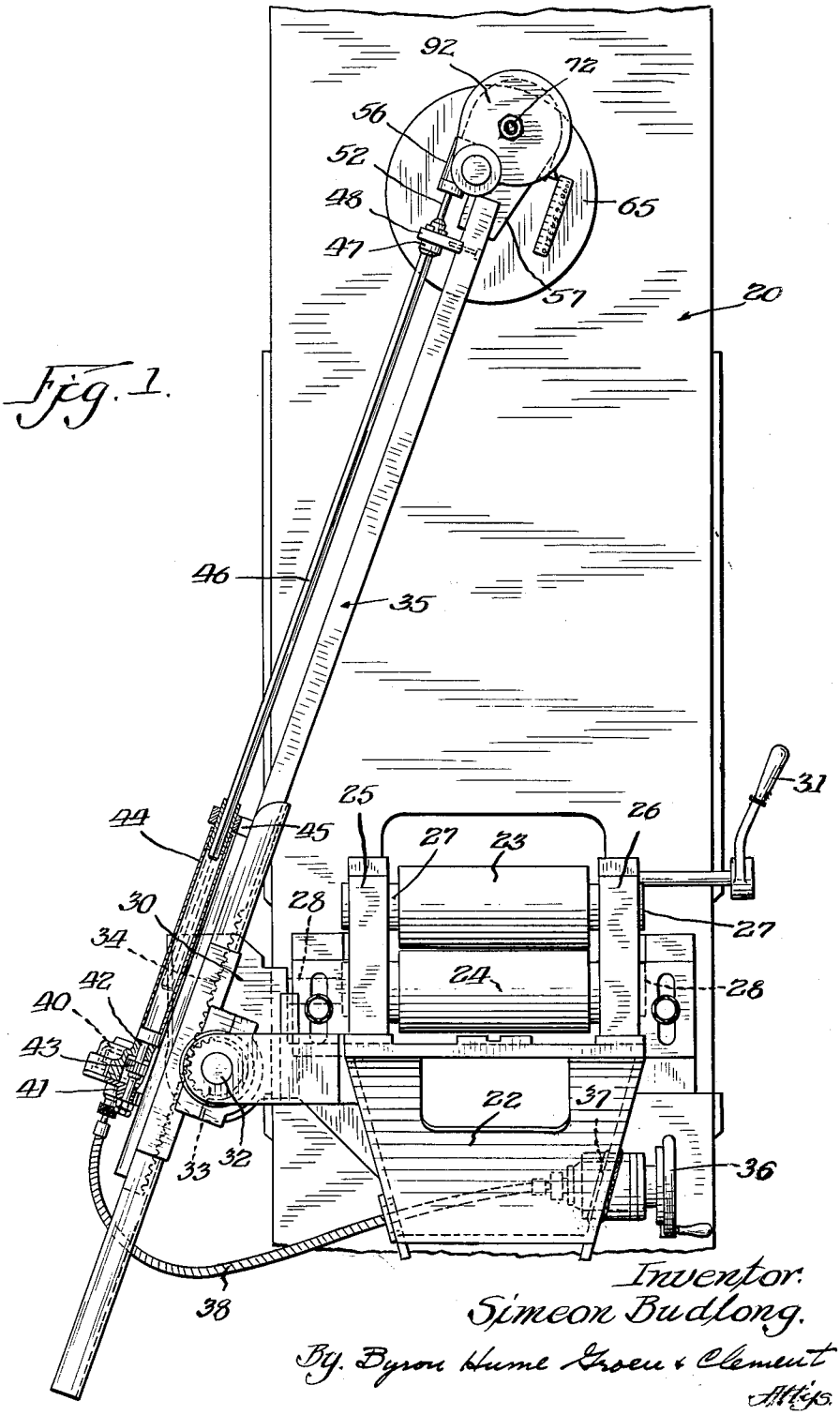
May 21, 1963 S. BUDLONG 3,090,250

MICRO-FEED ADJUSTING MECHANISM

Filed April 25, 1961 4 Sheets-Sheet 1

Fig. 1.



Inventor:
Simeon Budlong.
By. Byron Hume Green & Clement
Attys.

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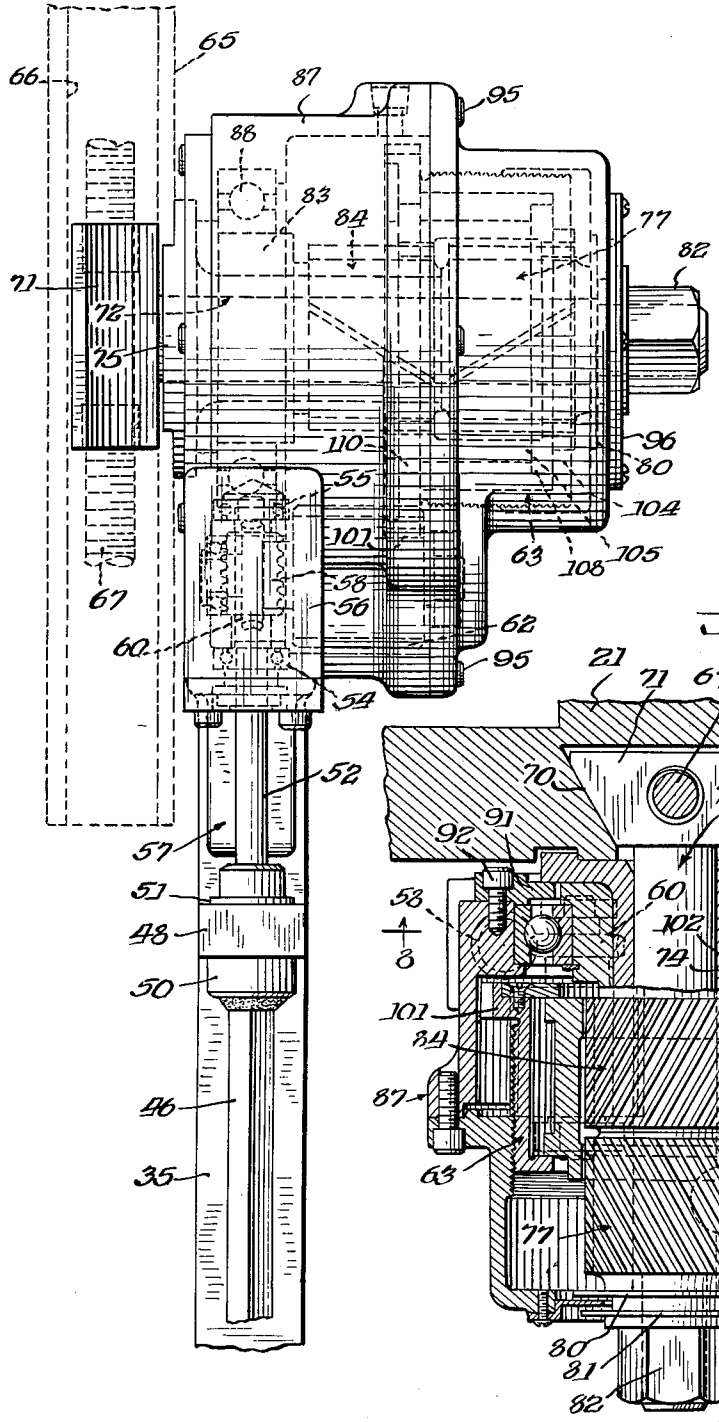

Fig. 2.

Fig. 6.

Inventor.
Simeon Budlong.
By. Byron Hume Groen & Clement
Attys.

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MICRO-FEED ADJUSTING MECHANISM

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Fig. 3.

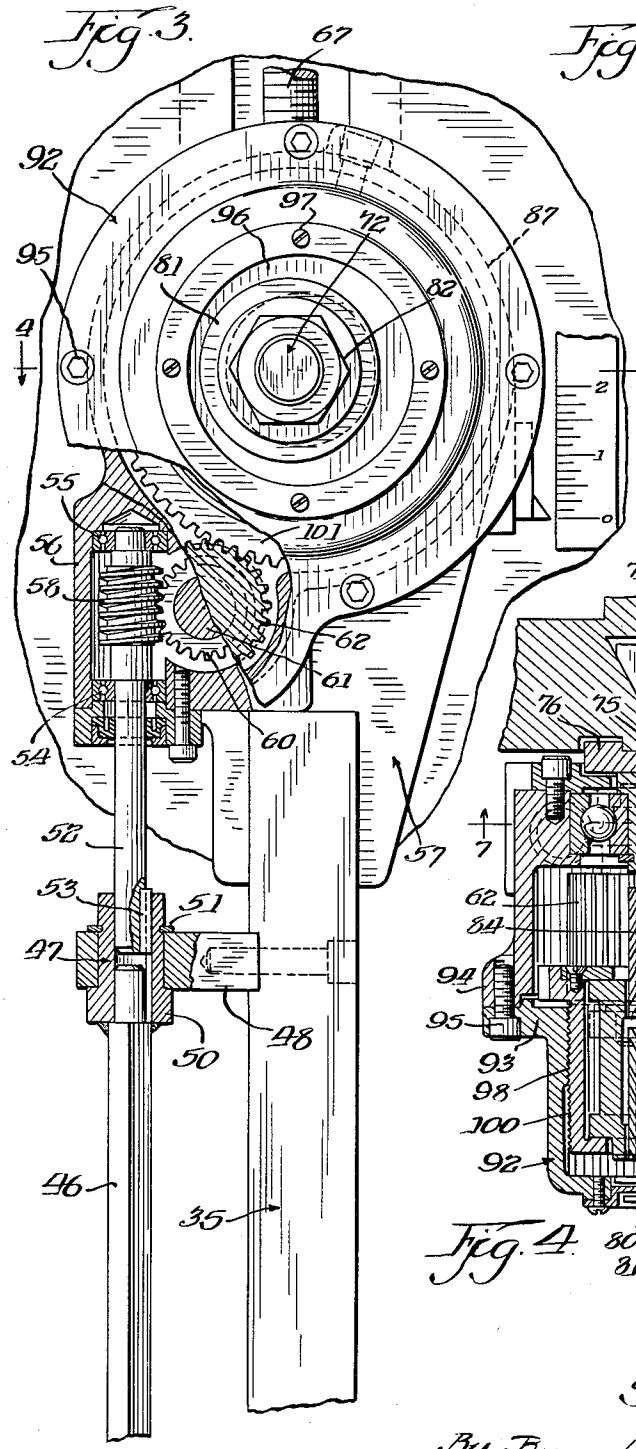
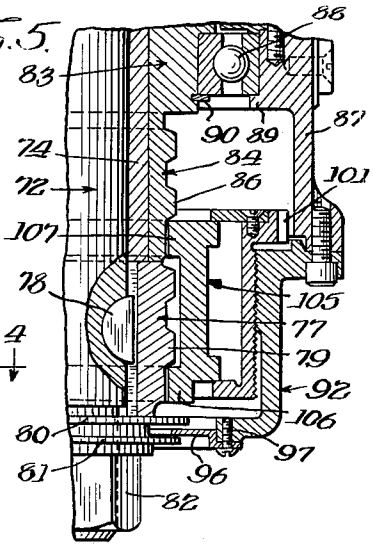


Fig. 5.



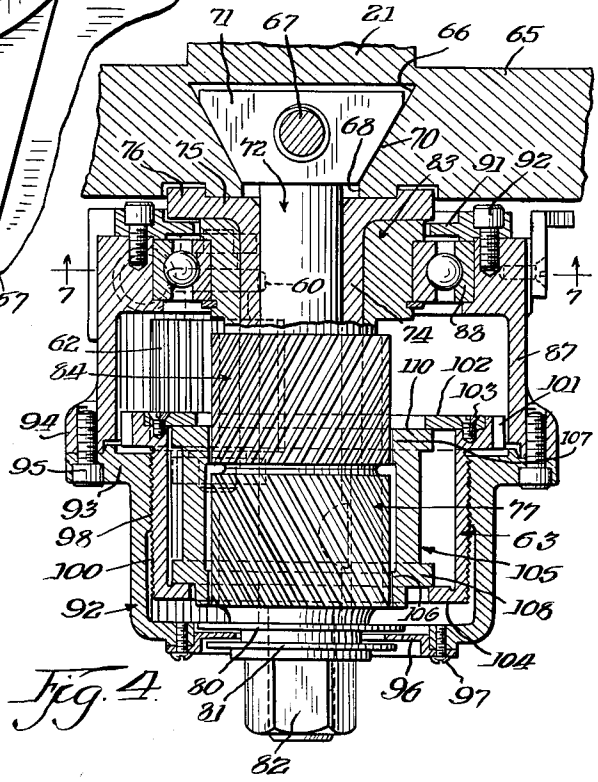


Fig. 4.

Inventor:
Simeon Budlong.
By Byron Hume Green & Clement
Attys.

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MICRO-FEED ADJUSTING MECHANISM

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Fig. 7.

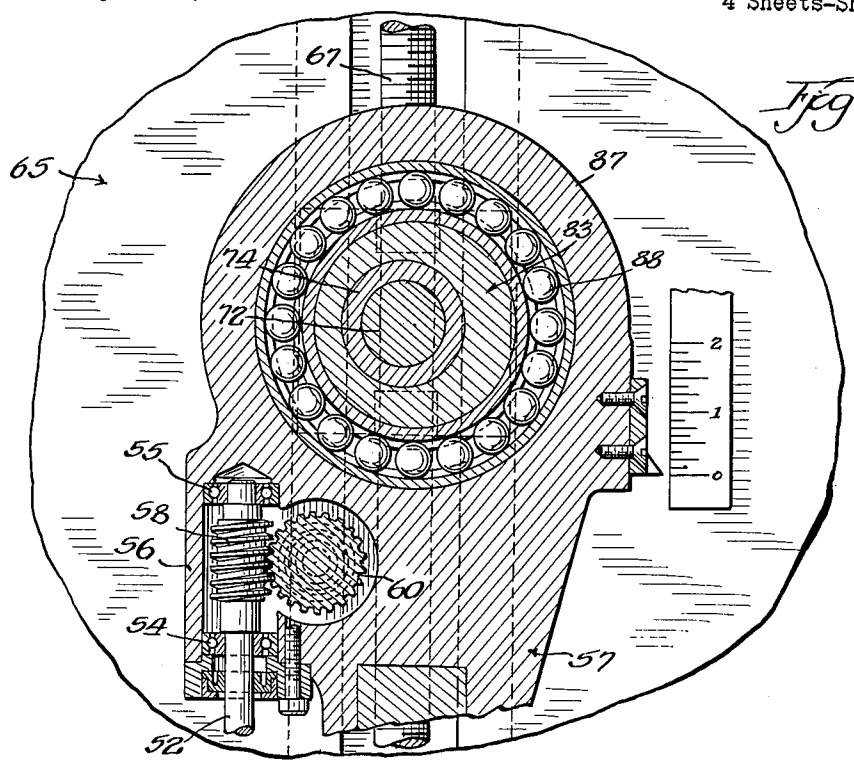
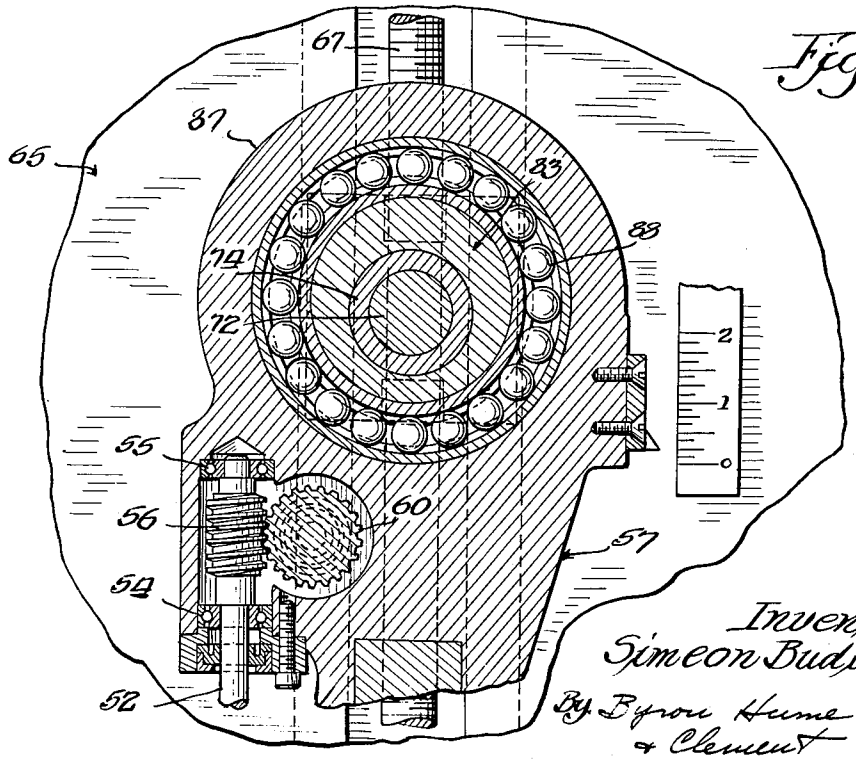


Fig. 8.



Inventor:
Simeon Budlong.
By Byron Hume Green
& Clement Attys.

United States Patent Office 3,090,250 Patented May 21, 1963

3,090,250

MICRO-FEED ADJUSTING MECHANISM

Simeon Budlong, Chicago, Ill., assignor to F. J. Littell Machine Company, Chicago, Ill., a corporation of Illinois

Filed Apr. 25, 1961, Ser. No. 105,324
10 Claims. (Cl. 74—600)

The invention relates to metal strip feeding devices of the reciprocating rack type, and has reference in particular to improved variating means for the crank arm to which the rack is secured, whereby the eccentricity of the crank arm can be adjusted to a limited extent for any particular manual setting of the crank arm.

Metal working machines, such as punch presses, are equipped with attachments for conditioning and feeding stock material in strip form to the plunger-actuated die of the press for cutting, punching or for similar operations. The feed of the strip material is performed by feeding rolls which have intermittent rotation and the material is operated on following each feeding movement. Since the speed of the press and the gripping action of the feed 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.

In the Budlong Patent 2,856,793 granted October 21, 1958, adjustable crank mechanism is disclosed and claimed, and which makes it possible for the operator to adjust the feeding extent of the rolls at any time, even while the press is operating.

An object of the present invention is to provide adjustable crank mechanism which will constitute an improvement over the device of the patent as above identified in the simplicity of its construction, in the reduced number of elements and auxiliary parts employed, and in the economies which result as regards the manufacture of the present device.

Another object of the invention is to provide adjustable crank mechanism which will be highly efficient in operation, which will not require a stopping of the press to adjust the same, and which will be so constructed and arranged that the said adjustments can be made by a hand wheel conveniently accessible to the operator.

Another object is to provide adjustable crank mechanism for reciprocating the rack of a punch press or the like, and which will incorporate rotatable means for effecting adjustments of an eccentric, the said eccentric constituting the basic element by means of which the reciprocating stroke of the rack are varied.

A more particular object of the invention resides in the provision of mechanism including a crank arm having an adjustable eccentric journalled thereon, the said mechanism also incorporating a pair of opposed helix gears and an encircling annular gear operatively meshing with the helix gears, respectively, whereby to effect adjustment of the eccentric by axial movement of the encircling annular gear.

With these and various 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—

FIGURE 1 is a side elevational view of a punch press equipped with the adjustable crank mechanism of the invention, and which is illustrated in combination with feeding rolls for the press, the same being intermittently actuated by rack and pinion mechanism;

FIGURE 2 is a side elevational view of the adjustable crank mechanism of the invention as applied to a trunnion member projecting from the rotating face plate of the punch press;

FIGURE 3 is a front elevational view, certain parts being shown in section, of the adjustable crank mechanism as illustrated in FIGURES 1 and 2;

FIGURE 4 is a sectional view taken substantially along the line 4—4 of FIGURE 3 and which illustrates the eccentric member in combination with the arrangement of helix gears and annular gear for adjusting the said eccentric member;

FIGURE 5 is a fragmentary, detailed sectional view, showing the manner in which the annular gear has operative engagement with both of the helix gears;

FIGURE 6 is a sectional view similar to FIGURE 4 but showing a changed position of the adjusting means and eccentric member;

FIGURE 7 is a transverse sectional view taken substantially along line 7—7 of FIGURE 4 and which shows the eccentric member in a zero position of adjustment; and

FIGURE 8 is a transverse sectional view taken substantially along line 8—8 of FIGURE 6 and showing the eccentric member in a maximum position of adjustment.

Referring to the drawings, and particularly FIGURE 1, the punch press selected for illustrating the present invention essentially consists of a pair of welded or cast uprights such as 20 which are suitably spaced to position a bed plate between the uprights, and which additionally mount a vertically reciprocating plunger for coaction with the bed plate, all of which constitutes conventional structure. The said plunger is actuated by the main operating shaft 21, FIGURES 4 and 6, the same being disposed transversely of the press and journalled for rotation by the uprights. Upon rotation of said main operating shaft 21, the plunger is reciprocated vertically and thus the plunger and the die carried thereby will have movement to and from the bed plate of the press to perform the desired punching, cutting or forming operation on the stock material fed thereto.

It will be understood that the feeding of the strip material to the punch press, such as herein illustrated and described, will take place intermittently in timed relation with the reciprocating movements of the plunger-actuated die. For the feeding operation the press is equipped with feeding rolls on respective sides thereof. However, for disclosing the micro-feed adjusting device of the invention and the crank arm and reciprocating rack associated therewith, only the feed rolls at the entrance end are illustrated, and accordingly the description will be limited thereto.

The bracket 22 extending laterally from the upright 20 on the feeding side of the press provides the support for the rear feed rolls 23 and 24. The said rolls are journalled by the side members 25 and 26 which are securely fastened at their base to the bracket 22. The shaft 27 for the top roll 23 extends a short distance beyond so as to project from each side of its journalling member and the same can be said for shaft 28 of the bottom roll 24.

However, the left end of said shaft 28 is reduced in diameter and this end extends a sufficient distance so as to enter the rack and pinion housing 30 for operative connection with driving elements located within the housing. The right hand end of shafts 27 and 28 are each provided with a gear, not shown, and which have meshing relation so that the rolls will rotate in unison and to a like extent. Also, the lever 31 is provided for hand operation in order to lift the top roll 23 for spacing the rolls to facilitate the insertion of stock material therebetween.

The housing 30 journals the shaft 32 to which is fixed the gear 33. Said gear has meshing relation with the teeth 34 of the reciprocating rack 35. This operative end of the rack is received and guided by the housing 30 and thus as the rack reciprocates, the gear 33 and shaft 32 are rotated first in a clockwise direction and then in a counterclockwise direction. By means of a conventional one-way clutch mounted on the shaft 32 and combined with interconnecting bevelled gearing, all of which is located within the housing 30, the rotations of the shaft 32 in a feeding direction only are transmitted to shaft 28 of the lower feed roll. Rack and pinion feeding mechanism for intermittently rotating feeding rolls is fully disclosed and described in the Littell Patent 1,947,015, granted February 13, 1934.

In order that the adjustable crank mechanism can be actuated during operation of the press, it is necessary to provide a hand wheel such as 36 for effecting said adjustments. The hand wheel should be conveniently located for access by the operator, and accordingly the same is mounted on bracket 20 as at 37. A flexible drive 38 operatively connects the hand wheel with the gear 40 located within and journalled by the bracket housing 41. The housing 41 is suitably fixed to the reciprocating rack 35 on the side opposite the teeth 34 and thus the bracket has movement with the rack. The housing 41 also journals the pinion shaft 42, having the pinion 43 fixed thereto, and which meshes with the gear 40. Rotation of the hand wheel 36 is thus imparted to the pinion shaft 42 and to the spline tube 44 which is fixed to the upper extending end of the pinion shaft. The upper end of the splined tube 44 is suitably journalled by the bracket 45 which is anchored on the reciprocating rack, and this end is provided with a square shaped opening for receiving the square rod 46. The said rod extends for approximately the length of the rack so as to have connection at its upper end with the adjustable crank mechanism whereby to effect the desired adjustments of the mechanism as the hand wheel is rotated in either direction.

Referring to FIGURE 3 it will be seen that the square shaped rod 46 terminates in the coupling 47 journalled by the bracket 48 which is also anchored on the reciprocating rack. The coupling is retained by the base flange 50 and the retaining washer 51. The lower end of shaft 52 is received by the coupling and said end is keyed thereto as at 53. The upper end of shaft 52 is journalled by the spaced ball bearings 54 and 55 within the integral section 56 of the journalling member 57 to which the rack 35 is secured. This journalled end of shaft 52 is provided with the worm pinion 58 and said pinion has meshing relation with the worm gear 60, FIGURES 2 and 3, also journalled for rotation by the shaft 61 within the integral section 56 of the member 57. It will be understood that said shaft 61 is thus disposed at right angles to the shaft 52. Shaft 61 also mounts a second gear 62 which has considerable length as best shown in FIGURES 2 and 4. It is necessary for gear 62 to have such length, since a threaded actuating ring 63 is adapted to be rotated thereby and said ring as a result of its rotation has bodily movement in a direction axially of shaft 61 and thus along the length of gear 62. The gear 62 and actuating ring 63 comprise essential parts of the adjustable crank mechanism, and the same will now be described in the manner in which they and other elements are combined with the

trunnion member projecting from the face plate of the press.

The face plate 65, FIGURES 1, 4 and 6, is provided with a groove 66 extending diametrically of the plate and within which there is mounted the threaded screw 67. The groove has a wide base with a much narrower open slot such as 68 so that diagonal walls 70 are provided. Accordingly the groove is adapted to receive the cone-shaped head 71 of the trunnion member 72, the head having threaded engagement with the screw 67 and whereby the trunnion member extends outwardly from the face plate through the slot 68. The trunnion member functions to journal the reciprocating rack 35 at the extreme upper end of the rack and thus the member forms a crank arm for the rack, the same being adjustable along groove 66 in order to vary the eccentricity or throw of the crank arm and thus the strokes of the reciprocating rack. Manual adjustment as regards the position of the trunnion member 72 is effected by rotation of the screw 67 and accordingly atjustment thereof to vary the reciprocating strokes of the rack requires that the press be stopped. However, for any particular manual setting of the trunnion member, the adjustable crank mechanism of the invention provides for a limited variation in its eccentricity, and thus the strokes of the rack can be varied to a degree during operation of the press for either increasing or decreasing the feeding action of the feed rolls.

The trunnion member 72 has a clamping sleeve 74 in telescoping relation therewith, and said sleeve has integral base flanges 75 which provide the lugs 76 having interfitting relation in grooves formed in the face plate 65. A stationary helix gear 77 is also located on the trunnion member 72 in front of the sleeve 74, the helix gear being telescoped on the trunnion member and being formed with a keyway slot on its inside surface for receiving the Woodruff key 78, FIGURE 5. A series of spaced washers such as 80 and 81 are are interposed between the end of helix gear 77 and the fastening nut 82 so that upon tightening the nut, the head 71 of the trunnion member is caused to engage the diagonal walls 70 of the groove 66 in the face plate, and a similar reactive force is applied to the sleeve 74 and to the helix gear 77 through the washers whereby to force the flanges 75 of the sleeve into firm and solid contact with the face plate. The sleeve and helix gear are thus held on the trunnion member in solid contact wtih each other and with the face plate and in a manner whereby turning of the parts is effectively prevented.

The eccentric member designated in its entirety by numeral 83 is in turn telescoped on the clamping sleeve 74, being mounted on the sleeve so as to rotate thereon. In accordance with the invention a second helix gear 84 is formed integral with the eccentric member 83. Said gear 84 is also adapted to rotate on sleeve 74 and said gear is concentric therewith. Whereas helix gear 77 is fixed to the trunnion member, the helix gear 84 is mounted for rotation. The said gears have the same outside diameter and the teeth formed on the exterior of the same are each disposed diagonally, having a slope of approximately 30 degrees with respect to a central axis as clearly shown in FIGURES 4 and 6. The teeth 79 of helix gear 77 slope in a direction from left to right beginning at the inside edge to the outside edge adjacent the washers. The teeth 86 of the movable helix gear 84 slope in a reverse direction, namely from the right to the left, beginning at the inside edge to the outside edge adjacent helix 77. Also, the teeth of the respective gears are of the same size, each gear has the same number of teeth and the gears have the same length. A fillet 85 is provided by the sleeve 74 in order to accommodate the rounded edge of the eccentric member 83, which is adapted to rotate with gear 84 as a unit on the sleeve.

The cylindrical housing 87 for the adjustable crank arm mechanism is an integral part of the journalling member 57, and the combined unit is mounted on the

eccentric member 83 for substantial frictionless rotation by means of the ball bearing race 88. The ball bearing race is retained in place by the flange 89 and by the releasable retaining ring 90 located on the side of the bearing within the housing. On the side of the bearing adjacent the face plate a special retaining ring 91 is provided, being secured to the housing by the screws 92. The enclosing housing for the adjustable crank arm mechanism is completed by the cover 92 of special shape and which has a circular base flange 93 adapted to engage and interfit with a circular flange 94 provided by the housing 87. The screws 95 releasably secure the parts together. The front opening in the cover 92 through which the trunnion member extends is closed by the sealing ring 96 held to the cover by the screws 97. The sealing ring 96 extends between the spaced washers 80 and 81, and thus the ring provides an oil and grease retainer for the housing structure while permitting relative movement to take place between the ring and the washer.

The inside periphery of the cover 92 is threaded at 98 for a part of its length starting with the end adjacent the circular flange 93 and continuing to approximately midway of the length of the cover. The threads 98 have meshing relation with similar threads 100 formed on the exterior of the actuating ring 63, and thus the actuating ring is threaded within the cover so that upon rotation of the same its position with respect to the cover may be varied. For example, when rotated in one direction the ring will move into the cover, and when rotated in an opposite direction the ring will move out of the cover. The inside circular edge of the actuating ring terminates in a ring gear 101, FIGURE 3, which has meshing relation with the driving gear 62 and as previously explained, said gear 62 has considerable length, since the ring gear 101 will have axial movement as the result of its rotation. A retaining plate 102 is secured by screws 103 to the ring gear and said retaining plate is thus opposed to the inwardly extending flange 104 formed on the opposite end of the actuating ring 63.

An annular gear 105 is located within the actuating ring 63 and said annular gear has a dual set of teeth on its inside periphery at respective ends for meshing relation with the teeth on the helix gears. One set of teeth 106 is adapted to mesh with teeth 79 on the stationary helix gear 77. The second set of teeth 107 is adapted to mesh with the teeth 86 on the rotatable helix gear 84. In addition, the annular gear 105 has an annular projection 108, FIGURE 6, extending outwardly from adjacent the teeth 106, and a second annular projection 110 extends outwardly from adjacent the teeth 107. By means of the said projections the annular gear 105 is retained within the actuating ring, since projection 108 has contact with the flange 104, whereas the projection 110 has contact with the retaining plate 102. The contacting surfaces of the respective projections and the retaining elements are made smooth with a high finish in order to facilitate the circular movement which the annular gear 105 and actuating ring 63 will have relative to each other during rotation of the face plate for reciprocating the rack.

The mode of operation of the adjustable crank arm mechanism is believed to be readily apparent from the drawings, particularly as shown in FIGURES 4, 5 and 6. Upon actuation of the hand wheel 36 the rotation of the same is transmitted to the flexible shaft 38 and from said shaft to the spline 44, to the square rod 46, coupling 47, rod 52, to the worm pinion 58. Rotation of the pinion is imparted to its meshing worm gear 60, fixed to shaft 61 and rotation of this shaft will produce rotation of the gear 62 which is also fixed thereto. Said gear 62 thus constitutes the driving gear for the actuating ring 63, since the gear has meshing relation with the ring gear 101. Thus the actuating ring can be positioned for effecting the desired positioning of the eccentric 83. When said eccentric is located as shown in FIGURE 7, being disposed laterally

to the right, the crank arm adjusting mechanism is set at zero adjustment. In other words, the throw of the trunnion member for reciprocating the rack will be due entirely to its position as manually set by rotation of the threaded screw 67. When the eccentric member 83 is positioned as shown in FIGURE 8, the adjustment of the same is a maximum, and thus the throw of the trunnion member for reciprocating the rack will be different to the extent of the maximum adjustment of the eccentric member. The parts have been so designed that one turn of the hand wheel will effect a feeding adjustment of the feed rolls of approximately .0036 of an inch.

Referring to FIGURE 4 it will be observed that for zero adjustment of the eccentric member, the actuating ring is located within the cover to a maximum extent. Accordingly the annular gear 105 is located with respect to the helix gears 84 and 77, so that the teeth 106 and 107 of the annular gear mesh with the teeth of the helix gears adjacent their outer edges. Rotation of gear 62 to rotate the ring gear 101 in a direction to move the actuating ring 63 out of the cover, will cause the teeth 106 of the annular gear to ride along the diagonal teeth of the stationary helix gear 77. This will produce rotation of the annular gear in a counterclockwise direction, FIGURES 7 and 8. Such rotation of the annular gear is transmitted to the helix gear 84, since teeth 107 mesh with the teeth of the said helix gear. Additional rotation is imparted to the helix gear 84 since teeth 107 have engaging relation with the diagonal teeth of the helix, and accordingly the rotative action of the annular gear 105 caused by helix 77 is not only transmitted to helix 84 but the rotative movement is doubled by the opposed relation of the helix gears. Since the helix 84 is an integral part of the eccentric 83, the member is accordingly rotated so that its position with respect to the trunnion member is changed.

In the event the actuating ring 63 is rotated to move the same completely out of the cover, the ring will take the position as illustrated in FIGURE 6 wherein the teeth 106 and 107 of the annular gear engage the teeth of the helix gears 77 and 84 adjacent their inside edges. As a result the counter-clockwise rotation of the eccentric member is such as to move the same from the zero position of adjustment as shown in FIGURE 7, to the maximum position of adjustment as shown in FIGURE 8. As clearly evident from said figures the eccentric member has moved approximately 90 degrees, and thus the action of the actuating ring, in moving with respect to the cover so as to produce similar movement of the annular gear on the helix gears, is such as to produce this extent of rotation of the eccentric member. The helix gears since they are disposed adjacent each other can be described as presenting a herringbone arrangement, which, however, is uniquely characterized, since gear 77 is fixed to the trunnion whereas gear 84 is rotatable on the clamping sleeve, being formed integral with the eccentric member. Since the teeth of the two gears oppose each other, all stresses and strains incident to the driving of the reciprocating rack are effectively cancelled. Also, this opposed arrangement of the gear teeth on the respective helix gears doubles the motion of the movable helix for any degree of movement of the annular gear axially of the stationary helix. Since all of the parts are circular in formation, considerable economies can be effected in the manufacture of the same, and further reduction in cost is possible by reason of the simplicity of the device.

The housing unit 87 including cover 92 are generally positioned eccentrically of the trunnion member, since the parts are mounted for rotation of the eccentric member 83. Thus the coacting elements namely the actuating ring 63 and the annular gear 105 will have rotative movements simulating a wobble with respect to each other. However, the actuating ring has such end contact with the annular gear as to permit such wobble although any axial movement of the actuating ring will be effectively imparted

to the annular gear. Thus the invention provides variating means for the feeding mechanism of the press whereby the reciprocating strokes of the rack can be varied in length to a limited extent for any particular fixed setting of the trunnion member. Also, as designed, the said variating means can be adjusted at any time, even during operation of the press for which purpose the hand wheel 36 is provided.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In apparatus for processing strip material fed to said apparatus, in combination, an operating shaft, a plate member fixed to and rotating with the shaft, a trunnion member adjustably fixed to the plate member to form crank arm mechanism therewith, an adjustable eccentric device in associated relation with the trunnion member, whereby the device is capable of varying the eccentricity of the crank arm mechanism for any fixed position of the trunnion member, said device including a clamping sleeve in telescoping relation on the trunnion member and having its base end in contact with the plate member, a helix gear fixed to the trunnion member beyond the sleeve and having contact with the adjacent end of the sleeve, securing means on the trunnion member beyond the helix gear for retaining the trunnion member, sleeve and the gear as a unit in fixed position on the plate member an eccentric member having a second helix gear integral therewith, said eccentric member and second helix gear being mounted on the sleeve for rotation and being so arranged that the second helix gear is disposed adjacent and concentric with the fixed helix gear, an annular gear disposed in encircling relation with the said helix gears, said annular gear having internal teeth at respective ends thereof for meshing relation with the teeth of the helix gears, respectively, means for effecting axial movement of the annular gear, and a housing unit for said device mounted for rotation on the eccentric member.

2. Apparatus for processing strip material fed to said apparatus as defined by claim 1, wherein the means for effecting axial movement of the annular gear includes an actuating ring disposed concentrically with respect to the trunnion member and being threaded for axial movement within the housing unit, said actuating ring encircling the annular gear, and retaining means provided by the actuating ring and having contact with the annular gear at respective ends thereof, said retaining means and annular gear being so constructed and arranged as to permit rotative movements of the ring and gear independently of each other.

3. In an adjusting device of the character described, the combination with a plate member adapted for rotation, of a trunnion member projecting outwardly from the face of the plate member to form crank arm mechanism therewith, a clamping sleeve on the trunnion member having its base end in contact with the plate member, a helix gear in fixed relation on the trunnion member beyond the sleeve and in contact with the adjacent end of the sleeve, securing means threaded to the end of the trunnion member beyond the helix gear for retaining the trunnion member, sleeve and gear as a unit in fixed position on the plate member, an eccentric member having a second helix gear integral therewith, said eccentric member and second helix gear being mounted on the sleeve for rotation and being so arranged that the second helix gear is disposed adjacent and concentric with the fixed helix gear, said helix gears each having diagonal teeth in opposed relation to the teeth of the other gear, an annular gear disposed in encircling relation with the said helix gears, said annular gear having a set of internal teeth at each end, one set of teeth having meshing relation with the teeth of the fixed helix gear and the other set of teeth having meshing relation with the teeth of the second helix gear, a housing unit for said device mounted for rotation on the eccentric member, and means for effecting axial movement of the annular gear along the length of the helix gears, said means including an actuating ring encircling the annular gear and having a threaded relation with the inside surface of the housing unit for movement axially of the trunnion member.

4. An adjusting device of the character as defined by claim 3, additionally including retaining flanges provided by the actuating ring and which are disposed for contact with the respective ends of the annular gear, whereby said gear is caused to move with the axial movement of the actuating ring, said retaining flanges and contacting ends of the annular gear having smooth surfaces to permit rotative movements of the parts relative to each other.

5. In an adjusting device of the character described, the combination with a plate member adapted for rotation, of a trunnion member projecting outwardly from the face of the plate member to form crank arm mechanism therewith, an eccentric member mounted on the trunnion member for rotation with respect thereto and being disposed relatively adjacent the plate member, a helix gear also mounted for rotation on the trunnion member beyond the eccentric member and being concentric with the trunnion member, said helix gear and eccentric member being connected so as to rotate as a unit, a second helix gear mounted on the trunnion member and being fixed thereto, said helix gears being disposed adjacent each other and having diagonally opposed teeth whereby a herringbone arrangement is presented by the two said gears, an annular gear in encircling relation with the helix gears, said annular gear having a set of internal teeth at each end, one set of teeth having meshing relation with the teeth of the first mentioned helix gear and the other set of teeth having meshing relation with the teeth of the fixed helix gear, a housing unit for said device mounted for rotation on the eccentric member, and means provided by the housing unit for effecting axial movement of the annular gear along the length of the helix gears, whereby said annular gear is caused to rotate for any axial movement along the fixed helix gear and which is transmitted to the first mentioned helix gear to produce rotation of said gear and thus rotation of the eccentric member.

6. An adjusting device of the character as defined by claim 5, wherein the teeth of the helix gears are diagonally disposed approximately 30 degrees with respect to the rotative axis of the gears and wherein the teeth on one helix gear are equal in number and have the same size and shape as the teeth on the other helix gear.

7. An adjusting device of the character as defined by claim 5, wherein the means provided by the housing unit for effecting axial movement of the annular gear includes an actuating ring in surrounding relation with the annular gear and having threaded relation with the inside surfaces of the housing unit, whereby rotation of the actuating ring will produce movement axially of the same with respect to the housing unit.

8. An adjusting device of the character as defined by claim 7, additionally including a flexible drive connected to the housing unit and operative for effecting rotation of the actuating ring.

9. In an adjusting device, the combination with crank arm mechanism providing a trunnion, of an eccentric mounted on the trunnion for rotation, a first helix gear having a connected relation with the eccentric and being concentrically mounted on the trunnion outwardly of the eccentric, a second helix gear located outwardly of the first helix gear and being fixed to the trunnion in concen-

tric relation thereon, a housing unit mounted on the eccentric for relative rotation and enclosing the said helix gears, an actuating rack member fixed to the housing, and means in operative connected relation with the housing and with the helix gears for effecting rotative movements of the eccentric as said means is given movement relative to the housing and axially of the trunnion.

10. An adjusting device as defined by claim 9, wherein the said means includes an annular gear in meshing relation at its ends with the first helix gear and with the fixed helix gear, respectively, and an actuating ring in operative connected relation with the annular gear and having

threaded connection with the housing for movement axially of the trunnion and housing.

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