

Oct. 21, 1958

S. BUDLONG

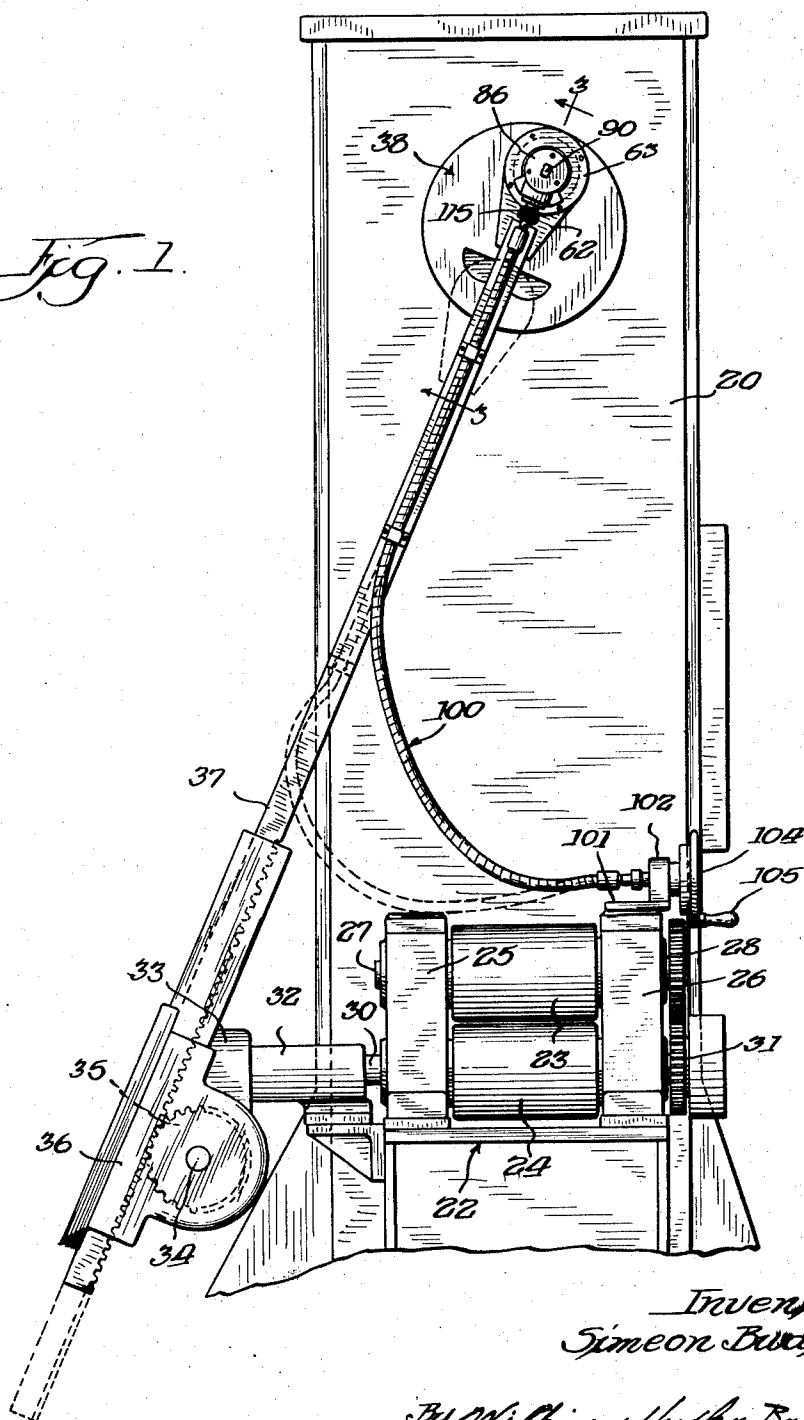
2,856,793

ADJUSTABLE CRANKS

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5 Sheets-Sheet 1

*Fig. 1.*



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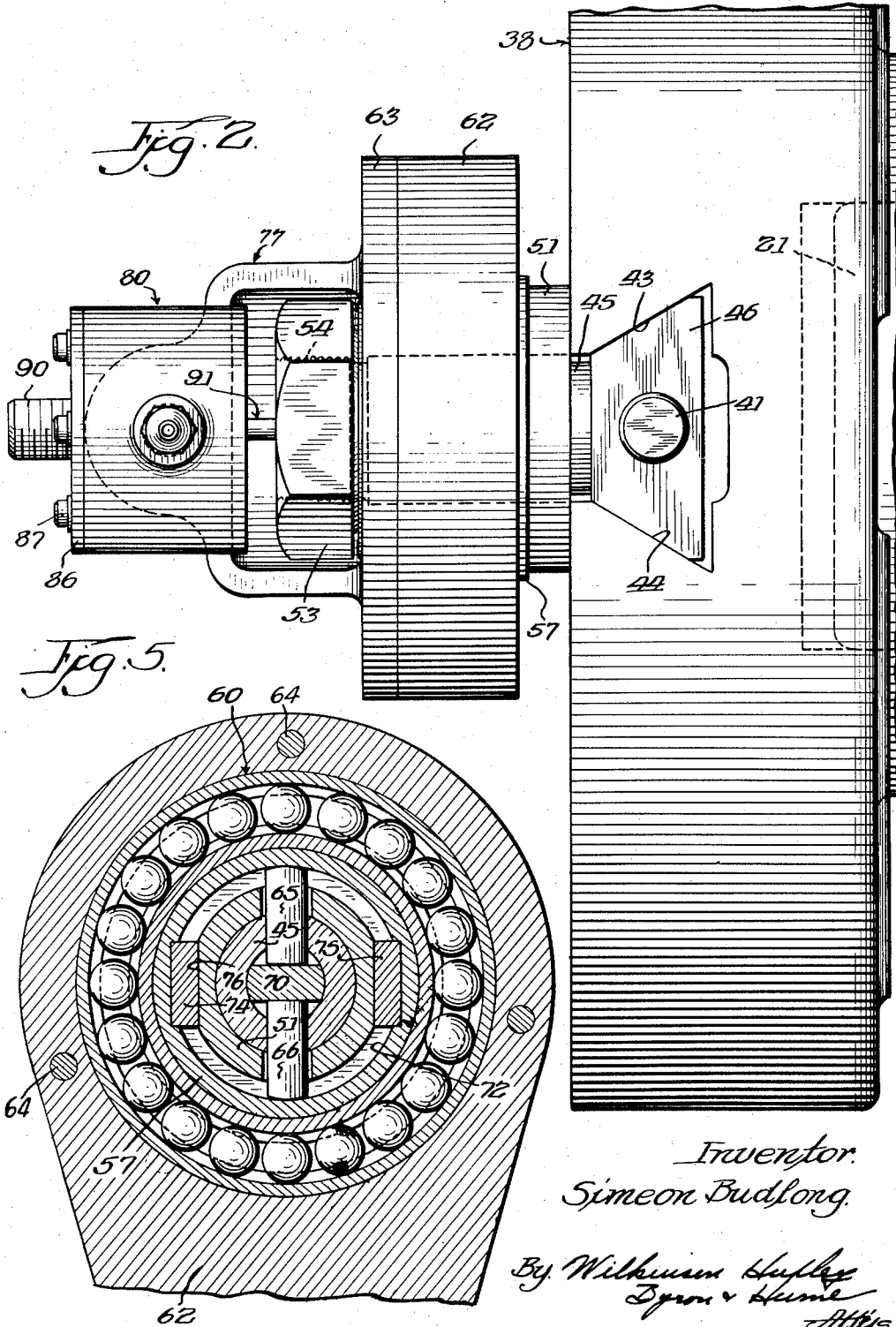
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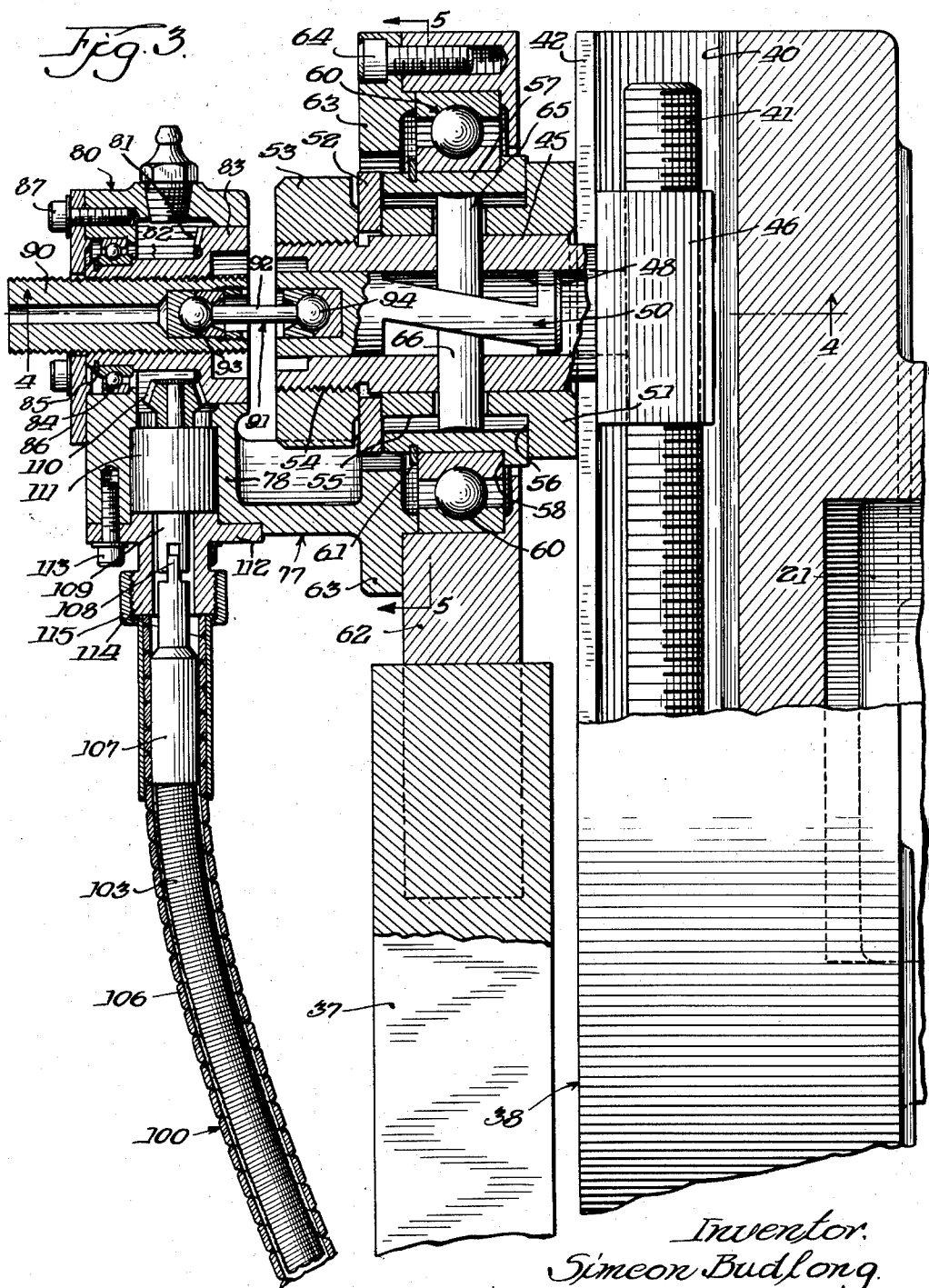
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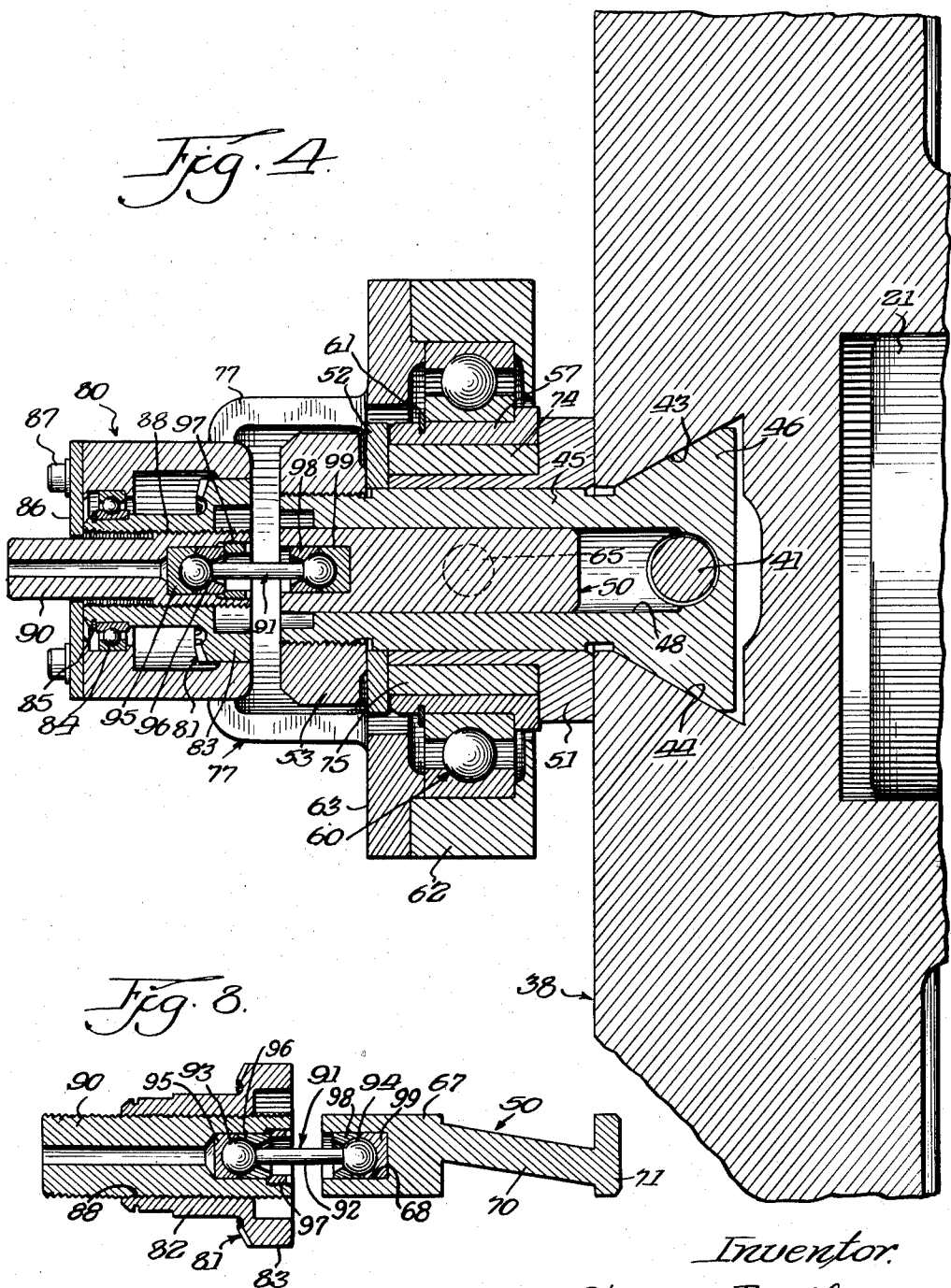
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*Fig. 4.*



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S. BUDLONG

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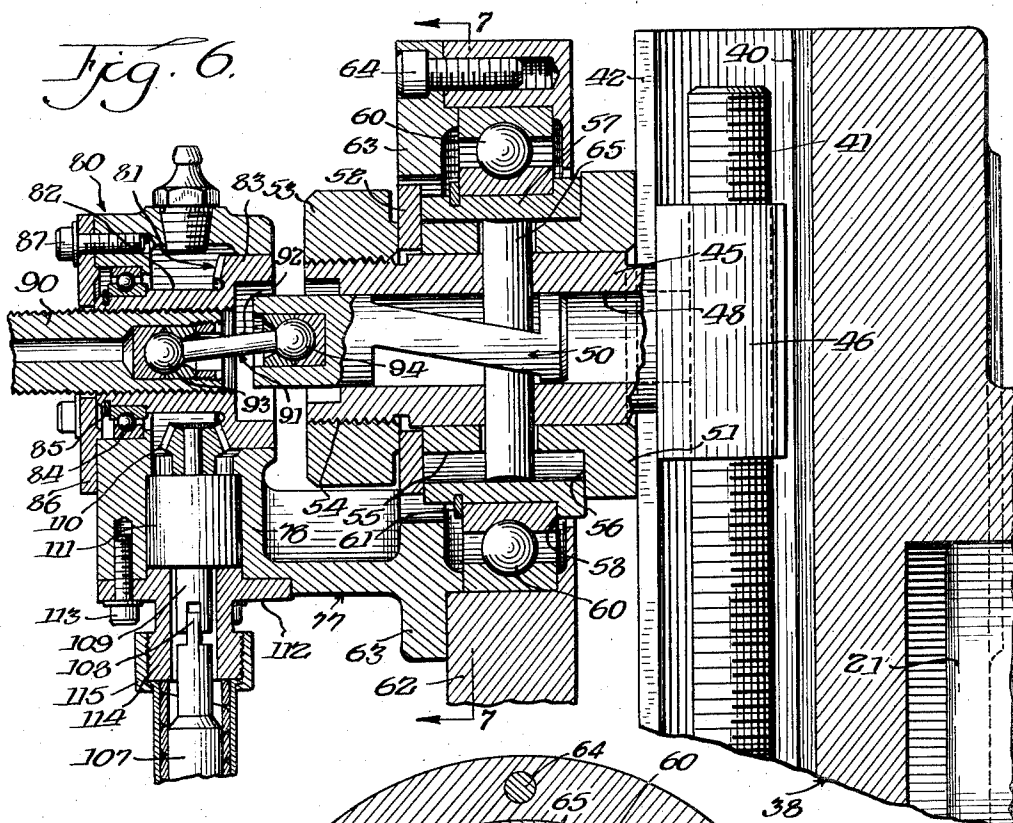
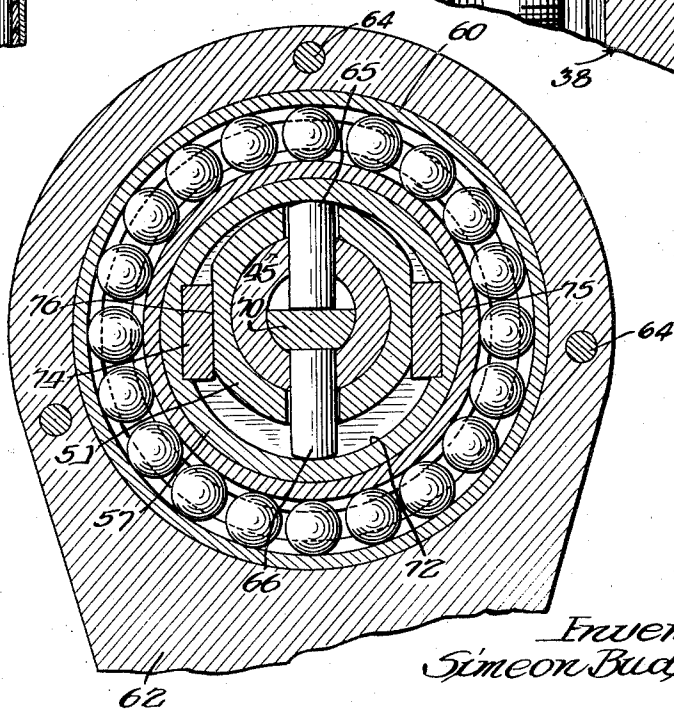


*Fig. 7.*



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2,856,793

## ADJUSTABLE CRANKS

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Application July 16, 1956, Serial No. 597,948

6 Claims. (Cl. 74—600)

The invention relates to adjustable crank arms and has reference more particularly to improved varying means for a crank arm 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 whereby stock material in strip form is conditioned and fed to the reciprocating plunger for blanking, punching or for similar operations.

The feeding of the strip material is performed by feed rolls having intermittent rotation and which have an opening action between feeding operations when the material is at rest to release the strip material so that the same is free for the punching or forming dies, the said dies accordingly having operation in an alternate manner with the feeding rolls, whereby the material is operated on following each feeding movement. It is necessary at times to make adjustments in the feeding action of the feed rolls in order to accurately position the stock for operation thereon by the dies, since the speed of the press and the gripping action of the rolls on the strip material are variable. For example, for the same setting of the feed mechanism, the feeding action on the material will be somewhat greater for a high speed press than for a low speed press. Heretofore such adjustments required that the press be stopped since the feed rolls are driven through a one-way clutch from the main driving shaft by means of a reciprocating rack and the said adjustments as heretofore made were made to said rack.

Accordingly, an object of the invention is to provide improved varying means for adjusting the eccentricity of crank arms for driving strip feeding mechanism such as described and which can be adjusted at any time even during operation to effect a change in the feeding action of the feed rolls.

In this connection, another object of the invention resides in the provision of varying means of improved design which will not require stopping of the press in order to adjust the same, but which will embody a hand wheel conveniently accessible to the operator whereby minute adjustments of the varying means can be easily and quickly made and wherein said varying means will be simple in construction so as to embody relatively few parts.

Another object of the invention is to provide conventional rack and pinion feeding means with improved crank arm mechanism incorporating a micro feed adjusting device, whereby the eccentricity of the crank arm can be varied to a limited extent, either plus or minus, for any particular manual setting of said crank arm.

Another object of the invention is to provide a micro

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adjusting device for crank arm mechanism such as described and which will essentially consist of a center pin mounted for axial movement and so constructed and arranged that such movement of the pin will operate to vary the eccentricity of the crank arm.

A more particular object resides in the provision of adjustable crank arm mechanism for reciprocating the rack of a punch press or the like which will incorporate a micro adjusting device of novel design for effecting minute adjustments as regards any manual setting of the crank arm, and wherein the driving connections between relatively movable parts essentially consists of parallel plates diametrically spaced and which absorb practically all the thrust so that the axially movable center pin and adjusting pins are free of all binding stresses and strains and very little effort is therefore required to move the pins even though the crank arm mechanism may be operating.

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 invention, and wherein like reference characters are used to designate like parts—

Figure 1 is a side elevational view of a punch press illustrating adjustable crank arm mechanism for actuating the feed rolls through conventional rack and pinion feeding means, the said crank arm mechanism incorporating the improved micro feed adjusting device of the invention;

Figure 2 is a top plan view showing the manually adjustable crank arm mechanism in associated relation with a micro feed adjusting device, the combined structure having an operative connection with the face plate of the press;

Figure 3 is a vertical sectional view illustrating the manual adjusting means for the crank arm mechanism and also showing in detail the structure and arrangement of the parts comprising the micro feed adjusting device of the invention, the same being shown in a neutral position;

Figure 4 is a horizontal sectional view of the apparatus of Figure 3 taken substantially along line 4—4 of said figure;

Figure 5 is a vertical sectional view along line 5—5 of Figure 3, the said figure particularly illustrating the ball bearing mounting for the journalling member of the rack and further showing the driving connections in the form of thrust plates which have location between relatively movable parts;

Figure 6 is a fragmentary, sectional view similar to Figure 3 but showing the micro adjusting device in an adjusted position for decreasing the eccentricity of the crank arm;

Figure 7 is a fragmentary sectional view taken substantially along line 7—7 of Figure 6; and

Figure 8 is a sectional view of the plunger, actuating gear wheel, adjusting pin and connecting link.

Referring to the drawings, 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 recip-

reciprocating plunger for coaction with the bed plate, said plunger actuated by the main operating shaft 21, Figure 4, extending transversely of the press and being journaled by said uprights. Upon rotation of the main operating shaft the plunger will be reciprocated vertically and thus said plunger will have movement to and from the bed plate of the press to perform the desired punching, cutting or forming operations on the strip material fed thereto.

It will be understood that the feeding of the strip material to punch presses such as herein described will take place intermittently in timed relation with the reciprocating movements of the plunger, so that following a feeding operation the feed rolls may be separated for freeing the material whereby to facilitate the action of the plunger of the press in processing the strip material. For said feeding operation the press is equipped with feed rolls on respective sides thereof. However, in disclosing the micro feed adjusting device and the crank arm mechanism in association therewith only the feed rolls at the entrance end of the press have been shown 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 feed rolls are suitably journaled by side members 25 and 26 securely fastened at their base to the bracket 22. The shaft 27 for the top feeding roll 22 extends a short distance to the right of side member 26 and said extending end receives the gear wheel 28. Likewise the shaft 30 for the lower feed roll 24 extends to the right of member 26 and the gear wheel 31 is secured to said extending end, said gear wheels having meshing relation with each other so that the feed rolls are operatively connected. The feed roll drive shaft 30 is additionally extended a considerable distance to the left, said left extending end being journaled by bearing 32 and said end having location within clutch housing 33. Said clutch housing is provided with a one-way clutch of conventional construction and by means of said clutch the shaft 34 is operatively connected to the shaft 30 and thus to the feed rolls. The pinion gear 35 is keyed to shaft 34 and said gear has location within the rack and pinion housing designated in its entirety by numeral 36. The reciprocating rack 37 is adapted to operate within said housing 36 and accordingly the rack has a geared relationship with pinion 35 to produce rotation of said pinion first in a clockwise direction and then in a counterclockwise direction as rack 37 reciprocates. Conventional rack and pinion feeding mechanism for intermittently rotating feed rolls is fully disclosed and described in Patent No. 1,947,015, granted February 13, 1934, to Frederick J. Littell et al. and entitled Strip Stock Feed for Presses.

In the punch press herein disclosed the main operating shaft 21 of the press is provided with a face plate or disc 38 to which the reciprocating rack 37 is operatively connected by crank arm mechanism embodying a micro feed adjusting device, the structure of which is shown in detail in Figures 3, 4 and 5. The face plate is provided with a groove 40 extending diametrically of the plate and within which there is mounted the threaded screw 41. The groove 40 has a wide base with a much narrower open slot such as 42 so that diagonal side walls 43 and 44 are provided, as best shown in Figure 4. Accordingly, the groove 40 is adapted to receive the trunnion member 45 having the cone-shaped head 46, the head having threaded engagement with screw 41 so that the trunnion member 45 projects through slot 42 and extends outwardly from the face of plate 38. The trunnion member functions to journal the reciprocating rack 37 at its extreme upper end and thus the member forms a crank arm for the rack, the same being adjustable along groove 40 in order to vary the eccentricity or throw of the crank arm and thus the strokes of the reciprocating rack. Manual

adjustment of the trunnion member 45 is effected by rotation of the screw 41 and accordingly adjustment thereof to vary the reciprocating strokes of the rack requires that the press be stopped. However, the invention provides a micro adjusting device in operative associated relation with the trunnion member and even though the rack has a manual setting which is fixed, nevertheless by reason of said device a variation can be effected in the strokes of the rack to thereby vary within limits the action of the feed rolls to either increase or decrease the feeding length as fixed by the manual setting.

The trunnion member 45 is cored centrally in a longitudinal direction to provide the passage 48 which receives the axially movable adjusting pin designated in its entirety by numeral 50. The trunnion member provides a mounting for sleeve 51, the right hand end of which is adapted to contact the face of plate 38. The opposite end of the sleeve has contact with the washer 52 and by means of the nut 53, which is threaded to the trunnion member at 54, the said trunnion member, nut, washer and sleeve are fixedly and securely held to the face plate 38 in any adjusted position, depending on the stroke desired for the reciprocating rack. When the nut 53 is tightened the trunnion member 45 is drawn outwardly and the head 46 will be placed in firm contact with the diagonal surfaces 43 and 44. Simultaneously therewith reactive forces are applied to washer 52 and to sleeve 51, the latter thereby being pressed solidly against the face of plate 38 so that all said parts are united to form a fixed substantially integral unit which, however, can be released for manual adjustment purposes. The sleeve 51 is provided with a stepped surface 55 and the shoulder 56 thus provided in combination with the washer 52 forms a circumferential groove within which is positioned the collar 57. The exterior surface of the collar is also formed to provide a shoulder 58 adjacent the right hand edge thereof and the ball bearing assembly 60 has a press fit on the collar, being retained between shoulder 58 and the retaining washer 61. The journalling member 62, secured to and comprising part of the rack structure 37 is in turn mounted on the ball bearing assembly 60, also with a press fit, and with the cover 63 being secured to the member by screws 64 to enclose the bearing assembly, the parts are thereby fixedly united so that the journalling member, the ball bearing assembly and the collar comprise a second unit, which is adjustable on the trunnion member 45 by a micro adjusting device which will now be described in detail.

The said device essentially consists of the axially movable adjusting pin 50 adapted for movement within the passage or bore 48 and coaxing positioning pins 65 and 66, the former being located above pin 50 and the latter being located below pin 50. As best shown in Figure 8, the adjusting pin includes a forward member 67 having a recess 68 bored therein and which is open at the forward end of the member. The diagonal portion 70 of the pin 50 joins the forward member 67 with the rear member 71, both members being cylindrical and having a free sliding fit within bore 48. Upon movement of the adjusting pin within said bore the positioning pins 65 and 66 will be shifted either up or down and thus the position of the collar 57 with respect to trunnion member 45 will be varied. As shown in Figures 3 and 5, the collar is concentric with the trunnion member. However, when the adjusting pin is moved to the right, for example, as shown in Figure 6, then the collar has an eccentric position on the trunnion member and the eccentricity is such as to increase the crank arm effect of the trunnion member and to thus increase the reciprocating strokes of the rack 37. It will be observed that the pins 65 and 66 extend through aligned openings, respectively, in the trunnion member 45 and the sleeve 51, and whereas, the inner ends are flat and tapered complementary to the slope of the diagonal portion 70, the outer ends of the

pin are arcuate for contact with the inner surface 72, Figure 5, of the collar 57.

Upon rotation of the face plate 38 the trunnion member 45 will travel in a circular orbit, the diameter of which will depend on the particular manual setting for the member. The journalling member 62 will likewise travel in the same orbit and accordingly the rack 37 will be reciprocated to produce intermittent rotation of the feeding rolls 23 and 24. Each intermittent rotation of the feeding rolls results in a feeding action on the strip material and accordingly the rack 37 has an operative stroke followed by an inoperative stroke. The stresses and strains resulting from the work done by the reciprocating rack are accordingly transmitted through the journalling member 62 to the trunnion member 45. It is necessary therefore to relieve the pins 65 and 66 of these stresses and strains or else difficulty will be encountered by the operator in effecting movement of adjusting pin 50 for adjustment purposes. In accordance with the invention thrust plates 74 and 75 are provided, Figures 4 and 5, and which are disposed in planes substantially parallel to the rack 37, the same having location between sleeve 51 and the collar 57. More particularly, the inside surface 72 of the collar 57 is grooved at diametrically spaced locations to receive and thereby position the thrust plates 74 and 75, respectively. The plates are thus fixedly held by the collar, whereas, the sleeve 51 has diametrically opposite sides thereof flattened, as indicated by numeral 76, for contact with the adjacent flat surfaces of the thrust plates. All strain and stress between the movable parts is taken up by the thrust plates which, however, are so constructed and arranged as to permit adjustment of the second unit including the journalling member, ball bearing assembly and collar with respect to the first unit formed by the trunnion member, nut, washer and sleeve. The position of the thrust plates 74 and 75 with respect to sleeve 51 for an eccentrically adjusted position of the parts is best shown in Figure 7.

The mechanism for effecting adjustment of the pin 50 is supported by bracket 77 which is formed integral with the cover plate 63 and the bracket therefore projects forwardly of the plate and provides the cylindrical base portion 78 and the annular housing 80. The gear wheel 81 has a shank portion 82 and a hub portion 83, the hub portion having a rotatable fit within the rear opening of housing 80 and the shank portion being journaled by the ball bearing assembly 84. The assembly has a press fit within the front opening of the housing 80 and the said assembly is retained on the shank portion by the retaining ring 85. The mounting and journalling of gear wheel 81 is completed by the end plate 86 secured to the front face of the housing by the screws 87. The axial passage extending through gear 81 is threaded as at 88 and as a result the gear wheel has threaded relation with plunger 90 which is accordingly movable in an axial direction, either to the right or to the left upon rotation of the gear wheel. The plunger is threaded to the gear wheel as shown and it will be observed that the plunger is flattened on opposite sides and which contact the sides of the opening in the face plate 86 whereby the plunger is prevented from rotating although axial movement is permitted. Said movement of the plunger 90 is transmitted to the adjusting pin 50 by means of a universal link connection indicated in its entirety by numeral 91. The bar 92 of said connection is spherically shaped at its ends providing the ball portions 93 and 94 and which are releasably and adjustably held to the plunger 90 and to the pin 50, respectively. The ball portion 93 has location within a recess formed in the right hand end of plunger 90 and the members 95 and 96 are inserted within the recess in a manner to form a ball and socket connection with the portion 93. The parts are retained in place by the threaded retaining ring 97. In a similar manner the recess formed in the left hand end of the ad-

justing pin 50 receives the members 98 and 99, which engage ball portion 94 to likewise form a ball and socket connection therewith.

By reason of the universal link connection 91 it will be understood that axial movement of plunger 90 will be transmitted to the adjusting pin 50 and that movement of said pin will function to adjust the eccentricity of the journalling member 62 and also the cover plate 63. Any adjustment of the cover plate 63 will vary the relative position of the bracket structure 77 and housing 80. However, the resulting eccentric movement of the housing 80 will not interfere with the link connection due to the provision of the universal joints at the respective ends thereof. In other words, when the parts are adjusted, for example, as shown in Figure 6, the wobble which will take place as regards plunger 90, because it is out of line with the adjusting pin 50, will not interfere with either the operation of the parts or with their ability to effect different eccentric positions of the crank arm mechanism.

In accordance with the invention it is possible for the operator to rotate the gear wheel 81 and thus effect movement of the adjusting pin 50 at a location remote therefrom and while the punch press is operating. The flexible control indicated by numeral 100 extends from the housing 80 to the side member 26. The flexible control 100 is anchored to member 26 by means of base plate 101 and member 102 journals this end of the flexible wire member 103 and also journals wheel 104 to which the wire member is secured. As best shown in Figure 3, the wire member 103 is encased within the flexible metal conduit 106 and the upper end of said wire member is journaled by the bearing 107. Said end provides the reduced finger tip 108 which has operative connection with the shank 109 of the pinion 110, which in turn meshes with gear wheel 81. The pinion 110 is suitably journaled by bearing 111 having location within the cylindrical base portion 78 of the bracket structure 77. The cover 112, secured to the base portion by screws 113, retains the bearing 111 in position and said cover also provides a part 114 to which the knurled ring 115 is threaded for anchoring the upper end of the metal conduit 106.

When the feeding length for any particular operation of the press has been determined the operator makes a manual adjustment of the trunnion member 45 whereby the desired crank arm action and reciprocating strokes of the rack are secured for rotating the feed rolls 23 and 24 to produce the desired feeding lengths on the strip material fed to the press. However, as previously explained, the said feeding lengths will vary, depending on the speed of the press and the gripping action of the feed rolls on the strip material. Should the operator find that the feeding action of the feed rolls requires adjustment he can accomplish the same by rotating the hand wheel 104. The flexible wire member 103 has connection with the hand wheel 104 and thus the member will be correspondingly rotated to rotate the pinion 110 and the gear wheel 81. Said gear wheel is rotatably mounted by housing 80 for free turning movement and upon the same taking place it will be understood that the plunger 90 will be caused to move in an axial direction, either to the right or to the left, depending on whether the operator desires to increase the feeding action of the rolls or to decrease their feeding action. Assuming that the plunger 90 is moved from its neutral position, as shown in Figure 3, to an adjusted position, as shown in Figure 6, it will be seen that the adjusting pin 50 is likewise moved to the left, which adjusts the positioning pins 65 and 66 downwardly. The roller 57, ball bearing assembly 60, journalling member 62, and cover plate 63 constituting the second unit previously referred to will be correspondingly adjusted so that this unit will now be positioned eccentrically with respect to trunnion member 45. Adjustment of the cover plate 63 will produce

similar adjustment of the housing 80 and mechanism journaled thereby. However, this adjustment is conveniently provided for by the universal connecting joints which the connecting link has with the plunger and adjusting pin, respectively. The eccentric positioning of the second unit subtracts from the crank arm action of the mechanism and thus decreases the reciprocating strokes of the rack to decrease the feeding action of the feed rolls.

The present invention therefore provides varying means for the feeding mechanism of the press and as a result thereof the reciprocating strokes of the rack can be varied in length for any particular fixed setting of the trunnion member 45. The said varying means can be actuated at any time, even during operation of the press, and the hand wheel 104 for effecting said adjustments is located adjacent the feeding mechanism conveniently accessible to the operator. Very little effort is required for adjustment purposes since the thrust plates 74 and 75 provide the driving connections between the several parts of the mechanism which have relative movement. The working faces of the thrust plates are disposed substantially parallel to the reciprocating rack and accordingly adjustment of the movable second unit takes place in a plane parallel to the rack to vary the eccentricity of the crank arm. However, the thrust plates form a solid connection between the relatively movable parts and thus all stress and strain due to the working action of the reciprocating rack is absorbed by the plates, thereby releasing the adjusting pin and the positioning pins of any binding action so that they may have movement in a free and easy manner.

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 an adjusting device of the character described, the combination with a plate member adapted for rotation, of a trunnion member projecting outwardly from a slot formed in the plate member, said trunnion member having a head portion confined within the slot, a sleeve in telescoping relation on the trunnion member and having contact at one end with the plate member, means including a nut threaded to the trunnion member and in contact with the other end of the sleeve for releasably holding the trunnion member in a fixed position on the plate member to form crank arm mechanism therewith, said sleeve in combination with said means forming a groove encircling the trunnion member, a collar positioned in said groove and having spaced relation with the base of the groove so as to have concentric or eccentric positions with respect to the sleeve, a pair of thrust plates positioned between the collar and the sleeve in diametrically spaced relation, said thrust plates being carried by the collar and said plates having parallel work faces in contact with parallel faces, respectively, provided by the sleeve whereby the thrust plates form a driving connection between the parts while permitting relative movement thereof, said trunnion member having an axially extending bore, an adjusting pin within the bore and adapted to have axial movement longitudinally of the trunnion member, and positioning means extending diametrically of the trunnion member through openings in said member and sleeve and having contact with the collar and with the adjusting pin at respective ends of said means, said positioning means operating to transform axial movement of the adjusting pin into radial movement and which is thereby transmitted to the collar to position the collar with respect to the sleeve.

2. In an adjusting device of the character described, the combination with a plate member adapted for rota-

tion, of a trunnion member projecting outwardly from the face of the plate member to form crank arm mechanism therewith, a collar in spaced encircling relation with said trunnion member, means providing a groove for receiving the collar and which may thereby have concentric or eccentric positions with respect to the trunnion member, a journalling member having journalling relation on the collar, said trunnion member having an axial bore, an adjusting pin mounted within the bore for axial movement and having a diagonal portion, a pair of positioning pins extending through openings diametrically of the trunnion member to contact the collar at their outer ends and said pins engaging the respective surfaces of the diagonal portion at their inner ends, said positioning pins and diagonal portion operating in a manner to transform axial movement of the adjusting pin into radial movement and which is thereby transmitted to the collar to position said collar with respect to the trunnion member.

3. An adjusting device as defined by claim 2, additionally including bracket structure having a fixed relation with the journalling member, and means supported by the bracket structure for effecting axial movement of the adjusting pin.

4. In an adjusting device of the character described, the combination with a plate member adapted for rotation, of a trunnion member fixed to said plate member in an eccentric position to form crank arm mechanism therewith, a collar in spaced encircling relation with the trunnion member, a pair of thrust plates positioned between the collar and the trunnion member in diametrically spaced relation, said thrust plates being carried by the collar and said plates having parallel work faces in contact with parallel faces, respectively, provided by the trunnion member whereby the thrust plates form a driving connection between the parts while permitting relative movement thereof, said movement effecting adjustment of the collar from a concentric position with respect to the trunnion member to various eccentric positions as regards the member, and means carried by the trunnion member for moving said collar to thereby adjust the position of the same, whereby the device is capable of varying the eccentricity of the crank arm mechanism for any fixed position of the trunnion member.

5. In an adjusting device of the character described, the combination with a plate member adapted for rotation, of a trunnion member fixed to said plate member in an eccentric position to form crank arm mechanism therewith, a collar in spaced encircling relation with the trunnion member, a pair of thrust plates positioned between the collar and the trunnion member in diametrically spaced relation, said thrust plates being carried by the collar and said plates having parallel work faces in contact with parallel faces, respectively, provided by the trunnion member whereby the thrust plates form a driving connection between the parts while permitting relative movement thereof, said movement effecting adjustment of the collar from a concentric position with respect to the trunnion member to various eccentric positions as regards the member, an annular ball bearing race mounted on the collar, a journalling member in encircling relation with said ball bearing race and being journaled on the collar thereby, said trunnion member having an axially extending bore, an adjusting pin within the bore and adapted to have axial movement longitudinally of the trunnion member, and positioning means extending radially of the trunnion member through openings therein and having contact with the adjusting pin and with the collar at respective ends of said means, said positioning means operating in a manner to transform axial movement of the adjusting pin into radial movement and which is thereby transmitted to the collar to effect adjustment of said collar, whereby

the device is capable of varying the eccentricity of the crank arm mechanism.

6. An adjusting device as defined by claim 5 additionally including a cover plate having a fixed relation with the journalling member, bracket structure provided by the cover plate, a positioning gear journaled by the bracket structure and having its axis of rotation in alignment with the axially extending bore, a plunger having operative connection with the gear and being moved axially thereof upon rotation of the gear, means providing a universal joint connecting the plunger with the adjusting pin, and other means operatively connecting with said positioning gear for rotating said gear.

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