MICRO-FEED ADJUSTING MECHANISM

Filed June 1, 1964 3 Sheets-Sheet 1

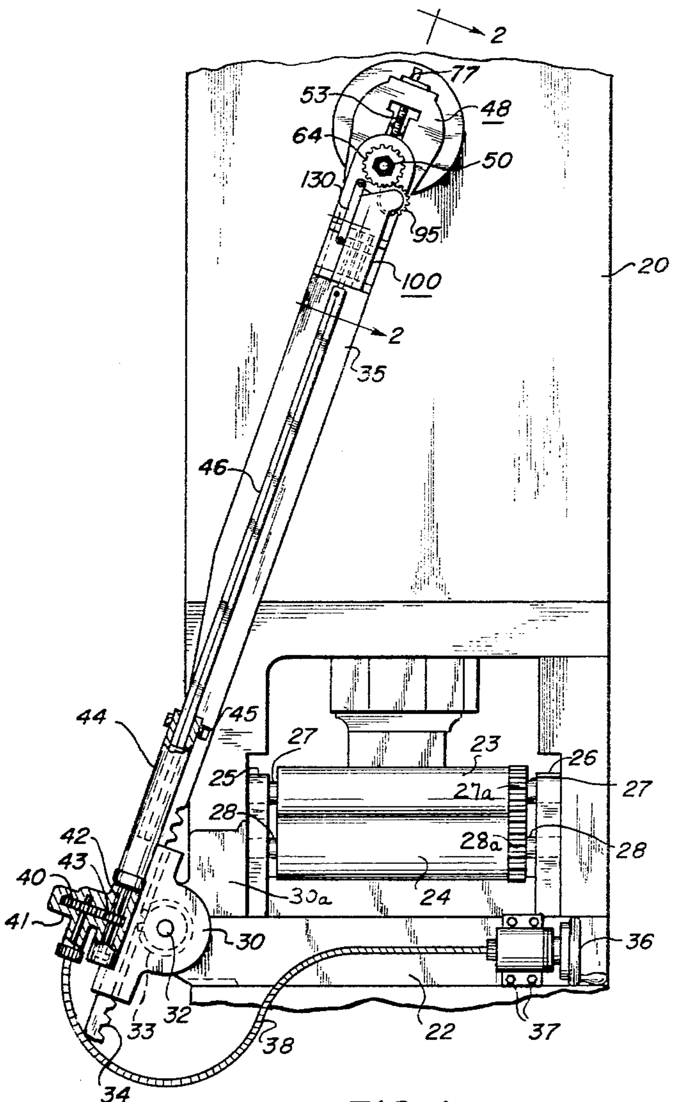

FIG. 1

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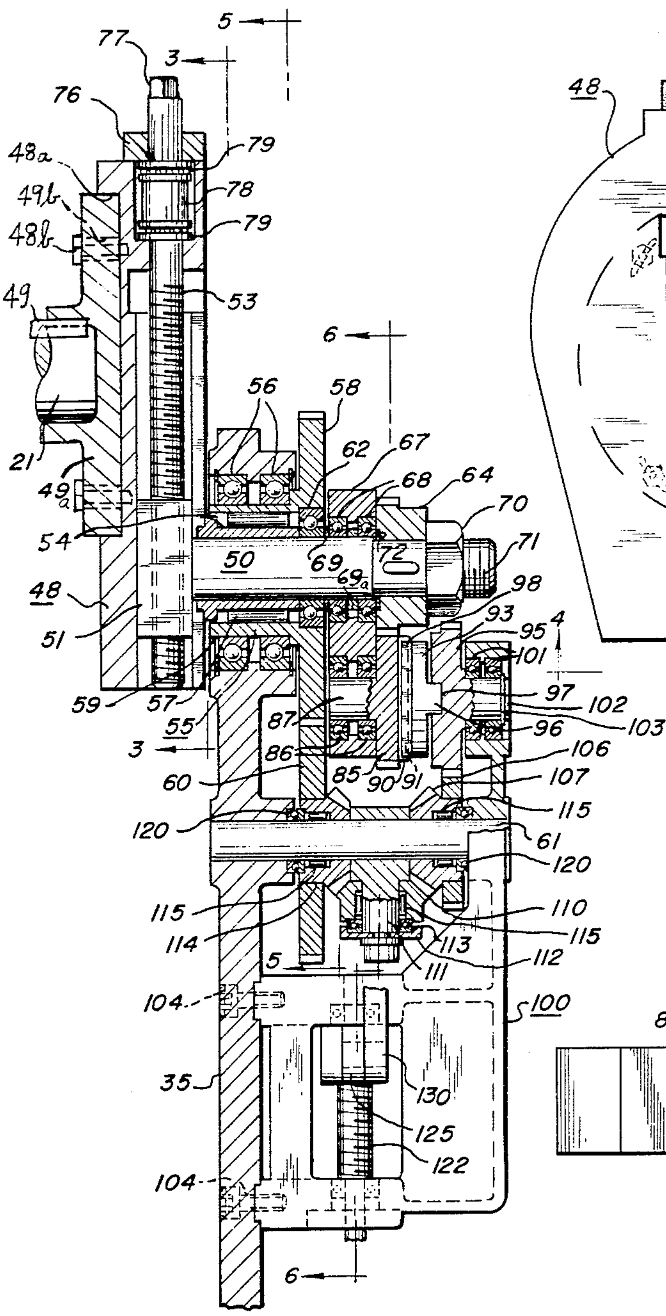

FIG. 2

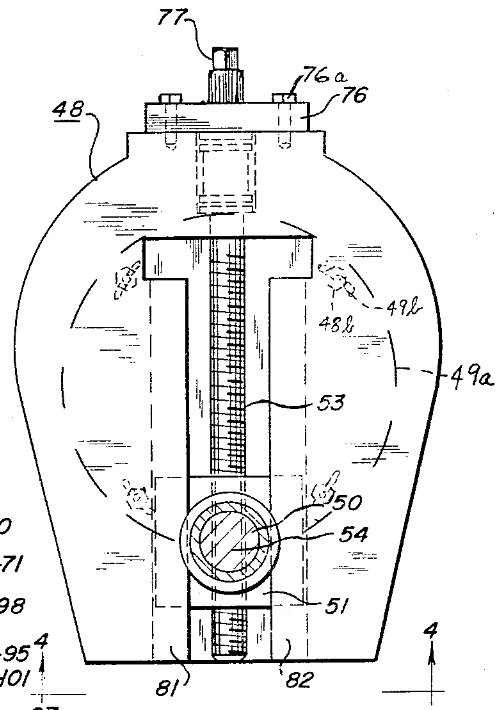

FIG. 3

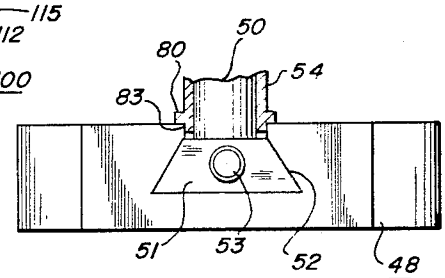

FIG. 4

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MICRO-FEED ADJUSTING MECHANISM

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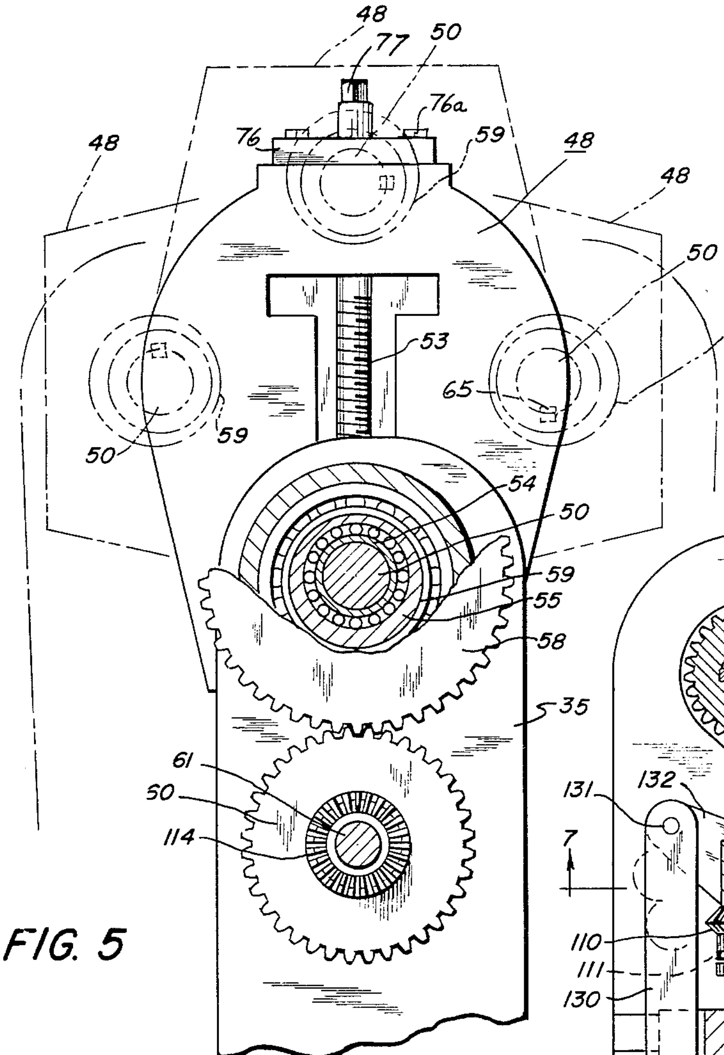

FIG. 5

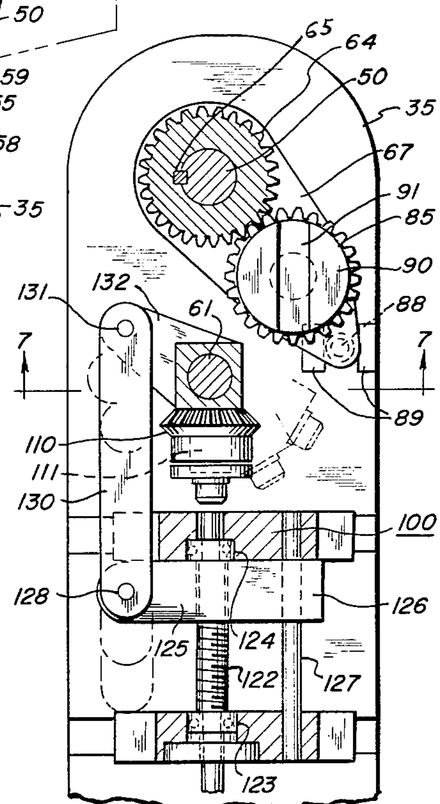

FIG. 6

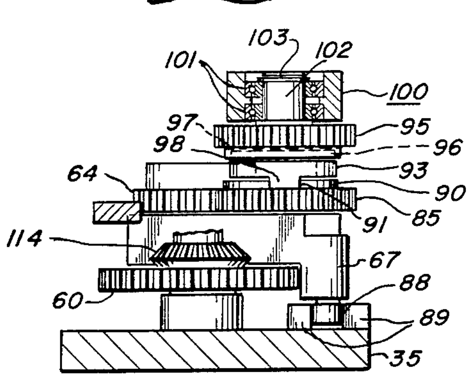

FIG. 7

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3,244,023
MICRO-FEED ADJUSTING MECHANISM

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18 Claims. (Cl. 74—600)

This invention relates to metal strip feeding devices, and more particularly to metal strip feeding devices of the reciprocating rack type in which the mechanism feeds a predetermined but adjustable length of strip to another apparatus.

Micro-feed adjusting mechanisms are well known in the art. One example of the prior art is disclosed in Budlong Patent No. 3,090,250 in which a metal strip feeding device of the reciprocating rack type is controlled by means of a crank arm and an eccentric mounted on the crank arm to manually adjust the length of the strip fed by the device. The prior art devices, however, exhibit certain disadvantages. For example, they include provisions for adjusting the length of the strip being fed only while the strip feed apparatus is in operation. Alternatively, other devices contain provision for adjusting the length of the strip material being fed only when the strip feed apparatus is stopped. Further, certain of these devices include provisions for adjusting the length of the strip being fed in which equal adjustments or degrees of angular rotation of a manually operated crank arm produce different degrees of change in the length of the strip being fed. Stated in another manner, certain of the prior art devices employ a manually operable handle for controlling this length of the strip, and the handle is coupled through a mechanism in which a substantially non-linear relationship exists between the degree of rotation of the handle and the degree of change of the length of the strip. Accordingly, it is an object of this invention to provide an improved micro-feed adjusting mechanism.

It is another object of this invention to provide a feed adjusting mechanism for a strip feeding apparatus in which the length of the strip can be quickly and accurately adjusted either while the apparatus is in operation or while the apparatus is stopped.

A further object of this invention is to provide a micro-feed adjusting mechanism for a strip feed apparatus in which a substantially linear relationship exists between the degree of movement of a manually controllable member and the degree of movement of the length of the strip being fed by the apparatus.

A still further object of this invention is to provide an apparatus for adjusting the length of a strip being fed from a strip feeding device which apparatus may be quickly and accurately adjusted to a high degree of precision and may be adjusted either during the operation of the strip feeding device or while the strip feeding device is stopped.

A still further object of this invention is to provide a strip feeding apparatus with an adjustable mechanism including a manually operable crank in which the amount of adjustment of the strip is the same for each increment of rotation of the crank. In other words, no matter how far the adjustment is made, the amount of adjustment is substantially always the same amount for each revolution of the crank.

Briefly, in accordance with aspects of this invention, we have discovered an improved device for adjusting the stroke of a rack relative to a trunnion by employing a first gear rotatably mounted on the trunnion and having an eccentric surface depending therefrom, a second gear secured to the trunnion, a rack rotatably engaging the eccentric surface, means coupling the first and second gears, and means mounted on the rack for varying the position of said first gear relative to said second gear. In accordance with one illustrative embodiment, this coupling means includes a universal coupling and a bevel gear train, and the position varying means includes means for manually adjusting one of the bevel gears of the bevel gear train to position this one bevel gear and while so doing to position the eccentric. Preferably, the eccentric surface is generated by producing a cylindrical hole eccentrically in a cylindrical member which couples a trunnion to a rack, such that the change in the rack stroke varies in a substantially linear manner with the angular change in the position of the eccentric surface relative to the trunnion.

In accordance with still other aspects of this invention, we employ a coupling and a bevel gear train in which one of the gears is mounted on a shaft pivotally mounted on the rack and in which a linking arrangement including a square rod is employed to link the pivotally mounted gear shaft to a manually operable handle wherein the position of the pivotally mounted shaft and the position of the eccentric may be modified either while the rack is reciprocating or while the rack is stationary.

In accordance with other aspects of this invention, we have discovered an apparatus for modifying the stroke of a rack relative to a crank arm which apparatus includes a first gear rotatably eccentrically mounted on the trunnion of the crank arm, an eccentric member integral with the first gear and having an external eccentric surface, a second gear secured to said trunnion, a bevel gear train rotatably mounted on said rack and operatively connected to said first gear, an Oldham coupling for coupling said second gear to said bevel gear train, said bevel gear train including a gear shaft pivotally mounted relative to the rack and means for positioning the pivotally mounted shaft relative to said rack whereby changes in position of said pivotally mounted shaft are accompanied by proportionate rotation of said first gear and proportionate rotations of said eccentric member. Advantageously, this eccentric surface is generated by producing a cylindrical passage eccentrically through a cylindrical member whereby the changes in the stroke of said rack vary in a substantially linear manner with the changes in position of said pivotally mounted gear shaft. Also advantageously, this means for positioning the pivotally mounted shaft includes a link coupled to the shaft, a threaded rod, a slide threadably engaging the threaded rod and coupled to the link, a square rod operatively connected to the threaded rod and means slidably engaging the rod for rotating the rod such that the threaded rod may be rotated to pivot the shaft while the rack is stationary, or while the rack is reciprocated thus to change the stroke of the rack either while the apparatus is stationary or while the apparatus is in motion.

These and various objects and features of the invention will be more clearly understood from a reading of the detailed description of the invention in conjunction with the drawings in which:

FIG. 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 a rack and pinion mechanism;

FIG. 2 is a view in elevation, partly in section, taken along the lines 2—2 of FIG. 1;

FIG. 3 is a view in elevation of a throw block constituting a portion of the invention;

FIG. 4 is a bottom plan view of the throw block of FIG. 3;

FIG. 5 is a view in elevation, partly in section, of the device of FIG. 2, taken along the line 5—5 thereof and looking in the direction of the arrows;

FIG. 6 is a view in elevation and in section of the device of FIG. 2, taken along the line 6—6 thereof and looking in the direction of the arrows; and,

FIG. 7 is a view in section, taken along the line 7—7 of FIG. 6.

Referring now to the drawings in which like numbers are employed to designate the same parts and particularly to FIGS. 1 and 2, the punch press selected for illustrating the present invention includes a pair of welded or cast uprights such as **20**, which are preferably suitably spaced to position a bed plate between the uprights and which additionally mount a vertically reciprocating plunger for coacting with a bed plate, all of which constitutes conventional structure. The plunger is actuated by a main operating shaft **21**, shown in FIG. 2, disposed transversely of the press and journaled for rotation in the uprights, such as **20**. Upon rotation of the main operating shaft **21** the plunger is reciprocated vertically and thus the plunger and 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 being fed thereto. The feeding of the strip material to the punch press takes place intermittently in timed relation with the reciprocating movements of the plunger actuated die. For the feeding operation the press may be equipped with feeding rolls on either one or both sides thereof, or on either one or both ends thereof. The feeding rolls may also be self contained in a separate housing. 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 is limited thereto.

The bracket **22** extending laterally from the upright **20** on the feeding side of the press provides the support for the feed rolls **23, 24**. The rolls **23, 24** are journaled by a pair of side members **25, 26** which are securely fastened at their base to the bracket **22**. A shaft **27** rotatably supporting the top roll **23** extends a short distance beyond to project on each side of its journaling member, and this relationship is also true of a shaft **28** for the bottom roller **24**. The left hand end, as viewed in FIG. 1, of the shaft **28** is reduced in diameter and extends a sufficient distance to enter a rack and pinion housing **30** for operative connection with driving elements located within the housing. The right hand end of rolls **23, 24** are each normally provided with a gear as **27***a*, **28***a*, and which have meshing relation so that the rolls will rotate in unison and to a like extent. Also, the top roll **23** may be provided with suitable means (not shown) for releasing and lifting the top roll to facilitate the insertion of stock material between the rolls **23, 24**.

The housing **30** journals a shaft **32** to which is fixed a gear **33**. The gear has meshing relation with a linear set of teeth **34** of a reciprocating rack **35**. The operative end of the rack **35** is received and guided by the housing **30** and thus as the rack reciprocates, the gear **33** and the shaft **32** in a feeding direction only is transmitted to shaft then in a counter-clockwise direction. By means of a conventional one-way clutch mounted on the shaft **32** and combined with interconnecting gearing, all of which is located within a separate housing **30***a*, the rotation of the shaft **32** is in feeding direction only is transmitted to shaft **28** of the lower feed roll.

In order that the adjustable crank mechanism can be actuated during operation of the press, it is necessary to provide a suitable adjustment means such as a handwheel **36** for effecting these adjustments. It will be understood that this adjustment function may also be carried out by a suitable motor means. The handwheel **36** is conveniently located for access by the operator, and in this particular embodiment is mounted on bracket **22** by suitable means, such as by a group of bolts **37**. A flexible drive **38** operatively connects the handwheel with a gear **40** located within and journaled by a bracket housing **41**.

The housing **41** is suitably fixed to the reciprocating rack or crank arm **35** on the side opposite the teeth **34** and thus the bracket has movement with the rack. The housing **41** also journals a pinion shaft **42** having a pinion **43** fixed thereto and meshes with the gear **40**. Rotation of the handwheel **36** is thus imparted to the pinion shaft **42** and to a splined tube **44** which is fixed to the upper extending end of the pinion shaft. The upper end of the splined tube **44** is suitably journaled by a bracket **45** which is anchored on the reciprocating rack, and this end is provided with a square shaped opening for receiving a square rod **46**. The rod **46** extends for approximately the length of the rack so as to have connection at its upper end with the adjustable crank mechanism for adjusting the relative position of an eccentric member relative to a shaft on the throw block, all of which will be subsequently described.

As best seen in FIG. 2, the main operating shaft **21** acts as a drive shaft for the micro-feed adjusting mechanism and the rack. The drive shaft **21** is shown as being adjustably mounted to the throw block **48** but it will be understood that, if desired, the drive shaft **21** may be fixedly connected to the throw block **48** by any suitable means. As best seen in FIG. 2 the drive shaft **21** is drivably connected to the hub **49***a* by means of the key **49**. The hub **49***a* has an enlarged annular portion which is seated in the annular recess **48***a* formed in the throw block **48**. The enlarged annular portion of the hub **49***a* is adapted to be adjustably connected to the throw block **48** by means of a plurality of suitable bolts **48***b* which pass through the arcuate slots **49***b* and are threadably engaged in the throw block **48**. A T-bolt or trunnion **50** which has a dovetail T-portion **51** is slidably mounted in a complimentary channel **52** in the throw block **48** and threadably engages a screw **53**. The rack **35** is rotatably mounted on the T-bolt **50** by means of a drive sleeve **54**, an eccentric **55** and bearings **56, 57**. The eccentric **55** is formed integrally with a gear **58**, and the eccentric **55** and gear **58**, are a portion of the means for micro adjustment of the strip feed mechanism. Eccentric **55** includes an eccentric surface **59** which is eccentric to the periphery of the T-bolt **50** and is also eccentric to the inside diameter of the gear **58**. The inside diameter or bore of the gear **58** is eccentric to the outside diameter or the teeth of the gear and the degrees of eccentricity of the gear teeth of gear **58** and of the surface **59** are the same. That is, the gear **58** and surface **59** are concentric. A circular gear **60** is rotatably mounted on a pin **61** secured to the rack **35** such that the gears **58, 60** are always enmeshed. Eccentric gear **58** is rotatably mounted on the trunnion **50** by means of bearings **57** and **62**. The gears **58, 60** are in continued meshed relationship because the rack **35** rides on the eccentric surface **59**. A gear train and universal coupling couples the rotation of the trunnion **50** to the gear **58**. All the gears of this gear train have a predetermined teeth relationship such that the eccentric gear **58** makes one revolution for each revolution of the throw block **48** and the trunnion **50** and this in turn is controlled by a drive gear **64** which is keyed to the trunion **50** by means of a suitable key or spline **65**. The key or spline **65** engages a suitable axially extending slot, not shown, in gear **64** which slot permits the gear **64** to slide axially relatively to the trunnion **50**. A plate **67** is rotatably mounted on trunnion **50** by means of bearings **68**. The left hand bearing **68**, as viewed in FIG. 2, is spaced from the bearing **62** by means of a washer **69**. The gear **64** is retained on trunnion **50** by means of a nut **70** which threadably engages a threaded portion **71** of trunnion **50**. Gear **64** is spaced from the right hand bearing, as viewed in FIG. 2, by means of a washer **72**. The bearings **68** are spaced by a suitable washer **69***a*.

The stroke of the rack **35** is determined primarily by the length of the crank arm measured between the axes of the main drive shaft **21** and the trunnion **50**. As best seen in FIGS. 2, 3 and 4, this distance may be adjusted by releasing nut **70**, and rotating the extension **77** of screw **53** in an appropriate direction. Because the screw **53** is rotatably mounted in collar **76** and is journalled in a sleeve **78** and a pair of bearings **79** and threadably engages dovetail **51** of trunnion **50**, rotation of screw **53** constitutes a coarse adjustment of the length of the crank arm. The collar **76** is secured to the throw block **48** by any suitable means, as by the bolts **76*a***. After this coarse adjustment, nut **70** is tightened to apply an axial force through gear **64**, washer **72**, the outer bearing **68**, washer **69*a***, washer **69**, inner bearing **68**, bearings **62** and drive sleeve **54**, which force is applied through an annular flange **80** of sleeve **54** to a pair of parallel surfaces **81**, **82** of the throw block **48**. The drive sleeve **54** includes a reduced cylindrical extension **83** which extends between the trunnion **50** and the surfaces **81**, **82** to give the drive sleeve **54** additional support and prevent rotation of drive sleeve **54** on trunnion **50**.

Gear **64** meshes with a gear **85** which is rotatably mounted in idler bracket **67** by means of bearings **86** which engage a shaft **87** of gear **85**. Gear **85** makes one revolution for each revolution of the throw block **48**. Because the gear **58** is eccentric and must remain meshed with circular gear **60**, the distance between the axes of trunnion **50** and the pin **61** varies throughout the cycle of throw block **48**, as shown in FIG. 5. This variation is obtained by the engagement of the rack **35** with the eccentric surface **59** through the bearings **56**. Advantageously, gear **85** is coupled to the gear **60** by means of a universal coupling which permits relative movement between the axes of gears **85**, **60** while closely maintaining the rotational relationship of gears **85**, **60**. This universal coupling is operatively connected to the gear **60** through a bevel gear train which defines a means for modifying the relative rotational relationship between gears **85**, **60** and thus modifying the position of eccentric gear **58** and its integral eccentric surface **59** relative to trunnion **50** to thereby achieve a fine adjustment of the stroke of rack **35**, which modifying means will be subsequently described in detail.

Gear **85** and the idler bracket **67** are permitted to reciprocate relative to rack **35** while they are prevented from rotating thereto by means of a pin **88** which slidably engages a pair of parallel blocks **89**. The pin **88** is rotatably mounted on bracket **67** and the blocks **89** are secured to rack **35** in parallel, spaced relationship as best seen in FIGS. 6 and 7. The previously mentioned universal coupling is an "Oldham" coupling which includes a cylindrical projection **90** extending axially from the gear **85** and axially aligned therewith and having a diametrically extending, rectangularly cross sectioned slot **91** therein. The Oldham coupling also includes a slide member **93** and a rotary member **95** slidably engaging a engaging a rectangularly cross sectioned diametrically extending projection **96** on slide member **93** by means of a slot **97**. The slide member **93** is generally cylindrical and includes a diametrically extending rectangularly cross sectioned projection **98** disposed at 90° relative to projection **96** and positioned on the opposite surface therefrom, the projection **96** engaging slot **91**.

The rotary member **95** is rotatably mounted on a bracket or frame **100** by means of a pair of bearings **101** secured to frame **100** which engage a reduced cylindrical portion **102** of member **95** and a suitable retainer ring **103** which engages portion **102** and bearings **101**. The bracket **100** is mounted on rack **35** by means of bolts **104**, shown in dotted line in FIG. 2. The rotary member **95** has an integral gear **106** which drives a bevel gear train mounted on the frame **100** in a manner which will be subsequently described.

The bevel gear train includes a first bevel gear **107** formed integrally with a cylindrical gear **106** and rotatably mounted on the pin **61** and engages a second bevel gear **110**, rotatably mounted on a shaft **111** by means of a suitable bearing retainer **112** and bearings **113** and **115**. Shaft **111** is pivotally mounted on pin **61**. The pivotal position of shaft **111** is controlled by rotation of hand wheel **36** and its operatively connected square rod **46** in a manner which will be described. As long as wheel **36** and rod **46** are stationary, the position of the bevel gear **110** remains unchanged and the rate of rotation between gears **58** and **64** remains unchanged. Under these conditions, gears **107** and **106** always makes one revolution for each revolution of the gear **64**. A third bevel gear **114** is mounted on pin **61** and connected in driven relationship to the bevel gear **110**. The bevel gears **107**, **110** and **114** are each provided with a suitable mounting bearing **115**. Bevel gear **110** acts as an idler and makes one revolution for each revolution of the throw block **48** unless the plane of bevel gear **110** is changed. If the plane of bevel gear **110** is changed, it either advances or retracts the rest of the train including the driven eccentric gear **58**. The third bevel gear **114** is formed integrally with the circular gear **60** which meshes with eccentric gear **58**. A first bearing **120** separates bevel gear **114** from rack **35**. Similarly a second bearing **120** separates bevel gear **107** from the frame **100**.

The means for pivotally moving the bevel gear **110** relative to the pin **61** is best seen in FIGS. 2 and 6. As therein depicted, a screw **122** is rotatably mounted in frame **100** by bearings **123**, and **124**, and is operatively connected to square rod **46**. A slide member **125** threadably engages screw **122** and includes an extension or arm **126** which slidably engages a pin **127** in frame **100** to prevent member **125** from rotating. When screw **122** rotates, slide **125** moves upwardly or downwardly, as viewed in FIGS. 2 and 6, depending on the direction of screw rotation. The slide **125** is operatively connected by means of a pin **128**, a link **130** and a pin **131** to an arm **132** secured to shaft **111**. Thus, rotation of handwheel **36** changes the pivotal position of shaft **111** and thereby advances or retards the eccentric gear **58** and eccentric surface **59** to define a fine adjustment of the crank arm of rack **35**.

This fine adjustment of the stroke of rack **35** is achieved through the rotation of eccentric surface **59** relative to the rack **35** which rotation is accomplished through the bevel gear train and Oldham coupling, previously described, and this adjustment is achieved by rotation of the square rod **46**. The details of the operation of the variable stroke adjustment can best be described with reference to FIG. 5 which is a view in elevation, partly in section and partly broken away, taken along the lines **5—5** of FIG. 2 and looking in the direction of the arrows and showing, in full lines, the terminal downward portion of rack **35** and showing in dotted outline various positions of the eccentric surface **59** and the throw block **48**. These positions of the eccentric member **55** correspond to positions which the member **55** will have during the rotation of one cycle of the throw block **48**. Because all of the gears are provided with suitable bearings and because the eccentric member **55** is journalled in suitable bearings, it is possible to quickly and easily pivot the shaft **111** of bevel **110** relative to the pin **61**. When the shaft **111** pivots, bevel gear **110** acts as a lever connecting gears **107** and **114** with a force applied intermediate the level by shaft **111** and with the gear **107** acting as a fulcrum. Thus an upward force on the arm **132** produces a downward force on shaft **111** and gear **114**. This force produces a corresponding rotation in eccentric surface **59** and a proportionate change in the stroke of rack **35**, also termed a stroke arm.

Because the manual adjustment of the handle **36** of FIG. 1 produces a proportional rotation of the square rod **46** and this rotation produces a substantially proportional pivotal movement of the shaft **111** of bevel gear **110** and because the eccentric member **55** constitutes a pair of eccentric circles, the change in stroke will always be a substantially linear function of the angular rotation of the handwheel **36**. Thus, for example, with eccentric surface **59** having an eccentricity of ⅛", the stroke of the rack **35** may be varied over a total micro-adjustment range of ¼". In this particular embodiment, the gear **58** may be rotated through a radial distance of 90° such that the angular range of displacement or change of the stroke of the rack **35** will change ¼". Further, as previously explained, because of the bearing mounting of all the gears in the gear train, it is possible to change the position of the bevel gear **110** while the mechanism is stationary, or it may be changed while the mechanism is in operation feeding strips. Still another advantage of this mechanism is that there is no backlash gearing and everything remains locked so that there is no looseness from one stroke to another.

While we have shown and described one illustrative embodiment of this invention, it is understood that the concepts thereof may be employed in other embodiments without departing from the spirit and scope of this invention.

What we claim is:

1. In a drive stroke adjusting device for varying the stroke of a drive arm, the combination comprising:
- a rotary shaft;
- a throw block secured to said shaft;
- a T-bolt adjustably mounted in said throw block;
- a gear secured to said T-bolt;
- a universal coupling operatively connected to said gear;
- a bevel gear operatively connected to said universal coupling;
- a first shaft rotatably mounting said bevel gear;
- a second shaft pivotally mounted on said first shaft;
- means for pivoting said second shaft;
- a second bevel gear mounted on said second shaft;
- a third bevel gear rotatably mounted on said first shaft, said bevel gears being drivingly connected together;
- an eccentric member rotatably mounted on said T-bolt; and
- gear means operatively connecting said third bevel gear to said eccentric member, said eccentric member being rotatably mounted on said drive arm, whereby rotation of the second shaft changes the position of the eccentric relative to the T-bolt and thus changes the length of the stroke of the drive cam.

2. In a drive stroke adjusting device for controlling a predetermined longitudinal stroke of a drive arm, the combination comprising:
- a crank arm;
- a trunnion mounted on said crank arm;
- an eccentric rotatably mounted on said trunnion;
- a drive gear secured to said trunnion;
- a drive arm rotatably connected to said eccentric;
- a bevel gear train including a shaft mounted on said drive arm, a first bevel gear rotatably mounted on said shaft, a second shaft pivotally mounted on said first shaft, a second bevel gear rotatably mounted on said second shaft, and a third bevel gear rotatably mounted on said first shaft;
- a universal coupling for operatively connecting said drive gear to said bevel gear train;
- gear means operatively connecting said bevel gear train to said eccentric; and
- means for radially positioning said second shaft relative to said first shaft.

3. The combination according to claim **2** wherein said crank arm is a throw block including means coupling said trunnion to said crank arm in sliding relationship to define a coarse adjustment of the drive arm stroke.

4. The combination according to claim **2** wherein said means for pivoting said second shaft relative to said first shaft includes an operable crank, and means slidably and operatively connecting said operable crank to said second shaft.

5. In a drive stroke adjusting device of the character described, the combination comprising:
- a trunnion;
- a bevel gear train;
- a universal coupling, operatively connecting said bevel gear train to said trunnion;
- an eccentric rotatably mounted on said trunnion;
- drive means rotatably mounted on said eccentric;
- gear means operatively connecting said bevel gear train to said eccentric; and
- means for pivoting one gear of said bevel gear train to change the relative position of said eccentric relative to said trunnion.

6. In a drive stroke adjusting device of the character described, the combination comprising:
- a drive shaft;
- a crank arm mounted on said drive shaft;
- a trunnion coupled to said crank arm;
- an eccentric rotatably mounted on said trunnion;
- drive means rotatably mounted on said eccentric;
- a bevel gear train mounted on said drive means;
- gear means operatively connecting said bevel gear train to said eccentric;
- universal coupling means operatively connecting said trunnion to said bevel gear train; and
- means for pivoting one gear of said bevel train to change the position of said eccentric relative to said trunnion.

7. The combination according to claim **6**, wherein said one bevel gear is rotatably mounted on a shaft which shaft is pivotally mounted on said drive means, and wherein said means for moving said one gear comprises an arm coupled to said last pivotally mounted shaft for pivoting said shaft, whereby the degree of said pivoting of said shaft is related substantially linear to the degree of rotation of said eccentric relative to said trunnion.

8. The combination according to claim **5**, wherein said combination includes a drive sleeve mounted on said trunnion and wherein said eccentric is rotatably mounted on said drive sleeve, said eccentric including a pair of eccentric cylindrical surfaces whereby the stroke of the drive means varies substantially linear with the degree of rotation of said eccentric.

9. A drive stroke adjusting device for adjusting the stroke of a drive means comprising:
- a trunnion;
- an eccentric rotatable mounted on said trunnion;
- drive means coupled to said eccentric;
- bevel gear means mounted on said drive means for operatively connecting said trunnion to said eccentric; and
- means for positioning one of said bevel gear means relative to said drive means whereby the stroke of said drive means is modified.

10. The combination according to claim **9** wherein said eccentric comprises a cylindrical member having a cylindrical surface for rotatably coupling said eccentric to said trunnion whereby the changes in the stroke of said drive means vary substantially linear with the degree of rotation of said eccentric.

11. The combination according to claim **10** wherein said means for positioning one of said bevel gear means includes an arm and means for manually adjusting the position of said arm whereby the stroke of said drive means varies substantially linear with changes in the position of said arm.

12. The combination according to claim **11** including a universal coupling operatively connected to said trunnion to be driven thereby and operatively connected in driving relationship to said bevel gear means.

13. In a drive stroke adjusting device for adjusting the longitudinal stroke of a reciprocating drive means, the combination comprising:
- a trunnion;
- an eccentric rotatably mounted on said trunnion;

a drive means operatively connected to said eccentric;
bevel gear means mounted on said drive means and operatively connected to said eccentric;
a coupling means operatively connecting said trunnion to said bevel gear means; and
means for positioning one of said bevel gear means relative to said drive means for varying the stroke of said drive means.

14. The combination according to claim 13 wherein said eccentric comprises a cylindrical member having an eccentric cylindrical passage therethrough whereby the changes in the stroke of said drive means vary substantially linear with the changes in rotation of said eccentric.

15. The combination according to claim 14 wherein said bevel gear means includes a gear shaft pivotally mounted on said drive means, and wherein said means for positioning one of said bevel gear means includes means for adjusting the position of said gear shaft relative to said drive means whereby said eccentric is rotated relative to said trunnion, the degree of eccentric rotation being directly proportional to the amount of gear shaft pivotal movement.

16. A drive stroke adjusting device for adjusting the throw of a drive means comprising;
a main drive shaft;
a throw block secured to said main drive shaft;
a trunnion mounted on said throw block;
a gear secured to said trunnion;
an idler bracket rotatably mounted on said trunnion;
eccentric gear means rotatably mounted on said trunnion and having an eccentric surface depending therefrom;
drive means rotatably mounted on said eccentric surface;
coupling means slidably operatively connected to said drive means to said idler bracket;
an idler gear rotatably mounted on said idler bracket and operatively connected to said first mentioned gear;
a gear rotatably mounted on said drive means;
a coupling means operatively connected between said idler gear and said last mentioned gear;
first bevel gear means including a gear operatively connected to said gear which is rotatably mounted on said drive means;
second bevel gear means including a bevel gear and means pivotally mounting said bevel gear relative to said first bevel gear means;
third bevel gear means operatively connected to said second bevel gear means to said eccentric gear whereby pivotal movement of said second bevel gear means is accompanied by proportionate changes in position of said eccentric surface.

17. A drive stroke adjusting device for adjusting the stroke of a drive means comprising:
a main drive shaft;
a throw block secured to said main drive shaft;
a trunnion mounted on said throw block;
a gear secured to said trunnion;
an idler bracket rotatably mounted on said trunnion;
eccentric gear means rotatably mounted on said trunnion and having an eccentric surface depending therefrom;
drive means rotatably mounted on said eccentric surface;
coupling means slidably coupling said idler bracket to said drive means;
an idler gear rotatably mounted on said idler bracket and meshing with said first mentioned gear;
a gear rotatably mounted on said drive means;
a coupling means coupled between said drive means mounted gear and said idler gear;
a first bevel gear rotatably mounted on said drive means and coupled in driven relationship to said coupling means;
a first shaft rotatably supporting said first bevel gear;
a second shaft pivotally mounted on said first shaft;
a second bevel gear rotatably mounted on said second shaft and meshing with said first bevel gear;
a third bevel gear mounted on said first shaft and meshing with said second bevel gear;
means coupling said third bevel gear to said eccentric gear; and
means coupled to said second shaft for pivoting said second shaft relative to said first shaft whereby the position of said eccentric gear relative to said trunnion is changed.

18. The combination according to claim 17 wherein said means for pivoting said second shaft relative to said first shaft includes a screw rotatably mounted in said drive means, means for rotating said screw, slide means threadably engaging said screw, an arm depending from said second shaft; and, link means coupling said slide means to said arm.

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