United States Patent [19]

Ross

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[54] **BAR FEEDER**

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[73] Assignee: **Mayfran Incorporated,** Village of Mayfield, Ohio

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[52] **U.S. Cl.** **214/1.2,** 214/1.5

[51] **Int. Cl.** **B23q 5/22**

[58] **Field of Search** 226/162, 167; 221/233, 221/234, 235, 268; 214/1.2, 1.5, 1.1, 1.3, 1.4

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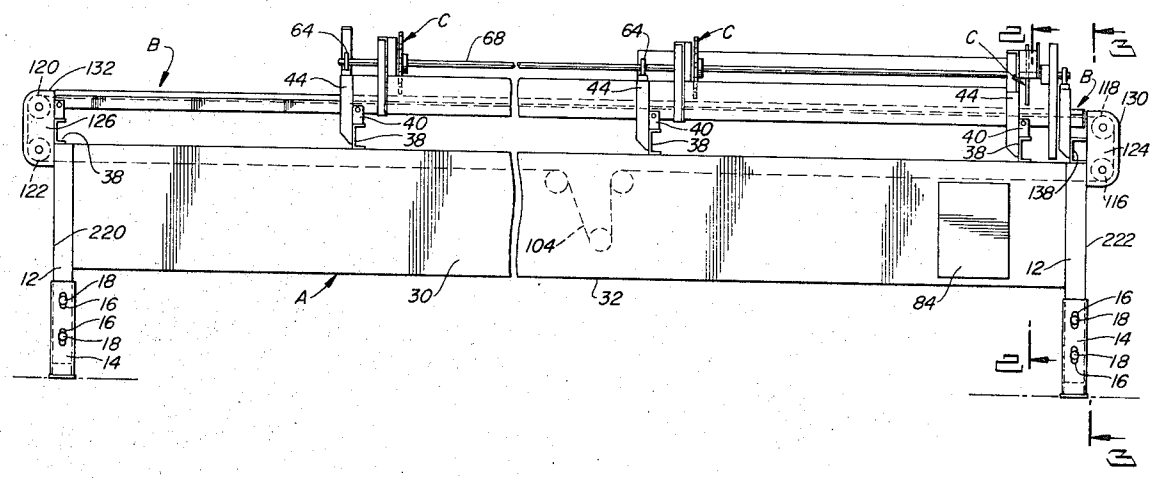
Primary Examiner—Allen N. Knowles

Attorney, Agent, or Firm—Meyer, Tilberry & Body

[57] **ABSTRACT**

A bar feeder includes an elongated rectangular box having an open top. An elongated trough is mounted on the top of the box. A bar push rod is slidably positioned in the trough. Drive means is mounted within the box for moving the push rod along the trough. A feed device feeds elongated cylindrical bars into the trough ahead of the push rod. The push rod forces the bars along the trough into another machine. The drive means is a variable speed, limited torque eddy current clutch.

19 Claims, 14 Drawing Figures



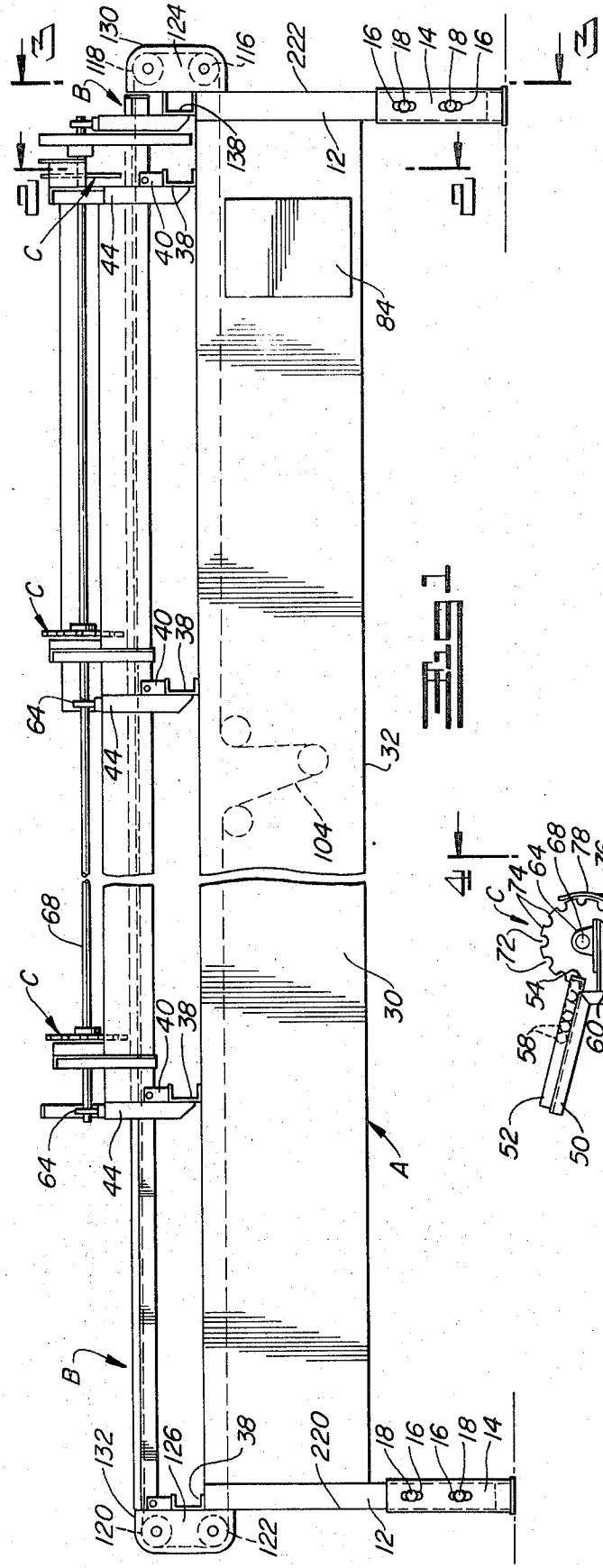


FIG. 1

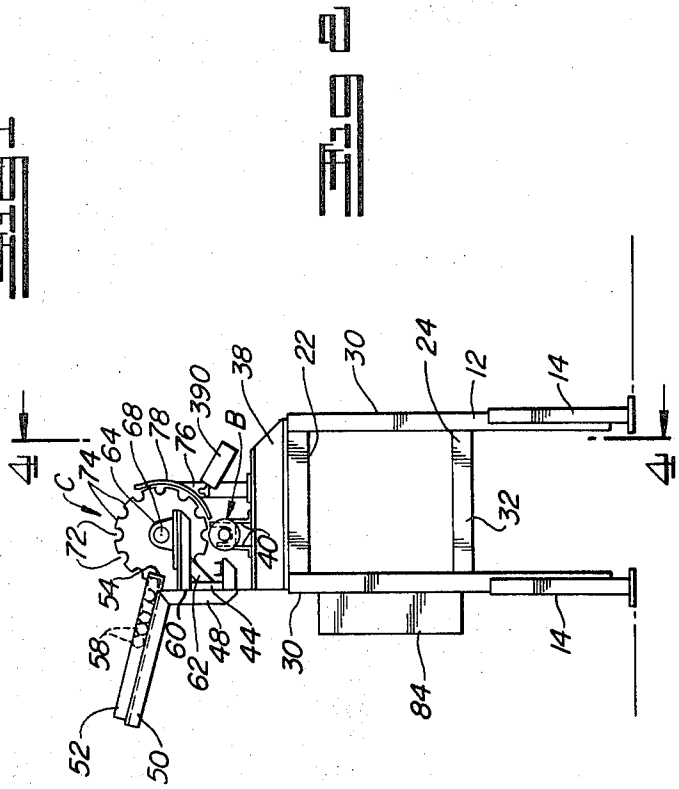


FIG. 2

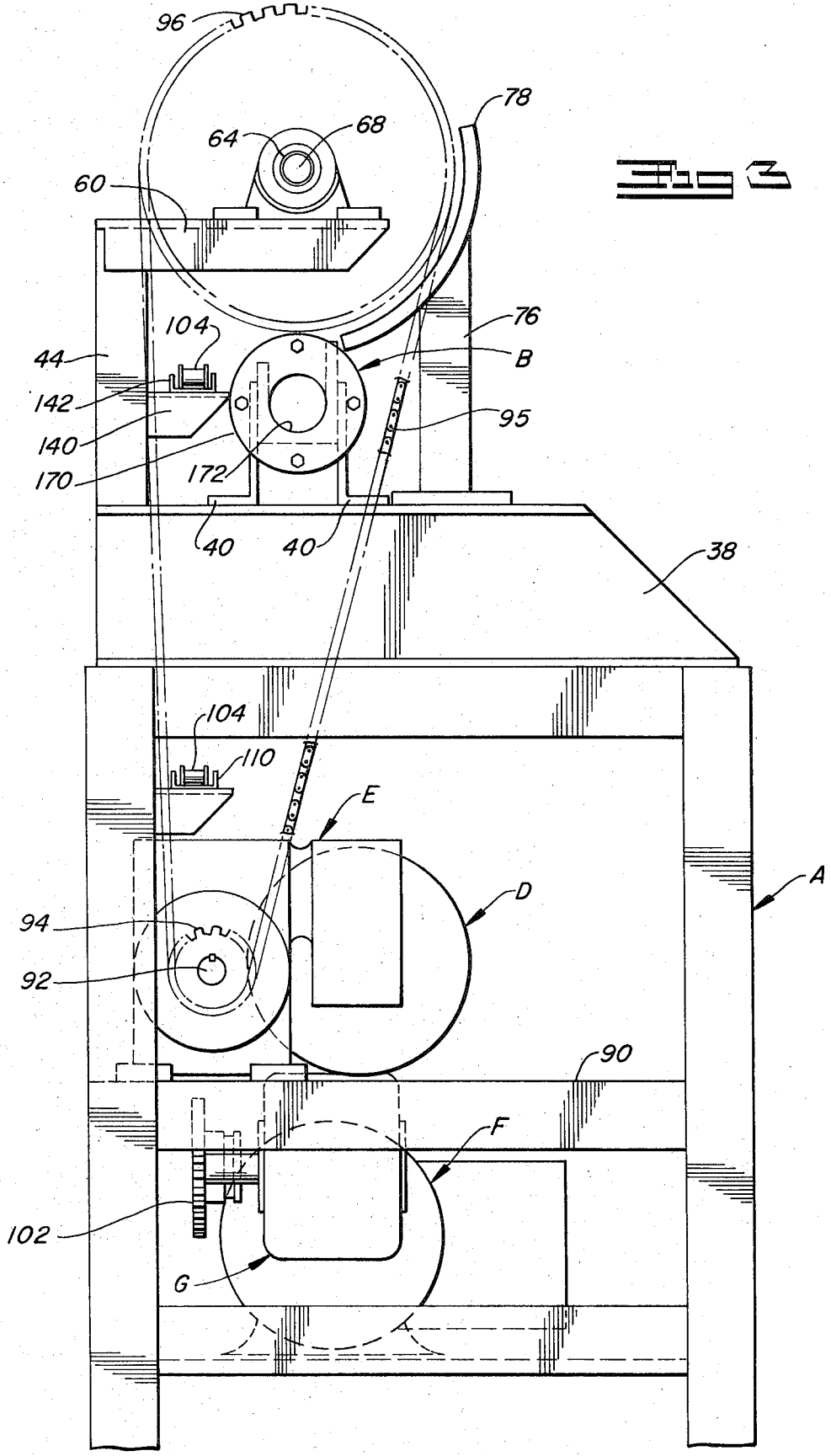

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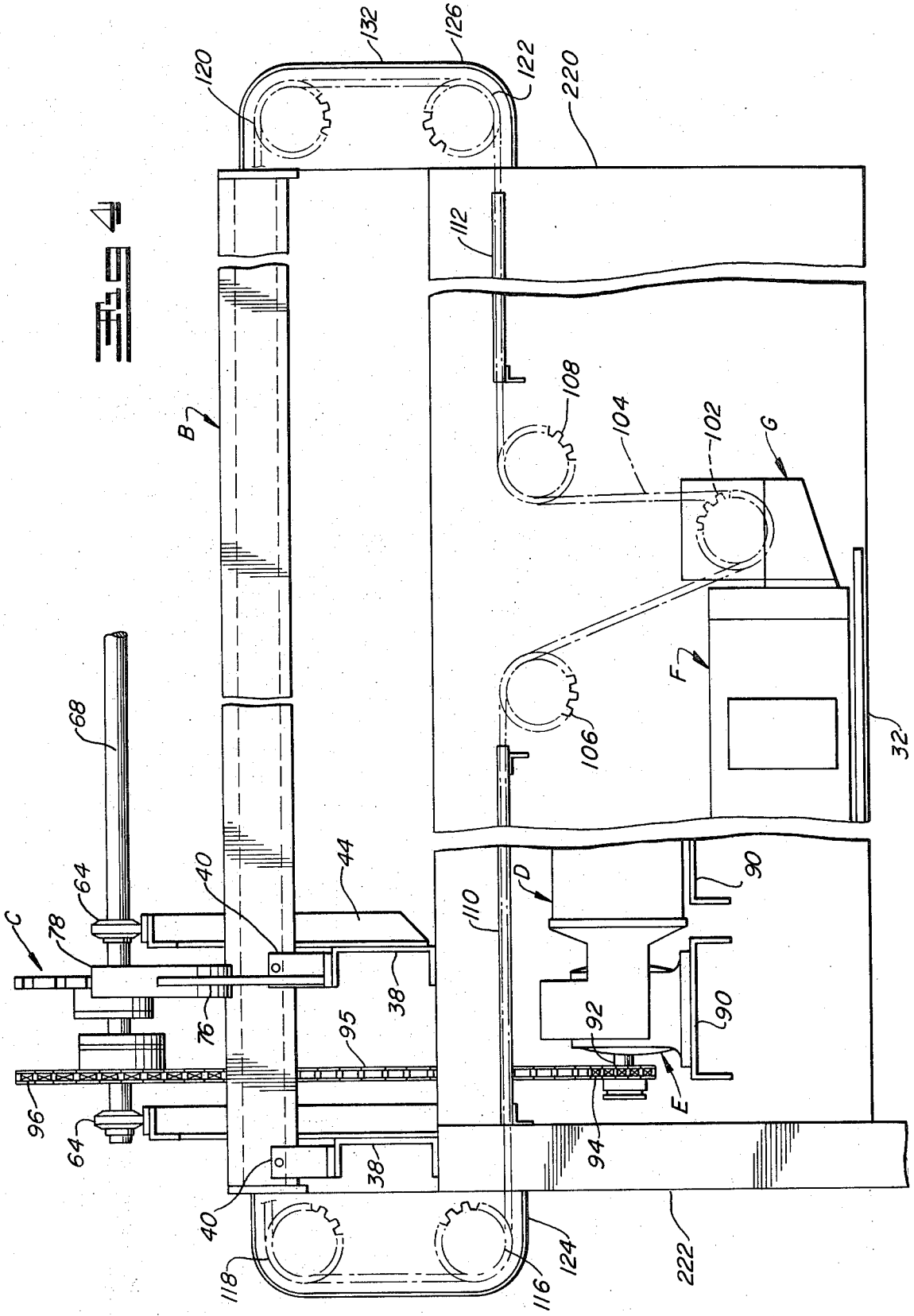
FIG 2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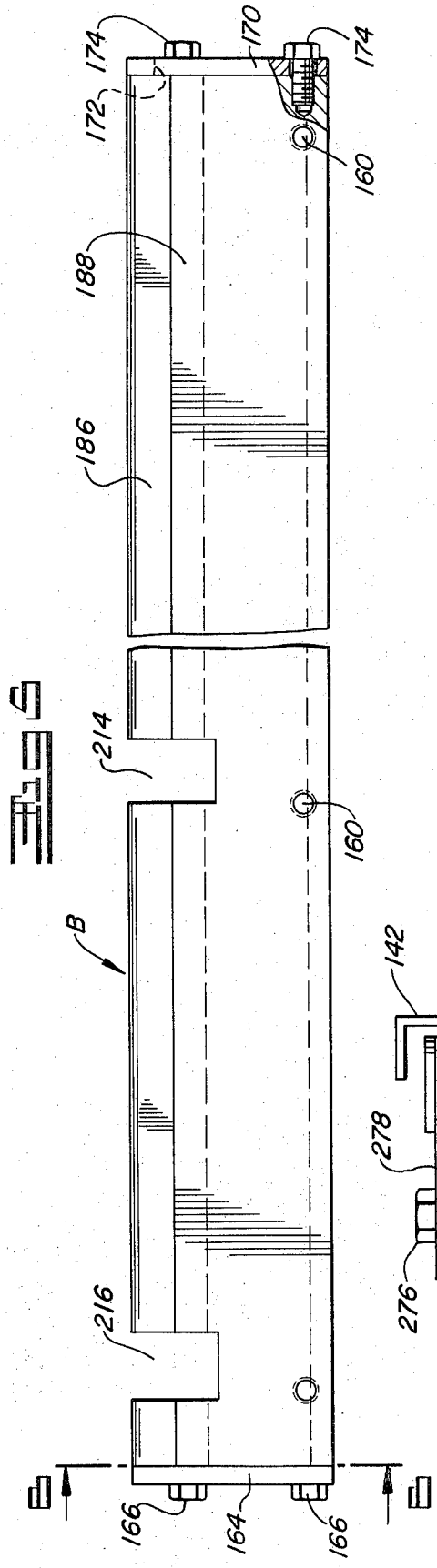

Fig. 5

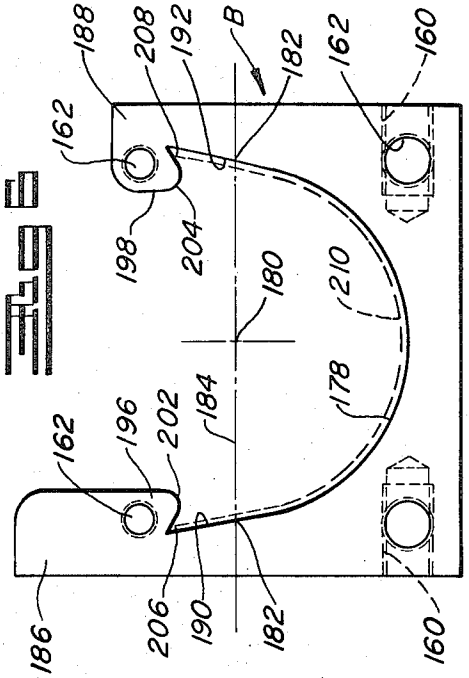

Fig. 6

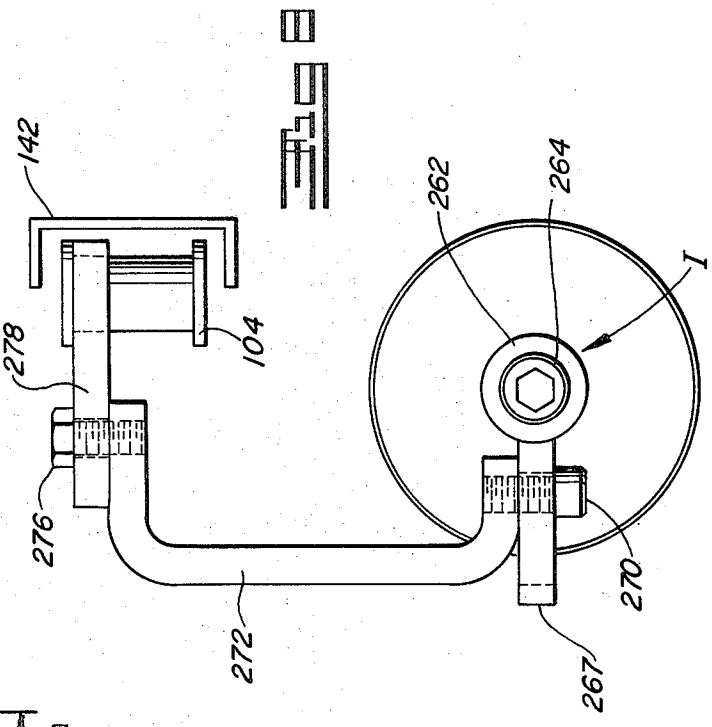

Fig. 8

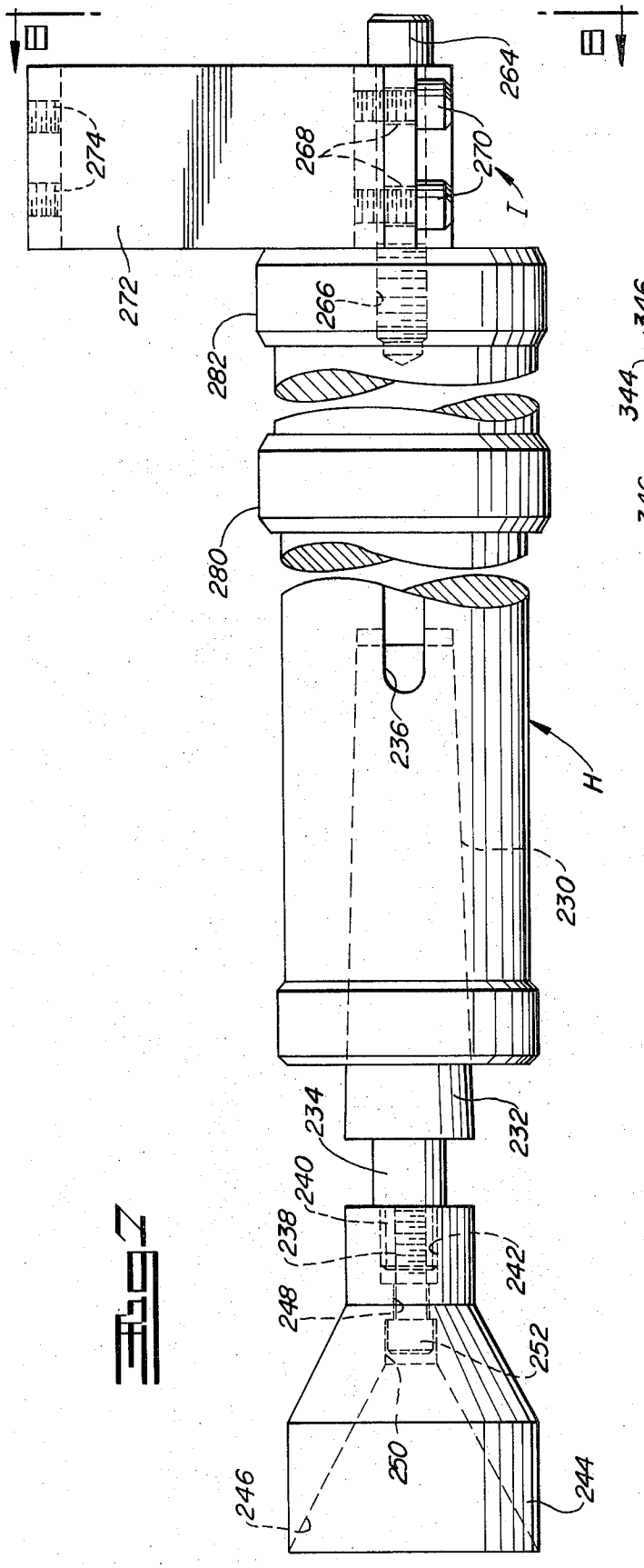
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FIG 7

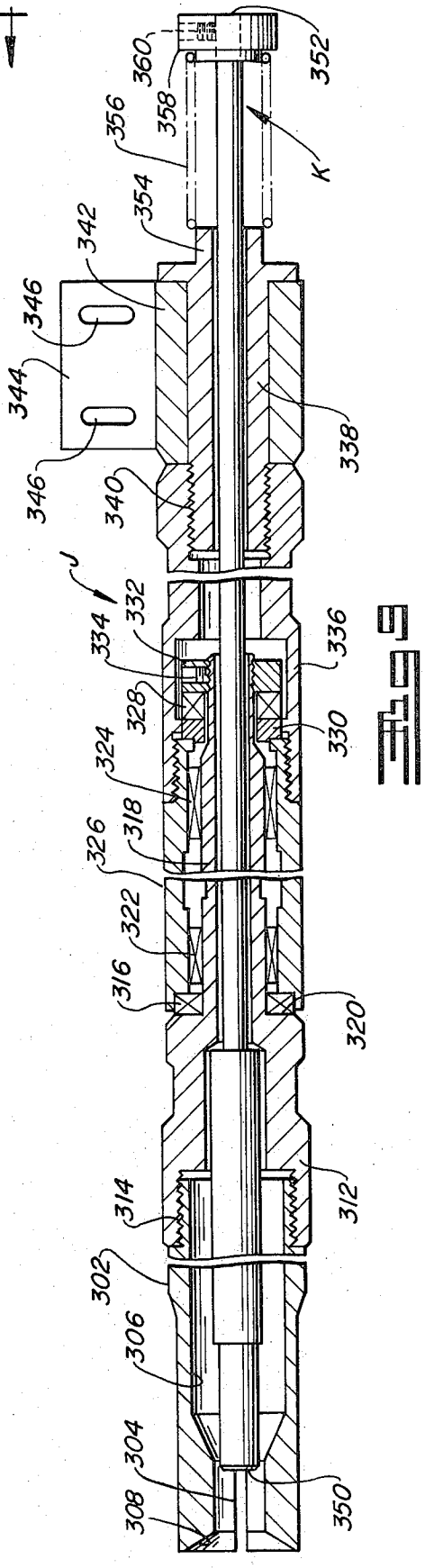
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FIG 8

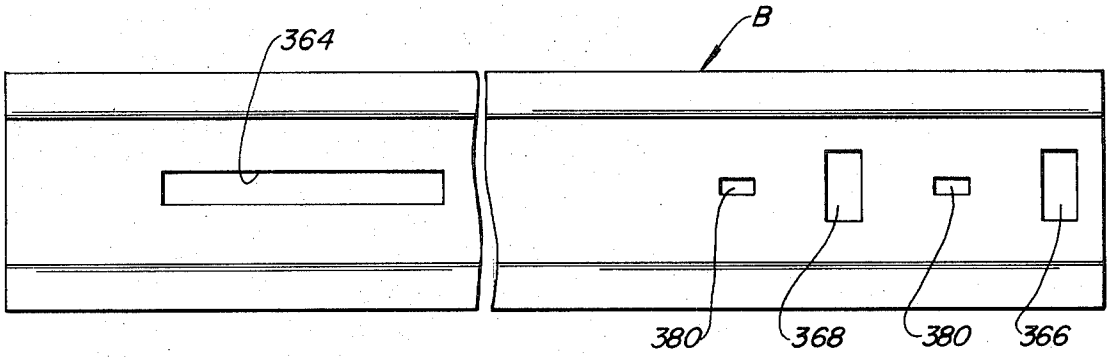


Fig 10

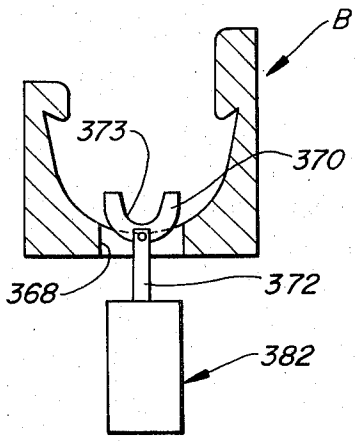


Fig 11

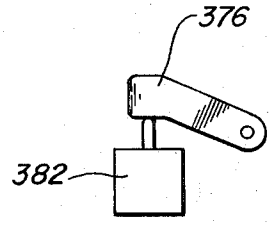


Fig 12

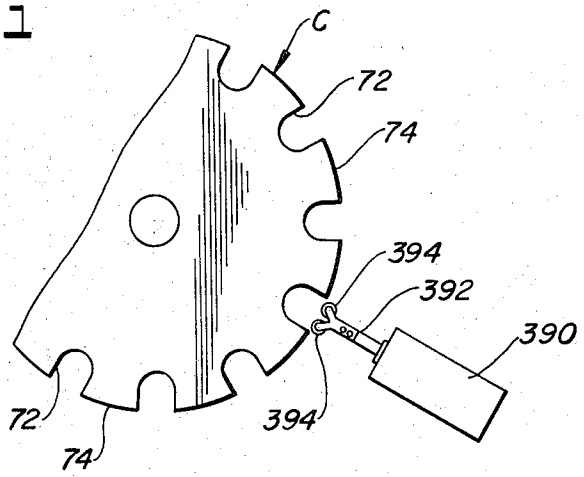
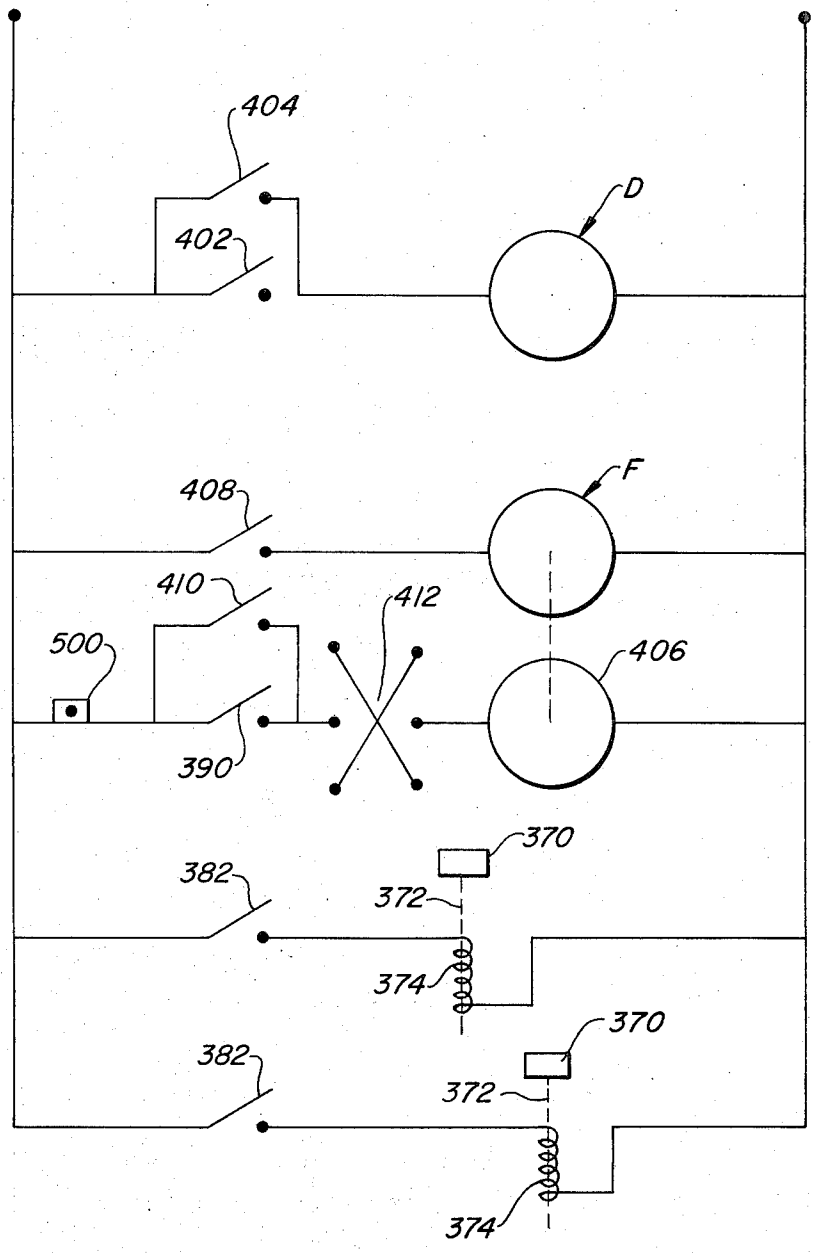


Fig 13

Fig 14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BAR FEEDER

BACKGROUND OF THE INVENTION

This application pertains to the art of feed mechanisms and more particularly to a bar feeder for feeding elongated cylindrical bars into another machine. Although the invention is particularly applicable for feeding elongated cylindrical rods, it will be appreciated that the invention has broader applications and may be used for feeding other workpieces.

There are many known types of apparatus for feeding workpieces into a machine. Reciprocating apparatus of a known type for feeding elongated cylindrical bars to another machine includes a type having a tube with an elongated top opening. A pusher rod is slidably received in the tube with a close fit. Elongated bars are dropped into the tube through the top opening when the pusher rod is in its retracted position. The pusher rod then moves the tube into another machine. In apparatus of this type, it is necessary to insert a liner into the tube when changing from large diameters to small diameters. In changing from small diameters to larger diameters, it is necessary to remove the liner from the tube. In addition, changing of the pusher rod is required when changing from one size of bar to another. This is very time consuming becuase the apparatus must be extensively modified when it is desired to feed bars of substantially different diameters.

the bars apparatus for feeding elongated cylindrical bars also include a variable speed drive for adjusting the speed with which the1bars are fed. Previous apparatus has included complicated drive mechanisms providing limited adjustment of the speed and torque.

Previous apparatus of the type described has not included a remnant or scrap retracting device on the pusher rod for automatically removing scrap lengths from the mechanism.

Extensive changes to the bar feeder in changing from one bar diameter to another results in extensive downtime for the equipment.

SUMMARY

Apparatus for feeding elongated cylindrical bars to a machine comprises a self-contained assembly which may be mounted in position where it will be used.

The bar feeder includes an elongated rectangular box having an open top. An elongated trough having a substantially U-shaped cross-sectional configuration is mounted on the top of the box.

In accordance with one arrangement, an elongated push rod is positioned in the trough for sliding movement therealong. The trough has a length substantially greater than the length of the push rod, and the push rod reciprocates relative to the trough between a rearward retracted position and a forward position.

In the retracted position of the push rod, an elongated bar is deposited in the trough forwardly of the push rod. The push rod then moves toward its forwardmost position and moves the rod out of the trough. The forward end of the rod is grabbed by jaws or a collet on a cut-off machine or the like.

I a preferred arrangement, the drive means for driving the push rod forward includes a limited torque clutch. When the forward end of a bar hits a stop on the cut-off machine or the like, the limited torque clutch simply slips. Once the machine has cut off a predetermined length of the bar and moved it away, a limited torque clutch will again move the push rod forward so that another length of bar may be cut by the machine.

In a preferred arrangement, the drive means for moving the push rod is mounted within the box. Most of the moving parts of the drive mechanism are thereby protected. Also, the danger of workmen or other objects becoming caught in the drive mechanism are minimized.

In the preferred arrangement, the trough member has a U-shaped cross-sectional configuration which includes a curved bottom portion and a pair of spaced-apart upright legs. Each of the legs has a projection thereon extending inwardly and downwardly therefrom. The under surfaces of the projection cooperate with the facing inner surfaces of the legs to define downwardly facing recesses extending along substantially the entire length of the trough. A wear member of plastic or other material may be positioned in the trough with its edges received in the recesses.

The inwardly and downwardly extending projections on the legs also define stops for preventing the push rod from moving upward out of the trough. The terminal ends of the projections lie just outward of a cylindrical portion of the push rod and are spaced-apart a distance less than that cylindrical portion of the push rod. This prevents the push rod from being upwardly displaced from the trough as it moves relative thereto in feeding bars.

In a preferred arrangement, only a short length of the push rod has an enlarged diameter which will not fit upwardly through the projections. In a location aligned with that short length of the push rod in its retracted position, the projections are cut away from the trough over a length at least as greater as that short length of the push rod. Therefore, the push rod may be lifted out of the trough in its retracted position because the enlarged short length of the push rod will fit through the cut-away portion of the trough.

In accordance with another aspect of the device, the push rod includes a pusher end portion having a substantially conical recess therein. When the cut-off machine grabs and spins the rod, the rear end of the rod moves into the center of the conical recess so that it is properly aligned. This pusher end portion of the push rod is preferably rotatable relative to the push rod itself.

In accordance with another aspect of the device, the push rod has an elongated bore therethrough and the terminal end portion includes bar gripping means. An ejector rod is reciprocatingly mounted in the bore. The ejector rod has a length greater than the length of the push rod between the gripping means and its opposite end portion. Biasing means normally bias the ejector rod in a direction away from the gripping means and towards the opposite end portion of the push rod. When the push rod is retracted, the gripping means holds onto the scrap length of bar. When the push rod approaches its retracted position, abutment means on the bar feeder strikes the ejector rod and moves it toward the gripping means to eject the scrap length of bar therefrom. The trough may have an elongated slot forwardly of the gripping means so that the scrap length of bar will simply fall therethrough.

In accordance with still another aspect of the device, a limited torque variable speed eddy current drive

clutch is used for reciprocating the push rod. This makes it possible to approach a bar at slow speed and to then speed up the push rod for feeding the bar to another machine at a desirable speed. This adjustment also makes it possible to vary the torque of the drive coupling so that the force with which the bar is fed to another machine can be varied.

It is a principal object of the present invention to provide a self-contained bar feeder.

It is another object of the present invention to provide a bar feeder which is more economical to manufacture and maintain.

It is an additional object of the present invention to provide a bar feeder which is very reliable in operation.

It is a further object of the present invention to provide a bar feeder having an improved push rod.

It is also an object of the present invention to provide a bar feeder having an improved trough member in which the push rod and bars slide.

It is still another object of the present invention to provide a reciprocating bar feeder with an improved variable speed limited torque drive device.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention may take form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof.

FIG. 1 is a side elevational view showing a bar feeder constructed in accordance with the present invention;

FIG. 2 is an end elevational cross-sectional view looking generally in the direction of arrows 2—2 of FIG. 1;

FIG. 3 is an end elevational cross-sectional view looking generally in the direction of arrows 3—3 of FIG. 1;

FIG. 4 is a side elevational view looking generally in the direction of arrows 4—4 of FIG. 2;

FIG. 5 is a side elevational view of a trough member used in the apparatus of FIGS. 1–4;

FIG. 6 is an end elevational view looking generally in the direction of arrows 6—6 of FIG. 5;

FIG. 7 is a plan view showing a push rod used with the apparatus of FIGS. 1–4;

FIG. 8 is an end elevational view looking generally in the direction of arrows 8—8 of FIG. 7;

FIG. 9 is a cross-sectional view of a push rod used with the apparatus of FIGS. 1–4;

FIG. 10 is a plan view of a trough member;

FIG. 11 is a sectional view of a bar support member;

FIG. 12 is a diagramatic elevational illustration of a switch operating member for the support of FIG. 11;

FIG. 13 is an end elevational view showing a bar feed disc and switch member; and

FIG. 14 is a general circuit diagram showing briefly how a bar operates.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, wherein the showings are for purposes of illustrating a preferred embodiment of the invention only and not for purposes of limiting same, FIG. 1 shows a bar feeder which includes an elongated box-like member A. Box-like member A includes vertical legs 12 positioned at the corners of a rectangle. Legs 12 may have a U-shaped cross-sectional configuration. In other words, leg member 12 may be structural channels. Additional short lengths of channels 14, having an internal size and shape to slidably receive legs 12, are positioned over the bottom end portions of legs 12. Shorter channels 14 have vertical slots 16 through the web portions thereof. The bottom portions of legs 12 have holes therethrough aligned with vertical slots 16. Bolts 18 are receivable through vertical slots 16 and the holes in the bottom portions of legs 12. Nuts applied to the bolts then secure short length channels 14 in adjusted position relative to legs 12. Box member A may be leveled and positioned at a desirable height by means of these adjustable legs. Vertically-spaced upper and lower channel members 22 and 24 are secured to legs 12. Rectangular side panel members 30 and bottom panel member 32 are secured by welding or bolting to the outer surfaces of legs 12 and lower braces 24. The opposite end portions of box member A may be left open or may be closed by end panel members.

With the arrangment described, box member A has an open top portion. A plurality of longitudinally spaced-apart bracing and supporting channel members 38 extend completely across the open top of box member A and are welded to the upper edges of side panels 30. L-shaped bracket members 40 are welded or bolted to the horizontally extending upper flanges of support channels 38 in spaced-apart relationship. L-shaped brackets 40 support an elongated trough member B which extends the complete length of box member A.

Vertical channel members 44 are welded to the vertical outer surfaces of the webs on support channels 38. Additional channel members 48, which include upwardly and outwardly inclined portions 50, are welded to vertical members 44. Upwardly and outwardly inclined portions 50 have guide members 52 welded thereto. Guide members 52 include lower stops 54. A plurality of elongated cylindrical bars 58 are positionable on guides 52 and rest against stops 54.

Horizontally extending channel members 60 are welded to vertical members 44. Diagonal braces 62 may also be welded between vertical members 44 and horizontally extending members 60. Bearing members 64 are mounted on the upper surfaces of horizontal members 60 for rotatably receiving an elongated shaft 68. Shaft 68 has a plurality of longitudinally spaced bar feed disc members C secured thereto. Bar feed discs C have a plurality of circumferentially spaced bar receiving recesses 72 therein. Each bar feed disc C includes solid peripheral portions 74 between recesses 72. Bar feed discs C are mounted so that solid peripheral portions 74 extend inwardly of bar stops 54 on guides 52. Bar feed discs C are also mounted so that the lowermost bar 58 resting against stops 54 is above the centerline of discs C so that a bar 58 will be grabbed in recesses 72 as discs C rotate.

Vertical support members 76 are also bolted or welded to the upper horizontal legs of support channels 38. Vertical support members 76 have arcuate guide members 78 secured thereto and spaced longitudinally a slight distance from discs C. Arcuate guides 78 extend up above the centerline of discs C and terminate at their lower ends directly above the open top portion

of trough B. As bar feed discs C rotate, a bar **58** will be received in each successive slot **72.** The bars are held within recesses **72** as discs C rotate in a clockwise direction as shown in FIG. **2.** Guides **78** prevent bars **58** from falling out of recesses **72** until a lowermost recess is directly above the open top portion of trough B. Vertical supports **76** and arcuate guides **78** are in longitudinally spaced relationship and spaced slightly from bearings **64.** A control panel **84** may be suitably mounted to the outside of one side panel **30** on box member A.

Box member A has a plurality of horizontal support channels as at **90** therein. Channel members **90** mount an electric motor D which is drivingly connected through a speed reducer E having an output shaft **92** on which a sprocket **94** is keyed. A drive chain **95** extends around sprocket **94** and upwardly around a drive sprocket **96** keyed to shaft **68** on which bar feed discs C are mounted.

A combined electric drive motor and limited torque eddy current clutch unit F is mounted to bottom wall **32** of box member A, and has its outer shaft connected with a speed reducer G which drives a sprocket **102.** A chain **104** extends around drive sprocket **102** on speed reducer G. Idler sprockets **106** and **108** are mounted within box member A and chain **104** extends therearound. At least one of sprockets **106** or **108** may be adjustable for adjusting the tension in chain **104.** Horizontal guide channels **110** and **112** are suitably mounted within the upper portion of box member A and chain **104** extends through these channels. Idler sprockets **116, 118, 120** and **122** are mounted on suitable supports **124** and **126** at the upper opposite end portions of box member A. Cover members **130** and **132** may be positioned over these end idler sprockets.

Horizontal guide supports **140** are welded to vertical supports **44** and extend inwardly therefrom. Horizontal guide supports **140** have an elongated channel member **142** welded to the upper surface thereof adjacent trough B. Channels **142** open upwardly for receiving chain **104.** Upper and outer idler sprockets **118** and **120** are positioned so that chain **104** is guided directly into guide channel **142.**

Elongated trough member B may be an aluminum extrusion having a substantially U-shaped cross-sectional configuration. As shown in FIGS. **5** and **6,** trough member B has a plurality of spaced-apart holes **160** in the opposite lower outer surfaces thereof for receiving bolts which extend through suitable holes in L-shaped brackets **40** to secure trough B above box member A. Suitable holes as at **162** are provided in the opposite end portions of trough member B. A solid plate **164** is secured to the rear end of trough member B as by bolts **166** threaded into threaded bores **162.** A plate member **170** having a circular hole **172** therethrough is secured to the front end of trough member B as by bolts **174** threaded into threaded bores **162.** Trough member B includes a curved bottom surface portion **178** which lies on the periphery of a circle having a center as at **180.** This bottom portion terminates as at **182** on a horizontal line **184** passing through center **180** of the circle on which bottom surface **178** lies.

Trough member B includes spaced-apart upright leg portions **186** and **188.** Legs **186** and **188** have inner facing surfaces **190** and **192** which slope upward at around 10° from vertical lines extended through points **182.** Each upright leg **186** and **188** has an inwardly and downwardly extending longitudinal projection **196** and **198** thereon. Projections **196** and **198** have inwardly and downwardly facing terminal ends **202** and **204.** The under surfaces of projections **196** and **198** cooperate with facing inner surfaces **190** and **192** of legs **186** and **188** to define downwardly facing elongated recesses **206** and **208.** An elongated flexible wear member of plastic or other suitable material as shown by dotted line **210** may be positioned within trough B and deformed so that its longitudinal edges extend into downwardly facing recesses **206** and **208.** It will be recognized that wear member **210** may be inserted into trough **8,** with an end plate as at **170** removed, by shoving on wear member **210** longitudinally of trough B. This will make wear member **210** a very tight fit within trough member B. Wear member **210** may be removed for replacement at desirable intervals. Upright legs **186** and **188** are cut away to omit short lengths of projections **196** and **198** as shown at **214** and **216** in FIG. **5.**

Box member A may be considered as having a tail end **220** and a forward end **222.** A substantially cylindrical push rod H is slidably positioned within trough B. Push rod H has a length so as to extend from tail end **220** of box member A up to around first bearing **64** when moving from left to right in FIG. **1.** In its retracted position, push rod H is to the left in FIG. **1.** Push rod H is movable from left to right relative to trough B in FIG. **1** for feeding elongated cylindrical bars to another machine.

The forward end of push rod H has a centrally located conical recess **230** therein wedgingly receiving a bell head member **232** in which a shaft **234** is rotatably journaled. A slot **236** may be provided to intersect conical recess **230** for dislodging bell head **232** therefrom. Rotatable shaft **234** has a threaded bore **238** therein and a reduced diameter portion **240** received in a cylindrical recess **242** of pusher end portion **244** on push rod H. Pusher end portion **244** has an outwardly opening conical recess **246** therein. Pusher end portion **244** includes a hole **248** extending therethrough and intersecting bore **242.** Pusher end portion **244** also includes an enlarged bore portion **250** aligned with hole **248.** A socket head cap screw **252** is positioned through hole **248** and threads into threaded bore **238** in rotatable shaft portion **234.**

The opposite or rear end portion of push rod H has a threaded bore **266** therein. A bracket member I including a cylindrical portion **262** receives a socket head cap screw **264** which threads into threaded bore **266.** Bracket member I includes an elongated plate **267** welded to cylindrical portion **262** and having longitudinally spaced vertical slots **268** therethrough. Socket head cap screws **270** extend through slots **268** and thread into threaded holes in a U-shaped bracket member **272.** Bracket member **272** has threaded holes **274** therein for receiving bolts **276** which extend through suitable slots in a dog member **278** which is attached to chain **104** and extends upwardly from guide channel **142.**

Push rod H has longitudinally spaced enlarged diameter portions **280** and **282** thereon. Terminal ends **202** and **204** on projections **196** and **198** are spaced-apart a distance less than the diameter of enlarged portions **280** and **282,** and are spaced above the lowermost portion of bottom surface **178** on trough B a distance

greater than the radius of enlarged diameter portions **280** and **282.** With push rod H positioned within trough B, terminal ends **202** and **204** on projections **196** and **198** lie just outward of the outer peripheral surface of enlarged diameter portions **280** and **282.** This allows push rod H to freely reciprocate within trough member B without allowing vertical displacement thereof while it is operating. The remaining portions of push rod H have a diameter less than the horizontal spacing between terminal ends **202** and **204** on projections **196** and **198.** Cut-away portions **214** and **216** on trough member B are located toward tail end **220** of box member A and are aligned with enlarged diameter portions **280** and **282** when push rod H is in its retracted position. Therefore, push rod H can be lifted vertically out of trough member B because cut-away portions **214** and **216** provide clearance for enlarged diameter portions **280** and **282.**

As push rod H advances an elongated bar into the collet of a cut-off machine, the collet grabs the bar and spins it. The rod then spins up into outwardly opening conical portion **246** on pusher end portion **244** so that it is centered. Pusher end portion **244** is easily replaced to provide a different size conical portion when it is desired to feed different sizes of bars.

In accordance with another arrangement, a gripping push rod member J is shown in FIG. **9.** Push rod member J includes a forward member **302** having a plurality of circumferentially spaced longitudinal slits **304** therein to hollow interior **306** thereof. The forward end portion of part **302** is also provided with a conical recess **308.** Longitudinal slits **304** provide a plurality of circumferentially spaced resilient fingers on part **302.** Part **302** is threaded into another part **312** as at **314.** A bearing **316** is received over elongated portion **318** of part **312** and bears against shoulder **320** thereon. Additional bearings **322** and **324** are also positioned in spaced-apart relationship over elongated shank portion **318.** Another tubular part **326** is then positioned over shank portion **318.** Another bearing **328** is then positioned over shank portion **318** and bears against a shoulder **330** on part **326.** A stop member **332** is then positioned over shank portion **318** against bearing **328** and secured thereto as by a set screw **334.** This assembly is then secured to another part **336** by threading part **326** thereto. Another cylindrical part **338** is threaded into part **336** as at **340.** Part **338** receives a sleeve member **342** having a plate member **344** welded thereto and having vertical slots **346.** Sleeve **342** and plate **344** are for connecting rod J to a drive member on a chain and serve the same purpose as sleeve **262** and plate **267** of FIG. **8.**

All of the joined parts of push rod J are hollow so that a hollow bore therethrough is provided for reciprocatingly receiving an ejector rod K. Ejector rod K has a forward end **350** and rear end **352.** The length of ejector rod K is greater than the distance between the forward pusher end on part **302** of push rod J and opposite rear end **354** of push rod J. A coil spring **356** is positioned around ejector rod K and bears against part **338** at opposite end portion **354.** The other end of spring **356** bears against a stop member **358** positioned over rear end **352** of ejector rod K and secured thereto as by a socket head set screw **360.** Spring **356** defines a biasing means for normally biasing ejector rod K away from the pusher and gripping end portion of push rod J. When push rod J pushes against a bar, the hole in the forward pusher end thereof is just slightly smaller than the diameter of the bars. Therefore, the bar will be grabbed by the gripping fingers during retracting movement of push rod J. As push rod J approaches its fully retracted position, stop member **358** strikes against rear plate **164** which defines an abutment means on trough B. Ejector rod K is then shifted longitudinally toward the pusher end portion of rod J to eject the scrap length of a bar therefrom.

When push rod J is in its fully retracted position, trough member B may have an elongated slot extending beneath the pusher end thereof and along a substantial length of trough B. Such an elongated slot is shown at **364** in FIG. **10.** A scrap length of bar ejected from push rod J will simply fall through slot **364.** Inclined guide members may be mounted beneath trough B under slot **364** to guide such scrap lengths into a scrap bin.

The forward portion of trough B may also have longitudinally spaced lateral openings as at **366** and **368** therein. U-shaped cradle members **370** of FIG. **11** extend upward through lateral openings **366** and **368.** Support members **370** are secured to rods **372** connected with solenoids **374.** Supports **370** have arcuate inner surfaces **373** extending above the lower surface of trough member B. For small diameter bar stock, the bar tends to deform as it is rotated by the cut-off machine. Support members **370** would support such small diameter bar stock at spaced locations along its length and prevent whipping thereof during rotation. As the pusher end of the push rod approaches support **370,** it could strike cammed switch actuating members **376** extending upwardly into trough B ahead of supports **370** through openings **380.** Switch actuating members **376** could be spring biased upwardly through holes **380.** Downward movement of switch actuating members **376** would operate switches as at **382** to energize solenoids **374** for pulling supports **370** downward until their inner surfaces **373** were below the lower surface of trough B. Rods **372** of solenoids **374** would normally be spring biased upward so that they would again move upward into position as the push rod moved rearward and switch actuating members **376** moved upward to de-energize switches **382.** A switch member **390** may be mounted adjacent a bar feed disc C as shown in FIG. **13.** Switch member **390** has a Y-shaped member **392** attached to its operating member. Y-shaped member **392** has spaced-apart rollers **394** thereon having their outermost dimension slightly less than the width of a recess **72.** Switch **390** is adapted to be closed when rollers **394** are positioned within a recess **72** and is adapted to be open when rollers **394** are riding against a solid outer peripheral portion **74** of bar feed disc C.

FIG. **14** shows generally how the bar feed device may operate. When push rod H or J reaches its rearmost retracted position, it may strike a switch **402.** In the alternative, a switch operating member may be mounted on chain **104** to operate switch **402** with the push rod in its retracted position. This will close switch **402** to operate drive motor D for the bar feed device. Discs C will then rotate to grab another bar and to deposit a bar within trough B.

A manual bypass switch **404** may be provided for overiding switch **402** to operate bar feed motor D if so desired. Once bar feed drive motor D begins to drive feed discs C, rollers **394** on switch **390** will ride up on solid peripheral portion **74** of disc C to open normally

closed switch **390.** This will de-energize limited torque eddy current clutch **406** which is driven by motor unit F. Motor unit F may have a main on-off switch **408.** A manual bypass switch **410** may also be provided around switch **390.** With switch **390** open, eddy current clutch **406** is not energized so that chain **104** will not be driven and push rod H or J will not move from its retracted position. Once discs C have indexed an increment equal to the spacing between two adjacent recesses **72,** a bar **58** will be deposited in trough B and rollers **394** will fall back into a recess **72** to close switch **390.** This will energize eddy current clutch **406** so that chain **104** will be driven to begin sliding push rod H or J forwardly from its retracted position against tail end **220** of box **30** toward forward end portion **222** thereof. The forward end of the bar will hit a stop on the cut-off machine and limited torque eddy current clutch **406** will simply slip while motor unit F continues to operate. The collet or gripping jaws on the machine will then grab the bar and rotate it. The tail end of the bar will move up to be centered in the conical recess in the pusher end portion of the pusher rod. The machine will cut off a length of bar and move it to another station. This will free the remaining length of bar and the push rod to move another length of bar into the machine. This operation is repeated until only a scrap length of the bar remains. When auxiliary supports **370** are used, the push rod will successively close switches **382** as shown in FIG. **14** to energize solenoids **374** and pull supports **370** below the surface of trough B so that they will not be struck by the pusher end portion of the push rod. When the push rod reaches its forwardmost position, a properly positioned switch operating arm on chain **104** may operate a reversing switch **412** connected in circuit with eddy current clutch **406.** This will reverse the driving direction of eddy current clutch **406** so that chain **104** will be driven in a reverse direction for retracting the push rod to its rearmost retracted position. Substantially upon reaching its rearmost retracted position, another switch operating member properly located on chain **104** will again trip reversing switch **412** so that eddy current clutch **406** is again in condition for driving the push rod forward. Substantially simultaneously with this operation of reversing switch **412,** switch **402** will close to energize bar feed drive motor D which then almost simultaneously opens switch **390** to de-energize eddy current clutch **406.** The described operation is simply repeated automatically as the bars are fed into the machine.

In accordance with another aspect of the invention, variable speed limited torque eddy current drive clutch F provides an arrangement whereby the speed with which elongated bars are fed to another machine may be varied between zero and maximum. In addition, it is possible to have the push rod approach a bar at slow speed and to then gain speed once the bar is engaged with the push rod. In one arrangement, drive unit F is a unit known as an Adjust-O-Speed Drive unit as available from Eaton Corporation, Dynamatic Division in Kenosha, Wisconsin, and identified by model number 2543. A variable speed control **500** in FIG. **14** varies the voltage supplied to the eddy current clutch for adjusting its speed and driving torque.

Although the invention has been shown and described with respect to certain preferred arrangements, it will be appreciated that equivalent alterations and modifications will occur to others skilled in the art upon the reading and understanding of this specification. The present invention includes all such equivalent alternations and modifications and is limited only by the scope of the claims.

Having thus described my invention, I claim:

1. A reciprocating bar feeder including an elongated bar receiving trough member, an elongated bar push rod slidably positioned in said trough member for movement therealong, drive means for driving said push rod along said trough, and feed means for feeding elongated bars into said trough, said trough member having a substantially U-shaped cross-sectional configuration including a curved bottom portion having a bottommost portion and spaced-apart upright leg portions, said legs having spaced-apart facing inner surfaces, at least one of said leg portions having projection means having a downwardly facing inner end portion spaced above said bottommost portion a vertical distance and spaced from said inner surface of the other of said leg portions a horizontal distance, at least a portion of said push rod having a diameter greater than said horizontal and vertical distances and a radius less than said vertical distance.

2. The device of claim **1** wherein said push rod includes a pusher end portion and a longitudinal axis, and a substantially conical recess in said pusher end portion substantially symmetrical about said axis.

3. The device of claim **2** wherein said pusher end portion is rotatable relative to said push rod.

4. The device of claim **3** wherein said pusher end portion includes bar gripping means and further including a bore through said push rod and terminal end portion, an elongated ejector rod reciprocatingly mounted in said bore, said push rod having an opposite end portion, biasing means for normally biasing said ejector rod outwardly of said opposite end portion, and abutment means on said feeder for moving said ejector rod relative to said push rod into said bar gripping means against force of said biasing means.

5. The device of claim **1** wherein said pusher rod includes a pusher end portion having bar gripping means thereon, said pusher rod having a centrally located bore therethrough and an opposite end portion, an elongated ejector rod reciprocatingly received in said bore and having a length greater than the distance between said opposite end portion and said gripping means of said push rod, biasing means for biasing said ejector rod away from said gripping means toward said opposite end portion of said push rod, said push rod being movable between forward and retracted positions relative to said trough, and abutment means on said feeder for moving said ejector rod toward said gripping means in said retracted position of said push rod.

6. The device of claim **5** wherein said trough member includes a bottom portion, and an elongated slot in said bottom portion forward of said gripping means when said push rod is in said retracted position, whereby scrap lengths of rod ejected from said gripping means may fall through said slot.

7. The device of claim **1** and including an elongated upwardly opening box member, having a top, said trough member being mounted on said top of said box member, and said drive means being mounted within said box member.

8. The device of claim **1** wherein said box member includes vertically adjustable supporting legs.

9. The device of claim 7 wherein said drive means includes an elongated drive chain extending within said box member and along said trough member, and connecting means for connecting said push rod to said drive chain.

10. The device of claim 9 and further including elongated chain guide means adjacent said trough member.

11. The device of claim 1 wherein said drive means comprises a variable speed limited torque eddy current clutch unit.

12. The device of claim 1 and further including retractable bar supports extending upwardly into said trough member.

13. The device of claim 12 and further including retracting means operated by said push rod during forward movement of said push rod as said push rod approaches said bar supports for retracting said bar supports.

14. A reciprocating bar feeder including an elongated bar receiving trough member, an elongated bar push rod slidably positioned in said trough member for movement therealong, drive means for driving said push rod along said trough, and feed means for feeding elongated bars into said trough, said trough having a substantially U-shaped cross-sectional configuration including a curved bottom portion and spaced-apart upright leg portions, said leg portions including facing inner surfaces, projection means on said inner surfaces above said curved bottom portion, said projection means extending downwardly and inwardly from said inner surfaces to define downwardly facing recess means on each of said leg portions, said projection means on said inner surfaces having spaced-apart terminal ends spaced above said curved bottom portion, said push rod having an outer surface, said terminal ends lying outwardly of said outer surface, at least a portion of said outer surface of said push rod having a diameter greater than the distance between said terminal ends of said projection means.

15. The device of claim 14 wherein a short length of said push rod has a diameter greater than the distance between said terminal ends.

16. The device of claim 15 wherein said push rod reciprocates in said trough member between a retracted position and a forward position, said projection means being cut away from said trough member over a length at least as greater as the length of said short length of said push rod and in a position aligned with said short length of said push rod when said push rod is in said retracted position, whereby said push rod can be lifted from said trough in said retracted position thereof.

17. The device of claim 16 wherein said push rod includes a pusher end portion and a longitudinal axis, and a substantially conical recess in said pusher end portion substantially symmetrical about said axis.

18. The device of claim 15 wherein said pusher end portion is rotatable relative to said push rod.

19. The device of claim 18 wherein said pusher end portion includes bar gripping means and further including a bore through said push rod and terminal end portion, an elongated ejector rod reciprocatingly mounted in said bore, said push rod having an opposite end portion, biasing means for normally biasing said ejector rod outwardly of said opposite end portion, and abutment means on said feeder for moving said ejector rod relative to said push rod into said bar gripping means against force of said biasing means.

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