

[54] **SWITCHING MECHANISM FOR CROPPING AND SAMPLING FRONT AND BACK ENDS OF BAR PRODUCT DELIVERED FROM MILL**

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[73] Assignee: **Morgan Construction Company**, Worcester, Mass.

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[51] Int. Cl. **B23d 25/08, B23d 31/00**

[58] Field of Search **83/106, 105, 288, 303, 83/306, 307**

[56]

References Cited

UNITED STATES PATENTS

3,109,340 11/1963 Kinnicutt et al. 83/105
3,258,951 7/1966 Kinnicutt et al. 83/105 X

Primary Examiner—J. M. Meister

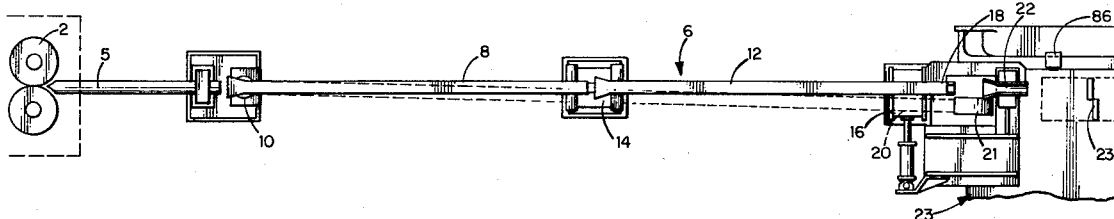
Attorney, Agent, or Firm—Thompson, Birch, Gauthier & Samuels

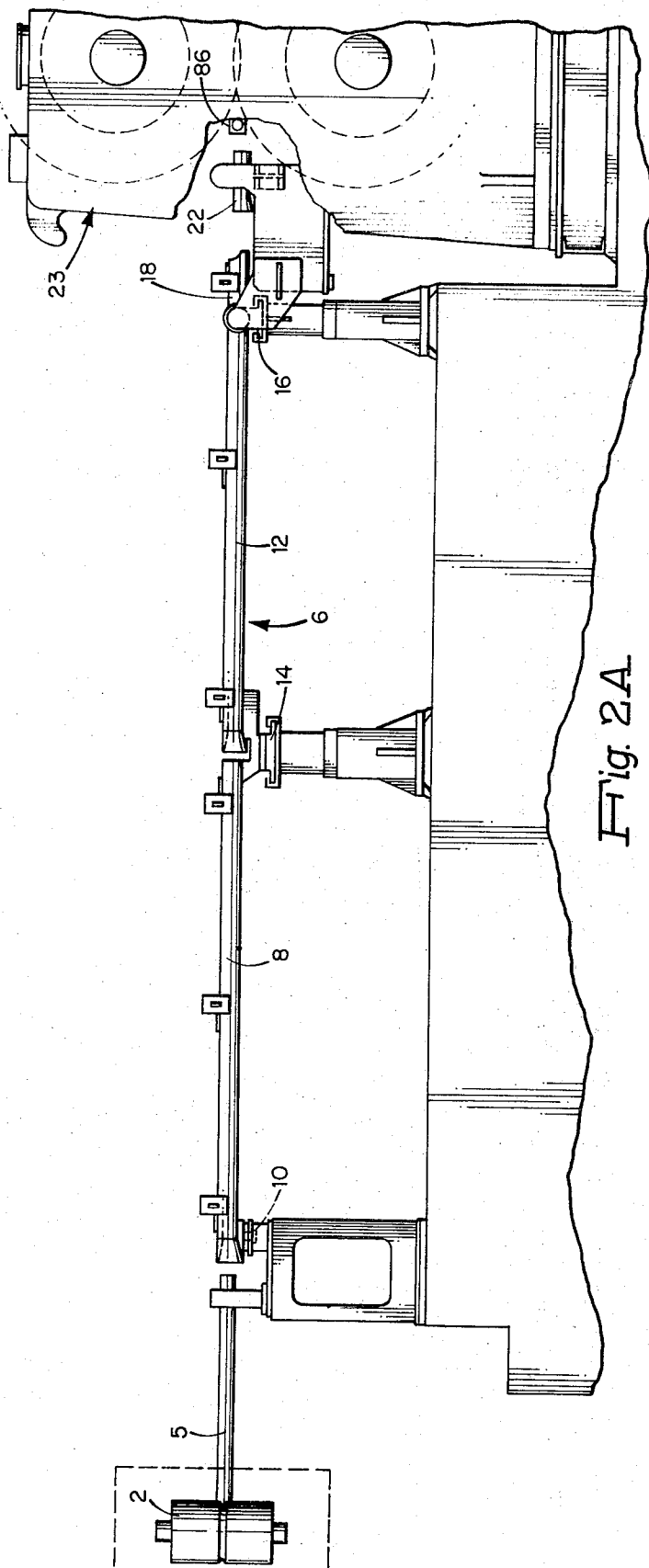
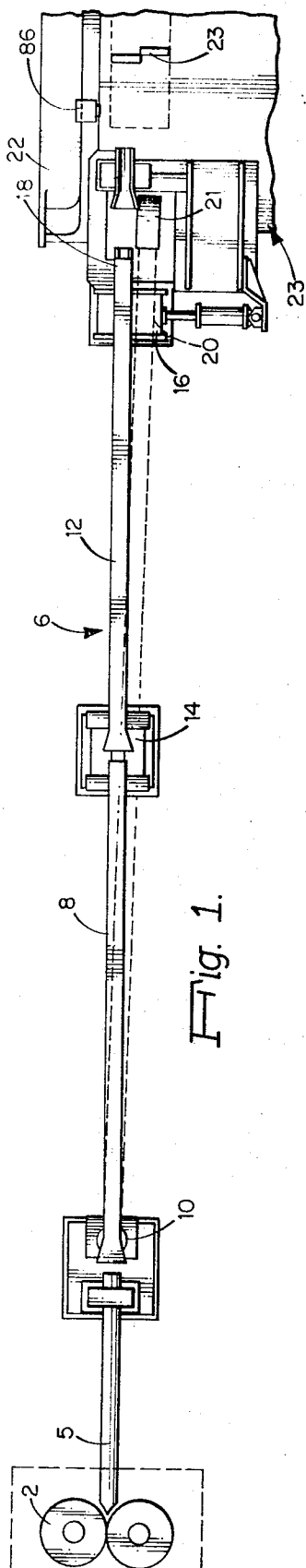
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ABSTRACT

On a rod mill, means for cropping the front and rear ends of the rod and delivering the cropped pieces directly from the shear to a crop box, and including means for dividing the rod, if desired, to produce suitable size coils.

14 Claims, 14 Drawing Figures





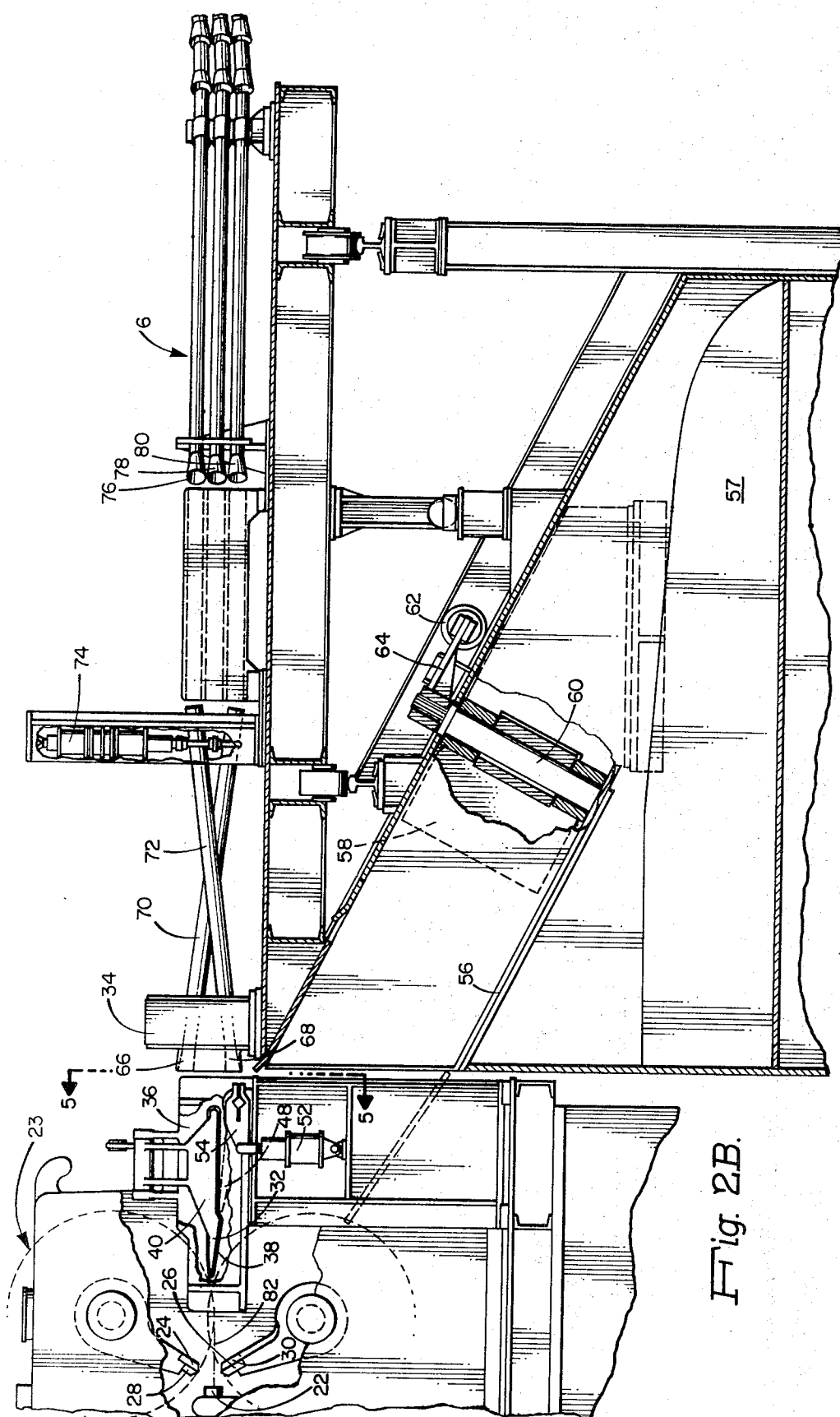


Fig. 2B.

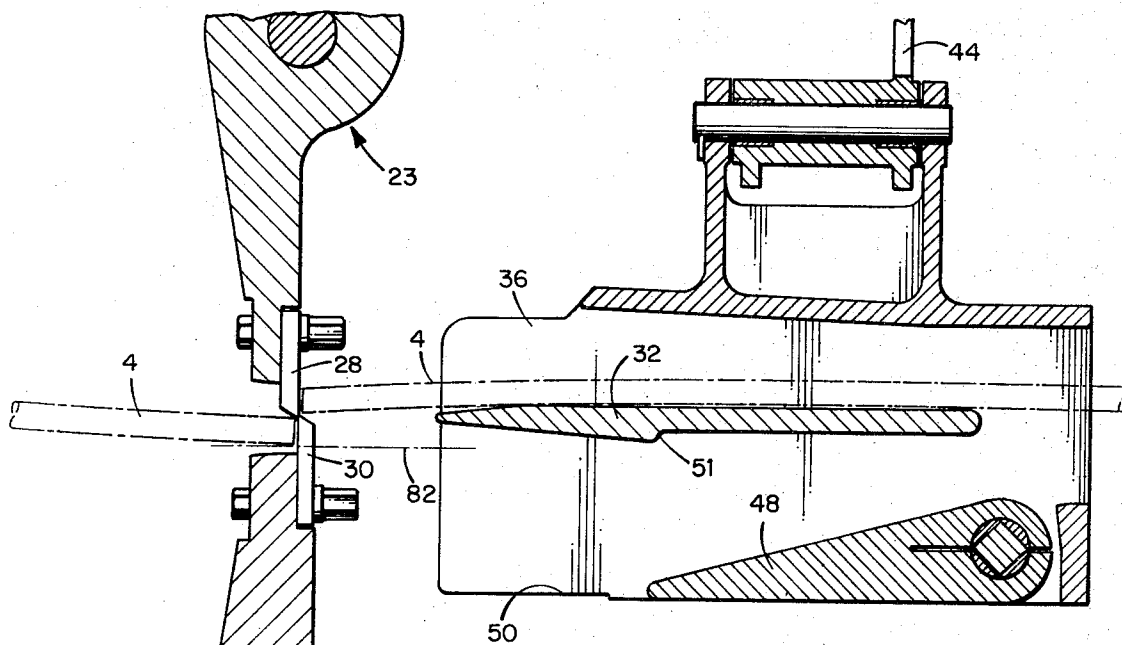


Fig. 3.

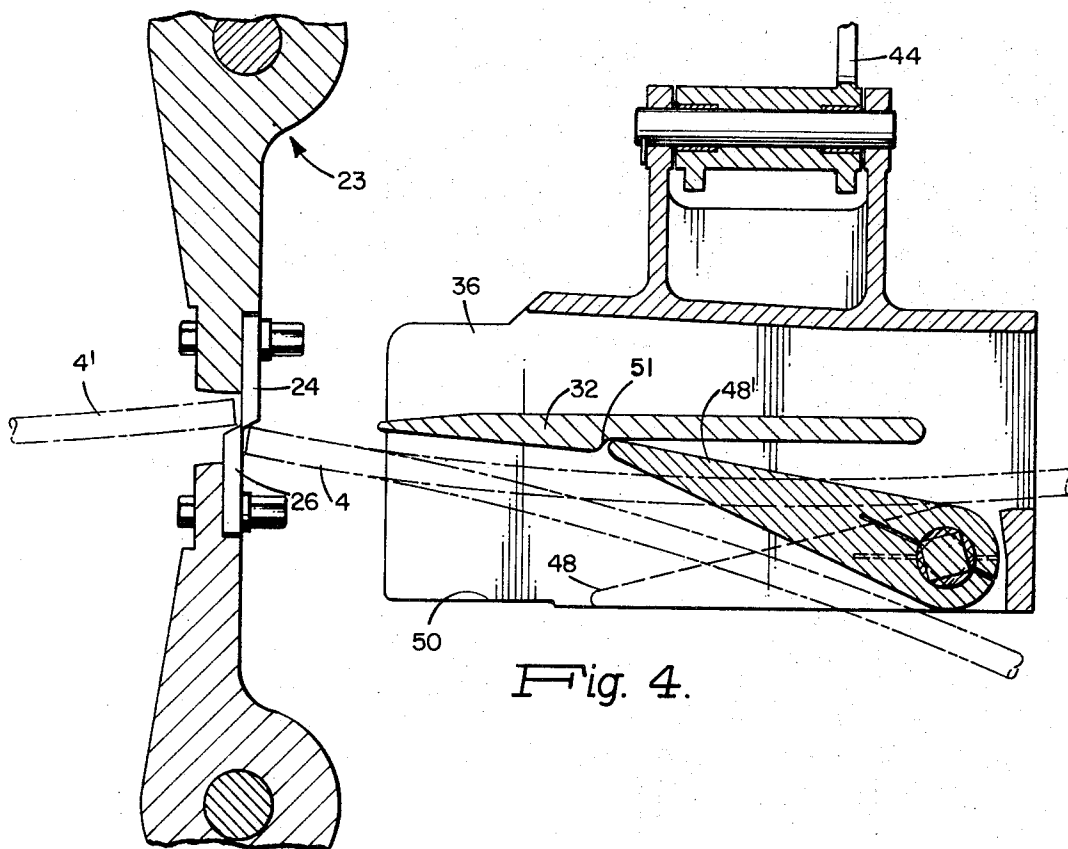
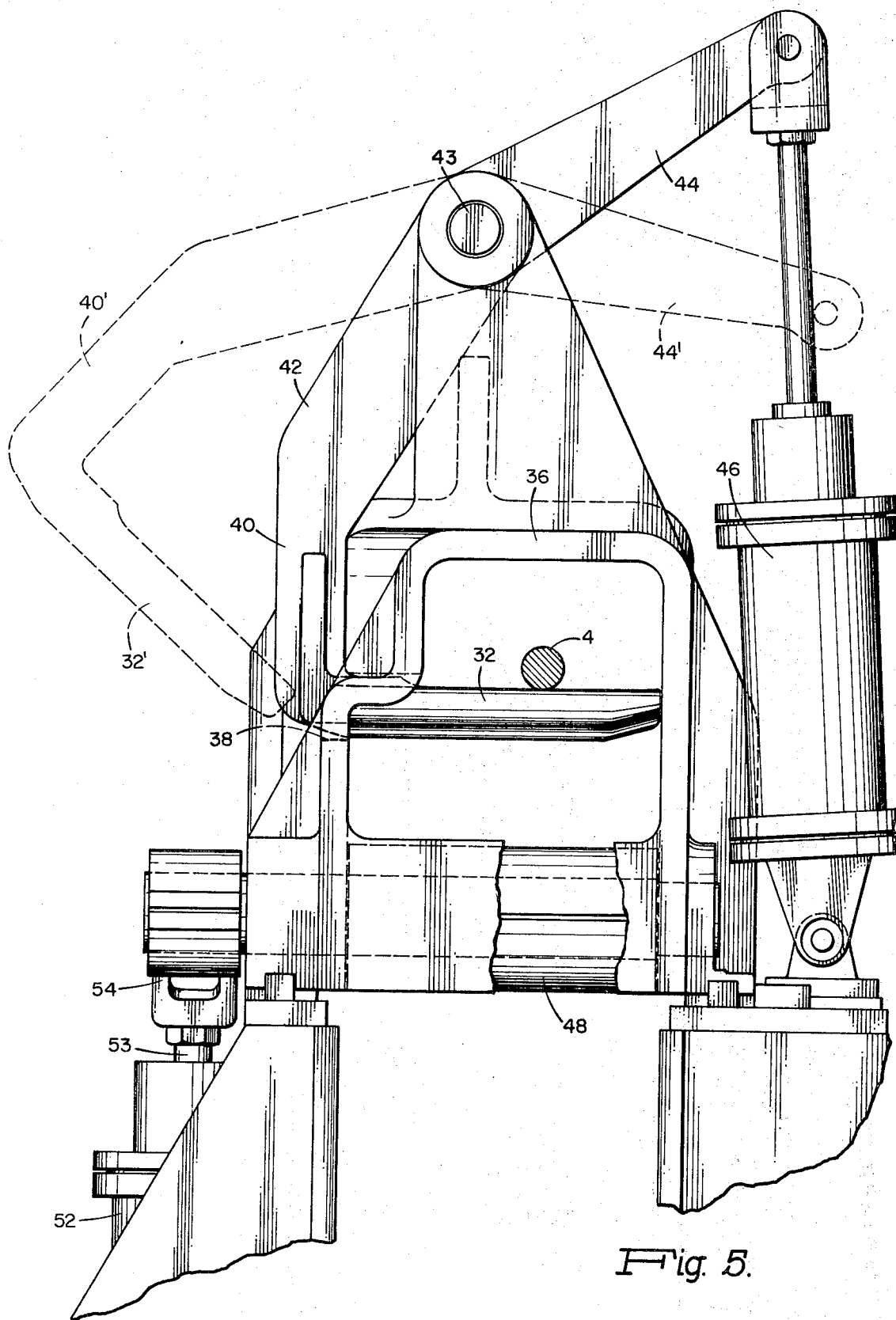
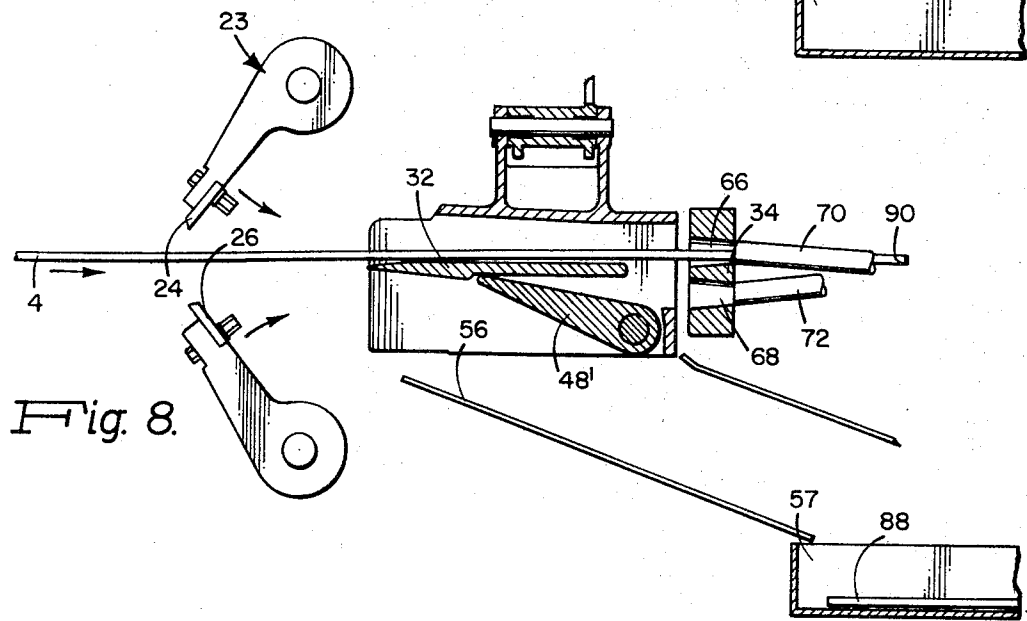
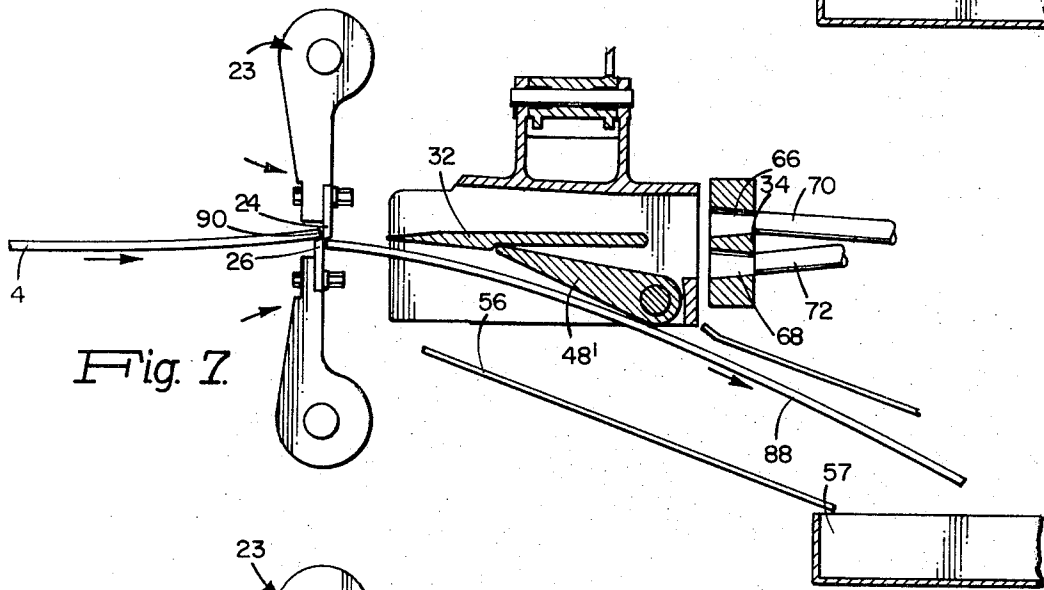
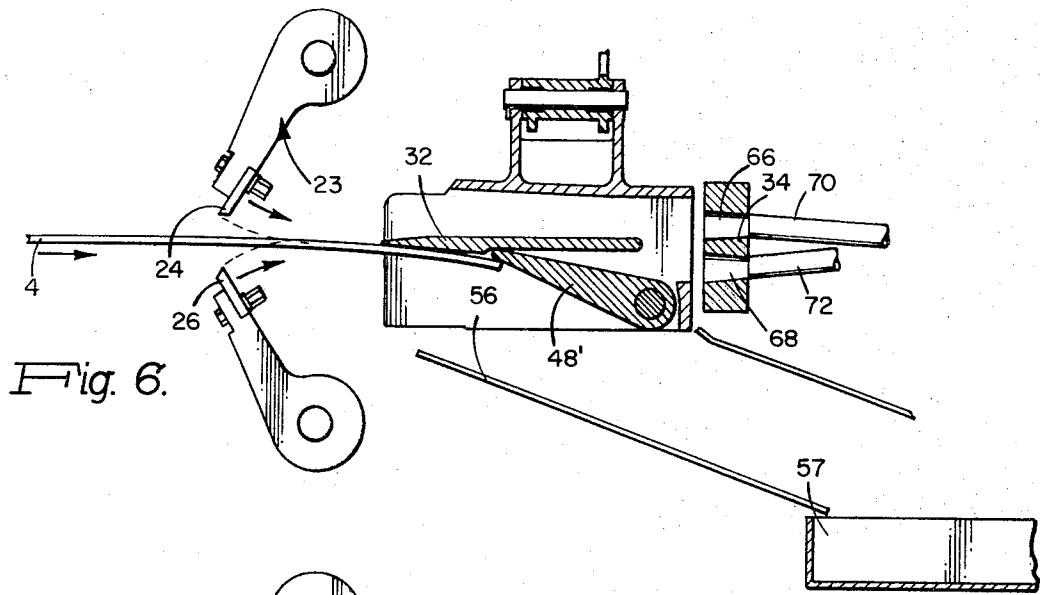
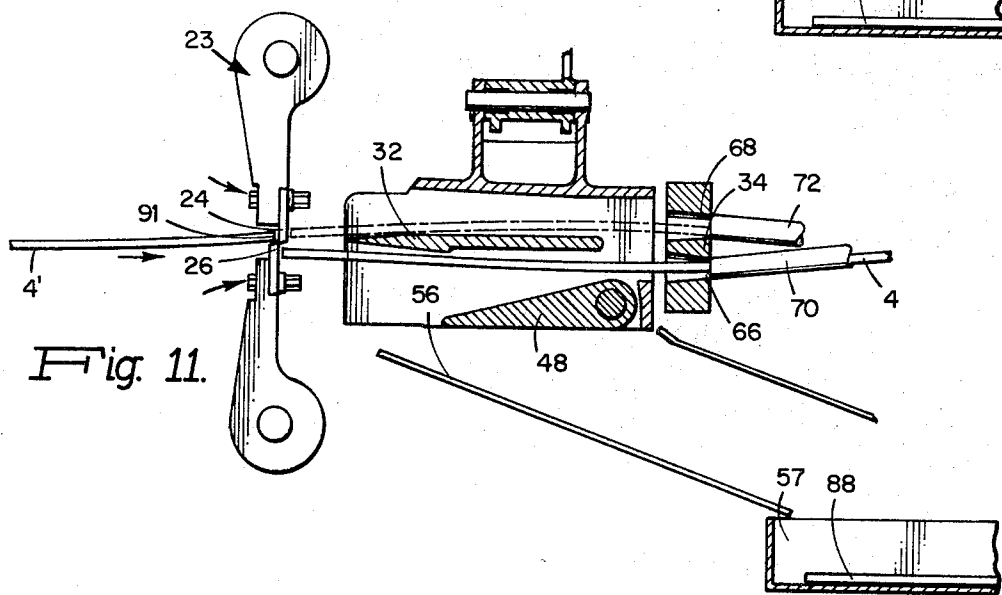
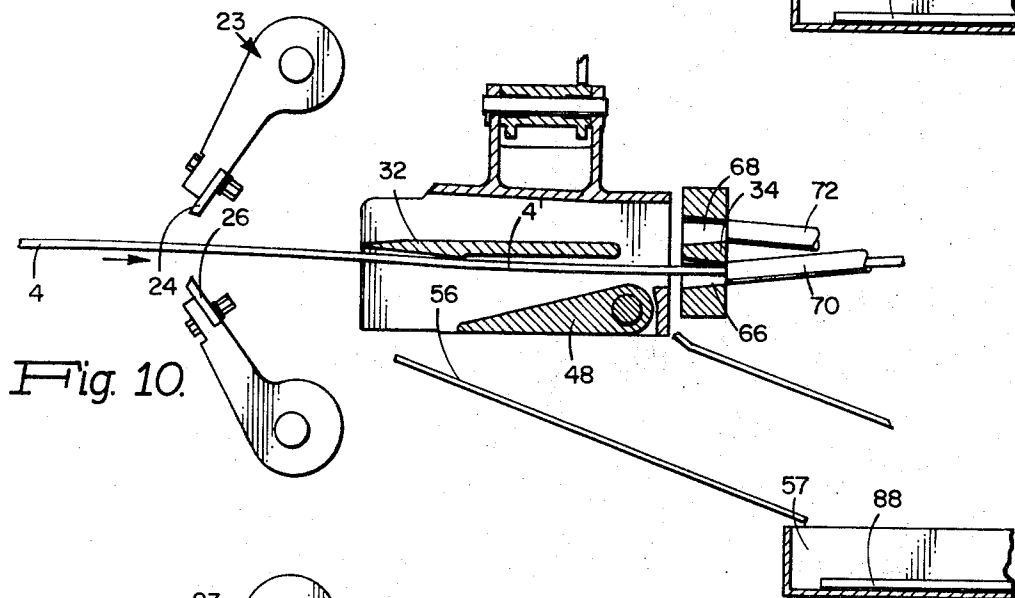
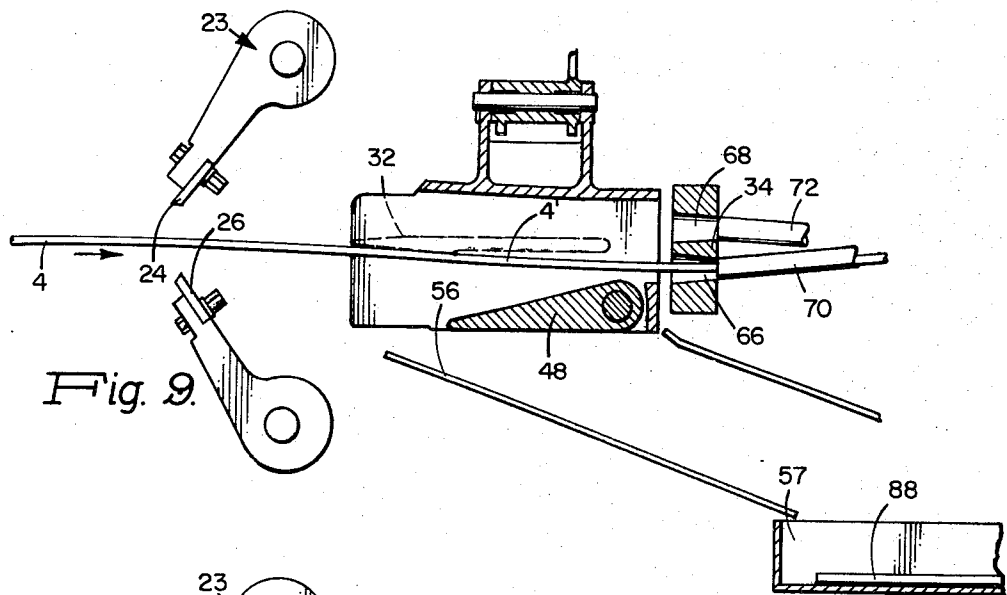
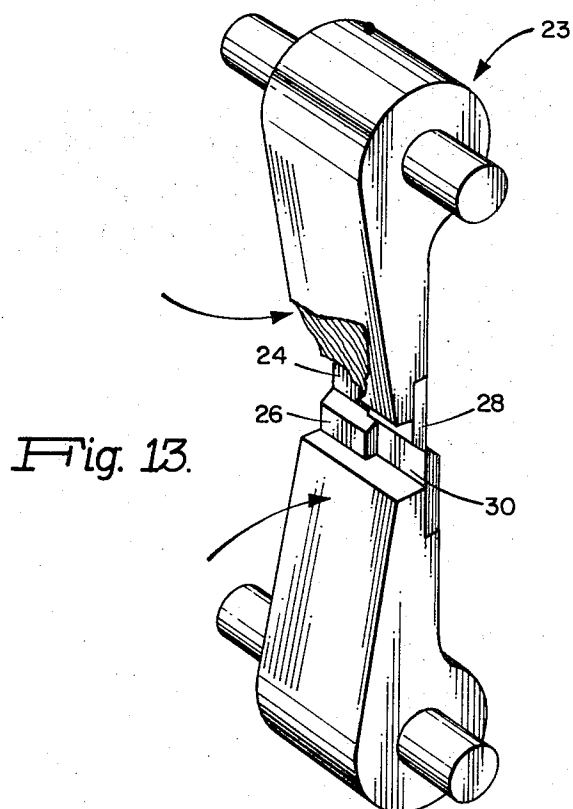
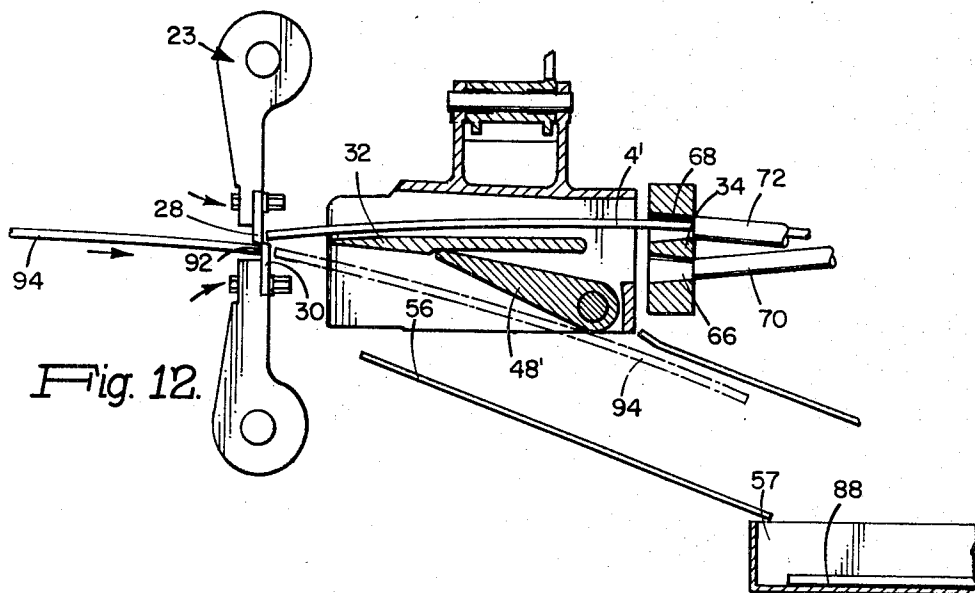


Fig. 4.









SWITCHING MECHANISM FOR CROPPING AND SAMPLING FRONT AND BACK ENDS OF BAR PRODUCT DELIVERED FROM MILL

BACKGROUND OF THE INVENTION

In the production of hot rolled rod in a rod rolling mill, the leading and tail ends of the rod are likely to be offsize and it is therefore customary to crop these parts. Additionally, the billet may be of such weight that the resulting rod must be subdivided to produce suitable size coils.

When a rod is to be divided, a switching mechanism is necessary so that the new leading end of the following section of rod can be directed to an adjacent empty pouring reel or laying reel as the case may be. Such switching mechanisms are shown in U.S. Pat. Nos. 3,109,340 and 3,258,951.

With respect to cropping the leading and tail ends of the rod, one of the problems has been to achieve suitable disposal of the cropped portions. In U.S. Pat. No. 3,258,951 just referred to, a switching mechanism is disclosed whereby the cropped ends are directed through a pipe leading to a crop collection box, or, alternately, are directed through pipes leading to a nearby crop chute. In either case, the cropped portions of the rod propelled only by their velocities must pass through pipes en route to the crop box. Where the rod is being delivered at a relatively slow speed, it has been found that on occasion the cropped portion will not be moving at sufficient velocity to discharge itself from the delivery pipe. If this occurs, the mill may have to be shut down until the delivery pipe is cleared of the cropped portion.

SUMMARY OF THE INVENTION

The present invention constitutes an improvement on the mechanisms disclosed in the aforesaid two mentioned patents. With regard to the cropping of the leading and tail ends of the rod, the invention is an improvement in that the cropped pipe is delivered directly from the shear to a crop box located below without passing through a delivery pipe.

The dividing operation, accomplished by different means, achieves the same result as that disclosed in the aforesaid patents, namely, that the divided portions of the rod may be directed through the use of a rotary switch to appropriate collecting stations (pouring reels, or laying reels). A major feature of the present invention involves the use of two side by side relatively closely adjacent rotary shears to which the rod is selectively directed by a switch pipe. The two rotary shears preferably are mounted on a common support and are driven by a single power source. Alternatively, the two rotary shears could be mounted side by side on separate supports with each shear being driven by an individual power source.

Each shear, as is well understood, consists of two knives or blades, which, coming together in their circular operative paths with the rod therebetween, sever the rod in known manner. The two side by side rotary shears, however, differ in this respect. The blades of one shear (hereinafter sometimes referred to as the "up" shear) are so arranged that when the rod is severed, the leading end of the next section will automatically be directed in an upwardly sloping direction to pass above a separator and thence into the open upper

entrance of a rotary switch. The blades or knives of the other shear (hereinafter sometimes referred to as the "down" shear) function in an opposite manner, namely, that the leading end of the next section will be directed to a position below the separator to engage a deflector which will put the cropped part of the rod on a downward sloping path toward the crop box. Thus, whenever the next section following a cut is to go to a collection station, the shear having the blades arranged to cause upward movement of the new leading end will be used, whereas, if the following section is to go to the crop box, the other shear, having blades arranged to direct the new leading end downwardly will be used.

Another feature of the present invention resides in the temporary removability of the separator and the capacity to shift the deflector from up to down position whereby the rotary switch can be operated to place the rod then passing through the rotary switch in the lower position and to present the empty entrance of the switch in the upper position where it will be ready to receive the leading end of the next section when the rod is thereafter divided. The invention will be described in more detail hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view running from the last roll stand of the mill to the location of the side by side shears and showing also the switching mechanism for directing the rod to the "up" shear or the "down" shear.

FIGS. 2A and 2B are side elevations of the invention which collectively run from the last roll stand of the mill through the side by side rotary shears, the housing containing the separator and the deflector, and the rotary switch to the several pipes to which the rod can be directed for collection at a selected pouring reel or laying head. This view also shows the crop box to which cropped pieces go directly without passing through any pipe.

FIG. 3 is an enlarged vertical section showing in more detail the blades of the "down" shear, the separator and the deflector. In this blade arrangement, the new end of the rod when cut will be directed below the separator.

FIG. 4 is a section similar to FIG. 3 showing the blades of the "up" shear reversed from those of the "down" shear to cause the new leading end to pass above the separator.

FIG. 5 is a vertical section taken on the line 5—5 of FIG. 2B illustrating the mechanism whereby the separator may be temporarily removed from its normal position.

FIG. 6 is a schematic view of a leading end engaging the deflector enroute to the crop box.

FIG. 7 is similar to FIG. 6 showing the leading end going to the crop box after having been cut from the following part of the rod by the "up" shear.

FIG. 8 shows the new leading end directed to a position passing above the separator and into the upper entrance of the rotary switch.

FIG. 9 is similar to FIG. 8 but with the separator removed and the deflector dropped and the rotary switch rotated through 180° to place the rod in lower position.

FIG. 10 shows the separator repositioned above the rod and the deflector still in down position.

FIG. 11 shows the rod divided by the "up" shear with the new leading end of the next section directed to a

position above the separator from which it will go into the upper now empty entrance of the rotary switch.

FIG. 12 shows the cropping of the tail end by the knives of the "down" shear which will direct the leading end of the crop portion downwardly below the separator to engage the deflector and thence pass into the crop box.

FIG. 13 is a perspective showing of the side by side "up" and "down" shears.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, the last stand of the rolling mill is shown at 2. The rolled rod 4 passes from the last stand in conventional manner through a pipe 5 to a switch generally referred to at 6, which comprises a first pipe 8 pivoted at 10 and a second pipe 12 aligned with pipe 8. The common support 14 for the adjacent ends of pipes 8 and 12 is arranged for limited transverse movement.

The right hand end of pipe 12 is mounted on a support 16 capable of moving the discharge end of pipe 12 from a first position 18 to a second position 20. Pinch rolls 21 aligned with switch position 20 act to grip and advance the tail end crop to deliver it properly to the crop box.

Closely adjacent to the discharge end of a delivery pipe 22 is a rotary shear mechanism generally referred to at 23. This mechanism comprises two side by side rotary shears mounted on common operating means. One of the rotary shears is aligned with the switch pipe first position 18 and the other rotary shear is aligned with the switch pipe second position 20. The shear blades or knives that are aligned with the first pipe position 18 are shown in FIG. 4 and numbered 24 and 26, and the blades aligned with the second pipe position 20 are shown in FIG. 3 and numbered 28 and 30. It will be noted that blades 24 and 26 shown in FIG. 4 are arranged the reverse of blades 28 and 30 shown in FIG. 3. The shearing ability of the blades in FIGS. 3 and 4 is the same but the effect of the blades in FIG. 4 is to cause the leading end of the new section to move upwardly with respect to the rear end of the preceding station, whereas the blades as arranged in FIG. 3 cause the new end of the following section to move downwardly with respect to the trailing end of the preceding station. Hence, in one case the newly cut leading end will be directed above a downstream separator 32, and in the other case the newly cut leading end will be directed below the separator 32.

THE SEPARATOR

The separator 32, shown on a reduced scale in side elevation in FIG. 2, on an enlarged section in FIG. 3 and in enlarged end elevation in FIG. 5 is a strong horizontal plate located within a housing 36 through which the rod 4 passes. The left side of the separator 32 as viewed in FIG. 5 passes through a horizontal opening 38 in the side of housing 36 and is attached to a vertical web 40 having upwardly extending arms 42 pivoted at 43 on an upward extension of housing 36. The arms are connected to a lever 44 which may be moved by actuation of air cylinder 46. The separator 32 in this way may be quickly removed from the housing 36 by downward movement of the piston of air cylinder 46 causing the separator 32 to swing outwardly through opening 38 to the position 32' shown in FIG. 5. The reason for

the temporary removal of the separator 32 is to permit rotation of the rotary switch 34 to shift rod 4 from its upper position above the separator as shown in FIG. 8 to a lower position 4' below the separator as shown in FIGS. 9 and 10.

THE DEFLECTOR

The deflector 48 is best shown in detail in FIGS. 2B 3 and 4. In its down position shown in FIG. 3, the deflector covers the entrance to the crop box chute 56 and is adjacent the bottom 50 of the housing 36. In its up position as indicated at 48' in FIG. 4, its forward end engages the underside of separator 32 immediately behind a shoulder 51. The entrance to chute 56 is then open. When the deflector is in down position, there is sufficient space between it and the underside of separator 32 to permit the rod 4 to pass therebetween. When the deflector is in up position as at 48' in FIG. 4, the leading end of any rod directed thereto will be deflected downwardly to travel freely through chute 56 to a crop box 57 therebelow. The deflector 48 is actuated by an air cylinder 52 whose piston 53 is pivotally connected to a lever arm 54 (see FIGS. 2B and 5).

As shown in FIG. 2B, the chute 56 may include a longitudinally extending gate 58 swingable from one side of the chute to the other about a centrally located pivot 60 to direct the cropped portions specifically to a scrap bin or a sampling bin which bins together comprise the crop box 57. The gate 58 is moved from one position to the other by an air cylinder 62 connected to the pivot 60 by an arm 64.

ROTARY SWITCH

The rotary switch 34 shown in FIG. 2B is substantially the same as the rotary switch illustrated in the previously referred to U.S. Pat. No. 3,109,340. This switch, which is rotatable back and forth through 180°, has two passages 66 and 68 therethrough. The passage 66 leads to pipe 70 and the passage 68 leads to pipe 72. The delivery ends of pipes 70 and 72 are separately movable up and down by two independent air cylinders, one of which is indicated at 74. Each air cylinder is arranged to put the discharge end of each pipe in alignment with a pipe running to any empty pouring reel (or laying reel) so that the oncoming rod may be directed thereto. One set of pipes 76, 78 and 80 cooperates with pipe 70 and a second set of three pipes (therebehind and not shown) cooperates with pipe 72.

MODE OF OPERATION

The leading end of the rod 4 delivered by the last stand 2 of the mill is directed through pipe 5 and into the first pipe 8 of switch 6, whence it passes on to the second pipe 12. The delivery end of the pipe 12 is shown in full lines at the first position 18 in FIGS. 1 and 2A. As the rod 4 leaves pipe 12 it is fed into the short delivery pipe 22 and thence directed into the nip of the then stationary first rotary shear shown in FIG. 4 with the blades 24 and 26. Since the leading end of the rod is to be cropped, the deflector 48 will be in up position 48' as shown in FIG. 6 and the blades 24 and 26 will be open so the rod 4 passes therebetween along its pass-line to enter housing 36 on the underside of separator 32. The leading end of the rod will then engage the underside of deflector 48 and be deflected downwardly into chute 56. The leading end of the rod 4 will

have been detected by a sensing device 86 (see FIG. 1) which puts the shear mechanism 23 in operation after a predetermined length of the leading end of the rod has passed the sensor enroute to the crop box. As previously mentioned, whenever the shear mechanism 23 is operated, both of the side by side shears, the "up" shear and the "down" shear, are rotated but the cutting of the rod is done only by those blades 24 and 26 or 28 and 30 which are in alignment with the rod at that time.

The rod 4 traveling through pipe 12 along the line of first position 18 will as noted by aligned with "up" shear blades 24 and 26. When the shear goes into operation to sever the rod at the predetermined leading end crop position, the front severed portion 88 (see FIG. 7) will be deflected down into the crop box, but the leading end 90 of the following portion of rod 4 will be directed by operation of shear blades 24 and 26 upwardly at a small angle so that it will be delivered to the top side of separator 32. The rod 4 continues over separator 32 through the housing 36 to pass into the empty upper entrance 66 of the rotary switch 34, thence on through pipe 70 (see FIG. 8) and into one of the pipes 76, 78 or 80 leading to a vacant pouring reel.

If the rod is to be divided so as to produce two or more coils of rod, then the following steps are undertaken. Air cylinder 46 is actuated to swing the separator 32 out of housing 36 as shown at 32' in FIG. 5. At the same time that the separator is being removed from the housing, the deflector 48 is dropped from up position 48' to down position 48 by operation of air cylinder 52. The rotary switch 34 is then actuated to rotate through 180° to place the passage 68 in the upper position and passage 66 in the lower position as shown in FIG. 9 with the rod 4 still passing through pipe 70 enroute to the pouring reel. Immediately thereafter, separator 32 is returned to its normal position within housing 36, as in FIG. 10, and the deflector 48 remains in down position. The rod 4 is now in condition to be divided by the blades 24 and 26 of the "up" shear which are automatically put into operation as in FIG. 11 when the predetermined weight or length of rod has been deposited in the first pouring reel. Upon actuation of the "up" shear, with rod 4 still running in first position 18, the leading end 91 (see FIG. 11) of the severed rod 4' automatically is directed to the top side of separator 32, thence on into the upper empty entrance 68 in the rotary switch 34, through pipe 72 and thence to the appropriate pipe leading to the empty pouring reel in which the next coil is to be assembled. The tail end of rod 4 that was running through entrance 66 and pipe 70 of the rotary switch has now passed on to the pouring reel and the entrance 66 is again open.

Assuming that the rod 4' of FIG. 11 will be of a proper length to complete the second coil of rod in the appropriate pouring reel, then rod 4' must be cropped at its tail end in accordance with customary practice. This is accomplished in the following manner. The switch pipe 12 is shifted from first position 18 to second position 20 in which it will become aligned with the "down" shear blades 28 and 30 shown in FIGS. 3 and 12. With switch pipe 12 in position 20, the rod 4' continues to pass over separator 32 into rotary switch entrance 68 and thence through pipe 72 to the associated pouring reel. While this is going on, the deflector 48 is swung to up position 48' prior to the next actuation of the "down" shear. The "down" shear is then actuated

by a sensor causing rod 4' to be sheared an appropriate distance ahead of the tail end to make a suitable tail end crop. The shearing is done by the blades 28 and 30 shown in FIGS. 3 and 12. These blades are arranged the reverse from blades 24 and 26 so that when shearing occurs the leading end 92 of the tail end crop portion 94 is directed downwardly as shown in dotted line in FIG. 12 to pass below separator 32 to engage the deflector 48 and be sent downwardly through chute 56 to the crop box 57.

The sensor that puts the "down" shear into operation also causes the pinch rolls 21 to close on the rod so that the cropped tail end will continue to be advanced at the same speed on its way to the crop box.

From the foregoing explanation, it is seen that the combination of side by side rotary shears one (the "up" shears) designed to direct the new leading end upwardly and the other (the "down" shear) designed to direct the new leading end downwardly combined with the removal separator and the movable deflector makes it possible to crop the leading and tail ends of a rod so that the crop portions will go directly to a crop box without the necessity of passing through any pipe and the rod may be divided into as many portions as deemed necessary to make the appropriate number and size of coils.

As herein employed, the term "rod" is employed in the generic sense, and includes all elongated product lengths produced by a rolling mill.

It is intended to cover all changes and modifications of the examples of the invention herein chosen for purposes of the disclosure which do not constitute departures from the spirit and scope of the invention.

We claim:

1. Means for cropping the leading and tail ends of moving rod emerging from a rolling mill, said means comprising a rotary "up" shear, a rotary "down" shear, a separator adjacent said shears and above the rod pass line, a deflector below said separator for directing rod to a crop box therebelow, a rod switch for first delivering oncoming rod through said "up" shear and below said separator to engage said deflector, whereby upon actuation of said "up" shear at an appropriate time, the leading end will be cropped and will continue on directly to said crop box and the newly cut end of the rod will pass over said separator enroute to a collecting station, and whereby upon shifting said rod switch to deliver said oncoming rod to a position in which it passes through said "down" shear while the rod still passes over said separator and upon actuation of said "down" shear at an appropriate time, the tail end of the rod will be cropped and the leading end of the tail end crop will pass below said separator to engage said deflector and go to said crop box.

2. The combination set forth in claim 1 and a two-entrance rotary switch beyond said separator for receiving in its upper entrance rod delivered thereto following actuation of said "up" shear, said separator being temporarily removable, and said deflector being movable to non-intercepting position, whereby with said separator removed and said deflector in non-intercepting position, said rotary switch may be rotated to lower the level of rod passing therethrough to a position below said normal separator position, and whereby upon return of said separator to normal operative position, said rod may be divided by actuation of said "up" shear and the newly cut leading end of the following

rod will pass over said separator to be received in the empty upper entrance of said rotary switch.

3. The combination set forth in claim 1, said shears being mounted on a common actuating shaft.

4. The combination set forth in claim 2, said separator being located within an open ended housing, and means for moving said separator in a transverse direction out of said housing.

5. The combination set forth in claim 1 and a chute running from a position below said deflector diagonally downward to said crop box.

6. In a rod mill, in combination a rod switch, a pair of side by side rotary shears for selectively cutting rod delivered from said switch, a separator adjacent said shears and above the rod pass line, a deflector below said separator for directing rod to a crop box, a two-entrance rotary switch immediately beyond said separator for receiving and directing rod to a collecting station, means associated with one of said shears for causing the new end of rod when cut by said one shear to pass above said separator and into the upper entrance of said rotary switch, means associated with the other of said shears for directing the new end of rod when cut by said other shear to pass below said separator to engage said deflector, means for positioning said rotary switch so that there will be an empty entrance available to receive the leading end of rod cut by said one shear and passing over said separator, and means for removing said separator and deflector and for rotating said rotary switch to shift the rod position from above said separator to below said separator prior to subsequent actuation of said one shear.

7. In a rod rolling mill, means for cropping and/or dividing the rolled rod at a position between the last stand and the rod collecting station, said means comprising two adjacent rotatable shears, means for supporting said moving rod at a constant vertical position as it approaches said shears, switching means for shifting the path of said rod horizontally from one shear to the other, a horizontal separator closely adjacent the cutting positions of said shears and above said constant vertical position, a deflector below said separator and movable from an up position crossing the said vertical position to a down position spaced from the underside of said separator, a two-entrance rotary switch adjacent said separator to receive in its upper entrance rod passing over said separator, one of said shears arranged when cutting said rod to direct the new cut end above said separator, the other of said shears arranged when cutting said rod to direct the new cut end below said separator and against said deflector when the latter is in up position, and a crop box to receive rod directed thereto by said deflector.

8. In combination in a rod mill, a rod switch for shifting transversely the line of travel of moving rod without shifting the vertical position of the rod pass line so that said rod can be delivered selectively to either of a pair of side by side rotatable shears in which the arrangement of the cutting blades of one shear is substantially the reverse of the cutting blades of the other, a removable horizontal separator adjacent said shears and above the normal pass line of said rod, a deflector below said separator and movable from up to down position whereby when said deflector is in up position, it will intercept the leading end of a rod passing below said separator plate to direct said rod to a crop box, a two-entrance rotary switch for receiving rod delivered

thereto along the upper side of said separator and for shifting the line of travel of said rod to a lower level below said separator position when said separator has been removed and said deflector has been moved to non-intercepting position whereby after said rod has been lowered by rotation of said rotary switch and said separator has been replaced, said rod may be divided by one of said shears and the new leading cut end of said rod will be directed along the top side of said separator and into the now empty entrance of said rotary switch.

9. The combination set forth in claim 8, said other shear operable when the rod is passing through said other shear and over said separator into the upper entrance of said rotary switch, whereby upon operation of said other shear the new leading cut end will be directed below said separator to engage said deflector and thence go to said crop box.

10. Rod cropping and dividing means for use in a rod rolling mill at a position between the last stand and the rod collecting station, said means comprising means for shifting transversely the line of travel of said moving rod from a first position to a second position, a first rotatable shear aligned with said first position for cutting said rod, a second rotatable shear aligned with said second position for cutting said rod, a separator extending laterally at least the width of said first and second positions and located immediately beyond said shears and above the normal pass line of said rod, the shear blades on said first shear when actuated to cut said rod passing therebetween so constructed that the new leading end of the cut rod will be directed above said separator, the shear blades on said second shear when actuated to cut said rod passing therebetween so constructed that the new leading end of the cut rod will be directed below said separator, means for temporarily removing said separator from its operative position with respect to said rod, a rod deflector located below said separator and movable from an up position where it will intercept rod passing below said separator to a down position spaced from said separator and below the normal pass line of said rod, said deflector when in up position presenting a downward sloping undersurface to engage and direct the leading end of any rod traveling beneath said separator to a crop box, a two-position rotary switch beyond said separator and having upper and lower entrances and associated switch pipes, said upper entrance being above and said lower entrance being below said separator, means for directing the leading end of a rod traveling on the upper surface of said separator into said upper entrance, means for rotating said rotary switch after said separator has been temporarily removed and said deflector is in down position and said rod shifting means is in said first position to reverse the positions of said rotary switch entrances thereby to lower the said upper entrance and the rod therein to a level below said separator position and whereby upon replacement of said separator, said rod will be therebelow and aligned with said first shear and whereby upon the actuation of said first shear said rod will be divided and the new leading end will be delivered above said separator and into the now empty upper entrance of said rotary switch, and when said rod shifting means is in said second position and said rod is aligned with said second shear and traveling above said separator and through the upper entrance of said rotary switch and said deflector is in up position, operation of said second

shear will crop said rod and direct the leading end of said cropped portion below said separator and against said deflector and thence to said crop box.

11. Apparatus for subdividing a longitudinally moving product length comprising: shear means, including laterally adjacent pairs of cooperating rotatable shear blades, one pair of shear blades being operable to cut the moving product length while directing the leading end of the cut section upwardly, the other pair of shear blades being operable to cut the moving product length while directing the leading end of the cut section downwardly; switch means for directing the moving product length through said shear means, and switch means being adjustable laterally to position the moving product length in the operative range of one or the other of said pairs of shear blades; and receiving means for receiving the product passing through said shear means.

12. The apparatus as claimed in claim 11 wherein said receiving means includes a crop receptacle, and

guide means for selectively directing the leading end of a product section downwardly into said crop receptacle.

13. The apparatus as claimed in claim 11 wherein said receiving means includes a second switch means having rotatably adjustable vertically spaced inlets with separate delivery pipes in communication therewith at their upstream ends, and means for vertically adjusting the downstream ends of said delivery pipes to thereby selectively position the same in alignment with fixed conduits.

14. The apparatus as claimed in claim 13 wherein said guide means includes a housing divided by a separator into upper and lower passageways in alignment with the vertically spaced inlets of said second switch means, and a deflector cooperating with said separator to deflect product passing through said lower passageway downwardly into a crop receptacle.

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UNITED STATES PATENT AND TRADEMARK OFFICE

Certificate

Patent No. 3,834,260

Patented September 10, 1974

Donald Sieurin and Robert Anderson

Application having been made by Donald Sieurin and Robert Anderson, the inventors named in the patent above identified, and Morgan Construction Company, Worcester, Massachusetts, a corporation of Massachusetts, the assignee, for the issuance of a certificate under the provisions of Title 35, Section 256, of the United States Code, adding the name of Harold L. Fontaine as a joint inventor, and a showing and proof of facts satisfying the requirements of the said section having been submitted, it is this 1st day of April 1975, certified that the name of the said Harold L. Fontaine is hereby added to the said patent as a joint inventor with the said Donald Sieurin and Robert Anderson.

FRED W. SHERLING,
Associate Solicitor.