

April 14, 1959

M. MORGAN
SHEAR

2,881,835

Filed Nov. 21, 1956

7 Sheets-Sheet 1

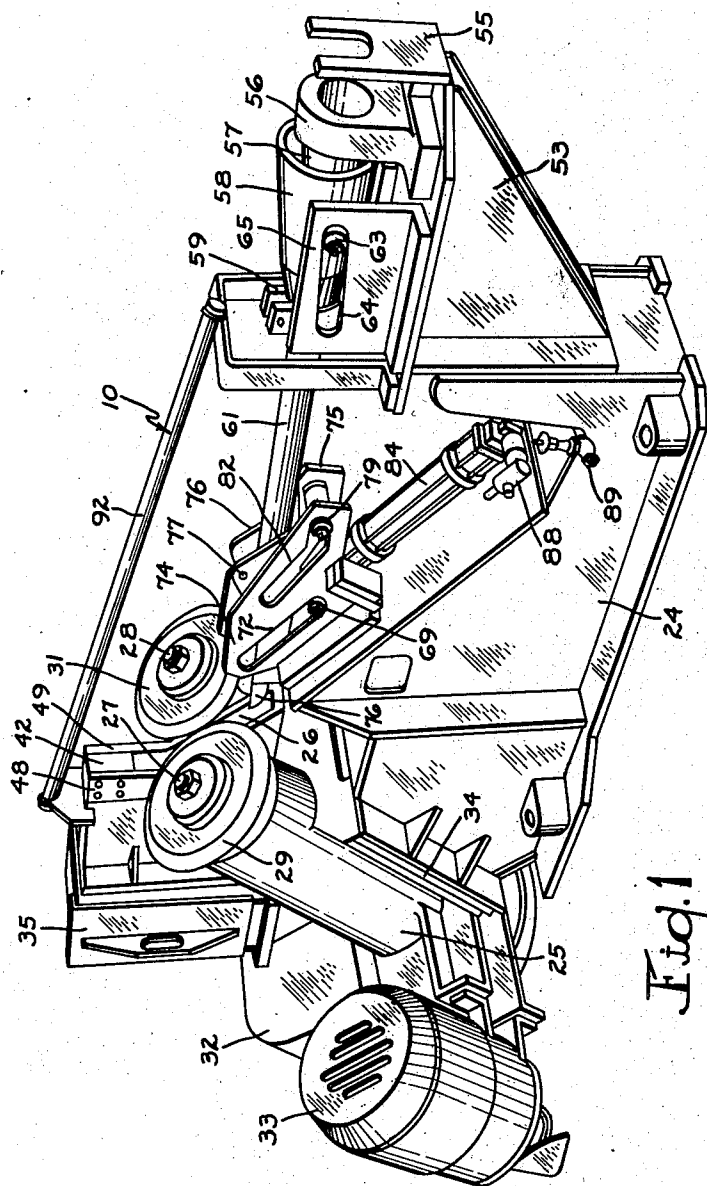


Fig. 1

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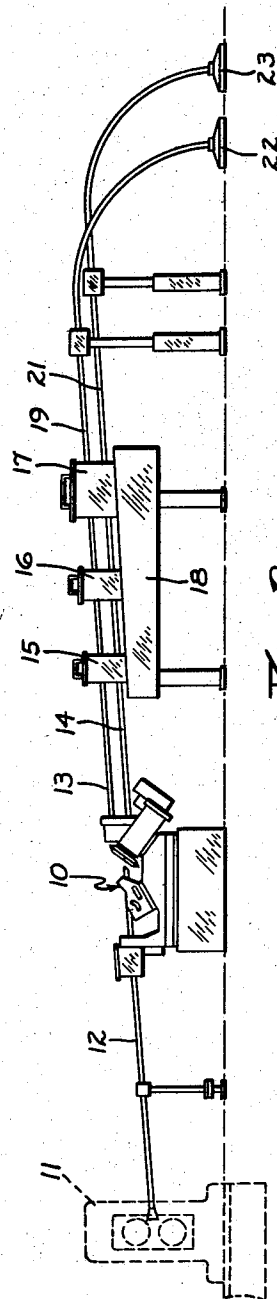
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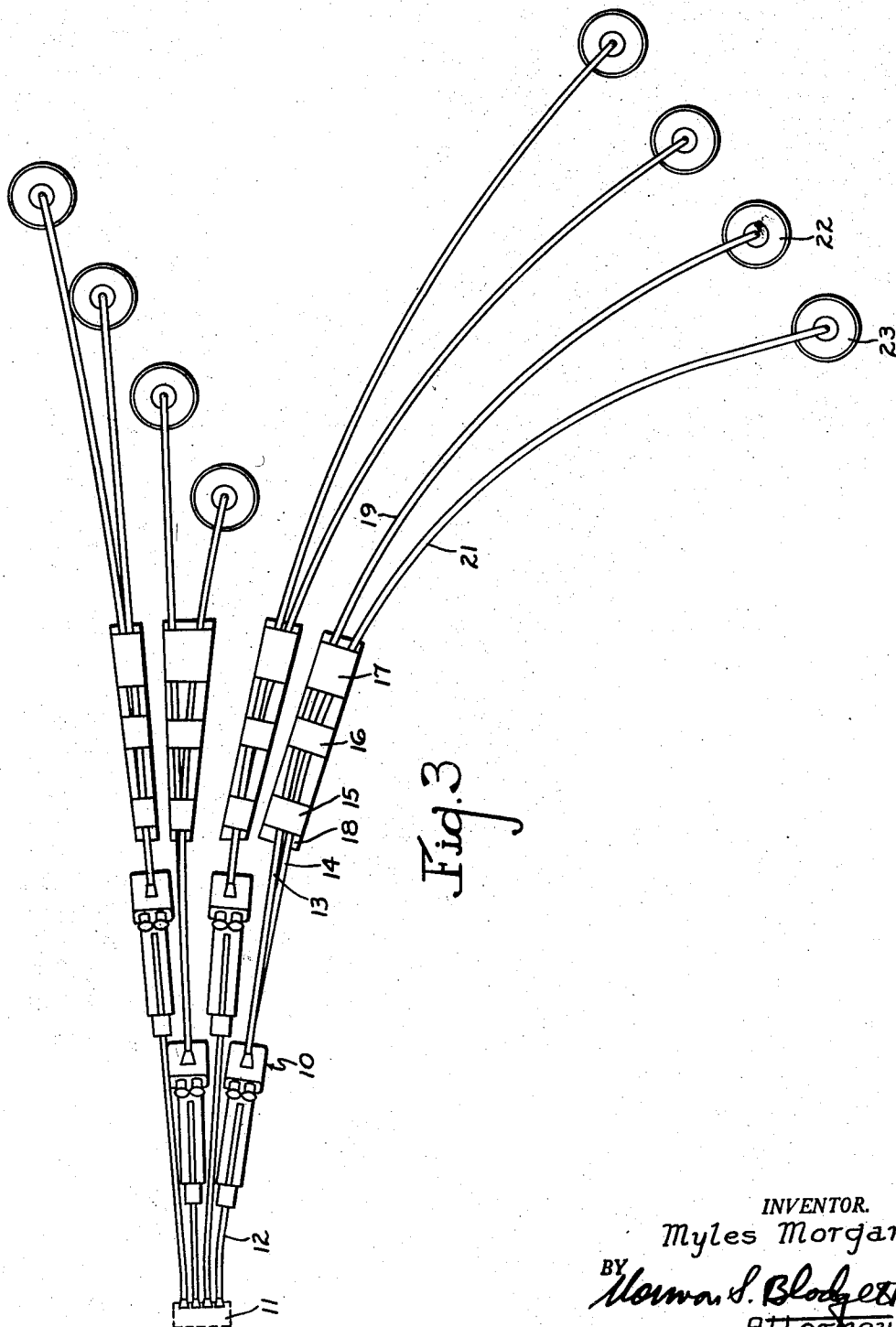
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7 Sheets-Sheet 4

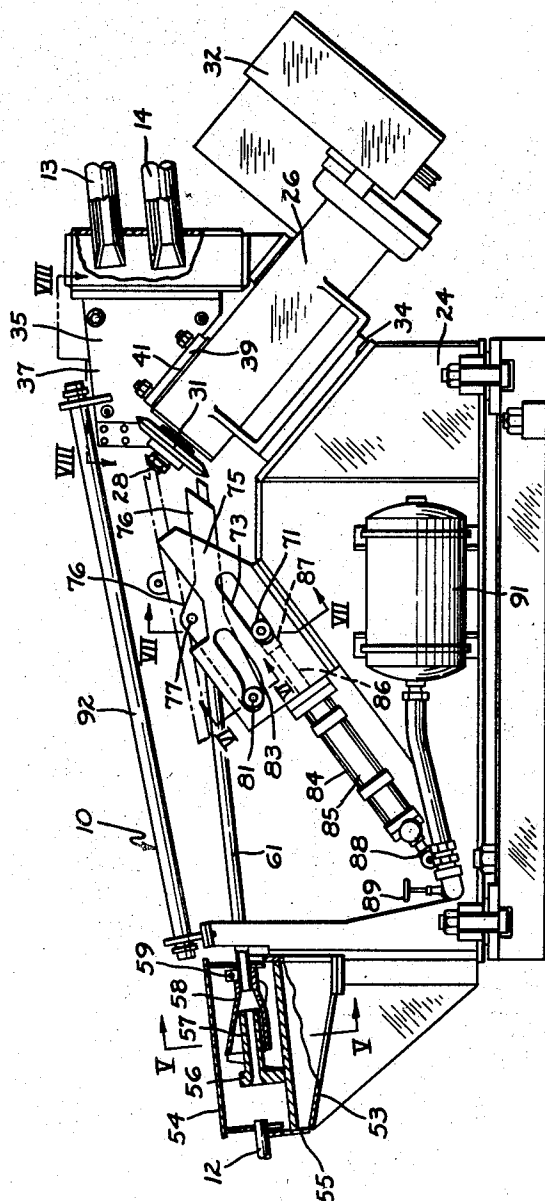


Fig. 4

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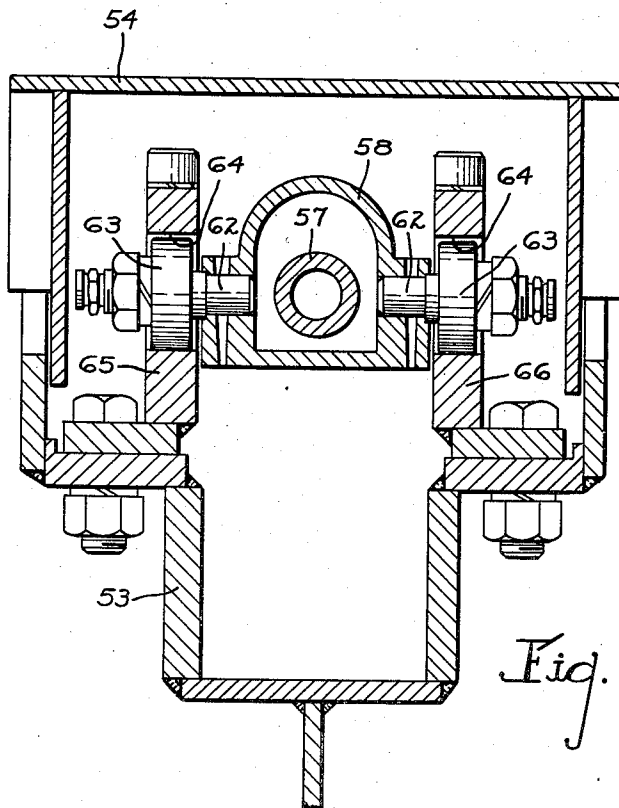


Fig. 5

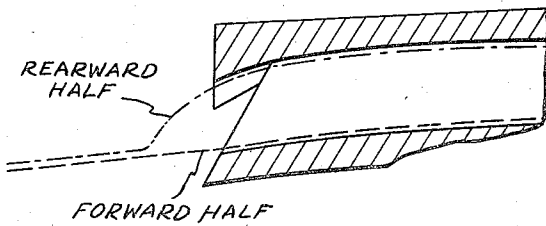


Fig. 10

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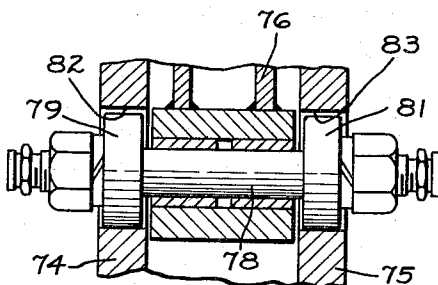
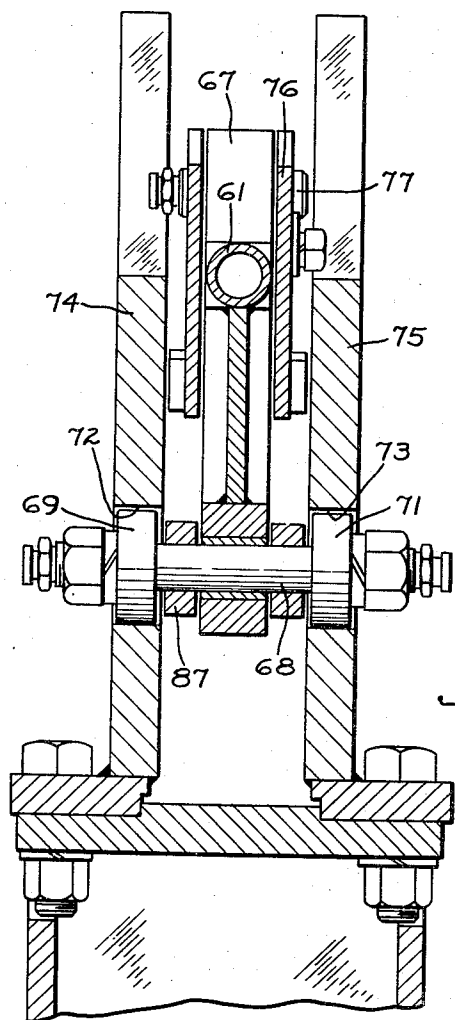


Fig. 6

Fig. 7

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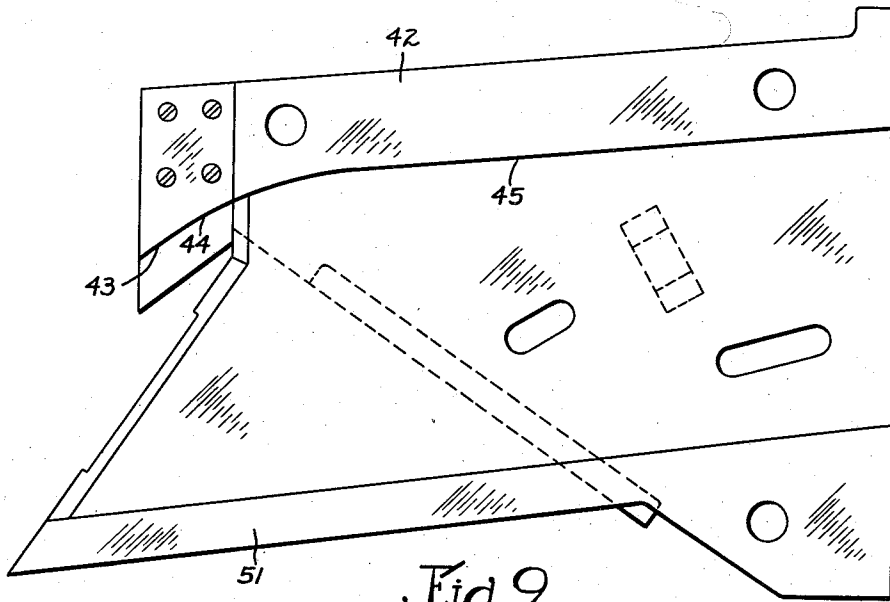


Fig. 9

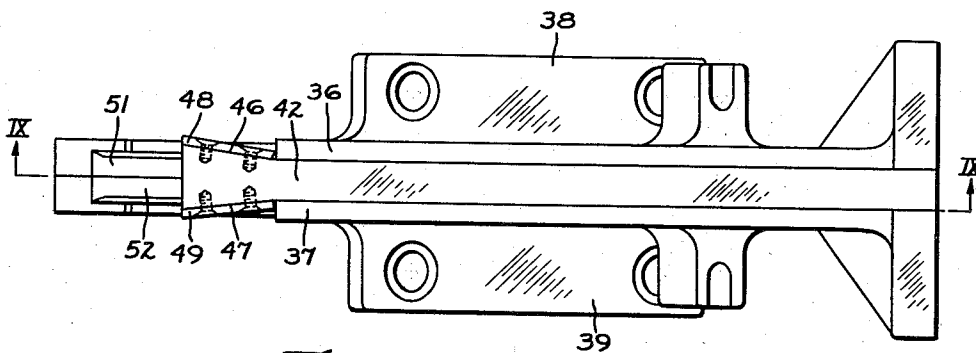


Fig. 8

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2,881,835

SHEAR

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10 Claims. (Cl. 164—62)

This invention relates to a shear and more particularly to apparatus for dividing rod passing through a rolling mill.

In the rolling of steel rod and similar material it is sometimes necessary to divide a length of rod into two parts and to direct each half to a separate coiling reel. This procedure is used when rod is rolled from large billets which produce the heavy coils desired by some customers, but which must be divided into lighter coils for other customers. However, with the rate of rod production by modern rolling mills increasing to the point where speeds in the order of 6000 feet per minute are sometimes encountered, the conventional shearing means is not adequate. It is the usual practice in dividing rod, where accuracy of length is not too important, to use a disk shear of the type shown and described in the patent to Morgan et al. No. 2,621,734. However, at the high speeds now being used, there has been a tendency for such a shear to bend the front end of the rearward half of the rod so that it does not enter the pipes and handling equipment properly. These and other difficulties experienced with previously-known devices of this kind have been obviated in a novel manner by the present invention.

It is therefore an outstanding object of the present invention to provide a shear for dividing rod traveling at high speed in such a manner that the rod is not deformed.

Another object of the invention is the provision of a disk-type dividing shear wherein the portion of the rod near the point of shearing is permitted to move laterally during the actual cutting without restriction by a guide or the like.

A still further object of this invention is the provision of a dividing shear having a means for guiding the front end of the rod into the pipe leading to a reel without deforming the end.

With these and other objects in view, as will be apparent to those skilled in the art, the invention resides in the combination of parts set forth in the specification and covered by the claims appended hereto.

The character of the invention, however, may be best understood by reference to certain of its structural forms, as illustrated by the accompanying drawings in which:

Figure 1 is a perspective view of a shear embodying the principles of the instant invention,

Figure 2 is a side elevational view of a portion of a rod rolling mill making use of the invention,

Figure 3 is a plan view of the portion of the rolling mill shown in Figure 2,

Figure 4 is a side elevational view of the shear with portions broken away for the sake of clarity of presentation,

Figure 5 is a sectional view of the shear taken on the line of Figure 4,

Figure 6 is a sectional view of the shear taken on the line VI—VI of Figure 4,

Figure 7 is a sectional view of the shear taken on the line VII—VII of Figure 4,

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Figure 8 is a plan view of a portion of the shear as observed on the line VIII—VIII of Figure 4,

Figure 9 is a sectional view of a portion of the shear taken on the line IX—IX of Figure 8, and

Figure 10 is a schematic view of the apparatus of Figure 9, showing the manner of operation.

Throughout this specification, the expression "longitudinal" will be used to indicate the direction in which rod travels through the shear, while the expression "transverse" will be used to indicate a direction at a right angle to the path of the rod. The word "forward" will indicate a location farthest away from oncoming rod, while the word "rearward" will be used to indicate a location nearest the oncoming rod.

Referring first to Figures 2 and 3, wherein are best shown the general features of the invention and their relationship with the other elements of a rod mill, the shear, indicated generally by the reference numeral 10, is shown as receiving rod from the last stand 11 of a rod rolling mill. As is evident in Figure 3, the mill rolls four strands at a time, but the description will be confined to the portion of the apparatus which serves one strand; however, it will be understood that each strand will be provided with its own dividing shear and associated equipment. A pipe-type guide 12 extends between the mill stand 11 and the entrance to the shear 10. Following the shear are two vertically-spaced pipe-type guides 13 and 14 which extend between the exit of the shear and a series of water boxes 15, 16 and 17 of the conventional type. The water boxes are mounted on a support 18 which also serves as a reservoir for the collection of water from the boxes. The guides 13 and 14 pass through the water boxes and are joined to guides 19 and 21, respectively, leading to rod reels 22 and 23.

The general features of the shear 10 are best shown in Figures 1 and 4. A base 24, adapted to be bolted to a foundation, carries housings 25 and 26 containing shafts 27 and 28 respectively, which are mounted at a substantial angle to the horizontal; suitable bearings, not shown, are provided for carrying the shafts for rotation with a minimum of friction. The shafts extend axially beyond the upper ends of the housings and have mounted thereon disk-type shear blades 29 and 31. The shafts are connected through a transmission 32 to a main drive motor 33. The housings, shafts, disks, transmission and main motor are formed as an independent unit which is capable of slidable adjustment along an inclined surface 34 of the base 24.

Mounted between the shaft housings is a receiver housing 35 from which the guides 13 and 14 emerge. The housing 35 is shown in detail in Figures 8 and 9. Two side plates 36 and 37 are provided with facing plane surfaces and transverse flanges 38 and 39 which extend outwardly and which are adapted to be bolted to an inclined surface 41 on each of the shaft housings. Clamped between the upper portions of these side plates is a hardened steel striking plate 42 provided with a curved lower edge 43; this edge is formed with a curve of downwardly-directed concave form starting with a lowermost front portion 44 of small radius of curvature, this portion of the curve emerging at its rearward uppermost point with a rearward portion 45 of very large radius of curvature. It might be said that the curve progresses always upwardly from its most forward point where it has the smallest radius of curvature to its rearwardmost point where it is practically a horizontal straight line, with the radius of curvature gradually increasing in that direction. The part of the striking plate subtended by the portion 44 extends forwardly from between the side plate and is provided in this area with inclined surfaces 46 and 47 to which are, respectively,

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bolted hard steel guide plates 48 and 49. These guide plates extend below the lower edge 43 of the striking plate, as is evident in Figure 9. The side plates 36 and 37 are provided in their lower portions with inwardly-directed shoulders 51 and 52, respectively, whose combined thickness is equal to the thickness of the main part of the striking plate 42. The manner in which the side plates and the striking plate are assembled is clear in Figure 8. It is clear that the forward lower portions of the plates and the shoulders 51 and 52 form a floor which underlies the edge 43 of the striking plate and also underlies the guide plates 48 and 49.

Returning again to Figures 1 and 4, it will be observed that an entrance apparatus 53 is fastened to the forward end of the base 24. The guide 12 enters this apparatus and is supported at one end thereby. The apparatus is provided with a cover 54, shown in Figure 4, but omitted in Figure 1. A rack piece 55 extends upwardly at the extreme front of the entrance apparatus to support the rearward end of the guide 12. This is followed by a fixed guide 56 which extends into the open end of a funnel member 58. The rearward end of the member 58 forms a split clamp 59 which engages the forward end of a switch pipe 61 and remains in fixed relation thereto. The funnel member 58 is provided at each side with horizontal trunnions 62 on which are mounted rollers 63 which ride in slots 64 formed in vertical side plates 65 and 66. These slots incline slightly downwardly in the forward direction.

The switch pipe 61 extends forward and more or less horizontally to a point adjacent the disks 29 and 31. At a part thereof adjacent the forward end, the pipe passes through and is rigidly connected to a support member 67, as is best shown in Figure 7. The support member extends downwardly from the pipe and is provided at its lower end with a transverse journal 68 on which are mounted rollers 69 and 71. These rollers ride in slots 72 and 73 formed in side plates 74 and 75, respectively. The slots are inclined upwardly and forwardly at an angle of around 45° to the horizontal. The portion of the pipe lying forwardly of the support member 67 has the upper part removed so that it has the appearance of a semi-circular trough. Over this open portion of the pipe extends an elongated hood 76 which is hingedly connected at its intermediate portion to the support member 67 by means of a pivot pin 77. At its rearward end it is provided, as is evident in Figure 6, with a transverse journal 78 having rollers 79 and 81 mounted thereon. The rollers are carried in and guided by slots 82 and 83 which are formed in the side plates 74 and 75, respectively. The slots are smoothly curved and have a first rearward portion which is practically horizontal, which portion merges smoothly into a second, forward portion which is inclined upwardly and forwardly at an angle to the horizontal approximately the same as that of the slots 72 and 73.

Mounted on the rearward ends of the side plates 74 and 75 is a pneumatic linear actuator 84 having a cylinder 85 and a piston rod 86 aligned centrally of the plate at the same angle as the slots 72 and 73. The forward end of the piston rod is connected by a yoke 87 to the journal 68 at the lower end of the support member 67. At the other end of the cylinder is mounted a solenoid-actuated pilot valve 88 which is connected through a shutoff valve 89 to an air reservoir 91. The pilot valve is connected to means not shown, for actuation in response to a preselected location of the rod relative to the shear. Other means, not shown, is provided to keep the air reservoir filled with air under pressure.

A coolant pipe 92 runs between the receiver housing 35 and the entrance apparatus 53 and is provided with apertures on its lower surface to permit water cooling of the switch pipe.

The operation of the invention will be readily under-

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stood in view of the above description. Referring to Figures 2 and 3, a length of rod leaves the rolling mill stand 11 and passes through the guide 12 to the shear 10. The front end will pass through the pipe 61, under the shear blades 29 and 31, and will then enter the receiving housing 35. It will then enter the lower guide 14 and enter the reel 23 after passing through the water boxes 15, 16 and 17. When half of the rod has passed through the shear, the bight of the rod is moved upwardly into contact with blades; the peripheral movement of the rotating blades is such as to grasp the rod and move it upward between them, thus severing it. The rear half of the rod length now resides above the blades and it enters the receiving housing 35 on a level with the guide 13. The rod enters the guide 13 and, after passing through the water boxes, enters the reel 22 to be formed into a coil.

Now, the shear blades move the rod upwardly at a very high rate of speed, i.e., much faster than it is possible to move the switch pipe 61. For that reason, in the past, the blades have bent the front end of the rear half of the rod upwardly because the rod has been held within the switch pipe except for the short length between the forward end of the pipe and the plane of the blades. This "hook" formed on the leading end of the rear half of the rod length prevented the rod from passing smoothly through the remainder of the apparatus and often caused cobbles. In the present arrangement, the admission of air into the cylinder 85 causes the piston rod 86 to move upwardly carrying the support member 67 and the switch pipe 61 with it. The upward movement is restrained to a preselected rate and path by the action of the rollers 69 and 71 in their respective slots 72 and 73. As the pipe and support member move upwardly they carry the hood 76 with them through the medium of the pivot pin 77. As the rod approaches its position of contact with the blades, the rearward end of the hood remains at the same level because of the engagement of the rollers 79 and 81 in the first portions of the slots 82 and 83; this lifts the hood well away from the pipe before the rod strikes the blades. Since the upper part of the forward portion of the pipe is open and the hood is removed, the rod is uninhibited in its rapid movement through the blades. After the rod has passed through the blades, the second portions of the slots 82 and 83 permit the pipe to catch up with the hood, so that the hood overlies the open part of the pipe and the rod is again completely enclosed for adequate guiding.

Before the upward movement of the rod for cutting takes place, the rod passes through the receiving housing in contact with the floor formed by the shoulders 51 and 52 on its way to the guide 14. After cutting takes place, the front half of the rod length continues forward in this same manner. The rear half, however, is on a much higher level. The front end of this rear half is thrown upwardly and strikes the lower edge 43 of the striking plate 42 with considerable force. With prior art constructions, this sometimes resulted in the bending or other deformation of the end of the rod and in subsequent difficulty in passage through the remainder of the apparatus. In the present arrangement, however, the front end slides smoothly along the curved surface of the striking member and is directed into the guide 13. The sharp curvature at the entrance end in the portion 44 assures that the rod end is instantly directed away from any erratic movement and places it under immediate control, while the smooth curvature of the portion 56 directs it smoothly into the guide 13. This is indicated in Figure 10 in which the dashed line indicates the path followed by the front end of the forward half of the rod, while the dash-dot line is the path of the front end of the rearward half.

It is obvious that minor changes may be made in the

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form and construction of the invention without departing from the material spirit thereof. It is not, however, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such as properly come within the scope claimed.

The invention having been thus described, what is claimed as new and desired to secure by Letters Patent is:

1. A shear for rod and the like comprising two blades mounted for rotation on parallel axes and adapted to sever a length of rod into front and rear halves by passage therebetween, a switch pipe for moving the length of rod laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the receiving housing having a plane surface along which the front half of the length of rod slides before the rod is severed and a curved surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end, the switch pipe having an open portion adjacent the blades, a hood, and means to cause the hood to cover the open portion of the pipe at all times except during the severing of the rod.

2. A shear for severing a length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes and adapted to sever a length of rod into front and rear halves by lateral movement therebetween, a switch pipe for moving the length of rod laterally between the blades, a receiving housing located on the side of the blades opposite the pipe and which the rod enters after passing longitudinally the plane of the blades, the receiving housing having a horizontal plane surface along which the front half of the rod slides and a curved surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end, the switch pipe having an open portion adjacent the blades, a hood normally covering the open portion of the pipe, and means for moving the hood away from the open portion of the pipe during the passage of the rod between the blades.

3. A shear for dividing a length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes and adapted to sever a length of rod into front and rear halves by passage therebetween, a switch pipe, means for moving the pipe and the length of rod contained therein laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the receiving housing have a plane surface along which the front half of the length of rod slides before the rod is severed and a curved surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end, the switch pipe having an open portion adjacent the blades, and a hood normally covering the open portion of the pipe, the means for moving the pipe also serving to move the hood away from the open portion of the pipe during the passage of the rod between the blades.

4. A shear for dividing a length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes, the blades residing side by side in closely adjacent relationship and adapted to sever a horizontally longitudinally-moving length of rod into front and rear halves by vertical lateral passage therebetween, a switch pipe for containing and guiding the length rod in its longitudinal movement, means for moving the pipe and the length of rod vertically laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after pass-

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ing the blades, the receiving housing having a horizontal plane surface below the level of the blades along which the front half of the length of rod slides before the rod is severed and an opposed curved surface spaced from the plane surface and above the level of the blades along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end, the switch pipe having an upwardly-opening portion adjacent the blades, and a hood covering the open portion of the pipe, the means for moving the pipe also serving to remove the hood from the said portion of the pipe during the vertical passage of the rod between the blades.

5. A shear for dividing a longitudinally-moving length of rod or the like comprising two blades mounted for rotation on parallel axes and adapted to sever the length of rod into front and rear halves by passages therebetween, a switch pipe for moving the length of rod laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the switch pipe having an open portion adjacent the blades, a hood mounted adjacent the pipe, and means to cause the hood to cover the open portion of the pipe at all times except during the severing of the rod.

6. A shear for dividing a longitudinally-moving length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes and adapted to sever the length of rod into front and rear halves by lateral passage therebetween, a switch pipe for guiding the rod, means for moving the pipe and the length of rod laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the switch pipe having an open portion adjacent the blades, and a hood covering the open portion of the pipe at all times except during the severing of the rod, the means for moving the pipe also serving to remove the hood from the open portion of the pipe during the passage of the rod between the blades.

7. A shear for dividing a horizontally and longitudinally-moving length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes perpendicular to the plane of the disks and adapted to sever the length of rod into front and rear halves by upward lateral passage therebetween, the disk blades residing side by side with their peripheries closely adjacent, a switch pipe for guiding the rod, means for moving the pipe and the length of rod vertically laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the switch pipe having an upwardly-opening portion adjacent the blades, and a hood covering the open portion of the pipe at all times except during the severing of the rod, the means for moving the pipe also serving to remove the hood from the said portion of the pipe during the passage of the rod between the blades.

8. A shear for dividing a longitudinally-moving length of rod or the like comprising two blades mounted for rotation on parallel axes and adapted to sever the length of rod into front and rear halves by passage therebetween, a switch pipe for moving the length of rod laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the receiving housing having a plane surface along which the front half of the length of rod slides before the rod is severed and a curved surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end.

9. A shear for dividing a longitudinally-moving length

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of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes and adapted to sever the length of rod into front and rear halves by lateral passage therebetween, a switch pipe for guiding the rod, means for moving the pipe and the length of rod laterally between the blades, a receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the receiving housing having a plane surface along which the front half of the length of rod slides before the rod is severed and a curved surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end to a large radius of curvature at the discharge end.

10. A shear for dividing a horizontally-moving length of rod or the like comprising two coplanar disk blades mounted for rotation on parallel axes perpendicular to the plane of the disks and adapted to sever the length of rod into front and rear halves by upward lateral pas-

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sage therebetween, the disk blades residing side by side with their peripheries closely adjacent, a switch pipe for moving the length of rod laterally between the blades, an open-ended receiving housing located on the opposite side of the blades from the pipe and which the rod enters after passing the blades, the receiving housing having a horizontal plane surface along which the front half of the length of rod slides before the rod is severed and an opposed curved surface spaced from the plane surface along which the rear half of the length of rod slides after the rod is severed, the curve surface graduating from a small radius of curvature at the entrance end of the housing to a large radius of curvature at the discharge end, the open end of the receiving housing having outwardly-flaring plates for facilitating the entrance of the rod.

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