

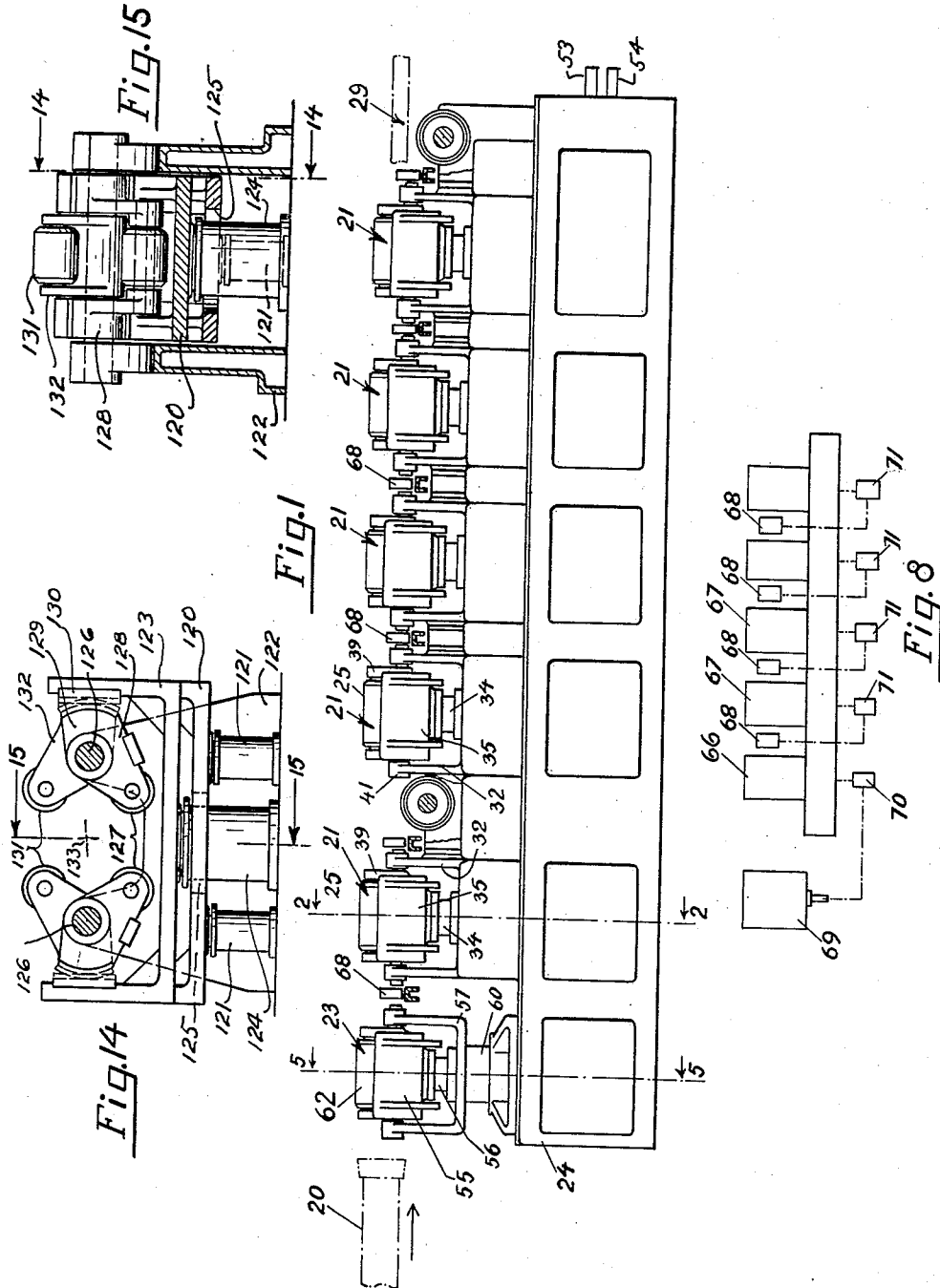
Aug. 17, 1954

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TUBE MILL GUIDE

2,686,444

Filed March 31, 1950

5 Sheets-Sheet 1



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5 Sheets-Sheet 2

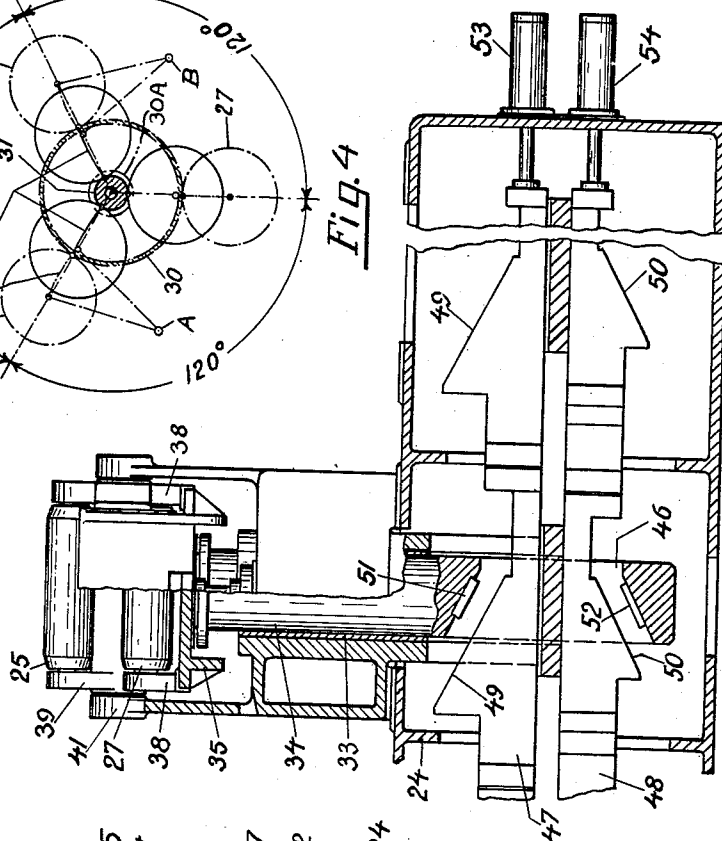
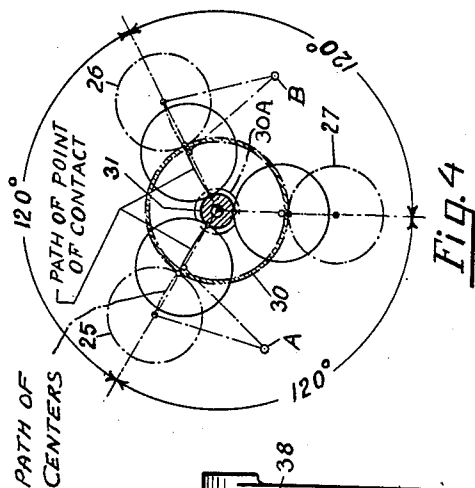


Fig. 3

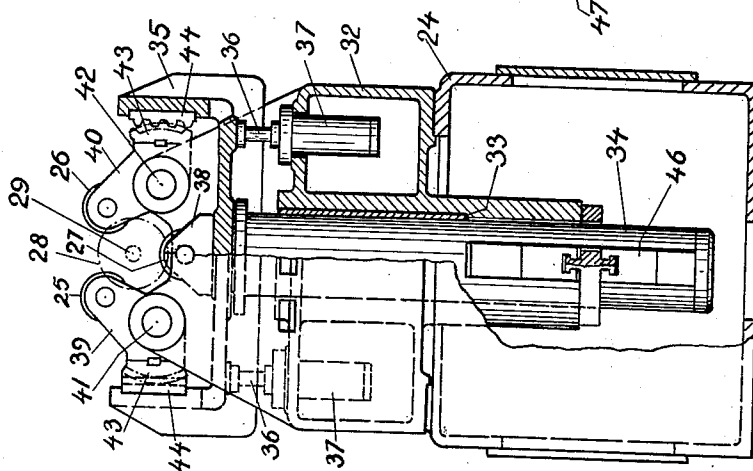


Fig. 2

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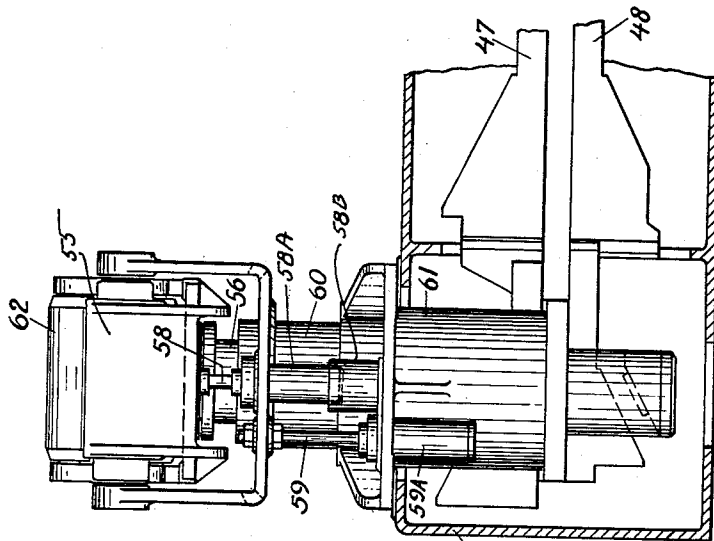


Fig. 6

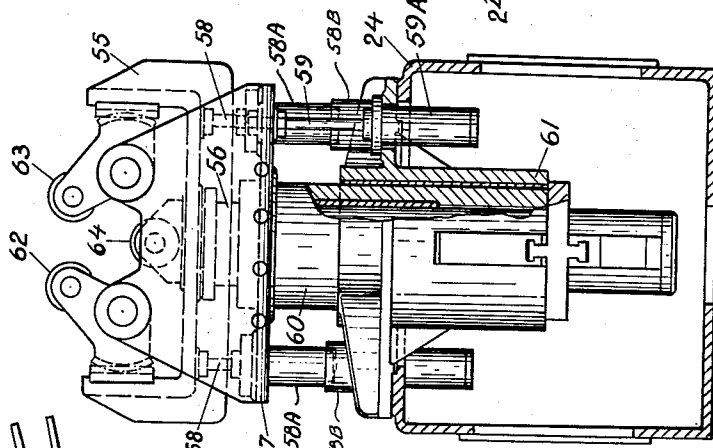


Fig. 5

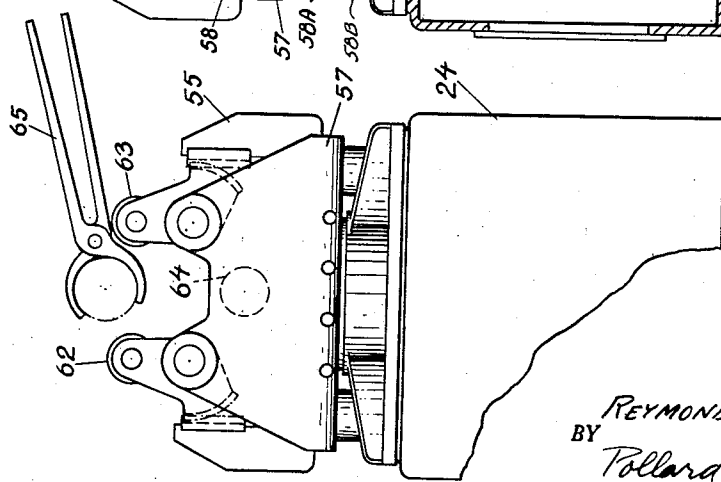


Fig. 7

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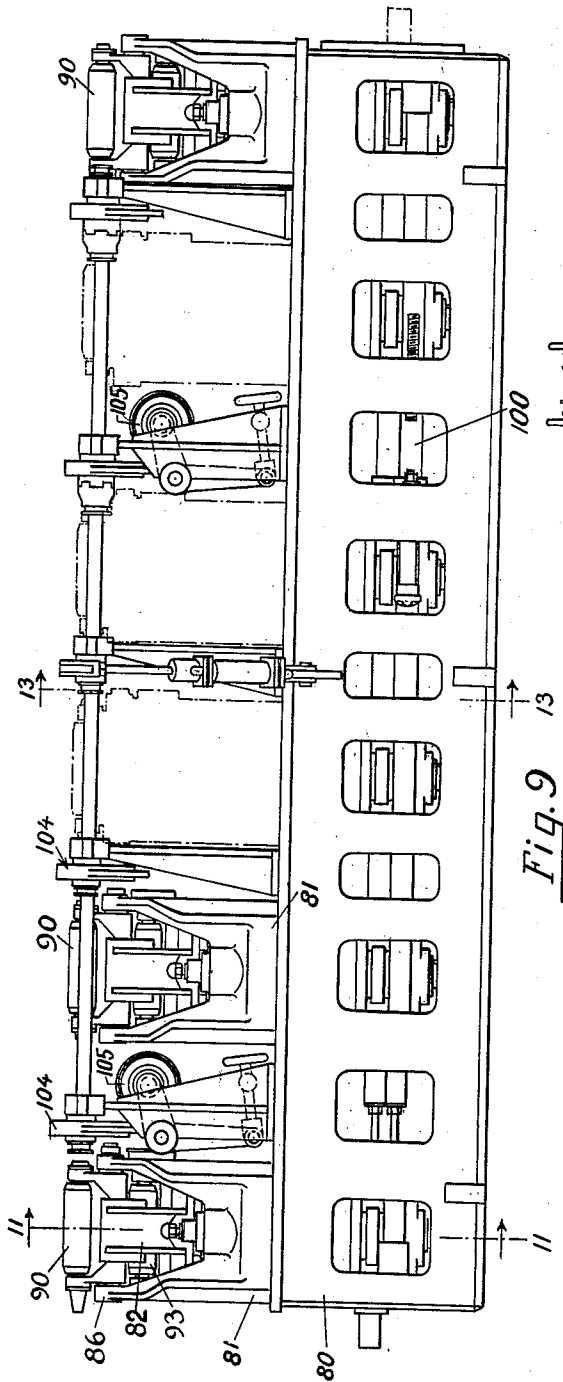


Fig. 9

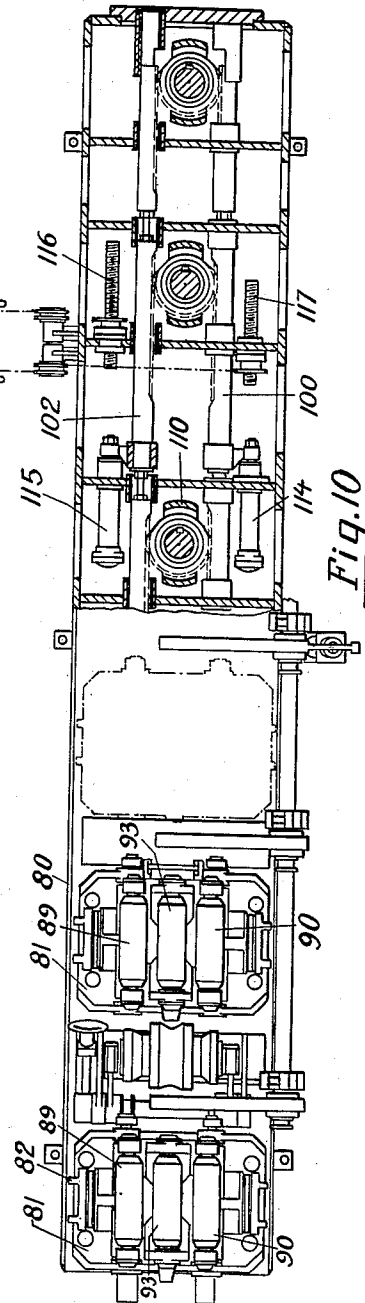


Fig. 10

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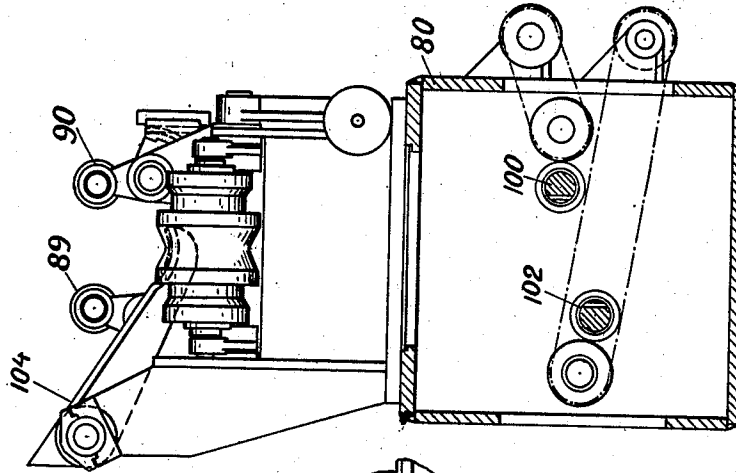


Fig. 13

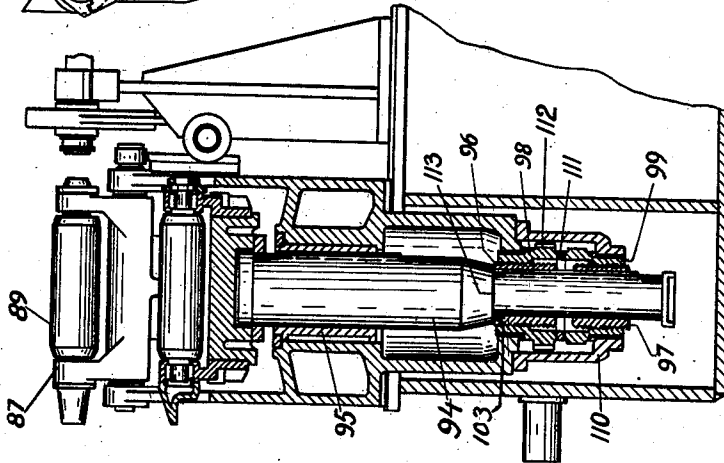


Fig. 12

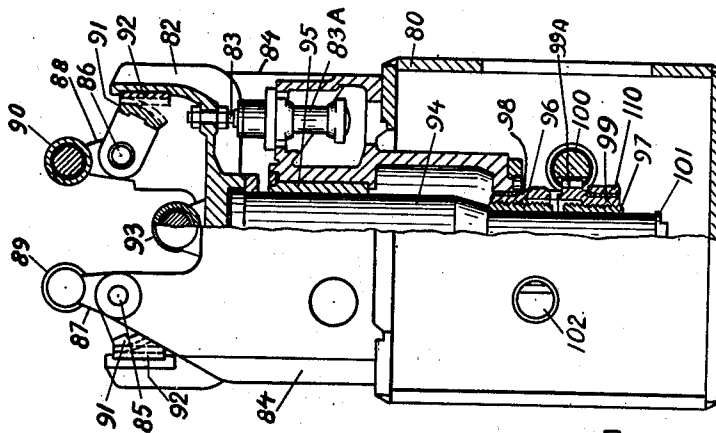


Fig. 11

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## UNITED STATES PATENT OFFICE

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## TUBE MILL GUIDE

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Application March 31, 1950, Serial No. 153,270

8 Claims. (Cl. 80—51)

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This invention relates to an outlet guide for a seamless tube mill or the like, and particularly to an arrangement guiding the rotating piercer rod before the pierced pipe emerges from the mill, and for holding the pipe with the piercer rod therein as the pipe emerges from the piercer mill.

In previous devices, difficulty has been encountered in accurately centering widely varying diameters of tubes and piercer rods encountered in tube mills. Because of the lengths involved, it is desirable to tightly grip the tube or rod so as to avoid vibration and shock. Also, it is desirable to be able to quickly adjust the mechanism for various size rods and pipes.

The tube mills contemplated are of well known types wherein a relatively thin and long piercer rod is used, the bloom or billet being forced over a mandrel carried on the piercer rod, conventional piercing rolls set askew relative to each other being employed.

One of the objects of the invention is to provide an improved arrangement for rigidly and accurately holding and guiding the piercer rod and pipe or tube being formed, the rod or pipe being held at a predetermined center or axis.

Another of the objects of the invention is to provide an easily adjustable guide arrangement for holding various size pipes and rods.

In one aspect of the invention, a plurality of stands are provided having guide roll members therein automatically adjustable so that they can closely engage the piercer rod, or open up and closely engage the exterior of the tube or pipe being formed. Arrangements also are provided to open the roll members to a position which is of greater diameter than the tube so as to permit the tube to be removed with ease. If desired, but not necessarily, the arrangement can have control devices associated therewith such that the stands can be made to automatically open as the formed pipe approaches the same.

In a preferred aspect, a plurality of roll means are provided on each stand, preferably three or more, said roll means being mounted on independently operated supports. The supports can be operated by suitable mechanism moving the roll means in and out relative to each other and the axis of the piercer rod or tube, the angular relationship between the roll means being maintained substantially constant for all adjusted positions. Preferably, the rolls or roll means are substantially equiangularly spaced so as to support the tube or rod equally around its circumference. Then, when the diameter is changed,

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the same relationship is maintained so as to equally support any size rod or tube.

The guide stands are located relatively close along the length of the apparatus. In one form, a specially arranged stand can be employed for moving the opened rolls to a lower position to provide easier access to the piercer mandrel. These and other objects, advantages and features of the invention will become apparent from the following description and drawings which are merely exemplary:

Figure 1 is an elevation showing one form of the invention.

Figure 2 is an enlarged view partially in section taken along the line 2—2 of Figure 1.

Figure 3 is a broken side view of the arrangement of Figure 2; Figure 3 being partially in section.

Figure 4 is a diagrammatic view showing the relative position of the supporting rollers.

Figure 5 is an enlarged view partially in section taken generally along the line 5—5 of Figure 1 showing one form which the first stand can take.

Figure 6 is a side view partially in section of Figure 5.

Figure 7 is a fragmentary end elevation of the first stand shown in Figures 5 and 6, but with the parts in another position.

Figure 8 is a schematic view illustrating a control apparatus for Figure 1.

Figure 9 is a side elevation of a modified form of the invention, portions being omitted.

Figure 10 is a plan view of Figure 9, portions being in section.

Figure 11 is an enlarged view partially in section taken approximately along the line 11—11 of Figure 9.

Figure 12 is a side view partially in section of Figure 11.

Figure 13 is a view taken approximately along the line 13—13 of Figure 9.

Figure 14 is a diagrammatic front view showing the invention with the use of four rolls and taken along the line 14—14 of Figure 15.

Figure 15 is a view taken along the line 15—15 of Figure 14.

In Figure 1, the piercer mill arrangement 20 is schematically shown, a billet ready to be pierced being indicated in dot-dash lines. A plurality of stands 23, 21 are provided for the purpose of supporting the piercer rod 29 and of supporting the pierced pipe as it is moved to the right from the piercer mill 20. The first stand 23 can be arranged with a double platform as will be de-

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scribed hereafter, so that it can be lowered sufficiently for the purpose of permitting changing of the piercing plug or mandrel with ease. As will be pointed out, it is not absolutely necessary, however, that the first guide stand be different than the other stands. The various guide stands are mounted on machine base 24, the guide stands being spaced relatively close together and only far enough apart to permit ejector arms and/or stripper rolls to be mounted therebetween.

First, a guide stand 21 remote from the first station will be described. As illustrated in Figure 2, three rolls 25, 26, 27 are employed to engage the exterior of the pipe 28 or the exterior of the piercer rod 29. The rolls are mounted so that they can be moved toward and away from each other to accommodate any particular diameter. At any adjusted point, substantially the same relative distance is maintained between the rolls and the center line or axis of the piercer rod. Also, preferably, substantially the same relative angle is maintained between the rolls, guide members, or roll means, in the form shown this angle being equal.

As illustrated in Figure 4, rolls 25, 26, 27 are shown in dot-dash lines in their maximum open position while engaging a relatively large pipe 30. The rolls are shown in full lines engaging a piercer rod 31 suitable for a smaller tube or for a tube having an outside diameter indicated at 30 and one of smaller diameter at 30A. Such a range of adjustment and movement has been very difficult to obtain in prior devices. The angular relationship between the three roll means will be maintained substantially the same. Normally and preferably, each roll means comprises a single roll, although in some instances a double roll may be employed.

Base 24 (Fig. 2) has frame 32 mounted thereon, said frame having a bushing 33. Guide plunger 34 is connected with reciprocating frame or crosshead 35, said reciprocating frame being reciprocable by pistons 36 operable by hydraulic cylinders 37. Roll 27 is mounted in bearings 38 on either side of reciprocable frame 35. Bell crank levers 39 and 40 are pivotally mounted at 41, 42 on either side of the stationary frame 32, said bell crank levers carrying rolls 25, 26 thereon. Each of said bell crank levers has arcuately arranged gear teeth 43 located thereon, said gear teeth being engaged by racks 44 located on an upstanding portion of the reciprocable frame 35.

When the reciprocable frame 35 is moved upwardly, central roll 27 will move upwardly and rolls 25 and 26 will be moved inwardly because of the engagement of the racks with the gear teeth on the bell crank levers, all of said rolls moving substantially equal increments at all times and the angular relationship being substantially the same. The pivot points 41 and 42 (A, B, Fig. 4) are located so that the proper relationship will exist between the rolls relative to the center of the tube or pipe to be held thereby to produce the desired movement. Referring to Figure 4, when three rolls are used, they are located substantially 120° apart for all adjusted positions. When more than three rolls are used, the angle can be suitably selected.

In order to limit adjustably the movement of the rolls in and out relative to each other, a slot 46 may be provided in guide plunger 34 through which longitudinally movable adjusting bars 47 and 48 can pass, said bars having sloping or cam surfaces 49 and 50, respectively. Hardened metal pads 51 and 52 may be provided on either side of

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slot 46 for engagement by surfaces 49 and 50, respectively.

The position of surface 49 can be adjusted so as to regulate the downward movement of the plunger 34 and thus the opening or gripping diameter of the rolls. The lower surface 50 can be positioned to govern the distance the plunger 34 can travel upwardly and thus the minimum diameter engageable by the rolls. As will be described hereafter, bars 47 and 48 can be reciprocated by hydraulic cylinders 53 and 54, or by any other suitable mechanism for the purpose of adjusting the limits of movement of the rolls.

The first stand (Figs. 5, 6) is arranged so that the rolls can be lowered more than the other guide stands to permit removal or replacement of the piercer mandrel at this point. Reciprocable frame 55 (Figs. 5, 6) is carried by plunger 56, said reciprocable frame 55 and plunger 56 being reciprocable relative to support 57 by hydraulic pistons 58 movable in cylinders 58A. Cylinders 58A are mounted on the second reciprocable frame 57. Protecting member 58B surrounds the lower portions of cylinders 58A. The support 57 is vertically reciprocable by means of hydraulic motors 59A operating piston rods 59, plunger 60 being reciprocable in the guide 61. Longitudinally reciprocable bars having adjusting surfaces, similar to those described for Figures 2 and 3, can be used to adjust the movement of the rolls. Rolls 62, 63 and 64 correspond to rolls 25, 26, 27 of Figures 2 and 3, these rolls being moved inwardly and outwardly by a gear and rack arrangement similar to that described for Figures 2 and 3.

In Figure 7, the arrangement of Figures 5 and 6 is depicted with the rolls open the maximum amount and the support 57 lowered to its lowest position. A pair of tongs 65 adapted to grip the tube or piercer head adjacent the first stand can be used.

One control arrangement for the apparatus just described is illustrated schematically in Figure 8, wherein the stands are diagrammatically shown at 66, 67, with photoelectric cell operated controllers therebetween. The piercer mill motor is schematically shown at 69 with a schematic wiring connection to the solenoid relay valve 70 of the hydraulic cylinders of the first stand 66. Each of the photoelectric cells 68 is shown schematically connected to a solenoid relay valve means 71 to operate the hydraulic control apparatus or cylinders for the stand involved, such controlling the supply of fluid thereto. A schematic connection is indicated between each relay valve 70, 71 with its stand. The piercer mill motor 69 is arranged so that when it becomes loaded due to operation on a billet or bloom at the start of a piercing operation, relay 70 will be operated or energized to control the hydraulic support to the cylinder means of the first stand so as to open the rolls of the first stand 66 sufficiently to adjust the guide to the exterior diameter of the pipe, the rolls previously having been closed on the long, thin piercer rod inserted from the right of the machine. As the leading pipe edge reaches each succeeding photoelectric cell, the next guide stand will be opened from engagement with the piercer rod to the diameter necessary to receive the exterior of the pipe. Various suitable photo-cell circuits and amplifiers can be used to control conventional valves, such as the usual solenoid operated relay valve, for the supply of hydraulic fluid to the hydraulic motors involved. The

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controls can be arranged to operate the hydraulic cylinder 53 as or just before the tube is completed, so as to move the surfaces 49 to permit the rolls to open up so as to facilitate removal of the pipe. Thus, as the pipe approaches the next stand, the pipe sensing means, such as a photocell, feeler means, or similar device, energizes the solenoid of the relay valve, which in turn moves said relay valve to admit fluid to the appropriate hydraulic motor of the roll stand.

A modified form of the invention is seen in Figure 9 wherein the adjusting means is arranged in a slightly different manner than that described for the form illustrated in Figures 1-8, inclusive. Frame 80 (Figs. 9, 10) supports guide stands 81, said guide stands having rollers mounted thereon as will be described hereafter.

Referring to Figure 11, base 80 has a reciprocating frame 82 movable by piston rod 83 operable by motor 83A. Stationary frame 84 has bell crank levers 87 and 88 pivoted at 85 and 86, said bell crank levers having rolls 89 and 90 carried thereby. The opposite ends of bell crank levers 87 and 88 have gear teeth 91 engageable with racks 92 so that reciprocation of the reciprocable frame 82 will cause rolls 89 and 90 to move toward and away from each other in conjunction with center roll 93. Center roll 93 is carried by the reciprocable frame 82, the rolls cooperating with each other in the same manner as described for Figures 1-8, inclusive.

Reciprocable frame 82 has a depending plunger 94 mounted in guide 95, the plunger sliding through a pair of screw-threaded bushings 96, 97. Bushings 96, 97 have nuts 98 and 99 connected respectively therewith. The nuts 98 and 99 are retained vertically by depending yoke 100, the nuts being separated by bushing 101 and being rotatable relative to each other. The lower vertically movable adjusting nut 99 is rotatable by longitudinally extending rack 100 through gear teeth 99A. The lower face of nut 97 serves as an abutment for the projection 101 of plunger 94 thus limiting upward movement of the plunger 94. The upper vertically movable adjusting nut 98 is operable by longitudinally extending adjusting bar 102 engaging gear teeth 102 of nut 98. The upper face 103 of nut 98 serves as a stop means for shoulder 103 of plunger 94 and thus limits downward movement thereof. The adjusting bars 100 and 102 may be operated by suitable hydraulic cylinders 104 and 105 (Fig. 10). Adjustable stops 106, 107 operated by control means 108 can be provided to limit movement of the bars 100, and 102. The stops can be adjusted in a manner similar to that described for the first embodiment of the invention.

Between each of the guide stands, a suitable ejector arrangement 104 (Figs. 9, 13) can be employed for lifting up the formed pipe. The ejector lever 104 can be operated by any suitable type of motor.

Other arrangements and numbers of guide rolls can be used, such as one wherein four rolls are employed instead of three, the rolls being mounted on independent supporting means, each of the support means being operable to move the rolls toward and away from a central axis as in the previous forms of the device.

One example of a suitable arrangement is illustrated in Figures 14 and 15 wherein two oppositely reciprocable platforms and frames are used. Inner reciprocable frame 120 can be reciprocated by hydraulic motors 121, 121 relative

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to the guide stand frame 122. The outer reciprocable frame 123 can be reciprocated by hydraulic motor 124, inner frame 120 being provided with a suitable aperture 125 through which the motor cylinder can extend. Pivot shafts 126 can have lower guide rolls 127 mounted on bell crank levers 128 which are pivotally carried by the shafts 126, there being one lever on each side of its respective inner reciprocable frame. Arms 129 of the levers are engageable with suitable gear racks 130 mounted on the outer reciprocable frame 123. The upper rolls 131 are carried on bell crank levers 132 which are mounted on shafts 126. The ends of the bell crank levers 132 are provided with suitable gear tooth sectors engageable with gear racks on the inner reciprocable frame 120.

Operation of the rolls is effected by an opposite reciprocation of the inner frame relative to the outer frame, so that the independent roll supports are moved inwardly and outwardly relative to a central axis at 133.

It is to be understood that various details of the construction can be changed without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. In an outlet guide for a seamless tube mill, having a piercer rod and tube manipulating mechanism, the combination including a guide stand frame, a reciprocable means on said frame, a guide roll connected to said reciprocable means and reciprocating therewith, a pair of guide rolls pivotally mounted on said guide stand frame, and connections between said reciprocable means and said pivotally mounted guide rolls, operating said pivotally mounted guide rolls toward and away from each other, so that all of said guide rolls move inwardly and outwardly relative to the central axis of the piercer rod and tube as said reciprocable means is operated.

2. In an outlet guide for a seamless tube mill, having a piercer rod and tube manipulating mechanism, the combination including a guide stand frame, a guide roll mounted on a reciprocable support, a pair of bell crank levers pivotally mounted on said guide stand frame, guide rolls adjacent one end of each of said levers, gear teeth adjacent the other end of said levers, and racks on said reciprocable support engaging said bell crank gear teeth, so that movement of said reciprocable support will cause all of said guide rolls to move inwardly and outwardly relative to each other and to a central axis to accommodate selectively rods and tubes of different sizes.

3. In an outlet guide for a seamless tube mill, having a piercer rod and tube manipulating mechanism, the combination including a guide stand frame, a platform reciprocably mounted on said frame, hydraulic motor means connected to said platform, a guide roll means mounted on said platform, gear racks connected to said platform and mounted on either side of said guide roll means, bell crank levers pivotally mounted on said guide stand frame on either side of said guide roll, guide roll means on the inner ends of each of said bell crank levers, gear teeth on the other end of said bell crank levers engageable with said gear racks, so that reciprocation of said platform will cause movement of said rolls inwardly and outwardly relative to each other and a central axis.

4. In an outlet guide for a seamless tube mill,

having a piercer rod and tube manipulating mechanism, said piercer rod and mechanism having an axis along which a tube moves, the combination including a guide stand frame, a plurality of guide roll means on said stand, independent support means for each of said guide roll means, support moving means including a reciprocable movable member having spaced motion limiting abutments thereon, screw threadedly adjustable motion limiting means located in the path of said abutments and contactable by said abutments, and longitudinally movable adjustable means movable relative to said frame and connected to said screw threadedly adjustable motion limiting means adjustably limiting movement of the support moving means, so as to control the opening between said guide members.

5. In an outlet guide for a seamless tube mill having a piercer rod, said piercer rod having an axis along which a tube moves, the combination including a guide stand frame, at least three guide roll means on said stand, independent support means for each of said guide roll means including at least two independent pivotally mounted arm supports for at least two of said guide roll means, only one guide roll means being mounted on each arm, and a third support means independently supporting the other guide roll means, said third support means being movable in conjunction with said pivotally mounted arm supports, and means connected with all of said support means operable to move all of said support means to various positions toward and away from the axis of said rod with each of the guide roll means substantially equiangularly spaced from each other and equidistant from said axis of the piercer rod.

6. In an outlet guide apparatus for a seamless tube mill having a piercer rod and a plurality of guide stands for supporting said rod and a tube pierced thereby, the combination comprising at least three guide roll means on each stand movable to closed and open positions to support a rod and tube selectively, said guide roll means being in closed position at the beginning of an operation to hold said piercer rod, means independently supporting each of said guide roll means and moving the guide roll means in substantially equiangularly spaced paths at all times, hydraulic operating means connected to said guide roll means, hydraulic control means connected to said hydraulic operating means, adjustable motion limiting mechanism having spaced control surfaces contactable with said operating means, said operating means positioning said guide roll means in closed rod supporting position when one of said surfaces is contacted and positioning said guide roll means in open tube supporting position when contacting the other surface, and tube presence detecting means automatically activating said control means as a tube approaches each stand to move said guide roll means from a closed roll supporting position to an open tube supporting position.

7. In an outlet guide apparatus for a seamless tube mill having a piercer rod and a plurality

of guide stands for supporting said rod and a tube pierced thereby, the combination comprising at least three guide roll means on each stand movable to closed and open positions to support a rod and tube selectively, said guide roll means being in closed position at the beginning of an operation to hold said piercer rod, a pair of bell crank levers pivotally mounted on each guide stand and a reciprocable support on each stand to actuate said bell crank levers, said levers and support each carrying one of said guide roll means, said guide roll means being movable in substantially equiangularly spaced paths at all times, hydraulic operating means connected to said guide roll means, hydraulic control means connected to said hydraulic operating means, adjustable motion limiting mechanism having spaced control surfaces contactable with said operating means, said operating means positioning said guide roll means in closed rod supporting position when one of said surfaces is contacted and positioning said guide roll means in open tube supporting position when contacting the other surface, and a photoelectric cell tube presence detecting means automatically activating said control means as a tube approaches each stand to move said guide roll means from a closed roll supporting position to an open tube supporting position.

8. In an outlet guide for a seamless tube mill having a piercer rod, said piercer rod having an axis along which a tube moves, the combination including a guide stand frame, at least three guide roll means on said stand, independent support means for each of said guide roll means including at least two independent pivotally mounted arm supports for at least two of said guide roll means, only one guide roll means being mounted on each arm, and a third support means independently supporting the other guide roll means, said third support means being movable in conjunction with said pivotally mounted arm supports, means connected with all of said support means operable to move all of said support means to various positions toward and away from the axis of said rod with each of the guide roll means substantially equiangularly spaced from each other and equidistant from said axis of the piercer rod to move said guide roll means between rod guiding and tube guiding positions and so as to accommodate and accurately center various sizes of tubes and piercer rods, and reciprocable means carrying said independent support means and movable toward and away from the axis of said rod for lowering said guide roll means as a unit so as to obtain access to the piercer rod.

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