Jan. 13, 1959 A. L. THURMAN ET AL 2,868,348

ROLLING MILL KICKOUT APPARATUS

Filed Oct. 18, 1956 3 Sheets-Sheet 1

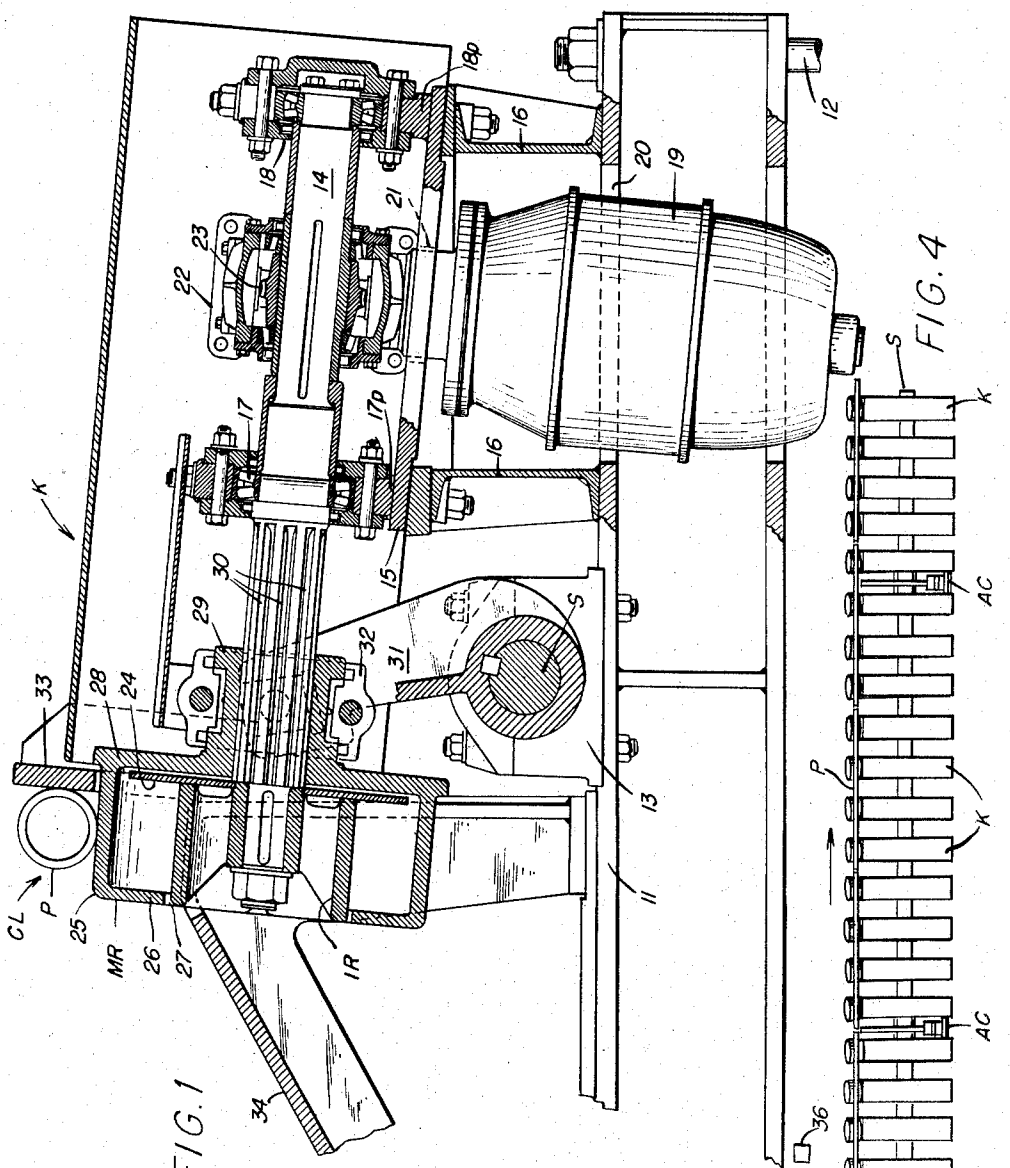


FIG. 1

FIG. 4

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FIG. 2

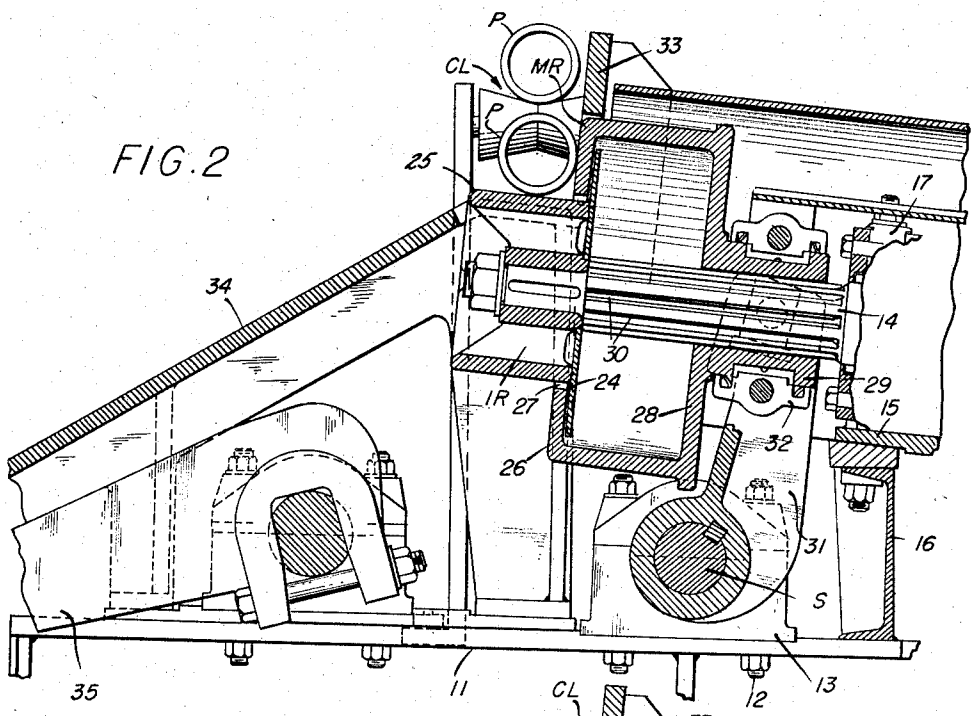
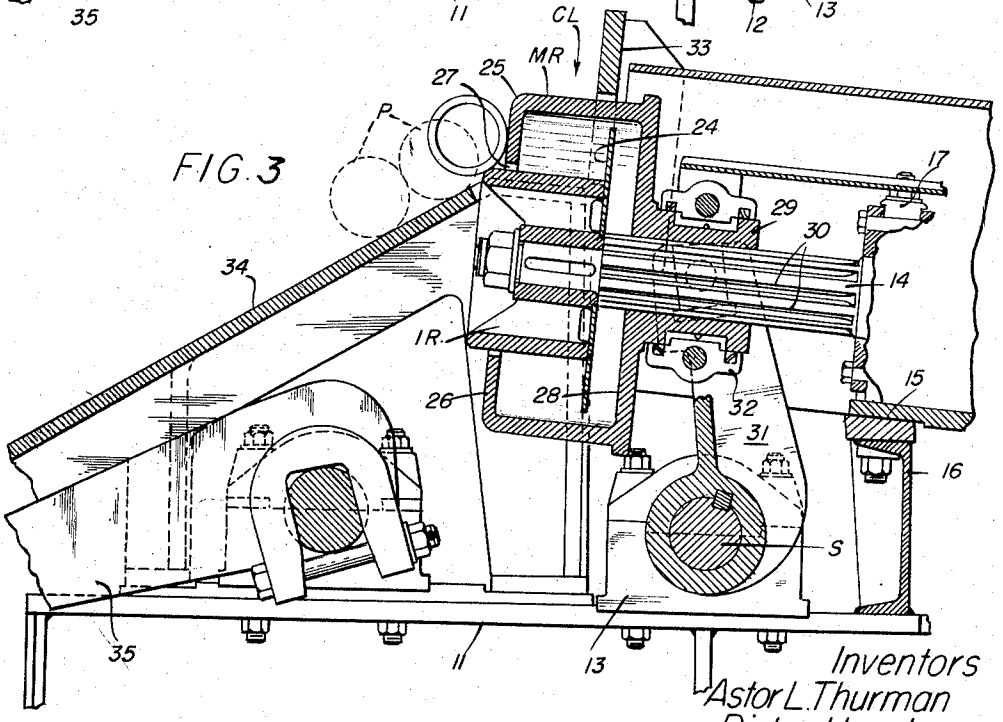


FIG. 3



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FIG. 5

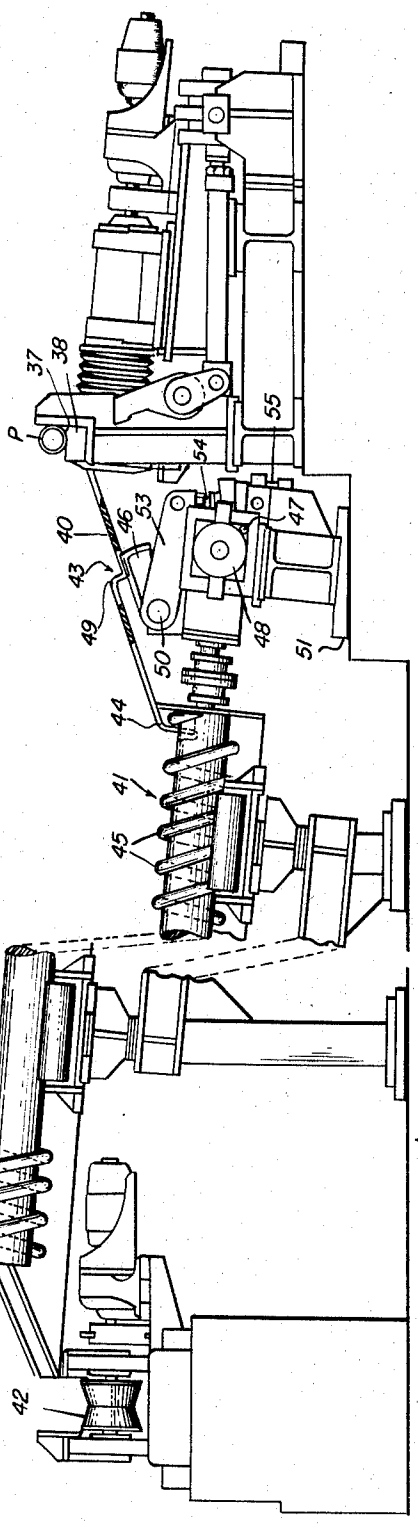
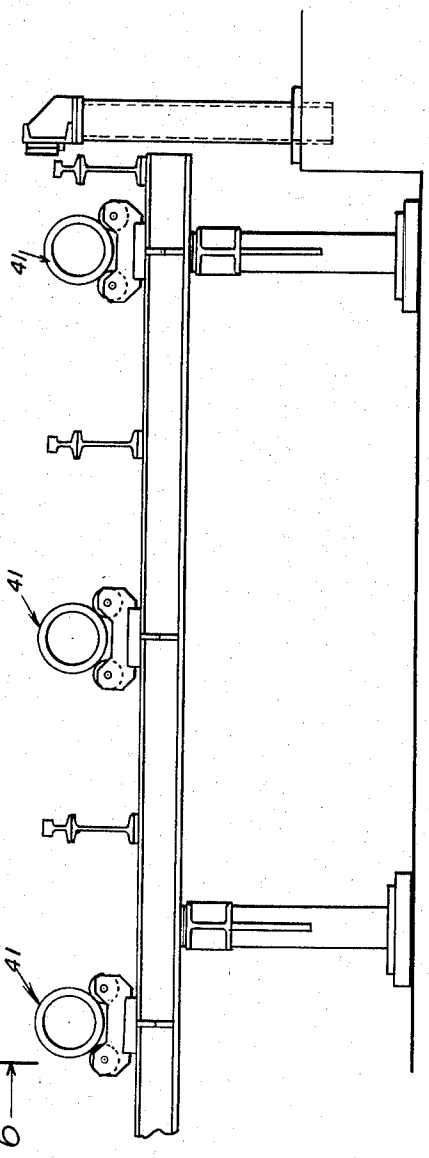


FIG. 6



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United States Patent Office 2,868,348 Patented Jan. 13, 1959

2,868,348

ROLLING MILL KICKOUT APPARATUS

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Application October 18, 1956, Serial No. 616,779
9 Claims. (Cl. 198—21)

This invention relates to rolling mill kickout apparatus for transferring laterally pipe, rods or the like while they are being conveyed lengthwise on a conveyor. More particularly the invention relates to a kickout for use in handling hot finished pipe at high speed in a tube rolling mill. The invention will be described in an embodiment adapted to receive separate or discrete pipe lengths from a stretch reducing mill and to transfer the pipe lengths to cooling beds, although the invention is not limited to such use.

In a seamless tube rolling mill, after the discrete lengths of pipe have been through a stretch reducing or sizing mill they go through cooling beds. The outlet conveyor from the sizing mill moves the pipe lengths lengthwise, i. e. axially, at a high rate of speed and the lengths of pipe are correspondingly spaced apart. It is necessary to stop their forward movement and to move them sidewise onto a laterally moving cooling bed. Ordinarily the pieces of pipe are short enough so that several lengths can be assembled close together on the cooling bed. No satisfactory way has heretofore been known of assembling a plurality of lengths serially close together, stopping their axial movement, and then moving them laterally out of the conveyor line in time for the kickout to receive the following pipe at the speeds at which it is coming in modern high speed mills.

It is an object of the present invention to stop the axial movement while assembling the lengths of pipe and to kick them out of the conveyor line in time to receive the next length.

It is characteristic of the invention that the new kickout has two rolls positively driven, at least one being driven at a speed less than the axial rate of movement of the pipe, and that while still kicking out one group of pipe lengths the kickouts are so constructed as to be ready to receive the next group. Specifically, the kickout contains a lower or inner roll which comprises rotatable means positively driven at a peripheral speed less than the axial speed of the pipe lengths to be kicked out. There also is an axially movable roll outside or at a higher level than the inner roll adapted to kick one pipe length out of the conveyor line while receiving the next pipe length. Other features of the invention will be described in the following specification.

In the drawings:

Fig. 1 is a view in cross section through the axes of the rolls and across the conveyor line as a pipe length first enters a kickout made according to the invention.

Fig. 2 is a similar view in cross section of the rolls of Fig. 1, showing the outer roll retracted, one pipe length down on the inner roll and the next length still on the conveyor line.

Fig. 3 is a view similar to Fig. 2, showing the outer roll in the process of ejecting a pipe length and yet positioned to receive the next pipe length.

Fig. 4 is a diagrammatic plan view of a series of the new kickout units and the common operating shaft for the kickouts and the two air cylinders for operating the shaft.

Fig. 5 is a view in side elevation of another form of the new kickout associated with a screw conveyor cooling bed. The center of the bed is omitted.

Fig. 6 is a view in cross section of a plurality of

screw conveyors such as shown in Fig. 5, taken approximately on the line 6—6 of that figure.

The kickout itself will be described first and then the mechanism which synchronizes it with the cooling bed.

In Fig. 4 is shown in diagram a series of twenty-two kickouts K arranged in line so as to receive pipe lengths P from the high speed conveyor line CL. To give the kickouts their ejecting action, a common operating shaft S is provided. Oscillatory action is imparted to the shaft S by two air cylinders AC, through any suitable conventional means (not shown). It could also be obtained from a rotating motor. The arrow pointing to the right in Fig. 4 indicates the direction of approach of the pipe from the sizing mill.

In Fig. 1 the common operating shaft S for the kickouts appears in the center of the figure and a length of pipe P coming in on the conveyor line CL appears in section at the top of the figure. This length of pipe P is shown resting upon the peripheral surface of a rotating and axially movable outer receiving roll MR whose axle is tilted slightly clockwise from the horizontal as it appears in this figure. The axis of the roll is at right angles to the conveyor line CL. This tilts the roll a little away from the side to which the pipe is to be kicked out. This first or outer roll is at the level of the conveyor line and in line therewith. Inside this movable outer roll MR is a smaller fixed inner receiving roll IR revolving on the same axle. Axial reciprocation of the outer roll MR is imparted by the common operating shaft S, as hereinafter described. Each of the two rolls receives at the proper time the lengths of pipe on its periphery. The second roll is at a lower level but need not necessarily be located at the same point in the pipe length travel and therefore inside the first roll.

Each new kickout structure K is mounted on a steel base **11** bolted to the mill floor by bolts **12**. The common operating shaft S held in pillow blocks **13** is bolted on top of the base **11**. The outer and inner rolls MR and IR are also supported from the base **11** by means of their common axle **14** which is held on a support plate **15** bolted to channel beams **16** welded or otherwise secured on top of the base at the right of the figure. To thus support the axle **14**, two roller bearings are supported in axially spaced posts **17** and **18** provided on the support plate **15**, the post **18** holding the rear end of the axle and the center post **17** holding the axle at a point about midway between the rear end and the two rolls MR and IR. To rotate this axle for the rolls, an electric motor **19** is provided. This motor **19** is suspended to one side and below the axle **14** in openings **20** in the base **11** and opening **21** in the axle-support plate **15**. To connect the motor and axle, the plate supports at its rear edge, i. e. behind the axle as viewed in Fig. 1, a gear box **22** driven by the motor. By means of a gear **23** on the axle **14** meshing with a gear (not shown) on the shaft of the motor, the proper speed ratio is obtained. For an example of a suitable speed ratio, a motor with an R. P. M. of 1750 may be used and a gear box with a ratio of 3.5 to 1. The movable outer roll MR may be sixteen inches in diameter and the inner roll IR ten and five-eighths inches in diameter.

The inner roll IR is bolted tight on the forward or higher end of the axle **14**. An annular stop plate **24** is fixed on the axle against the inner face of this inner roll. The inner roll is covered by the outer roll when the latter is in its outermost position, as shown in Fig. 1. The axle has no movement in the axial direction.

The axial reciprocation of the movable outer roll is

obtained by the following means and in the following manner. The outer roll has a cylindrical periphery 25 with an end or outer flange 26 extending radially inward therefrom but leaving a central opening 27 just large enough for passage of the inner roll through it. The flange and periphery are supported by an inner wall 28 radially extending from a hub 29 which engages the axle 14. Between the rolls and the post 17, the axle has a number of grooves 30 cut in it and the hub has corresponding ribs fitting slidably in the grooves. The hub 29 of the outer roll is shorter than the grooves, so it is possible to retract the outer roll and uncover the inner roll IR by sliding the hub 29 toward post 17 along the grooves 30.

The common operating shaft S controls and causes this reciprocatory movement by means of a rocking lever 31 provided for each kickout K. Each lever extends upward to a point opposite the center line of the axle 14. A block 32 is pivotally mounted on the upper end of the lever and the block surrounds the hub 29 of the movable roll. The hub is free to turn inside the block. The forward or outer position of the movable roll MR where it covers the inner roll IR is in line with and at the level of the conveyor line, as shown in Fig. 1. In Fig. 2 the outer roll is shown retracted out of the path of the pipe lengths on the conveyor line uncovering the inner roll and leaving the latter to receive any pipe lengths above it. A guard plate 33 carried by the common shaft pillow block 13 can be provided above the outer roll MR at the lower edge of the periphery of the roll. This keeps the pipe lengths P in the conveyor line in spite of the slope of the axle and regardless of the position of the outer roll. The outer roll reciprocates under the guard plate. If desired, a rim 37 can be added on the roll 38 in place of the guard plate 33 of Figs. 1–3 (see Fig. 5). It will be seen that a unitary, positive drive means is thus provided for the two rolls. It should also be noted that the peripheral speed of the inner roll is less than the linear speed of the oncoming pipe lengths.

Opposite the highest point of the periphery of the inner roll IR and downwardly to the left and away from the rolls toward the side where the pipe lengths are to be ejected, is an apron 34. As can be seen from Fig. 3, when the outer roll has been retracted as shown in Fig. 2 and a pipe length P has dropped onto the inner roll, the return of the outer roll to its outer position will cause the pipe length to be kicked off the inner roll by the outer flange 26 as shown by the pipe length in solid line position in this figure. This starts the pipe length rolling laterally down the apron 34, as shown by the two dotted line showings. The reciprocating lever 35 at the left of Figs. 2 and 3 is a simple form of feeder to control the placement of the pipe lengths on the cooling bed. A preferred form of means to feed the pipe lengths on a screw type cooling bed is shown in Figs. 5 and 6. The same type of synchronism may be used with a chain type bed with dogs.

With the movable roll MR in the position of Fig. 1, it is ready to receive the oncoming pipe. When the pipe lengths have arrived on a sufficient number of the kickouts K, an electric eye 36 (see Fig. 4), acting as control means, causes the air cylinders AC to turn the common operating shaft S and thus move the movable outer rolls in all kickouts to retracted position simultaneously. As shown in Fig. 2, this allows the pipe lengths to fall down on the inner rolls IR. Because the inner rolls are positively driven at a peripheral linear speed less than the axial speed of the pipe, the latter is caused to lose speed down to the peripheral speed of the inner roll. When the pipe lengths have reached the proper position, the electric eye 36 causes the outer rolls to return to their outermost position, kicking the pipe P off onto the apron 34, as shown in Fig. 3, and out of the conveyor line CL. It will be seen that pipe lengths are pushed off by all the outer rolls simultaneously. This makes it possible to handle pipe of any length merely by adjusting the electric eye control. It also ensures that the pipe lengths arrive at each entering position of the cooling bed simultaneously, making it simple to fill all the cooling bed.

It will be noted that during the return of the movable roll to the out position (see Fig. 3) as well as when it has reached the outer position (see Fig. 1), this roll is ready to receive the next length of pipe. In fact, as soon as the old length is out of line with the conveyor line, the movable roll is ready to receive the oncoming lengths of pipe. The rolls rotate continuously. Thus, by proper operation the kickout unit is able to dispose of successive pipes at high speed. The positive lower speed of the inner roll and the bringing of that feature to bear on the problem of stopping axial movement while the outer roll is assuming a position to eject the roll, play large parts in the effectiveness of the kickout.

Figs. 5 and 6 of the drawings show means for delivering the pipe lengths to the cooling bed in proper timed relation to the screw movements in the cooling bed. This delivery means is indexing mechanism which assures that the pipe lengths are delivered at the proper time with relation to the threads on the screws of a screw conveyor bed or the chain dogs on a chain type bed. The indexing mechanism is shown actuated from a rotary limit switch driven by the drive of a screw type conveyor cooling bed.

In Figs. 5 and 6 the pipe lengths P enter an apron 40 from the kickout at the right of the figure and travel up the screws 41 from right to left. They then drop off onto an axial conveyor 42 lying across the end of the screw conveyor. The axial conveyor 42 may take the pipe lengths to a second cooling bed or whatever other operation is to take place next.

The preferred kickout apron 40 in Fig. 5 has an offset intermediate its ends which forms a shoulder 43 that holds back pipe lengths kicked onto the apron by the outer roll. When a pipe length is raised over this shoulder the apron lets the pipe fall onto the screw 41 over the apron. The lower end 44 of the apron overlaps the end of the screw by more than the thickness of a thread 45 on the screw. The lower end 44 of the apron is cut away to permit the thread 45 to turn inside it and thus cause the thread convolution to reciprocate in under the end 44 of the apron and out again. Thus a pipe length falling onto the screw 41 when the end thread convolution on the top of the screw is under the end 44 of the apron will be picked up by that convolution and started on its travel across the bed.

To release the pipe lengths from the shoulder 43 of the apron one at a time and in synchronized relation with the rotation of the screw 45, a raise arm 46 at the shoulder 43 is operated by a rotary limit switch 47 actuated by the drive 48 for the cooling bed. There is a slot 49 in the apron at the shoulder and the raise arm 46 is adapted to rise through this slot under the leading pipe length P resting against the shoulder 43. This lifts the pipe length clear of the shoulder so that it can roll down the rest of the apron onto the screw. The arm 46 is tight on a horizontal shaft 50 pivotally supported above the end of the screw 41 by a base 51 carrying the drive 48 for the screw. Also tight on the shaft 50 is a connecting lever 53 pivotally connected to a plunger 54 adapted to move in a vertical hydraulic cylinder 55. This cylinder is filled and emptied with liquid under the control of the rotary limit switch which may, for example, be tripped each way once every revolution of the screw 41. When the cylinder 55 is filled with liquid the connecting lever 53 rises and the shaft 50 raises the arm 46, freeing a pipe length from the shoulder 43. This is one manner in which the arrival of each pipe length at the screw can be synchronized with the longitudinal position of the thread convolutions on the screw so as to pick up the pipe length properly.

In tube rolling mill apparatus a number of screws can be driven by unitary drive means and the threads 45 on the screws thus synchronized. In this case the horizontal shaft 50 for the raise arms 46 can be made long enough to operate the raise arms of a series of kickout units simultaneously.

What is claimed is:

1. Rolling mill kickout apparatus for transferring laterally lengths of pipe, rod or the like moving axially on a conveyor, the apparatus comprising a conveyor, a kickout comprising rotatable means in line with the conveyor to receive pipe lengths from the conveyor, driving means for the rotatable means in which there are rolls to contact the pipe driven positively at a linear speed less than the axial speed of the oncoming lengths of pipe and thereby tending to reduce the axial speed of the pipe to the linear speed of the said rolls, in combination with means adapted to kick the pipe lengths laterally off the rotatable means.

2. Rolling mill kickout apparatus for transferring lengths of pipe, rod or the like moving axially on a conveyor, comprising an inner roll whose periphery is in line with but below the conveyor line, and an outer roll surrounding the first roll also in line with the conveyor, in combination with means driving the inner roll at a peripheral speed less than that of the outer roll and means adapted to retract the outer roll and return it to its outer position to kick the pipe lengths out, whereby each pipe length is slowed down in its axial movement and then transferred out of line with the conveyor.

3. Rolling mill kickout apparatus for transferring laterally lengths of pipe, rod or the like moving axially on a conveyor, the kickout comprising two rolls to receive the lengths of pipe on their periphery, namely, a first roll in line with the conveyor adapted to receive pipe lengths axially therefrom on its periphery and a second roll also in line with the conveyor but at a lower level than the first, and means positively to drive the second roll at a peripheral speed less than the axial speed of the oncoming lengths of pipe, in combination with means adapted to reciprocate the first roll axially out of and back into line with the conveyor; whereby retraction of the first roll permits the second roll to slow the pipe lengths down and return of the first roll to position in line enables it to kick that pipe length out laterally while receiving another pipe length on its periphery.

4. Rolling mill kickout apparatus for transferring laterally lengths of pipe, rod or the like moving axially on a conveyor, in which there is a roll in line with the conveyor adapted to receive a pipe length from the conveyor on its periphery, said roll having an outer flange, and means positively driving the roll at peripheral speed not greater than the axial speed of the oncoming pipe length, in combination with means adapted to reciprocate the roll axially out of and back into line with the conveyor, and means to support the pipe length at the level of the outer flange of the roll when the roll is reciprocated out of line with the conveyor; whereby the roll can kick one pipe length out of line with the conveyor while receiving another pipe length on its periphery.

5. Rolling mill kickout apparatus for transferring laterally lengths of pipe, rod or the like moving axially on a conveyor, the kickout comprising a movable roll adapted to receive pipe lengths on its periphery from the conveyor when in its outer position, means adapted to retract the movable roll from its outer position and to return it to that position, in combination with an inner roll inside the movable roll adapted to receive pipe from the movable roll when the latter is retracted, there being a discharge apron associated with the edge of the inner roll, and means to drive the inner roll at a peripheral speed less than the linear speed of the pipe length approaching on the conveyor; whereby retraction and return of the movable roll will cause the pipe length to be slowed down and kicked out of the conveyor.

6. Rolling mill kickout apparatus for transferring laterally lengths of pipe, rod or the like moving axially on a conveyor, the kickout comprising two rolls, one movable out into line with the conveyor to receive pipe lengths therefrom or to be retracted out of line therewith and means to retract the movable roll from and return it to its outer position in line with the conveyor, the other roll being a roll inside the first roll and of smaller diameter adapted to receive pipe lengths from the movable roll when the movable roll is retracted, in combination with unitary, positive drive means for rotating the two rolls adapted to drive the inner roll at a peripheral speed less than the linear speed of the pipe length approaching on the conveyor; whereby the kickout slows down the linear movement of each pipe length before kicking it out of line with the conveyor.

7. Tube rolling mill apparatus comprising a high speed conveyor for moving discrete lengths of tube, rod or the like axially, a plurality of kickout units adapted to receive pipe lengths from the conveyor and a common operating lever for the units; each kickout unit comprising an inner roll and an outer roll of greater diameter than the lesser roll, the outer roll being movable from a position in line with the conveyor and covering the inner roll to a retracted position clear of the conveyor, and means to drive both rolls positively, the inner roll at a lesser peripheral speed than the axial movement of the oncoming pipe lengths, in combination with means to retract and return the outer rolls of the units, and a discharge apron to receive pipe lengths pushed off the inner rolls by a return movement of the outer rolls; whereby pipe lengths can be transferred at any number of kickouts simultaneously and the kickout movement leaves the apparatus ready to receive more lengths.

8. Tube rolling mill apparatus comprising a high speed conveyor for moving discrete lengths of tube, rod or the like axially, a plurality of kickout units adapted to receive pipe lengths from the conveyor and a common operating shaft for the units, in combination with means to operate the shaft to transfer the pipe lengths when the pipe lengths are properly positioned on the kickout units; each kickout unit comprising an inner roll whose periphery is in line with but below the level of the conveyor, an outer roll surrounding the inner roll also in line with the conveyor and at the level of the latter, means to drive the inner roll at a peripheral speed less than that of the outer roll, and means controlled by the common operating shaft to retract the outer roll out of line with the conveyor and to return it to the in-line position; whereby a series of lengths of pipe can be closely assembled on the kickout units, and when the lengths are transferred together out of line with the conveyor the kickout units are ready to receive more lengths of pipe.

9. Tube rolling mill apparatus comprising a high speed conveyor for moving lengths of tube, rod or the like axially, a plurality of kickout units each comprising two rolls in line with the conveyor to receive the lengths of pipe on their periphery, namely, a movable first roll and a second roll at a lower level than the first, and means positively to drive the second roll at a peripheral speed less than the axial speed of the oncoming lengths of pipe, in combination with control means checking the lengths of pipe at the kickouts, a common operating shaft for all the kickouts triggered by the control means, and means actuated by said shaft to retract the first rolls permitting the second rolls to slow down and assemble the lengths of pipe and then to return the first rolls to pipe receiving position and simultaneously kick out the lengths of pipe on the second rolls.

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