July 3, 1934. J. R. COE 1,965,219

ROLLING MILL

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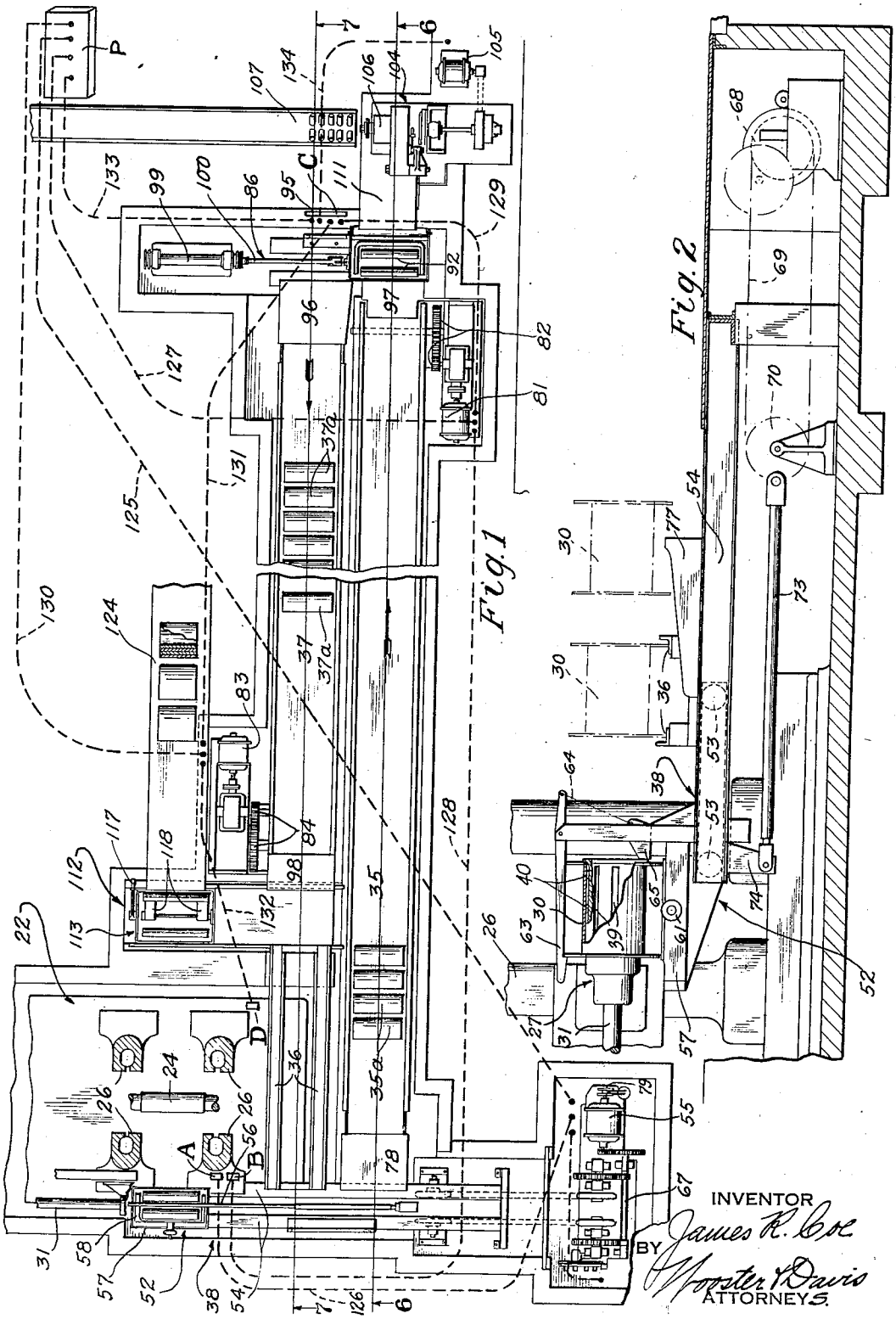


Fig. 1

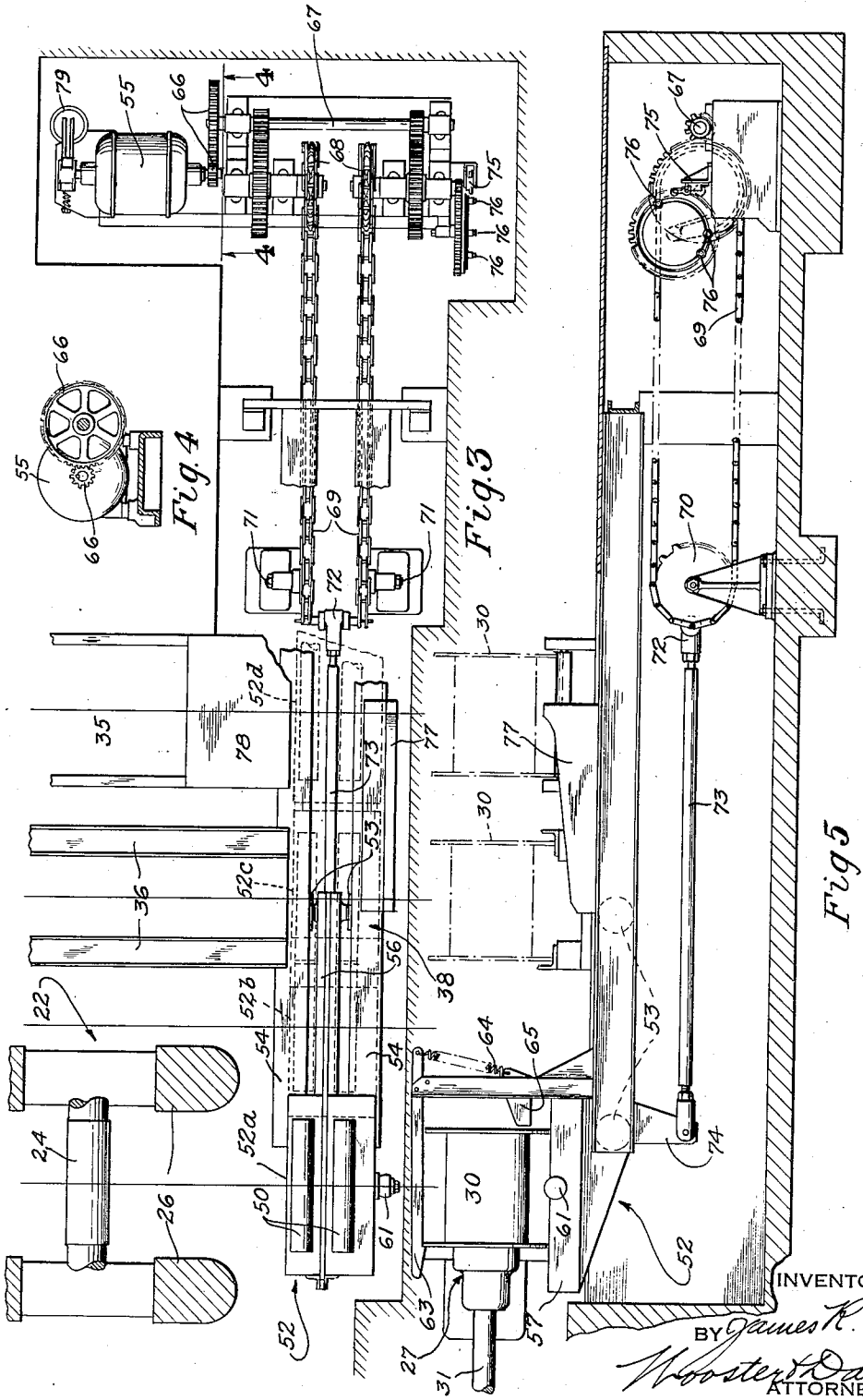
Fig. 2

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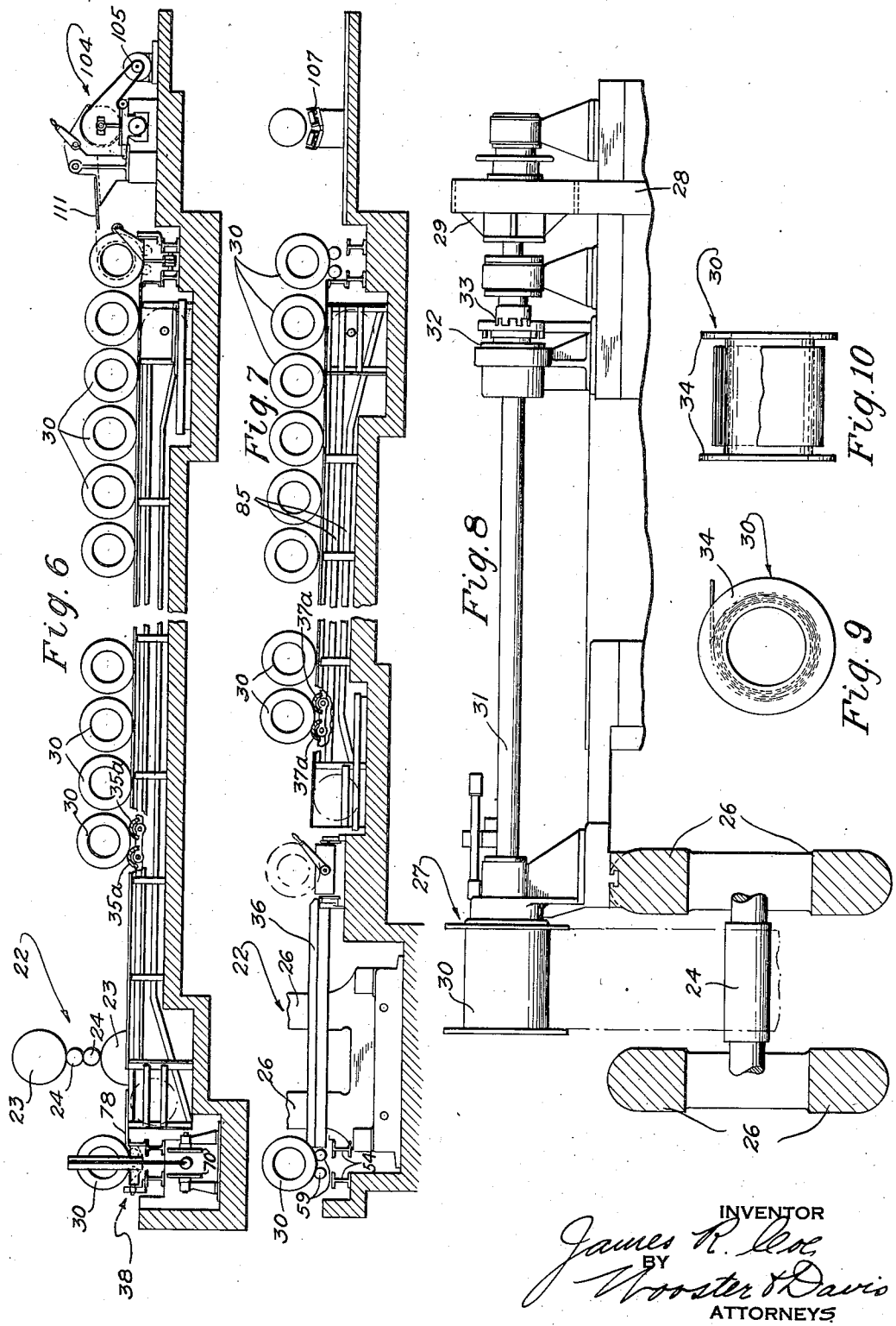


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ROLLING MILL

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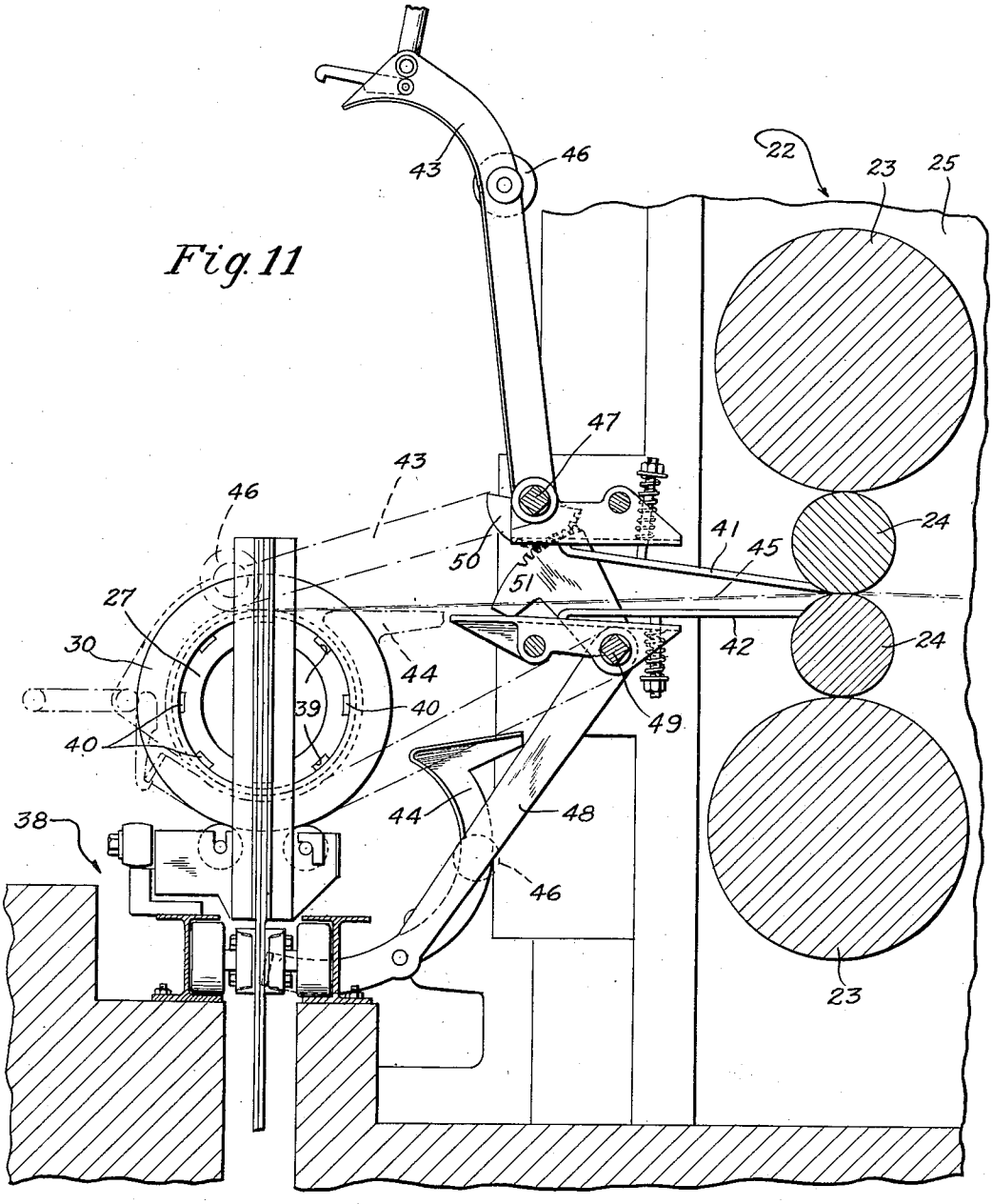
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ROLLING MILL

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Fig. 11



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ROLLING MILL

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Fig. 14

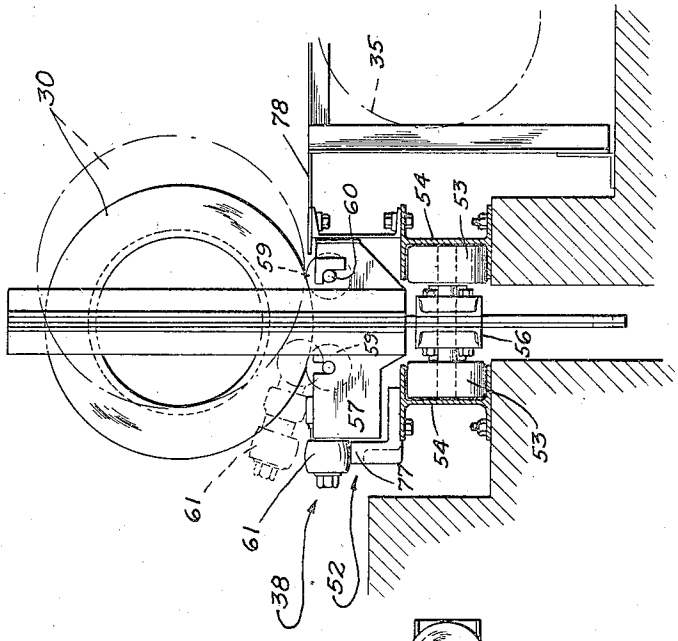


Fig. 12

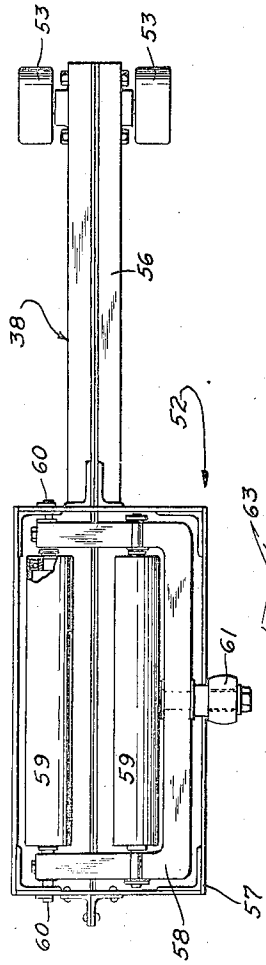
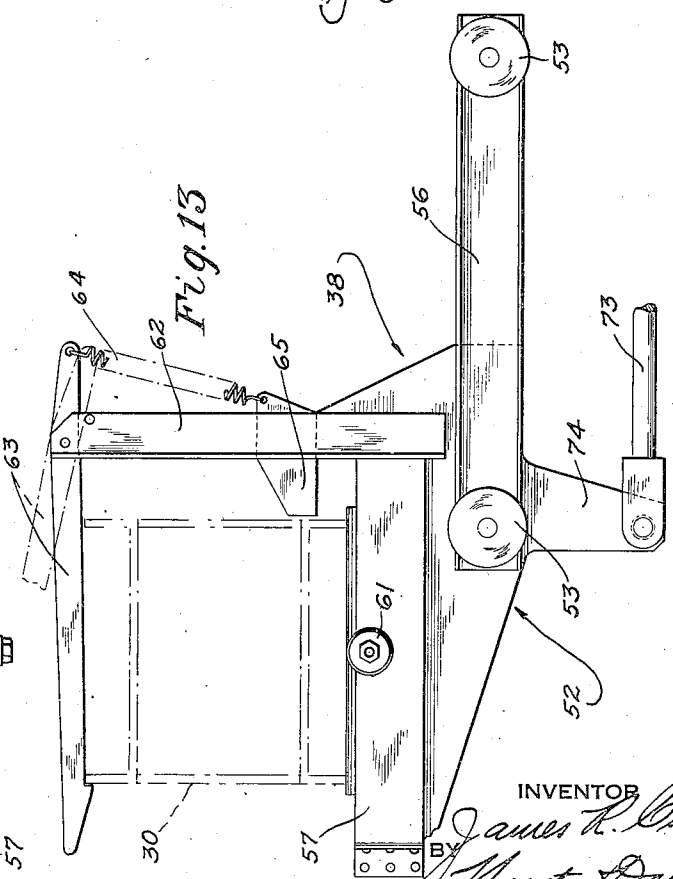


Fig. 13

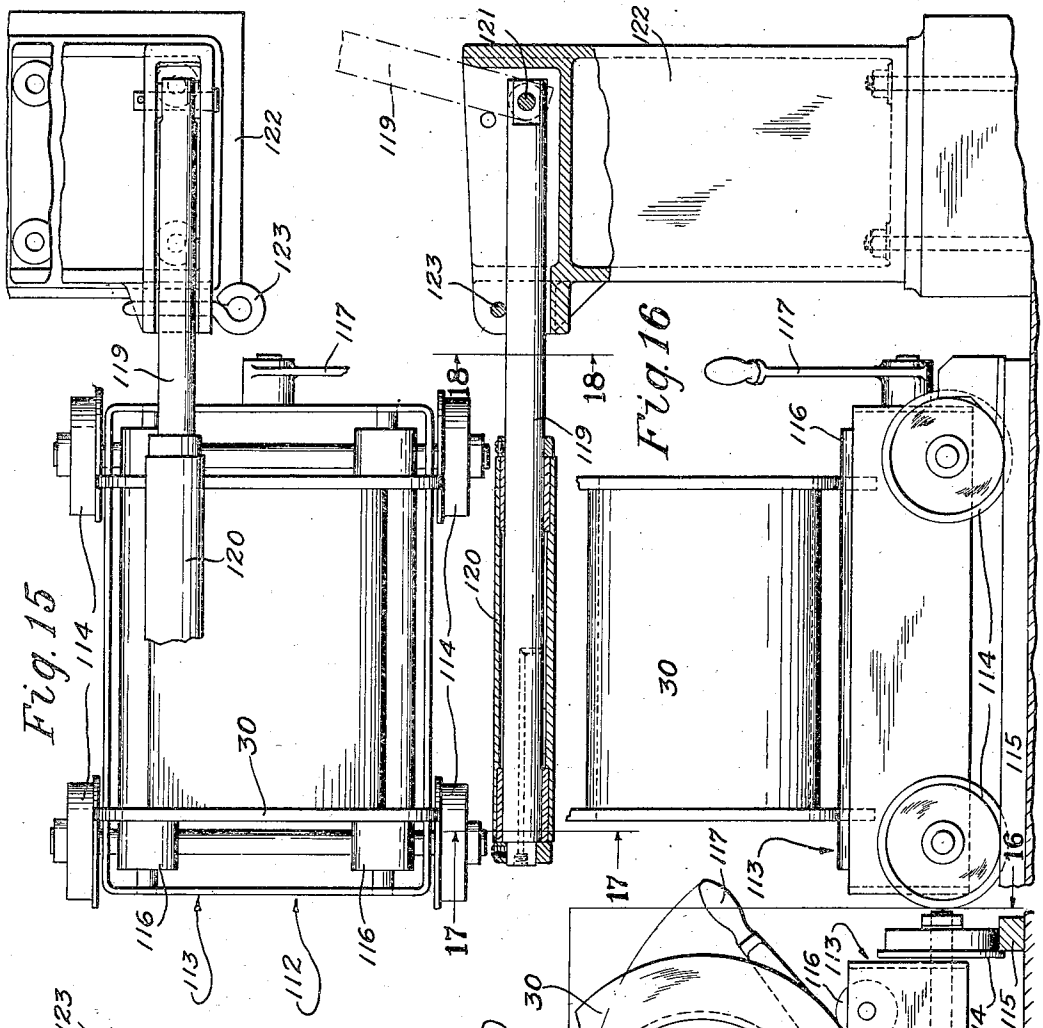


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ROLLING MILL

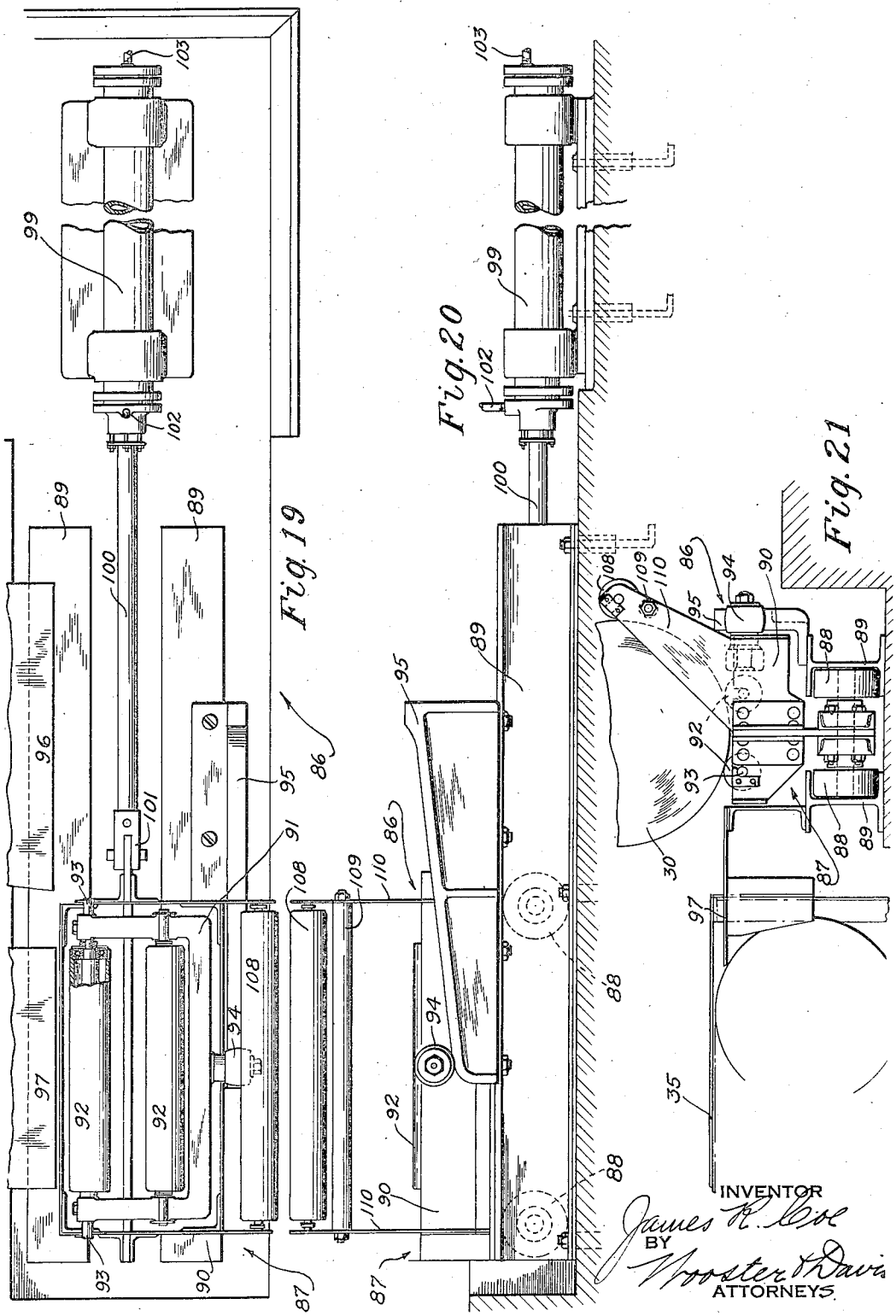
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ROLLING MILL

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Patented July 3, 1934

1,965,219

UNITED STATES PATENT OFFICE

1,965,219

ROLLING MILL

James R. Coe, Watertown, Conn., assignor to The American Brass Company, Waterbury, Conn., a corporation of Connecticut

Application March 6, 1933, Serial No. 659,745

22 Claims. (Cl. 80—32)

This invention relates to new and useful improvements in rolling mills, particularly to rolling mills for rolling strips of flat metal which can be wound or coiled on spools or reels to facilitate handling.

An object of the invention is to provide a means for handling the metal in heavy coils to and from the rolling mill with a minimum of manual effort.

Another object is to provide a means whereby the metal may be handled in an expeditious manner and whereby the metal is protected from damage both on its edges and surface during the necessary handling.

A further object is to provide an arrangement whereby a comparatively large number of coils of metal of a given gauge can be passed in succession through a rolling mill with a given setting, and after passing through the rolls can be stored and handled in such a way that after all the coils have been passed through the rolls the rolls can be reset and the coils again passed through in succession, and so on until all the metal of the coils has been brought to the desired gauge.

The invention also comprehends certain improvements in the means and method disclosed in my prior application Serial Number 540,301, filed May 27, 1931.

The method and apparatus of the invention are of particular value in connection with four-high and similar rolling mills in which the metal can be passed through the mill repeatedly without intermediate annealing and cleaning operations, and it is also of special value when rolling metal the coils of which are of a weight beyond the ability of a man to lift and carry.

Other objects and advantages will become apparent from a consideration of the following detailed description taken in connection with the accompanying drawings wherein a satisfactory embodiment of the invention is shown. However, it will be understood that the invention is not limited to the details disclosed but includes all such variations and modifications as fall within the spirit of the invention and the scope of the appended claims.

In the accompanying drawings I have shown the invention as used in connection with a four-high rolling mill, although obviously it is not limited to use with this type of mill but may be used with any type of rolling mill.

In the drawings:

Fig. 1 is a top plan view showing somewhat diagrammatically the present arrangement of devices in connection with a rolling mill;

Fig. 2 is an elevational view looking from the left in Fig. 1, the view being on a somewhat enlarged scale, and the near portion of the foundation being omitted;

Fig. 3 is a plan view on an enlarged scale showing that end portion of the layout at the rear of the rolls of the mill, certain parts being broken away;

Fig. 4 is a detailed sectional view taken substantially along the line 4—4 of Fig. 3;

Fig. 5 is a view similar to Fig. 2 but on a larger scale and giving greater detail;

Fig. 6 is a longitudinal sectional view taken substantially along the line 6—6 of Fig. 1;

Fig. 7 is a longitudinal view taken substantially along the line 7—7 of Fig. 1;

Fig. 8 is a top plan view of the winding mechanism, the view showing the roll housings in section;

Figs. 9 and 10 are side and front elevational views respectively showing a spool or reel having the strip of metal coiled thereon;

Fig. 11 is a vertical sectional view through the rolls and a portion of the transfer coil mechanism indicating the coiling mechanism in elevation;

Fig. 12 is a top plan view of a transfer car or means used at the rear or outlet side of the rolling mill;

Fig. 13 is a side elevational view showing the car;

Fig. 14 is an end view showing the car on its tracks and the broken lines suggesting the dumping or unloading position of the car;

Fig. 15 is a top plan view showing the transfer car used at the front of the mill, a part of an associated mechanism being shown;

Fig. 16 is a side elevational view of the device of Fig. 15;

Fig. 17 is an end view thereof, the device being shown in place on its tracks;

Fig. 18 is a detail sectional view taken substantially along the line 18—18 of Fig. 16;

Fig. 19 is a top plan view of the transfer car and its operating means used for shifting loaded spools from one conveyor to another and for supporting a loaded spool in position to have the metal thereon fed to a winder;

Fig. 20 is a side elevational view of the car and its operating means of Fig. 19; and

Fig. 21 is an end elevational view thereof looking from the left in Fig. 20.

The method and operation of rolling the metal according to this invention comprises:

1st. Winding the metal on heavy spools or reels as it leaves the rolling mill;

2nd. Removing the loaded spool from the wind-

ing block or shaft to a storage means or conveyor; and

3rd. Receiving an empty spool from a storage means and placing it on the winding drum.

These operations all take place at the back or delivery side of the mill.

4th. Unwinding the metal from a spool or reel rotatably mounted on a transfer car and feeding the metal to the mill as the metal is unwound;

5th. Then moving the transfer car to place the empty spool in a storage means; and

6th. Receiving a loaded spool from a storage means and transferring it to the proper position in front of the rolls.

These latter operations take place on the front or receiving side of the rolls.

The invention also comprehends the transfer of loaded spools or reels from one storage means to another by means of a transfer car and the utilization of said transfer car to rotatably support a reel while the metal thereon is transferred to a winder after said metal has been passed for the last time through the mill and has been reduced to the desired gauge.

Referring in detail to the drawings, a rolling mill is indicated at 22 and as shown is a four-high mill having relatively large backing rolls 23 for the relatively small working rolls 24 suitably mounted in bearings in housings 25 including columns or uprights 26. The work rolls are driven from any suitable source of power, not shown.

To the rear of the rolls is a winding drum 27 driven from the roll shaft of the roll driving mechanism by any suitable means such for example as a chain drive indicated diagrammatically at 28 in Fig. 8 operating through a friction clutch 29. The drum 27 is adapted to carry a reel or spool 30 on which the metal is wound. The drum 27 is driven by a shaft 31 arranged to drive the spool 30 at a somewhat higher surface speed than the surface speed of the working rolls so as to hold the metal straight and taut and to wind it tightly on the spool, the clutch 29 being adapted to slip to compensate for this higher surface speed.

A brake mechanism 32 may be provided to stop rotation of the shaft 31 and the loaded spool after the shaft is disconnected from the drive by releasing a clutch 33, so that after a spool is filled or loaded a minimum of time is lost in bringing it to rest so that it can be removed from the winding drum. The winding mechanism and the means for removing a loaded spool from the winding drum 27 and placing an empty spool thereon will later be more fully described. Here, however, it is pointed out that the spool 30 includes side flanges 34 which flanges serve to guide the metal as it is being wound onto the spool and serve also to protect the edges and surface of the metal as the coils are shifted or transferred.

To one side of the mill is a storage means 35 for loaded spools or reels, this storage means comprising a relatively long endless conveyor. This conveyor may be of the standard type and may comprise substantially semi-circular slats 35*a* secured to the links of a flexible chain. These slats form between them transverse channels in which the rims of the flanges of the spools rest so that they can be carried forward. Arranged parallel with the conveyor or storage means 35 and between it and the mill is a relatively short storage means 36 for empty spools, this empty spool storage means being in the form of a pair of spaced tracks on which the flanges 34 of the spools 30 engage. Rearwardly and in alignment with the storage means 36 and parallel with the storage means 35 is a second endless conveyor storage means 37 for loaded spools, this storage conveyor being of the same construction as the conveyor 35 and comprising the substantially semi-circular slats 37*a* to support the spools.

Operating in the rear or at the delivery side of the rolling mill 22 is a spool transfer means generally designated 38 and this means is adapted to remove a loaded spool from the block or drum 27 and transfer it to a position in alignment with the storage conveyor 35 and to then be shifted to receive an empty spool from the empty spool storage means 36 and carry it to and place it on the drum. It will be understood that the loaded spool is discharged from the transfer means at the storage conveyor 35 and that an empty spool is rolled onto the transfer means at the empty storage means 36.

Referring particularly to Fig. 11, it will be seen that the winding and blocking mechanism comprises the block or drum 27 mounted on the shaft 31 (Fig. 8) and driven as above described. This drum 27 is provided in its surface with a plurality of grooves or keyways 39 to receive a key or similar driving means 40 on the inner surface of the reel or spool 30. In the present instance, the members 40 are shouldered studs riveted to the body of the reel so as to project inwardly from the inner surface thereof and extend into one of the keyways 39, but lie flush with the outer surface of the spool so as not to mar the surface of the metal wound thereon. As above suggested the flanges 34 of the spool guide the metal during the winding and unwinding operations and also protect the edges of the metal during handling.

As the metal comes through the rolls 24 it is guided by the guides 41 and 42 to the guide members 43 and 44 of the winding and blocking mechanism, which as shown in dotted lines (Fig. 11) extend around and embrace the body of the spool, and as the strip of metal indicated by the dot and dash line 45 passes between these members and the spool its free end is guided around the spool which is being rotated by its driving mechanism. After the metal is overlapped a few times the guide members 43 and 44 may be removed from about the spool to the full line positions and the strip will then continue to be wound around the spool.

The guide members 43 and 44 carry rolls 46 which reduce the friction on the metal and assist in causing the free end of the metal to be wrapped around the spool and prevent marring of the surface of the metal. The guide member 43 is pivoted at 47 and guide 44 is mounted on arms 48 pivoted at 49. Pivoting means 47 and 49 comprise suitable shafts which are connected by gear segments 50 and 51 so that they move together. It will be seen that when the arms or guides 43 and 44 are in their full line positions everything is clear about the spool 30 to permit of the use of means to withdraw a loaded or filled spool from the drum 27 to transfer it to a storage space or means, and to permit the mounting of an empty spool on the drum.

The body of the spool 30 is purposely made of large diameter to enable it to hold a considerable weight of metal without material difference between the inside and outside diameters of the coil to reduce the amount of slippage in the friction clutch 29 to a minimum and to maintain a practically uniform tension on the metal dur-

ing the rolling and coiling operation. As these spools or reels must be of very heavy construction to withstand the crushing effect of the metal wrapped tightly around them, and also to resist flange wear caused by the rolling of the spools during the transfer and unwinding operations, they are so heavy that it is impossible for a man to lift or carry them even when empty, and mechanical means is therefore provided for handling both empty and loaded spools to and from the winding and unwinding positions at the rolls. As now employed, these spools weigh approximately 625 pounds when loaded, but of course I am not limited to this weight and the sizes of the spools and coils may vary.

For loading an empty spool or reel onto the winding drum 27 and removing a loaded spool therefrom I employ the transfer mechanism 38 (see especially Figs. 1, 2, 3, 5, 12, 13 and 14) including a car indicated as a whole at 52 and arranged to slide back and forth to and from the winding drum. This car has wheels 53 running in tracks 54 and is actuated by a motor 55 through intermediate means to be described. Current for this motor may be supplied from a panel P (Fig. 1) as indicated by heavy dotted line 125 representing suitable wiring, and this motor controlled by a push button control A, preferably located adjacent the rolls 22, the control wiring being indicated at 126.

The car 52 includes a tongue-like portion 56 which can be conveniently made of channel sections and on which the wheels 53 are mounted, and projecting forwardly of this portion 56 is an outer open frame 57 within which is a subframe 58 rotatably mounting a pair of rollers 59, and this subframe 58 is adapted for a tilting movement relative to the frame 57 and to this end is pivoted to the latter at 60. Projecting laterally from the tiltable frame 58 is a stud carrying a roller 61 the purpose of which will later be more fully described. An upright 62 at the rear of the frame 57 has a hook 63 pivotally mounted on it and a coil spring 64 normally serves to maintain this hook in the broken line position of Fig. 13. A pusher block 65 is carried by the upright 62 and serves to push an empty spool or reel onto the winding drum 27 as will later be more fully described.

Through suitable gearing 66 the motor 55 drives a jack shaft 67 which in turn through suitable gearing as clearly shown in Figs. 1 and 3 drives a pair of laterally spaced sprockets 68 over which are trained a pair of chains 69 which are also trained over sprockets 70 on stud shafts 71 rotatably mounted in suitable brackets. The chains 69 are driven at the same speed and connected with each of the chains is a cross head 72 to which is connected the rear end of a connecting rod 73 the forward end portion of which is pivotally connected to a downwardly extending lug 74 carried by the car 52. It will now be understood that through the motor 55 the chains 69 are driven and that such chains acting through the rod 73 serve to shift the car 52 back and forth on the track 54, the connecting rod being adapted to pass between the chains.

Suitable means shown as a limitation or stop switch 75 is provided for controlling the shifting of the car 52 by the motor 55. A gear carrying suitably spaced pins 76 is driven from a pinion on the shaft of one of the sprockets 68 and these pins 76 at various times serve to trip the switch 75 to open the circuit to the motor 55. The car 52 has four locations the first of which is in the rear of and in alignment with the rolls 24 as shown in full lines 52*a*, Fig. 3, the second of which is at the side of the rolls as indicated in dotted lines 52*b*, Fig. 3, the third of which is in alignment with the empty spool storage means 36 as indicated in dotted lines 52*c*, Fig. 3, and the fourth of which is in alignment with the loaded spool storage conveyor 35 as indicated in dotted lines 52*d*, Fig. 3. The second position 52*d* or that laterally of the mill and between the mill and the storage 36 may be described as the normal position of the car. When the car is in this position and the motor 55 started as by the operator pushing the push button control at A, (Fig. 1) adjacent the rolls the car is shifted forwardly to a position in the rear of the mill and beneath a spool on the winding drum 27 as shown in Fig. 2. The operator presses downwardly on the hook 63 to have it engage over the flange of the spool on the winding drum and as the motor 55 continues to operate the car is drawn rearwardly along its tracks in a direction laterally of the mill through the chains 69, cross-head 72 and rod 73.

As the car approaches its fourth position, that is its position 52*d* opposite the loaded spool storage conveyor 35, the laterally disposed roller 61 rides up on a cam 77 and the inner or tiltable frame 58 of the car is rocked upwardly as suggested by the broken lines in Fig. 14 and the loaded spool rolls off onto a guide plate 78 and onto the conveyor 35. The limiting switch 75 again operates, and after the spool has been discharged onto the conveyor the motor may again be started and the car shifted forwardly to the third position 52*c* opposite the empty spool storage means 36 when the limiting switch means again operates to stop the motor.

An empty spool is rolled onto the car and the motor again started by the push button control and the car is carried forwardly and shifts the new or empty spool onto the winding block 27. The pusher block or plate 65 serves to insure of the empty spool being fully disposed on the winding block 27 and it will be understood that the hook 63 is in elevated position owing to the action of the spring 64. Without stopping the motor 55 the car is carried rearwardly through positions 2, 3 and 4 (52*b*, 52*c* and 52*d* respectively) and then forwardly through position 3 (52*c*) to position 2 (52*b*) where it comes to rest, as motor 55 is stopped by the automatic switch. The guides 43 and 44 are operated as before and the stock coming from the mill is wrapped about the new reel or spool. A solenoid brake 79 may be applied to the shaft of motor 55 if desired to insure quick stopping of the motor.

The conveyor 35 is trained at its ends over suitable wheels or drums and its upper and lower flights are supported and guided as by guide rails 80 (see Fig. 6) and the conveyor is driven as by a motor 81 operating through suitable gearing 82 (see Fig. 1). Current may be supplied to motor 81 by wiring 127 and the operation of the motor may be operated by a push button or other control B near the rolls 22 through wiring 128 or by a push button or other control C adjacent the winder 104 through wiring 129. Conveyor 37 operates in a direction opposite to that in which the conveyor 35 operates and is driven by a motor 83 acting through a suitable gearing 84. Current for this motor may be supplied from panel P through wiring 130 and the motor operation controlled by a push button or other control at location C near the winder 104 or a push button

or similar control D near the rolls 22 through the wiring 131 and 132 respectively. The conveyor 37 is mounted and guided by the frame or rail members 85 as shown in Fig. 7. As viewed in Fig. 1 the conveyor 35 or storage means 35 operates to carry loaded spools toward the right while the storage conveyor 37 operates to carry loaded spools toward the left.

Means is provided for transferring spools from the storage means 35 to the storage means 37 and this transfer means is generally designated 86 and is shown in detail in Figs. 19, 20 and 21. Transfer means 86 includes a car 87 mounted on wheels 88 operating in tracks 89 and the car is shiftable from a position in alignment with the conveyor 35 to a position in alignment with the conveyor 37. Car 87 includes an outer frame 90 within which is disposed a tiltable frame 91 rotatably mounting rollers 92 adapted to support a spool or reel 30 as shown in Fig. 21. This inner frame 91 is pivoted to the outer frame as at 93 whereby the inner frame may be tilted to discharge a spool or reel from the car. Projecting laterally from the inner frame 91 is a stud carrying a roll 94 adapted, as the car moves into position in alignment with the conveyor 37 to ride up on a stationary cam 95 whereby frame 91 will be tilted and a loaded reel discharged onto a guide or loading plate 96 at the receiving end of the conveyor 37.

The normal position of the car 87 may be said to be in alignment with the storage conveyor 35 and from the guide plate or platform 97 at the end of this conveyor a loaded spool is rolled onto the car and the car is then shifted to dump or discharge the spool onto the plate or platform 96 as above suggested. As the loaded spool is rolled onto the conveyor 37 the latter will carry the spool forwardly or in the direction of its guide or discharge plate 98. Suitable means are provided for shifting the car 87 and this means as here shown includes a cylinder 99 having a piston therein connected with a rod 100 which at its forward end is connected with the car as at 101. Air or other fluid under pressure is admitted at one end or the other to the cylinder 99 as through connections 102 and 103 whereby to shift the piston in the desired direction in the cylinder and shift the car accordingly. The operating cylinder 99 may be controlled by a valve at location C (Fig. 1).

After the metal has been passed through the mill for the last time and has been reduced to the desired gauge it may be taken from the spool while the latter is supported on the car 87 in what has been above described as the normal position of the car in alignment with the rear end of conveyor 35. To this end a winder mechanism generally designated 104 is provided. Mechanism 104 is driven in any suitable manner as by motor 105 and includes a winder 106 onto which the metal from a spool supported by the car 87 may be wound. When such a spool has been emptied the coil formed on the winder 106 may be taken from the same and dropped onto a gravity conveyor 107 by which the coil may be delivered to a slitting machine or the like (not shown). To keep a spool in place on the car while the metal is being transferred to the winding mechanism a pair of upper rolls 108 and 109 (Figs. 19, 20 and 21) are provided the same being supported in uprights 110 on the car 87. The metal may be guided between these rolls 108 and 109 and over a platform 111 and the rolls 108 and 109 will prevent the spool being pulled off the car during the winding operation. The motor 105 may be supplied with current from panel P and controlled by a switch at location C through the wiring 133 and 134.

Forwardly of the rolling mill or at the front side of the rolling mill is a spool transfer means generally designated 112 and shown in detail in Figs. 15 through 18. This transfer means 112 comprises a car 113 mounted on wheels 114 running on tracks 115. The tracks 115 extend from a position in front of the rolling mill 22 to a position between the adjacent ends of the storage means 36 and 37, and the car 113 is shiftable along these tracks between a position in front of the mill and a position between the adjacent ends of said storage means. The car includes a pair of rollers 116 for mounting a spool 30 and mounted on the car and disposed at one of its ends is a lever 117 adapted to operate cams 118 located between the rolls 116. In use the normal position of the car may be said to be when the car is located in front of the rolling mill.

A spool of a flat strip of metal is placed upon the car 113 and the metal fed from the spool between the rolls 24. To prevent the spool being drawn off the car a bar 119 having a tubular casing 120 rotatably mounted thereon is provided. This bar 119 is pivoted as at 121 to a stand 122 and when the bar is in horizontal position it extends across a spool supported on the rollers 116. The bar may be locked in this position as by a pin or key 123 and as the metal is drawn from the spool the spool rotates on the rollers 116 and is prevented from being drawn off the rollers by engagement of the flanges of the spool with the sleeve 120. Bar 119 may be shifted to an out of the way position as indicated by the broken lines in Fig. 16 on removal of the key or pin 123.

When the spool on the car 113 is empty the car is shifted along the tracks 115 to a position at the inner end of the empty spool storage means 36 and the lever 117 may be rocked from its full line position of Fig. 17 to its broken line position of that figure and in such movement the cam 118 will be operated to engage the flanges of the empty spool and roll it off the car onto the storage means 36. A loaded spool may now be rolled from the loaded spool storage conveyor 37 if desired or the car may be run empty back to its normal position and a coil of flat metal from a receiving table or platform 124 may be rolled onto the car.

In the operation of the device coils of metal of heavy gauge are delivered to the platform or table 124 from which they are rolled one at a time onto the car 113. The metal is fed to the mill as above explained and the rolled metal is wound onto a spool 30 on the block or drum 27. Motor 55 is then started by operator compressing push button A and the car 52 shifted forwardly to a position beneath the roll and the operator depresses the hook 63 to engage the flange of the reel, and without stopping motor 55 the car starts back and pulls the reel from the winding block onto the car, the loaded spool is carried back and dumped or discharged onto the platform 78 of storage conveyor 35 by engagement of the roll 61 with the cam 77 and the car comes to rest automatically through the automatic stop for motor 55. The operator then again pushes the push button and the car 113 is shifted into alignment with the storage means 36 where it automatically comes to rest. An empty spool is placed on the car 52 from the storage means 36. The operator then pushes button A and the car 52 travels to position 52a and places the empty spool on the block

or drum 27 after which the car without stopping passes through the positions 52*b*, 52*c*, 52*d* and 52*c* and thus returns to its normal position 52*b* as above explained and completing one cycle.

The car 113 may in the meantime have been returned to its position in front of the rolls and a second coil is rolled onto it from the platform or table 124. The loaded spools discharged onto conveyor 35 are carried down to platform 97 and rolled onto the car 87 and by it carried to and discharged onto the platform 96 when the roll 94 of said car engages the cam 95. After each loaded spool or reel is placed on the conveyor 35 this conveyor is advanced sufficiently to receive the next loaded spool and so on until the conveyor is filled. Movements of the conveyor may be controlled by an operator either at control B at the rolling mill housing or at C near the winder 106 and the discharge end of the conveyor. The conveyor 35 may be of any desired capacity but in the present installation has a capacity of 22 loaded reels of 625 pounds each. From platform 96 loaded spools are rolled onto the storage conveyor 37 and carried forward by it. This conveyor in the layout mentioned has a capacity of sixteen reels and is controlled by an operator either at point C or D. This sequence of operations is repeated until a sufficient number of coils of metal have been passed through the mill and the storage conveyors 35 and 37 filled with loaded spools or reels. Thus when the last length of metal has gone through the mill all of the spools of metal which have passed through the mill will be on the storage means 35 and 37. The rolls of the mill may now be adjusted to roll the metal to a finer gauge. Car 113 can then be shifted to its innermost position in front of conveyor 37 and a loaded spool rolled onto it from this conveyor.

Car 113 is now shifted outwardly to its position in front of the rolls where the metal will be fed to the mill and after passing through the mill wound on a spool supported by the block or drum 27. When all of the metal of a particular spool has been passed through the mill the car 52 is operated as described above and the car 113 is shifted inwardly into alignment with storage tracks 36 and its lever 117 operated to discharge the empty spool onto this storage means 36, after which a loaded spool from the storage means 37 is rolled onto the car. This cycle of operations is repeated until the metal has been reduced to the desired gauge. As the spools of the desired gauge, or that is the last operation, come from the mill they are carried by conveyor 35 to and positioned on the car 87 from which the metal on them may be fed to the winding means 104 after which it is delivered to the gravity conveyor 107 in coils as above set forth.

Having thus set forth the nature of my invention, what I claim is:

1. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools between said first storage means and the mill, a storage means for loaded spools at the side of said first storage means and at the rear of and in substantial alignment with said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, and other means for transferring spools from the first to the third storage means.

2. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools between said first storage means and the mill and extending parallel with the first storage means, a storage means for loaded spools at the side of said first storage means and parallel therewith and at the rear of and in alignment with said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, and other means for transferring spools from the rear of the first to the rear of the third storage means.

3. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools between said first storage means and the mill, a storage means for loaded spools at the side of said first storage means and at the rear of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, a second transfer means for transferring spools from the first to the third storage means, and a third transfer means, said third transfer means being shiftable between a position in front of a mill whereby metal may be fed from a spool supported by it to the mill and a position between the second and third storage means where it may discharge an empty spool onto the second storage means and receive a loaded spool from the third storage means.

4. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools between said first storage means and the mill, a storage means for loaded spools laterally of the first storage means and rearwardly of the second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, a second transfer means for transferring spools from the first to the third storage means, a third transfer means, said third transfer means being shiftable between a position in front of the mill whereby metal may be fed from a spool supported by it to the mill and a position between the second and third storage means where it may discharge an empty spool onto the second storage means and receive a loaded spool from the third storage means, a receiving means forwardly of the mill and on which coils of metal to be rolled may be delivered, and said third transfer means adapted to receive a coil from said receiving means and support it while the metal is fed to the mill.

5. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools between said first storage means

and the mill, a storage means for loaded spools laterally of the first storage means and rearwardly of the second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, a second transfer means for transferring spools from the first to the third storage means, a third transfer means, said third transfer means shiftable between a position in front of the mill and a position where it may discharge an empty spool onto the second storage means, a receiving means forwardly of the mill and on which coils of metal to be rolled may be delivered, and said third transfer means adapted to receive a coil from said receiving means and support the coil while the metal is fed to the mill.

6. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of and in substantial alignment with said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, and said first storage means comprising a conveyor to receive loaded spools from the first transfer means and deliver them to the second transfer means.

7. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of and in substantial alignment with said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, and said third storage means comprising a conveyor receiving at one of its ends spools from the second transfer means and carrying such spools forward to a position to be placed on a third transfer means.

8. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of and in substantial alignment with said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, said first storage means comprising a conveyor to receive loaded spools from the first transfer means and deliver them to the second transfer means, and said third storage means comprising a conveyor receiving at one of its ends spools from the second transfer means and carrying such spools forward to position to be placed on a third transfer means.

9. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, a winder mechanism, and said second transfer means adapted to support a loaded spool in position to feed the metal to said winder when said metal has been passed for the last time through the mill and reduced to the desired gauge.

10. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of mill for loaded spools, a storage means for empty spools arranged at one side of the mill, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, said transfer means including a trackway, a car shiftable on said trackway, means to shift said car, said means including a pair of endless chains, means to drive said chains, a rod connected at one end with said car, and a cross head connecting the other end of the rod with each of said chains.

11. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, and means whereby said transfer means is actuated to discharge a loaded spool on reaching the first storage means.

12. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, and means whereby said second transfer means is automatically actuated to discharge its spool on reaching the third storage means.

13. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of

said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, said transfer means including a tiltable spool carrying frame, and means whereby said frame is automatically tilted to discharge a spool when the means reaches the first storage means.

14. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, said second transfer means including a tiltable spool carrying frame, and means whereby said frame is automatically tilted to discharge a spool when the transfer means reaches the third storage means.

15. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, and one of said transfer means comprising a car including a tiltable spool carrying frame adapted to be tilted to discharge a spool.

16. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, a third transfer means, said third transfer means shiftable between a position in front of the mill whereby metal may be fed from it to the mill and a position between the second and third storage means where it may discharge an empty spool into the second storage means and receive a loaded spool from the third storage means, one of said transfer means including a car, a lever pivoted to said car, a cam actuated by said lever, and said lever adapted to be operated to cause said cam to engage a spool and shift it off the car.

17. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, a third transfer means, said third transfer means shiftable between a position in front of the mill whereby metal may be fed from it to the mill and a position between the second and third storage means where it may discharge an empty spool into the second storage means and receive a loaded spool from the third storage means, and means associated with said third transfer means to prevent a spool being drawn off the same while the metal is being fed from the spool to the mill.

18. In a device of the character described, a rolling mill, means at the outlet side of the mill for rotating a spool on which to wind the metal after being rolled, a storage means at one side of the mill for loaded spools, a storage means for empty spools arranged at one side of the mill, a storage means for loaded spools laterally of said first storage means and rearwardly of said second storage means, means for transferring a loaded spool from said winding means to said first storage means and for transferring an empty spool from the second storage means to the winding means, other means for transferring spools from the first to the third storage means, a winder mechanism, said second transfer means adapted to support a loaded spool in position to feed the metal to said winder when said metal has been passed for the last time through the mill and reduced to the desired gauge, and means associated with said second transfer means to prevent a spool being drawn off the same while the metal is being fed from the spool to the winder.

19. In a device of the character described, a rolling mill, means at the outlet side of the mill for carrying and rotating a spool on which to wind the metal after being rolled, separate storage means for loaded and empty spools respectively at one side of the mill, means for transferring a loaded spool from the winding device to the first storage means, means for shifting said transfer means to a position to receive an empty spool from the second storage means and transfer it to the winding mechanism, said transfer means including a tiltable spool carrying frame, and means whereby said frame is automatically tilted to discharge a loaded spool when the means reaches the storage means for loaded spools.

20. In a device for rolling metal, a rolling mill, a rotatable drum at the rear of the mill for carrying a flanged spool to wind the metal thereon as it leaves the mill, a transfer mechanism including a track and a car running thereon, a frame pivotally mounted on the car, rolls mounted on said frame for supporting a spool with its flanges resting on said rolls, means on the car to engage a spool on the drum and withdraw it from the drum onto said rolls, and cooperating means on the frame and beside the track to tilt the frame to discharge the spool as the car moves to a given position.

21. In a device for rolling metal, a rolling mill, a rotatable drum at the rear of the mill for car-

rying a flanged spool to wind the metal thereon as it leaves the mill, a transfer mechanism including a track and a car running thereon, means on the car for removing a loaded spool from the drum and applying an empty spool thereto, means for shifting the car comprising a connecting rod connected thereto, a chain running over sprockets, means for connecting the connecting rod to the chain, a motor for operating the chain to shift the car, manually operated means for starting the motor, and means for automatically stopping the motor with the car in given positions.

22. In a device for rolling metal, a rolling mill, a rotatable drum at the rear of the mill for carrying a flanged spool to wind the metal thereon as it leaves the mill, a transfer mechanism including a track and a car running thereon, means on the car for removing a loaded spool from the drum and applying an empty spool thereto, a connecting rod connected to the car, a pair of laterally spaced endless chains running over sprockets, a cross head between the chains and connected thereto, means for connecting the cross head to the connecting rod, and means for operating the chains to shift the car.

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