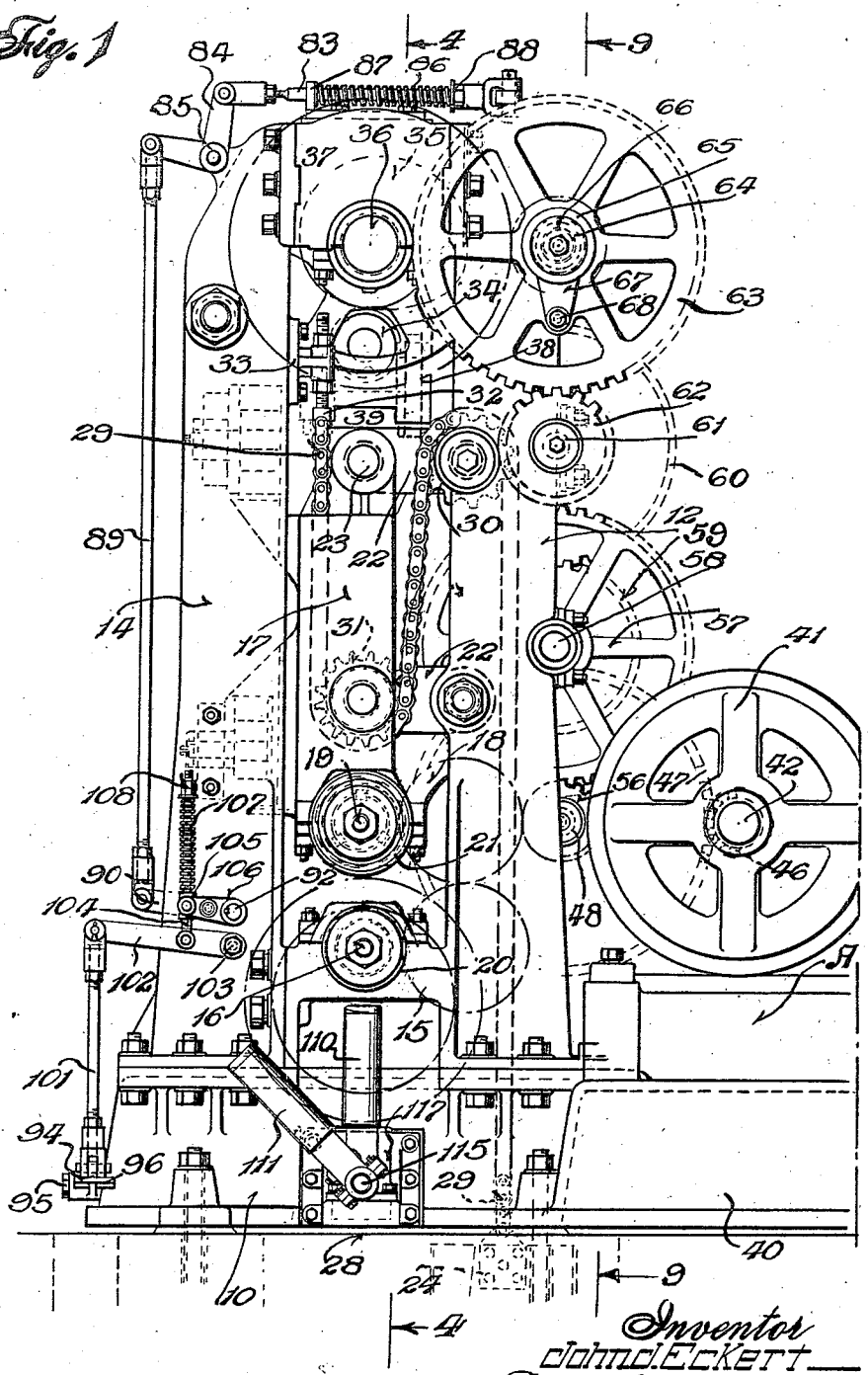
Oct. 16, 1934. J. J. ECKERT 1,976,927

RING ROLLING MACHINE

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Fig. 1



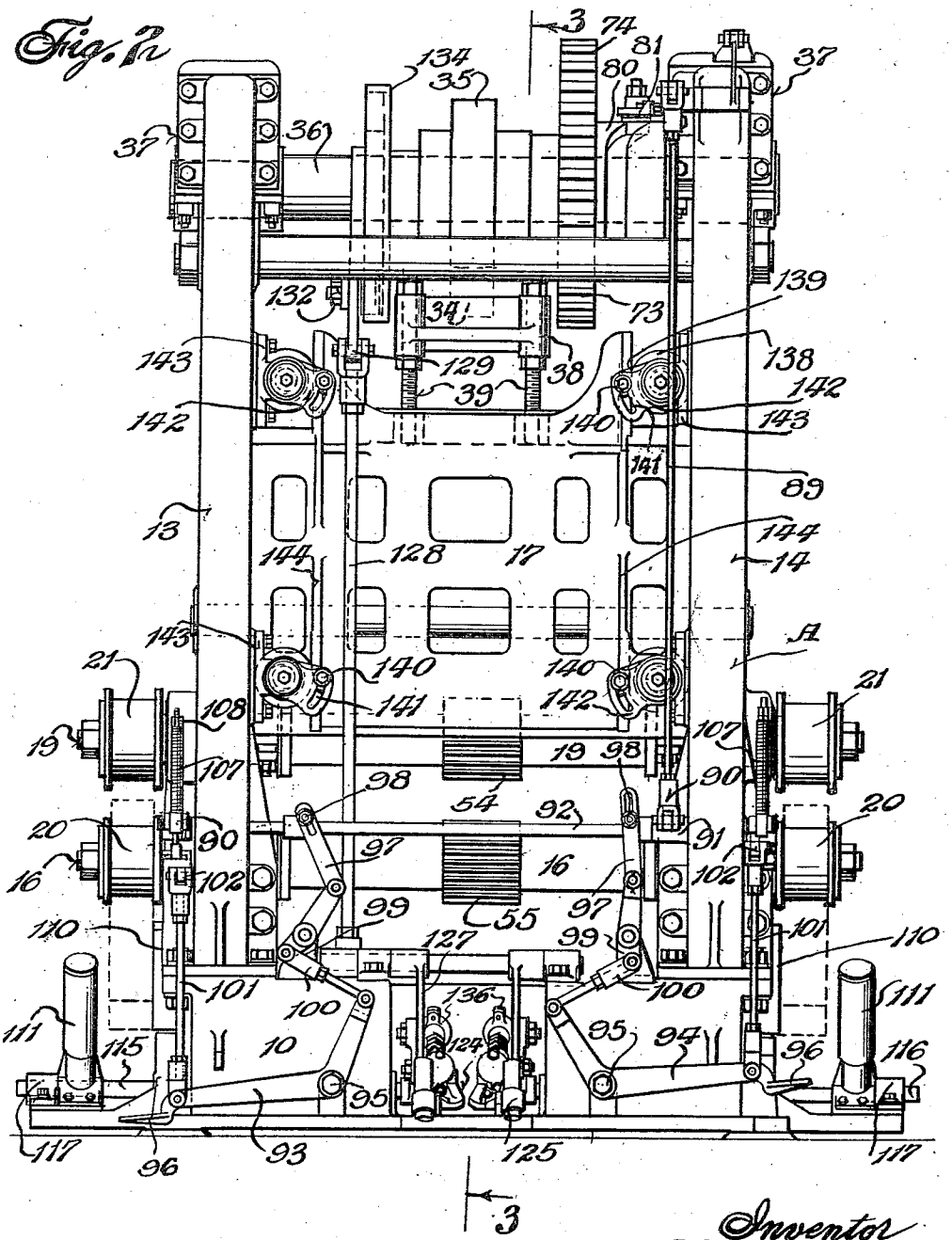
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RING ROLLING MACHINE

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Fig. 2.



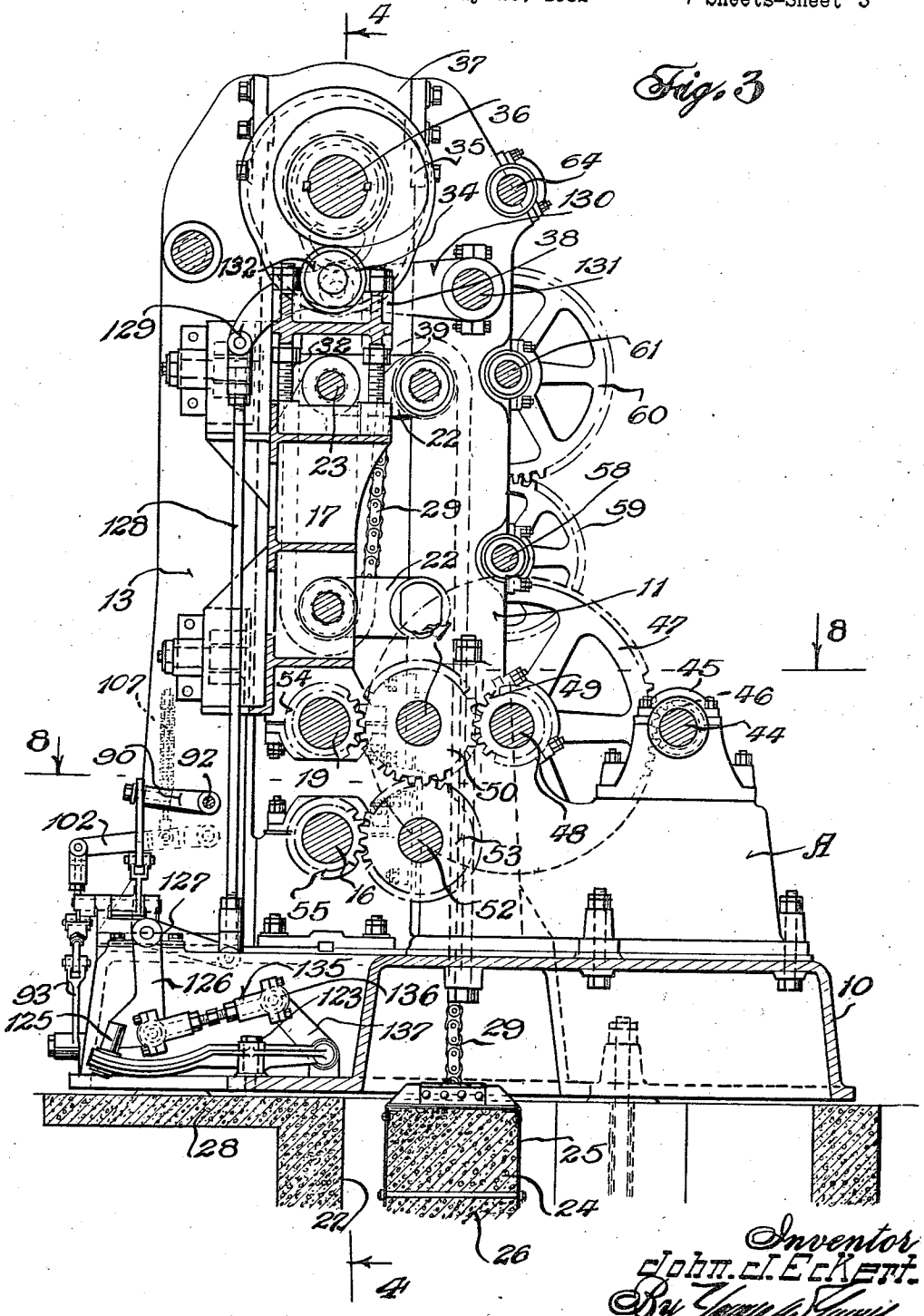
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RING ROLLING MACHINE

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Fig. 3



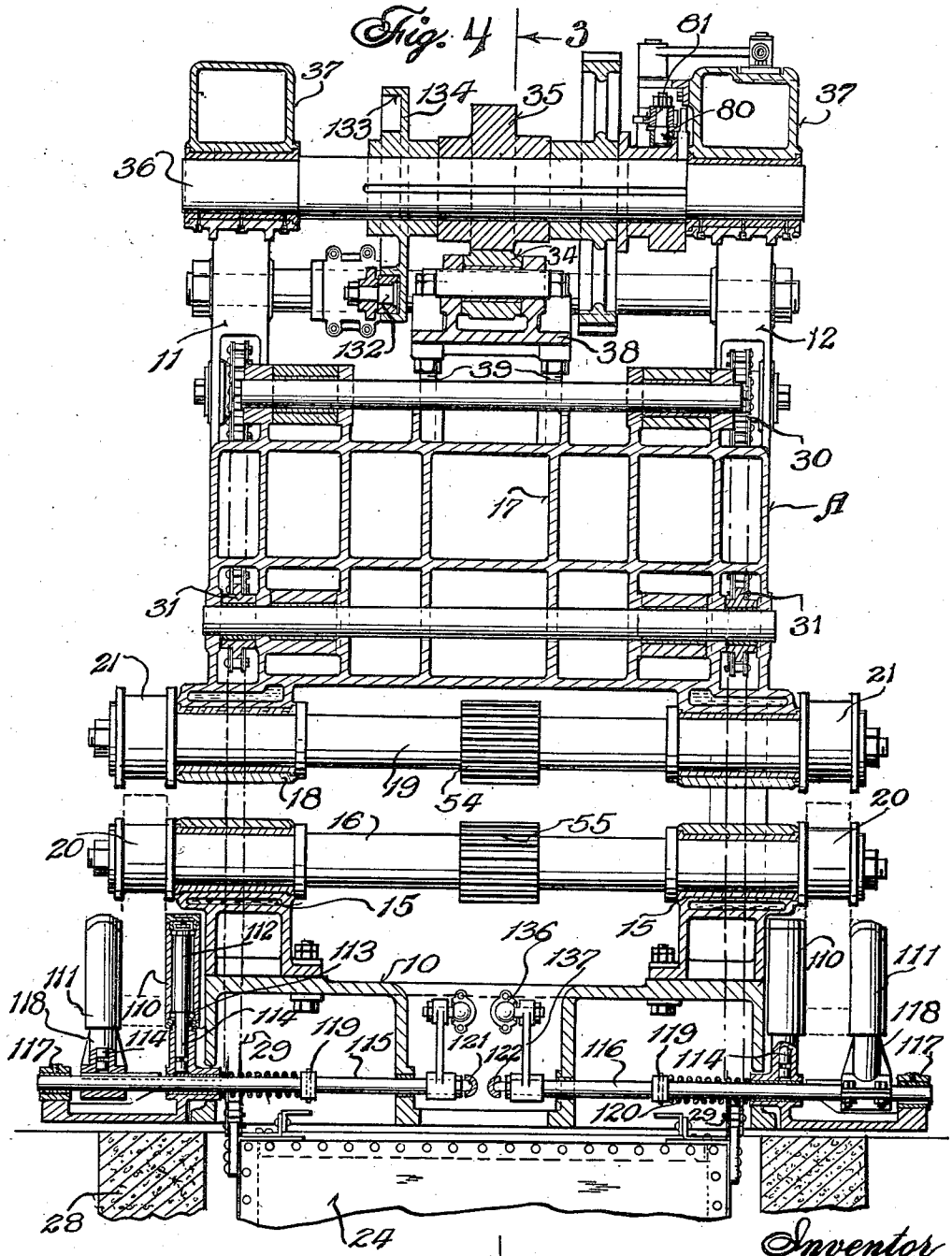
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Fig. 4



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RING ROLLING MACHINE

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Fig. 5

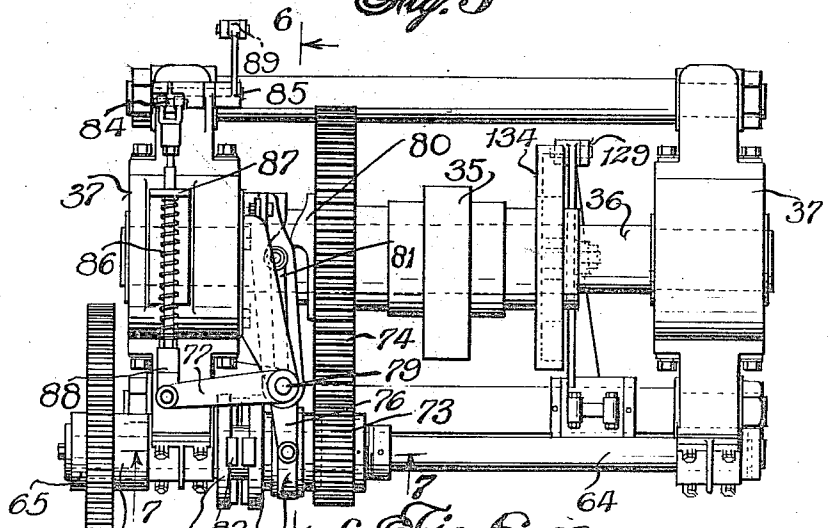


Fig. 6

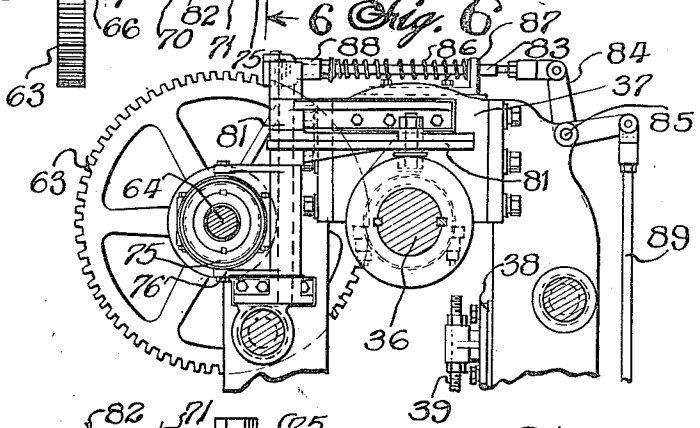
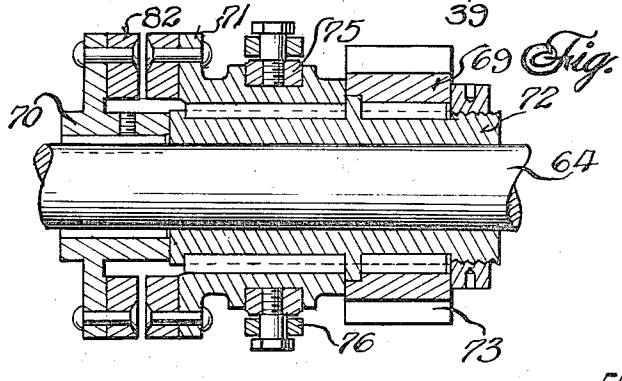


Fig. 7



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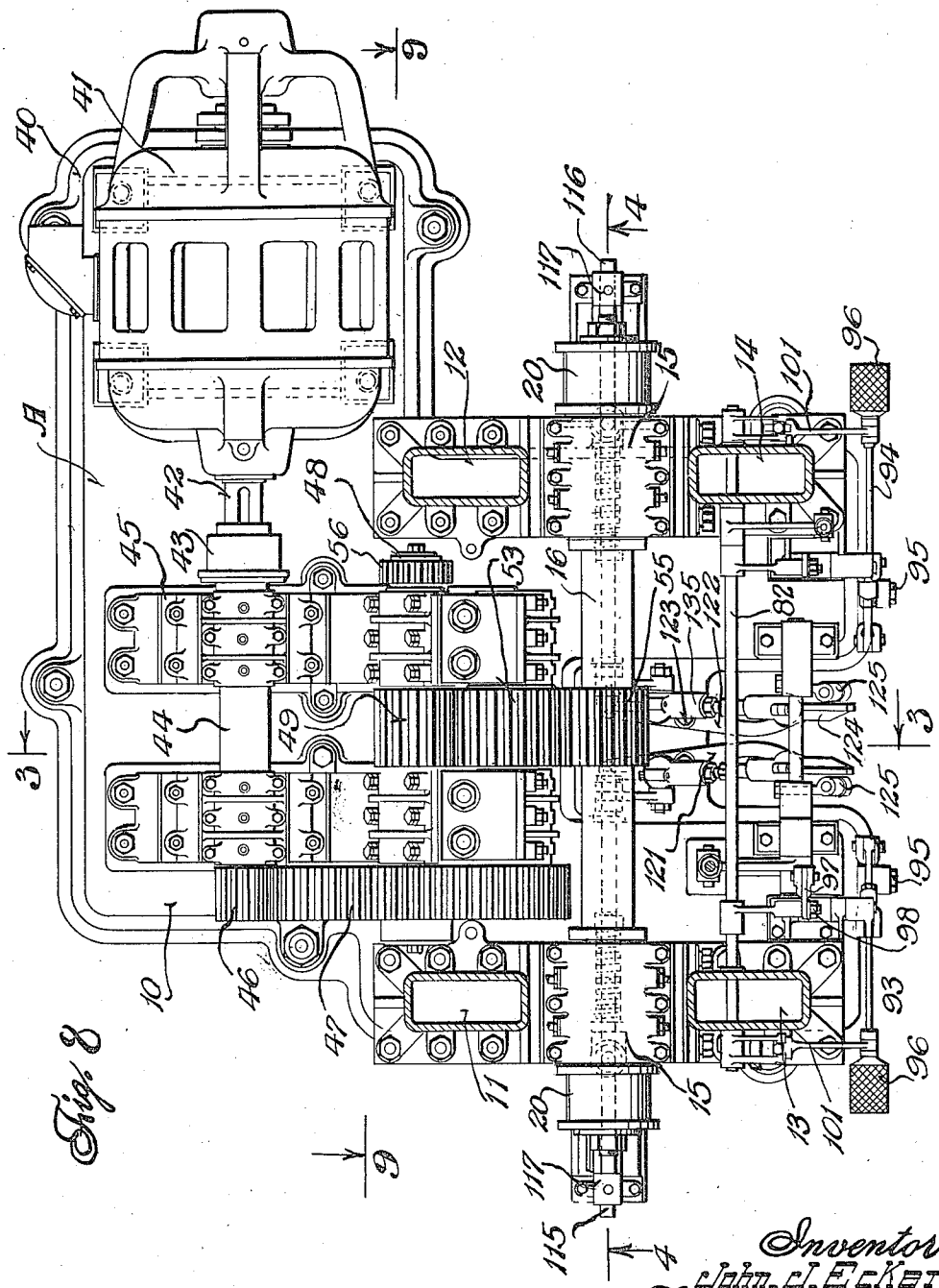


Fig. 8

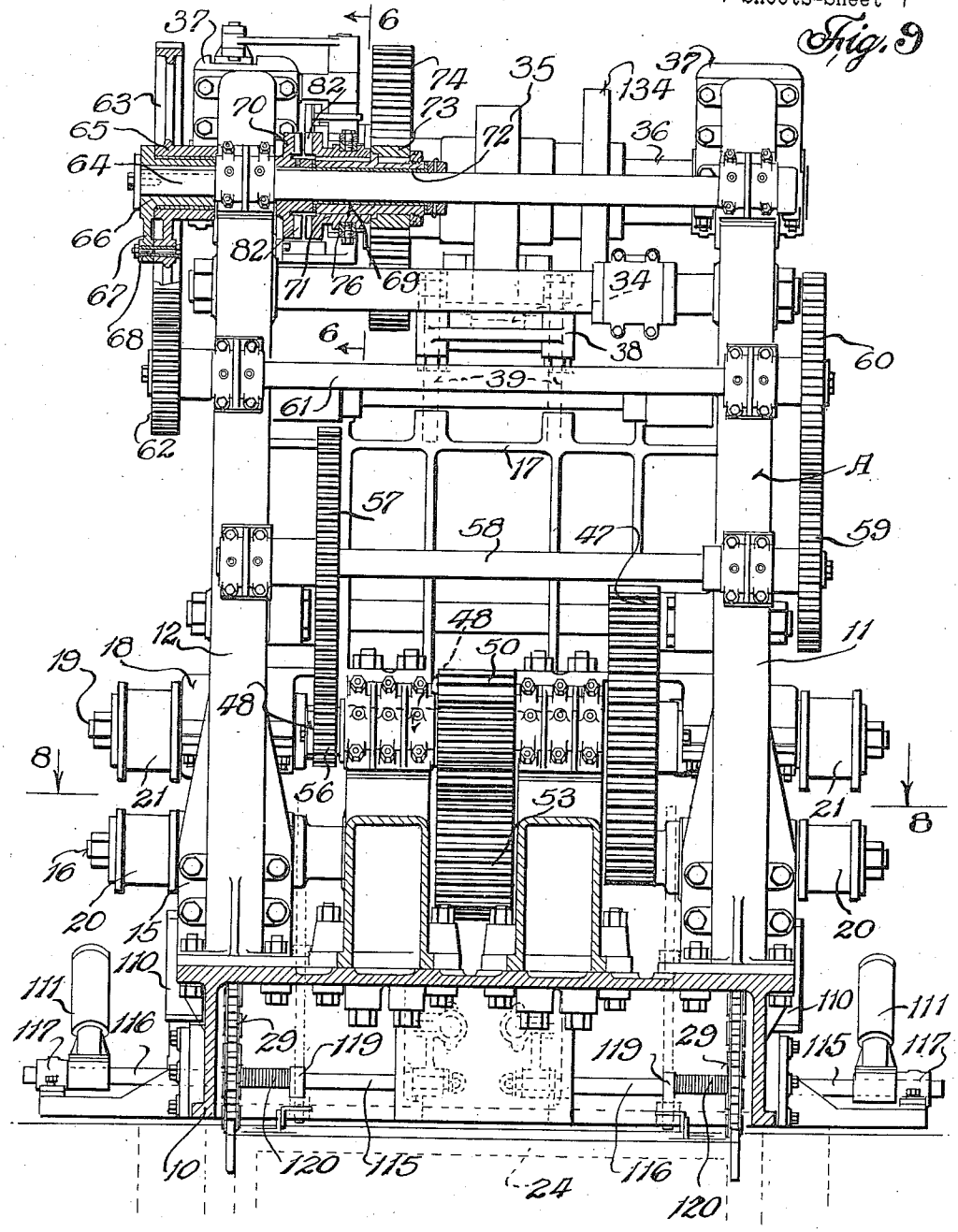
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Fig. 9



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UNITED STATES PATENT OFFICE

1,976,927

RING ROLLING MACHINE

John J. Eckert, Milwaukee, Wis.

Application May 20, 1932, Serial No. 612,404

4 Claims. (Cl. 80—5)

This invention appertains to a novel machine for rolling rings from a solid piece of metal.

One of the primary objects of the present invention is to provide novel means for forming the machine whereby the rings can be rolled simultaneously on each side of the machine thereby permitting a maximum number of rings to be rolled by a single machine in a minimum amount of time.

Another prime object of my invention is the provision of novel means for supporting the upper roll shaft, whereby the same can be bodily lifted to permit the simultaneous introduction of the rings between the opposite ends of the upper and lower rolls.

A further salient object of my invention is the provision of novel means for mounting the carriage carrying the upper roll on the frame of the machine, whereby the carriage will have an oscillating movement so that the upper roll will follow the teeth of its drive gear to permit the constant driving of the upper roll during the raising and lowering movement of the carriage, the rocking movement of the carriage allowing the upper roll to swing slightly to one side of the longitudinal center of the lower roll, whereby to obtain a maximum amount of rolling efficiency for forming the rings.

A further object of my invention is the provision of novel means for counter-balancing the weight of the carriage and the upper roll carried thereby and for normally urging the carriage to a raised position, with means for forcibly lowering the carriage so as to bring about the proper degree of pressure between the upper and lower rolls.

A further object of my invention is the provision of novel means for automatically stopping the movement of the carriage after the same has been raised, so as to permit the insertion of the new rings between the rollers without danger on the part of the operators of the machine.

A further object of my invention is the provision of means under control of the operators of the machine for starting the carriage in motion after the rings have been placed in posit on on the rolls, said means being automatically locked to prevent accidental operation thereof.

A further important object of my invention is the provision of means whereby the release for the carriage must be actuated by each of the operators of the machine so that the machine will be prevented from being set into operation by a single operator, thereby insuring that the rings will be placed in position on each side of the machine prior to the operation thereof.

A further object of my invention is the provision of novel means for engaging the rings during the forming thereof, so as to effectively guide the rings and to hold the same in alinement to permit the true accurate rolling thereof, said guide means being automatically moved to an inoperative position upon the raising of the carriage to allow the free removal of the formed rings from between the rollers and the free insertion of the rings to be formed between the rollers.

A further object of my invention is the provision of novel means incorporated in the drive of the machine for rendering the drive inoperative should the machine become overloaded or should a ring become jammed for any reason, and thereby prevent breakage of the various parts.

With these and other objects in view, the invention consists in the novel construction, arrangement and formation of parts, as will be hereinafter more specifically described, claimed and illustrated in the accompanying drawings, in which drawings:

Figure 1 is a side elevation of my improved machine showing the carriage in its raised position to permit the placing of rings in position.

Figure 2 is a front elevation of my improved machine, the carriage being shown in its raised position.

Figure 3 is a vertical section through my improved machine, the view being taken on the line 3—3 of Figure 2 looking in the direction of the arrows.

Figure 4 is a vertical section taken at right angles to Figure 3 and on the line 4—4 of Figure 3 looking in the direction of the arrows.

Figure 5 is a fragmentary top plan view of the machine illustrating the mechanism employed for bringing about the drive of the cam shaft for the carriage.

Figure 6 is a fragmentary vertical sectional view taken on the line 6—6 of Figure 5 looking in the direction of the arrows illustrating a part of the operating means for the clutch of the cam shaft.

Figure 7 is an enlarged fragmentary section taken on the line 7—7 of Figure 6 looking in the direction of the arrows illustrating the clutch for the cam shaft.

Figure 8 is a horizontal section through the improved machine taken on the line 8—8 of Figure 9 looking in the direction of the arrows.

Figure 9 is a vertical section through the improved machine taken on the line 9—9 of Figure 8 looking in the direction of the arrows.

Referring to the drawings in detail, wherein similar reference characters designate the corresponding parts, the letter A generally indicates my improved machine which comprises a base 10 which has bolted or otherwise secured thereto, the four supporting uprights or standards 11, 12, 13 and 14. As shown, these standards are arranged in spaced parallel pairs and the lower ends of the pairs of standards support the bearings 15 for the lower roll shaft 16. These bearings are lubricated in any preferred manner and are preferably water-cooled so as to insure a maximum amount of efficiency from the machine. Slidably mounted above the base 10 between the pairs of standards or uprights is the movable carriage 17 which supports the bearings 18 for rotatably supporting the upper roll shaft 19. The bearings for the upper roll shaft are likewise provided with means for lubricating the same and these bearings can also be water-cooled if desired.

As shown, the lower and upper roll shafts 16 and 19 extend transversely across the machine and project beyond the opposite sides thereof and the terminals of these shafts are so formed as to removably receive the rolls 20 and 21 for forming the rings. These rolls 20 and 21 can be made in different shapes, so as to permit the forming of the rings of different shape in cross section. Upper and lower pairs of rocking arms 22 are pivotally secured to the uprights or standards 11 and 12 and these arms are in turn pivotally connected, as at 23 to the carriage 17. The carriage 17 is moved toward and away from the lower roll shaft 16, by means, which will be later described, and due to the connection of the carriage with the standards 11 and 12, the same will have an oscillating movement.

To facilitate the easy raising of the carriage 17 and the roll shaft 19 on the non-working stroke of the carriage, I provide novel means for counter-balancing the carriage and shaft. This means comprises a weight 24 which may be formed of any desired material and in any preferred way. As shown, the weight embodies a metallic casing 25 filled with concrete 26. This weight is mounted within a pit 27 formed in the concrete supporting structure 28 for the base 10. Securely anchored to the weight 24 is a supporting sprocket chain 29 which is trained over an idle sprocket wheel 30 rotatably supported by the frame of the machine. The sprocket chain is brought down under an idle sprocket wheel 31 carried by the carriage 17 and is then brought upward and anchored to a supporting rod 32. This supporting rod 32 is adjustably mounted within a supporting bracket 33 bolted or otherwise secured to the standards 13 and 14. The weight 24 also functions to normally hold the carriage in a raised position, with the roller 34 in engagement with the periphery of a cam 35. The cam 35 is keyed or otherwise secured to a transversely extending shaft 36. This shaft 36 is rotatably mounted in suitable bearings 37 carried by the upper ends of the standards 11, 12, 13 and 14. The cam normally functions to forcibly move the carriage downward against the action of the weight 24, so as to bring about the proper forcible contact of the ring forming rolls 20 and 21. As shown, the roller 34 is carried by a block 38 and this block is connected by means of adjustable bolts 39 with the upper end of the carriage 17. By this construction the block can be adjusted relative to the carriage, so that the initial position of the carriage can be changed relative to the lower roll shaft 16. This permits the accommodating of different sized rings.

The base 10 is provided at one corner with a lateral extension 40 on which is mounted the prime mover 41 which may be an electric motor, as shown. The armature shaft 42 of the motor is connected by means of a flexible coupling 43, with the main drive shaft 44. The drive shaft 44 is rotatably mounted in suitable bearing brackets 45 bolted or otherwise secured to the base. Secured to the main drive shaft 44 is a drive pinion 46 which meshes with a large spur gear 47 keyed or otherwise secured to a cross shaft 48. Secured to the cross shaft 48 is a drive pinion 49, which in turn meshes with a gear 50 keyed or otherwise secured to a cross shaft 51. The cross shaft 51 is arranged directly above a second cross shaft 52 and these shafts are connected by the spur gear 50 on the shaft 51 and a spur gear 53 on the shaft 52. The gears 50 and 53 are of the same diameter and mesh respectively with small drive gears 54 and 55 keyed or otherwise secured to the upper and lower roll shafts 19 and 16. By this arrangement the roll shafts are driven at the same rate of speed and in opposite directions. By referring to Figure 3 of the drawings, it will be noted that the radius of the swinging or rocker arms 22 is equal to center line distance between gears 50 and 54. Thus, as the carriage 17 moves through its cycle of operation it swings on a radius equal to the gear centers, which insures the meshing of gears 54 and 50 at all times.

The cam shaft 36 is operated through a train of gearing which may include a spur gear 57 meshing with the drive gear 56. The drive gear 56 is secured to shaft 48. This spur gear 57 is keyed or otherwise secured to a transversely extending shaft 58 which also has keyed thereto a gear 59, which meshes with a gear 60 keyed or otherwise secured to a transversely extending shaft 61. The shaft 61 has in turn keyed thereto a small gear 62 which meshes with a relatively large gear 63. The gear 63 is mounted on the top cross shaft 64 in a novel manner. As shown, the gear 63 has formed thereon a hub 65 which is rotatably mounted on a sleeve 66. This sleeve 66 is in turn keyed to the shaft 64 and is provided with a radially extending arm 67. The arm 67 is connected to the gear 63 by means of a frangible pin or the like 68. Should the machine become overloaded or jammed in any way, the frangible pin 68 will sheer and thus cause the discontinuing of the drive to the cam shaft 36. All of the shafts 48, 51, 52, 58, 61, and 64 are mounted in suitable bearings secured to the uprights or standards 11 and 12. The gears 59 and 60 are readily removable from their shafts 58 and 61, so that gears of different sizes can be substituted therefor, to obtain different driving speeds for the cam shaft 36, so as to take care of rings of different diameters.

I provide novel means for driving the cam shaft 36 from the top shaft 64 and this means includes a clutch 69. The clutch 69 embodies a clutch section 70 keyed or otherwise secured to the top shaft 64 and a clutch section 71. The clutch section 71 is feathered on a sleeve 72, which is rotatably mounted on the shaft 64.

The sleeve 72 has keyed thereto a drive pinion 73, which meshes at all times with a large spur gear 74 keyed or otherwise secured to the cam shaft 36. The movable clutch section 71 rotatably supports a shift ring 75 to which is connected the shift yoke 76. The yoke 76 constitutes a part of a bell crank 77 which is rockably mounted at its angle, as at 79, on a suitable part of the frame of the machine. Obviously, upon movement of the bell crank 77 the clutch section 71 can be moved into and out of engagement with the drive clutch section.

Novel means is provided for automatically shifting the clutch section 71 to a neutral position after the cam shaft has made one revolution and the carriage has been moved to a raised position with the upper roll shaft 19 above the lower roll shaft 16. This means comprises a cam 80 formed on the large gear 74 and this cam is arranged in the path of an arm 81 formed or connected with the bell crank 77. Thus, when the high point of the cam 80 engages the arm 81, the clutch section 71 will be shifted to the right and out of engagement with the drive clutch section 70. Referring again to the clutch, I preferably provide the meeting faces of the clutch sections 70 and 71 with inter-engaging hardened teeth 82. The teeth 82 can be made removable, so that the same can be replaced when worn.

From the construction so far it can be seen that the clutch is automatically released when the cam has been raised and manual means is provided for actuating the clutch to restart the machine. The manual means for operating the clutch includes a pull rod 83 which is pivotally connected to one arm of a bell crank 84 rockably mounted at its angle as at 85 on the upper end of the front of the machine. Coiled around the pull rod 83 is an expansion spring 86 and this spring bears against a stationary bracket 87 secured to the frame of the machine at one end and against an abutment 88 carried by the rod. Thus, the spring 86 normally functions to hold the bell crank 77 in a released position. Connected with and depending from the bell crank 84 is a connecting rod 89. The lower end of the connecting rod 89 is pivotally connected with a crank 90 formed on a sleeve 91 secured to the rock shaft 92. Below the shaft 92 and on each side of the machine are foot treadles 93 and 94. These foot treadles 93 and 94 are of a bell crank shape and are rockably mounted at their angles on suitable supporting bolts or shafts 95. The outer ends of the treadles 93 and 94 have arranged thereon the operating foot pedals 96. Disposed between the rock shafts 92 and the foot treadles 93 and 94 are pairs of toggle links 97. The upper links of the toggle are connected to the rock shaft 92 by means of pins 98 secured to and projecting radially from the rock shaft. These links are slotted as shown to receive the pins. The lower links of the toggles are rockably mounted intermediate their ends on bearing brackets 99 connected to the base 10 and the extreme lower ends of the lower links beyond their pivots which are connected by means of links 100 with the upper inner ends of the foot treadles 93 and 94. When the treadles are in their raised positions, the links of the toggles will be straightened and the pins 98 will be at the lower ends of their slots and rocking movement of the pins will be prevented. This holds the rock shaft from movement and as the pivots of the toggles will all be in line the braking of the toggle is prevented. Upon depression of the foot treadles 93 and 94 the links of the toggles will be broken and consequently, movement of the rock shaft is permitted. To bring about the rocking of the shaft 92 from the foot treadles 93 and 94 I provide connecting rods 101. These connecting rods 101 are pivotally connected to the treadles adjacent to their outer ends and extend upwardly therefrom. The upper ends of the rods 101 are pivotally connected to crank arms 102 arranged on opposite sides of the machine and these crank arms are mounted upon pivot pins 103 secured to the front pair of uprights or standards 11 and 12. Pivotally secured to the crank arms 102 are the rods 104. The rods 104 are slidably mounted in sleeves 105 pivotally connected with the outer ends of crank arms 106 secured to the rock shaft. Bearing against the upper ends of the sleeves 105 are expansion springs 107. These springs 107 abut at their upper ends adjustable nuts 108.

When it is desired to start the operation of the carriage after the formed rings have been removed from between the upper and lower forming rolls 21 and 20 on each side of the machine and the new blanks have been placed between the rolls, the pedals 96 on the opposite sides of the machine are depressed. This will brake the toggles 97 as heretofore described, and at the same time the rods 104 will be pulled downward. The downward pulling of the rods 104 will tension the springs 107 which will in turn rock the crank arms 106 and actuate the rock shaft 92. The swinging movement of the rock shaft 92 will pull down on the connecting rod 89 and through the medium of the bell crank 84 and rod 83 will actuate the bell crank 77 and the clutch and bring about the proper engagement of the clutch sections 70 and 71. The cam shaft 36 will now be set in operation and the carriage will be forcibly lowered by the engagement of the cam 35 with the roller 34. When one complete rotation of the shaft 36 has taken place and the high point of the cam has ridden past the roller 34, the clutch will be automatically disconnected due to the engagement of the cam 80 with the arm 81, as heretofore explained.

I provide two foot treadles so as to make it necessary for each operator standing on opposite sides of the machine to actuate the same and if only one treadle is depressed the other treadle will be in a raised position and its toggle will be straightened which will prevent the movement of the rock shaft 92. Consequently, when a workman removes the formed ring on his side of the machine and places a new blank in position, he depresses the adjacent pedal, but the machine will not be started in operation until the workman on the opposite side has removed the formed ring from his rolls and inserted a new blank thereon. As soon as this is done the workman then depresses the pedal on his side of the machine. Independent downward movement of the rods 104 relative to one another is permitted due to the mounting of the rods within the sleeves 105.

I have provided an improved means of engaging and holding the ring blanks true during the rolling thereof. This means comprises inner and outer guide rollers 110 and 111 arranged on each side of the machine below the forming rolls 20 and 21. The inner and outer guide rollers engage the rings being formed adjacent to their lower ends and hold the rings against lateral shifting movement, but at the same time permit

the free rolling thereof between the said forming rolls. Each of the guide rollers is mounted upon shanks 112 and suitable ball-bearings 113 are incorporated between the shanks and rollers, so as to permit the free turning thereof. The lower ends of the shanks 112 for the inner guide rollers 110 are firmly anchored to supporting brackets 114 and thus, the inner rollers are normally held in a vertical plane against shifting movement. The outer rollers 111 are mounted both for lateral shifting and swinging movement below the rings, so that the ring blanks can be readily introduced between the forming roll and removed from the roll after the same have been treated. Novel means is provided for automatically shifting the outer guide rollers 111 and for swinging the same in timed relation to the carriage 17. Thus, by this mechanism when the carriage is in its elevated position with the upper forming rolls 21 above the lower forming rolls 20, the outer guide rollers 111 will be swung to a lowered position. In order to bring about the synchronized action between the outer guide rollers and the carriage I provide a pair of shiftable rock shafts 115 and 116. These shafts are rotatably and slidably mounted in suitable bearings 117 carried by the base and it is to be noted that there is a shaft for each outer guide roller, and the shanks 112 for the outer guide rollers are anchored to brackets 118 which are keyed to the shafts 115 and 116 for movement therewith. An abutment 119 is secured to each shaft and expansion coil springs 120 are placed upon the shafts and bear against the abutments 119 and against suitable portions of the frame. Thus, these springs function to normally hold the guide rollers 111 toward the guide rollers 110 and in contact with the rings being formed. Bearing against the inner ends of the shafts 115 and 116 are swinging actuating levers 121 and 122. These levers have their ends cupped for engagement with the shafts, so as to form a substantial universal connection therewith. The levers are rockably mounted intermediate their ends on suitable pivot pins 123 and the outer ends of the levers are provided with cam faces 124 for a purpose which will be later set forth. Bearing against the cam faces 124 of the levers 121 and 122 are rollers 125 carried by swinging arms 126 arranged on opposite sides of the machine. Each of the swinging arms 126 has connected thereto a crank arm 127 and the crank arm 127 has in turn pivotally connected thereto a connecting rod 128 which leads toward the top of the machine. The connecting rod 128 is pivoted as at 129 to a swinging operating lever 130 which is rockably mounted on a supporting shaft 131. This operating lever 130 at a point intermediate its ends is provided with a roller 132, which travels in a cam track 133 formed in a cam wheel 134. The cam wheel 134 is keyed or otherwise secured to the main cam shaft 36 and operates in conjunction therewith and the main cam 35 employed in conjunction with the carriage 17. Referring again to the swinging arms 126, it will be noted that each of the same have pivotally connected therewith inwardly extending adjustable connecting rods 135 and the inner ends of these rods have connected thereto a universal joint 136 and cranks 137 which are in turn connected with the sliding rock shafts 115 and 116.

From the foregoing description, it can be seen that when the main cam 35 raises, so as to allow the carriage 17 to swing upwardly the operating crank 130 will be depressed owing to the arrangement of the cam wheel 134 and the roller 132. This will depress the connecting rod 128 which will push down on the crank 127. Downward movement of the crank 127 will move the swinging arms 126 outward. The rollers 125 carried thereby bearing against the cam ends of the members 121 and 122 will swing the inner ends of these members outwardly forcing the sliding rock shafts 115 and 116 away from one another. This will carry the guide rollers 111 away from the guide rollers 110 and the rings being formed.

Synchronous with this action the swinging arms 126 will pull on the connecting rods 135 which will rock the crank arms 137. The crank arms in turn will rock the shafts 115 and 116 and thus, the guide rollers 111 will be at an angle to the vertical and at one side to the rings being made. When the operating crank 130 is raised by the cam, this action is reversed and consequently, the outer guide rollers 111 will be moved to a vertical position and will be forced inward toward the rings.

With the above description in mind, it will be noted that I have provided a comparatively simple ring rolling machine in which the carriage carrying the upper roll shaft is bodily movable and that the operation of the carriage is stopped automatically when the same reaches an elevated position and that the carriage can again only be depressed by like movements of the two operators on opposite sides of the machine.

Lateral shifting movement of the carriage 17 is prevented by the use of anti-friction rollers 138 which are rotatably supported by plates 139. These plates are provided with pins 140 which are mounted in arcuate slots 141 formed in supporting plates 142. The supporting plates 142 are connected to bearing brackets 143 secured to the uprights or standards 13 and 14. The provision of the pins 140 and the plates provide means for adjusting the rollers to compensate for wear and to make it possible to line up the upper and lower roll shafts 19 and 16. As clearly shown in Figure 2 of the drawings, the rollers 138 bear against guide ribs 144 formed on the carriage.

Changes in details may be made without departing from the spirit or the scope of this invention, but what I claim as new is:

1. In a ring rolling machine, a supporting frame, a lower roll shaft rotatably mounted in the supporting frame, a swinging carriage mounted on the frame, an upper roll shaft rotatably mounted on the lower end of the carriage, means normally tending to move the carriage to an elevated position, a roller connected with the upper end of the carriage, a cam shaft, means for rotating the cam shaft, a cam on the cam shaft engaging said roller for forcibly lowering the carriage, a ring forming roll on each end of each roll shaft, inner and outer ring guide rollers disposed below the ring forming rolls, a sliding rock shaft connected to each outer ring guiding roller, means for rocking and sliding the last mentioned shafts automatically from the cam shaft including a rock arm mounted on the frame, a cam on the cam shaft for actuating the rock arm, a pair of swinging arms mounted below the rock arm, a connecting rod operatively connecting the rock arm to the

swinging arms, a pair of levers mounted for rocking movement in a horizontal plane, means operatively connecting the inner ends of the levers to the sliding rock shafts, cam rollers on the swinging arms for engaging the outer ends of the levers, a crank on each rock shaft, and a universal joint connection connecting the crank arms with the swinging arms.

2. In a ring rolling machine, a supporting frame, a lower roll shaft rotatably mounted on the frame, a swinging carriage mounted on the frame, an upper roll shaft rotatably mounted on the carriage, ring forming rolls connected to each end of each roll shaft, means for rotating the roll shafts in opposite directions, means normally tending to elevate the carriage, a cam shaft for forcibly lowering the carriage, means including a clutch for rotating the cam, said clutch including a shiftable section, means for automatically actuating the shiftable section upon a single rotation of the cam for stopping the rotation of the cam, operator controlled means for moving said clutch section to an engaged position including a pair of foot treadles arranged on opposite sides of the machine, a rock shaft, means operatively connecting the rock shaft to the movable clutch section, means operatively connecting each foot treadle to the rock shaft, and means for latching the rock shaft against movement by each of said treadles.

3. In a ring rolling machine, a supporting frame, a lower roll shaft rotatably mounted on the frame, a swinging carriage mounted on the frame, an upper roll shaft connected with the carriage, means normally tending to elevate the carriage, a cam shaft, a cam on the cam shaft for forcibly lowering the carriage, a motor, means for rotating the roll shafts in opposite directions from the motor, a cross shaft, means for constantly driving the cross shaft from the motor, a clutch on the cross shaft including a clutch section rigidly connected with the cross shaft and a clutch section slidably and rotatably mounted on the cross shaft, a gear on the cam shaft, a gear operated by the movable clutch section engaging the gear on the cam shaft, means for automatically moving the movable clutch section from out of engagement with the rigid clutch section from the cam shaft upon one rotation thereof, and operator controlled means for moving the movable clutch section into engagement with the rigid clutch section.

4. In a ring rolling machine, a supporting frame, a lower roll shaft rotatably mounted on the supporting frame, a swinging carriage, a counter-balancing weight normally tending to elevate the carriage, an upper roll shaft rotatably supported by the lower end of the carriage, a ring forming roll connected with each end of each roll shaft, a cam shaft for forcibly lowering the carriage, means for rotating the cam shaft including a clutch, means for actuating the clutch for stopping the rotation of the cam shaft upon rotation thereof, means for rendering the clutch operative including a rock shaft, means operatively connecting the rock shaft to the clutch, a pair of foot treadles, radial arms formed on the rock shaft, a toggle joint connection between the arms and the foot treadles, the toggle joints acting to hold the rock shaft against movement when the treadles are in one position, a crank arm on each end of the rock shaft, swinging operating arms arranged below the crank arms, a pivoted rod connected to each swinging arm and slidably mounted in the crank arms, expansion springs carried by the rods engaging at one of their ends against abutments on the rods and at the other ends against the crank arms, and means operatively connecting the swinging arms to the treadles.

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