Aug. 31, 1937. W. A. WHITING 2,091,540

MEANS FOR MAKING REINFORCEMENT WIRE CAGES

Filed July 18, 1936 4 Sheets-Sheet 1

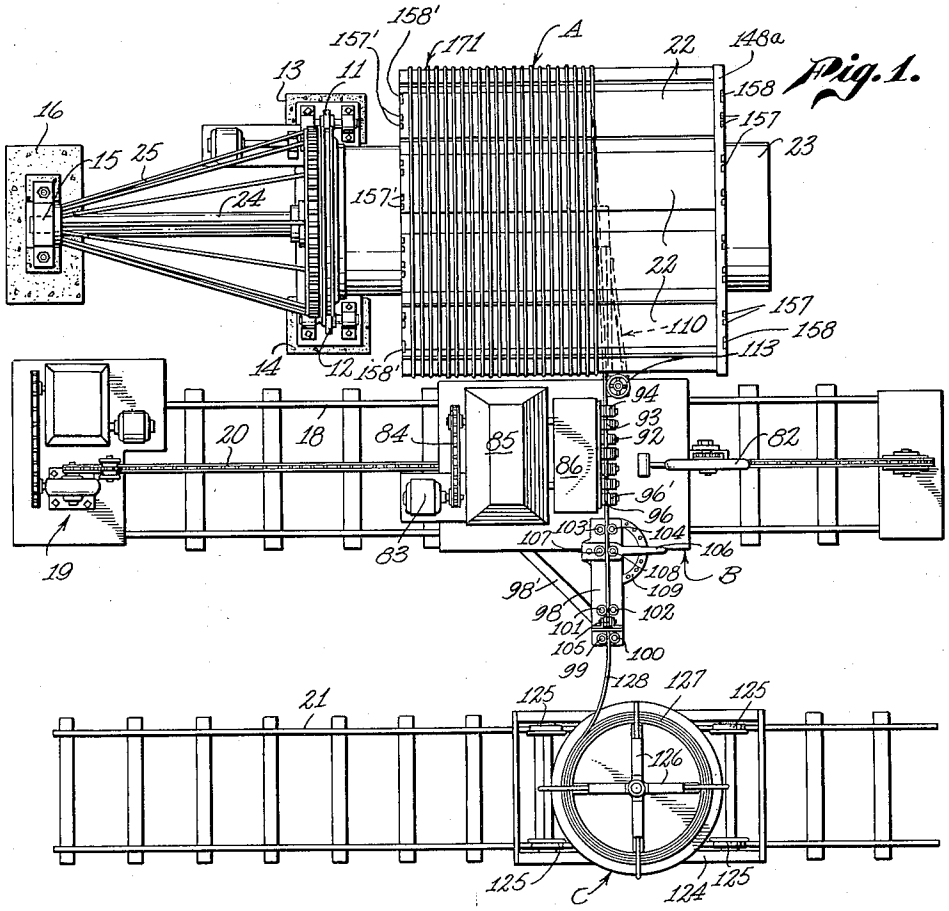


Fig. 1.

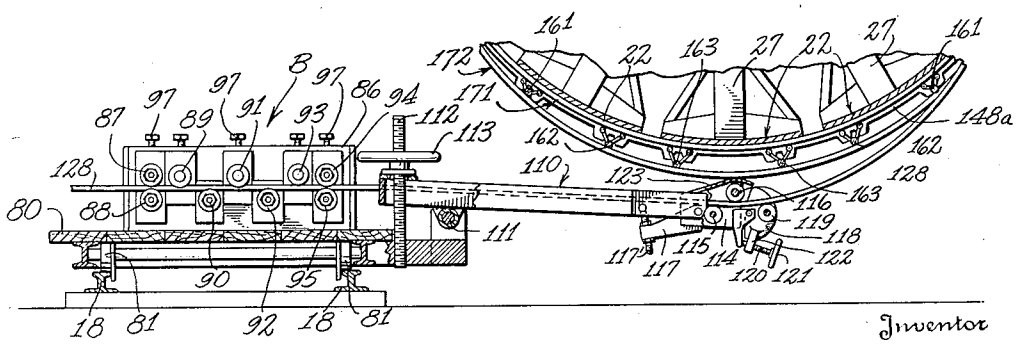


Fig. 3.

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MEANS FOR MAKING REINFORCEMENT WIRE CAGES

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Fig. 2.

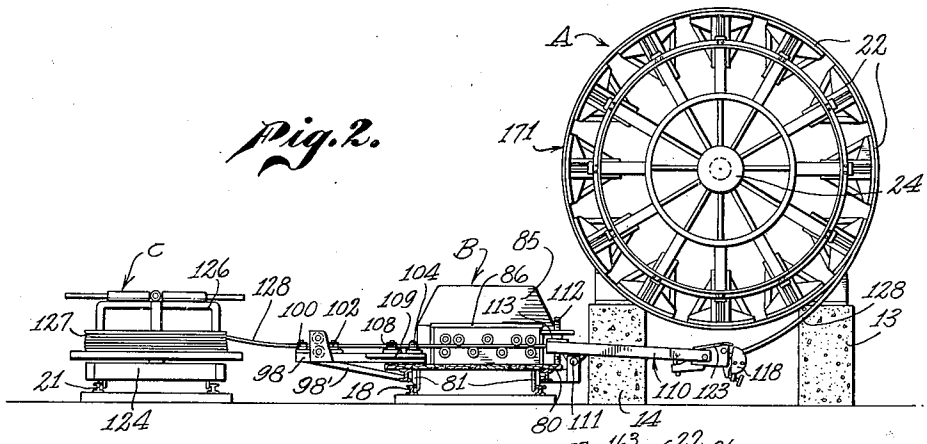


Fig. 4.

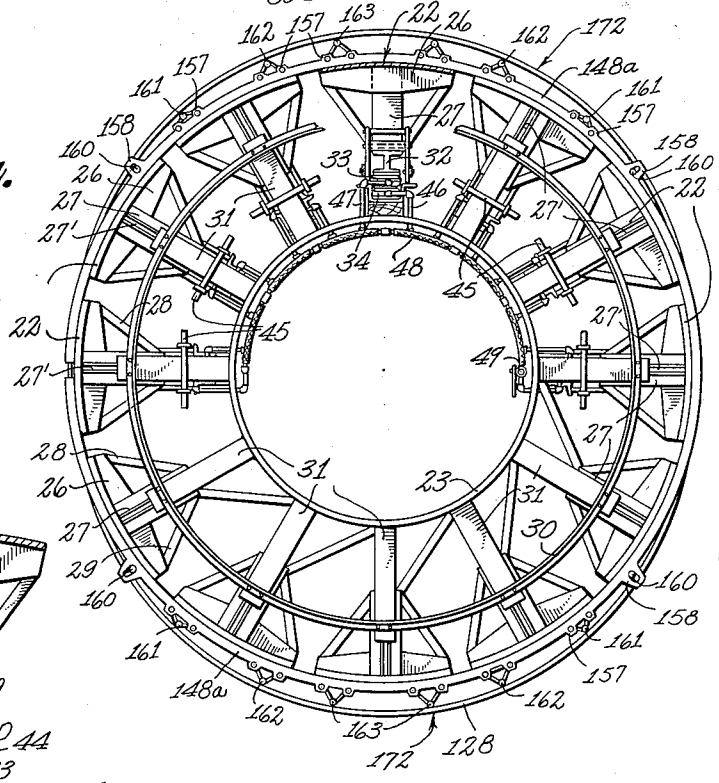
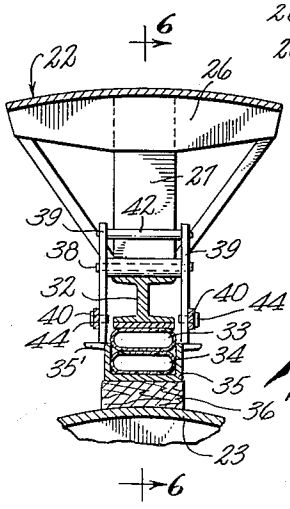


Fig. 5.



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MEANS FOR MAKING REINFORCEMENT WIRE CAGES

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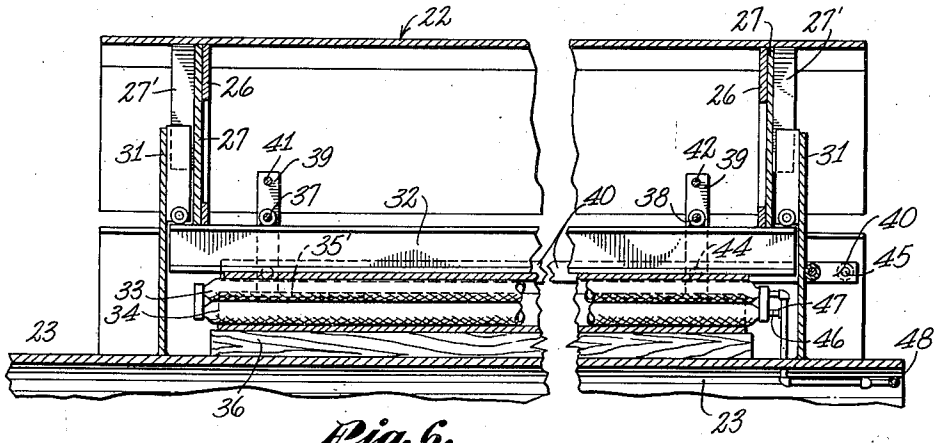


Fig. 6.

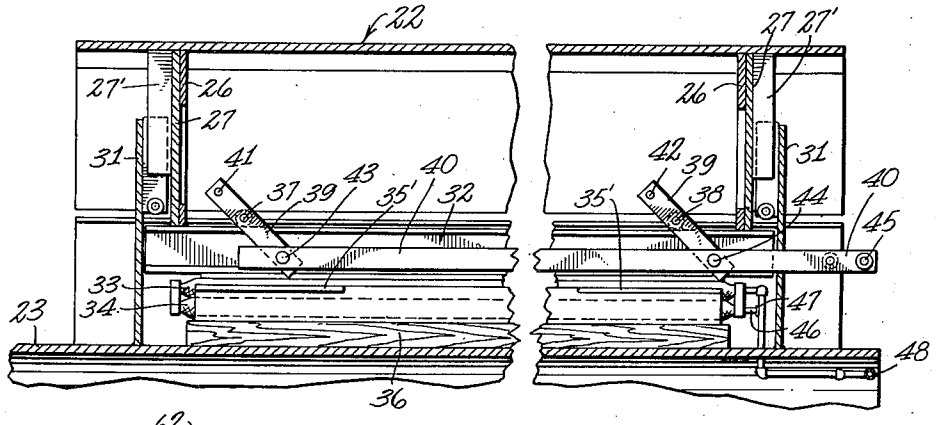


Fig. 7.

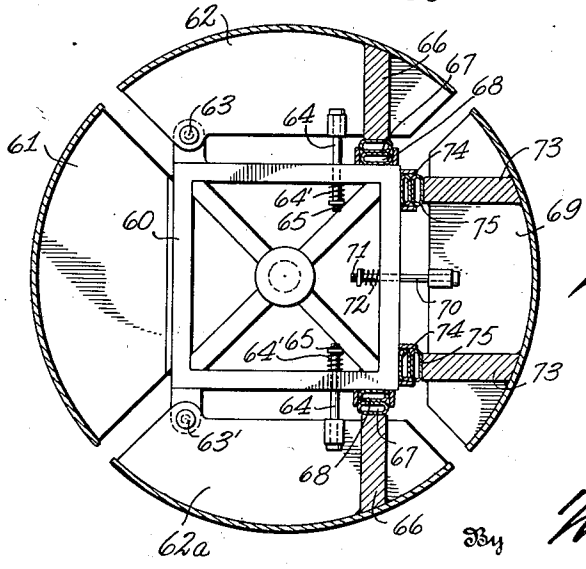


Fig. 8.

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MEANS FOR MAKING REINFORCEMENT WIRE CAGES

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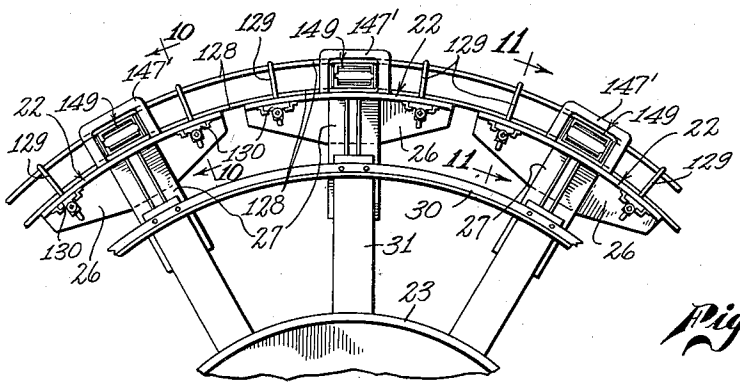


Fig. 9.

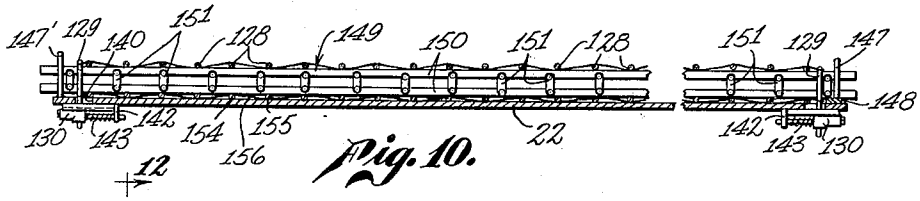


Fig. 10.

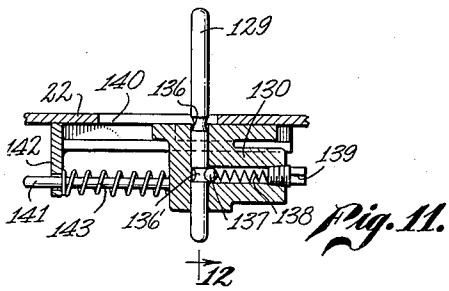


Fig. 11.

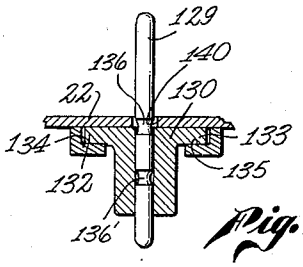


Fig. 12.

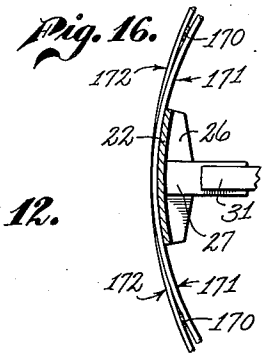


Fig. 16.

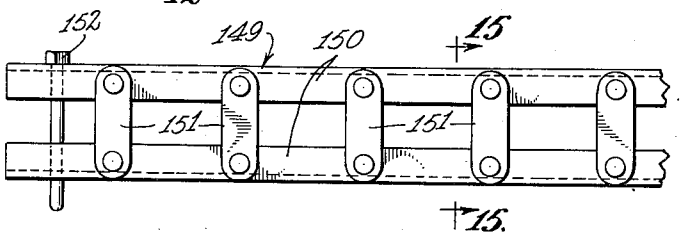


Fig. 13

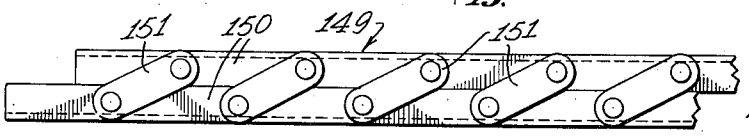


Fig. 14.

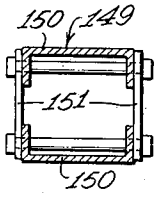


Fig. 15.

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UNITED STATES PATENT OFFICE

2,091,540

MEANS FOR MAKING REINFORCEMENT WIRE CAGES

William A. Whiting, Southgate, Calif., assignor to American Concrete & Steel Pipe Company, a corporation of Delaware

Application July 18, 1936, Serial No. 91,437

5 Claims. (Cl. 140—92.2)

This invention relates to the art of making wire reinforcement members or cages for use in concrete structures such as concrete pipe sections in which such reinforcement usually consists of wire wound in helical form to form what has been termed a cage. This cage may consist of an inner winding of wire and a spaced outer winding of wire, the outer winding being either concentric to the inner winding or elliptical in shape, the wire of the narrow portion of the ellipse being welded or otherwise secured to the wire of the inner winding. In both forms of cage, just referred to, the cage may be also provided with longitudinally extending wires forming additional reinforcing members for the cage. The machine, herein described, is particularly designed for winding wire in either circular or elliptical form to produce such reinforcing cages for use in the manufacture of concrete pipe sections.

It is a primary object of this invention to provide an improved type of reinforcement cage winding machine for use in connection with the making of concrete structures which will automatically and symmetrically wind reinforcing wire into the form of a cage of the character above referred to. It is a further object of this invention to provide a machine which is capable of winding either circular or elliptical reinforcement wire cages either separately, or first an inner circular winding and an outer elliptical winding or vice versa. It is a further object to provide a machine which is capable of winding spaced concentric circular windings of wire to form a cage.

It is also an object to provide a suitable wire feeding device capable of accommodating different size reinforcement wire and which is capable of feeding the wire at a desired tension. As a part of this feeding device it is an object to provide an arm which is capable of pre-bending the wire before it is wound upon the drum, such pre-bending mechanism being automatically adjustable to the different curves in the winding of an elliptical cage.

It is still a further object to provide a cage winding machine wherein the drum upon which the reinforcement wire is wound is semi-collapsible in order to facilitate removal of a completed wound wire cage and it is a particular object of the invention to provide improved means for thus semi-collapsing the winding drum of the cage machine.

It is a still further object to provide improved means for spacing concentrically wound circular cages, and it is also an object to provide improved means for spacing an outer elliptically wound cage from an inner circular cage. It is another object to provide improved means for holding reinforcing wires running longitudinally of the winding drum whereby such holding means are self-adjusting to accommodate the stress of the crimping of the longitudinal wires.

Fig. 1 is a plan view showing a preferred form of apparatus used in carrying out my invention;

Fig. 2 is an end elevation of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged end elevation partially in section of the wire feeding mechanism showing its use in connection with the winding of an elliptical cage;

Fig. 4 is an end elevation of the winding drum showing the semi-collapsible segments of the drum and showing one segment with the outer post removed and the annular ring partly broken away;

Fig. 5 is a fragmentary sectional view of one of the semi-collapsible segments of the winding drum;

Fig. 6 is a longitudinal section on line 6—6 of Fig. 5, illustrating a form of collapsing mechanism shown in extended position;

Fig. 7 is a view similar to Fig. 6 showing the mechanism in collapsed position;

Fig. 8 is an end elevation partly in section of a modified form of winding drum;

Fig. 9 is a fragmentary end elevation of a portion of the winding drum showing the spacers used for winding concentric cages and showing the hand, or cross, wire pins, the spacers, eye members, and hand wire pins being exaggerated;

Fig. 10 is a longitudinal section on line 10—10 of Fig. 9, showing the spacer used for separating concentrically wound wire cages;

Fig. 11 is a sectional view of a hand wire pin mounting on line 11—11 of Fig. 9;

Fig. 12 is a sectional view of a hand wire pin mounting on line 12—12 of Fig. 11;

Fig. 13 is a face view of a spacer used for winding concentric circular wire cages, the spacer being shown in extended position;

Fig. 14 is a similar view of the spacer shown in Fig. 13 in collapsed position;

Fig. 15 is a sectional view of the spacer, taken on the line 15—15 of Fig. 13; and

Fig. 16 is a diagrammatic view showing a manner of connecting an inner circular cage and an outer elliptical cage.

Referring to the drawings "A" generally indicates the winding drum which is supported by

rollers 11 and 12 on foundations 13 and 14, and by bearing 15 on foundation 16. "B" generally indicates the wire feeder which operates on tracks 18 and is propelled by a motor and reduction gears generally indicated by 19 which operate a chain 20 attached to the feeder. "C" generally indicates a wire holder operating on tracks 21.

The winding drum "A" comprises an outer winding drum composed of segments 22 which are mounted on an inner drum 23 supported on a shaft 24, the drum 23 being further supported on the shaft braces 25. In the preferred form of this invention five of the segments 22 forming the outer or wire winding drum are rigidly mounted on the inner drum 23 by means of an annular ring 30 at each end of the drum mounted upon radially disposed posts 31.

The segmental members generally indicated by 22 include across supports 26, a central column 27 and angle bars 28 and 29.

Seven of the segmental members 22 are radially slidably mounted on the inner drum 23, the posts 27 being provided with guides 27' adapted to engage a corresponding engaging member on the posts 31 (not shown). In the slidable segments 22 the posts 27 are mounted on a longitudinal H beam 32 which rests upon pneumatic tubes 33 and 34 which are carried within a U beam 35. The beam 35 is supported by suitable longitudinal wood supports 36 resting on the inner drum 23 and secured thereto in any suitable manner. Pivotally mounted at 37 and 38 (Fig. 6) on H beam 32 are links 39 which support parallel locking bars 40, the links being connected to each other by pins 41 and 42. In their extended position shown in Fig. 6, the lower ends of the links 39 are adapted to engage flanges 35' on U beam 35 to hold the segments 22 in extended or outward position. The links 39 are also pivoted on the locking bar 40 by pins 43 and 44. The bar 40 is provided with handle portions 45.

The tubes or pneumatic members 33 and 34 are supplied with air by means of pipes 46 and 47 which are connected with an air hose 48 mounted within the inner drum 23 and which is provided with a suitable valve connection 49 which may be attached to an air hose connected to a source of compressed air.

Although the invention has been described as embodying seven movable drum segments and five rigidly mounted segments, in fact any number of segments may be used to form the drum and of these any number may be movably mounted.

In Fig. 8 is shown a modified form of collapsible segmental winding drum in which the outer drum segments are mounted upon an inner box-like frame 60, one of the segmental sections 61 is rigidly mounted upon this inner frame structure. Segmental portions 62 and 62*a* are pivotally mounted on the inner frame 60 at 63 and 63' respectively. A bolt 64 having a nut 65 and spring 64' serves to yieldingly hold the segments 62 and 62*a* inwardly. Opposed to this action is post 66 cooperating with pneumatic tubes 67 and 68 which are carried on the inner frame 60 and which may be connected to a suitable source of compressed air for inflation in order to swing one end of the segment outwardly. Segment 69 is provided with a bolt 70, nuts 71 and spring 72 which tends to pull the segment inwardly toward the frame. This segment carries posts 73 which rest on pneumatic tubes 74 and 75 which may be connected to a suitable source of compressed air for inflation of the tubes to move the segment outwardly.

The wire feeder generally indicated by "B" consists of a car 80 having wheels 81 adapted to ride on tracks 18. The car is automatically propelled along the track by means of chain 20 attached thereto as has been pointed out. It may also be propelled manually by means of hand wheel 82 cooperating with chain 20. Mounted upon the car is a motor 83 which is connected by a chain 84 which drives suitable reduction gear means 85. Mounted on the car is a wire feeding and straightening device comprising rollers 87, 88, 89, 90, 91, 92, 93, 94 and 95. With the exception of rollers 89, 91 and 93 the rollers are driven from power supplied by motor 83. The rollers contain two grooves, one at 96 and one at 96' as shown in Fig. 1, the grooves being of different size in order to accommodate different size reinforcing wires. The upper rollers 87, 89, 91, 93 and 94 are vertically adjustable with respect to the lower rollers as indicated by bolts 97.

Mounted on car 80 between the wire straightening and feeding mechanism 86 and the wire holder "C" is a wire guiding device 98 supported by a frame 98'. The guiding device carries horizontally disposed rollers mounted in sets of pairs shown at 99, 100, 101, 102, 103, 104 and a pair of vertically disposed rollers indicated at 105. This device also embraces a pivoted arm 106 which carries rollers 107 and 108. By changing the position of the arm it may be used to straighten the wire as it comes from the wire holder. An arc-like plate 109 having holes therein is adapted to receive a pin or projection on the arm for holding the arm in a desired position.

Mounted upon the side of the wire feeder "B" is a wire feeding arm 110 pivotally mounted at 111. The arm is vertically adjustable by means of the screw 112 and hand wheel 113. At the outer end of the arm 110 is pivotally mounted a head 114 which carries rollers 115 and 116. Extending from the head 114 is an arm 117 having a bolt 117' for vertically adjusting the head 114 with respect to the arm 110. Pivotally mounted on head 114 is a member 118 carrying roller 119 and carrying bolt 120 operated by hand wheel 121 which operates on arm 122 of head 114 in order to vertically adjust the member 118 on the head. The arm 110 also carries a sliding contact or guide member 123.

This wire feeding arm 110 is free to move upwardly toward the winding drum "A" as the winding wire is tensioned by the pull of the winding drum upon it. The upward movement of the arm is limited by the sliding contact or guide member 123 which is adapted to ride upon the drum or the wire which has been wound about the drum. Downward movement of the arm is limited by wheel 113 on screw 112. By adjusting the rollers at the end of the arm the wire may be pre-bent to any desired curvature before it is wound about the drum. Thus by bending the wire in a curve having a smaller radius than the curvature of the winding drum a resulting tight winding of the wire about the drum is insured, the pull of the winding drum taking out the excess curvature of the wire. This pre-bending of the wire also prevents the wire from flattening out between spacers in the process of winding spaced cages.

Also, in winding an elliptical cage, the curvature placed in the winding wire is made to vary according to the ellipse to be wound by reason of the fact that the sliding contact member 123 rides upon the spacers forming the ellipse before

the wire has been wound upon the drum and subsequently, after a round or two of wire has been wound, it rides upon the wound wire forming the ellipse. This causes the arm 110 to pivot in a vertical plane and tends to change the curvature placed in the wire prior to its being wound upon the drum.

Wire sufficient for the winding of one layer of wire on the winding drum or other desirable quantity is carried on the wire holder "C" which comprises a frame 124 having mounted thereon wheels 125 adapted to ride on tracks 21. The frame 124 supports a wire holding frame 126 which supports a coil of wire 127. In the operation of the wire feeding mechanism, wire 128 is fed manually through the rollers carried by wire guiding device 98, the end being inserted between rollers 87 and 88 of the driving and feeding mechanism 86. The motor is then started to pull the wire through the various rollers until it is in the position shown in Fig. 3. By means of adjusting the outer member 118 on arm 110 vertically with respect to the rest of the arm the wire may be bent at any desirable curvature before being wound upon the winding drum. The feeding mechanism 86 can be adjusted to feed the wire to the winding drum at a speed slightly less than the speed at which the winding drum draws upon the wire, thereby creating sufficient tension in the wire to insure a tight wrapping of the wire about the winding drum "A".

After the feeding mechanism 86 has been threaded, sufficient wire is run through the machine to enable the workmen to attach the wire to the end of the drum where the wire winding is to begin. The wire feeder generally indicated at "B" is placed at the proper position on the tracks 18 and both the drum and the feeding mechanism are started. As the winding progresses the wire feeder "B" automatically is propelled along the track at the proper speed by means of the driven chain 20.

Drum segments 22 also have mounted thereon at each end so-called hand pins 129 which are adapted to hold the ends of what are termed hand wires, or cross wires, when it is desirable to use wires extending longitudinally of the drum. These pins are mounted in a housing 130 having angular shoulders 132 and 133 and are slidably secured to the drum segments by means of tracks 134 and 135. The pins 129 have annular grooves 136 and 136' into which a ball 137 may be thrust by spring 138. The spring and ball are held by means of screw plug 139. Thus the pin may be held in either an extended or lowered position by means of this mechanism. The pins 129 extend through longitudinal slots 140 in the drum segments.

Mounted on housing 130 is a rod 141 which is slidably mounted in a bracket 142. The rod carries spring 143 between the bracket and pin housing. From this description it can be seen that the hand pins are longitudinally slidable with respect to the drum segments 22 in the slots 140.

For the purpose of winding spaced concentric layers of wire the drum segments are provided with eye members 147 and 147'. The members 147 are carried by detachable ring 148 at the end of the drum from which the wire cage is removed after being wound. The eye members 147' are mounted directly on the drum segments 22 at the other end of the drum. These eye members may be mounted either inwardly or outwardly with respect to pins 129. Adapted to fit inside these eye members, as illustrated in Fig. 9, are the spacers generally indicated at 149 comprising parallel channel members 150 connected by a plurality of links 151 pivotally connected at each end to the channel members. In Fig. 13 a spacer is shown in extended position, held in that position by means of pins 152. If desirable, pneumatic tubes such as heretofore described may be used to hold the spacers in extended position. Fig. 10 illustrates the use of the spacers in winding concentric layers of wire at predetermined distances apart and also illustrates the use of the hand wire pins 129. In winding reinforcement cages it is often desirable to wind a layer of wire as at 154 upon the drum and then string hand wires or cross wires preferably looping the ends of the wire about the pins 129. A second winding is then made as shown at 155. This creates the marcel-like effect shown in Fig. 10 in the cross wire or hand wire. This crimping of the hand wires is compensated for by the longitudinally slidable pins 129 which move inwardly against spring 143. A spacer may then be placed over the last winding of wire and inserted in brackets 147 and 147' whereupon an outer cage may be wound as was done in winding the inner cage.

My invention is also adaptable for first winding a circular cage and then a spaced outer elliptical cage. For this operation different size spacers are employed as in Fig. 3 and Fig. 4. The drum segments 22 carry eye members 157' and 158' mounted thereon at the inner end of the drum as heretofore described which are similar to those carried by the ring 148a and shown at 157 and 158 at the outer end of the drum. The spacers, which may be of any desired construction, are indicated at 160, 161, 162 and 163. The spacers are of varying size and adapted to fit into the eye members 159. The spacers, with exception of the spacers indicated at 160 which are merely bars, are formed of three parallel bars spaced by means of straps to form a triangle in cross section. They are graduated in size so that when placed in proper position, as shown in Fig. 4, a wire wound about them will form a true ellipse.

The method of making cages comprising an inner circular cage and an outer elliptical cage includes the additional step of manually inserting a minimum number of bars 170 (Fig. 16) longitudinally of the winding drum after the two windings have been made between the inner cage 171 and outer cage 172 at the portions where the cages tend to converge and welding the inner and outer cages to these bars in order to hold them in proper relationship after they have been removed from the winding drum.

In the operation of the invention wire from the wire holder "C" is threaded through the wire feeding mechanism "B" and wound about winding drum "A". After one winding of wire has been placed about the drum "A", cross wires may be secured about the pins 129 if desired, or spacers 149 may be installed and a second concentric cage may be wound at a spaced distance from the first. If it is desired, a second cage elliptical in shape may be wound in place of either of the former operations and if such is desired to be done the elliptical spacers may be placed in position affording a base upon which to wind the outer or elliptical cage. If, after the first winding or cage has been put upon the drum it is desired to use the hand wires as in Fig. 10, shown at 156, a second winding as shown at 155 may be wound around

the hand wires. The spacers 149 may then be employed as illustrated in Fig. 10 and the process repeated for an outer cage. These are merely some of the many possible combinations of cage design which may be made upon the apparatus described herein.

After the desired cage has been wound upon the winding drum "A", it may be easily removed by suitable tackle, after the segmental collapsible members 22 have been collapsed. This is done by pulling out the locking bars 39 to the position shown in Fig. 7. Air is then allowed to escape from the tubes 33 and 34, thus allowing the segmental members 22 to collapse or move inwardly of their own weight, when brought into a position at the upper end of the drum by revolving the winding drum "A". The cage structure may then be removed from the winding drum "A".

After the cage has been removed and before a second cage has been started, the tubes 33 and 34 are inflated forcing out the collapsible segments 22 into a position to form a circular outer winding drum. The locking bar 39 is then forced into position as shown in Fig. 6 in order to relieve the pressure on the tubes 33 and 34 and hold the segments 22 in position during the winding operation.

I claim as my invention:

1. In combination with a winding drum of a cage winding machine of the class described: wire straightening and feeding rollers; means for driving some of said rollers; an adjustable arm member mounted adjacent said rollers; an adjustable head mounted on the end of said arm; an upper and a lower roller mounted on said head; a member pivotally and adjustably mounted on said head; and a wire-bending roller mounted on said last named member.

2. In a wire cage winding machine: a supporting member; an arm pivotally mounted on said member; a head pivotally mounted on said arm; rollers on said head arranged to receive wire therebetween; a jaw pivotally mounted on the head; a wire bending roller mounted on said jaw; and means for adjusting the jaw on the head to vary the relationship of said bending roller to the rollers on the head.

3. In a wire cage winding machine; a supporting member; an arm pivotally mounted on said member; wire engaging rollers mounted on said arm; a member pivotally mounted on said arm; a wire bending roller on said last named member and means for adjusting the position of the last named roller with respect to the other rollers.

4. In combination with a winding drum of a cage winding machine of the class described: a wire feeding car adapted to move longitudinally of said winding drum; wire feeding and straightening rollers adjustably mounted on said car; means for driving some of said rollers; a wire feeding arm pivotally mounted on said car; means mounted on said arm for bending the wire; and a cam member on said arm adapted to ride on said winding drum.

5. In combination with a winding drum of a cage winding machine of the class described: a wire feeding car adapted to move longitudinally of said winding drum; wire feeding and straightening rollers adjustably mounted on said car; means for driving some of said rollers; a wire feeding arm pivotally mounted on said car; means mounted on said arm for bending the wire; and means for automatically moving said arm in a plane at substantially 90 degrees to the axis of the winding drum to compensate for the winding of non-circular cages.

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