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WIRE STRAIGHTENING DEVICE

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The present invention relates to wire straightening devices arranged to operate in conjunction with wire forming mechanisms of various kinds for delivering straight wire thereto.

In prior devices of this character, a straightening effect has been obtained by passing the wire through a set of rolls offset from one another to cause straightening in one plane, additional sets of rolls being employed to obtain a straightening effect in more than one plane. In practice, difficulties have been encountered in producing perfectly straight wire with the above described arrangement, both because of the tendency of the wire to twist between different sets of rolls, and by reason of the straightening operations in different planes occurring independently of each other.

The object of the present invention is to provide an improved wire straightening device characterized by its ability to obtain a maximum straightening effect from a single set of rolls arranged for simultaneous straightening of the wire in more than one plane. Other and further objects and advantages will appear from the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a plan view of a wire straightening device embodying the invention.

Fig. 2 is a vertical section along the lines 2—2 of Fig. 1, portions between being in elevation.

Fig. 3 is a side elevation of the device showing the extent of the bending action during the straightening operation.

Like reference characters refer to like parts throughout the drawing.

Referring particularly to Fig. 1, the wire straightening device is supported on a substantially rectangular base 1 in which are mounted a series of spindles 2, carrying straightening rolls 3, substantially in alignment longitudinally of the device, with a second series of spindles 4 carrying straightening rolls 5, also in alignment longitudinally of the device and spaced laterally from the rolls 3. The rolls 3 are arranged in alternate staggered relation with respect to the rolls 5 to receive a wire therebetween and to perform a compound straightening action thereon as the wire passes through the device.

The spindles 2 are arranged for individual adjustment on the base 1 at right angles to their axes, such adjustment being procured by a number of hand wheels 6 extending beyond the base 1. Each hand wheel 6 determines the position of the corresponding spindle 2, whereby each of the rolls 3 is independently adjustable toward or away from the rolls 5 in the plane of said rolls. As shown in Fig. 2, the spindles 2 are each shiftable in a slot 7 provided in the base 1, since the lower end of each spindle is mounted in a block 8 transversely slideable on the under side of the base of the machine and held in position by a plate 9 secured to said base. Each block 8 is provided at one end with a threaded bore for the reception of a feed screw 10 which extends through a depending longitudinal flange 11 on the base and is held against axial movement relative to said base by collars 12 and 13 engaging opposite sides of the flange 11. The hand wheels 6 are secured to the outer ends of the feed screws 10, and rotation of each hand wheel 6 causes sliding movement of the corresponding block 8 transversely of the base to carry the roll 3 mounted on the corresponding spindle 2 toward or away from the other group of rolls 5.

Similarly, the rolls 5 are adjustable individually at right angles to their axes toward or away from the group of rolls 3 by rotation of a corresponding number of hand wheels 14. Each hand wheel 14 is mounted on the outer end of a feed screw 15, the inner end of which engages a threaded bore 16 in
a block 17 transversely slideable on the under side of the base 1 between adjacent blocks 8, above, and held in position by the plate 2. Each block 17 supports the lower end of the corresponding spindle 4, said spindle extending upwardly from said block through an elongated slot 18 in the base. Each roll 5 is mounted for rotation on the upper end of the corresponding spindle 4 substantially in the plane of the other group of rolls 3 and rotation of the hand wheels 14, as will be apparent, carries the rolls 5 individually inwardly or outwardly in the plane of said rolls relative to the other group of rolls.

The staggered relation of the rolls 3 and 5 provides for a reverse bending of the wire a substantially in a second plane angularly related to the first plane of bending, so that the wire passing through the device is entirely straightened, the bending actions in both planes occurring simultaneously. As best shown by the sectional view of Fig. 2, each of the rolls 3 is provided with a flange 19 extending outwardly from the face of said roll on the upper portion thereof. The lower face 20 of said flange extends upwardly from the surface of said roll at a small angle to the horizontal, to provide, with the vertical surface 22 of the roll, a downwardly opening groove 21 in which the wire a is received during its passage through the machine. Each of the rolls 5 has a flange 23 extending from the lower portion of said roll, said flange having its upper surface 24 extending downwardly at a slight angle to the horizontal, the intersecting vertical surface 25 of the roll and the surface 24 providing an upwardly opening groove 26 for the reception of the wire a.

The construction shown in the drawing is particularly intended for straightening a wire rectangular in cross-section, and the grooves 21 and 26 each accordingly provide a rectangular portion within which a corner of the wire is received as said wire passes through the straightening device. To this end, the cylindrical surfaces 22 and 25 of rolls 3 and 5, respectively, are undercut adjacent the flanges 19 and 23 to provide narrow frusto-conical surfaces 27 and 28 at right angles to the inclined annular surfaces 20 and 24 of said flanges. This rectangular portion of each groove prevents undesired twisting of the wire a as will hereinafter appear. As the wire a passes between the rolls, in the grooves 21 and 26 which grooves, as shown in Fig. 2, are displaced vertically, a bending action in a second plane angularly related to the first plane of bending is procured and the extent of the bending action in this plane may be varied by axial adjustment of one set of rolls relative to the other, as will next be described.

The rolls 3 and 5 are mounted for free rotation of the spindles 2 and 4 respectively, and are supported against the axial thrust resulting from the second bending action. Referring to Fig. 2, the upper end of each spindle 4, on which one of the rolls 5 is mounted, is reduced in diameter and carries thereon the inner race 30 of a ball bearing 31 which race engages a shoulder 32 on said spindle. The upper end of the race 30 is in engagement with a plate or washer 33 through which a bolt 34 extends for screw threaded engagement in the end of the spindle 4, said plate 33 holding the bearing race in position against axial movement. The outer race 35 of the bearing is received in an internal bore 5a of the roll 5 and abuts at its upper end a shoulder 36 provided at the upper end of the bore 5a. The lower end of the outer race 35 is engaged by a projecting flange 37 on an annular retaining cap 38 which is mounted on the under side of the roll 5 with its flange 37 received within the bore 5a of the roll 5. Another cap 40 closes the upper end of the roll 5 with a flange 41 seated in the smaller portion of the roll bore 5a. Thus, the bearing 31 permits free rotation of the roll 5 on the spindle 4, while solidly supporting the roll 5 on the spindle against downward axial thrust on said roll. In a somewhat different manner, each of the rolls 3 is rotatably mounted on a ball bearing 44 against upward movement of its corresponding spindle 2, the roll and the entire ball bearing assembly being carried by a sleeve 42 surrounding the spindle 2 and slideable axially thereon. The sleeve 42 provides a shoulder 42a on its outer surface against which the upper end of the inner race 43 of the ball bearing 44 is pressed in an internal bore of the roll 3 in engagement with a shoulder 46. The bearing is covered at its upper end by an annular cap 47 surrounding the upper end of a sleeve 45, with a depending flange 48 engaging the bore of the roll 3. A hand wheel 50 is screw threaded on the upper end of the spindle 2, the lower surface of said hand wheel engaging with the upper end of the sleeve 42 to hold the sleeve 42 and the entire roll assembly against axial movement on the spindle 2. Integral with the hand wheel 50 is an outwardly extending flange 51 which extends over the annular cap to prevent dust and foreign matter from entering the bearing.

As above pointed out, the rolls 3 are individually adjustable vertically on the spindles.
2 to vary the bending action on the wire and to this end, a coil spring 52 surrounds each spindle 2 above its mounting in the block 8 to press the roll assembly on the sleeve 42 against hand wheel 50. The lower end of the spring 52 seats on the block 8 with the upper end engaging a ring 53 which supports the lower end of the sleeve 42. Consequently, rotation of each hand wheel 50 causes individual vertical movement of each roll 3 along the corresponding spindle 2, the spring 52 acting to always maintain the upper end of the sleeve 42 in contact with the hand wheel. The adjustment in vertical position of the rolls 3, as will be readily apparent from a consideration of the drawing, determines the degree of bending effect on the wire due to the vertical displacement of the roll grooves 21 and 26.

As the wire a is drawn through the device between the rolls 3 and 5, in the direction indicated by the arrows in Figs. 1 and 3, it is subjected to bending actions occurring simultaneously in different planes. The first bending action results from the staggered relation of alternate rolls 3 and 5 in the plane of the rolls, and by reason of the angularity of surfaces 27 and 28 the bending action occurs in a plane substantially perpendicular to said surfaces. As most clearly shown in Fig. 1, the bending in this plane is diminished by predetermined amounts, as the wire passes through the straightening device, by the individual setting of the successive rolls 3 or 5, toward or away from the opposite rolls, such roll adjustment being obtained through the hand wheels 6 and 14. The second bending action occurs simultaneously with the first bending action as the wire a is bent substantially perpendicularly to the surfaces 20 and 24 of the flanges during its passage between the rolls. As best shown in Fig. 3, the surfaces 20 and 24 of the rolls 3 and 5 are offset vertically, the surfaces 20 being lower than the surfaces 24, so that the wire is bent by alternate downward thrust of the successive flanges 19 and upward thrust of the flanges 23. The bending action in this plane is decreased as the wire reaches the end of the device by diminishing the offset of the surfaces 20 and the surfaces 24 in successive rolls through adjustment by the hand wheels 50. The angularity of the surfaces of the roll flanges allows the wire to pass from one roll to the next without an abrupt bend at any point.

While the above description has been directed specifically to a construction in which the straightening action takes place on a wire rectangular in cross-section, it will be apparent that substantially the same action will take place on a wire having any other desired cross-section, since the corresponding angularly related planes in which the two bending actions occur are always normal to the surfaces on the rolls receiving the angular thrusts. As will be apparent from Fig. 2, the wire, being rectangular in cross-section, engages the rectangular grooves in the rolls, and, said grooves in successive rolls having substantially parallel sides, the wire is prevented from rotating or twisting as it passes through the device. In this manner each successive reverse bend on the wire in either plane of bending occurs along the same diameter or diagonal, throughout the straightening action.

Form the foregoing, it will be apparent that the present invention provides a single set of rolls for bending a wire passing between them in two angularly related planes, the bending action in both of said planes occurring simultaneously. The device is adjustable so that the degree of bending in either plane may be varied by individual adjustment of the rolls both in the plane of the rolls and axially relative to one another.

I claim:

1. In a device of the class described, a series of wire straightening rolls to bend a wire substantially in one plane, and staggered flanges on said rolls for simultaneously bending the same section of the wire in another plane angularly related to said first plane.

2. In a wire straightening device, a series of wire straightening rolls adjustable in one plane, and a second series of cooperating rolls spaced from and in staggered relation to said first series, said second series being adjustable both normal and parallel to the plane of adjustment of the first series.

3. In a device of the class described, a series of wire straightening rolls and a second series of cooperating rolls in staggered relation to the first rolls and in substantially the plane of the first rolls, means to adjust individually the rolls of one of said series relative to the other series in the plane of said rolls and other means to adjust individually the rolls of one of said series relative to the other series perpendicularly to the plane of the rolls.

4. In a wire straightening device a plurality of straightening rolls in staggered relation between which a wire is drawn for a straightening operation, said rolls having opposed flanges for reversely bending the wire at an angle to the plane of said rolls, said rolls being relatively adjustable individually toward and away from each other in the plane of said rolls and perpendicularly thereof.

5. In a wire straightening device, a set of wire straightening rolls alternately spaced and staggered for bending a wire substantially in one plane, and means cooperating with said rolls for bending the wire simultaneously in another plane, each plane of bending being angularly related to the plane of said rolls.

6. In a device of the class described, a...
series of wire straightening rolls and a second series of cooperating rolls in staggered relation to the first rolls and substantially in the plane of the first rolls, means to adjust individually the rolls of at least one of said series relative to the other series in the plane of said rolls, and other means to adjust individually the rolls of at least one of said series relative to the other series perpendicular to the plane of the rolls.

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