APPARATUS FOR HELICALLY COILING FLAT METAL STRIPS

INVENTOR.

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3 Claims. (Cl. 153--64.5)

In said annexed drawing:

Figs. 1 and 2 are diametral cross section views of typical heat exchange tubes having helically coiled strips of the type formed by the present method and apparatus welded there onto;

Fig. 3 is a top plan view (with the top bearing block removed) of a preferred apparatus for helically coiling a flat strip of metal on edge, said apparatus being illustrated in its starting position;

Fig. 4 is a cross section view taken substantially along the line 4--4, Fig. 3, illustrating the apparatus in a position with a portion of the strip formed into a coil; and

Fig. 5 is a view similar to Fig. 3 except illustrating the apparatus in a condition for stripping the finished coil therefrom.

Referring now to the drawing and first more especially to Figs. 1 and 2 thereof there is shown therein a tube 1 having a helical fin or rib 2 welded thereto as indicated by the numeral 3, said fin being welded on one side only in Fig. 1 and on both sides in Fig. 2. Said fin 2 preferably comprises a metal strip, usually steel, helically coiled on edge so as to provide relatively large area heat radiating surfaces. Formation of the heat exchange tube assembly in this manner is obviously preferred over casting the same or machining a helical groove in a thick wall tube or welding separate washers in axially spaced relation onto a tube. To further render the formation of heat exchange tube assemblies in the preferred manner indicated above in a yet more feasible manner, the present invention has to do with the formation of the helical coil component of the assembly in a most simple and expeditious manner.

The coiling apparatus illustrated in Figs. 3, 4, and 5 comprises a base structure 4 including a vertically extending plate member 5 provided with a fixed transversely projecting bearing block 6 at its lower end and a removable bearing block 7 at its upper end held on plate 5 as by the bolt 8. Journalined in the bearing blocks 6 and 7 are the reduced ends of a pair of parallel steel rolls 9 and 10 which have their outer cylindrical surfaces substantially in contact or at least very closely adjacent one another. The roll 9 has its lower end 11 projecting through the bearing block 6 for connection to any suitable reversible driving means (not shown). The roll 10 is an idler or follower roll freely rotatable in the bearings at each end thereof.

The driven roll 9 is formed with a helical groove 12 therein of desired pitch corresponding with that of the coil to be formed, such groove having
radial and axial dimensions as close as practicable to the width and thickness of the steel strip S which is to be coiled. The root diameter of groove 12 is equal to the diameter of the tube 1 onto which the formed coil is to be subsequently assembled. The strip S which is to be coiled is attached to the roll 9 as by a bolt 13 projecting through a whole formed in the end of the strip and threaded into, the top convolution in roll 9 as best shown in Fig. 4.

The strip S may be taken from a coil or may be in the form of a straight section of convenient length. With the strip S attached to roll 9 and its free end unconstrained, the roll 9 is driven in the direction indicated by the arrow in Fig. 3 whereupon the strip is caused to be wrapped into the helical groove 12 by the pressure exerted against the outer edge of the strip by roll 10. It is to be noted that at the point of bending of the strip and pressure, application thereon the entire perimeter of the transverse cross section thereat is confined in a cavity of the same size and shape, defined by the three walls of the groove 12, along opposite sides and at the inner edge of the strip and the outer wall of roll 10 at the outer edge of the strip. The pressure between the strip and roll 10 causes the latter to rotate in the direction, of the arrow in Fig. 3, without sliding friction with the strip, such rotation being at the same speed as roll 9.

With the above arrangement, it has been discovered, that the coil formed in the helical groove 12 of roll 9, is free from wrinkles and other flaws. Also, because the strip S is confined to rectangular radial cross section there is no opportunity for thickening at the inner edge and thinning at the outer edge. In practice it is desirable to apply a suitable lubricant onto opposite sides of the strip to facilitate forcing thereof into the helical groove 12 and removing of the finished coil from the groove.

When the coil is of desired axial length or when the free end of the strip S is within a few inches from rolls 9 and 10, the driven roll 9 is stopped whereby to leave an uncoiled tail end on the strip. The top bearing block 7 and bolt 13 are then removed and the roll 9 driven in a reverse direction as indicated by the arrow in Fig. 5 whereupon the tail of the strip engages plate 5, the finished coil thus unthreading and rising axially from roll 9. The tail end 14 and the other end of the coil are then trimmed off and the coil slipped over a tube 14 and welded thereunto. With a coil made as just described, there is no perceptible spring-back in the strip whereby the root diameter of the helical groove, 12 in roll 9 may be equal to the diameter of the tube. I so as to form a coil having a snug fit over said tube and thus establish good heat contact between the coil and tube.

With the present invention it is a very simple matter to collate relatively wide thin strips of metal to unusually small diameter and pitch without the supplementary heating, tensioning, slitting, or corrugating operations hitherto regarded as imperative to the satisfactory production of small diameter edge coiled wide thin strips. For example, in the practice of the present invention hot rolled steel strips ½ x 1 ¾ " and 1 x 1 ¼ " have been formed into coils of 2" inside diameter and ½ " pitch without the usual attendant difficulties and without requiring any of the aforesaid supplementary operations. In the case of long heat exchange tubes, the coils are made in relatively short lengths and positioned end to end on the tube, the ends being welded together if desired. With the particular apparatus described the rolls 9 and 10 if longer than about three feet require intermediate supports against bending.

Other modes of applying the principle of the invention may be employed. Change being made as regards the details described, provided the features stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:

1. Apparatus for coiling flat metal strips on edge comprising a base, a pair of parallel rolls including cylindrical portions of equal length substantially in contact with one another throughout their respective lengths, said rolls having reduced opposite ends journalled in said base, one of said rolls being driven and formed, with an external helical groove thereabout extending from one end to the other of the cylindrical portion thereof, such groove being of axial width and radius depth closely corresponding with the transverse cross-section thickness and width respectively of a strip to be coiled, means for attaching an end of a strip in such groove so as to extend tangentially from said one roll whereby driving of said one roll effects progressive forcing of the strip attached thereto into such groove by pressure exerted on an edge of the strip by the other of said rolls, said other roll being driven by frictional engagement with the strip and being operative to retain the coiled strip wholly within such groove, with the outer edge of the strip substantially flush with the cylindrical portion of said one roll.

2. Apparatus for coiling flat metal strips on edge comprising a base, a pair of spaced bearing blocks on said base, one of said blocks being detachable from said base, a pair of parallel rolls including cylindrical portions of equal length substantially in contact with one another and having reduced opposite ends journalled in said bearing blocks, one of said rolls being driven from the end adjacent the other of said blocks and formed with an external helical groove whereabouts extending from one end to the other of the cylindrical portion thereof, such groove being of axial width and radial depth closely corresponding with the transverse cross-section thickness and width respectively of a strip to be coiled, means for attaching an end of a strip in such groove so as to extend tangentially from said one roll whereby driving of said one roll effects progressive forcing of the strip attached thereto into such groove by pressure exerted on an edge of the strip by the other of said rolls, said other roll being driven by frictional engagement with the strip and being operative to retain the coiled strip wholly within such groove, with the outer edge of the strip substantially flush with the cylindrical portion of said one roll.

3. Apparatus for coiling flat metal strips on edge comprising a base provided with an upright plate, a fixed bearing block projecting transversely from the lower end of said plate, another bearing block above said fixed bearing block detachably secured on said plate, a pair of vertically disposed parallel rolls including cylindrical portions of equal length substantially in contact with one another having reduced opposite ends journalled in said bearing blocks, one of said rolls being driven and formed with
an external helical groove thereabout extending from one end to the other of the cylindrical portion thereof, such groove being of axial width and radial depth closely corresponding with the transverse cross-section thickness and width respectively of a strip to be coiled, means for attaching an end of a strip in such groove so as to extend tangentially from the upper end of the cylindrical portion of said one roll whereby driving of said one roll effects progressive forcing of the strip attached thereto into such groove by pressure exerted on an edge of the strip by the other of said rolls, said other roll being driven by frictional engagement with the strip and being operative to retain the coiled strip wholly within such groove with the outer edge of the strip substantially flush with the cylindrical portion of said one roll.

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