

PATENT SPECIFICATION

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(54) IMPROVED APPARATUS FOR USE IN HELICALLY ROLLING METAL STRIP TO FORM METAL TUBES

(71) We, W. BYARD & COMPANY (SPIRAL PIPE) LIMITED, formerly called Hiplon Limited, a British Company of 27A, East Mains Industrial Estate, Broxburn, West Lothian, Scotland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for use in helically rolling metal strip to form metal tubes, and is particularly concerned with apparatus of the kind having forming mechanism comprising front and back roller assemblies whereof roller devices have their rollers engageable with one face of the strip, and a roller assembly intermediate the front and back assemblies and whereof roller devices have their rollers engageable with the other face of the strip, the arrangement being such that all three roller assemblies co-operate to cause strip fed through the mechanism from front to rear thereof to curl towards the intermediate roller assembly and form a helix in which the two longitudinal edges of the strip abut each other along a helical line and can be joined together.

In previously proposed apparatus of the aforesaid kind, each and every roller assembly of the forming mechanism includes a series of roller devices each adjustably rotatable about an axis substantially normal to the direction of movement of the strip past the assembly, so that the rollers of the devices can be set to the required helix angle. In this previous arrangement adjustment of the helix angle of the rollers is difficult and time-consuming, as is adjustment of the front assembly to suit different strip thicknesses, and servicing of the mechanism is also difficult.

An object of the present invention is to simplify and otherwise improve the construction of the forming mechanism of the apparatus.

According to the present invention, we

provide apparatus of the aforesaid kind for use in helically rolling metal strip to form metal tubes, wherein the front and intermediate roller assemblies have the roller devices thereof disposed with the roller axes at the helix angle, and the back roller assembly has the roller devices thereof disposed with the roller axes parallel to the axis of the tube to be formed.

By virtue of the invention, the number of rollers of the mechanism requiring rotatable adjustment to the helix angle is considerably reduced.

Preferably the back roller assembly includes a co-axial series of elongate cylindrical rollers. By thus providing rollers of maximum strip-contacting area it is found that there is no undesirable marking of the strip by the rollers.

Preferably also the roller devices of the back roller assembly are individually adjustable reciprocally in the axial direction, and the back roller assembly is reciprocable in a direction transverse to the axis of the tube to be formed, so that the mechanism can be pre-adjusted to produce any diameter of tube from a range of diameters while providing stable support for the strip.

In said previously proposed apparatus each roller assembly includes a series of roller devices pivotally adjustable about axes normal to the axes of rotation of the rollers of the devices, arms on the devices, and a reciprocable bar connected to the arms so that reciprocation of the bar effects adjustment of all the rollers of the devices to the desired helix angle.

Preferably, therefore, the roller devices of a roller assembly include spur wheels, and a reciprocable rack is in meshing engagement with the spur wheels so as to effect rotational adjustment of the rollers of the devices to the desired helix angle.

It is found that with the spur-and-rack gearing, adjustment is facilitated and can be effected during operation of the apparatus.

An embodiment of the invention will now

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be described by way of example with reference to the accompanying drawings in which:

5 Fig. 1 is a fragmentary top plan view showing the feed mechanism and forming mechanism of the apparatus.

Fig. 2 is an end view in the direction of the arrow II of Fig. 1.

10 Fig. 3 is an end view of the forming mechanism.

Fig. 4 is a top plan view of the forming mechanism.

15 Fig. 5 is a front view of a roller unit of a back roller assembly of the forming mechanism.

Fig. 6 is a top plan view of the unit of Fig. 5 with the roller structure removed from the support structure of the unit.

20 Figs. 7 and 8 are respectively front and end views of a roller unit of a front roller assembly of the forming mechanism.

Fig. 9 is a top plan view of Fig. 7 with the roller structure removed from the support structure of the unit.

25 Fig. 10 is a front view of the roller structure of a top roller assembly of the forming mechanism.

Referring to the drawings:—

30 Apparatus for use in helically rolling metal strip to form metal tubes includes feed mechanism 1 and forming mechanism 2 adjacent to the feed mechanism and comprising an elongate table 3, a boom 4 extending longitudinally over the table 3 and having an end thereof clamped in a plinth 5 at the adjacent end of the table 3, and three elongate, forming-roller assemblies 6, 7 and 8 whereof 6 and 7 are longitudinally disposed and spaced laterally side-by-side on the table 3, and 8 is longitudinally disposed on the boom 4 underneath same to overhang the table 3.

45 The roller assembly 6 at the entry to the mechanism (the front assembly) includes a carrier beam 9 on which are mounted two longitudinally spaced sets of five pivotable roller units 10 whereof the rollers have flat profiles 11 and are set at the helix angle, the beam 9 being mounted in a guideway 12 on the table for longitudinal reciprocating adjustment as indicated by arrows A (Fig. 4), and the guideway 12 being mounted on the table 3 for transverse reciprocating adjustment, as indicated by arrows B (Fig. 4), by means of leadscrews indicated at 13.

55 The roller assembly 8 on the boom 4 (the intermediate or top assembly) includes a carrier beam 14 which is secured to the boom 4 and on which are pivotally mounted a series of roller units 15 whereof the rollers have curved profiles 16 and are set at the helix angle, the boom 4 being reciprocally mounted in the plinth 5, as indicated by arrows C (Fig. 4), to enable longitudinal adjustment of the roller units 15.

The roller assembly 7 at the outlet from the mechanism (the back or buttress assembly) includes a carrier block 17 on which are mounted a series of four roller units 18 including four elongate co-axial (cylindrical) rollers with flat profiles 19 and with their axes parallel to the axis of the tube being formed, each unit having a base portion 20 secured to a base plate 21 which is reciprocable in a guideway 22 on the block 17 for individual longitudinal reciprocating adjustment, as indicated by the arrows D (Fig. 4). The carrier block 17 is mounted on the table 3 for transverse reciprocating adjustment, as indicated by the arrows E (Fig. 4), by means of leadscrews indicated at 23. The roller units 18 of the back assembly have their base portions 20 fixed to the base plates 21 e.g. by bolts at 24, no adjustment of the helix angle being provided for. Thus, the structure and maintenance of the forming mechanism are considerably simplified. Moreover, the back rollers with their flat profiles 19 and considerable length, together present a substantially continuous elongate buttressing face which curls the strip most efficiently without marking same. The guideway 22 carrying the base plates 21 of the back roller units 18 is secured to a forwardly and downwardly sloped top face of the carrier block 17 on the table 3 so that the upright medial plane of each unit is disposed radially of the axis of the tube being formed. By appropriate adjustment of the back-roller units 18 and the carrier block 17, there is provided optimum support for the strip irrespective of the diameter of the tube being formed.

105 The boom 4 carrying the top roller assembly 8 has therein a longitudinal recess 25, and the beam 14 carrying the roller units 15 of the top roller assembly engages in the recess 25 and abuts a packing strip 26 on the bottom of the recess, being removably secured in the recess by bolts at 27. By loosening the beam 14, replacing the packing strip 24 with one of a different thickness, and re-securing the beam 14, accurate up-and-down positioning of the rollers units 15 is easily effected, and as the bolts at 27 are on the overhanging beam 4, easy access for adjustment purposes is ensured.

120 In each of the front and top roller assemblies 6 and 8, the base portions 28 and 29 of the pivotal roller units 10 and 15 respectively are formed as spur gear wheels which are rotatably mounted on pins 34 and 35 secured to the beams 9 and 14. Racks 30 and 31, slidingly mounted in rack guides 32 and 33 on the beams 9 and 14 respectively, mesh with the spur wheels 28 and 29 so that reciprocation of the racks effects adjustment of the helix angle of the rollers 130

of the units. It is found that the rack-and-spur gearing is durable and reliable and enables adjustment of the helix angle of the rollers in the course of tube production.

5 Each of the roller units 10, 15 and 18 is composed of a supporting structure and a roller structure detachably mounted on the supporting structure. In each case the supporting structure consists of a base
10 portion (20, 28, 29) and a pair of end plates 36 and 37 on the base portion, and the roller structure consists of a roller in the form of a tubular shell 38, a spindle 39 extending through the shell 38, and a pair of end
15 bearings 40 and 41 carried by the spindle 39 and rotatably supporting the shell 38. The spindle ends are positioned in laterally extending open-ended slots 42, 43 in the end plates 36, 37, and are releasably retained in
20 position by a pair of bars 44, 45 secured to the end plates by bolts 46. The bars 44, 45 in retaining position close the slots 42, 43 and abut flats 47 on the ends of the spindle. To remove the rolled structures of all three
25 assemblies for servicing during a production run, it is a simple matter to unbolt the bars 44, 45 and remove the spindle ends from the slots 42, 43.

Reference is made to the complete
30 specification of copending application no. 8026129 Serial no. 1600499

WHAT WE CLAIM IS:—

1. Apparatus of the aforesaid kind for use
35 in helically rolling metal strip to form metal tubes, wherein the front and intermediate roller assemblies have the roller devices thereof disposed with the roller axes at the helix angle, and the back roller assembly has the roller devices thereof disposed with the
40 roller axes parallel to the axis of the tube to be formed.

2. Apparatus according to claim 1, wherein the back roller assembly includes a co-axial series of elongate cylindrical rollers.

3. Apparatus according to claim 1 or 2, wherein the roller devices of the back roller assembly are individually adjustable reciprocally in the axial direction, and the back roller assembly is reciprocable in a
50 direction transverse to the axis of the tube to be formed, so that the mechanism can be pre-adjusted to produce any diameter of tube from a range of diameters while providing stable support for the strip.

4. Apparatus according to any preceding claim, wherein the roller devices of the front and intermediate roller assemblies include spur wheels, and a reciprocable rack is in meshing engagement with the spur wheels
60 so as to effect rotational adjustment of the rollers of the devices to the desired helix angle.

5. Apparatus of the aforesaid kind for use in helically rolling metal strip to form metal
65 tubes, substantially as hereinbefore described with reference to Figures 3—6 of the accompanying drawings.

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2. Apparatus according to claim 1, wherein the back roller assembly includes a co-axial series of elongate cylindrical rollers.

3. Apparatus according to claim 1 or 2, wherein the roller devices of the back roller assembly are individually adjustable reciprocally in the axial direction, and the back roller assembly is reciprocable in a direction transverse to the axis of the tube to be formed, so that the mechanism can be pre-adjusted to produce any diameter of tube from a range of diameters while providing stable support for the strip.

4. Apparatus according to any preceding claim, wherein the roller devices of the front and intermediate roller assemblies include spur wheels, and a reciprocable rack is in meshing engagement with the spur wheels so as to effect rotational adjustment of the rollers of the devices to the desired helix angle.

5. Apparatus of the aforesaid kind for use in helically rolling metal strip to form metal tubes, substantially as hereinbefore described with reference to Figures 3—6 of the accompanying drawings.

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