

PATENT SPECIFICATION

(11) 1 600 499

1 600 499

- (21) Application No. 26129/80 (22) Filed 10 Nov. 1977
(62) Divided out of No. 1600498
(23) Complete Specification filed 30 May 1978
(44) Complete Specification published 14 Oct. 1981
(51) INT CL³ B21D 5/14
(52) Index at acceptance
B3E 10E1 10E2 14J 1H4 1Y 3K 3Y LA
(72) Inventor KENNETH THOMAS WILLIAM WEST



(54) HELICALLY ROLLING METAL STRIP TO FORM TUBE

(71) We W. BYARD & COMPANY (SPIRAL PIPE) LIMITED, formerly called Hiplon Limited, a British company of Site 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, the roller devices of each assembly include rollers rotatably mounted on spindles having their ends engaging in apertures in end plates projecting from pivotal bases from which actuating arms project. With this arrangement, removal of the rollers for servicing during a production run is difficult and time-consuming.

According to the present invention, we provide apparatus of the aforesaid kind wherein each roller device of an assembly comprises a support structure including a base and a pair of end plates of the base and having therein a pair of slots, and a roller structure including a roller and spindle means carrying the roller and removably engaging in the slots in the end plates so that

the roller structure is removably mounted on the support structure.

Preferably the spindle means consists of a spindle and the slots are open-ended slots in which the end portions of the spindle engage, and bars are removably bolted to the end plates to close the slot ends and retain the end portions of the spindle in the slots.

With this construction of roller device the roller structure can be removed from the support structure for servicing following unbolting and removal of the bars on the end plates of the support structure.

In said previously proposed apparatus, the front roller assembly is firmly secured to a formation table, and the intermediate roller assembly is mounted on a boom overhanging the formation table. Adjustment of the nip between the rollers of these two roller assemblies to suit different strip thicknesses is usually effected by providing removable packing between the front assembly and the table.

Preferably, therefore, the intermediate roller assembly is mounted on a boom overhanging a formation table, the intermediate roller assembly engaging in a recess in the underface of the boom and being releasably secured in said recess, and a removable packing strip is provided in the recess on the base thereof so that the nip is adjustable by substituting a packing strip of appropriate thickness for the packing strip in the recess.

It is found that packing strip substitution is more easily effected on the boom than on the formation table, as the boom is more accessible and the attachment means required to secure the intermediate roller assembly to the boom are less elaborate than the attachment means required to secure the front roller assembly to the table.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

50

55

60

65

70

75

80

85

90

95

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.

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

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

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.

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.

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

Referring to the drawings:—

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.

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.

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 reciprocably 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 effectively 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.

The boom 4 carrying the top roller assembly 8 has therein a longitudinal recess 25, and the beam 14 carrying the rollers 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 removable 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.

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, slidably 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 of the units. It is found that the track-and-spur gearing is durable and reliable and

13

enables adjustment of the helix angle of the rollers in the course of tube production.

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 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 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 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 roller structures of all three 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 specification of copending application no. 46774/77 Serial no. 1600498

30 WHAT WE CLAIM IS:—

1. Apparatus of the aforesaid kind wherein each roller device of an assembly comprises a support structure including a base and a pair of end plates on the base and having therein a pair of slots, and a roller structure including a roller and a spindle means carrying the roller and removably engaging in the slots in the end plates so that the roller structure is removably mounted on the support structure.

40 2. Apparatus according to claim 1 wherein the spindle means consists of a

spindle and the slots are open-ended slots in which the end portions of the spindle engage, and bars are removably bolted to the end plates to close the slot ends and retain the end portions of the spindle in the slots. 45

3. Apparatus according to claim 2, wherein the end portions of the spindle are flattened and the flats are engaged by the bars. 50

4. Apparatus according to any preceding claim, wherein the intermediate roller assembly is mounted on a boom overhanging a formation table, the intermediate roller assembly engaging in a recess in the underface of the boom and being releasably secured in said recess, and a removable packing strip is provided in the recess on the base thereof so that the nip is adjustable by substituting a packing strip of appropriate thickness for the packing strip in the recess. 55 60

5. Apparatus of the aforesaid kind substantially as hereinbefore described with reference to and as shown in figures 3 and 5 to 8 of the accompanying drawings. 65

FORRESTER, KETLEY & CO.

Chartered Patent Agents,
Scottish Provident Building,
29 St. Vincent Place.

Glasgow G1 2DT
and also at

Rutland House,
148 Edmund Street,
Birmingham B3 2LD
and

Forrester House,
52 Bounds Green Road,
London N11 2EY
Agents for the Applicants



13

3

1,600,499

3

enables adjustment of the helix angle of the rollers in the course of tube production.

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 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 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 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 roller structures of all three 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 specification of copending application no. 46774/77 Serial no. 1600498

WHAT WE CLAIM IS:—

1. Apparatus of the aforesaid kind wherein each roller device of an assembly comprises a support structure including a base and a pair of end plates on the base and having therein a pair of slots, and a roller structure including a roller and a spindle means carrying the roller and removably engaging in the slots in the end plates so that the roller structure is removably mounted on the support structure.

2. Apparatus according to claim 1 wherein the spindle means consists of a

spindle and the slots are open-ended slots in which the end portions of the spindle engage, and bars are removably bolted to the end plates to close the slot ends and retain the end portions of the spindle in the slots.

3. Apparatus according to claim 2, wherein the end portions of the spindle are flattened and the flats are engaged by the bars.

4. Apparatus according to any preceding claim, wherein the intermediate roller assembly is mounted on a boom overhanging a formation table, the intermediate roller assembly engaging in a recess in the underface of the boom and being releasably secured in said recess, and a removable packing strip is provided in the recess on the base thereof so that the nip is adjustable by substituting a packing strip of appropriate thickness for the packing strip in the recess.

5. Apparatus of the aforesaid kind substantially as hereinbefore described with reference to and as shown in figures 3 and 5 to 8 of the accompanying drawings.

FORRESTER, KETLEY & CO.

Chartered Patent Agents,
Scottish Provident Building,
29 St. Vincent Place.

Glasgow G1 2DT
and also at

Rutland House,
148 Edmund Street,
Birmingham B3 2LD

and

Forrester House,
52 Bounds Green Road,
London N11 2EY

Agents for the Applicants