United States Patent [19]

Ekroos et al.

[11] **3,868,840**

[45] **Mar. 4, 1975**

[54] **TUBE MADE OF METAL STRIP BY MEANS OF SPIRAL SEAMING AND A DEVICE INTENDED FOR A SPIRAL SEAMING TUBE MACHINE FOR THE PRODUCTION OF SUCH A TUBE**

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[22] Filed: **Feb. 15, 1974**

[21] Appl. No.: **443,036**

[30] **Foreign Application Priority Data**

Feb. 9, 1971 Finland 344/71

[52] **U.S. Cl.** **72/49,** 29/477.3, 72/137, 138/135

[51] **Int. Cl.** **B21c 37/12**

[58] **Field of Search** 72/49, 50, 137, 135, 136; 29/477.3, 477.7, 477; 138/135, 136

[56] **References Cited**

UNITED STATES PATENTS

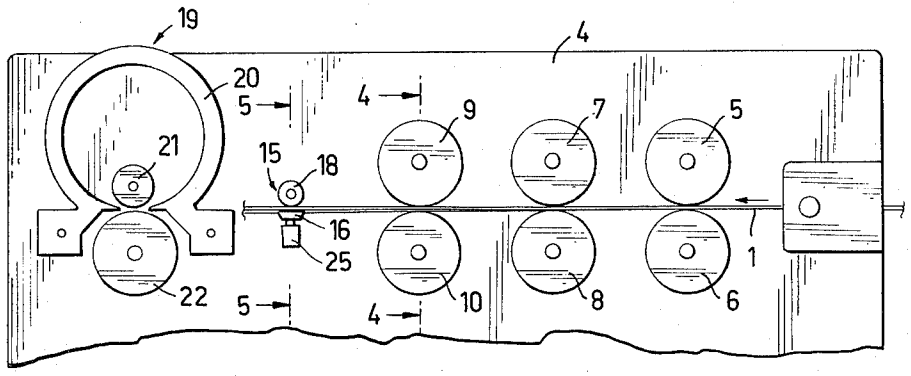
1,761,980	6/1930	Bundy	29/477
2,841,183	7/1958	Rejeski	138/135

Primary Examiner—C. W. Lanham
Assistant Examiner—Robert M. Rogers

[57] **ABSTRACT**

A machine for forming a spirally seamed tube from a continuous metal strip formed with at least one integral stiffening ridge between the spiral seams formed at the longitudinal edges of said metal strips. The machine comprises prebending rollers for forming a longitudinal ridge in said metal strip and a guiding unit for bending the strip to form a spiral tube having an axis extending transversely with respect to the longitudinal direction of the metal strip. The machine further comprises seaming rollers for joining together adjacent edges of the spiral tube. A pair of ridge flattening rollers are provided between said prebending rollers and said guiding unit for flattening of the foot of the ridge to form in cross-section a loop forming a space between the walls of said ridge inside said loop.

1 Claim, 5 Drawing Figures



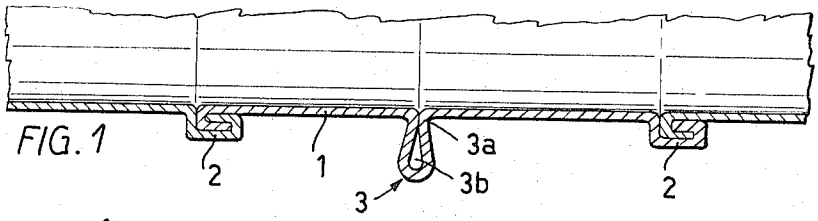


FIG. 1

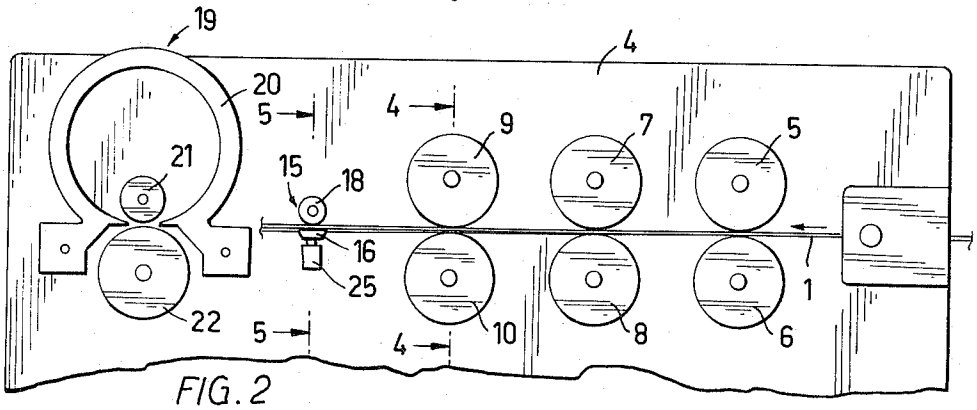


FIG. 2

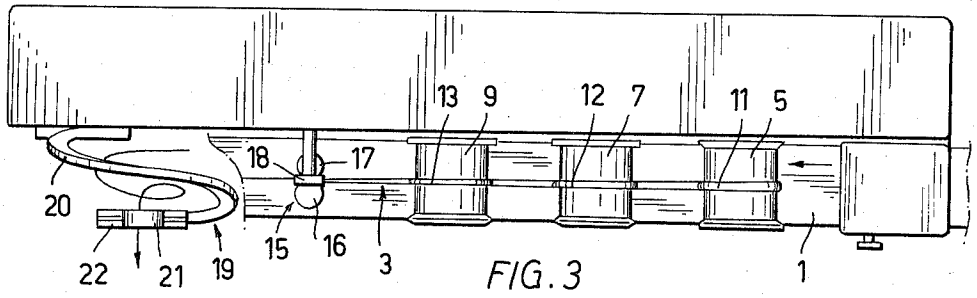


FIG. 3

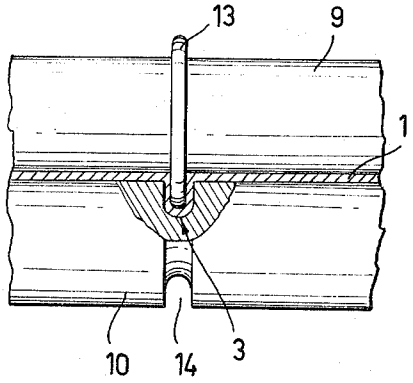


FIG. 4

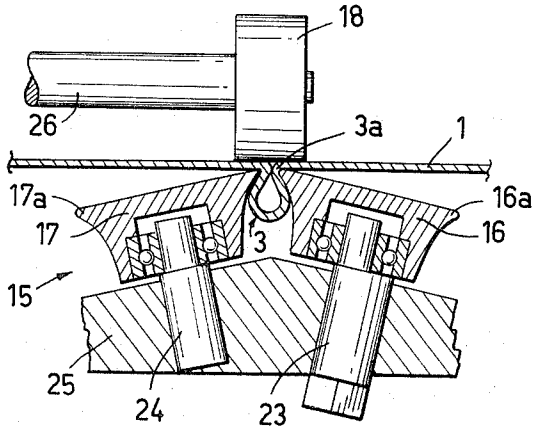


FIG. 5

TUBE MADE OF METAL STRIP BY MEANS OF SPIRAL SEAMING AND A DEVICE INTENDED FOR A SPIRAL SEAMING TUBE MACHINE FOR THE PRODUCTION OF SUCH A TUBE

The present invention relates to a machine for forming a spirally seamed tube from a continuous metal strip formed with at least one integral stiffening ridge between the spiral seams formed at the longitudinal edges of said metal strip.

It is earlier known from U.S. Pat. No. 1,761,980 to form a tube from a continuous metal strip by passing the metal strip through a series of pairs of rollers bending the metal strip successively around the longitudinal axis of said metal strip in order to obtain a cylindrical tube provided with a straight longitudinally extending seam. The metal strip has been passed through prebending rolls to form a longitudinal stiffening ridge in said metal strip and thereafter passed through a die in order to flatten said ridge completely over its entire height before the metal strip is passed on to said series of pairs of rollers.

It is also earlier known from U.S. Pat. No. 3,666,779 to form a tube from a continuous metal strip by passing the metal strip helically around a mandrel and by pressing said metal strip against said mandrel by means of pressure rollers arranged around said mandrel for seaming together adjacent edges of the spiral tube. The axis of the mandrel and correspondingly also the axis of the spirally seamed tube extends transversely with respect to the longitudinal direction of the metal strip. A longitudinal stiffening ridge is preformed in the metal strip.

In the spirally seamed tube formed according to said U.S. Pat. No. 3,606,779 the ridge formed in the metal strip is open i.e., the ridge forms in the inner surface of the spiral tube a groove. However, a spirally seamed tube provided with an open ridge causes considerable inconvenience for the use of the tube as a ventilating duct. The open ridge causes pressure losses, and impurities tend to collect at the ridge on the inner surface of the tube, and this is why such a spiral seam tube has been used as ventilating ducts only to a limited extent.

In the tube forming method according to the above mentioned U.S. Pat. No. 1,761,980 where the metal strip is rolled to a tubular shape around the longitudinal axis of the metal strip, it is possible to utilize a conventional die for flattening of the ridge formed in the metal strip. A conventional die comprising stationary ridge flattening means causes rather considerable friction forces which, however, are overcome by the engagement of the metal strips with several pairs of rollers positively drawing the metal strip through the die. Owing to the fact that the metal strip is in driving engagement with only a few rollers in the tube forming method according to the above mentioned U.S. Pat. No. 3,606,779, it is not possible to utilize a conventional die for flattening of the ridge when the tube is formed as a spirally seamed tube due to the considerable friction forces caused by a die.

The purpose of the present invention is to obtain a machine by which it is possible to provide also a spirally seamed tube with a stiffening ridge in which tube the inner surface thereof is essentially smooth. Owing to the fact that the ridge is flattened only at the foot of said ridge and the fact that the flattening is carried out by means of a pair of rollers instead of by means of a die the friction forces caused by the flattening operation are considerably decreased. Therefore, the rollers used for prebending the metal strip and for rolling the spirally extending seam of the tube formed provide alone a sufficient driving force for advancing the metal strip through the flattening rollers.

The invention is described in the following with reference to the attached drawings in which

FIG. **1** is an axial sectional view of a tube manufactured by means of a machine according to the present invention,

FIG. **2** is a front view of an embodiment of the machine according to the present invention,

FIG. **3** is a top view of the machine according to FIG. **2**,

FIG. **4** is a sectional view along line **4—4** in FIG. **2**, and

FIG. **5** is a sectional view along line **5—5** in FIG. **2**.

The tube illustrated in FIG. **1** is made of a spirally wound metal strip **1**. The adjacent spiral edges of the metal strip are fastened to each other by means of folded seams **2**. The metal strip is provided with a longitudinally extending ridge **3** extending in parallel with the folded seams **2** between each pair of seams in the tube formed. The ridge **3** extends along the outer mantle surface of the tube and it is flattened at the foot **3***a* of the ridge to form in cross-section a loop, a space **3***b* being formed between the walls of the ridge inside said loop. Thus, the inner mantle surface of the tube is rather smooth. The ridge **3** also gives the tube a high radial rigidity.

The machine illustrated in FIGS. **2** and **3** comprises a machine frame **4**, three pairs of pre-bending rollers **5**, **6** and **7**, **8** and **9**, **10** respectively which are rotatably mounted in the frame to be positioned with their pressure gaps in the same horizontal plane. The prebending rollers are provided with ribs **11**, **12** and **13** respectively and corresponding grooves **14** (FIG. **4**) for forming a pre-bent ridge of an open cross-section in the metal strip **1** when the strip is passed between the driven pairs of rollers. The pre-bending rollers also prebend the opposite longitudinal edges of said metal strip.

The machine further comprises a flattening unit **15** comprising two vertical flattening rollers **16** and **17** and a horisontal pressure roller **18**. The flattening unit is described more in detail in connection with FIG. **5**.

The machine finally comprises a guiding unit **19** including a spirally extending guide rail **20** forcing the metal strip fed by the rollers to a spiral form and provided with means for mating the opposite pre-bent edges of adjacent spiral loops into each other. A pair of seaming rollers **21** and **22** are rotatably mounted in the frame **4** for carrying out the final seaming of the mating opposite edges of the metal strip to form the above mentioned seams **2** of the ridge tube. The guiding unit and the seaming rollers may be of the type described in U.S. Pat. No. 3,155,063.

FIG. **5** illustrates the flattening unit **15**. The flattening rollers **16** and **17** are rotatably mounted on shafts **23** and **24** fastened in a support **25** fastened in the machine frame. The shaft **23** is excentric whereby the distance between the rollers is adjustable. The rollers form an enlarged circumferential edge **16***a* and **17***a* respectively and the gap between said edges is positioned essentially on the same level as the gaps of the pre-bending rollers **5–10** and aligned with said ribs and grooves of the prebending rollers so that the ridge **3** is flattened at the

foot 3*a* by said edges when the metal strip is passed above said rollers **16** and **17.** The pressure roller **18** which is rotatably supported by a shaft **26** presses the metal strip against the rollers **16** and **17** whereby the inner mantle surface of the ridge becomes smooth.

Air pressure loss measurements have been carried out with spiral tubes manufactured with a machine according to the present invention. The air pressure loss has proved to be essentially the same as the air pressure loss in a ridgeless spiral seam tube.

The ridge flattened at the foot provides for a smooth inner mantle surface of the spiral tube as well as for an increased rigidity of the tube.

The metal strip may be provided with more than one ridge between the longitudinal edges of the strip. In such a case the machine is provided with a separate flattening unit for each ridge.

Instead of a fold seam the tube may be made with a welded seam.

What we claim is:

1. A machine for forming a spirally seamed tube from a continuous metal strip formed with at least one integral stiffening ridge between the spiral seams formed at the longitudinal edges of said metal strip, said machine comprising in combination a machine frame, pairs of pre-bending rollers rotatably mounted in said frame and positively driven to feed the metal strip in the longitudinal direction thereof between said pairs of rollers and to form a pre-bent ridge in said metal strip, a pair of further rollers positioned after said pre-bending rolls with respect to the advancing direction of said metal strip and rotatably supported by said frame, the circumferential edges of said further rollers being mutually spaced to engage said pre-bent ridge from opposite sides thereof and to flatten said ridge only at the foot of said ridge in order to form in cross-section a loop, a space being formed between the walls of said ridge inside said loop, and further comprising a guiding unit for spirally bending the metal strip into a spiral tube the axis of which extends transversely with respect to said advancing direction of said metal strip and seaming means for joining together adjacent edges of the metal strip of said spirally bent tube to form said spiral seams.

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