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APPARATUS FOR FINNING METAL TUBES

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FIG. 1.

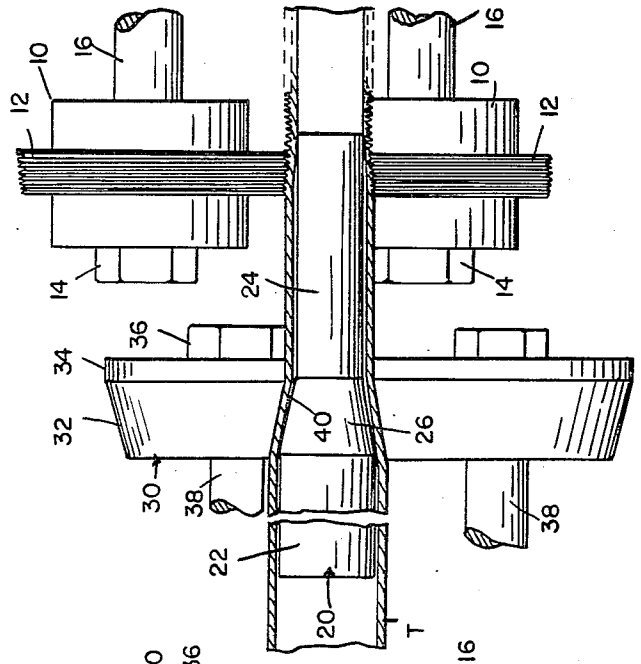
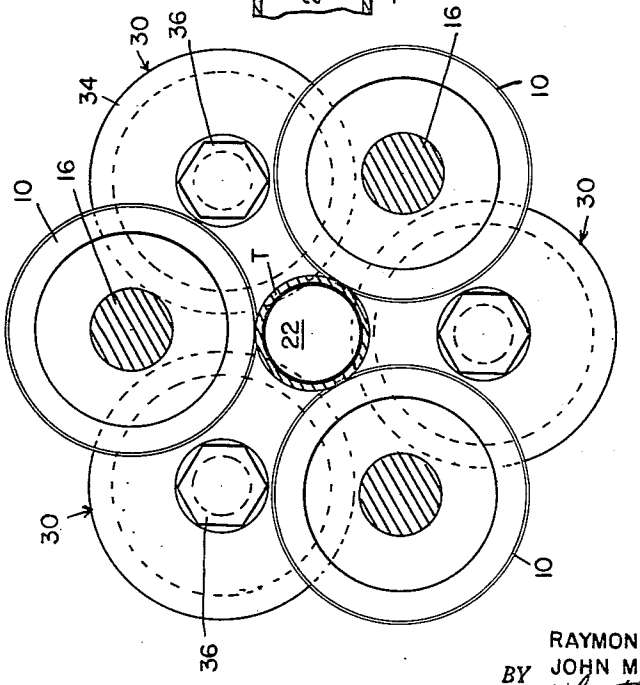


FIG. 2.



INVENTORS
RAYMOND H. GREENE
BY JOHN M. KEYES
Whittemore, Hulbert & Belknap
ATTORNEYS

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APPARATUS FOR FINNING METAL TUBES

Raymond H. Greene, Detroit, and John M. Keyes, Northville, Mich., assignors to Calumet & Hecla, Inc., Calumet, Mich., a corporation of Michigan

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10 Claims. (Cl. 80—13)

The present invention relates to apparatus for finning metal tubes.

It is an object of the present invention to provide apparatus for making finned tubes which comprises a floating mandrel adapted to be positioned within the tube having a relatively large and a relatively small end portion interconnected by a conical portion, a set of reducing rolls adapted to engage the tube in the zone of the conical portion of the mandrel, and a set of rolls adapted to produce a helical fin on the tube by extrusion engaging the surface of the tube in the zone of the relatively small diameter end portion thereof.

It is a further object of the present invention to provide apparatus as described in the preceding paragraph in which the reducing rolls are provided with their axes parallel to the tube axis and have conically shaped reduced portions disposed in conformity to the conical portion of the mandrel.

It is a further object of the present invention to provide the apparatus as described in the foregoing in which the reducing rolls and finning rolls are each uniformly spaced around the tube to produce balanced forces thereon.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a fragmentary longitudinal view of a tube in the process of reduction and having fins formed thereon by extrusion.

Figure 2 is an end view of the structure shown in Figure 1 as viewed from the right thereof.

The present invention includes apparatus for producing a helical fin on metal tubing by extrusion as more fully set forth in Hill Patent 2,508,517 or 2,562,785. These prior patents disclose the formation of a helically extending fin by an operation in which the material of the fin is extruded radially outwardly from the material of the tube. Reference is made to these prior patents for a more complete description of the details and operation of the finning rolls.

In the present case the finning rolls are shown at **10**, three such rolls being illustrated as comprising a single set in the drawing. However, the operation may in a proper case be carried out with a single roll or preferably, with two forming rolls disposed at diametrically opposite sides of the tube.

Each of the rolls includes a plurality of annular fin forming rib portions **12** which conveniently may be the peripheral edge portion of separate discs assembled together by suitable clamping means such for example as the nut **14** threaded on the end of the roll supporting and driving arbor **16**.

The tube which is first reduced in diameter and thereafter provided with extruded fins in a second operation which further reduces its internal diameter is illustrated at T. Located within the tube is a floating mandrel **20** having a relatively large cylindrical end portion **22**, a relatively small cylindrical end portion **24**, and a conical portion **26** intermediate the larger and smaller end portions. The diameter of the larger end portion **22** of the floating mandrel is slightly smaller than the internal

diameter of the tube T as it is supplied to the reducing and finning apparatus. The small end portion **24** of the floating mandrel has a diameter equal to the required internal diameter of the completely reduced and finned tube.

Associated with the floating mandrel and the tube T are a plurality of reducing rolls **30** each of which as illustrated comprises a conical reducing portion **32** and a cylindrical portion **34**. The rolls **30** are clamped by suitable means such as the nut **36** on the threaded end of a supporting and driving arbor **38**.

As best seen in Figure 1, the conical portion **32** of the reducing rolls is disposed radially opposite and in conformity to the conical portion **26** of the floating mandrel. The conical portion **32** is so shaped and the reducing rolls **30** are so located that the internal diameter of the tube T in the zone where it is being reduced, as indicated at **40**, is smaller than the diameter of the large end portion **22** of the mandrel. Accordingly, the inclined conical surface **40** of the tube T prevents travel of the floating mandrel **20** longitudinally of the tube and at the same time provides a support for the relatively small end portion **24** in the zone of operation of the finning rolls **10**.

As is well understood in the art, the finning rolls **10** are inclined at an appropriate angle so as to be substantially conjugate to the helical fin extruded on the exterior surface of the tube. Means are provided for effecting relative rotation between the sets of rolls and the tube about the longitudinal axis of the tube, and the inclined relationship of the fin forming rib portions **12** is effective to insure axial advance of the tube T at the required rate as the helical fin is extruded from its exterior surface. Conveniently, and as more fully described in the Hill patents referred to, the required relative rotation may be produced by rotating the rolls **10** about their axes while the tube is rotated thereby and simultaneously advanced axially.

With the present apparatus the reducing roll operates to reduce the diameter of the tube T to desired dimensions and in addition, serves as means for securing or retaining the floating mandrel **20** in the position required for its proper cooperation with the forming rolls **10**.

The drawings and the foregoing specification constitute a description of the improved apparatus for finning metal tubes in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls.

2. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, said reducing rolls being

uniformly spaced around the circumference of the tube, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls.

3. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, said reducing rolls being three in number and uniformly spaced around the circumference of the tube, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls.

4. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls having their axes parallel to the tube axis and having conically shaped reducing portions engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls.

5. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls having their axes parallel to the tube axis and having conically shaped reducing portions engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin.

6. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls having their axes parallel to the tube axis and having conically shaped reducing portions engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin, said finning rolls being spaced uniformly around the circumference of the tube.

7. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of

stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls having their axes parallel to the tube axis and having conically shaped reducing portions engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin, said finning rolls being three in number and spaced uniformly around the circumference of the tube.

8. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin.

9. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin, said finning rolls being spaced uniformly around the circumference of the tube.

10. Apparatus for extruding fins on metal tubes by a rolling operation which comprises a floating mandrel located within a tube, said mandrel having end portions of stepped diameter connected by an intermediate conical portion, a plurality of reducing rolls engaging the periphery of the tube in a zone opposite the conical portion of said mandrel and adapted to reduce the internal diameter of the tube to a value less than the diameter of the large end of said mandrel, a plurality of finning rolls engaging the periphery of the tube after reduction by said reducing rolls and in a zone opposite the small end of said mandrel, and means for effecting relative rotation between the tube and said rolls, said finning rolls each comprising a plurality of discs and being disposed at an angle to the axis of the tube so as to extrude material therefrom in the shape of a helical fin, said finning rolls being three in number and spaced uniformly around the circumference of the tube.

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