N° 24,931 A.D. 1897

Date of Application, 27th Oct., 1897

Complete Specification Left, 25th July, 1898—Accepted, 27th Oct., 1898

PROVISIONAL SPECIFICATION.

Improvements relating to the Manufacture of Tubes.

We, ALFRED MILWARD REYNOLDS, Manufacturer, and JOHN THOMAS HEWITT, Foreman, both of Newtown Row, in the City of Birmingham, do hereby declare the nature of this invention to be as follows:—

This invention consists of improvements relating to the manufacture of seamless steel and other tubes for boilers, for cycle construction, and for other purposes, our object being to readily produce such tubes with a varying distribution of metal, or with the ends or other required parts of a greater thickness than the body of the tubes.

In the manufacture of tubes in accordance with our invention having a parallel or uniform bore or internal diameter, we draw the tube in an ordinary manner to a suitable thickness, and we subsequently further draw it upon a mandrel which is necked down or reduced in diameter at the parts corresponding with the required thickened portions of the tube. In such drawing a tube is produced with a parallel or uniform external diameter, but with an internal diameter corresponding with the variations in the diameter of its mandrel. The tube with its mandrel is subjected to the action of an ordinary reeling or releasing machine and the tube is then withdrawn from the mandrel in the draw-bench, the mandrel being attached to the outer end of the bench. During the withdrawal of the tube the thickened portions of the metal are raised, and on the complete removal from the mandrel a tube is produced of uniform bore or internal diameter but with an additional thickness of metal on the exterior at the ends or other required parts. A bulb or plug mandrel is afterwards drawn through the tube if desired, to accurately finish the interior to the required size.

In the manufacture of tubes having a varying thickness of metal but with uniform external diameter for cycle construction and other purposes, we first make the tube with the thickened parts forming external projections, in the manner hereinbefore described, and we then subject the tube to a further drawing for the purpose of returning the external projections to the level of the body of the tube, the additional metal being thus again disposed within the tube or in the position it was originally compelled to assume when drawn upon the mandrel with the necked or reduced parts.

In drawing tubes with thickened ends the mandrel can be made sufficiently long and be so shaped as to enable two or more of such tubes to be formed in one piece which is afterwards cut to the lengths required.

In order to avoid wasting the tube by nosing or tagging each length preparatory to drawing, we sometimes use a screwed stem formed with a head or collar which fits loosely in the tube; such collar bears against an internal flange formed on the end of the tube. A sleeve is screwed over the stem and grips the flanged end of the tube against the collar of the stem, which is prevented from turning by interlocking or engaging with the end of the mandrel inserted through the open end of the tube.

The tube with its mandrel is drawn through the die and is afterwards withdrawn from the mandrel as before described.

In the manufacture of tubes having a tapering thickness of metal, a required length of tube with a parallel thickness of metal has one end flanged in or partially closed. Such internally flanged end of the tube is gripped between the extremity of a suitably tapered mandrel and a plug which is screwed into the mandrel and serves as a gripping piece for the drawing of the tube and mandrel through the draw-bench die. After the drawing the tapered tube and its mandrel can be subjected to the action of a releasing or reeling machine, and then on unscrewing the plug the mandrel can be withdrawn in the draw-bench from the end of the tube opposite to that on which the internal flange is formed, the tube abutting against a sharp edged die. The tube can be subsequently drawn through a sizing die by means of a stem having a collar or enlarged end for abutting against the internal flange, which is afterwards cut off in any ordinary manner.

We modify the shape and construction of the mandrels and dies and other tools employed in the application of our invention, to suit the particular class of tubes required.

Dated this 25th day of October 1897.

MARKS & CLERK,
18, Southampton Buildings, London, W.C., and
13, Temple Street, Birmingham.

COMPLETE SPECIFICATION.

Improvements relating to the Manufacture of Tubes.

We, ALFRED MILWARD REYNOLDS, Manufacturer, and JOHN THOMAS HEWITT, Foreman, both of Newtown Row, in the City of Birmingham, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

This invention consists of improvements relating to the manufacture of seamless steel and other tubes for boilers, for cycle construction, and for other purposes, and especially to the production of such tubes with a varying distribution of metal, or with the ends or other required parts of a greater thickness than the body of the tubes.

In the two accompanying sheets of explanatory drawings to be hereinafter referred to.—

Figures 1, 2 and 3 are sectional views of a tube at different stages of manufacture in accordance with our invention, the tube having when finished a parallel or uniform bore or internal diameter but with an additional thickness of metal at the ends on its exterior surface.

Figures 4, 5, 6, and 7, are sectional views illustrating the manufacture of a tube with thickened or butted ends in accordance with our invention, but in this case the additional thickness of metal is disposed on the interior surface of the finished tube, the external surface having a uniform diameter throughout.

Figure 8 is a part sectional view of the body part of the mandrel we employ in the production of long tubes with thickened ends, whilst Figures 9, 10 and 11 represent the detachable end pieces which are screwed into the body part of the mandrel.

Figures 12 to 19 inclusive represent the method and means we adopt for drawing the tubes through the reducing dies without tagging or closing the end which is usually gripped by the machine.

Figures 20, 21 and 22 illustrate our method of manufacturing tubes with a tapering thickness of metal.

Figures 23 and 24 illustrate our method of drawing a taper tube thickened at one end only.

The same reference letters in the different views indicate the same parts.

In the manufacture of tubes in accordance with our invention having a parallel or uniform bore or internal diameter, we draw a tube in an ordinary manner to a suitable thickness, and we subsequently further draw such tube as A Figures 1 and 2 upon a mandrel B which is necked down or reduced in diameter at the parts $b\,b^1$ corresponding with the required thickened portions of the tube. In such drawing a tube is produced with a parallel or uniform external diameter, but with an internal diameter corresponding with the variations in the diameter of its mandrel. Figure 1 represents the tube A and its mandrel B before drawing, and Figure 2 the same parts after they have been drawn together through a suitable die in any ordinary tube drawing machine. The drawn tube A Figure 2 with its mandrel is subjected to the action of an ordinary reeling or releasing machine and the tube is then withdrawn from the mandrel in the draw-bench, the mandrel being attached to the outer end of the bench in any ordinary manner, or the tube may be held stationary whilst the mandrel is withdrawn therefrom. During such detachment of the tube and mandrel the thickened portions of the tube metal are raised by the passage of the larger diameter of the mandrel through the smaller internal diameter of the tube, and on the complete removal from the mandrel a tube is produced such as shown at Figure 3 of uniform or approximately uniform bore or internal diameter but with an additional thickness of metal on the exterior at the ends or other required parts. The closed end A^1 of the tube is cut off along the line *x x* Figure 3. A bulb or plug mandrel is afterwards drawn through the tube if desired, to accurately finish the interior to the required size.

The bulb or rounded end B^1 of the mandrel B is omitted if the thick portion of the tube adjoining it is not required to be swelled or expanded to the same bore or internal diameter as the remainder of the tube.

In the manufacture of tubes having a varying thickness of metal but with uniform external diameter, we first make the tube with the thickened part or parts or one of them, forming an external projection in the manner hereinbefore described, and we then subject the tube to a further drawing for the purpose of returning the external projection or projections to the level of the body of the tube, the additional metal being thus again disposed within the tube or in the position it was originally compelled to assume when drawn upon the mandrel with the necked or reduced parts. The manufacture of such a tube is illustrated by Figures 4 to 7 inclusive. Figure 6 illustrates the tube A after its detachment from the mandrel, whilst Figure 7 shows the tube after it has been re-drawn through a die. The closed end A^1 of the tube is cut off along the line *x x* Figure 7. The mandrel C has a plain end *c* as illustrated.

In the case of long tubes we sometimes make the ends or heads of the mandrel separate from its body or central part which is shown at Figure 8. The ends of the body part have each a tapped hole to receive the screwed stems of the mandrel heads; three different forms of such heads or ends are shown at Figures 9, 10 and 11. We suitably harden the mandrel ends to enable them to better withstand the wear and tear to which they are subjected in use.

In drawing tubes of moderate length with their ends or other part or parts thickened as hereinbefore described, the mandrel can be made sufficiently long and be so shaped as to enable two or more of such tubes to be formed in one piece which is afterwards cut to the length required.

In order to avoid waste of metal by fully closing or tagging each tube preparatory to drawing and for other reasons hereinafter set forth, more particularly when making short tubes such as shown by the Figures 12 to 24, for cycle con-

struction and other purposes, we use a screwed stem as D (Figures 14 15 17 and 18) having a head or collar which fits loosely in the tube and bears against an internal flange as A^2 formed on the end of the tube A (Figures 12, 17 and 18). A sleeve or nut E (Figures 13, 17, and 18) is screwed on to the externally projecting portion of the stem D and grips the flanged end A^2 of the tube against the head of the stem D as illustrated at Figures 17 and 18; the stem is prevented from turning whilst the sleeve is screwed on to it by the interlocking or engagement of its head with the square end F^1 of the mandrel F the opposite end of the mandrel being preferably held in the moving or sliding part of the tube drawing machine. Figure 12 shows the tube A with one end flanged in; Figure 13 represents the sleeve or nut alone; Figure 14 is a side elevation with part in section and Figure 15 an end elevation of the screwed attachment stem with its hollow or socket-like head for fitting loosely within the tube; Figure 16 represents the mandrel alone, held by its outer end in the moving or sliding part F^3 of the drawing machine. Figure 17 is a sectional view of the tube after it has been passed, on the mandrel F, through the reducing die; the tube is subsequently subjected to the action of an ordinary reeling or releasing machine to permit of its ready detachment from the mandrel as hereinbefore described. Figure 18 shows the tube after removal from the mandrel but with the screwed stem and its sleeve or nut still in attachment with the tube which is again passed through a die, on a loosely fitting mandrel, for the purpose of making the tube of a uniform diameter throughout as shown at Figure 19 representing the finished double-butted tube having the internally projecting flange cut away. The removal of the tube from the mandrel is effected preferably by holding back the tube by means of a retaining piece engaging with the groove *e* of the sleeve E, the mandrel F being drawn out by the moving or sliding part of the tube drawing machine which is in engagement with the groove *f*; or the mandrel may be kept stationary whilst the tube is withdrawn from it.

We manufacture tubes having a tapering thickness of metal, and the maximum at the centre or mid-way between the ends, from tubes of uniform thickness which we draw down upon a mandrel G, Figure 20, tapered to correspond with the required taper in the tube metal. One end of the tube has an internally projecting flange formed upon it, as shown, to permit of its attachment with a screwed stem and a sleeve or nut such as hereinbefore described. After the tube has been released from the mandrel by the action of an ordinary reeling or releasing machine the mandrel is removed from it, as with tubes having thickened or butted ends as hereinbefore described, and thus a tube is produced as shown at Figure 21, having a thickened central portion and with a uniform bore or internal diameter. If the tube is required to be of uniform external diameter it is passed through a die on a loosely fitting mandrel; the internally projecting flange is then cut away leaving the finished tube as shown at Figure 22.

We manufacture tubes having a tapering thickness but with the maximum at one end, from tubes having a parallel thickness of metal, by drawing such tubes on a suitably tapered mandrel as H at Figure 23. Figure 24 represents the finished tube, with a uniform external diameter, after the removal of the mandrel H and the cutting away of the internally projecting flange by which the tube was held during its pass through the die. We sometimes provide the mandrel H with the screwed stem for passing through the flanged end, omitting the internal socket head, formed in one piece with or screwed into the said mandrel.

We modify the shape and construction of the mandrels and dies and other tools employed in the application of our invention to suit the particular class of tubes required.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In the manufacture of tubes with a varying distribution of metal, detaching

the tube from the mandrel on which it has been passed through a reducing die by the withdrawal of one part whilst the other is held stationary thereby expanding the thickened portions of the tube, substantially as set forth.

2. The improved process of manufacturing tubes having a varying thickness of metal, consisting in the placing of a tube having metal of a uniform thickness throughout upon a mandrel having reduced portions corresponding with the required thicker portions of the finished tube, drawing both tube and mandrel together through a die, passing same through a reeling or releasing machine, and subsequently withdrawing the one whilst the other is held stationary substantially as set forth.

3. The improved process of manufacturing tubes having a uniform external diameter but with a varying thickness of metal, consisting in the placing of a tube having metal of a uniform thickness throughout upon a mandrel having reduced portions corresponding with the required thicker portions of the finished tube, drawing both tube and mandrel together through a die, passing same through a reeling or releasing machine, withdrawing the one whilst the other is held stationary, and subsequently re-drawing the tube through a die, substantially as set forth.

4. In tube drawing, the combination of a mandrel centre or body having a tapped hole at each end, with screwed mandrel end pieces, the said end pieces being in part of less diameter than the said mandrel centre or body, substantially as set forth.

5. In tube drawing, the combination with the internally flanged end of the tube to be drawn of a screwed stem having a socket like head for engaging with the inner end of the mandrel on which the tube is placed, and a sleeve or nut for the said screwed stem, substantially as set forth.

6. In tube drawing, effecting the removal of the tube from its mandrel by retaining the tube, by the engagement of the groove e in the sleeve E with a fixed part of the drawing machine, whilst the mandrel is withdrawn, or by retaining the mandrel whilst the tube is withdrawn therefrom, substantially as set forth.

7. In tube drawing, the combination in the tube to be reduced of an internal flange A^3 formed on one end of the said tube and a mandrel H having a shoulder abutting against the inner surface of the said flange, and a projecting screwed stem, for the reception of a clamping sleeve, substantially as set forth.

Dated this 23rd day of July 1898.

MARKS & CLERK,
18, Southampton Buildings, London, W.C., and
13, Temple Street, Birmingham, Agents for the Applicants.

Redhill: Printed for Her Majesty's Stationery Office, by Malcomson & Co., Ltd.—1898

A.D. 1897. Oct. 27. No. 24,951.

REYNOLDS & *another's* Complete Specification.

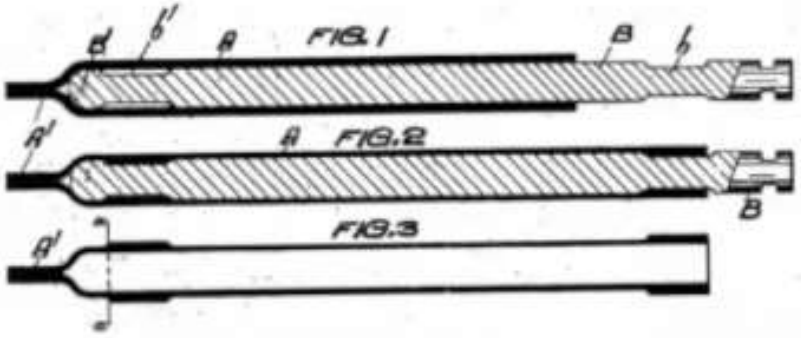


FIG. 1.

FIG. 2.

FIG. 3.

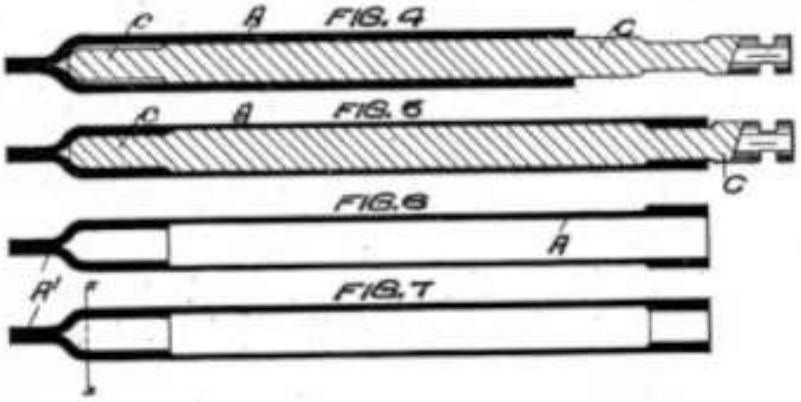


FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9. FIG. 10. FIG. 11.

FIG. 12

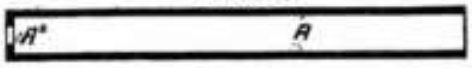


FIG. 13

FIG. 14

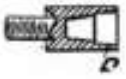


FIG. 15

FIG. 16

FIG. 17

FIG. 18

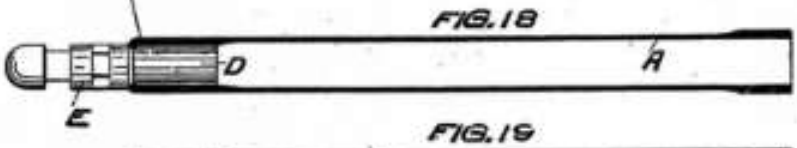


FIG. 19

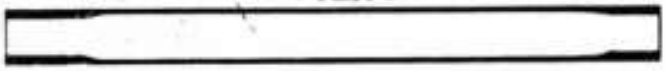


FIG. 20

FIG. 21

FIG. 22

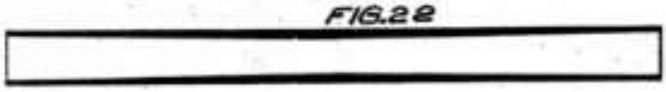
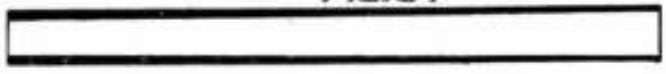


FIG. 23

FIG. 24



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[This Drawing is a reproduction of the Original on a reduced scale.]