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(71) Applicant: **Glynwed Tubes & Fittings Limited**
Headland House
New Coventry Road
Sheldon Birmingham B26 3AZ(GB)

(72) Inventor: **Winfield, Philip William**
22 Old End Lane,
Coseley
Bilston, West Midlands WV14 9Gl(GB)

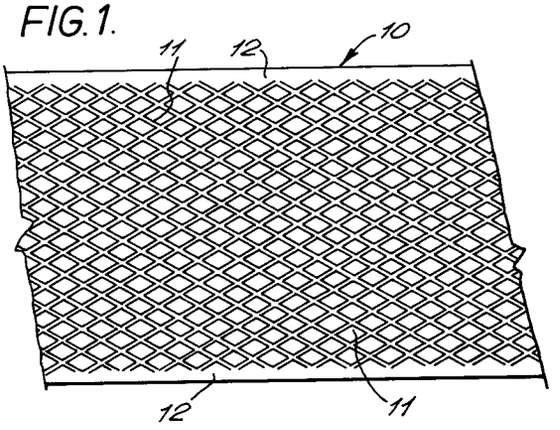
(74) Representative: **Moore, John Hamilton**
J. H. Moore & Co.,
8 Gaiafields Road
Lichfield, Staffs. WS13 7LT (GB)

(54) Method of producing tubing.

(57) The invention relates to steel tubing having a contoured pattern embossed on its external surface and is particularly concerned to provide such patterns on mild steel tubing.

A method is provided, of making mild steel tubing(21) having a contoured pattern(11) on its external surface, in which flat mild steel strip(10) of width corresponding to the outside diameter of the desired tubing(21) is passed through embossing rolls which emboss a contoured pattern(11) on one surface of the strip, the embossed strip is passed through shaping rolls(13, 14) which shape the strip to tubular form(21) with the embossed pattern outermost, the opposed longitudinal edges(16, 17) of the tubular form are subjected to high frequency induction heating and the heated edges are press-forged together to form a longitudinally-extending welded joint(20).

FIG.1.



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This invention relates to tubing, particularly to steel tubing having a contoured exterior surface, and to a method of making such tubing.

Steel tubing is conventionally made in a continuous process in which cold flat steel strip of the desired width is passed through a series of rolls which shape the strip from flat to circular transverse cross-sectional form. The so-shaped form, with the longitudinal edges of the erstwhile strip now abutting, is passed to a welding station where the abutting edges are welded together to form closed tubing of the desired diameter. The tubing is then passed through finishing stations where external and, if desired, internal flash is removed, the tubing is sized, tested for soundness of weld and then cut to desired length.

For certain end uses it may be desirable to pattern the surface of the tubing and one means of achieving this is to emboss a pattern onto the flat steel strip prior to its formation into tubing. Although it has been proposed to manufacture embossed stainless steel tubing by this means, it has not hitherto proved possible to form satisfactorily mild steel tubing with a contoured external surface.

It will be appreciated that the forming processes for stainless steel and mild steel tubing differ significantly, particularly in the welding techniques used and, consequently, in the speed of the continuous process.

Stainless steel is normally welded into tubular form by so-called tungsten inert gas welding or, alternatively, by so-called metal inert gas welding. Both techniques involve passing the to-be-welded tubing through a work station where it is subjected to an electric arc which melts the steel in the region of the desired joint. A metal filler wire is directed into the joint region in the so-called metal inert gas welding process. This welding technique restricts the throughput of the forming process to the order of about five metres per minute.

Mild steel is welded into tubular form by heating the abutting edges of the tubing by high frequency induction heating means and then press-forging the abutting edges together to form the joint. This enables the throughput of the process to be of the order of 400 metres per minute.

It will be further appreciated that when a contoured pattern has been embossed onto the surface of a flat steel strip, the welding together of the abutting longitudinal edges of the tubing is difficult to achieve satisfactorily as exact mating of the corresponding higher and lower regions of the opposed edges cannot be expected. Clearly this problem is more acute in the higher speed process of mild steel tubing manufacture.

Accordingly, in one aspect, the present invention provides a method of making mild steel tubing having a contoured pattern on its exterior surface in which flat mild steel strip of width corresponding to the outside diameter of the desired tubing is passed through embossing rolls which emboss a contoured pattern on at least one surface of the strip, the embossed strip is passed through shaping rolls which shape the strip to tubular form with the embossed pattern outermost, the opposed longitudinal edges of the tubular form are subjected to high frequency induction heating and the heated edges are press-forged together to form a longitudinally-extending welded joint.

The tube is then passed to a finishing station where any metal "flash" from the welding process is removed or "scarfed" from the outside (and inside, if so desired) of the still hot tubing. The tubing can then be cooled, sized and cut to desired length.

It may be found convenient in the manufacturing process to emboss simultaneously a pattern on both surfaces of the flat strip. By this means indentations on one surace can correspond to protrusions on the other.

We have found, surprisingly, that a satisfactorily welded joint is achieved despite the above-mentioned problem of alignment of the highs and lows of the contoured pattern on the opposed longitudinal edges of the tubing in the relatively high speed mild steel process. Thus, although the longitudinal weld may not be completely continuous and may in effect be stitch-welded, the resulting joint is satisfactory and can withstand, for example, subsequent bending of the tubing into desired shapes.

In another aspect, therefore, the invention provides a mild steel tubing having a contoured external surface and a longitudinal welded joint. The joint may be discontinuous, i.e. stitch-welded, along the entire length or randomly dispersed along the length between continuous welded lengths.

By "mild steel" in the present invention is meant to embrace all steels falling within the cold-rolled and hot-rolled definitions of Euro-Norms 111-77 and 130-77.

In a preferred embodiment, the pattern that is embossed onto the flat strip does not extend across the entire width of the strip but is applied centrally leaving a narrow unembossed margin along each longitudinal edge of the strip. When the edges of the strip are then brought together and welded, a good continuously extending weld is then more readily obtained.

Thus the invention also provides steel tubing having a contoured pattern over its external surface except for a non-contoured portion extending along and bordering the weldline.

Normally in the end use of the contoured tubing, the non-embossed portion can be positioned out of sight at the rear of the tubing.

The contoured pattern of the tubing can have a dual-purpose. It may be primarily decorative or primarily to provide frictional, e.g. hand-gripping, properties but in many applications both functions will be of value.

Specific end uses for the tubing of the invention are manifold and the following list is by no means exhaustive.

Handrails of many types, e.g. for buses, trains, stairways, ferries and in theatres.

Shop fittings.

Furniture.

Architectural fittings, e.g. decorative and functional fittings inside and outside buildings.

Any desired patterns may be applied to the surface of the strip subject only to the embossing capabilities of the rolls on mild steel.

The invention is further illustrated by way of example only by reference to the accompanying drawings in which:-

Figure 1 is a perspective view of a flat mild steel strip having an embossed pattern on its visible surface;

Figure 2 is a perspective view of the strip of Figure 1 passing through forming rolls and formed to semi-cylindrical shape;

Figure 3 is a side view of a later stage in the forming process showing the formation of the tubing at the welding station; and

Figure 4 is a perspective view of the finished product.

In Figure 1, flat mild steel strip 10 has had an embossed pattern 11 applied to its central region leaving an unembossed margin 12 along the longitudinal edges of the strip.

In Figure 2, the embossed strip of Figure 1 is shown passing through pairs of forming rolls 13 and 14 at the stage of the tubing forming process where it is in semi-cylindrical form 15. The embossed pattern is not shown in this view. The tubing being formed is passing from rolls 13 to 14 and undergoing a conventional reduction in diameter.

In Figure 3, the semi-cylindrical form from the stage of Figure 2 is shown being formed into the desired tubular shape. As shown, the longitudinal edges 16 and 17 of the semi-cylindrical form are brought gradually closer together as they pass through the high frequency induction heating station 18. Opposed longitudinal edges 16 and 17 are then welded together while hot between forging rolls 19 to form the desired tubular product with welded joint line 20.

The finished product is shown in Figure 4. Tubing 21 has the embossed pattern 11 on its exterior surface with an unembossed margin 12 on each side of weld line 20.

Claims

1. A method of making mild steel tubing(21) having a contoured pattern(11) on its external surface, in which flat mild steel strip(10) of width corresponding to the outside diameter of the desired tubing(21) is passed through embossing rolls which emboss a contoured pattern(11) on one surface of the strip, the embossed strip is passed through shaping rolls(13, 14) which shape the strip to tubular form(21) with the embossed pattern outermost, characterised in that the opposed longitudinal edges(16, 17) of the tubular form are subjected to high frequency induction heating and the heated edges are press-forged together to form a longitudinally-extending welded joint(20).

2. A method according to Claim 1, characterised in that the welded tubing(21) is subjected to a scarfing operation while still hot to remove metal flash from the exterior of the tubing.

3. A method according to Claim 1 or 2, characterised in that the contoured pattern(11) that is embossed on the flat strip(10) does not extend across the entire width of the strip but is applied centrally to leave an unembossed margin(12) along each longitudinal edge of the strip.

4. A method according to Claim 1, 2 or 3, characterised in that the welded joint(20) is discontinuous or stitch-welded.

5. Mild steel tubing(21) having a contoured embossed external surface(11) and a longitudinal welded joint(20).

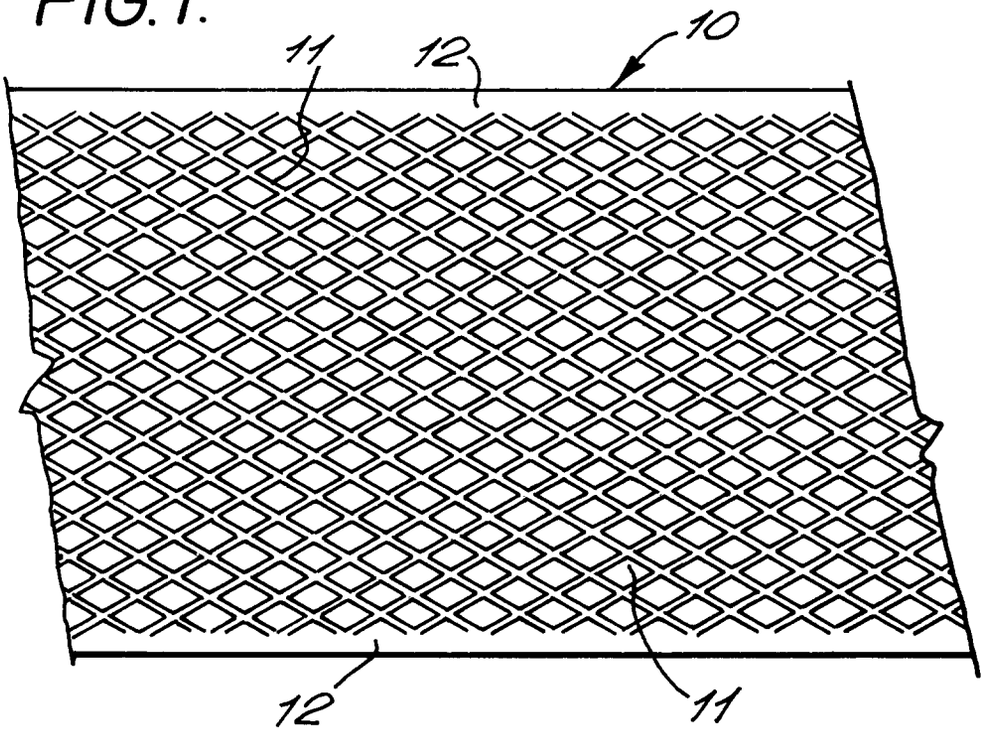
6. Mild steel tubing according to Claim 5, characterised in that the welded joint(20) is discontinouous along its length.

7. Mild steel tubing according to Claim 5 or 6, characterised in that the contoured embossed surface pattern(11) does not extend completely around the tubing, leaving a non-contoured portion(12) extending along and bordering the weld line(20).

8. Mild steel tubing according to Claim 5, 6 or 7, characterised in that the contoured embossed pattern(11) has a decorative and functional purpose.

9. Mild steel tubing according to any one of Claims 5, 6, 7 or 8, characterised in that the tubing is used as a handrail or in furniture.

FIG. 1.



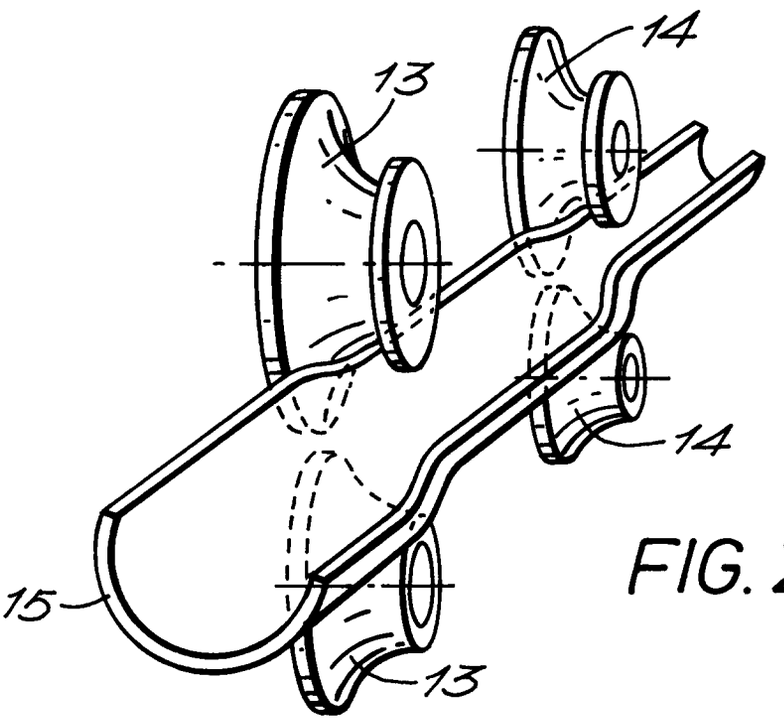


FIG. 2.

FIG.3.

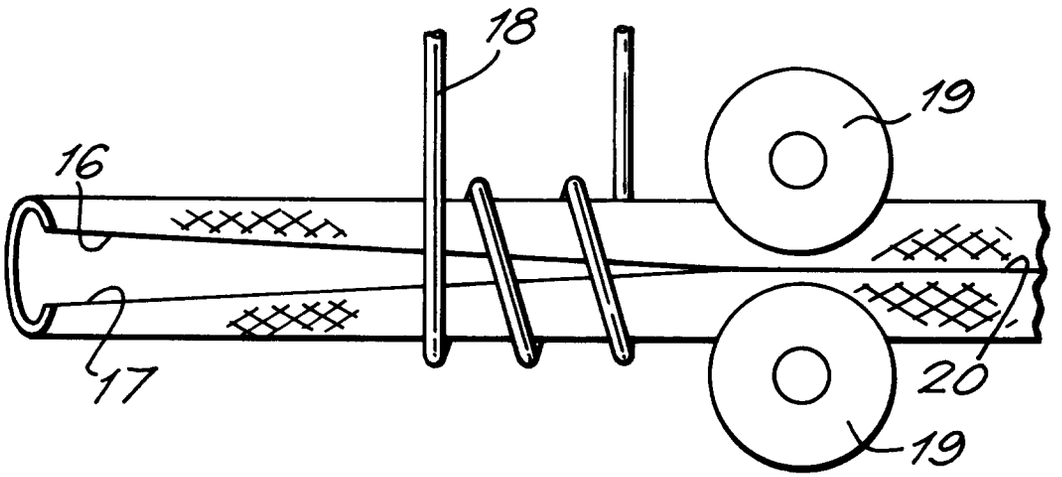
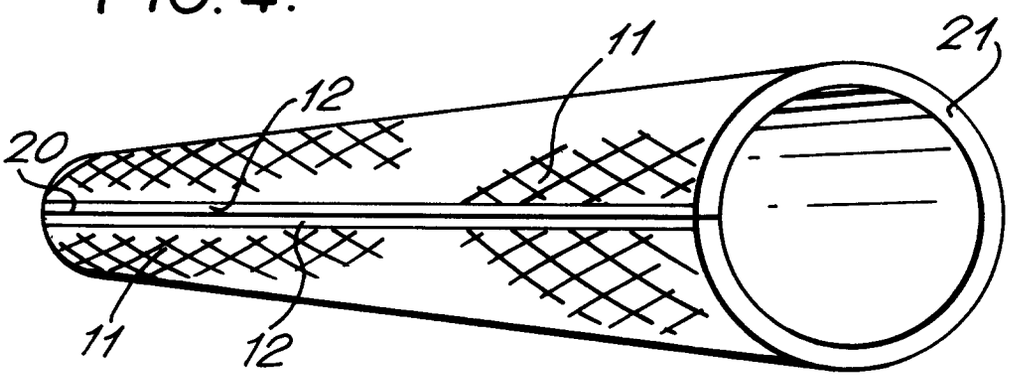


FIG. 4.



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EUROPEAN SEARCH REPORT

Application Number
EP 92 30 8616

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-3 918 626 (OLIN CORPORATION) * the whole document *	1,2,5,8,9	B21C37/083
Y		3,7	
Y	DE-A-3 326 010 (MANNESMANN) * the whole document *	3,7	
X	US-A-3 858 785 (OLIN CORPORATION) * the whole document *	1,5	
X	EP-A-0 164 233 (ALLIED TUBE & CONDUIT CORPORATION) * the whole document *	1,5	
X	CH-A-433 168 (LEHNERT) * the whole document *	1,5	
X	PATENT ABSTRACTS OF JAPAN vol. 7, no. 44 (M-195)22 February 1983 & JP-A-57 193 226 (SUMITOMO KINZOKUKOGYO) 27 November 1982 * abstract *	1,5	TECHNICAL FIELDS SEARCHED (Int. Cl.5) B21C
X	PATENT ABSTRACTS OF JAPAN vol. 9, no. 191 (M-402)(1914) 7 August 1985 & JP-A-60 56 418 (SANOU KOGYO K.K.) 2 April 1985 * abstract *	1,5	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 MAY 1993	PEETERS L.

CATEGORY OF CITED DOCUMENTS

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