United States Patent

[11] **3,545,496**

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a company of Austria

[32] Priority **Aug. 9, 1966**
[33] **Austria**
[31] **No. A7605/66**

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[54] **FOLD FLANGE TUBE AND PROCESS AND INSTALLATION FOR PRODUCING SUCH FOLD FLANGE TUBES**
1 Claim, 50 Drawing Figs.

[52] **U.S. Cl.** **138/171,** 219/59, 219/67; 138/156, 138/178
[51] **Int. Cl.** **F16l 9/22**
[50] **Field of Search** 138/106, 157, 156, 158, 170, 171, 177, 178; 219/67, 59

[56] **References Cited**

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Primary Examiner—Herbert F. Ross
Attorney—Brumbaugh, Graves, Donohue & Raymond

ABSTRACT: The invention relates to fold flange tubes made from two component sections joined by welding, at least one of said component sections comprising one or several fold flanges, and provides a process for producing such fold flange tubes from strip stock in a continuous manner and in a single plant, and an installation for carrying out this process.

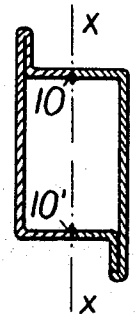

FIG. 1

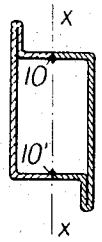

FIG. 1a

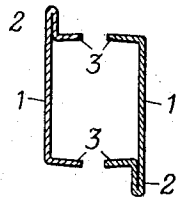

FIG. 2

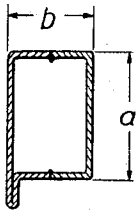

FIG. 2a

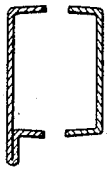

FIG. 3

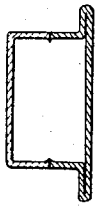

FIG. 3a

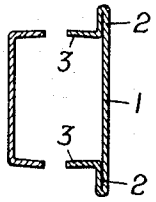

FIG. 4

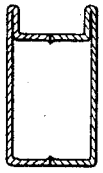

FIG. 4a

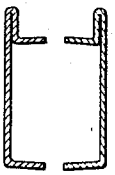

FIG. 5

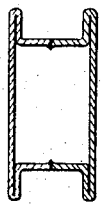

FIG. 5a

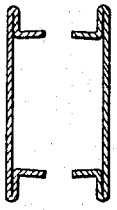

FIG. 6

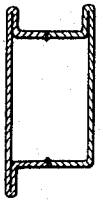

FIG. 6a

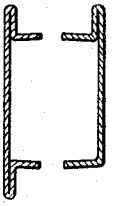

FIG. 7

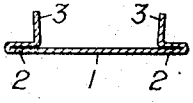

FIG. 8

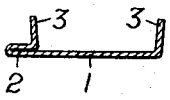

FIG. 9

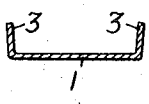

FIG. 10

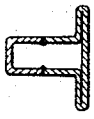

FIG. 10a

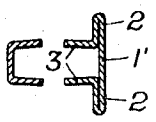

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FIG. 11

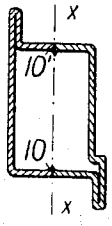


FIG. 11a

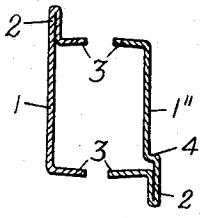


FIG. 12

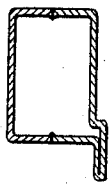


FIG. 12a

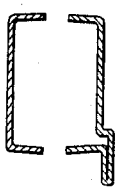


FIG. 13

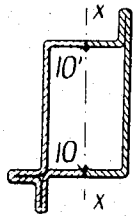


FIG. 13a

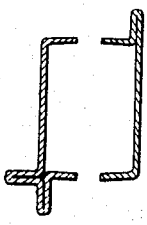


FIG. 14

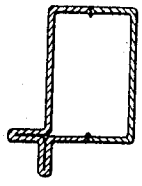


FIG. 14a

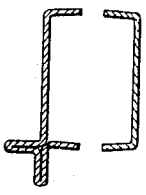


FIG. 15

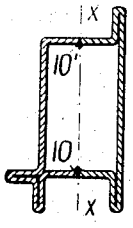


FIG. 15a

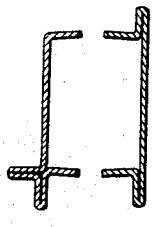


FIG. 16

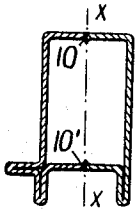


FIG. 16a

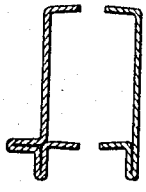


FIG. 17

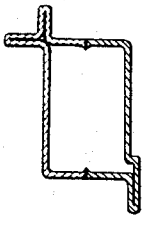


FIG. 17a

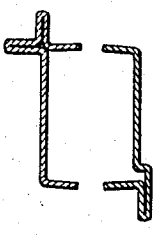


FIG. 18

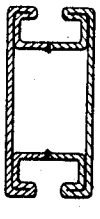


FIG. 18a

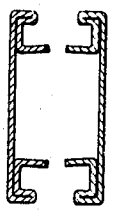


FIG. 19

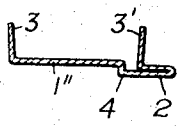


FIG. 20

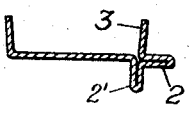
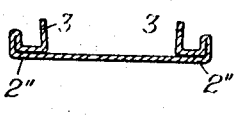


FIG. 21



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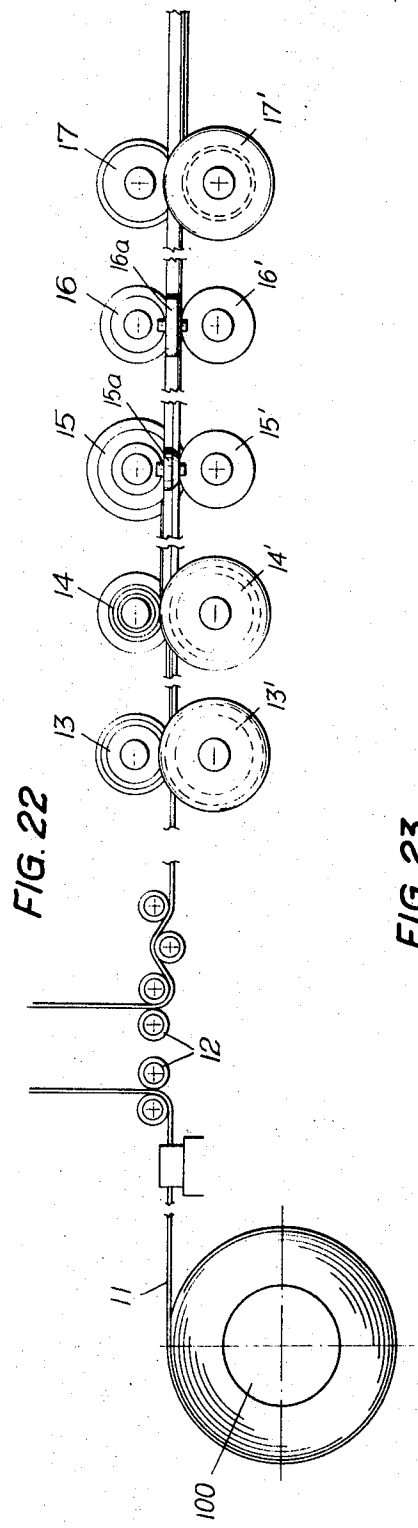

FIG. 22

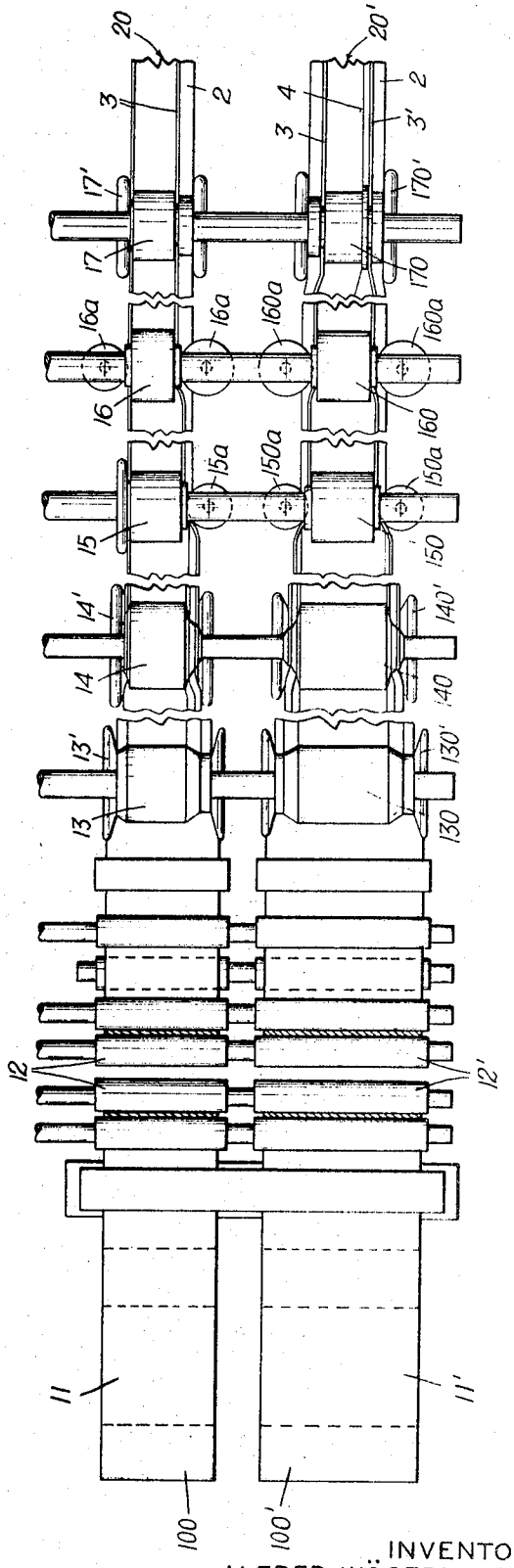

FIG. 23

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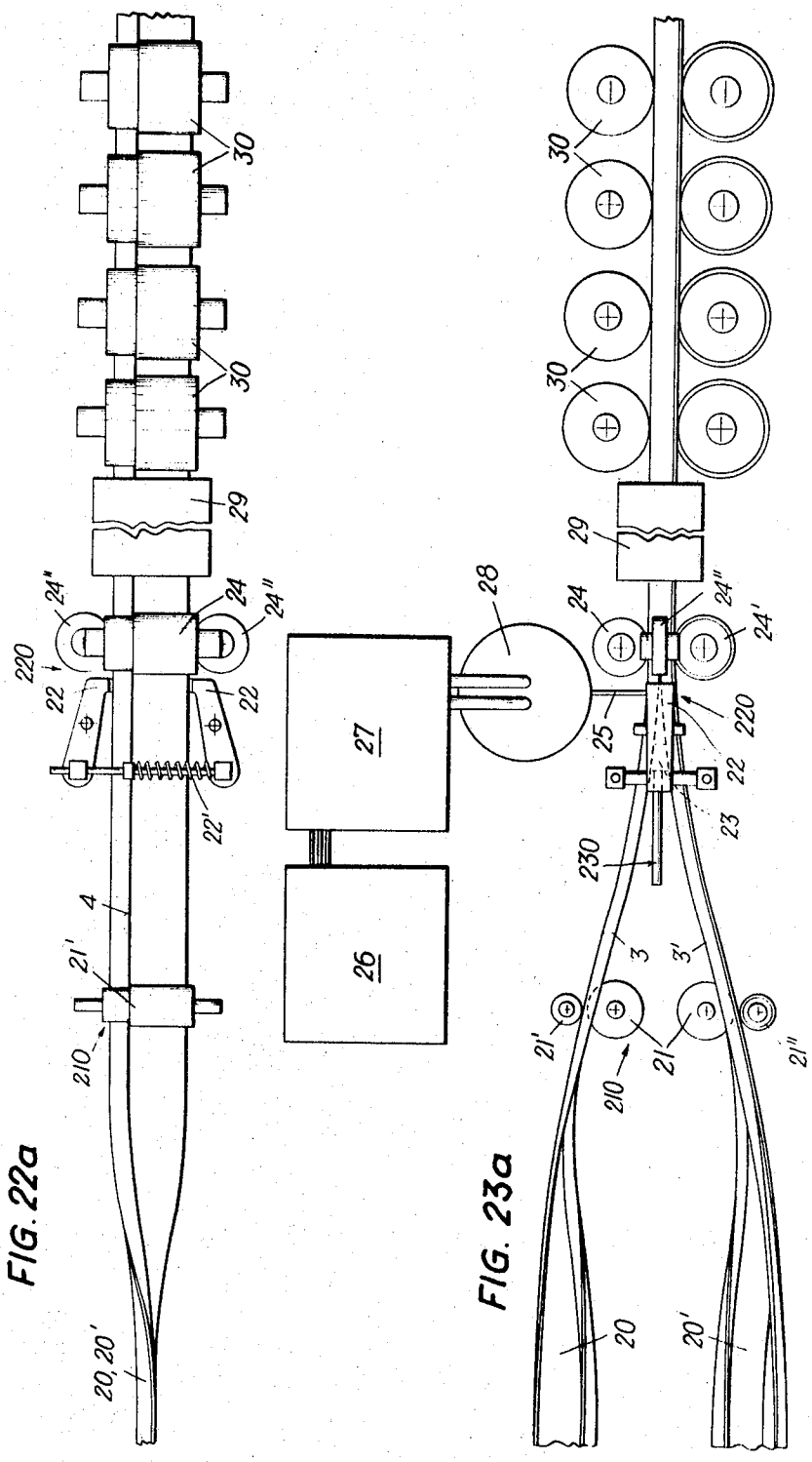

FIG. 22a

FIG. 23a

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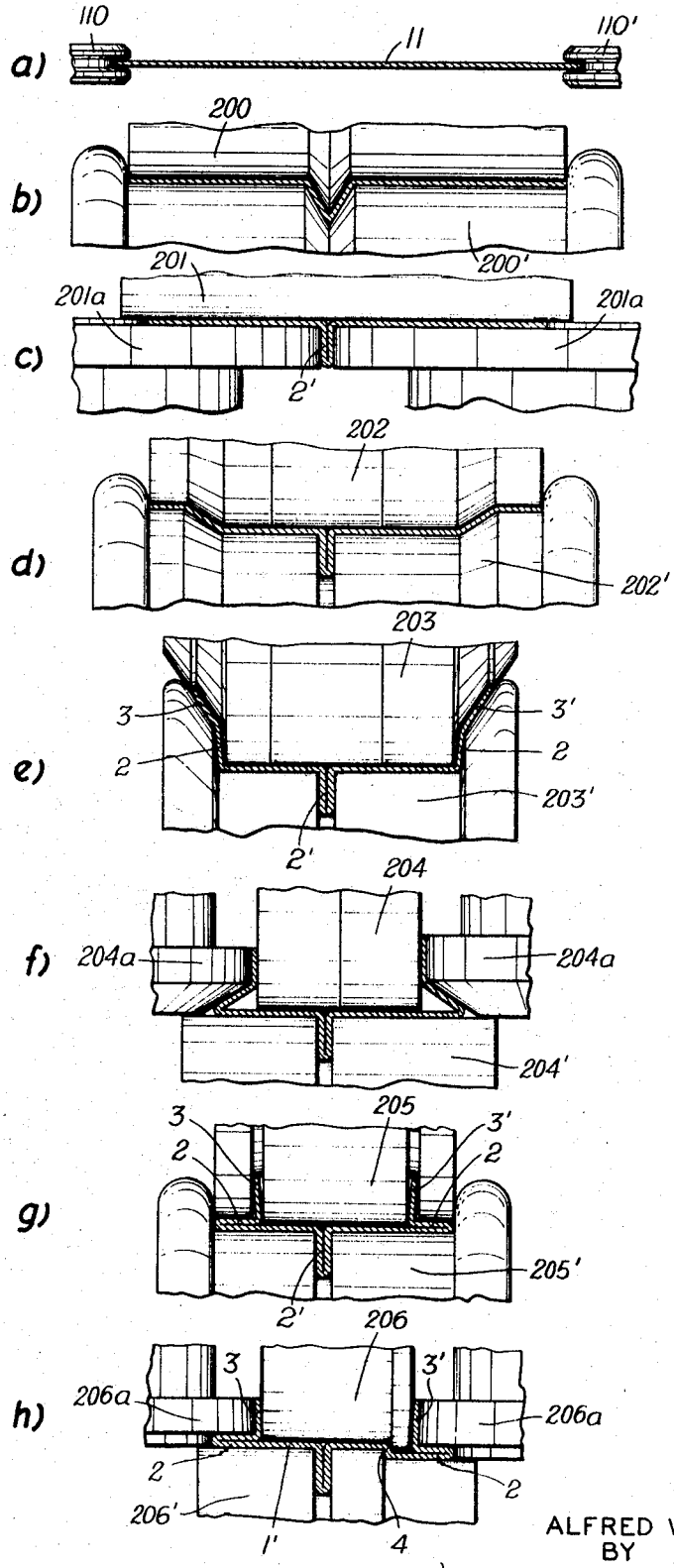

FIG. 24

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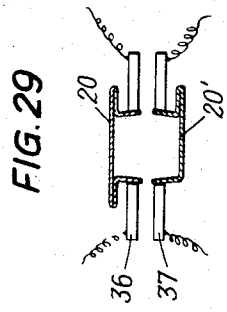

FIG. 29

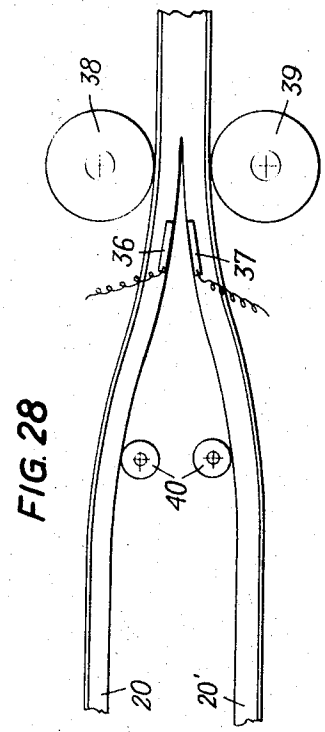

FIG. 28

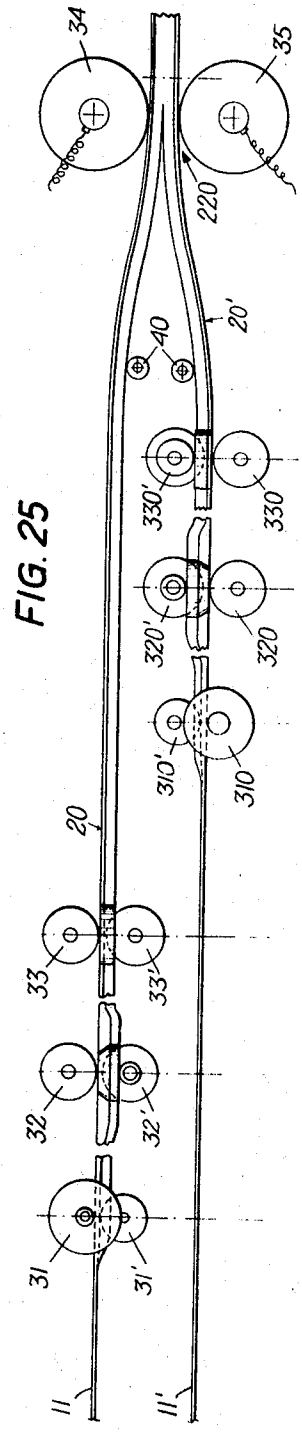

FIG. 25

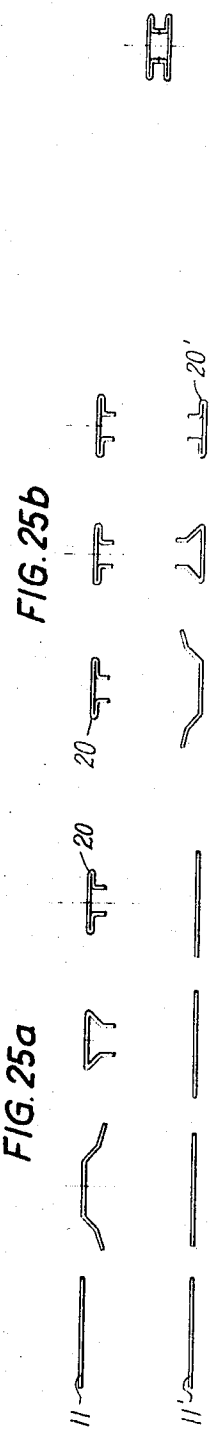

FIG. 25b

FIG. 25a

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FIG. 27

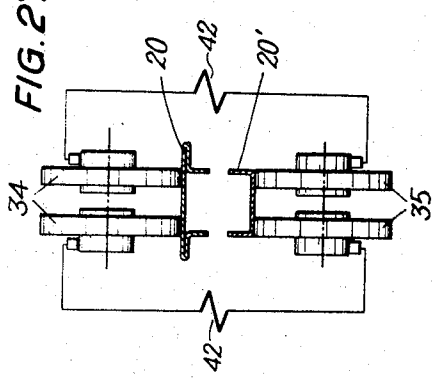


FIG. 31

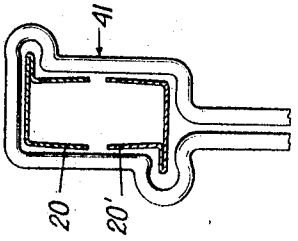


FIG. 26

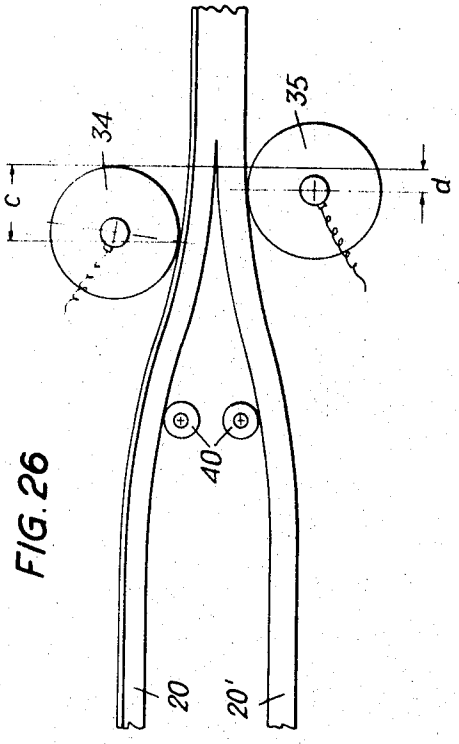
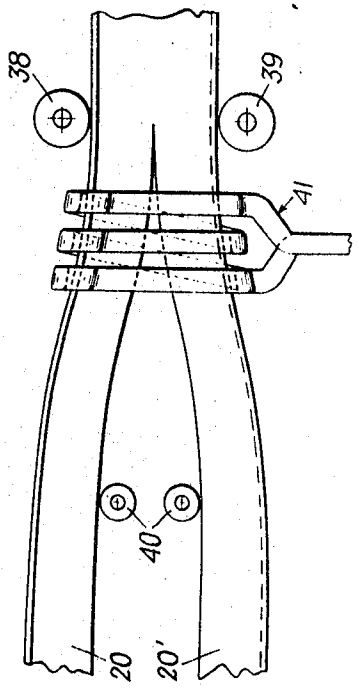


FIG. 30



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FOLD FLANGE TUBE AND PROCESS AND INSTALLATION FOR PRODUCING SUCH FOLD FLANGE TUBES

The invention relates to a fold flange tube and to processes and installations for producing such fold flange tubes from metal strips.

Fold flange or lap tubes are increasingly used by building fitters, in portal building, and the like, for making doors, windows, frames, etc. Originally, fold flange tubes were exclusively produced by reshaping of round tubes upon draw benches. This process is expensive, as it requires many separate steps and a considerable amount of material. Further, fold flange tubes are also produced in a tube welding plant where preshaped tubes instead of round tubes are made. Such tubes receive the desired shape by a final cold-draw. This process requires multiple-stand welding machines and complicated tooling equipment so that fold flange tubes produced by this process are expensive. With increasingly complicated shapes, this process becomes ever less economical. The limit is apparently a maximum of three fold flanges.

The invention aims at avoiding these disadvantages and difficulties. In particular, it has as its object to produce fold flange tubes from strip stock in a continuous manner and in a single plant.

A further object is the production of fold flange tubes of complicated shape, i.e. such having four to eight fold flanges, with a comparatively small set of tools.

The fold flange tube of the invention with which these objects are achieved is characterized in that it is made from two component sections joined by welding, at least one of said component sections having one or several fold flanges.

Preferably, the connecting welds lie opposite each other in a plane passing through the middle axis of the fold flange section.

The process of the invention for the production of fold flange tubes of the above characteristics comprises continuously passing two metal strips through successive shaping stations to form component sections of which at least one is provided with one or several fold flanges, and bringing said component sections together so that their edges to be welded face each other and joining said edges by butt welding to form a finished section.

According to a modified embodiment, the two strips are rolled into shape in one plane parallel to each other, whereupon the component sections are twisted towards each other and the edges are welded.

According to another embodiment, the strips are shaped to component sections in superposed planes and the two component sections are then vertically approached so that the edges which are to be welded contact.

The invention is illustrated in the drawing by way of several exemplary embodiments. In addition, the process of the invention and the installations used for carrying out this process are diagrammatically illustrated in the drawing.

FIGS. **1**, **2**, **3**, **4**, **5**, and **6** show six basic types of fold flange tubes according to the invention, FIGS. **1***a*, **2***a*, **3***a*, **4***a*, **5***a*, and **6***a*, respectively, demonstrating the two components which are joined by welding to form the pertinent fold flange tube. These components can be traced back to the three basic shapes shown in FIGS. **7**, **8**, and **9**. The basic shape shown in FIG. **7** has a trough-shaped profile and comprises the web **1**, two fold flanges **2**, and the projecting branches **3**. The basic shape according to FIG. **8** also has a trough-shaped profile and comprises web **1**, one single fold flange **2**, and branches **3**, and the basic shape according to FIG. **9**, which is simply U-shaped, comprises the web **1** and the two branches **3**.

The fold flange tube according to FIG. **1** is thus composed of two component sections according to FIG. **8** having only one fold flange **2**, the fold flange tube according to FIG. **2** of one basic shape according to FIG. **8** and one according to FIG. **9**, the fold flange tube according to FIG. **3** of one basic shape according to FIG. **9** and one according to FIG. **7**, etc., as evident from the drawing.

As shown in FIGS. **1** to **9**, the height *b* of the two branches **3** as well as the width *a* of web **1** are equal in all these embodiments. Thus, all combinations have the same interior cross section so that the types shown in FIGS. **1** to **6** are also interconnectable, e.g. by means of corner connections to form frames, without detracting from the stability of the construction as a whole.

FIGS. **10** and **10***a* show a modified embodiment in which, although the height of the branch is the same as shown in the basic shapes according to FIGS. **7** to **9**, the width of the web **1'** is smaller. Such embodiments in which one dimension corresponds to that of the embodiments according to FIGS. **1** to **9** and the other dimension is smaller, can also be used in frames, for instance as cross bars.

FIGS. **11**, **11***a*, **12**, **12***a*, **13**, **13***a*, **14**, **14***a*, **15**, **15***a*, **16**, **16***a*, **17**, **17***a*, and **18**, **18***a* show further embodiments of fold flange tubes derivable from basic shapes of FIGS. **19** to **21** and eventually from those of FIGS. **7** to **9**. For instance, the basic shape according to FIG. **19** differs in that the web **1''** has a steplike recess **4** continued in a fold flange **2**, to which the one branch **3'**, which is longer by the thickness of the metal sheet than the other branch **3**, is attached at right angles. FIG. **20** shows two fold flanges **2** and **2'** arranged at right angles to each other and to the one branch **3**. The basic shape according to FIG. **21** is characterized in that the fold flanges **2''** are longer than in the previously described embodiments, and flexed, and have shorter branches **3**.

As shown, the fold flange tube according to FIG. **11** is composed of a basic shape according to FIG. **19** and one according to FIG. **8**; the fold flange tube according to FIG. **12** of one basic shape according to FIG. **19** and one according to FIG. **9**, the fold flange tube according to FIG. **13** of one basic shape according to FIG. **8** and one according to FIG. **20**, etc. The fold flange tube according to FIG. **18** is composed of two basic shapes according to FIG. **21**.

In all these embodiments, the welding seams **10** and **10'** are arranged opposite each other in a plane *x*–*x* extending through the middle axis of the fold flange tubes.

FIGS. **22** and **23**, one showing a lateral view and the other a top view, illustrate the process according to the invention in its continuous steps. According to this illustration, the starting material are two strips arranged in parallel in a horizontal plane, said strips being drawn off supply cylinders **100**, **100'**. The strips **11**, **11'** are passed over guide pulleys **12**, **12'** to form a loop and are then shaped to one of the basic shapes according to FIG. **8** (strip **11**) or FIG. **19** (strip **11'**) in a series of pairs of shaping rolls: **13**, **13'**, **14**, **14'**, **15**, **15'**, **16**, **16'**, **17**, **17'** as well as rolls **15***a* and **16***a* for strip **11**, and pairs of shaping rolls **130**, **130'**, **140**, **140'**, **150**, **150'**, **160**, **160'**, **170**, **170'** as well as rolls **150***a* and **160***a* for strip **11'**. It must be remarked that in practice, depending upon the kind of component section to be made, more than five shaping stations are required.

FIG. **24** illustrates the production of a section similar to that of FIG. **19**, showing the successive stages of the shaping process. Stage (*a*) shows a flat strip **11** between two guide pulleys **110** and **110'**; in stage (b) a bead longitudinal of the direction of the strip is shaped by means of two shaping rolls **200**, **200'** and in stage (*c*) is rolled by means of two shaping rolls **201***a* to form a flat flange **2'**, while a further, smooth roll prevents warping of the shaped strip. In stages (*d*) and (*e*), the side flanges **2** and branches **3**, **3'** are preshaped by further shaping rolls **202**, **202'**, and **203**, **203'**. In stages (*f*) and (*g*), the flanges **2** and branches **3**, **3'** receive their final shape through rolls **204**, **204'**, **205**, **205'**, and the pair of rolls **204***a*. In stage (*h*), the step **4** in web **1'** is formed by the rolls **206**, **206'**, and the pair of rolls **206***a*.

The shaping rolls may be assembled from component parts so that sections of varying width can be produced with a small number of roll parts. In a similar manner, all the basic shapes according to FIGS. **7** to **9** and **19** to **21**, respectively, as well as any desired modifications of these basic shapes can be produced.

FIGS. 22*a* and 23*a* show the continuation of the installation illustrated in FIGS. 22 and 23. The component fold flange sections 20 and 20' are twisted towards each other between the last pair of shaping rolls (17, 17', and 170, 170'; FIGS. 22 and 23) and a twisting roll stand 210 comprising rolls 21, 21', 21'' so that the branches 3, 3' come to face each other, as shown in FIGS. 1*a* to 6*a* and 11*a* to 18*a*. In this position, the facing component sections 20, 20' enter the welding machine 220. The welding machine comprises, as known per se, a straddling device 230, e.g. a mandrel 23 or pulleys 40, pressure rollers 24, 24', 24'', and two welding jaws 22 pressed against component sections 20, 20' by means of a spring 22', said welding jaws receiving the required current through a welding current line 25. The welding process is based on the principle of bringing the edges of branches 3, 3' together at an acute angle to form a so-called notch wherearound the electric current circulates in high concentration and effects the welding. Numeral 26 denotes a rectifier, 27 a high frequency generator and 28 a matching transformer. 29 is a cooling device and 30 a set of stretching and straightening rollers.

FIG. 25 shows a modified version of the production process in which two series of shape rolling stands comprising pairs of shaping rolls are arranged in staggered relationship in a vertical plane rather than side by side as in FIG. 23. Strip 11 enters the first series of shape rolling stands, three of which, 31, 31', 32, 32', and 33, 33', are illustrated, wherein strip 11 is shaped as shown in FIG. 25*a*, while strip 11' remains unshaped. In the second series of shape rolling stands arranged behind and below the first series, whereof again three roll pairs are designated by 310, 310', 320, 320', and 330, 330', the section 20 remains undeformed, as shown in FIG. 25*b*, while the strip 11' is shaped to section 20'. In this modified version of the process the sections need not be twisted towards each other, but are vertically approached until the branch edges to be welded come to face each other, and are then welded in welding machine 220. The production process as illustrated in FIG. 25 is to be preferred if comparatively complicated profiles with several fold flanges, which present a greater resistance to twisting, are to be produced. FIGS. 26 and 27 illustrate a possible welding current supply, FIGS. 28 and 29 another possibility and FIGS. 30 and 31 a third possibility. In the version according to FIGS. 26 and 27, low frequency current is supplied from a transformer 42 by way of electrode rollers 34, 35, which are staggered in the feed direction of the sections 20, 20'. The rollers 34 and 35 are adjustable in feed direction and also in relation to each other, according to the dimensions *e*, *d*. This adjustability has the purpose that, when using low frequency welding current, and when the fold flange tubes are unsymmetrical, the problem arises of uniformly heating the two butting branches. When a U-section branch having a fold flange lies opposite another branch having no such flange, the branch of the U-section with fold flange would remain cooler than the branch without fold flange. The adjustability of the current supply rollers makes it possible to exclude differential heating.

FIGS. 28 and 29 show a preferred method of welding using high frequency current supplied through sliding contacts 36 and 37. Numerals 38 and 39 again denote the pressure rollers, numeral 40 the straddling rollers.

According to FIGS. 30 and 31, the welding current is supplied by way of an induction coil 41 surrounding the section at an even distance, which induces an adequate current in component sections 20 and 20' the circuit being closed by the butting branch edges which are thereby heated and joined. Numerals 38 and 39 again denote the pressure rollers and numeral 40 the straddling rollers.

I claim:

1. A fold flange tube comprising, a pair of longitudinal component sections joined together by butt welding, the welding seams being disposed opposite each other in a plane passing through the middle axis of said tube, at least one of said component sections having at least one fold flange disposed in a plane parallel to the plane defined by said welding seams.