March 25, 1941. T. E. MURRAY, JR 2,236,185

PRODUCTION OF TUBULAR UNITS FOR BOILERS AND THE LIKE

Filed Feb. 20, 1937 3 Sheets-Sheet 1

Fig. 1.

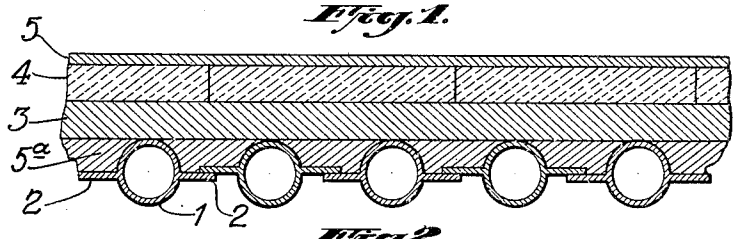


Fig. 2.

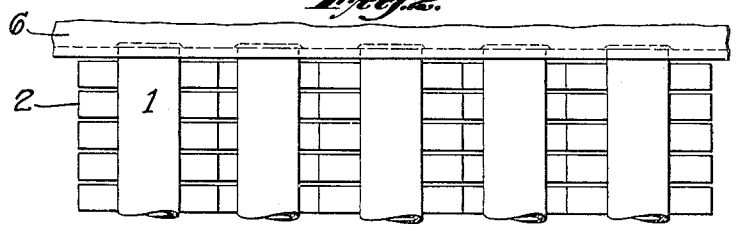


Fig. 3.

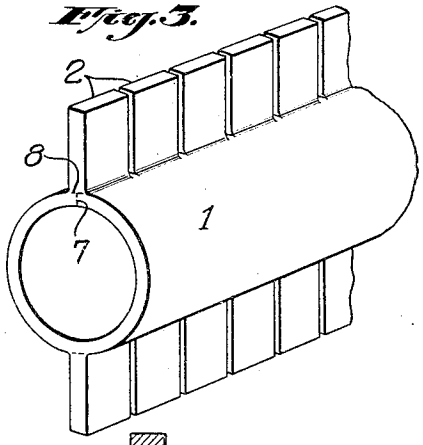


Fig. 6.

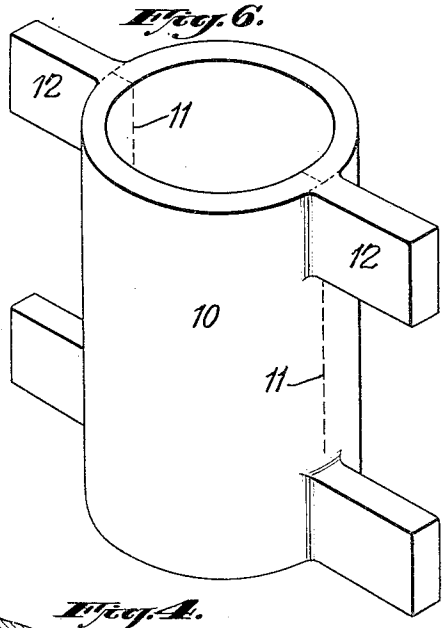


Fig. 5.

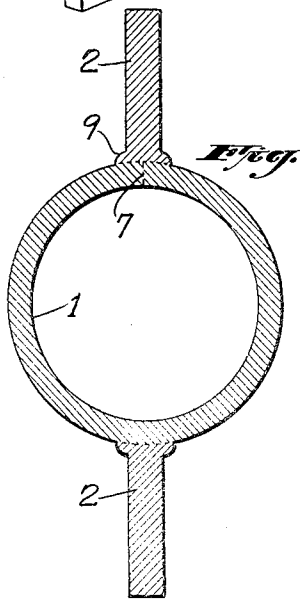
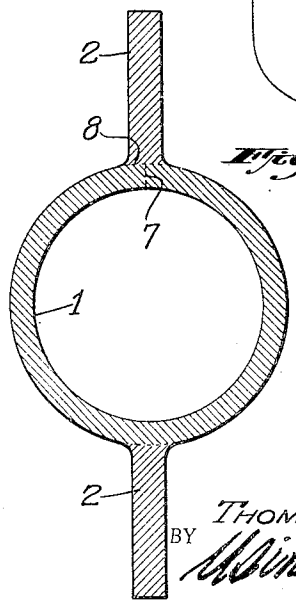


Fig. 4.



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PRODUCTION OF TUBULAR UNITS FOR BOILERS AND THE LIKE

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Fig. 7.

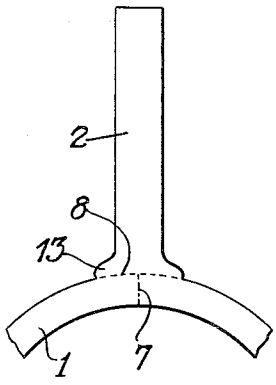


Fig. 8.

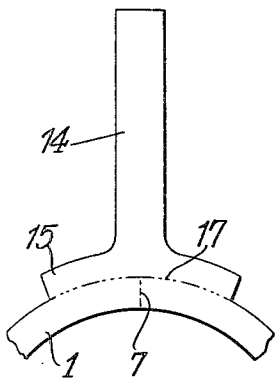


Fig. 9.

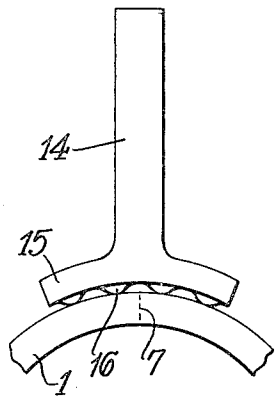


Fig. 10.

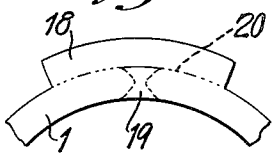


Fig. 11.

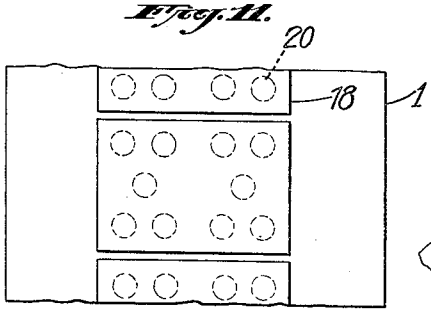


Fig. 12.

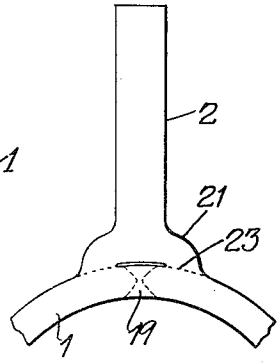


Fig. 13.

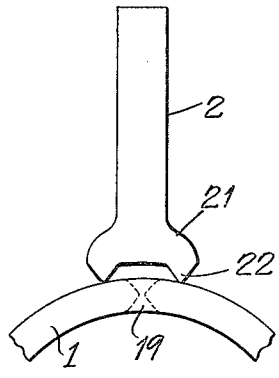


Fig. 14.

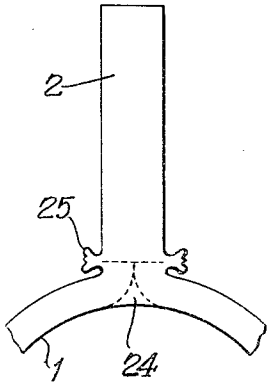
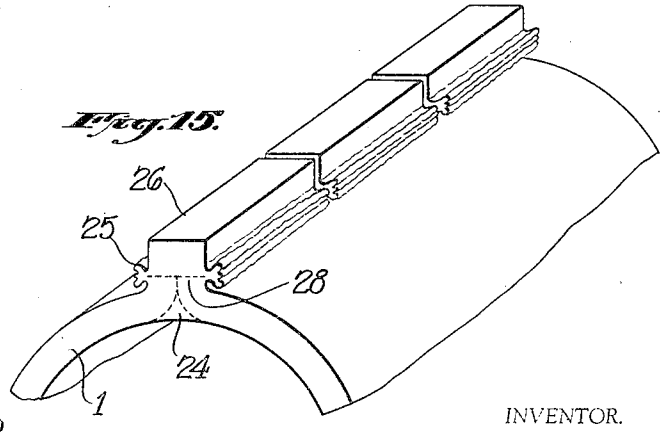


Fig. 15.



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Fig. 16.

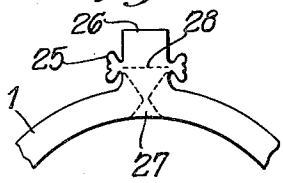


Fig. 17.

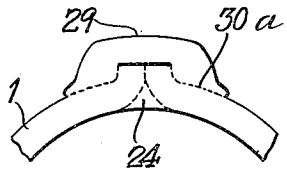


Fig. 18.

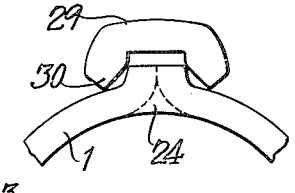


Fig. 19.

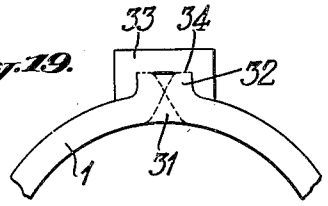


Fig. 20.

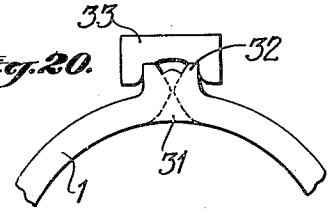


Fig. 21.

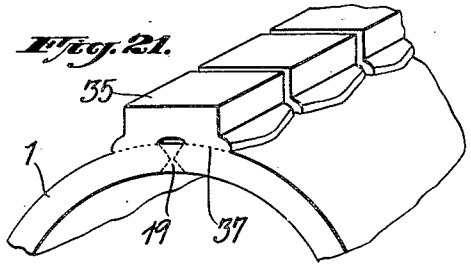


Fig. 22.

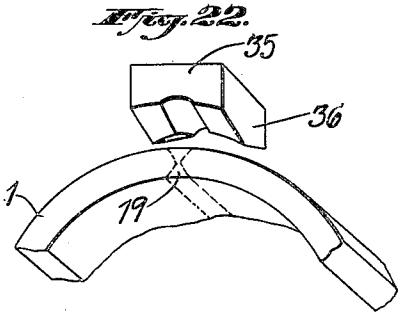


Fig. 24.

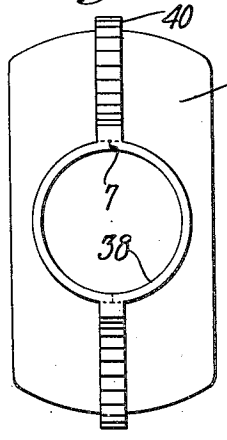


Fig. 25.

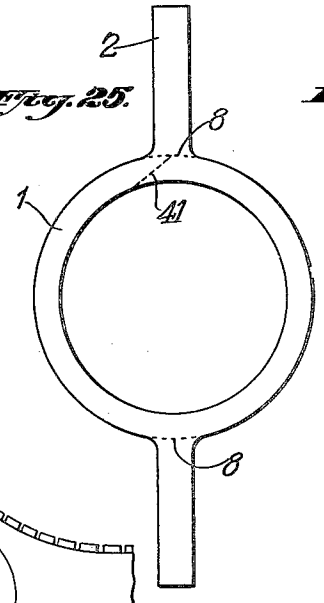


Fig. 26.

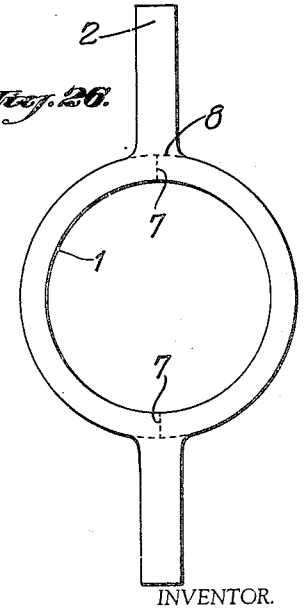
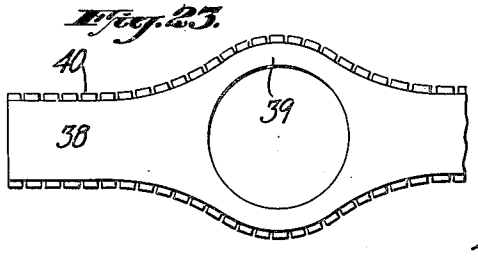


Fig. 23.



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Patented Mar. 25, 1941 2,236,185

UNITED STATES PATENT OFFICE

2,236,185

PRODUCTION OF TUBULAR UNITS FOR BOILERS AND THE LIKE

Thomas E. Murray, Jr., Brooklyn, N. Y.

Application February 20, 1937, Serial No. 126,760

12 Claims. (Cl. 219—10)

In a prior patent of Murray, No. 2,029,437 granted February 4, 1936, there is described a tubular heat exchange unit for boilers and the like comprising an ordinary steel boiler tube with a flange, or flanges, on the outside to provide a substantially increased external area. Similar tubular units find value in other structures.

The present invention aims to provide a unit of this general class and an improved method of producing the same.

The accompanying drawings illustrate embodiments of the invention.

Figs. 1 and 2 are respectively a horizontal section and an elevation of the upper part of a boiler wall, similar to that in the above patent, made with the units of the present invention; Fig. 3 is a perspective view of a portion of such a unit; Figs. 4 and 5 are cross-sections of alternative constructions; Fig. 6 is a perspective of a unit suitable for other purposes than boiler walls; Figs. 7 and 8 are fragmentary end views of alternative designs; Fig. 9 is a similar view of the parts of Fig. 8 before welding the projections; Figs. 10 and 11 are respectively a fragmentary end view and elevation of another style; Figs. 12 and 13 are fragmentary end views illustrating respectively another style of construction after and before the welding operation; Fig. 14 is a view similar to Fig. 7 of another construction; Fig. 15 is a fragmentary perspective of still another construction; Figs. 16 and 17 are fragmentary end views of other constructions; Fig. 18 is a similar view of the parts of Fig. 17 before welding; Figs. 19 and 20 are end views of another construction after and before welding respectively; Figs. 21 and 22 are fragmentary perspective views of another construction after and before welding respectively; Figs. 23 and 24 respectively are a side view and an end view on a larger scale of another tubular article; Figs. 25 and 26 are end views illustrating alternative constructions.

Starting with Figs. 1 to 4, we have a boiler wall made with an inner lining or screen comprising tubes 1 with lateral flanges 2 extending across the spaces between the tubes and overlapping each other (or they may substantially abut end-to-end) so as to form a baffle between them. On the outside of this screen is the wall of the boiler structure, which may be of any usual or suitable material, and which as illustrated comprises refractory blocks or bricks 3 outside of which are tiles 4 of non-conducting material and an outer shell 5 of sheet metal. A filling 5a of plastic refractory is preferably used between the tubes in order to exclude the hot gases and retard the burning away of the edges of the flanges. The longitudinal flanges or fins extend throughout such portions of the length of the tubes as may be desired according to the design of the boiler. Generally they will be arranged to extend throughout the zone where their conducting effect is of the greatest value. They provide a substantial increase in the external area of the tubes for facilitating the exchange of heat; serving the double purpose of saving the wall from the otherwise destructive effect of high temperatures and of permitting such high temperatures and utilizing the heat units to generate an increased quantity of steam or for superheating, economizing and similar functions.

As shown in Fig. 2, the fins extend clear up to a header 6 into which the upper ends of the tubes are introduced. They may extend clear down to a similar header below or may be otherwise located according to circumstances.

The flanges are interrupted at intervals in their length, being applied in comparatively small separately formed projections 2, Fig. 3, separately welded to the tubes. By making them in this way rather than continuous along the length of the tube, we avoid the accumulation of strains in the tubes and flanges due to the heat required in the welding operation and also avoid the accumulation of strains in use which might cause cracks and ruptures of the tubes or flanges and increase the tendency to oxidize and burn down the flanges at their outer edges.

According to the present invention such fins are made to serve a new purpose. In the designs of Figs. 3, 4 and 5, the tube 1 is made of a strip or skelp bent around and welded along a longitudinal seam 7. A row of projections 2 is then welded along the external edge of the seam 7, this welded joint being indicated at 8. The fins in this case serve the double purpose of providing increased external area for exposure to the heat and also of reinforcing the longitudinal seam 7; covering the latter throughout the greater part of its length and being welded to the body of the tube at opposite sides of said longitudinal seam.

For high duty boiler tubes, it has been the prevailing practice to use seamless tubing, because of the security against rupture under high pressure. By the present invention the longitudinal seam is so fully reinforced as to produce a tube as good as if it were seamless.

The fins may be welded in various ways. The aforesaid patent describes a method of resist-

ance welding, such as is indicated in Fig. 4 in which the parts are forced together while a welding current is passed through them, the metal of the fin being extruded slightly to produce a small fillet as shown.

Fig. 5 illustrates an alternative method of welding. Molten metal 9 is deposited along the lines of contact at opposite sides, serving itself to fasten the parts together and serving also to heat them so that generally throughout their line of contact they are united.

In both Figs. 4 and 5 an additional line of fins 2 is located at the opposite side of the tube so that they may be used in the manner shown in Fig. 2. The invention, however, is applicable to tubes for various purposes in which the second line of fins is not provided. Similarly, in the other variants referred to hereinafter, it is generally true that one or more lines of fins may be used according to the purposes to which the product is to be put.

The product is useful not only for boiler tubes, in which generally the projections 2 will be so closely arranged as to constitute for most practical purposes a continuous metal flange, but also to articles like that of Fig. 6; which illustrates a drum made of two heavy semi-circular segments 10 welded to each other along their meeting lines to form seams 11; with covering and reinforcing members 12 overlying the seams and welded to the body at opposite sides thereof. The members 12 will be of such size and spacing that may be required according to the use to which the hollow article is to be put.

The boiler tube of Figs. 1 to 5 may be the usual steel tube of slight diameter, generally three to four inches, compared to its length of the order of twenty or thirty feet, and of slight wall thickness in about the ratio shown.

Fig. 6 is intended to illustrate the application of the invention to a tubular product which, compared with a boiler tube, is shorter and of larger diameter of wall thickness.

The remaining figures illustrating only the joint details are to be understood as applying to complete tubes generally, but not necessarily, with opposite rows of fins as in Fig. 3 applied in the same way to both sides of the tube.

Fig. 7 differs from Fig. 5 only in this: that the fin tube has at its base lateral extensions 13 which result in a joint 8 of greater width and overlap at the sides of the welded seam 7 of the tube.

According to Figs. 8 and 9, a fin 14 is used with fairly wide flanges 15 at the base; being formed originally with rounded projections 16 on its underface so that when pressed together under a welding current a series of small welds, indicated at 17, results.

Figs. 10 and 11 illustrate the use of the invention for providing a reinforcement without substantial increase in external area. It is to be understood that the several schemes herein described for making welded seams and applying projections which provide increased area may be used also for applying projections which serve wholly or chiefly as reinforcements. Similarly, methods described for applying reinforcements may be used for applying extended-area projections.

Figs. 10 and 11 show such reinforcements in the form of segmental plates 18. The edges of the tube 1 in this case are brought nearly to each other and united by an electric arc weld, the filling metal forming the joint being indicated at 19. Over this joint the blocks 18 are applied by the projection resistance method explained in connection with Figs. 8 and 9; the welds produced thereby being indicated at 20.

According to Figs. 12 and 13, the longitudinal seam 19 is also an arc-welded seam, the projection 2 has at its base separated flanges 21 with pointed edges 22 which when the parts are pressed together under a welding current form welds 23 located at opposite sides of the seam 19, omitting any weld of the projection directly to the metal forming the seam.

According to Figs. 14 and 15, the edges of the skelp are bent outward to form a slight projection from the tube, leaving a triangular space on the inside which is filled with arc weld metal 24. The projection 2 is then welded by a simple resistance method, extruded metal being indicated at 25 and being cut off or ground off or left in place according to the intended use of the article. Fig. 14 shows this idea applied to the use of wide fins 2 which provide a substantial increase in the external area; whereas Fig. 15 shows it applied to blocks 26 which provide only a slight increase in area and whose chief function is to reinforce the seam 24 of the tube.

Fig. 16 illustrates a similar product, varying only in that the seam 27 of deposited metal extends clear through the wall of the tube and the projections 26 are applied directly thereto by a resistance weld 28.

According to Figs. 17 and 18, the seam is made with an arc weld 24, similar to that of Fig. 15, and the projecting edges of the skelp are bridged by blocks 29 which are originally provided with reduced edges 30 so that when the parts are pressed together and the current passed resistance welds 30^a are formed at the sides.

According to Figs. 19 and 20, the seam is welded as at 31 leaving upward projections 32 formed by the edges of the skelp, and the blocks 33 are welded by pressure and resistance bringing the product to the shape of Fig. 19 with resistance welds 34 along the edges 32.

According to Figs. 21 and 22, an ordinary arc weld seam 19 (the same as in Fig. 10) is provided leaving a substantially round outer surface, and blocks 35 are applied thereto by resistance welding methods. The blocks have projecting edges 36 so that after the welding operation they are united by resistance welds 37 to the skelp at opposite sides of the tube, leaving the seam weld metal 19 clear on its outer face.

Figs. 23 and 24 illustrate the application of the invention to the making of a reinforced axle housing for automobiles. This is made of two segments welded together along a longitudinal vertical plane, each segment comprising substantially circular end portions 38 with central portions 39 that are enlarged in the vertical dimension and have flat vertical front and rear faces with openings for the insertion of the usual differential gearing. The full length of the housing may be made in this way, or portions of the length so made and afterwards united. Welded seams 7 at the top and bottom unite the two segments and are reinforced by blocks 40 applied thereto by a resistance weld such as is shown at 8 in Fig. 4. The seam welds and the weld of the blocks to the tube may be of any of the several kinds illustrated, or indeed, of any usual or suitable kind.

In connection with the previous figures, we have assumed the tube seam to be a butt weld made by an electric resistance or an electric arc method. There are a number of resistance and a number of arc welding methods available. And

the invention is applicable also to seams made by other methods. For example in Fig. 25 there is shown a tube 1 made from skelp united by a lap weld 41 made either electrically or with furnace heat. The projections 2 may be applied also by various welding methods. The welds 8 are assumed to be resistance welds the same as for Fig. 4.

Fig. 26 illustrates a tube made of two semi-circular segments with butt welds 7 at diametrically opposite points made either by electric resistance methods or by the aid of furnace heat.

Various other modifications may be made by those skilled in the art without departing from the invention as defined in the appended claims.

What I claim is:

1. A tubular metal product of the character described having a tubular body having wall elements directly abutting and united in a welded longitudinally-extending seam and having a series of covering and reinforcing members in longitudinal succession overlying said seam and welded to the body at opposite sides of said seam.

2. A tubular metal product of the character described having a tubular body composed of a plurality of segments directly abutting and united by welded longitudinally-extending seams and having a series of covering and reinforcing members in longitudinal succession overlying said seams and welded to the body at opposite sides of said seams.

3. A tubular heat-exchange unit for boilers and the like, comprising a steel tube of slight diameter compared to its length and slight wall thickness compared to its diameter, said tube having a welded longitudinal seam directly uniting wall elements thereof and a line of separate small projections closely spaced and separately welded along said seam so as to cover and reinforce the same.

4. A tubular heat-exchange unit for boilers and the like, comprising a steel tube of slight diameter compared to its length and slight wall thickness compared to its diameter, said tube consisting of a strip bent around to cylindrical form and having its edges directly welded together in a longitudinal seam and a line of separate small projections closely spaced and separately welded along said seam so as to cover and reinforce the same.

5. A tubular heat-exchange unit for boilers and the like, comprising a steel tube of slight diameter compared to its length and slight wall thickness compared to its diameter and two lines of small separately formed projections at opposite sides thereof, each line consisting of a number of such projections so close together as to constitute in effect a complete metal rib, said tube consisting of two segments directly welded together along longitudinal seams, said projections being welded on the tube along said seams so as to cover and reinforce the same.

6. A tubular heat-exchange unit for boilers and the like, comprising a steel tube of slight diameter compared to its length and slight wall thickness compared to its diameter and two lines of small separately formed projections at opposite sides thereof, each line consisting of a number of such projections so close together as to constitute in effect a complete metal rib, said tube consisting of a strip bent around to cylindrical form and having its edges welded together in a longitudinally extending seam, and a line of said projections being welded along said seam so as to cover and reinforce the same.

7. The method of making a tubular product of the character described which comprises, first, producing a tubular body with a welded longitudinally-extending seam and then applying covering and reinforcing members over said seam and welding them individually to the body at opposite sides of the seam.

8. The method of making a tubular product of the character described which comprises, first, producing a tubular body by welding segments together along longitudinally-extending seams and then applying covering and reinforcing members over said seams and welding them individually to the body at opposite sides of said seams.

9. The method of making a tubular product of the character described which comprises, first, producing a tubular body with a welded longitudinally-extending seam and then applying outwardly-extending projections along said seams and welding them to the body along opposite sides of the seam by electric resistance welding so as to cover and reinforce the same and at the same time provide a substantial increase in external area.

10. A hollow metal article having a longitudinally extending welded seam directly uniting the wall thereof and having a longitudinal series of reinforcing members spanning said seam and welded to the body at opposite sides of said seam.

11. The method of making a hollow article which comprises welding a sheet metal article on a longitudinal seam, placing a reinforcing member to span said seam and welding said reinforcing member to the body at opposite sides of the seam.

12. A method of reinforcing a welded metal seam which comprises placing a reinforcement in position to span said seam and welding said reinforcement to the metal at opposite sides of said seam by electric resistance welding.

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