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OIL REFINING STILL AND METHOD OF MAKING THE SAME
BY ELECTRIC ARC WELDING
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The invention relates to stills of enormous proportions, such as are employed in the operation of refining crude oils, and also to a method by the practice of the steps of which it is now rendered possible to construct stills embodying the invention in its concrete form. The invention resides in a still, and method of its manufacture, of the excessively thick metal type disclosed in the application by L. R. Smith, filed Dec. 13, 1924, for which Patent No. 1,577,410, was granted March 16, 1926, and in the application by W. F. Woolard, filed February 27, 1926, Serial No. 91,921.

The specifications of the patent and application referred to set forth some of the difficulties which heretofore have been encountered in the manufacture of satisfactory and efficient stills of the class to which the present invention relates, such difficulties existing by reason of certain physical limitations inseparable from such manufacture by methods heretofore known and practiced, and reference may be had to the said specifications for an explanation of the difficulties and limitations attending the practice of the prior art.

The present invention involves an improvement in the construction of the thick metal stills disclosed in the patent and application before mentioned, and resides in an arc-welded still in the specific construction of which all longitudinally extending welded joints are eliminated. In stills as manufactured heretofore from metal plates having in the extreme a thickness of about one and one-half inches, rolled into annular form and lap-welded at the meeting ends of the plate, the longitudinal joint there produced has always presented an element of weakness in the construction, in that such joint is weaker than the metal in which it is formed. This is due to the difficulty and uncertainty of lap-welding plates of that thickness, and the fact that the internal pressures existing in the stills while in operation are very great and are sufficient to create stresses in the metal, which condition sometimes is followed by disastrous results, as when the lap-welded joint ruptures under the expansive pressure to which the still is subjected.

The purpose of the invention is the production of the still from which the uncertain and often defective longitudinal joints produced by lap-welding are entirely obviated. This result I achieve by casting the still in annular or tubular sections of suitable length, aligning such sections in plural number in an end to end arrangement, and then arc-welding such plurality of sections in their circumferential meeting lines so as to produce an integral tubular or body section of the desired length. A still produced in this manner will be wholly free from any longitudinal welded seams or joints, and consequently will re-act effectively to the destructive strains attendant upon the use of the older type of stills in which longitudinal lap-welded joints are present. The practice of fusing and uniting the seamless annular sections at their circumferential meeting lines by means of an electric arc, is also advantageous over the prior methods of connecting such sections by lap-welding, inasmuch as tests have shown that in structures which are fused by the electric arc, the tensile strength of the metal is greater in the line of the weld than it is elsewhere. A physical limitation upon the thickness of the metal plates which may be united by lap-welding exists, but this is not true with reference to arc-welding. No such limitation exists here.

The annular sections which are to be joined end to end so as to produce the integral tubular structure constituting the body of the still, may be cast in any manner which will produce the desired degree of density in the metal and so free the same from porosity, such as is existent in ordinary castings. Centrifugal casting will produce the best results, inasmuch as by this process, a better and more nearly uniform molecular structure of the metal is attained. The steel used in casting the annular sections should be of such composition as to resist effectively the deteriorating influences of corrosion and heat. By subjecting the cast sections while in a heated condition to the action of rolls, the metal will be greatly refined and its structure improved and strengthened in such a degree that it will be more perfectly adapted to resist the destructive influences which attend the use of the still in the process of refining oil.
Suitable heads are fused to the ends of the cylindrical body to complete the closure.

The invention will now be described somewhat more in detail, and the novel features thereof will be pointed out in the appended claims.

In the drawing:

Figure 1 is a vertical sectional view on its center line of a still constructed in accordance with my invention.

Fig. 2 is a perspective view of one of the integrally cast annular sections, a plurality of which will be arranged end to end in axial alignment and fused together at their circumferential meeting lines by an electric arc, to produce a still of the construction shown in Fig. 1.

Fig. 3 is an enlarged vertical section in the plane of the view on which Fig. 1 is taken, showing one form of welding groove and the manner in which the abutting sections of the still are fused and welded into an integral structure.

Fig. 4 is a similar view showing a modification in the formation of the welding groove produced at the meeting line of two sections of the still, the fusion of the parts being effected in the same manner.

Fig. 1 of the drawing shows a still, the body of which is formed as an integral tubular structure by the union of a plurality of cast steel annular sections 12, 13 and 14 formed as endless rings of the type shown in Fig. 2, and of suitable length. These rings or still sections are produced by casting, and preferably the centrifugal process is resorted to in producing such castings, by reason of the opportunity afforded for effecting a more uniform density of the metal in the composition of the ring sections.

At the time of casting the ring sections, the ends thereof may be provided with a suitable bevel, so that when such sections are aligned, a welding groove extending circumferentially of the sections will be formed at the meeting line of the abutting sections. The provision of such a welding groove is a necessary feature to enable my invention to be carried into practice, inasmuch as ordinarily the electric arc could not be made to penetrate the very narrow space at the ends of abutting sections sufficiently to fuse the metal at the side opposite to that to which the arc is applied. Such welding grooves are usually formed by cutting away the outer corners of the end sections as at 15 to remove a quantity of surplus metal and by aligning two sections end to end, form a deep welding groove 16, having a bottom 17 formed by undisturbed portions which meet in an axial plane and upon which the arc may play so as to effect complete fusion and amalgamation of the metal at the bottom of the groove 16, at the commencement of the welding operation. The form of the welding groove 16 is not material. It may be V-shaped, U-shaped, or otherwise, it being required only that the groove be wide enough to allow the weldrod or electrode at the point of which the electric arc is formed to enter such groove freely, and permit the arc to fuse the thin metal at the bottom of the groove.

As indicated above, the tubular sections are produced without longitudinal seams or joints, and this feature of construction I have found to be greatly advantageous, inasmuch as stills produced with longitudinally extending lap-welded joints by the older process were inherently weak in the line of such joints. The internal strains arising from the expansive pressures generated in the operation of the still, exerted destructive influences upon the lap-welded joints, which were the weakest part of the construction. The defect previously existing is completely overcome by my improved method of manufacturing the still, so that it is wholly free from longitudinal welded joints.

The still is composed of two end sections 12 and 13 and intermediate sections 14, the latter being in such number as to constitute the desired length in the main body of the still. In producing the still, the plurality of the seamless annular sections will be assembled end to end in axial alignment, and the abutting ends of the sections in the region of the groove will be fused by the action of an electric arc and the sections united as at 20 into an integral tubular structure of the desired length. In fusing the ends of the still sections so as to produce the integral tubular structure, I prefer to use a destructible weldrod, at the point of which the electric arc is formed. The molten metal flowing from the fusible weldrod is deposited in the groove and amalgamated with the fused metal at the ends of the several sections.

On account of the thickness of the metal and consequent depth of the welding groove, a considerable quantity of weldrod material will be required to fill the groove and complete the contour of the tubular body. An economy in the more costly weldrod material may be effected and the same results attained by placing in the grooves additional welding material in the form of slugs or bars and fusing the latter by the action of the electric arc, so that the additional welding material will be amalgamated with the molten metal flowing from the weldrod and form a part of the fused union by which the sections are united into an integral tubular structure.

An economical manner of forming the welding groove is shown in Fig. 3, in which the ends of the annular sections are beveled from the outside to the inside, where they
meet or abut in an axial plane so as to form the thin bottom 17 for the welding groove. A modification of the form of the welding groove is shown in Fig. 4, wherein the ends of the annular sections are beveled from both the inside and outside, the lines converging in the longitudinal center line of the walls of the annular sections, so that when such sections are assembled the lines of convergence meet so as to form a common thin bottom 171 for both welding grooves. In this construction, the fusion of the ends is effected by arcs working at both sides of the tubular arrangement.

The still is completed as a closure by fusing heads 18 and 19 thereto, such heads being formed as hollow hemispheres, from metal of approximately the thickness of that of the annular sections of the main body of the still. The lines of meeting of the heads 18 and 19 with the end sections 12 and 13 of the still will be provided with grooves formed as before described, and such heads will be fused to the body of the still as before. In practice, the integral hollow structure will be provided with the necessary inlet and outlet connections, but the manner of their attachment is not concerned in this invention.

After the annular sections have been cast, the metal may be greatly refined by rolling the rings to the required diameter and densen the metal so as to produce a more uniform molecular structure in the same, and so increase the ability of the still while in operation to withstand the internal pressures and resist the corrosive action of its contents. The steel used for casting should therefore be such as will resist the destructive influences which are created in the operation of the still.

Also, the arc may be formed at the point of a carbon electrode, and caused to fuse the ends of the annular sections in the region of the welding grooves and the metal slugs or bars, which latter are laid into the grooves in quantities sufficient to fill the same, into a homogeneous structure of symmetrical contour. Although I have described my invention as embodied in a still for use in refining crude oils, it is to be understood that the invention is not to be so limited, and that it may be embodied in structures adapted for uses other than that recited.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. A still for use in refining oil, composed of a plurality of thick, seamless, annular sections of cast steel partially cut away at their ends to form circumferential welding grooves, the said sections being aligned end to end and fused together by an electric arc in the region of the grooves to constitute an integral structure without longitudinal joints, and heads fused to the ends of the tubular structure by an electric arc to complete the closure.

2. A still for use in refining oil, composed of a plurality of thick, seamless, annular sections and intermediate sections of cast steel of the same diameter partially cut away at their ends to form circumferential welding grooves, the said sections being aligned end to end and fused together by an electric arc in the region of the grooves to constitute an integral tubular structure without longitudinal joints, and heads fused to the ends of the tubular structure by an electric arc to complete the closure.

3. A still for use in refining oil, composed of a plurality of thick, seamless, annular end sections and intermediate sections of cast steel of the same diameter partially cut away at their ends to form circumferential welding grooves, the said sections being aligned end to end and fused together by an electric arc in the region of the grooves to constitute an integral tubular structure without longitudinal joints, heads fused to the ends of the tubular structure by an electric arc to complete the closure, and with the grooves filled with fused welding material.

4. In the manufacture of stills of extreme dimensions for use in oil distillation, the method which comprises the steps of casting thick, seamless, annular sections of metal in tubular form, assembling a plurality of such sections end to end in axial alignment, fusing the ends of the sections in the region of their circumferential meeting lines by an electric arc to unite the several sections into an integral tubular structure of the desired length, and fusing heads to the tubular structure to complete the closure.

5. In the manufacture of stills of extreme dimensions for use in oil distillation, the method which comprises the steps of casting thick, seamless, annular sections of metal in tubular form, assembling a plurality of such sections end to end in axial alignment, forming circumferential welding grooves at the ends of the sections, fusing the ends of the sections in the region of their circumferential meeting lines by an electric arc to unite the several sections into an integral tubular structure, fusing heads to the ends of the tubular structure by an electric arc to complete the closure, and fusing welding material into the grooves to fill the same.

6. In the manufacture of stills of extreme dimensions for use in oil distillation, the method which comprises the steps of casting thick, seamless, annular sections of metal in tubular form, rolling the seamless section to the desired diameter and to refine the metal, assembling a plurality of such sections end to end in axial alignment, cutting away portions of the metal at the ends of
the annular sections to form welding grooves, fusing the ends of the sections in
the region of their circumferential meeting lines by an electric arc to unite the several
sections into an integral tubular structure, fusing welding material into the grooves to
fill the same, and fusing heads to the ends of the tubular structure by an electric arc
to complete the closure.

In testimony whereof, I have signed my name at Milwaukee, this 11th day of March, 1926.

CLIFFORD B. LANGSTROTH.