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APPARATUS FOR MAKING WELDED TUBES

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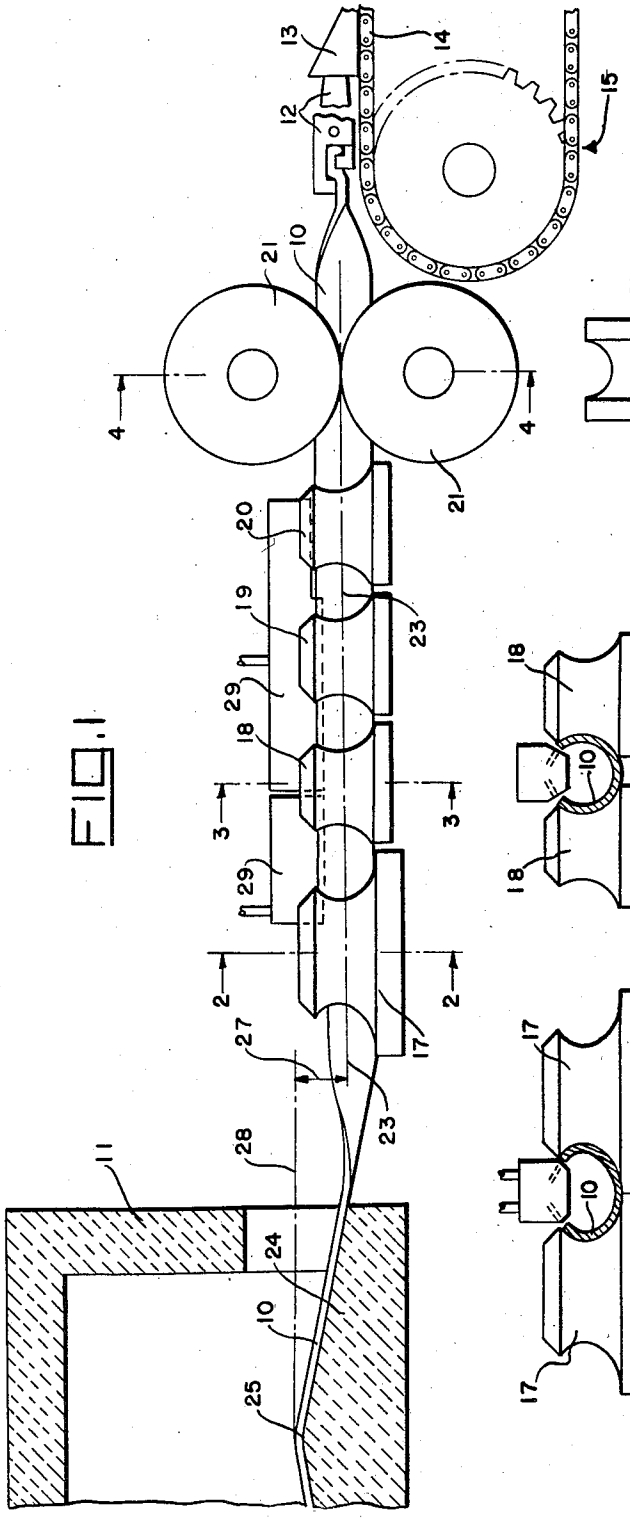


FIG. 1

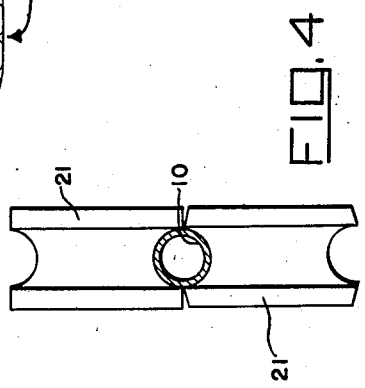


FIG. 4

FIG. 3

FIG. 2

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APPARATUS FOR MAKING WELDED TUBES

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4 Claims. (Cl. 78—87)

It is an object of this invention to provide an improved apparatus for making welded pipe or tubing from separate lengths of flat skelp.

In accordance with one feature of the invention the skelp is pulled over a transverse supporting ridge and downward into forming apparatus in such a way that flat skelp forms into a tube blank with the seam at the top of the blank without traveling through any break-down pass. Where the flat skelp is pulled directly from a furnace into forming and welding apparatus, the elimination of a break-down pass between the furnace and the forming and welding apparatus has important advantages. The rolls of a break-down pass take considerable heat out of the skelp, and therefore require that the metal be more highly heated in the furnace. Some metals, such as high carbon and certain alloy steels cannot stand high furnace heating without deterioration, and even low carbon steels have their finish roughened by high furnace heating.

By lowering the temperature to which the skelp must be heated in the furnace, this invention makes possible the manufacture of welded tubing from furnace-heated material that could not otherwise be used to make tubing without considerable supplementary edge-heating, and the invention obtains welded tubes with better finishes.

On small-size tubes, the finish is not so important because such tubes are usually not exposed after being installed, and the pitting that produces a rough finish extends for a comparatively small percentage of the thickness of the tube wall. In the case of larger tubes (such as those three inches or more in diameter) the situation is different. Such tubes are often exposed so that appearance of the surface must be considered, and the pits of a rough surface extend for a greater percentage of the thickness of the tube wall. Rough finishes on large-size tubes are not commercially acceptable.

The invention contemplates the use of supplementary heating of the edge faces by direct flame heating during the forming operation, but features of the invention can be used in the welding of furnace-heated skelp without supplementary edge heating.

Another object of the invention is to provide an improved apparatus for making welded tubes with forming rolls. The use of rolls instead of a bell permits skelp to be formed at lower temperatures without scratching. With roll forming some provision must be made for causing the seam to always form in the same position, preferably at the top of the tube blank. This invention pulls the skelp downward from a supporting ridge and then through successive roll passes that are alined on a level lower than the supporting ridge. The ridge is ordinarily within the furnace that heats the skelp.

Other features, objects, and advantages of the invention will appear or be pointed out as the specification proceeds.

In the accompanying drawing, forming a part hereof:

Fig. 1 is a diagrammatic side view, with the furnace in section, of apparatus for making welded tubes in accordance with this invention.

Figs. 2–4 are sectional views taken on the lines 2—2 to 4—4, respectively, of Fig. 1.

Separate lengths of skelp 10 are pulled successively from a furnace 11 by a pulling tool 12 that has an end portion which engages a dog 13 on a chain 14 of a drawbench 15. The pulling tool 12 is shown as conventional tongs, or other pulling tools can be employed.

The forming and welding apparatus between the furnace 11 and drawbench 15 includes five roll stands. This apparatus is illustrative, and other embodiments of the invention can include different forming and welding apparatus.

The first roll stand has two rolls 17 that form a pass of generally elliptical contour with the major axis of the ellipse horizontal. This first pass between the rolls 17 is of such size in proportion to the skelp width that the skelp extends somewhat more than half way around the ellipse with the edge portions of the skelp above the major axis, as shown in Fig. 2. This contour prevents the skelp from either rising or turning in the roll pass. Even though the top of the pass between the rolls 17 is rather wide open, the skelp cannot rise without being bent more sharply, and the skelp cannot rotate without bending a new part to the sharper curvature of the ends of the ellipse. Thus the stiffness, or resistance to bending, of the skelp prevents the skelp from either rising or turning in the first forming pass.

As the partially formed tube blank travels successively through the passes between pairs of rolls 18, 19 and 20, the edge faces are brought progressively closer and the form approaches the contour of a circle. The tube blank is indicated by the reference character 10, the same reference character used for the flat skelp. The final forming step is performed by welding rolls 21 that turn about horizontal axes and that define a closed circular pass in which the edge faces of the skelp are brought together to make the weld.

The rolls 17—21 are preferably idlers and the forces which they exert against the tube blank are, therefore, reaction forces caused by the draw-bench pull (i. e., the pull of the tongs on the end of the skelp).

The passes between the rolls 17, 18, 19, 20 and 21, respectively, are in line with each other and with the direction of pull of the tool 12, but the center line of these roll passes, indicated in Fig. 1 by the reference character 23, is at a level substantially below the highest point of the furnace bottom, so that the skelp is pulled downward at an obtuse angle to the line 23 as the skelp approaches the forming apparatus.

The furnace is shown built with a ramp 24 near its discharge end. The high point of the ramp is a horizontal ridge 25 that extends at right angles to the direction of movement of the skelp, and the furnace bottom slopes upward to the ridge 25 and then downward from the ridge to a point near the first forming rolls 17. The furnace could end at 25 but the disadvantage of such a construction would be that the skelp would then cool during its entire run to the level of the line 23. It is desirable that the skelp be heated, as nearly as possible, up until the time that it enters the first roll stand, and since there are minimum limits for the length of the downwardly extending run of skelp in front of the first forming pass, a ramp construction that locates a substantial length of the downward run inside of the furnace is to be preferred.

Pulling the flat skelp over a ridge and downward at an angle to the line 23 causes the skelp to always form with the seam at the top of the tube blank. Without the ridge 25 and this downward slope as it approaches the first forming pass, the skelp would sometimes form with the seam down, sometimes with the seam up, when using roll passes such as shown in the drawing. A break-down roll pass with a convex roll against the top surface of the skelp in addition to one or more supporting rolls against the bottom side of the skelp could be used to insure a top seam on all tube blanks, but this invention avoids the use of a break-down pass in order to prevent the serious loss of heat that is caused by such a roll pass with rolls in contact with both sides of the skelp.

The length and drop which the downwardly sloping portion of the skelp must have in order to insure upwardly turned edges when the skelp begins to form depends upon the width of the skelp. Good results are obtained by locating the level of the line 23 lower than the ridge 25 by a distance equal to the diameter of the tube that is made from the particular width of skelp being operated upon. In other words, the distance indicated in Fig. 1 by the dimension line 27 between line 23 and a parallel line 28 that passes through ridge 25 is equal to the diameter of the pass between the welding rolls 21. The longitudinal distance from the ridge 25 to the section line 2—2, which is the center line of the first forming roll stand, is at least five times as great as the length of the dimension line 27.

With forming and welding apparatus having interchangeable rolls for making tubes or pipes of different sizes, the limiting dimensions are those required for the largest tube (i. e. widest skelp) for which the apparatus is intended to be used.

Torches 29 extend along the edges of the partially formed tube as it travels through the forming apparatus. The jet orifices of the torches 29 are preferably disposed to project the flames directly against the edge faces of the tube blank as indicated in Figs. 2 and 3. This local heating of the edge faces raises them to a welding temperature. There is a surface fusion of the metal when producing welds of the best grade, but the invention can be used without actual fusion of the edge faces and with the rolls 21 adjusted to apply enough pressure to complete the weld.

It will be understood that terms of orientation in the specification and claims are relative, since the broken line of the skelp as it comes over the ridge 25, and the obtuse angle that the direction of movement of the skelp from the furnace makes with the direction in which the skelp travels through the forming apparatus, can be obtained with various directions of movement.

The rolls can be shaped to form the tube with the major axis of the elliptical cross-section vertical. Various other changes and modifications can be made in the illustrated embodiment of the invention and some features of the invention can be used without others.

I claim:

1. Pipe or tube welding apparatus including forming apparatus, means for moving the skelp through the forming apparatus along a given level, and a transverse ridge above said level and ahead of the forming apparatus for causing the skelp to approach the forming apparatus with a downward slope at an angle in a vertical plane to the level along which it moves through said forming apparatus, said forming apparatus including a pair of opposed rolls, both of which contact with one and the same side of the skelp and perform the initial operation in shaping the skelp to tubular form.

2. Apparatus for making welded pipe or tubing including a furnace in which separate lengths of skelp are heated, a ridge in the furnace extending transversely of the skelp at a region some distance back from the discharge end of the furnace, forming apparatus including successive forming roll stands in the region of the discharge end of the furnace, said forming roll stands being in alinement with each other on a level lower than the furnace ridge by a distance at least as great as the diameter of the pipe or tube that is formed by said roll stands, said roll stands including only rolls disposed to contact with one side of the skelp, torch means along the forming apparatus in position to project flame jets directly against the separated edge faces of the partially formed skelp, another roll stand in which the forming is completed and the edge faces brought together to make a weld, and means for pulling the skelp through the successive roll stands.

3. Apparatus for making welded pipe or tubing including a furnace in which separate lengths of skelp are heated, a ridge in the furnace extending transversely of the skelp at a region some distance back from the discharge end of the furnace, forming apparatus including successive forming roll stands in the region of the discharge end of the furnace, said forming roll stands being in alinement with each other on a level lower than the furnace ridge by a distance at least as great as the diameter of the pipe or tube that is being formed by said roll stands, said roll stands including only rolls disposed to contact with one side of the skelp, and means for pulling the skelp through the successive roll stands.

4. Apparatus for making welded pipe or tubing including means for heating separate lengths of

skelp, forming apparatus including successive forming roll stands in alinement with each other, said roll stands each including a pair of opposed rolls, both of which contact with one and the same side of the skelp, the first pair of said opposed rolls performing the initial operation in shaping the skelp to tubular form, a ridge extending transversely of the skelp and positioned in advance of the forming apparatus, the roll stands being on a lower level than said ridge by a distance at least as great as the diameter of the pipe or tube that is formed by said roll stands, and means for pulling the skelp through the successive roll stands.

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