United States Patent

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[54] **METHOD FOR FORMING CORNERS OF OMEGA-TYPE EXPANSION JOINTS**
8 Claims, 9 Drawing Figs.

[52] **U.S. Cl.** **29/481,** 29/480, 29/482
[51] **Int. Cl.** **B23k 31/02**
[50] **Field of Search** 29/475, 480, 481, 482

[56] **References Cited**

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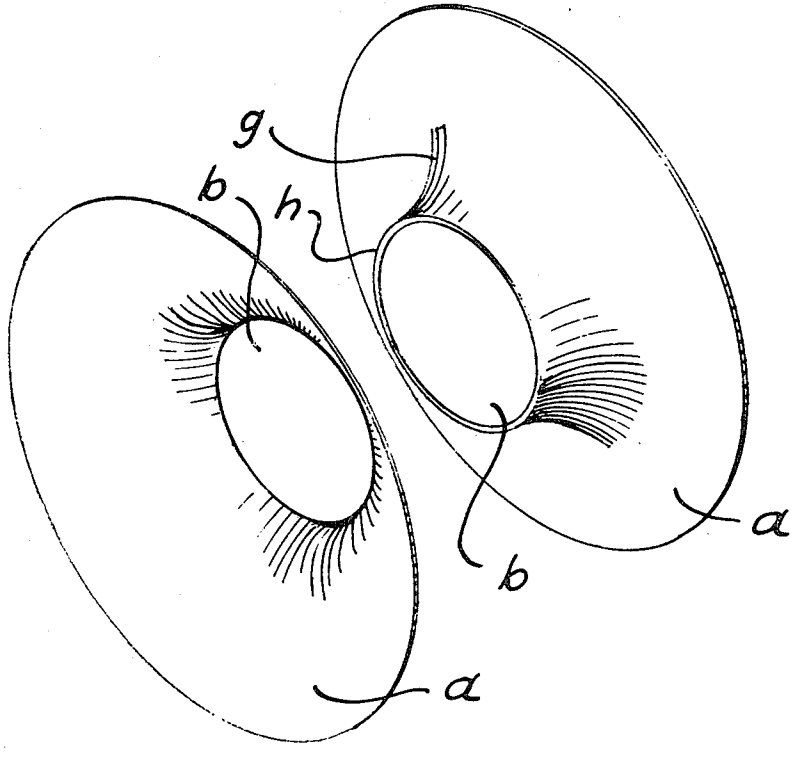
ABSTRACT: A method of fabricating an expansion joint embodying an inwardly facing U-shaped bellows member in which the corner portions of the joint are rounded and formed of united segments of oppositely facing plates having an arcuate portion produced by a spinning operation.



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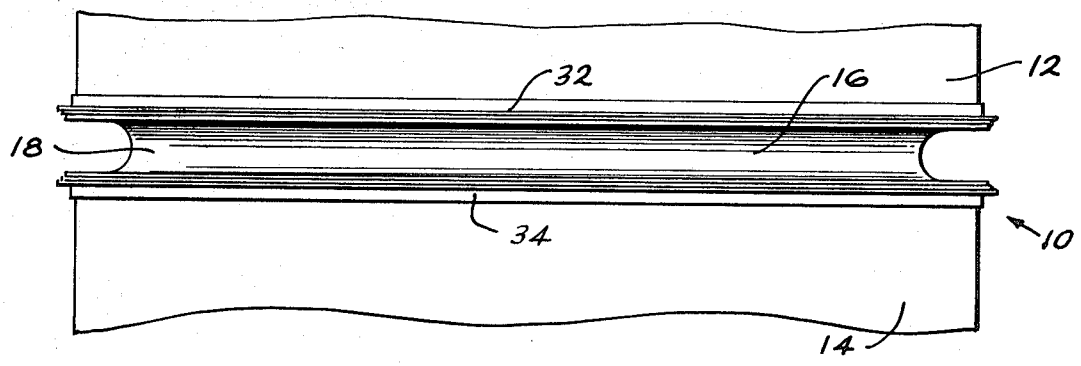

FIG-1

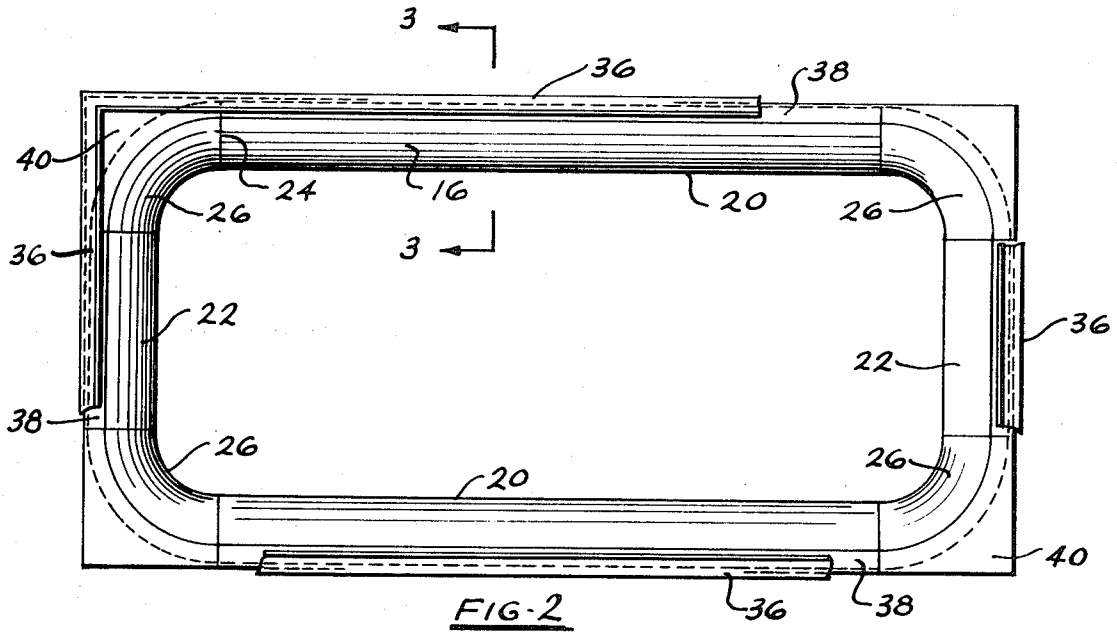

FIG-2

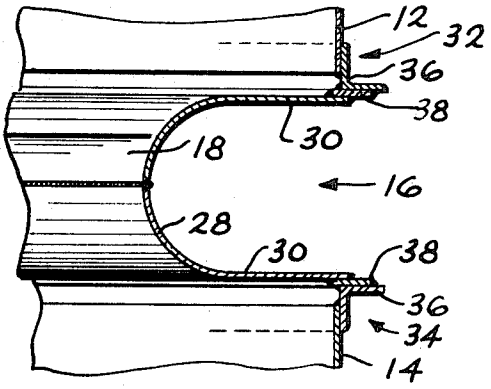

FIG-3

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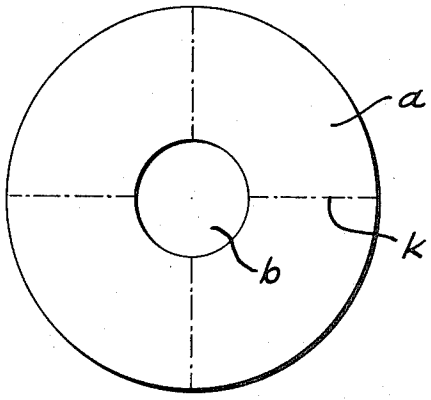

FIG-4

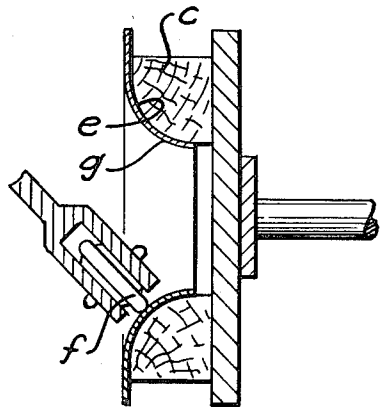

FIG-5

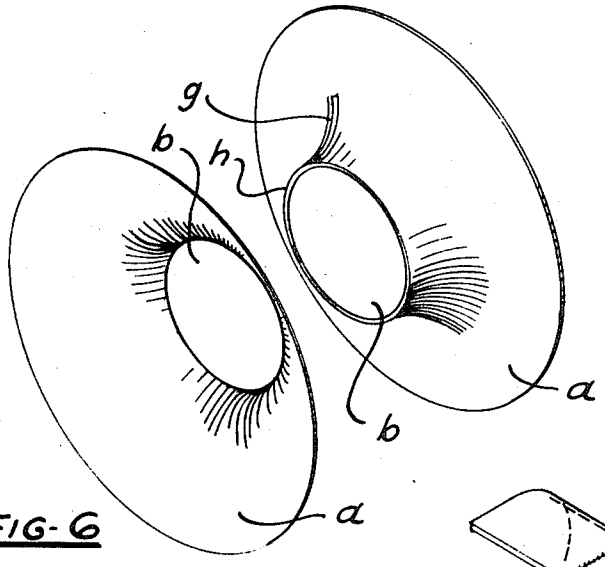

FIG-6

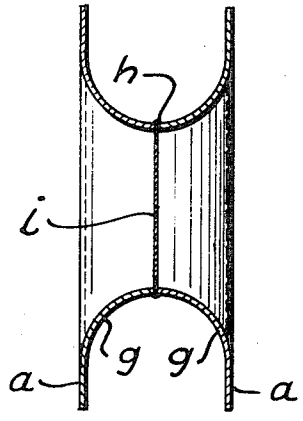

FIG-7

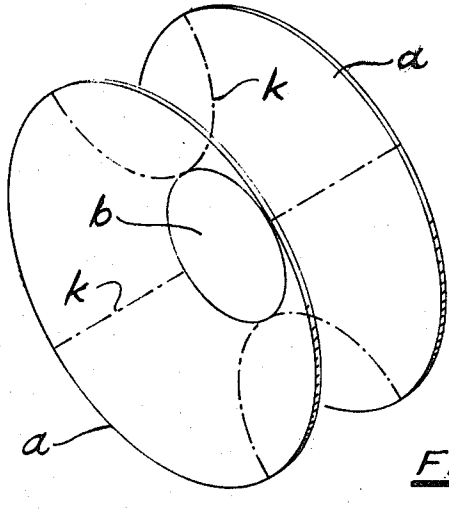

FIG-9

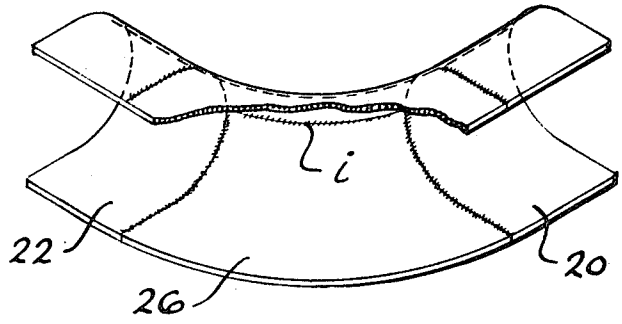

FIG-8

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METHOD FOR FORMING CORNERS OF OMEGA-TYPE EXPANSION JOINTS

BACKGROUND OF THE INVENTION

Conduits employed to conduct fluids under varying conditions of pressure and temperature are normally provided with expansion joints to accommodate relative movements that occur as a result of changes in the fluid conditions. In the past, expansion joints of the type involved have been of the bellows or accordion type wherein a joint consisting of a plurality of V-shaped sheet metal folds is interposed between adjacent conduit sections. While expansion joints of this type provide adequate performance in systems conducting relatively clean fluids, their use in systems wherein particle-laden fluids are conducted, such as the conduit systems of vapor generators in which heating gases bearing solid particles of fly ash and other contaminants flow, is limited. In these systems it has been found that the solid particles precipitate out of entrainment in the gases as they flow through the expansion joint and become lodged in the folds thereof. In time, after sufficient accumulation of solids, the joints become inoperative or are otherwise adversely affected. It has been proposed, in order to overcome this problem, to provide an expansion joint formed of a flexible membrane whose inner surface, which is exposed to the flowing fluid, possesses a smooth continuous shape. Such joints employ a U-shaped, sheet metal membrane spanning the space between the adjacent conduit sections with the convex surface innermost. By means of this arrangement, grooves or other spaces in which the precipitated solids can accumulate, are eliminated from the joint.

The present invention is directed to problems associated with the fabrication of expansion joints for use in connecting conduit sections having a rectangular cross section. Such joints have a rectangular configuration necessitating a connection of the corners at the sides. It has been proposed to effect this connection by a mitered connection of the adjacent sides at the corner, but this results in the establishment of points of stress concentration at the corners that are detrimental to the integrity of the structure in that it creates the possibility of failure by cycling fatigue. This problem can, in turn, be solved by forming the expansion joints with rounded corners; however, difficulty arises in the fabrication of rounded corners by conventional dye-forming procedures due to the magnitude of the diameter-to-thickness ratio encountered.

The present invention, therefore, is directed to the solution of this problem and to the manner of fabricating an improved form of expansion joint.

SUMMARY OF THE INVENTION

The present invention relates to a novel method for fabricating expansion joints; more particularly, it relates to an improved manner of fabricating arcuate cornerpieces for attachment between their respective rectangularly disposed, straight side members of an expansion joint, which members are U-shaped in cross section. In its preferred mode the invention entails forming sheet metal plates having a central opening into a surface of revolution that is substantially J-shaped in cross section. This metal-forming step is accomplished by means of a spinning operation. Thereafter, a pair of so-formed plates are placed in opposed abutting relation and are butt-welded about the line of abutment. Following this, the assembly is divided into quadrants each of which forms one of the four corners of the expansion joint.

In an alternate mode each plate can be divided in half after the spinning operation has been completed and the formed ends of each plate half butt-welded together to form an assembly which, when severed in half, produces two cornerpieces.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a pictorial representation of two rectangular conduit sections joined by expansion joint formed according to the present invention;

FIG. 2 is a plan view of an expansion joint formed according to the invention;

FIG. 3 is a section taken along line 3—3 of FIG. 2;

FIG. 4 illustrates a typical sheet metal plate prior to processing into a cornerpiece according to the invention;

FIG. 5 is a schematic representation of a sheet metal plate being processed by means of a spinning operation according to the invention;

FIG. 6 is a pictorial representation of two opposed formed plates prior to assembly;

FIG. 7 is a side view of an assembly of two formed plates; and

FIG. 8 is a pictorial representation of a typical cornerpiece formed according to the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 there is illustrated part of a conduit system **10** for conducting gaseous fluids at elevated pressures and temperatures. The system can, for example, be taken as being a portion of the combustion gas discharge ducting of a vapor generator (not shown). As shown, the system includes a pair of spaced, axially aligned conduit sections **12, 14** which, in the disclosed arrangement, are of rectangular cross section. The two conduit sections **12, 14** are interconnected by means of an expansion joint **16** arranged to accommodate relative movement that normally occurs between the sections in response to changes in the pressure or temperature of the gases being conducted.

The expansion joint **16** is connected between the conduit sections **12, 14** by means of appropriate frame structure indicated as **32, 34** and described in detail hereinafter. The joint comprises an inwardly bowed, flexible, sheet metal membrane **18** which includes rectangularly arranged side and end members, **20** and **22** respectively, that are joint in assembled relation by means of cornerpieces **24** in order to conform to the rectangular configuration of the conduit sections **12, 14**. The side and end members **20, 22** attach the corner pieces **24** by butt-welding as indicated at **26**.

As shown best in FIG. **3** the membrane **18** that comprises the expansion joint **16** is defined, in section, by a substantially semicircular bend portion **28** that terminates at both ends in opposed, straight legs **30**. The membrane is assembled in the joint with the convex surface of the bend portion **28** disposed inwardly with the passage formed by the conduit sections **12, 14** in facing relation to the gases flowing therethrough. By means of such arrangement, elongated grooves or crevices that are attendant with conventional bellows joint constructions are eliminated thereby rendering the improved form of expansion joint substantially free from fowling due to the accumulation of precipitated particulate matter.

As discussed hereinabove, the membrane **18** is attached between adjacent spaced conduit sections **12, 14** by means of oppositely spaced frame structures **32, 34** These structures, in their simplest form as shown in the attached drawings, comprise rectangularly arranged structural members **36**, here shown as angles having one leg welded securely to the external surface of the adjacent conduit section and the other leg similarly secured to the membrane **18**. Due to the fact that the membrane **18** is relatively thin, thicknesses of 12—to 16-gauge sheet metal being most desirable it is advantageous, in order to prevent incurring damage to the membrane caused by field welding it directly to the structural members, to effect the connection by shop welding the legs **30** of the membrane to elongated plates or bars, **38** or **40**, which are, in turn, welded to the structural members in the field.

Applicant's claim no invention in the particular expansion joint arrangement described herein. The invention instead resides in the improved method employed in forming the cornerpieces **26** of the described membrane **18**. The process will be described with particular reference to FIGS. through

through 8 of the drawing that illustrate the various steps employed in carrying out the method. As the description hereof proceeds, lowercase letters are used to designate the various elements as they relate to the process. This is in contradistinction to the numerals that are employed to designate the various elements of the assembled expansion joint.

Referring first to FIG. 4 there is shown a flat, sheet metal blank *a* here shown as having a circular periphery but which could equally as well be formed with rectangular sides. The blank *a* is provided with a central opening *b* having a diameter of sufficient size to permit the blank to undergo a spinning operation as hereinafter described.

According to the present invention the blank *a* is attached to a chuck *c* mounted on the rotatable faceplate *d* of a spinning lathe in order to undergo a spinning operation. The chuck *c*, most commonly a wooden member, is formed with an external surface *e* that is arcuate in section and which coacts with a spinning roll *f* to form the blank *a* with a surface of revolution *g* formed concentrically about the central opening *b*. As shown in FIG. 5, the arcuate external surface *e* of the chuck *c* is formed on a curve of approximately 90° extent whereupon the surface of revolution *g* formed on the blank *a* substantially I-shaped in section upon completion of the spinning operation.

After forming a second blank *a* in similar manner the two are disposed in opposed, face-to-face relation and their small-diameter ends *h* placed in mutual abutment. A circumferential butt weld *i* is applied about the line of abutment between the two ends *h*. The result of this step is to produce an annular element, as shown in FIG. 8, that is generally U-shaped in cross section.

Thereafter the welded assembly of formed blanks is severed into quadrants, i.e. along lines such as those indicated as *k* in FIG. 4 to produce four finished cornerpieces **26**. The cornerpieces **26** thus formed can then be weldedly affixed between appropriate side and end members **20, 22** to produce a complete membrane **18** having generally rectangularly arranged sides and rounded corners.

After assembly of the membrane **18** the plates **38, 40** are attached to the upper and lower surfaces of the respective legs **30** of the membrane, the elongated plates **38** being attached to the legs associated with the sides and end portions **20, 22** of the membrane and the L-shaped plate **40** being attached to the corner plates **26**. Attachment of the plates **38, 40** to the membrane legs **30** can be effected by welding with equipment present in a shop thereby rendering the application of a weld less hazardous to the sheet metal that comprises the membrane. The final connection of the plates **38, 40** to the structural members **36** can be effected by hand welding in the field.

While this preferred embodiment of the invention has been shown and described, it will be understood that it is merely illustrative and that changes may be made without departing from the scope of the invention as claimed.

What is claimed is:

1. The method of forming cornerpieces for expansion joints having a U-shaped cross-sectional configuration from flat sheet metal plate means comprising the steps of:

a. providing a central opening in said plate means;

b. forming said plate means about said opening into a surface of revolution that is arcuate in cross section and whose surface at the central opening end lies substantially tangent to a line parallel to the axis of said opening;

c. placing a pair of identically formed plate means with their arcuately formed central opening plate means with their arcuately formed central opening ends in opposed, abutting relation;

d. weldedly joining said abutting plate means along their line of abutment;

e. severing the so-formed assembly along lines substantially parallel to the axis of the opening to form corner pieces of substantially 90° extent.

2. The method of forming cornerpieces for expansion joints as recited in claim **1** wherein the cross section of said surface of revolution is substantially that of an arc of a circle.

3. The method of forming cornerpieces for expansion joints as recited in claim **2** wherein the cross-sectional arc of said surface of revolution is substantially 90° in extent.

4. The method of forming cornerpieces for expansion joints as recited in claim **1** wherein the plate means placed in opposed, abutting relation include minor diameter ends formed as complete circles.

5. The method of forming cornerpieces for expansion joints as recited in claim **4** wherein said severing step comprises cutting the assembled plate means into quadrants to form four identically shaped cornerpieces.

6. The method of forming cornerpieces for expansion joints as recited in claim **1** wherein the plate means placed in opposed, abutting relation include minor diameter ends formed with arcs that are substantially semicircular.

7. The method of forming cornerpieces for expansion joints as recited in claim **6** wherein said severing step comprises cutting the assembled plates means along lines to form two identically shaped cornerpieces.

8. The method of forming cornerpieces for expansion joints as recited in claim **1** wherein said plate-forming step is performed by a spinning procedure.

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