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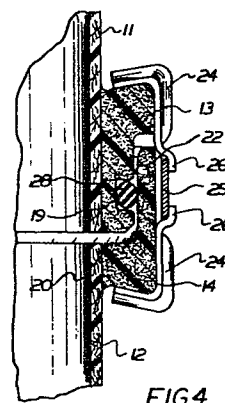
71 Applicant: **STRUCTURAL FIBERS, INC.**
Industrial Parkway
Chardon Ohio 44024(US)

72 Inventor: **Wiltshire, Arthur John**
352 Dumbarton Boulevard
Richmond Heights Ohio 44143(US)

74 Representative: **Jones, Michael Raymond et al,**
Haseltine Lake & Co. 28 Southampton Buildings
Chancery Lane
London WC2A 1AT(GB)

54 **Split tank assembly with reinforcement in the region of a joint.**

57 There are disclosed a split tank assembly with reinforcement in the region of a joint, and a method of making such a reinforced split tank assembly. Of particular interest is the possibility of releasably coupling tank sections 11 and 12 formed, for instance, by transversely splitting a bag-moulded, reinforced tank. The assembly includes external circumferential clamping flanges 13 and 14 which are conveniently provided by level winding a relatively narrow band of resin-impregnated filaments on the sidewall of the pressure vessel adjacent the midsection of the vessel. The resin in the filaments is cured and the band and vessel are cut into a plane perpendicular to the longitudinal axis of the vessel so that band parts 13 and 14 are provided adjacent each open mouth of the resulting tank sections 11 and 12 and those band parts constitute the aforementioned clamping flanges. A circumferential, outwardly facing recess 18 is machined in a one-band part 13 and an O-ring groove 19 is machined in that outwardly facing recess 18. A circumferential, inwardly facing recess 22 is machined in the other band part 14 and an O-ring 28 is provided in the O-ring groove 19. The band parts 13 and 14 are telescoped together to form a pressure vessel with the O-ring 28 pressed between the recesses 18 and 22. The band parts are clamped together by clamps 23 to form the assembly. The arrangement described above provides in an uncomplicated manner a means of providing reinforcement in the zones in which clamping is to occur.



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SPLIT TANK ASSEMBLY WITH REINFORCEMENT IN THE REGION OF A
JOINT, AND METHOD OF MAKING SUCH A REINFORCED SPLIT TANK
ASSEMBLY

5 This invention relates to a split tank assembly
with reinforcement in the region of a joint, and to a method
of making such a reinforced split tank assembly..

Bag-moulded fiberglass-reinforced tanks or other
similar pressure vessels are disclosed, for example, in
United States Reissue Patent Specification No. 25,241 and
10 United States Patent Specification No. 3,138,507. Split
tank assemblies of the general class to which the present
invention is directed are shown in United States Patent
Specifications Nos. 2,709,524 and 3,388,823. Split tank
assemblies of the type herein disclosed provide full
15 access to the interior of the tank for positioning and
removal of, for instance, rigid filter elements therein, and
for various other purposes.

In United States Patent Specification No. 4,133,442
there is disclosed a fiber-reinforced split tank assembly;
20 two basic arrangements are set forth in that patent for
clamping the tank sections together. In one such arrangement,
grooves are cut into the tank sections to accommodate
clamping members; however, in order to minimize weakening
the tank sections, the interior of the tank must be provided
25 with additional reinforcement in the area in which the grooves
are cut: this necessitates extra resin and glass and adds
further steps to the manufacturing operation.

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In the other basic arrangement clamping flanges formed of a plastics material are adhered to the tank sections, which flanges can be clamped together; however, the clamping flanges formed of a plastics material are expensive and
5 fit only a given size of tank: therefore, if a manufacturer makes tanks of different diameters, the manufacturer must also provide flanges of different sizes to accommodate various diameters.

According to one aspect of the present invention
10 there is provided a longitudinally-extending split tank assembly comprising:-

first and second tank sections each having a mating face, with one of the mating faces being telescoped within the other, each of the tank sections being provided
15 with an external circumferential flange adjacent its mating face, and each flange comprising a band of filament-wound, resin-impregnated fibers encircling the tank; sealing means between the mating faces; and clamping means clamping the flanges in fixed relationship to each
20 other.

Preferably those portions defining both the mating faces are also formed by the bands of filament-wound, resin-impregnated fibers.

Preferably the sealing means is an O-ring,
25 conveniently provided in a circumferential groove in one of the mating faces.

Preferably the clamping means comprises a plurality of clamping members maintained in a spaced array by a band which encircles the flanges. Each clamping member
30 may include a strip having two spaced-apart convergent arms.

The tank sections may be formed of a fiber-reinforced plastics material.

One embodiment of the split tank assembly of the present invention comprises first and second tank sections,
35 each with an open mouth, the open mouth of the first tank section having a multiplicity of resin-impregnated wound fibers adjacent the open mouth which fibers comprise a

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first clamping flange, the first clamping flange having an outwardly facing recess extending circumferentially around the flange, there being a circumferentially extending groove in the outwardly facing recess, there being an
5 O-ring in the groove, the open mouth of the second tank section having a multiplicity of resin-impregnated wound fibers adjacent that open mouth which fibers comprise a second clamping flange, the second clamping flange having an inwardly facing recess extending circumferentially around
10 the flange, the inner diameter of the inwardly facing recess being slightly greater than the outer diameter of the outwardly facing recess so that the first clamping flange may be telescoped into the second clamping flange with the O-ring forming a seal between the flanges, there
15 also being clamping means to clamp the flanges in fixed relationship.

Another aspect of the present invention provides a method of forming a fiber-reinforced split tank assembly formed of a plastic material, the method comprising:-
20 rotating a longitudinally-extending, hollow pressure vessel formed of a plastics material about its longitudinal axis, level winding resin-impregnated filaments on a sidewall region of the vessel while confining the filaments to a relatively narrow band, curing the resin
25 and the filaments, cutting the band and vessel in two at a plane perpendicular to the longitudinal axis and passing through an intermediate region of the band so that a band part is provided adjacent each resulting open mouth, machining a circumferential outwardly facing recess
30 in one band part, machining an O-ring groove in that outwardly facing recess, machining a circumferential inwardly facing recess in the other band part, providing an O-ring in the groove, telescoping the band parts together to form a pressure vessel with the O-ring pressed between
35 the recesses, and clamping the band parts together to form the assembly.

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Conveniently the band and vessel are cut in a plane which passes approximately through the midpoint of the band.

For a better understanding of the present invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 is an elevational view of a completed assembly in accordance with the present invention;

Figure 2 is a fragmentary, cross-sectional view of the tank after the filament-winding operation, illustrating a technique for confining the resin-impregnated filaments to a predetermined location on the sidewall of the tank;

Figure 3 is a fragmentary, cross-sectional view similar to that of Figure 2, but showing the tank after a severing operation;

Figure 4 is a fragmentary, cross-sectional view of the complete joint assembly; and

Figure 5 is a perspective view of one of the clamping members employed for holding together two tank sections.

Referring initially to Figure 1, there is illustrated a split tank assembly 10 constructed in accordance with the present invention. The assembly 10 includes first and second mating tank sections 11 and 12 formed by transversely splitting an elongated tank having a generally cylindrical sidewall and domed end walls. Preferably, the tank is originally an integral, bag-moulded, fiber-reinforced, closed tank such as that shown in the aforementioned United States Reissue Patent Specification No. 25,241, the disclosure of which is incorporated herein by reference. Each tank section 11, 12 is provided with an external clampable flange in the form of a band part 13, 14. The band parts 13 and 14 are initially fabricated as a single band 15 by a conventional filament-winding technique. In such a typical technique, the tank is mounted in a horizontal position for rotation about its longitudinal axis in a filament-winding machine which is similar to a lathe.

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To provide a stronger bond between the filaments and the tank sidewall, the sidewall is slightly abraded in the area to be wound. Resin-impregnated fiber filaments are then laid up on the sidewall by a guide which moves back and forth, at a predetermined rate which is geared to the rate of rotation of the vessel, between end guide ends 16 (shown in Figure 2). The rate of traverse is such that the filaments are laid down in a level-wound pattern where there is substantially no side-to-side overlap of the filaments. When the band 15 is built up to a suitable thickness, the resin is cured (by heat, a suitable catalyst, or both) and the end guides 16 are now removed.

Referring now to Figure 3, the tank sections 11 and 12 are formed by rotating the unitary tank about its longitudinal axis while severing the band 15 and the tank with a suitable tool, e.g. a tungsten carbide or diamond cutting tool.

Then the band parts 13 and 14 are machined in the following manner. The band part 13 is machined along the dotted line 17 to provide a recess with a mating face 18 and a circumferential O-ring groove 19. This operation may be done with a single cutting tool shaped to conform to the shape of the recess (with face 18) and the O-ring groove 19.

A portion 20 of the tank section 12, together with a portion 21 of the band part 14, is machined away to form an inwardly facing recess with an inwardly facing mating face 22 which has a diameter slightly greater than the diameter of the mating face 18.

After the machining operations are completed, an O-ring 28 is inserted in the O-ring groove 19 and, as is indicated in Figure 4, the tank sections 11 and 12 brought together by telescoping the face 18 into the face 22 so that the O-ring 28 is firmly pressed between the band parts 13 and 14. The ends of the band parts 13 and 14 are undercut slightly to provide a gripping surface for the clamps.

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As indicated in Figures 4 and 5, suitable clamping means, in the form of clamps 23, is provided. Each clamp 23 has what can loosely be regarded as a C-shaped configuration in the form of a strip with two spaced-apart convergent arms and is provided with raised stiffening portions 24 at the arms. The clamps 23 are held in place by a band 25 which extends through struck-out tab portions 26 on each clamp 23. The band is fastened together by a suitable fastener; in the illustrated embodiment this is a nut and bolt 27. As may be appreciated, the clamps 23 may be employed on tanks of various diameters, as opposed to prior art techniques wherein integral bands were employed as the clamping means.

As is evident in Figure 4, the arms of the clamps are slightly inclined toward each other so that they conform to the undercut portions of the band parts 13 and 14. To assemble the tank, the tank sections must be abutted to permit the arms to clear the ends of the band parts. When the tank is pressurized, the sections 11 and 12 move apart slightly, as is indicated in Figure 4, so that the clamps 23 cannot be removed while the tank is under pressure.

With the present invention, the clamping means may be employed to clamp together the sections of a variety of tanks having different diameters.

CLAIMS:

1. A longitudinally-extending split tank assembly comprising:-
first and second tank sections each having a mating face, with one of the mating faces being telescoped within the other, each of the tank sections being provided with an external circumferential flange adjacent its mating face, and each flange comprising a band of filament-wound, resin-impregnated fibres encircling the tank; sealing means between the mating faces; and clamping means clamping the flanges in fixed relationship to each other.
2. A split tank assembly according to claim 1, wherein those portions defining both the mating faces are also formed by the bands of filament-wound, resin-impregnated fibers.
3. A split tank assembly according to claim 1 or 2, wherein the sealing means is an O-ring.
4. A split tank assembly according to claim 3, wherein the O-ring is provided in a circumferential groove in one of the mating faces.
5. A split tank assembly according to any preceding claim, wherein the clamping means comprises a plurality of clamping members maintained in a spaced array by a band which encircles the flanges.
6. A split tank assembly according to claim 5, wherein each clamping member includes a strip having two spaced-apart convergent arms.
7. A split tank assembly according to any preceding claim, wherein the tank sections are formed of a fiber-reinforced plastics material.
8. A split tank assembly formed of a plastics material and comprising first and second tank sections, each with an open mouth, the open mouth of the first tank section having a multiplicity of resin-impregnated wound fibers adjacent the open mouth which fibers comprise a first clamping flange, the first clamping flange having an outwardly facing recess extending circumferentially around the flange, there being a circumferentially extending

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groove in the outwardly facing recess, there being an O-ring in the groove, the open mouth of the second tank section having a multiplicity of resin-impregnated wound fibers adjacent that open mouth which fibers comprise a second clamping flange, the second clamping flange having an inwardly facing recess extending circumferentially around the flange, the inner diameter of the inwardly facing recess being slightly greater than the outer diameter of the outwardly facing recess so that the first clamping flange may be telescoped into the second clamping flange with the O-ring forming a seal between the flanges, there also being clamping means to clamp the flanges in fixed relationship.

9. A method of forming a fiber-reinforced split tank assembly formed of a plastics material, the method comprising:- rotating a longitudinally-extending hollow pressure vessel formed of a plastics material about its longitudinal axis, level winding resin-impregnated filaments on a sidewall region of the vessel while confining the filaments to a relatively narrow band, curing the resin, cutting the band and vessel in two at a plane perpendicular to the longitudinal axis and passing through an intermediate region of the band so that a band part is provided adjacent each resulting open mouth, machining a circumferential outwardly facing recess in one band part, machining an O-ring groove in that outwardly facing recess, machining a circumferential inwardly facing recess in the other band part, providing an O-ring in the groove, telescoping the band parts together to form a pressure vessel with the O-ring pressed between the recesses and clamping the band parts together to form the assembly.

10. A method according to claim 9, wherein the band and vessel are cut in a plane which passes approximately through the midpoint of the band.

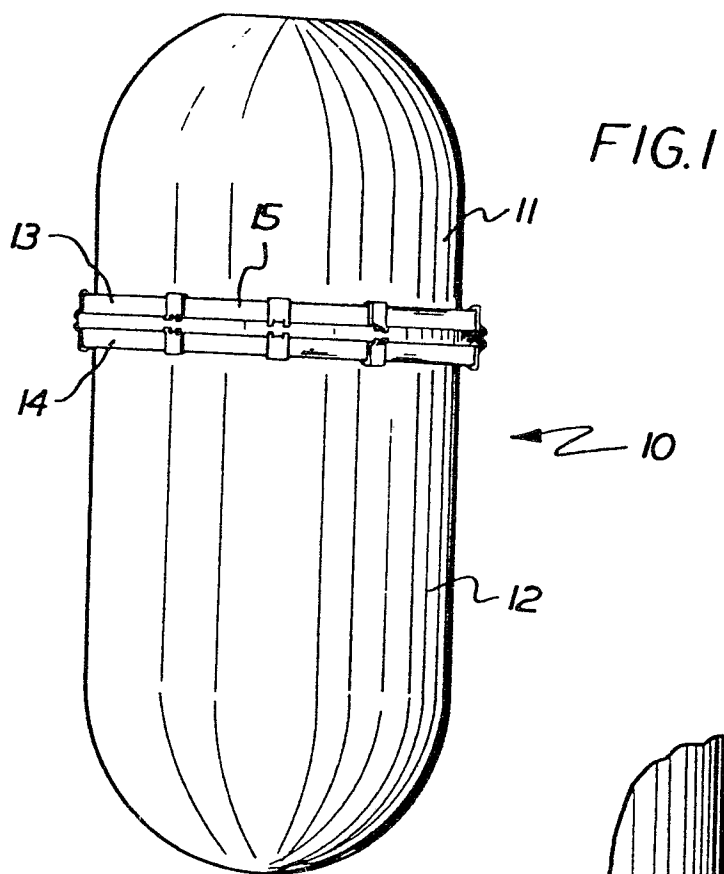


FIG. 2

