May 28, 1957 W. G. WOODS 2,793,779

HIGH NESTING SECTIONAL TANK

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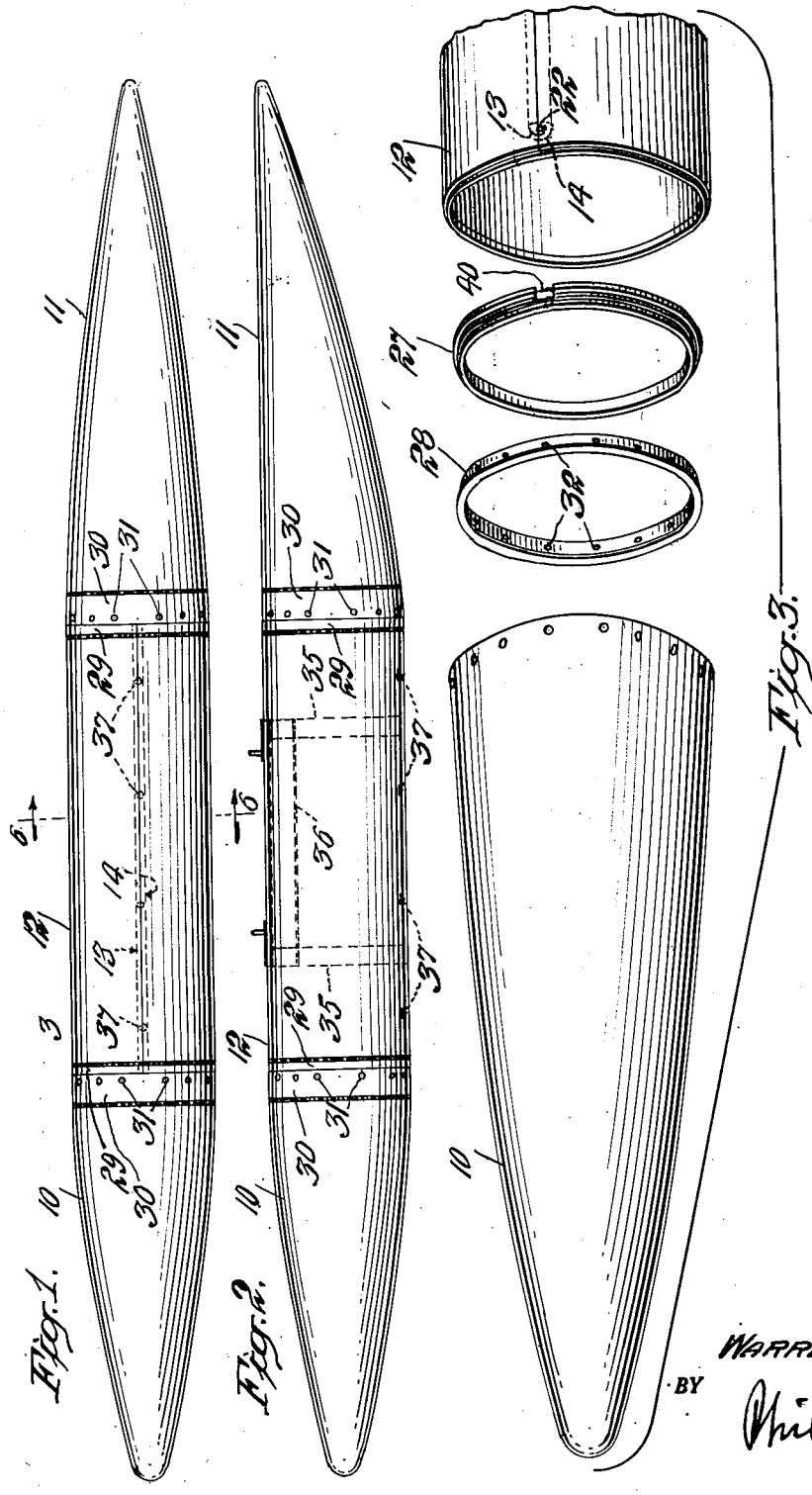


Fig. 1.

Fig. 2.

Fig. 3.

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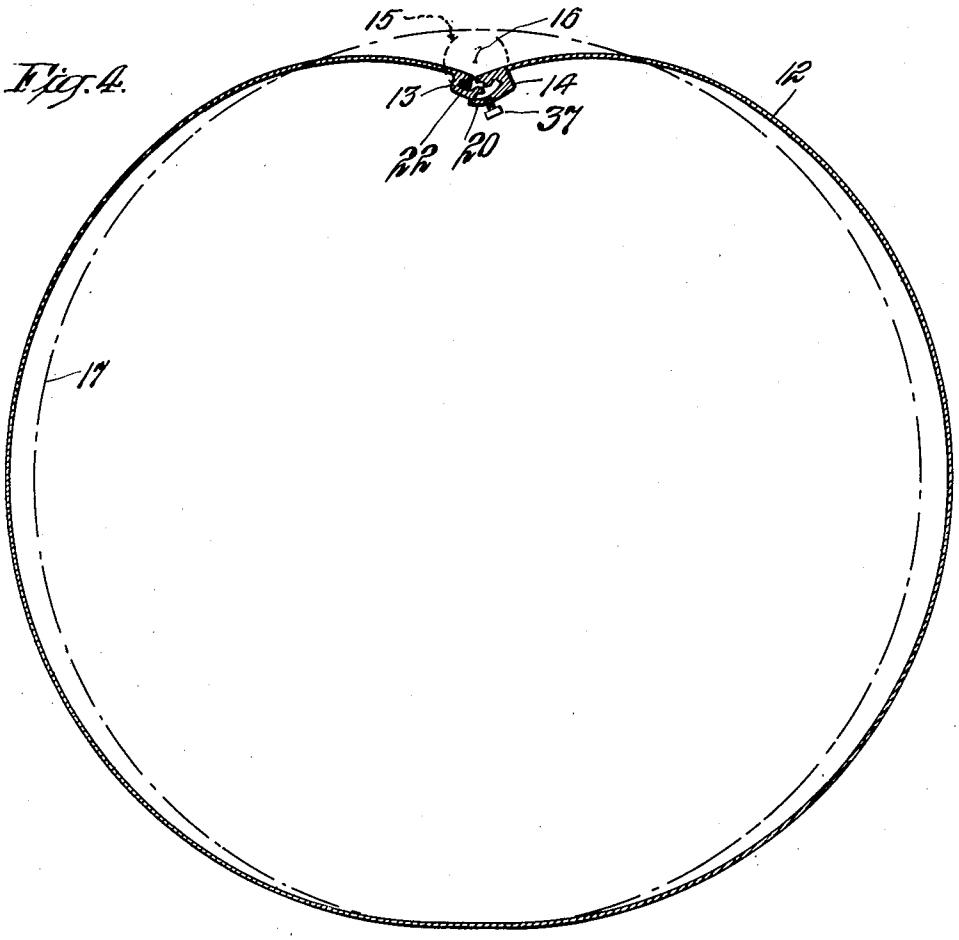
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Fig. 4.



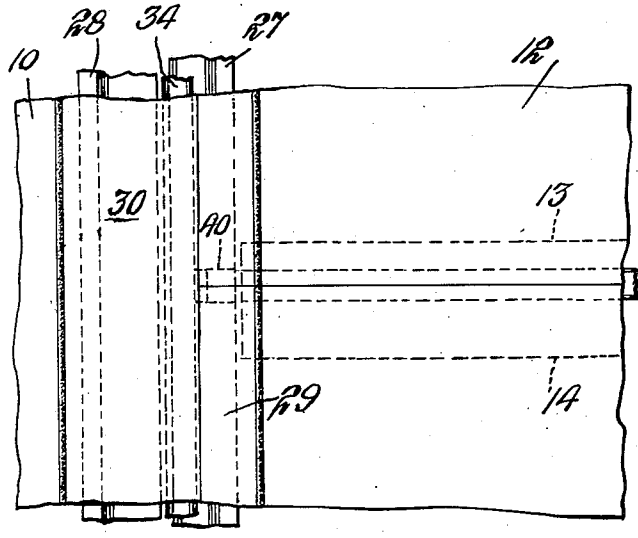


Fig. 5.

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Fig. 6.

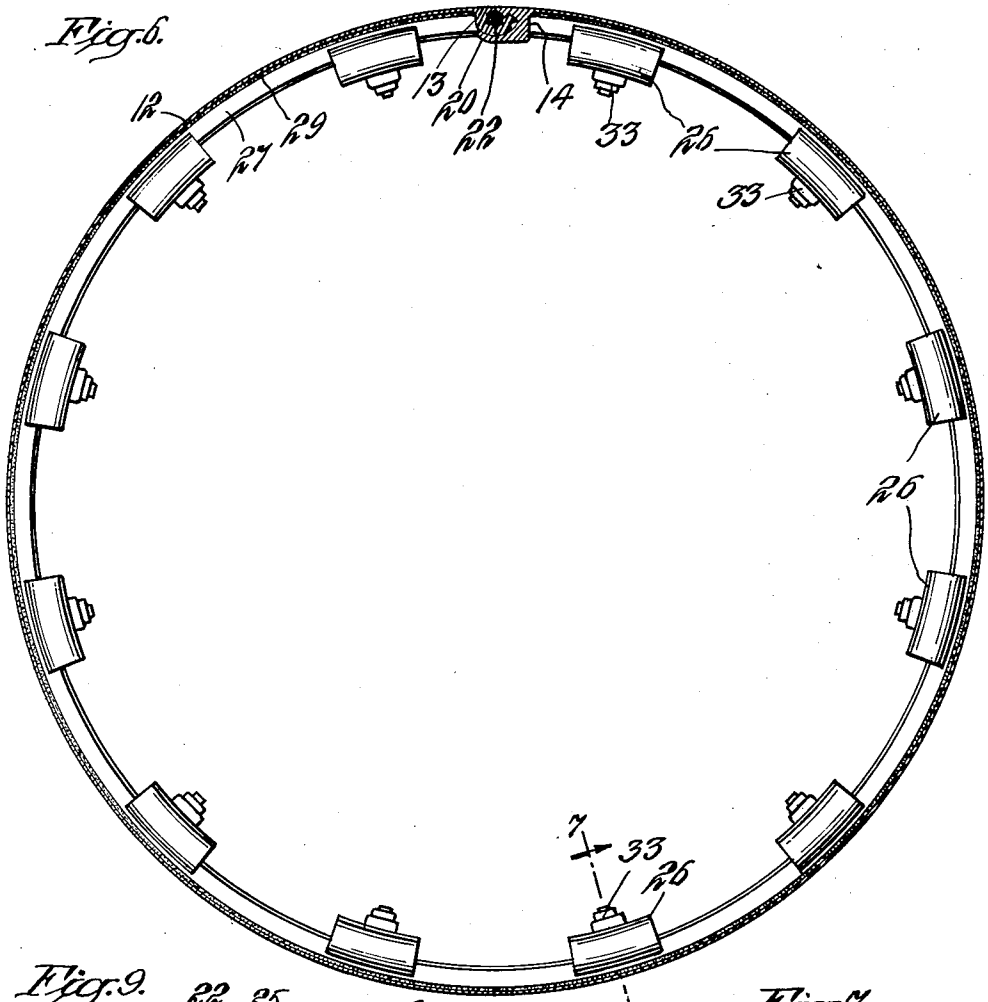


Fig. 9.

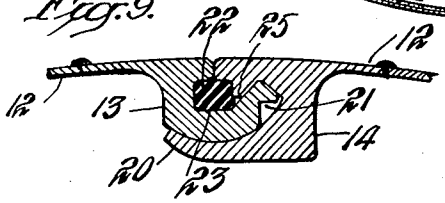


Fig. 8.

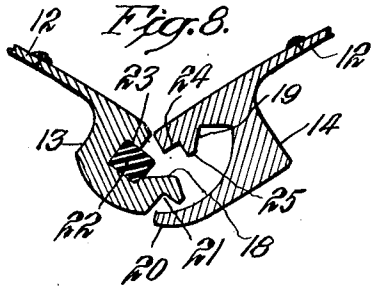
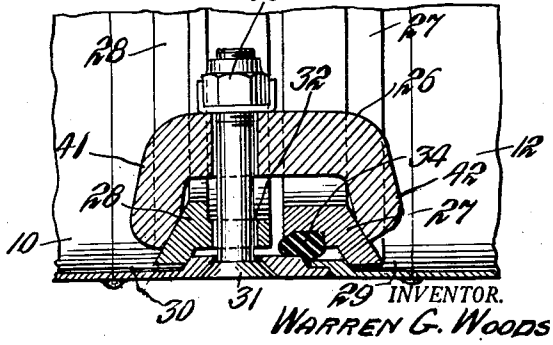


Fig. 7.



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HIGH NESTING SECTIONAL TANK

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Application December 2, 1955, Serial No. 550,564

10 Claims. (Cl. 220—5)

The invention herein disclosed relates to containers in the nature of wing tip auxiliary fuel tanks.

Special objects of the invention are to provide containers of this type so sectioned that they may be compactly nested for shipment and storage and so constructed that they may be quickly and easily assembled in securely connected, fully sealed, liquid-tight relation.

Further important special objects of the invention are to provide mechanically connecting and sealing means in a form which in the act of engagement will automatically lock and seal parts together and which with internal pressure developed within the tank, will lock and seal all the more securely.

Other special objects of the invention are to accomplish the results indicated with a simple, low cost construction, consisting of few parts and made up, so far as possible, of integrally connected elements which may be readily joined, requiring minimum skill and time.

Other desirable objects attained by the invention and the novel features of construction, combination and relation of parts comprising the invention are set forth and will appear in the course of the following specification.

Drawings accompanying and forming part of the specification illustrate a present commercial embodiment of the invention but structure may be modified and changed as regards the immediate illustration, all within the true intent and scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawings is a bottom plan view of a wing tank constructed in accordance with and embodying features of the invention;

Fig. 2 is a side elevation of the same;

Fig. 3 is a perspective view showing one of the end sections and a portion of the intermediate tank section with coupling rings, all in separated relation;

Fig. 4 is an end elevation of the split intermediate tank section deflected in the act of joining the meeting edges and with broken lines indicating how these parts will automatically interlock as the section is sprung back to normal circular shape;

Fig. 5 is a broken plan view illustrating the joinder of end and intermediate sections;

Fig. 6 is a cross-section taken through the intermediate tank section as on line 6—6 of Fig. 1;

Fig. 7 is an enlarged broken sectional detail of one of the transverse joints between end and intermediate sections as on line 7—7 of Fig. 6;

Figs. 8 and 9 are broken sectional detail views of parts forming the longitudinal joint and seal, showing them in initial meshing and fully connected condition.

The tank illustrated is shown made up of conically tapered nose and tail, end sections **10** and **11** joined to opposite ends of a substantially cylindrical intermediate section **12**.

The conical end sections can be closely packed in telescoped relation.

To enable complete nesting of all parts the intermediate

cylindrical section is spilt longitudinally, enabling it and a number of other mid-sections to be closely rolled about a number of nested end sections and thus all to form a compact package containing all parts of one or a number of the tanks.

Details of the longitudinal joint and seal are shown in Figs. 4, 8 and 9 as comprising integrally formed, companion tongue and groove elements **13, 14** along the opposite edges of the section, meeting and mating on a common arc **15** having a center **16** inside the normal cylindrical outline **17** of the skin forming this section.

This, as will be clear from Fig. 4, enables the parts to be joined with an outwardly rolling action as the skin, after inward deformation, is permitted or caused to be distended to the true cylindrical shape.

In the final interlocked position, Fig. 9, the lip **18** at the terminal edge of the tongue member **13** overlaps a ridge **19** within the groove member **14** and the terminal lip **20** on the groove member overlies and overlaps the back of the tongue member, thus providing a double lock between the two members.

The tongue forming member **13** is shown as longitudinally grooved along the outside of the tip portion at **21** to provide clearance for easy engagement of the lip **20**, Fig. 8, over the tongue at the beginning of the mating engagement.

Sealing of the joint is effected by a compressible packing strip **22** located in an undercut groove **23** in the projecting tongue element **13** in opposition to an undercut shoulder **24** in the opposing edge of the groove element **14**. The groove member is shown cut away at **25** adjoining the undercut seat **24** to allow for possible expansion of the packing strip.

The longitudinal packing **22**, located as it is in the forward underside of the tongue, comes into engagement with the opposing seat in the companion groove member as the parts are rocked together from the Fig. 8 to the Fig. 9 position, thus to automatically close and seal the joint as the parts reach the fully coupled, inseparable relation.

The transverse joints between the longitudinally spilt mid-section and the circularly complete end sections are shown in Figs. 6 and 7 as made and sealed by U-shaped clamps **26** engaged over bevel edge rings **27, 28** abutting the extruded skin rings **29, 30** which are welded to the skin at the opposing ends of the intermediate and end sections, these wedge clamps being drawn down over the wedge rings by O-ring packed self-sealing bolts **31** extended inwardly through guide openings **32** in rings **28** into engagement with fixedly attached nuts **33** at the back of the clamp members and the seal being effected by the packing rings **34**, Fig. 7, held by rings **27** over the joints between the opposing edges of the skin rings.

The rings **27** at the end of the split intermediate tank section are notched at **40** to admit end portions of packing **22**, thus enabling packing rings **34** to be integrally connected to the ends of the longitudinal packing strip **22**, all packing then formed as a single harness with possibility of leaks avoided.

The collapsible intermediate section may be held rigidly in the extended, interlocked, fully circular condition by expansible spreader bulkheads indicated at **35**, Fig. 2, connected at the top by a rigid backbone member **36**.

Set screws **37** may be provided on the inner member of the longitudinal joint for positively locking these members against any inward distortion such as might have a tendency to start the jaws in the direction of uncoupling, that is, toward the full line position shown in Fig. 4.

Both the longitudinal and the transverse joints are strong and secure and one set of joints reinforces the other, the completely circular transverse joints serving

as connectors for the ends of the split longitudinal seam joint. The longitudinal joint automatically interlocks and seals in the act of restoring the mid-section to normal circular outline and conversely this joint may be opened by bending the parts at the joint inwardly, out of the circular outline. Internal pressure such as occasioned by the load in the tank holds the joined parts extended to the fully interlocked and sealed circular conformation.

The transverse joints are equally strong and secure. The U-shaped lugs operate to hold the end sections positively interlocked to the intermediate section and the externally accessible bolt fastenings enable adjustment to take up any looseness if there be such.

The operations of assembly and disassembly are simple and quickly performed. In the separated or knocked-down condition the parts are closely nestable, enabling compact packaging for shipment or storage. The parts are few in number and of simple, low cost design.

The loose abutment rings **28** may be forced into the end sections over the skin rings **30** by slightly compressing them to ovular shape and possibly slightly spreading the skin rings, and then turning rings **28** into position in back of the annular shoulders on the skin rings.

Similarly, after solid engagement and connection of the tongue and groove members **13**, **14**, the loose end rings **27** may be forced into position in back of the skin rings **29** at the ends of the intermediate section, in this operation the notches **40** in these rings registering with and accepting the end portions of the longitudinal packing **22**. In the final setup the clamp rings **27**, as shown in Fig. 7, will hold the sealing rings **34** compressibly engaged over the joints at the meeting ends of the skin rings **29** and **30** on the ends of the intermediate and end sections.

To facilitate connection and securement of the parts the nuts **33** are fixedly secured to or may be integrally formed with the ring straddling clamps **26** and the latter are each formed with one leg **41** longer than the other leg **42** so that with insertion of screws **31** these clamps may be held attached at **41** to one ring, that is, in this case the ring **28**, with the other ends at **42** open far enough to reach inward over the companion rings **27**. Then upon tightening bolts **31** the clamps will be drawn outwardly into gripping and holding engagement over the bevel rings **27**.

This operation of assembly is facilitated by applying surrounding forms over the end sections which will hold the bolts **31** inwardly and the clamps thus open far enough to pass in over the clamp rings **27** as the end sections are assembled to the intermediate section.

The clamp positioning and securing bolts **31** may be slotted or countersunk for engagement of screw-driver, wrench or other turning tools, and these bolts may be of the self-sealing type equipped with O-rings or equivalent at the base of the bolt heads for automatically and securely sealing the same as they are tightened to final position.

To further assure the U-clamps remaining attached to one section while that section is being joined to the companion section, the loose clamp rings **28** may be made of greater internal extent than the companion clamp rings **27**, substantially as shown in Fig. 7. The bolts **31** by extending through guide openings **32** in rings **28**, act to position and center these rings, enabling them to assist in properly locating the clamps **26** so that they will be held in the open relation, ready to extend in over and in back of the companion clamp rings **27**.

The tongue and groove jaws forming the members of the longitudinal joint may be readily registered and aligned by bringing the outer corner edges of those members into the opposing abutting relation shown in Figs. 4 and 8, whereupon the spring of the then inwardly deformed tank section will automatically roll the jaw members outwardly about the line of abutment as a pivotal center, resulting in the completely interlocking final engagement illustrated in Figs. 6 and 9. After the companion jaw elements have thus been interlocked, with the section restored to circular formation, the bulkheads **35** and backbone member **36**, may be introduced and fastened as shown in Fig. 2, thus securing the tank section in the circular shape and fixing the jaws in the interlocked relation. At such time also, set screws **37**, may be applied to or tightened on the inner one of the jaw members to lock these members in the fully engaged relation.

The circular curvature of the interlocking and overlapping portions of the tongue and groove jaw members on arcs drawn with the convex side disposed inwardly of the tank section and the concave sides faced outwardly causes the jaws to automatically close together as the tank section is restored or springs back to its original cross-sectional shape.

What is claimed is:

1. A high nesting sectional tank comprising a longitudinally split, generally cylindrical intermediate section and substantially conical circularly complete end sections, longitudinally extending companion interlocking jaws along the meeting edges of the split intermediate section, packing engaged between said jaws and compressible thereby in the closing interlocking engagement of the jaws and means securing said circularly complete end sections to the ends of said split intermediate section, including circular clamp rings in the end portions of the end sections, companion circular clamp rings in the end portions of the split intermediate section and U-shaped clamps adjustably engaged over said circular clamp rings.

2. A high nesting sectional tank comprising a longitudinally split, generally cylindrical intermediate section and substantially conical circularly complete end sections, longitudinally extending companion interlocking jaws along the meeting edges of the split intermediate section, packing engaged between said jaws and compressible thereby in the closing interlocking engagement of the jaws and means securing said circularly complete end sections to the ends of said split intermediate section, including clamp rings in the end portions of the end sections, companion notched clamp rings in the end portions of the split intermediate section and U-shaped clamps adjustably engaged over said circular notched clamp rings, and packing rings engaged by said notched clamp rings, said longitudinal seam packing extending through the notches in said clamp rings into conjunction with said packing rings at the ends of the split tank section.

3. High nesting sectional tank comprising a longitudinally split, normally cylindrical intermediate tank section having companion interlocking jaws along the meeting edges of the section, end sections engageable with the ends of said intermediate section, said end and intermediate sections having internal, annularly shouldered skin rings at the ends of the same for abutting engagement when the end sections are assembled to the intermediate section, loose abutment rings in the end and intermediate sections in back of the annular shoulders of said skin rings, U-shaped clamps engageable over said loose clamp rings for drawing the sections together, said clamps carrying nut elements and externally accessible bolts extended inwardly into engagement with said nut elements for drawing said clamps outwardly to thereby effect securement of the end sections to said intermediate section.

4. High nesting sectional tank comprising a longitudinally split, normally cylindrical intermediate tank section having companion interlocking jaws along the meeting edges of the section, end sections engageable with the ends of said intermediate section, said end and intermediate sections having internal, annularly shouldered skin rings at the ends of the same for abutting engagement when the end sections are assembled to the intermediate section, loose abutment rings in the end and intermediate sections in back of the annular shoulders of said skin rings, U-shaped clamps engageable over said loose clamp rings for drawing the sections together, said clamps carrying nut elements and externally accessible bolts extended in-

wardly into engagement with said nut elements for drawing said clamps outwardly to thereby effect securement of the end sections to said intermediate section, transverse packing rings compressibly held by the clamp rings at the ends of the intermediate section over the joints between the end and intermediate sections, said rings having notches in line with the longitudinal joint of the intermediate section and a packing strip compressibly held between opposing jaws of the split intermediate section and extending through the notches in said clamp rings to said transverse packing rings.

5. High nesting sectional tank comprising a longitudinally split, normally cylindrical intermediate tank section having companion interlocking jaws along the meeting edges of the section, end sections engageable with the ends of said intermediate section, said end and intermediate sections having internal, annularly shouldered skin rings at the ends of the same for abutting engagement when the end sections are assembled to the intermediate section, loose abutment rings in the end and intermediate sections in back of the annular shoulders of said skin rings, U-shaped clamps engageable over said loose clamp rings for drawing the sections together, said clamps carrying nut elements and externally accessible bolts extended inwardly into engagement with said nut elements for drawing said clamps outwardly to thereby effect securement of the end sections to said intermediate sections, said U-shaped clamps being held by said bolts engaged at one end with one clamp ring, with the opposite end open far enough to pass over the companion clamp ring and whereby the clamps of adjoining sections may be held to one section in position to be engaged with the other section.

6. The invention according to claim 5, in which the U-shaped clamps are longer at one end than at the other to effect the attachment to one section while that section is being applied to the companion section.

7. The invention according to claim 5, in which the clamp ring on one section is of greater depth than the clamp ring on the companion section to thereby retain the U-shaped clamps attached to said first section while the same is being applied to the companion section.

8. The invention according to claim 5, in which one of the companion clamp rings is aligned with the clamp securing bolts and has openings therethrough for free passage of said bolts to the nut elements on the U-shaped clamps.

9. In a tank of the character set forth, a longitudinally split normally cylindrical tank section having interlocking companion tongue and groove jaw members along the meeting edges of the same, cylindrically curved on arcs disposed with the convex side toward the interior of the tank section and the concave side toward the outside of the tank section and said jaw members having opposed corner edges at the outside, abutting when the tank section is deformed inwardly out of circular outline, to thereby register the outwardly concave portions of said tongue and groove members for interlocking engagement as the tank section is distended to restore it to circular outline and circular bulkhead means in the tank section for holding same in the outwardly distended circular outline condition with said jaw members locked in interlocked relation.

10. In a tank of the character set forth, a longitudinally split normally cylindrical tank section having interlocking companion tongue and groove jaw members along the meeting edges of the same, cylindrically curved on arcs disposed with the convex side toward the interior of the tank section and the concave side toward the outside of the tank section and said jaw members having opposed corner edges at the outside, abutting when the tank section is deformed inwardly out of circular outline, to thereby register the outwardly concave portions of said tongue and groove members for interlocking engagement as the tank section is distended to restore it to circular outline and a longitudinally extending sealing strip interposed between said companion jaw members, one of said jaw members having a groove in the edge of the same opposed to the other jaw member and said sealing strip being partially seated in said groove and said other jaw member having a projecting ridge compressibly engaging the exposed portion of said sealing strip.

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