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MULTIPLE LAYER COLLAPSIBLE TUBE

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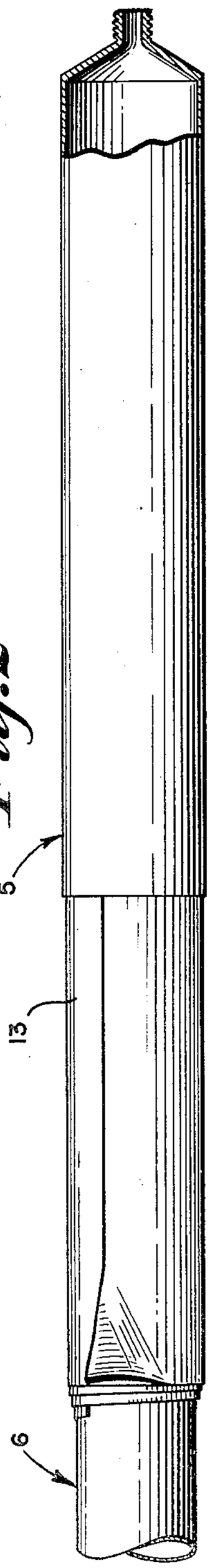

Fig. 2

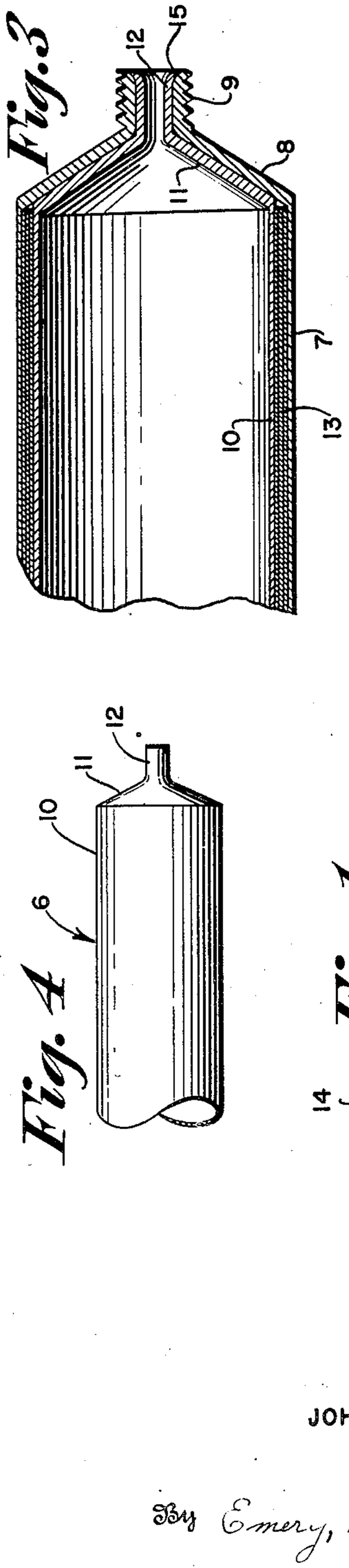

Fig. 3

Fig. 4

Fig. 1

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MULTIPLE LAYER COLLAPSIBLE TUBE

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4 Claims. (Cl. 222—107)

1

This invention relates to ductile metal collapsible tubes of the kind used for containing and dispensing many products of liquid, semi-liquid or paste-like characteristics, particularly such as are subject to gradual oxidation or deterioration in air.

Such ductile metal tubes have been only partly satisfactory due to the inherent tendency of thin sheets of ductile metal to break when subjected to working by repeated bending, to which collapsible tube walls are necessarily subjected in use. Thin sheets of ducti'e metal also are frequently defective by reason of pin holes or other imperfections.

Many efforts have been made to solve the problem presented by ductile metal collapsible tubes, since some of the ductile metals, such as tin, present qualities that are ideal for tube structures aside from the noted tendencies to defects. Thickening the tube walls does not present a solution, since it increases the stiffness of the wa'ls until their resistance to bending is beyond that which can be conveniently overcome. Multiple walled tubes have been proposed, but have proved to be stiff, and generally each wall or ply is subject to breaking, which permits escape of the material by creeping between the plies and thus reaching breaks in an outer ply, even though spaced from breaks in an inner ply.

The principal object of the invention is the provision of a novel collapsible tube, formed mostly of ductile metal, which is substantially free from leakage due to its novel arrangement and which protects the contents from the entrance of air.

Another object is to provide such a tube that is capable of easy manufacture, chiefly by standard tube manufacturing methods and is capable of filling and closing by standard practice.

Still another object is the provision of a novel form of interliner for a tube having multiple walls of ductile metal, which liner does not appreciably stiffen the tube wall, and which effectively stops leakage through the wall assembly by effectively resisting rupture and also preventing creeping of material from the outer surface of the inner wall to the inner surface of the outer wall.

In the accompanying drawings:

Fig. 1 is a plan view of a completed and closed tube constructed in accordance with the invention.

Fig. 2 is a view partly in section of a partly assembled tube.

Fig. 3. is a partial longitudinal section, taken on line 3—3 of Fig. 1.

2

Fig. 4 is a fragmentary plan of the inner tube member used in the assembly.

Describing the drawings in detail the collapsible tube assembly therein illustrated comprises an outer ductile metal tube 5 and an inner ductile metal tube 6. These tubes are both complete substantially standard metal tubes, the outer comprising a side wall 7, an end wall 8 and a discharge nipple 9 externally threaded to engage a cap. The inner tube similarly comprises a cylindrical side wall 10, an end wall 11 and an externally smooth discharge nipple 12. The side wall 10 of the inner tube is sufficiently smaller than that of the side wall 7 of the outer tube to be received within such outer wall, and provide a space between such walls when they are telescopically assembled. When the tubes are so assembled their end walls 8 and 11 are in close contact, and the nipple 12 telescopically is received within the bore of the nipple 9.

An interliner 13 is interposed in the space between the side walls 7 and 10. This liner is made of sheet material that is impervious to the material to be enclosed in the tube, and is formed from a sheet as a spirally wrapped cylinder. The successive laps of the liner 13 are free to slip locally over one another, and the surfaces of the liner are free to slip locally relative to the side walls 7 and 10, any major relative dislocation of the laps, or of the liner relative to the side walls being prevented by the abutment of the forward edge of the liner against the inner surface of the end wall 8 of the outer tube, and the crimping of the other end of the liner into the regular closing fold 14 at the back of the tube.

Various sheet materials may be used successfully for the interliner 13, the chief requisite characteristics of such material being imperviousness to the material to be contained by the tube, resiliency or springiness tending to make it expand when coiled, and non-adhesiveness of the material relative to itself and the metal of the side walls, either due to the material, substances with which it may be coated, or the influence of the material with which the tube is to be filled. Any reasonable number of laps may be made, but I regard two complete laps as the minimum permissible and prefer to use not less than three complete laps.

In assembling the tubes, the spirally wrapped or rol'ed liner 13 may be inserted in the side wall 7 of the outer tube, the inner tube inserted, and the two tubes secured together, preferably by joining the outer ends of their nipples 9 and 12. This may be accomplished advantageously

and simply by swaging the end of the inner nipple outwardly, as shown at 15 in Fig. 3. This assembly is sufficiently secure to maintain the parts together until the tube is filled and closed, since the liner 13 tends to expand against the outer side wall 7, and has little tendency to slip from between the assembled tubes 5 and 6.

In service, when the inner tube side wall of such an assembly becomes broken, or has a pin hole, the line prevents direct access of leaking material to the inner surface of the outer side wall and vice versa. The relatively great length of the spiral passage extending from the inner to the outer side wall between the successive laps of the liner, effectively prevents liquid or semi-liquid material from reaching the outer side wall by creeping, and prevents air from entering the inner tube through leaks in the outer tube, probably due to the fact that the laps of the liner are pressed together by compression of the liner between the side walls, especially when the tube side walls are pressed in, which pressure makes the liner tend to uncoil and expand, pressing the laps of the liner outward against outer laps and against the outer side wall 7. This expansion of the interliner tends to reinforce the outer side wall, which is stiff enough to retain its shape after being pressed in. A very effective barrier against creeping to the outer wall by material escaped from the inner tube is provided by this interliner of spirally rolled sheet material.

It will be noted that in the region adjacent the end structures 8, 11 of the tube, it would be possible for material to creep from the inner to the outer wall structures. As a matter of common practice the side walls of collapsible metal tubes increase in thickness as they approach the front end walls, and this, coupled with the fact that this region of a tube is not subject to much bending and working, makes occurrence of leaks in this region so rare as not to constitute a defect.

In a tube assembly so constructed the inner tube side wall may be made very thin, since it is protected from external injury by the surrounding outer tube side wall and the interliner. The chief function of the inner tube side wall is constructional, that is, it positions the inner lap of the interliner, maintains the laps of the liner in close contact, and serves as a barrier against entry of the material between the laps, as would occur were the liner unsupported and unprotected internally. The thin, ductile non-springy inner and outer walls prevent sucking of air into

the tube through the nipple or elsewhere when pressure on the tube is released after expelling a part of the contents notwithstanding the tendency of the interliner to expand, thereby preventing oxidation of the remaining portion of the contents.

I claim:

1. A collapsible tube assembly comprising inner and outer tubular side walls of thin ductile metal, means securing said walls together, and an interliner of spirally rolled sheet material impervious to the material to be contained by the tube and having sufficient springiness to tend to expand, said interliner being interposed between said side walls, being free to slip locally relative to said side walls, and the successive laps thereof being free to slip locally relative to each other.

2. A collapsible tube according to claim 1, wherein said spirally rolled inner liner comprises at least two complete laps.

3. A collapsible tube comprising inner and outer tubes each having an end wall provided with a projecting discharge nipple, and a thin side wall, the said tubes being telescopically assembled with their end walls closely abutting, their discharge nipples telescoped, and the side walls spaced apart, and an interliner of spirally rolled sheet material interposed between the side walls and contacting both of them, the sheet material of said liner being impervious to the material to be contained by the tube and having sufficient springiness to tend to expand, and free to slip locally relative to the side walls, and the successive plies thereof being free to slip locally relative to each other.

4. A collapsible tube according to claim 3, wherein one end of the interliner abuts the end wall of the outer tube.

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