June 8, 1965 J. D. HUBER 3,187,934

SHIPPING CONTAINER

Filed June 12, 1963 2 Sheets-Sheet 1

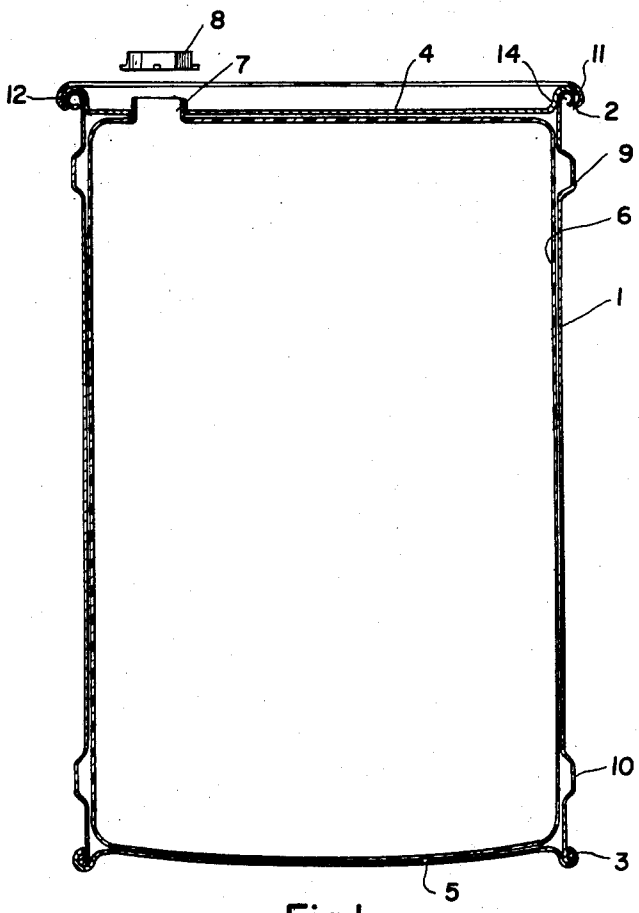


Fig. 1.

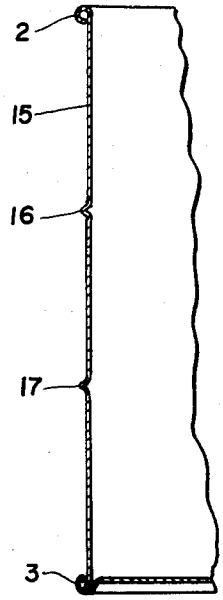


Fig. 2.

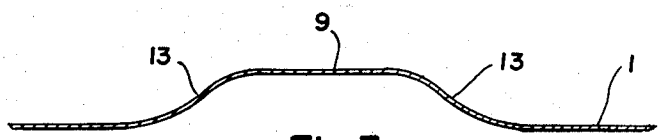


Fig. 3.

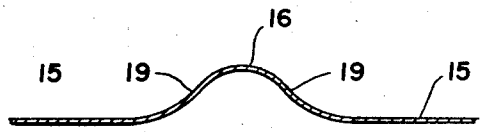


Fig. 4.

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June 8, 1965 J. D. HUBER 3,187,934

SHIPPING CONTAINER

Filed June 12, 1963 2 Sheets-Sheet 2

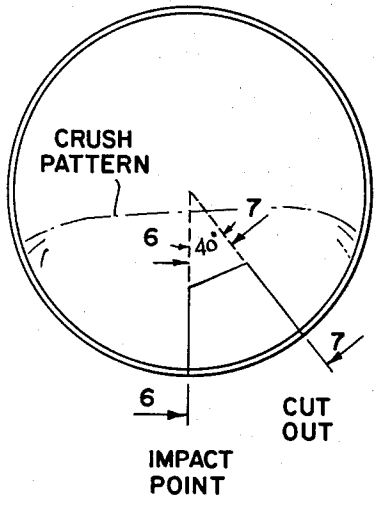


Fig. 5

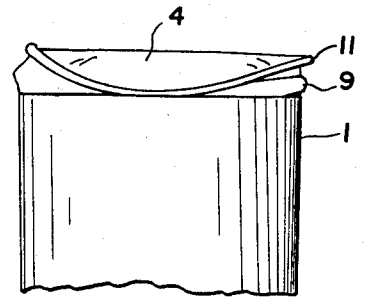


Fig. 10

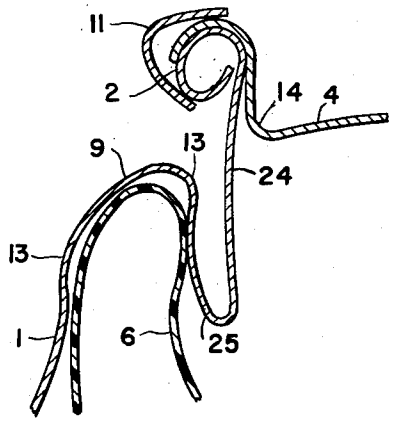


Fig. 7.

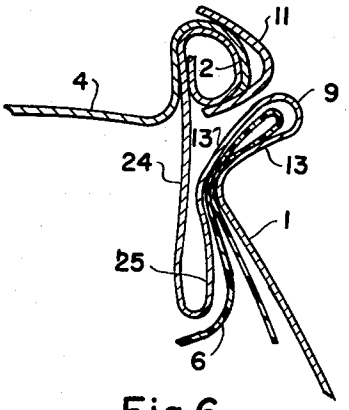


Fig. 6.

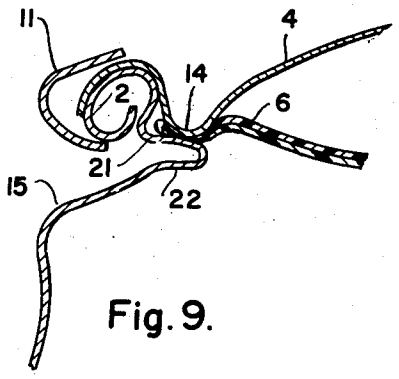


Fig. 9.

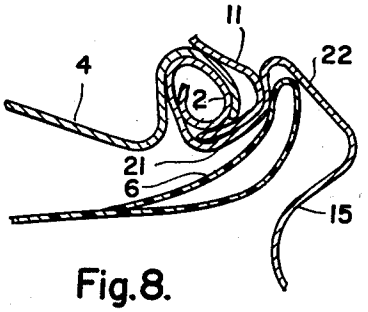


Fig. 8.

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United States Patent Office 3,187,934 Patented June 8, 1965

3,187,934

SHIPPING CONTAINER

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2 Claims. (Cl. 220—63)

This invention relates to metal shipping containers such as steel drums. It is more particularly concerned with a metal shipping container provided with an inserted flexible liner, and which will withstand rough handling.

Steel drums are commonly used for shipping liquid and granular materials. Certain reactive materials cannot be packed in contact with steel, and drums for shipment of those materials are commonly furnished with insertable light weight liners of flexible inert plastic material, usually polyethylene. Those drums are called composite drums or composite shipping containers. Drums of this type holding 5 and 15 gallons capacity are commonly used. These must meet the requirements of Interstate Commerce Commission Regulation 78.133, Specification 37 P.

That specification includes, among other provisions, certain drop tests for the composite drum. A container filled with water to 98% of its capacity and closed as for use must withstand a drop of a height of 4 feet onto solid concrete without leakage or potentially hazardous rupture of the outside container. Containers must meet the following three test, but no single container is required to withstand more than one of them.

(1) Diagonal drop on top chime.
(2) Diagonal drop on bottom chime.
(3) Flat drop on side of drum.

It would be desirable to ship many products in larger containers, such as the conventional 55 gallon steel drum, provided with plastic liners in the same way as the smaller containers above mentioned. However, conventional 55 gallon drums of standard gauge materials provided with light weight plastic liners have not been able to withstand, consistently, drop tests (1) and (2) above described. Consequently, Interstate Commerce Commission approval for the use of steel containers with plastic liners larger than 15 gallons capacity is difficult to obtain.

It is an object of my invention, therefore, to provide a 55 gallon steel drum with plasitc liner that will meet the Interstate Commerce Commission drop tests. It is another object to provide such a drum made from relatively light gauge steel. Other objects of my invention will appear in the course of the description thereof which follows.

I have found that failure of conventional 55 gallon drums with plastic liners in diagonal drops usually occurs because of the way the metal of the shell crumples or folds below the area of impact. The deformation of the metal seldom leads to rupture of the steel shell, but occurs in such a way as to pinch a portion of the liner between a folded or rigid portion of the shell and the container head. This pinching is often severe enough to shear the liner and so allow its contents to leak. I have also found that by relocating and, desirably, reshaping the rolling hoops in the drum shell, I can alter the way in which the shell folds or deforms below the area of impact so as to avoid pinching the liner.

An embodiment of my invention presently preferred by me, as well as portions of a conventional drum, are illustrated in the attached figures to which reference is now made.

FIGURE 1 is a vertical section through a composite shipping container of my invention.

FIGURE 2 is a partial vertical section through a conventional 55 gallon drum.

FIGURE 3 is an enlarged section through a rolling hoop of the drum FIGURE 1.

FIGURE 4 is an enlarged section through a rolling hoop of the drum of FIGURE 2.

FIGURE 5 is a plan of the top head of a drum which has been subjected to drop test (1) above described, showing the pattern of crushing of the head.

FIGURE 6 is a partial vertical section through the wall and top head of a drum of my invention which has been subjected to a diagonal drop, taken on the plane 6—6 of FIGURE 5.

FIGURE 7 is a partial vertical section through the wall of a drum of my invention which has been subjected to a diagonal drop, taken on the plane 7—7 of FIGURE 5.

FIGURE 8 is a partial vertical section through the wall and head of a conventional drum with liner which has been subjected to a diagonal drop, taken on the plane 6—6 of FIGURE 5.

FIGURE 9 is a partial vertical section through the wall and head of a conventional drum with liner which has been subjected to a diagonal drop, taken on the plane 7—7 of FIGURE 5.

FIGURE 10 is a partial elevation of a drum of my invention which has been subjected to a diagonal drop, showing the crush pattern of the top head.

The drum of my invention comprises, generally, a cylindrical steel shell 1, provided with a chime 2 at its upper end, and a chime 3 at its lower end. The upper end of the shell is closed by top head 4 which is formed with an annular shoulder 14 adjacent chime 2, and the lower end is closed by bottom head 5. Top head 4 is removable, and is held in place by closing ring 11 which fits over the curled rim 12 of head 4 and over chime 2. The drum is provided with a cylindrical polyethylene liner 6 which fits snugly inside. Liner 6 is formed with a filler opening 7 which extends through a hole in top head 4 and is closed by a closure 8. Shell 1 is formed with an upper annular outwardly projecting corrugation constituting rolling hoop 9 and a similar lower rolling hoop 10. Each of these hoops extends radially outwardly slightly beyond upper and lower chimes 2 and 3. As may be seen from FIGURE 3, each hoop is flat in section and merges through sloping shoulders 13—13 on each side into the drum shell 1. Rolling hoop 9 is positioned relatively close to chime 2, and rolling hoop 10 is positioned relatively close to chime 3, in a way and for a purpose to be described later.

For comparison, the arrangement of rolling hoops in the shell of a conventional drum is shown in FIGURE 2. Cylindrical shell 15 is provided with an upper outwardly projecting rolling hoop 16 and a lower outwardly projecting rolling hoop 17. The contour of those rolling hoops is shown in FIGURE 4. Each hoop is rounded and merges through shoulders 19—19 on each side into drum shell 15. Upper hoop 16 is positioned a substantial distance from the upper chime 2 of shell 15, and lower hoop 17 is positioned a substantial distance from the lower chime 3 of shell 15.

When a drum, either of my invention or known to the prior art, is dropped diagonally on either top or bottom chime, the extent of the head which is crushed or affected is substantially as illustrated in FIGURE 5. The boundary line of the crushed area, as well as the impact point, is indicated on that figure. As I have mentioned, FIGURES 8 and 9 are sections through planes 6—6 and 7—7 respectively of FIGURE 5 of a conventional drum with liner which has been subjected to a diagonal drop. The section of FIGURE 9, which is taken at a point about halfway between the impact point and the edge of the crush pattern, shows that the drop has deformed shell 15 which was originally at right angles to top head 4 so that the portion of the shell 21 immediately adjacent to chime 2 has been bent inwardly toward head 4 and then doubled back at 22. The impact has forced the shoulder 14 of

head 4 against the inbent portion 21 of the shell so as to fold liner 6 against itself and pinch it between shoulder 14 and shell portion 21. The top head 4 is conventionally made of heavier gauge material than shell 15, and shoulder 14 further stiffens head 4 so that liner 6 can be sheared in the way mentioned.

The section of FIGURE 8 was taken through the point of impact. It will be seen from FIGURE 8 that the impact has caused portion 21 of shell 15 immediately below chime 2 to be bent outwardly against ring 11 approximately at right angles to its original position, and then downwardly and inwardly at 22. The shell at this point does not pinch liner 6, a fold of which extends up into the region between portions 21 and 22 of shell 15. It will be appreciated, however, that as shell portion 21 is bent inwardly in FIGURE 9 and outwardly in FIGURE 8, there must be a region between the planes of those figures where it reverses its bend, and at that region the shell must buckle, which affords another possibility of pinching and shearing liner 6.

FIGURES 6 and 7 illustrate the deformation of the drum of my invention and correspond in location to FIGURES 8 and 9 respectively. It will be seen in FIGURE 7 that the drum shell portion 24 immediately below top head 4 still remains approximately at right angles to that head. At a location intermediate chime 2 and rolling hoop 9, the shell 1 is bent upwardly and outwardly back against itself at 25. Rolling hoop 9 is somewhat deformed, but does not pinch the fold 6 of the liner enclosed within it. The pattern of shell deformation at the point of impact is shown in FIGURE 6 and differs from that of FIGURE 7 only in degree. The impact has brought ring 11 down upon deformed rolling hoop 9 forcing fold 25 closer to portion 24. However, the shell at this point does not actually pinch the fold of the liner 6 which is enclosed within it. Furthermore, the fold of liner 6 is within a fold of the relatively thin gauge metal of shell 1 and is not caught between the shell 1 and the heavier gauge metal of top head 4.

It will thus be seen that the provision of a rolling hoop 9 at a location such that it helps to absorb the impact of chime 2 and ring 11 when the drum is dropped diagonally, prevents shearing of the liner. As the face of rolling hoop 9 is desirably made flat, part of the energy of impact is absorbed in bending that face into the curved configurations shown in FIGURES 6 and 7.

The provision of rolling hoop 9 at a location such that it is impacted by the chime when the container is dropped diagonally in accordance with Interstate Commerce Commission Specification 37 P, controls the bending or deforming of the metal of drum shell 1 so that the deformed metal does not pinch the liner. That location of the rolling hoop causes the portion of shell 1 immediately below chime 2 to remain approximately at right angles to head 4 while the folding of shell 1 in the area of impact takes place intermediate the chime and the rolling hoop so that the liner cannot be pinched against the relatively stiff head 4.

A conventional 55 gallon drum is about 36 inches high overall and about 23 inches in diameter. The rolling hoops 16 and 17 are centrally located 11 inches apart so that each is about 12½ inches from the nearer end of the shell . In the article of my invention, the height and diameter are as above indicated, rolling hoop 9 is located so that its center is about 4 inches from the top of chime 2, and rolling hoop 10 is similarly located with respect to chime 3. I prefer to make the width of the face of rolling hoop 9 about twice the distance it projects beyond shell 1.

I claim:

1. A closed sheet metal shipping container comprising a cylindrical shell having an outwardly turned chime at one end, a head fitting inside the chime and attached thereto, an inserted liner of flexible plastic material, and an annular outwardly projecting hollow corrugation in the shell spaced from the chime, the space between the top of the chime and the center of the corrugation being about one-sixth of the diameter of the container, so that when the container is dropped onto an unyielding surface diagonally on its chime, the corrugation is impacted by the chime.

2. A closed sheet metal shipping container comprising a cylindrical shell having an outwardly turned chime at one end, a head fitting inside the chime and attached thereto, an inserted liner of flexible plastic material, and an annular outwardly projecting hollow corrugation in the shell spaced from the chime so that when the container is dropped onto an unyielding surface diagonally on its chime, the shell wall between the chime and the corrugation folds inwardly against the corrugation without substantial change in its angular relation to the head.

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