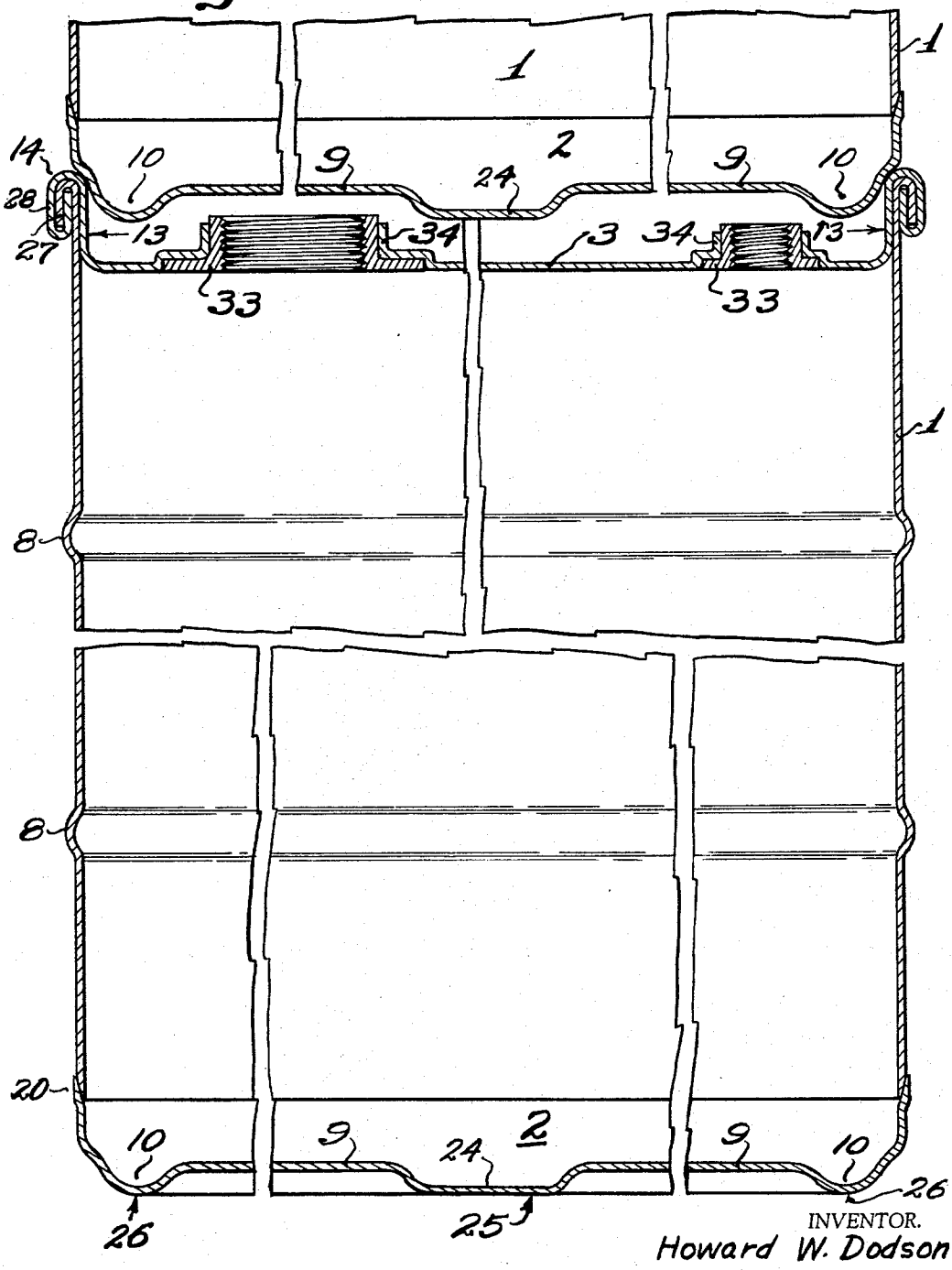
Oct. 18, 1966 H. W. DODSON 3,279,640

STEEL DRUM CONSTRUCTION

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Fig. 1.



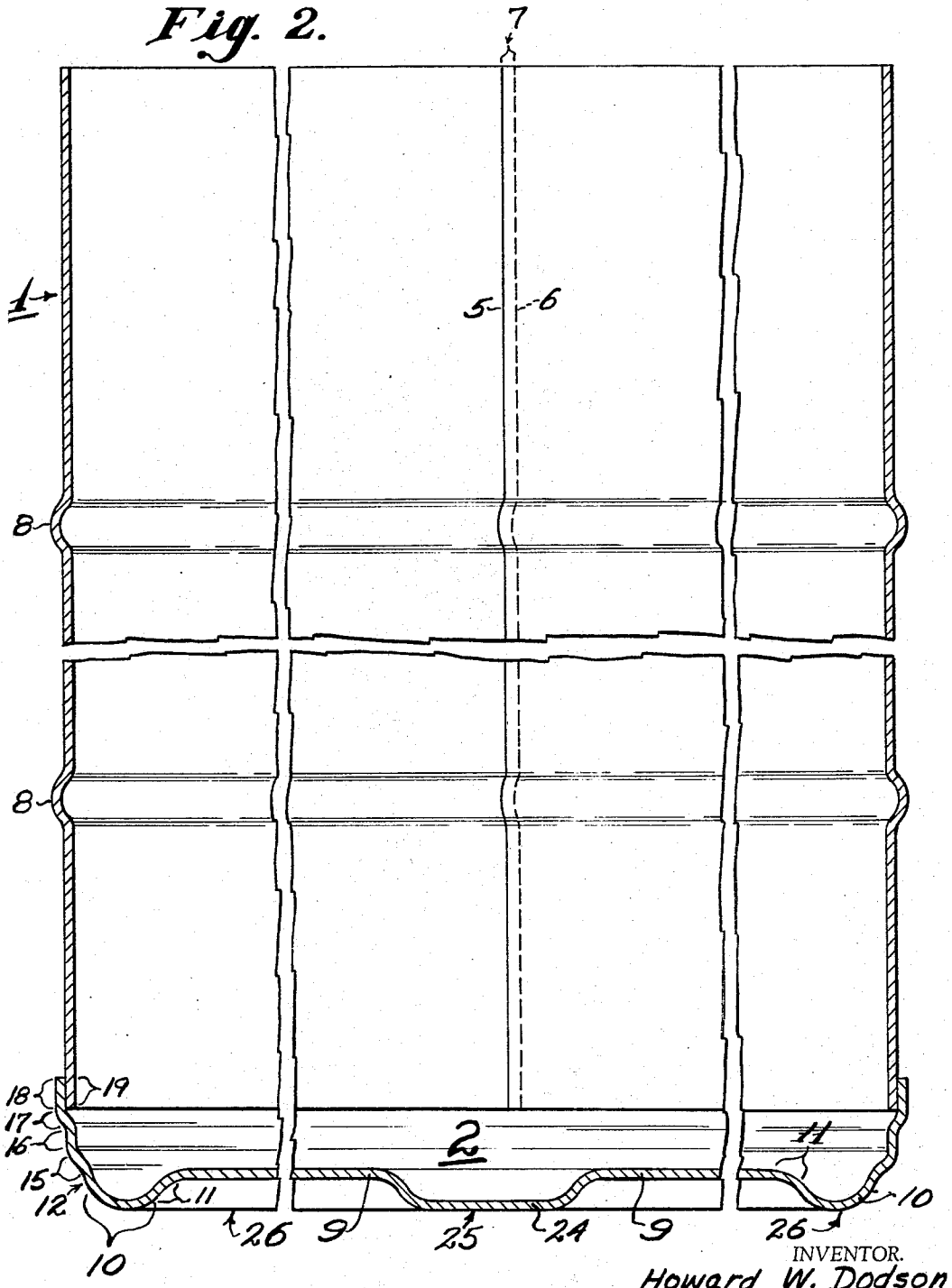
INVENTOR.
Howard W. Dodson
BY Leonard L. Kalish
Attorney.

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STEEL DRUM CONSTRUCTION

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Fig. 2.



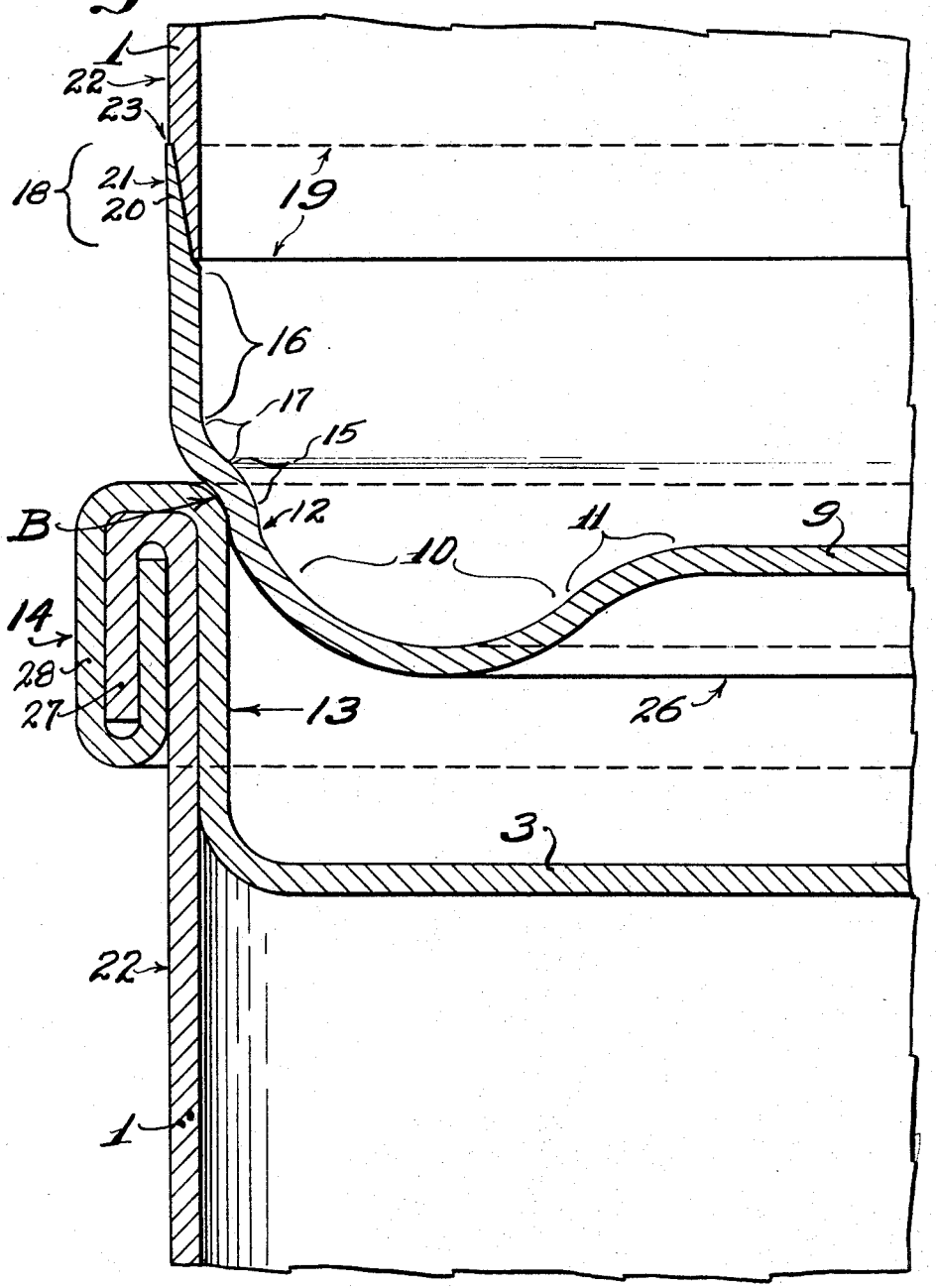
INVENTOR.
Howard W. Dodson
BY Leonard L. Falick
Attorney.

Oct. 18, 1966 H. W. DODSON 3,279,640

STEEL DRUM CONSTRUCTION

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Fig. 3



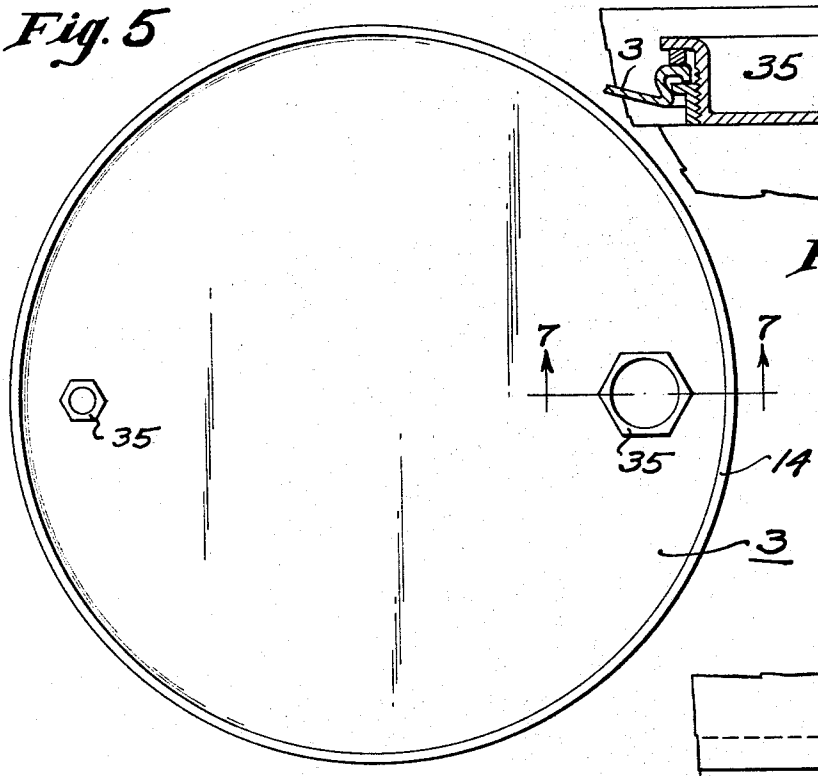
INVENTOR.
Howard W. Dodson
BY Howard L. Falish
Attorney.

Oct. 18, 1966 H. W. DODSON 3,279,640

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Fig. 5



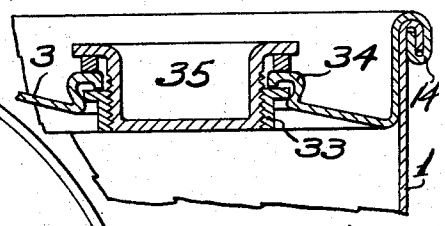


Fig. 7

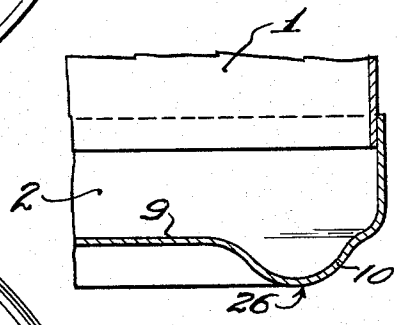


Fig. 6

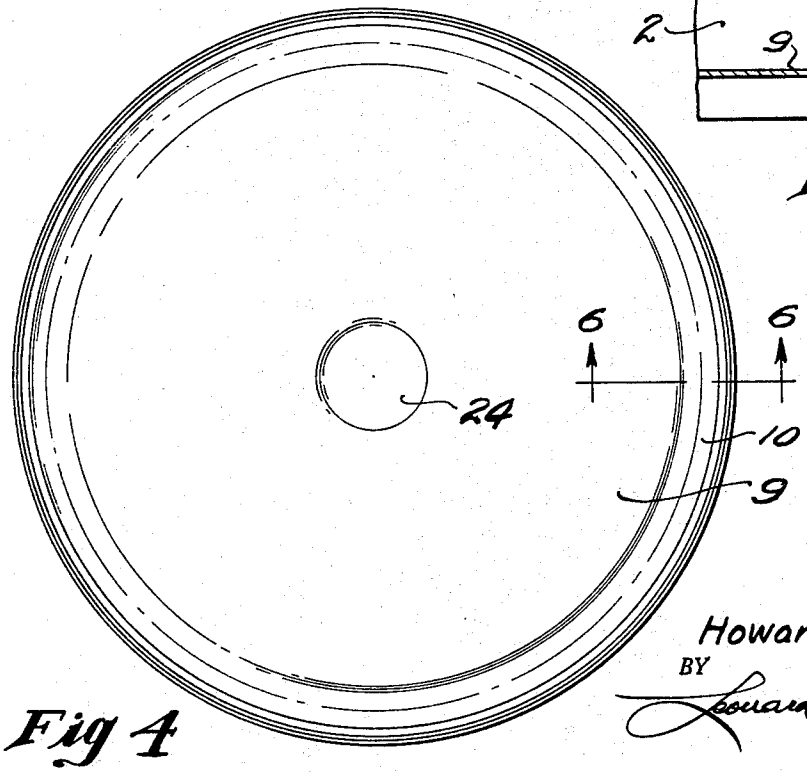


Fig 4

INVENTOR.
Howard W. Dodson
BY
Leonard L. Kalish
Attorney.

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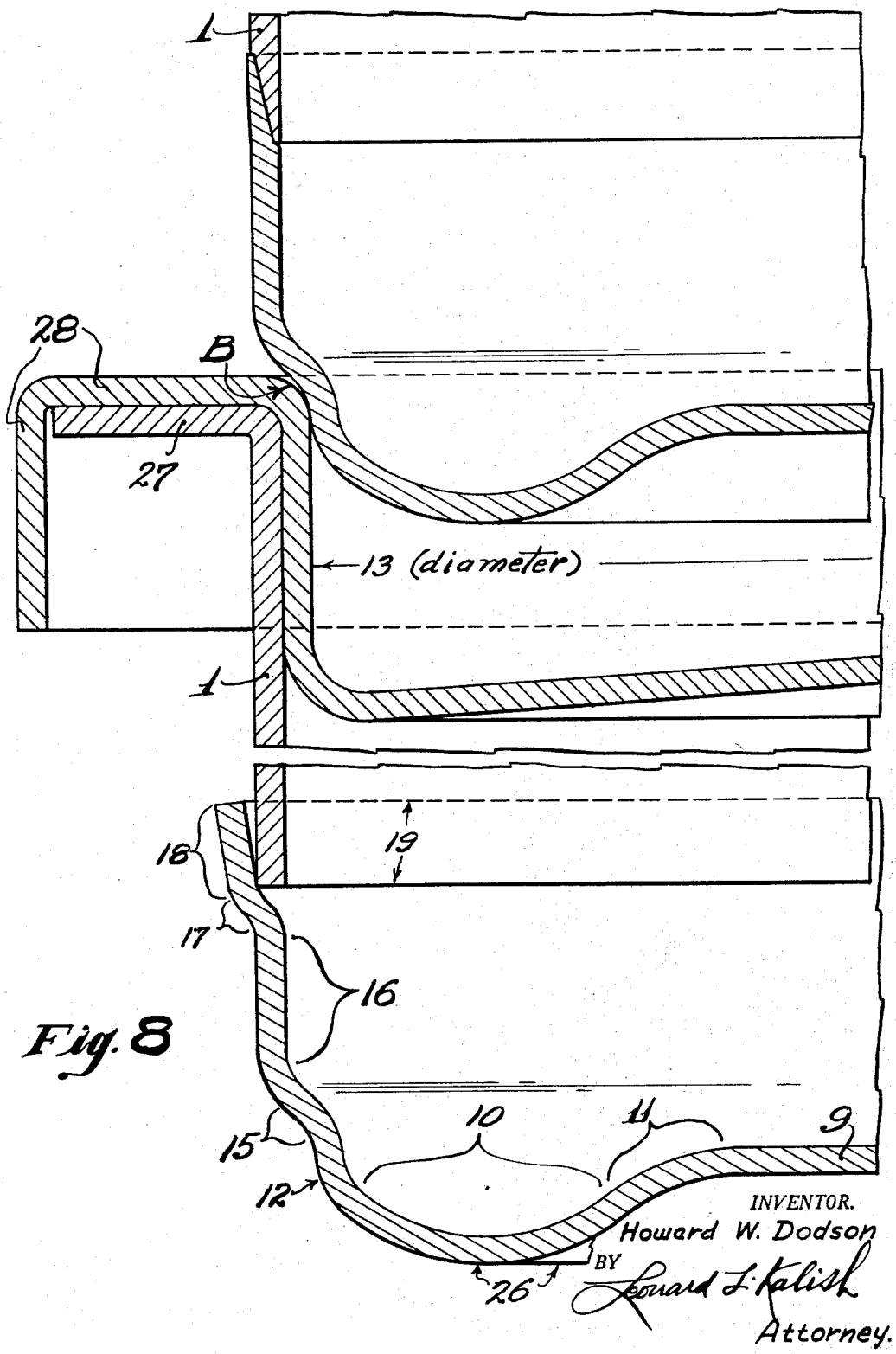


Fig. 8

INVENTOR.
Howard W. Dodson
BY
Leonard L. Kalish
Attorney.

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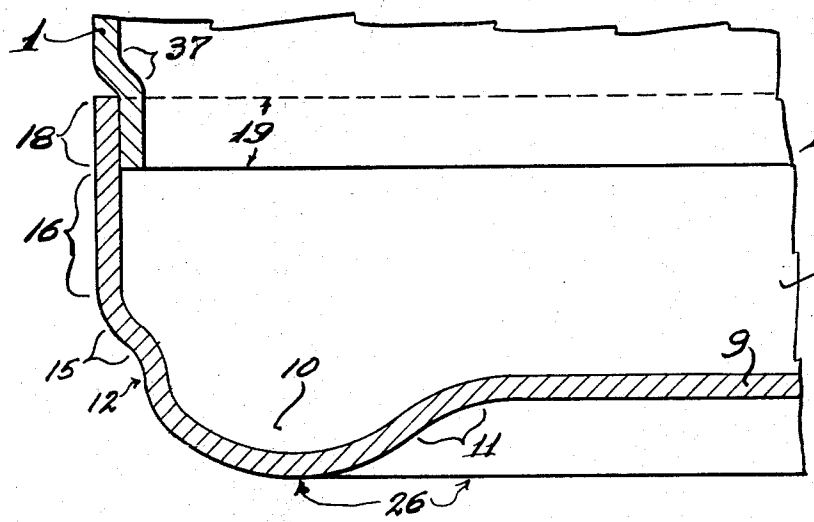


Fig. 9

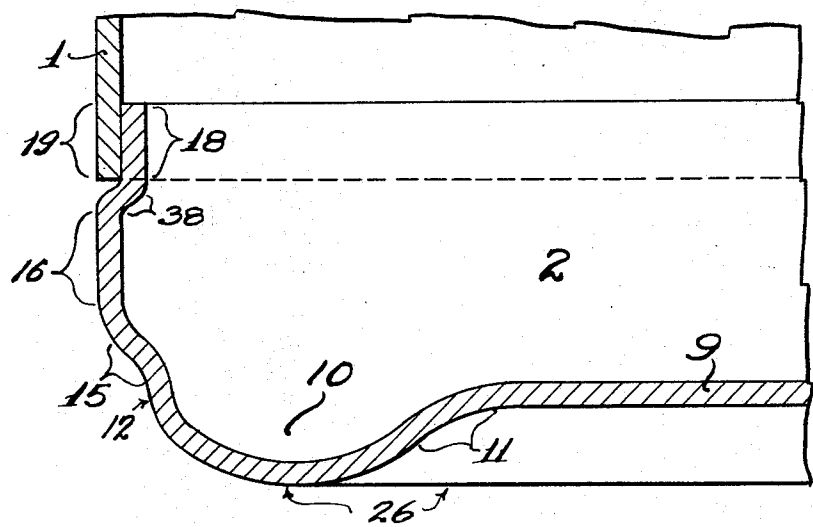


Fig. 10

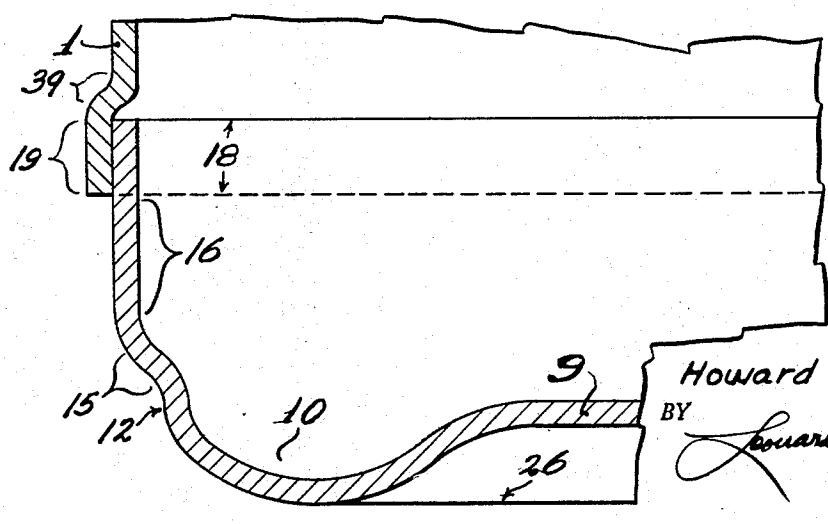


Fig. 11

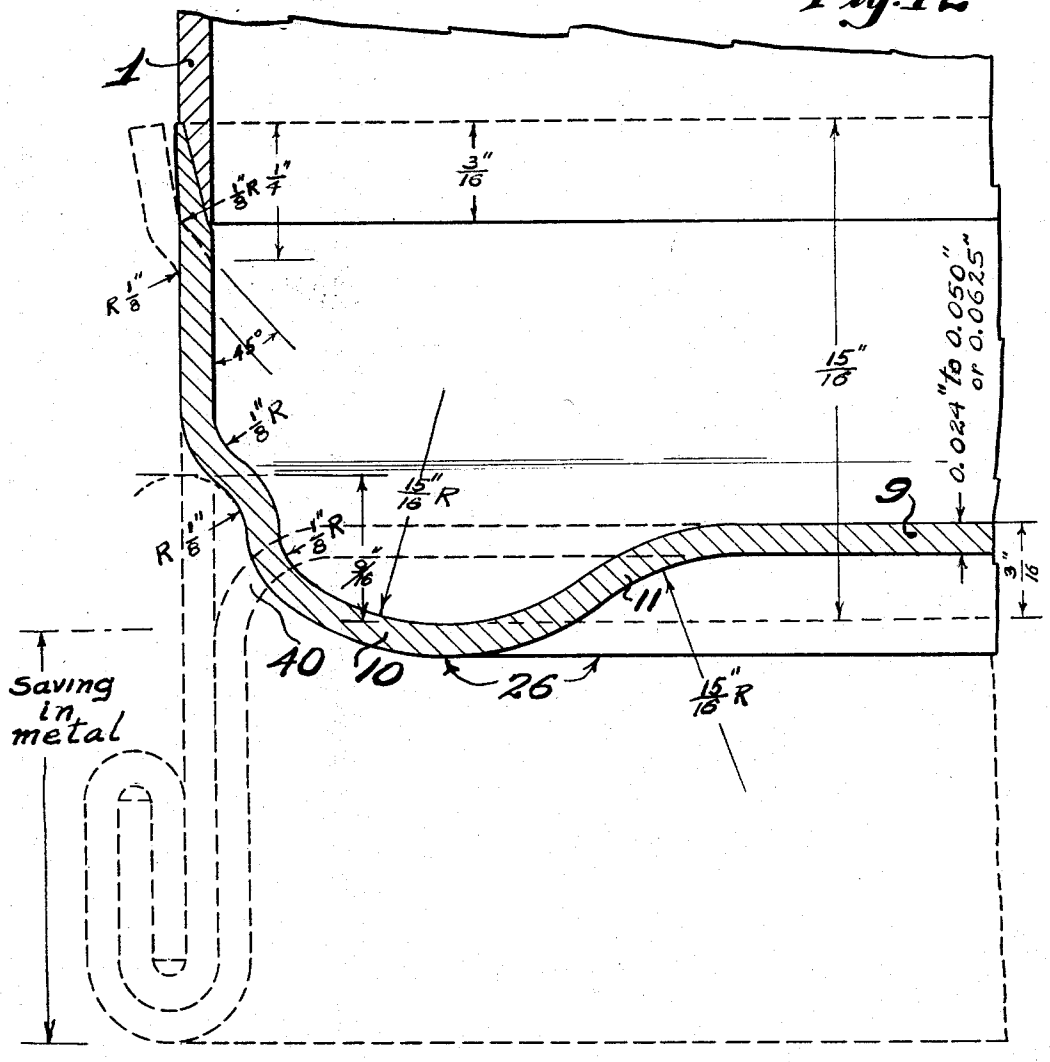
INVENTOR.
Howard W. Dodson
BY Howard L. Falish
ATTORNEY.

Oct. 18, 1966 H. W. DODSON 3,279,640

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Fig. 12



INVENTOR.
Howard W. Dodson
BY
Leonard L. Kalish
Attorney.

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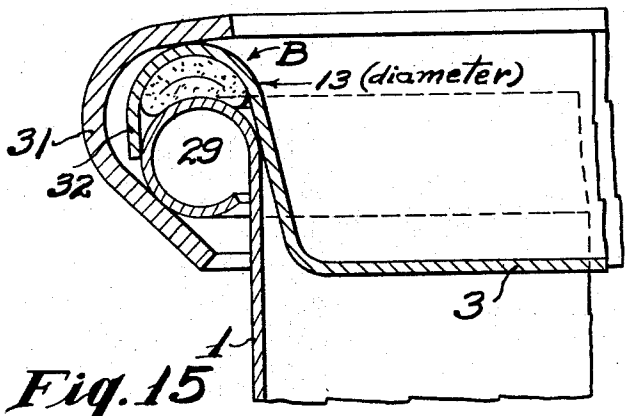


Fig. 15

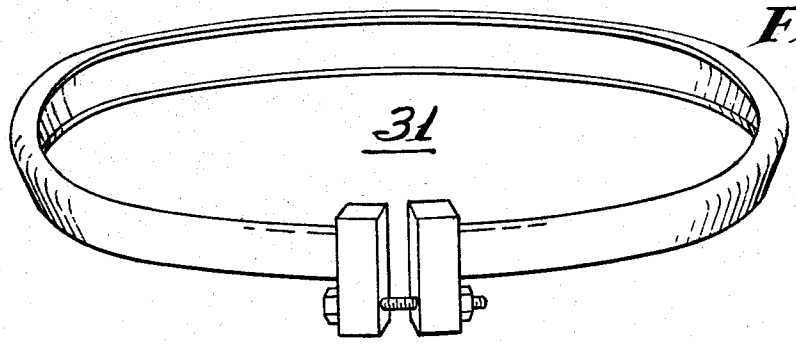


Fig. 16

Fig. 14

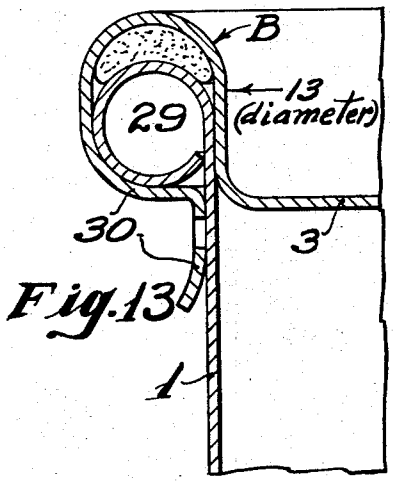
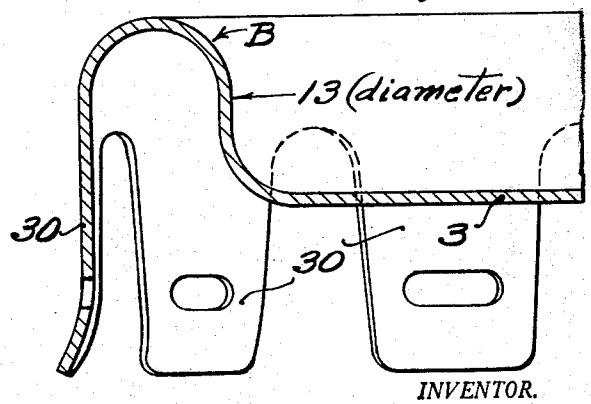


Fig. 13



INVENTOR.
Howard W. Dodson
BY
Leonard L. Kalish
Attorney.

United States Patent Office 3,279,640 Patented Oct. 18, 1966

3,279,640

STEEL DRUM CONSTRUCTION

Howard W. Dodson, Springfield Township, Delaware County, Pa., assignor to United Steel Barrel Co., Philadelphia, Pa., a corporation of Pennsylvania

Filed June 16, 1961, Ser. No. 117,658
1 Claim. (Cl. 220—5)

The present invention relates to the construction of steel drums and more particularly large "shipping" drums of sheet-steel of generally uniform thickness.

One of the objects of the present invention is to increase the durability of such steel drums and hence increase their safety factor against breakage (and resultant leakage) due to the fatigue and resultant cracking of the metal under long continued vibration and flexing of the bottom of the filled or loaded drum while in transit on railways or by truck over long distances and under repeated re-use involving such transit.

A further object of the present invention is to permit the use of thinner gauge sheet-steel while at the same time achieving the aforementioned durability and safety factor.

A further object of the present invention is a saving in amount of sheet-steel required for any given size drum.

A further object of the present invention is a steel drum construction which will achieve the foregoing objective and at the same time permit the drums to be stacked one on top of the other, with secure footing both of the bottom steel drum as well as of the steel drum (or drums) stacked thereon.

A further object of the present invention is a method of making steel drums whereby the cost of production thereof may be reduced.

Other objects will appear from the following description and accompanying drawings.

In the accompanying drawings, in which like reference characters indicate like parts,

FIGURE 1 represents a cross-sectional view of a steel drum embodying the present invention, but with portions thereof broken away so as to permit the details of the construction and method to be shown on a larger scale; this figure also showing the lower end of another like steel drum stacked upon the steel drum shown therebeneath.

FIGURE 2 represents a cross-sectional view of the cylindrical body of the steel-drum and of the dished bottom member in telescoped relation to each other, before the body and bottom member have been welded to each other and before the top of the drum has been applied to the body.

FIGURE 3 represents a fragmentary cross-sectional view of one side of the bottom and adjoining portion of the body of one steel drum and the top of another like steel drum therebeneath, shown on a much enlarged scale.

FIGURE 4 represents a top plan view of the main body of the drum and of the bottom member, as shown in FIGURE 2, before the top member has been applied to the body.

FIGURE 5 represents a top plan view of the completed drum.

FIGURE 6 represents a cross-sectional view on line 6—6 of FIGURE 4, on an enlarged scale.

FIGURE 7 represents a cross-sectional view on line 7—7 of FIGURE 5, on an enlarged scale.

FIGURE 8 represents a fragmentary vertical cross-sectional view, on a much enlarged scale, of the cylindrical drum-body telescoped into the dished bottom member, prior to the two being welded to each other; showing a modified form of construction in the dished bottom, and

also showing the upper closure member of the drum prior to being crimped to the body, and further showing the lower portion of another finished drum in stacked relation to the top of the lower drum indicated in this figure.

FIGURES 9, 10 and 11 represent fragmentary vertical cross-sectional views of the body and bottom members of drums, prior to being welded to each other; showing modified embodiments of the invention.

FIGURE 12 represents a fragmentary vertical cross-sectional view of the lower portion of a drum, of the embodiment shown, for instance, in FIGURES 1 to 3 and 8 to 11, with the heretofore conventional construction superimposed thereon in dotted lines, to indicate one of the savings in metal effected by the drum construction of the present invention.

FIGURE 13 represents a fragmentary vertical cross-sectional view through the top of the drum, showing an alternative mode of application of the top closure member of the drum.

FIGURE 14 represents a fragmentary vertical cross-sectional view of the upper closure member shown in FIGURE 13, in its condition prior to being crimped onto the peripherial bead at the top of the body of the drum.

FIGURE 15 represents a fragmentary vertical cross-sectional view of the top of the drum showing another alternative means of applying the top closure member to the body of the drum.

FIGURE 16 represents a perspective view of the lid-clamping ring indicated in cross-section in FIGURE 15.

An example of the steel drum intended to be illustrated in the drawings is a 55-gallon steel drum whose inside body-diameter is of the order of 22½ inches and whose interior height is of the order of 33 inches.

In the accompanying drawings, the main body of the drum is designated generally by the numeral **1**, while the bottom member is designated generally by the numeral **2**, and the top member is desginated generally by the numeral **3**.

The body **1** is formed of a sheet of steel which is rolled into a generally cylindrical formation as indicated in FIGURE 4, and the meeting edges **5** and **6** thereof united by forming a butt-weld or a lap-weld **7**, by electrical resistance welding (or by any other suitable seam).

One or a plurality of circular rolling hoops, beads or swedges **8** may be rolled into the so formed cylindrical main body **1**.

The dished bottom **2** is stamped, pressed and drawn out of a sheet of steel on a punch-press, between upper and lower dies (or progressive multiple dies) shaped generally to correspond to the upper and lower surfaces of the dished bottom.

The bottom member **2** may include a generally circular central panel or portion **9**, from the outer periphery of which the annular channel-like footing **10** of generally circular cross-section of large radius extends downwardly (as indicated in FIGURES 1, 2, 3, 6 and 8 to 12) with the concave side of such cross-section facing inwardly towards the interior of the drum;—the footing **10** forming an annular floor-contacting load-bearing, supporting the steel drum and its contents. The footing **10** is connected with the outer periphery of the central panel **9** by an annular portion **11** of a gradually reversed curvature of relatively large radius.

The outer periphery **12** of the footing **10** is preferably of a diameter equal to or slightly less than the inner diameter **13** of the crimped seam **14** or other upper closure bead (or "chime") at the top of the drum, so that the annular footing **10** may nest within the inner diameter **13** of the seam or bead or chime **14** at the top of the drum, as indicated in FIGURES 1 and 3 and 8 to 12.

From the outer periphery **12** of the annular footing

10, an annular stacking-seat portion 15 extends upwardly and outwardly, at an angle; this annular stacking-seat portion 15 being of a diameter just sufficiently great to overlap the inner annular bend-zone B of the top of the closure-seam or bead 14, as indicated in FIGURES 1, 3 and 8, and so as to cause the centering of the so stacked drums in relation to each other.

Above the annular stacking-seat 15 a generally annular cylindrical or upwardly flared portion 16 is provided, including or having above it an outwardly extending annular off-set portion 17, which, in turn, is surmounted by a short generally cylindrical (or conical) body-telescoping weld-portion 18, as indicated in FIGURES 2 and 3.

In FIGURE 12 typical proportions are shown. Thus, the curvatures of the cross-section of the annular footing 10 and of the annular reversley-curved connecting portion 11 are of relatively large radii.

The over-all vertical height of the dished bottom 2 is small in relation to the vertical height of the cylindrical body and in relation to the height of the drum, namely, in the ratio of one inch to more than thirty inches, so that the cylindrical body, 1 formed of a single piece of sheet-steel with but single longitudinal welded seam parallel with its axis, constitutes more than 90% of the over-all height of the drum and indeed constitutes something of the order of 95% to 97% of the over-all height of the drum.

If desired, the portions 16 and 17 may be merged into one, in a single upward and outward sweep.

The inner diameter of the body-telescoping portion 18 is made generally equal to or just slightly greater than the outer diameter of the cylindrical main body 1 (by a suitable working clearance).

The body-telescoping portion 18 of the bottom member 2 and the lower annular weld-portion 19 of the main cylindrical body 1 are then telescoped in relation to each other, as indicated in FIGURE 2.

A weld 20 (FIGURES 1, 3, 8 and 12) is then formed by progressive electrical resistance-welding of the overlapping telescoped portions 18 and 19, by continuously moving such overlapping annular portions between opposed electrodes (preferably rolling electrodes) of an electrical resistance-welding machine at a suitable linear rate of travel, and passing a suitable resistance-welding current therethrough while applying radial pressure between the electrodes, so as simultaneously to form a resistance-weld substantially throughout the contiguous surfaces of the overlapping annular portions 18 and 19 and compressing or "mashing" such overlapping portions 18 and 19 so as to reduce their combined thickness (as indicated in FIGURES 1, 3, 8 and 12), to bring the outer surface 21 of the overlapping portion 18 of the bottom member 2 nearly or completely in line with the outer surface 22 of the main body 1 of the drum and thereby to reduce to a minimum if not indeed eliminate any shoulder or off-set at 23 on the outside of the finished drum, and so that the main cylindrical body 1 of the drum will be in substantial vertical alignment with the cylindrical portion 16 of the dished bottom member 2 of the drum.

I may also form an auxiliary floor-contacting and bottom-stabilizing portion 24 in the central panel 9 of the bottom member 2, by pressing a suitable portion thereof downwardly, by correspondingly shaping the upper and lower forming dies between which the dished bottom member 2 is formed. The lower surface 25 of such intermediate floor-contacting portion 24 is generally at the same level or lies in the same plane as the floor-contacting seat or bearing annulus 26 of the footing 10. This intermediate floor-contacting portion 24 stabilizes the bottom panel 9 against undue vibration while the drum is in transit and thereby further reduces the hazard of metal fatigue both in the annular portion 11 connecting the panel 9 with the annular footing 10 as well as in the annular stacking-seat 15 and the other outer annular portions of the dished bottom member 2.

After the bottom member 2 has been welded to the cylindrical body 1, the lid or top member 3 is applied to the top of the cylindrical body 1 in the manner indicated in FIGURE 8, and their respective peripheral portions 27 and 28 are then interfolded in the manner indicated in the FIGURES 1 and 3 to form the crimped bead-like seam 14.

However, the lid member 3 may also be detachably secured to the upper end of the cylindrical body 1 (as indicated in FIGURES 13 and 14) by first forming an outwardly extending bead 29 along the upper edge of the cylindrical body 1, and then detachably securing the lid 3 by bendable prongs or tabs 30 along the outer peripheral edge thereof, which can be unbent to detach the lid, or by any suitable contractible and expansible auxiliary lid-securing steel band 31 of curved or U cross-section, with the concavity of its cross-section facing inwardly and embracing the aforementioned bead and the periphery 32 of the lid, and clamping the latter to the former (as indicated in FIGURES 15 and 16).

One or more internally threaded flanges 33 may be welded or otherwise affixed in sealed relation to the flanged opening 34 of the lid 3, for receiving a threaded closure-plug 35.

Instead of forming the annular weld-portion 18 of the bottom member 2 generally cylindrically as shown in FIGURE 2, I may flare it outwardly slightly, into a frustro-conical formation, as indicated in FIGURE 8. This permits the more ready telescoping of the annular weld-portion 19 of the cylindrical body 1 into the annular weld-portion 18 of the bottom 2.

Instead of off-setting the annular weld-portion 18 of the bottom 2 in a radially outward direction as indicated in FIGURES 1, 2 and 8, I may form the annular welded-zone 18 of the bottom 2 at the same diameter as the portion 16 thereof, without any intervening off-setting portion 17, as indicated in FIGURE 9, and off-set the annular weld-portion 19 of the cylindrical body 1 of the drum in a radially inward direction, through an annular off-setting portion 37, as indicated in FIGURE 9.

In the embodiment shown in FIGURES 10 and 11, the annular weld-zone 18 of the bottom member 2 is telescoped into the annular weld-portion 19 of the cylindrical body 1 of the drum, either by off-setting the weld-zone 18 in a radially inward direction, through the intermediate off-setting portion 38, as shown in FIGURE 10, or by off-setting the weld-portion 19 in a radially outward direction, through the annular off-setting portion 39, as shown in FIGURE 11.

In the embodiments indicated in FIGURES 2 and 8, the annular off-setting portion 17 acts as a "stop" against which the peripheral edge of the cyindrical body 1 may come to rest, so as to limit the amount of telescoping and to maintain the cylindrical member 1 and the body member 2 in co-axial relation wih each other.

In the embodiment shown in FIGURE 10 the annular off-setting portion 38 similarly serves as a stop to engage the end of the cylindrical body 1 so as to limit the telescoping and to maintain co-axial relationship.

In the embodiment shown in FIGURES 9 and 11 it is the upper annular edge of the bottom member 2 which is stopped by the annular off-setting portions 37 and 39, respectively, likewise to limit the telescoping and to maintain co-axial relationship.

By the construction of the present invention, a substantial saving is effected in the areas of the sheet-metal pieces required for the cylindrical body 1 and for the bottom member 2 respectively, as indicated in FIGURE 12.

Moreover, a thinner sheet-steel may be used for the same ultimate durability, because of the elimination of the annular fatigue-zone 40 which is present in the conventional crimp-seamed bottom construction indicated in dotted lines in FIGURE 12.

By the present construction, the fatigue and ultimate rupture or cracking of the bottom is greatly reduced.

Thus, in the heretofore conventional steel-drum constructions, in which the bottom was crimp-seamed to the cylindrical wall of the body, as indicated in dotted lines in FIGURE 12, the repeated flexing of the bottom, as it vibrates up and down while the filled drum is in transit, tends to create a fatigue in the metal in or near the annular zone where the more or less flat bottom panel is bent outwardly, adjacent the cylindrical wall of the body, to form the inter-folded crimped seam therewith.

Moreover, if such outwardly folded portion of the conventional crimp-seamed bottom is made in an arc of considerable radius, then the fatigue-zone is merely transferred to the outermost corner of such outwardly bent portion of the bottom, namely, where it is then folded outwardly in the crimp-seaming operation.

By the present construction, the main annular floor-contacting and bearing portion or footing **10** has a cross-section of large radius and is connected with the central bottom panel **9** through an annular portion **11** of reversed curvature but also of large radius and has its outer periphery connected through intervening annular portions whose cross-section is of short length and large radius.

By my present construction, there is virtually continuous or uninterrupted metal from the cylindrical side-wall of the body **1**, vertically downwardly through and into the bottom member **2**, and from there the metal continues without any interruptions and without any bends of small radius both through the stacking-seat **15** and through the annular footing **10** and finally into the main panel **9** of the bottom.

By the present construction, the possibility of metal fatigue and resultant weakening and ultimate fracture and cracking of metal is eliminated or so minimized as to greatly increase the safety factor in respect to the effects of transit-vibrations and also greatly to increase the effective life of the drum.

Having described and shown embodiments of my invention, I claim the following:

A steel drum having a generally cylindrical body formed of a flat sheet of steel curved into a generally cylindrical formation and having its juxtaposed edges electric-resistance welded to each other, a one-piece press-drawn dished sheet-steel bottom member having adjacent its periphery an annular channel-like footing of curved cross-section of large radius with its concave side facing inwardly of the dished formation of the bottom member and towards the interior of the drum and providing an annulus adapted to bearing against the floor or other supporting surface, said bottom member having a bottom stabilizing element extending downwardly from its center providing a relatively small central circular area co-planar with the lowermost surface of said bearing annulus and having also a generally flat elevated main bottom panel intermediate said element and the inner periphery of said annular footing and connected said annular footing through an annular portion of reversely-curved cross-section of large radius and having an annular stacking-seat portion extending upwardly and outwardly from the outer periphery of said annular footing and connected therewith through an annular portion of reversely-curved cross-section of large radius, and a vertically extending annular side-wall portion extending upwardly from said annular stacking-seat and telescoped with a corresponding lower annular portion of the cylindrical side-wall of the body electrical-resistance mash-welded thereto through the of large radius, and a vertically extending annular side-contiguous surfaces of said telescoped portions, with the combined thickness of said telescoped welded annular portions being substantially less than the sum of the original thicknesses of the telescoped portions, and a generally cylindrical annular portion of the side-wall of said bottom member beneath said telescoped welded portions being in substantial vertical alignment with the cylindrical side-wall of the body, the diameter of said stabilizing element being less than half the distance between said element and said footing whereby the major portion of the area of said bottom member comprising said main bottom panel is elevated above the plane of any substantially flat supporting surface on which the drum may be placed, and a sheet-steel top member having a main generally flat transverse panel portion and an outer peripheral flange extending upwardly therefrom and telescoped into the upper end of said body, the uppermost annular portion of said body being bent outwardly and the uppermost annular portion of the aforementioned flange of the top member being bent outwardly and extending out over the outwardly bent portion of top of the body and being sealingly secured thereto, the annular bend-zone between the aforementioned flange of the top member and its outwardly-bent portion forming a stacking-seat and being of a diameter slightly greater than the diameter of the outer periphery of the aforementioned annular footing of the bottom member and less than the outermost diameter of the aforementioned stacking-seat of said bottom member, and the vertical distance between such folded-over portion of the flange of the top member and the transverse panel portion of said top member being greater than the vertical distance between the effective seating zone of the stacking-seat and the bearing surface of the annular footing of the bottom member.

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THERON E. CONDON, *Primary Examiner.*

EARLE J. DRUMMOND, *Examiner.*

G. E. LOWRANCE, *Assistant Examiner.*