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Rosenbloom

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[54] **DRUM RECONDITIONING PROCESS**

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[52] **U.S. Cl.** .....**113/120 BB,** 113/1 K
[51] **Int. Cl.** **B21d 51/38**
[58] **Field of Search** .....113/120 BB, 1 K; 30/8, 9, 14, 15, 15.5

[56] **References Cited**

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2,175,411	10/1939	Rheem	113/120 BB
1,319,395	10/1919	Huddleston	113/1 K
2,845,887	8/1958	Kradoska	113/1 K
2,943,386	7/1960	Katz	113/1 K
3,083,455	4/1963	Marden	30/9

Primary Examiner—Richard J. Herbst
Attorney—Max Dressler et al.

[57] **ABSTRACT**

A drum reconditioning method including the steps of removing a double seamed closure from a drum body side wall by wedging the closure flange structure to an acute angle with respect to the drum body, rotating the drum and cutting the portion of the closure flange that bridges the drum body flange, removing the closure and treating the interior of the drum body, and double seaming a new closure to the treated drum body.

10 Claims, 5 Drawing Figures

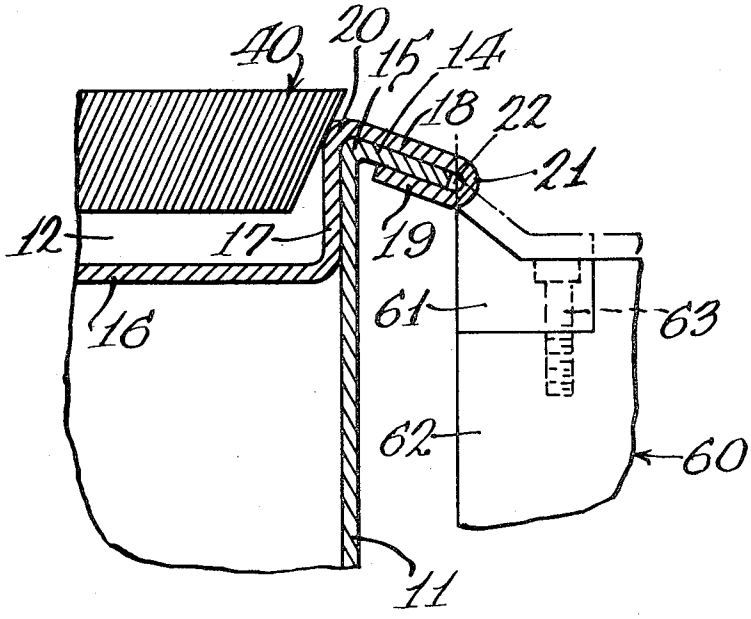


Fig. 1.

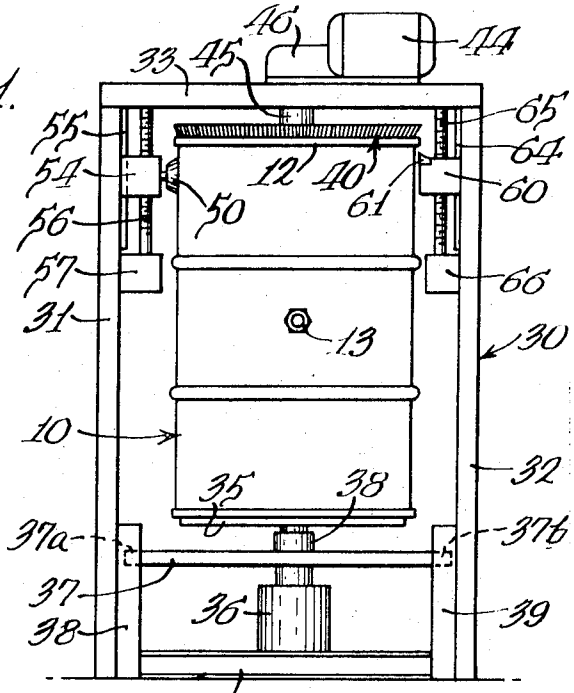


Fig. 2.

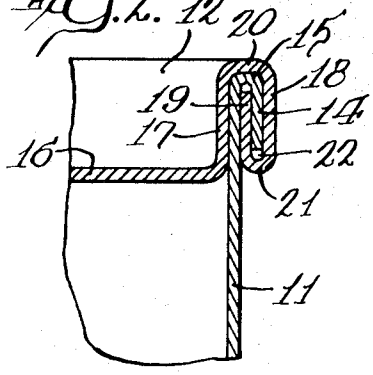


Fig. 3.

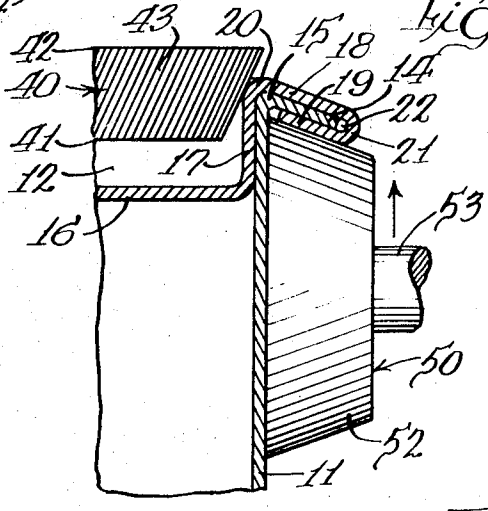


Fig. 4.

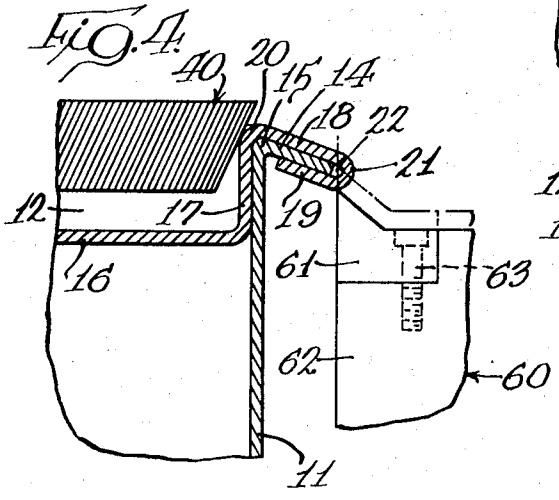
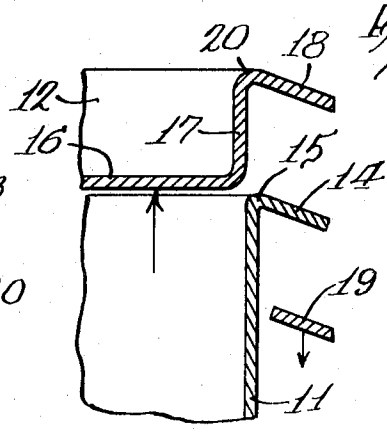


Fig. 5.



DRUM RECONDITIONING PROCESS

BACKGROUND OF THE INVENTION

The present invention relates in general to the reconditioning of large drums that are commonly used to ship fluids, such as petroleum products, chemicals, solvents, paints, adhesives, etc. Such drums conventionally include a hollow, generally cylindrically shaped body that is closed at both ends by a closure or head which is permanently secured to the body by a double seam configuration. Access to the interior of such drums for filling and discharge is attained through a bung hole that is commonly provided in the side wall of the drum, or in one of the ends thereof. Tight head drums of the above described type come in different sizes, but a common size is a 55 gallon drum, and it will be understood that drums of this size are relatively expensive. Hence, it has been common practice to reuse such drums to avoid the expense attendant to disposing of a drum after only a single use.

Since many of the products that are shipped within drums of the above described type leave a residue in the drum after it has been emptied, it is necessary to treat the interior of the drum after it has been emptied to remove the residue and place the drum in a condition suitable for use with a different product. The bung hole access opening does not provide sufficient clearance to enable a thorough interior cleaning operation to be performed, and hence those concerned with the reconditioning of tight head drums have resorted to several expedients in gaining access to a drum for reconditioning purposes.

The first, and most common, expedient that is practiced in the art is to convert a tight head drum to an open head drum by cutting into the side wall of the drum body beneath the closure lock seam. This provided ready access to the interior of the drum, but an open head drum is not completely satisfactory for all products, and hence the need remains for tight head drums.

In view of the continuing need for tight head drums, those skilled in the art have resorted to a technique which is commonly referred to as reheading or remanufacturing. The first reheading approach was to sever the drum body wall beneath the double seam and to double seam a new closure onto the body wall in the same manner as the original closure, after the interior of the drum had been treated. However, since the side wall of the drum was severed with this approach, such reheaded drums had a reduced volumetric capacity. It was a common experience for 55 gallon drums reheaded in this manner to lose as much as 1 ½ – 2 gallons of capacity in each reheading operation, and such drums also were not of equal height.

In view of the objection to loss of capacity and nonuniformity of drum size, those skilled in the art have long sought a satisfactory reheading method that would obviate these problems. It has been proposed (see for example Kradoska U.S. Pat. No. 2,845,887) to completely remove the head of a drum without cutting by unfolding the conventional double seam closure. This expedient has not been practiced commercially, because the equipment that is necessary to completely remove a lock seam closure in this fashion is prohibitively expensive.

A further reheading process that has been proposed is to partially unfold the double seam of the closure at

the bottom of a drum, sever the flange on the side wall of the drum body, and weld the closure back to the drum body side wall after the interior thereof has been treated. Such a process is disclosed, for example, in Katz U.S. Pat. No. 2,943,386. This process obviates the problem of loss of capacity, and at the same time insures that the reconditioned drums will be of the same size as original drums. However, drums having covers welded thereto cannot be repeatedly reconditioned, so that this expedient is limited.

SUMMARY OF THE INVENTION

The present invention solves the problems of the prior art by providing a process whereby drums may be reconditioned by cutting a portion of the double seam of the closure while retaining the flange on the body wall of the drum intact. This enables a new closure to be double seamed onto the drum body in a conventional manner after the interior of the drum has been treated, so that the reconditioned drum has the same capacity and height as the original drum. An end of the reconditioned drum can be removed again and again, and the drum reused with different products, so that the process of the present invention has great economic advantages over prior art processes. While the present invention requires the use of a new closure, the advantages of the invention far outweigh this increase in cost.

In its broadest sense, the present invention contemplates the severing of the portion of the closure that bridges the flanges of the closure which embrace the flange on the body of the drum by effecting relative rotary motion between the drum and a cutting tool that is fed under control and observation into progressive engagement with the closure structure. The closure flange structure is initially partially unfolded to a position disposed at an acute angle with respect to the body wall of the drum, to accurately locate the closure flange relative to the cutting tool, and to enable ready separation of the closure from the drum body once the severing step is completed. It will be understood that by only partially folding the closure flange structure relative to the drum body, the closure is not excessively fatigued.

The present invention also provides a means whereby the drum can accurately be positioned relative to the flange unfolding tool and the closure cutting tool. This is a problem of no small importance in removing the head of a large shipping drum, since relatively wide tolerances are accepted in the drum industry making various drums supposedly of the same size different from one another. For example, in a drum head having a 22 ½ inch inside diameter, tolerances of plus or minus one-sixteenth inch are tolerated, so that it is possible for drums of this size to have an overall diametric variance of one-eighth inch. To solve problems resulting from attempting to remove heads from drums of varying diameter, the present invention incorporates the step of accurately locating a drum relative to the drum removal means. In this regard, a tapered centering member is provided in fixed spatial relationship with respect to the flange unfolding mechanism and the flange severing mechanism, and relative movement is effected between a drum supporting platform and the centering member to cause the centering member to engage within the drum head and thereby accurately locate the drum relative to the head removal means.

In accordance with another aspect of the invention, the flange severing means is adjustably located at an

operator station, so that the position thereof can be accurately manually controlled to insure that the cutting means does not engage the flange on the body of the drum. To this end, both the cutting tool and the closure of the drum are readily visible at the operator station, and a means is provided whereby the relationship of the cutting means to the closure flange can be varied, when desired or necessary. The present invention contemplates that the cutting means will progressively shear the bridging portion of the closure flange that is wrapped around the end of the body flange, and since the body flange is normally spaced from the bridging portion of the closure flange, the operator can visually determine when the cutting operation has been completed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a drum in position at an operating station of an exemplary form of apparatus that may be used to remove the head from the drum;

FIG. 2 is an enlarged cross-sectional view through the upper portion of the drum of FIG. 1;

FIG. 3 is a view similar to FIG. 2, but showing the flange of the drum in a partially unfolded position;

FIG. 4 is a view similar to FIGS. 2 and 3 and showing in full lines a flange cutting member at the beginning of a flange cutting operation and in broken lines the position of the flange cutting member at the end of the flange cutting operations; and

FIG. 5 is a view similar to FIGS. 2–4 and showing the closure removal step of the process of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings and will herein be described in detail a preferred embodiment of the invention, with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the embodiment illustrated. The scope of the invention will be pointed out in the appended claims.

Referring first to FIG. 1, a closed end drum is illustrated in its entirety at 10, and drum 10 includes a generally cylindrical side wall 11 that is sealed at one end by a closure 12. Closure 12 is double seamed to the body wall 11 in the usual manner, and it will be appreciated that a closure 12 may be provided at each end of the drum 10, or the end of the drum opposite the closure 12 may be permanently sealed in a different fashion. A bung hole opening 13 is illustrated in FIG. 1 in the side wall 11 of drum 10, for filling and dispensing of products, and it will be understood that a similar bung hole opening may also be provided in closure 16.

Referring now to FIG. 2, body wall 11 includes a reversely bend flange 14 at one end thereof, and flange 14 is connected to body wall 11 by a bridging portion 15. Drum portions 14 and 15, of course, extend circumferentially around the end of the body wall 11 and flange portion 14 is generally parallel with side wall 11. Closure 16 includes a main head portion 16 recesses inwardly from the end of body wall 11; a first flange 17 extending outwardly from head portion 16 generally parallel with body wall 11 and engaging the interior thereof; a second flange 18 reversely bent with respect to flange 17, generally parallel with body wall 11, and engaging the outer surface of body flange 14; and a third flange 19 generally parallel with body wall 11, reversely bent with respect to flange 18, and interposed between body flange 14 and the end of wall 11 and in face-to-face engagement therewith. Flanges 17–19, of course, extend circumferentially around the end of wall 11, and flanges 17 and 18 are joined by bridging portion 20, while flanges 18 and 19 are joined by bridging portion 21. The flanges on the closure 12 and body wall 11 cooperate to form a conventional double seam, as will be well understood to those skilled in the art. In forming such a seam in relatively heavy gauge material that is utilized in drums of the type with which the present invention is concerned, when the double seam is formed, a gap 22 exists between the end of body flange 14 and the bridging portion 21 between closure flanges 18 and 19. The present invention takes advantage of this clearance opening, which is approximately one-sixteenth inch in 18 gauge material (0.047 inch) commonly used in drums of the type described herein, by severing the closure at this juncture, as is shown in FIG. 4 and as will be hereinafter described.

The method of the present invention will be best understood by referring briefly to an exemplary form of apparatus that may be utilized to perform the various steps of the invention. Such apparatus is shown generally at 30 in FIG. 1, and includes side members 31 and 32 spanned by a top member 33 and a base 34. A drum supporting platform 35 is provided at an operator station associated with apparatus 30, and in the illustrated embodiment, platform 35 is arranged for vertical movement relative to the frame structure by a pneumatic cylinder 36 carried by base 34. Platform 35 may be supported upon a carrier member 37, with bearing means 38 being provided between platform 35 and carrier member 37, so as to enable platform 35 to rotate relative to carrier member 37. Carrier member 37 may be held against rotation by having end portions 37A and 37B thereof engage within guide members 38 and 39 on frame members 31 and 32, respectively, it being understood that guide members 38 and 39 are arranged so as to guide the carrier member 37 and platform 35 during vertical movement thereof by cylinder 36.

Because of the relatively wide tolerance that is accepted in the drum industry, in order to insure that the drum 10 is accurately centered with respect to the apparatus 30, a tapered centering member 40 is rotatably supported upon cross member 33 above platform 35. Locating member 40 has a first small diameter portion 41 (FIG. 3) that is smaller in diameter than the internal diameter of flange 17 of closure 12, and a second large diameter portion 42 that is larger in diameter than the inner diameter of flange portion 17 of closure 12. In this manner, when the drum 10 is moved upwardly by cylinder 36, the portion of centering member 40 between ends 41 and 42 will engage within the closure 12 and positively center the drum on the apparatus 30.

In the performance of the process of the present invention, rotary motion is imparted to drum 10, and the centering member 40 may be utilized to perform this step. In this regard, the centering member 40 is preferably a hardened metal member which is provided with a knurled or serrated outer surface 43, so that when the cylinder 36 moves the drum 10 into engagement with the centering member, the drum will be driven thereby.

Member 40 may be rotated by a motor 44 carried by frame member 33 and coupled to a shaft 45 on the member 40 through a gear box 46.

Summarizing briefly, the drum 10 is initially loaded upon platform 35, which is initially spaced vertically below centering member 40. Cylinder 36 is then energized in a conventional manner to move carrier member 37 and platform 35 vertically upwardly until positive driving engagement is established between centering member 40 and closure 12. It will be understood that when the centering member 40 engages within closure 12, the drum 10 is accurately located relative to the frame of the machine. Motor 44 is then energized to impart rotary motion to drum 10, and bearing 38 enables platform 35 to rotate relative to carrier member 37 which is constrained against rotation by guide members 38 and 39.

The next step of the process of the present invention is to partially unfold the double seam flange configuration of the drum from the position of FIG. 2 to the position of FIG. 3. To achieve this, a wedging member 50 is provided which has a frusto-conically shaped external surface 52 that is disposed at an acute angle with respect to body wall 11. Member 52 is carried by a shaft 53, which may be driven by a motor, not shown, although to perform the method of the present invention it is not necessary that the member 52 be driven. Shaft 53 is supported within a housing 54, and housing 54 is mounted for vertical movement relative to apparatus 30 by guide surfaces 55 on frame member 31. While any suitable means may be provided for moving housing 54, a lead screw 56 is illustrated in FIG. 1, with one end of the lead screw being rotated by a motor 57, and with the other end of the lead screw being rotatably supported in frame member 33. It will be appreciated that when motor 57 is energized, lead screw 56 engages an internally threaded hole within housing 54 to vary the position of the wedging member relative to the closure 12 on drum 10. The movement of wedging member 50 need not be motorized, and can be done manually, but in any event, wedging member 50 is mounted in fixed relationship with respect to centering member 40, so that when the wedging member is moved into engagement with the flange structure of closure 12 as the drum 10 is rotated, the flange structure will be accurately moved to the position of FIG. 3.

The relationship of the flange structure illustrated in FIG. 3 is important to the performance of the process of the present invention, since by folding the flange structure to an angle less than 90° with respect to the wall 11 of the drum, severe stresses are not imparted to the bridging portions 15 and 20 of the drum wall and closure, respectively. In the present invention, it is contemplated that drums will be capable of being repeatively reconditioned, and it is desirable, to the extent possible, to minimize flexure of the flange structure which ultimately results in fatiguing of metal.

After the flange structure has been wedged, or partially unfolded to the position of FIG. 3, a cutting member 60 is actuated under manual control to sever the bridging portion 21 and thereby free closure 12 from the body of the drum 10. While the flange unfolding and cutting steps may be performed on the same machine and at the same work station, as shown in FIG. 1, it should be understood that this is not critical to the present invention, and these operations could be performed at different work stations by different pieces of equipment.

In FIG. 4, cutting tool 60 is illustrated as including a cutting member 61 secured to a holder 62 by a set screw 63, although it should be understood that the present invention contemplates that any suitable type of cutting tool may be provided. Cutting tool 60 is mounted for vertical movement relative to apparatus 30 by suitable guide surfaces 64 on frame member 32 and a lead screw 65 is illustrated in FIG. 1 for moving cutting tool 60. One end of lead screw 65 is rotatably supported in frame member 30, while the opposite end of lead screw 65 is driven under manual control either by a motor 66, or directly by hand. Lead screw 65 is positioned within an internally threaded hole within cutting tool 60, so that when the lead screw is rotated the cutting tool is moved vertically relative to the drum 10, it being understood that the cutting tool 60 moves along a path that is fixed spatially relative to centering member 40.

After cutting tool 60 is moved vertically upwardly from the full line position to the broken line position shown in FIG. 4, the cutting member 61 progressively severs the corner of bridging portion 21. The relationship between the position of centering member 40, wedging member 50 and cutting tool 60 is selected so that the edge of cutting member 61 passes through the center of the gap 22 at the end of body flange 14. Means, not shown, may be provided for adjusting wedging member 50 and cutting tool 60 radially to accommodate different size drums.

As previously noted, it is desirable that the cutting member 61 progressively move through the bridging portion 21 of the closure seam. In accordance with the present invention, the drum 10 is rotated through a plurality of revolutions as the cutting tool 60 is moved along its broken line cutting path illustrated in FIG. 4. This not only reduces cutting effort, but also insures that if a flange of the drum has been bent during use so that the edge of flange 14 is not precisely located relative to the cutting member 61, the operator can readily vary the position of the cutting tool, as desired. The cutting tool 60 may be advanced to cut off both thicknesses of material on opposite sides of gap 22, as shown in FIG. 5, or only the lower thickness of material may be severed. In either event, once the platform 35 has been lowered to withdraw the centering member 40, the closure 12 can be readily removed. It should be noted that, with reference to FIG. 5, the internal diameter of the severed flange 19 is larger than the circumferential ribs that are conventionally provided on the drum side wall, so that the flange 19 can be readily removed from the drum.

Once the closure 12 has been removed from the drum side wall, the interior of the drum may be treated in a suitable manner to remove whatever residue is present therein from the previously shipped material. The treatment of the interior of the drum 10 may take the form of initially burning off any material therein, and subsequently shot blasting the charred remains of the residue. The interior of the drum may then be subjected to chemical baths, dried, painted and/or lined. If the side wall 11 of the drum has been bent during previous use, the drum may be expanded to its original configuration prior to the performance of the last steps. Once the drum has been restored to a condition suitable for reuse, a new closure is secured to the open end

of the drum in the conventional manner to form a double seam with the pre-existing flange 14 on the side wall of the drum body.

From the foregoing it will be recognized that the process of the present invention enables a drum head to be removed without damage or destruction to the flange on the drum side wall, so that when a new head is double seamed to the drum body, the reconditioned drum has the same capacity and height as the original drum.

What is claimed is:

1. A method of reconditioning a normally closed generally cylindrical drum having a hollow body wall and a closure sealed to said wall at least at one end of said drum; said wall including a reversely bent flange at said one end which extends circumferentially around said wall in parallelism therewith; said closure including a main head portion positioned interiorly of said body wall at said one end and first, second, and third flanges extending circumferentially around said wall in parallelism with said body wall and in sealed relationship therewith, said first flange merging with said main body portion and engaging the inner surface of said body wall at said one end, said second flange merging with said first flange and being reversely bent relative thereto and engaging the outer surface at said body wall flange, and said third flange merging with said second flange and being reversely bent relative thereto and positioned between said body wall flange and the outer surface of said one end of said body wall, said method comprising: rotating said drum about the axis of said body wall; forcing a wedging tool into a flange folding position between the outer surface of said body wall and the third flange of said closure; retaining said wedging tool in said flange folding position during rotation of said drum to fold the second and third flanges of the closure and the body flange to a position at an acute angle with respect to said body wall; moving a cutting tool relative to said drum into a flange severing position in engagement with the portion of said closure bridging said second and third flanges; progressively moving said cutting tool relative to said bridging portion during rotation of said drum to sever said third flange from said closure while said body flange remains completely intact; removing said closure from said one end of said body wall to provide access to the interior thereof; treating the interior of said drum; placing a new closure on the open end of said body wall; and folding first, second and third flanges on said new closure into the previously described sealed relationship with said body wall and flange thereof to thereby provide a reconditioned drum having the same height and volumetric capacity as the original drum and which is itself capable of being further reconditioned.

2. A method as set forth in claim 1 in which the main head portion of said closure is recessed inwardly of the end of said body wall, and including the further step of inserting a tapered centering member into said closure to locate said drum relative to said wedging tool and said cutting tool.

3. A method as set forth in claim 2 wherein said drum rotating step is performed by positively holding said drum against said centering member, and rotating said centering member.

4. A method as set forth in claim 3 in which said drum is rotated about a vertical axis, and wherein said holding step is performed by moving a drum supporting platform upwardly relative to said centering member.

5. A method as set forth in claim 1 wherein said drum is rotated several revolutions as said cutting tool is progressively moved relative to said bridging portion.

6. A method as set forth in claim 5 including the initial step of locating the drum at an operator station where the cutting tool and closure are readily visible, and including the further step of manually controlling the progressive movement of said cutting tool to insure that the cutting tool does not engage the body flange.

7. A method of reconditioning a normally closed generally cylindrical drum having a hollow body wall and a closure sealed to said wall at least at one end of said drum; said wall including a reversely bent flange at said one end which extends circumferentially around said wall in parallelism therewith; said closure including a main head portion recessed inwardly of said body wall at said one end and first, second, and third flanges extending circumferentially around said wall in parallelism with said body wall and in sealed relationship therewith, said first flange merging with said main body portion and engaging the inner surface of said body wall at said one end, said second flange merging with said first flange and being reversely bent relative thereto and engaging the outer surface at said body wall flange, and said third flange merging with said second flange and being reversely bent relative thereto and positioned between said body wall flange and the outer surface of said one end of said body wall, said body flange terminating short of the closure portion which bridges said second and third flanges to provide a gap therebetween which extends circumferentially around said body wall, said method comprising: placing said drum on a supporting platform at an operator station in spaced relationship with respect to a tapered centering member having a first portion with an external diameter smaller than the internal diameter of the first flange of said closure and a second portion with an external diameter larger than the internal diameter of the first flange of said closure; effecting relative movement between said platform and said centering member to cause said centering member to engage within said closure and center said drum at said operator station and to place said drum in a location where said closure is readily visible; rotating said drum about the axis of said body wall; forcing a wedging tool into a flange folding position between the outer surface of said body wall and the third flange of said closure; retaining said wedging tool in said flange folding position during rotation of said drum to fold the second and third flanges of the closure and the body flange to a position at an acute angle with respect to said body wall; moving a cutting tool relative to said drum into a flange severing position in engagement with the portion of said closure bridging said second and third flanges; progressively moving said cutting tool relative to said bridging portion under manual control during rotation of said drum while observing said closure to cause said cutting tool to enter the gap between said body flange and bridging portion to thereby sever said third flanges from said closure while said body flange remains completely intact; effecting relative movement between said platform means and said centering member and removing said drum from said operator station; removing said closure from said one end of said body wall to provide access to the interior thereof; treating the interior of said drum; placing a new closure on the open end of said body wall; and folding first, second and third flanges on said new clo-

sure into the previously described sealed relationship with said body wall and flange thereof to thereby provide a reconditioned drum having the same height and volumetric capacity as the original drum and which is itself capable of being further reconditioned.

8. A method as set forth in claim 7 wherein relative movement between said platform and said centering member is effected by moving said platform relative to said centering member.

9. A method as set forth in claim 8 wherein said centering member is positioned above said platform, and wherein said platform is moved vertically relative to said centering member.

10. A method as set forth in claim 9 wherein said drum rotating step is performed by rotating said centering member while said drum is held thereagainst by said platform.

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