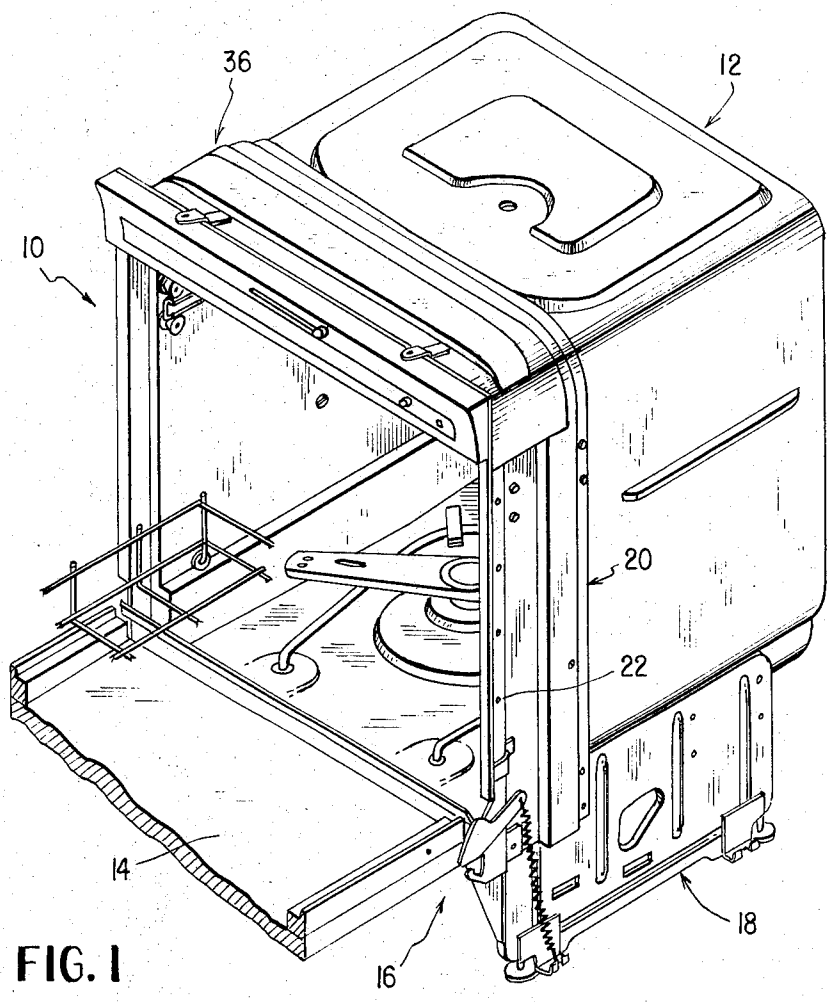


FIG. 1

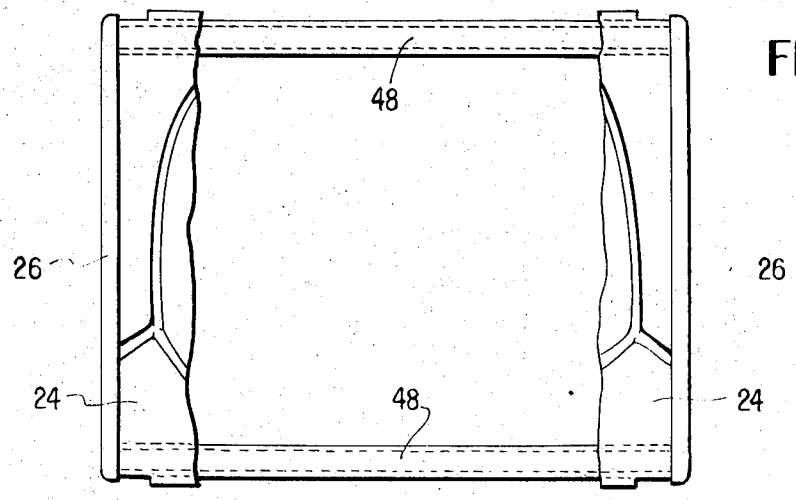


FIG. 4

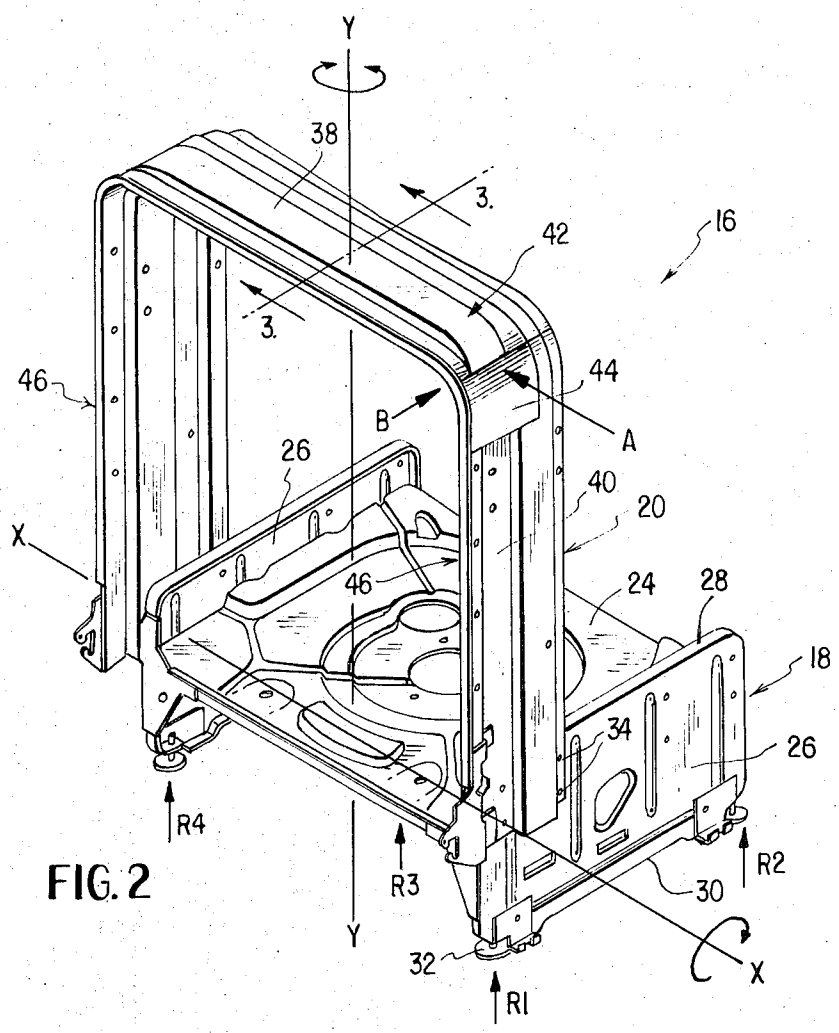

Y
38
3
42
16
3
46
44
B
A
26
40
20
X
46
24
28
18
34
26
R4
R3
R2
30
Y
32
X
R1

FIG. 2

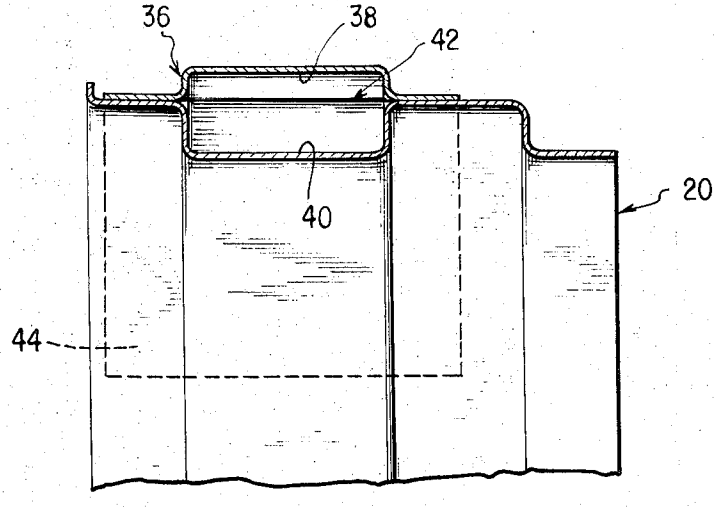

36
38
42
40
20
44

FIG. 3

TORSIONALLY REINFORCED, SKELETAL SUPPORT FRAME FOR PLASTIC TUBS

BACKGROUND OF THE INVENTION

The invention is directed to large capacity front loading dishwashers of the type normally comprising a permanent installation and employing upper and lower dish supporting racks as opposed to the smaller, low capacity, portable and/or top loading dishwashers. The reason for the distinction is that the ultimate objective of the invention is the employment of a unipartite plastic tub in large capacity, front loading dishwashers and while some of the problems presented by a proposed use of such a tub would be common to dishwashers of either type; the majority are distinct. Typical distinctions relate to increasing wall flexibility with increasing area, the absence of encompassing metal housings, greater tub shape complexity and additional interior tub mountings such as dual rack support structures. Accordingly, the ensuing background discussion relates primarily to front loading dishwasehrs of the type normally adapted for a permanent, under cabinet. installation.

The high temperature, corrosive environment to which automatic dishwasher chambers are subjected dictates that the surfaces of those internal components in contact with such environment be either highly resistant, or immune, to corrosion. Corrosion resistant metals such as stainless steel represent a substantial cost factor in this highly competitive appliance field and the long term industry trend has been toward the use of inert materials to resist the corrosive effects of the chamber environment which are magnified adjacent the usual metal tub seam welds. Insofar as the tub itself, representing the far greater internal surface area exposure, is concerned; the general trend in the United states has been toward the application of an adherent plastic coating to the tub interior while European manufacturers have gone more to the use of plastic tub liners. In either event, the basic structural and design parameters that have prevailed since the advent of the modern front loading automatic dishwasher remained valid. This for the reason that overall dishwasher design parameters, both as regards utility and structural integrity, are virtually unaffected by whether the conventional metal tub is coated, lined or exposed.

Conceptually, the use of a unipartite plastic dishwasher tub, i.e., one not requiring a more rigid backing or outer support structure, represents a substantial advance in the art. Exemplary are the greatly decreased cost factors of a molded plastic tub vis-a-vis that of a metal tub requiring a further coating or lining operation; reduction in finishing labor requirements and particularly tub welding operations; longer tub life due to corrosion resistance which is independent of faulty coating procedures or chipping; decreased thermal and acoustical tranmission thus minimizing the need for separate insulation; and a lesser invention requirement for separable components susceptible of integral molding with the tub.

The reduction to practice of such a concept, as applied to front loading dishwashers on an assembly line basis, however, presents a myriad of problems which arise as a requirement for difrerent approaches to those engineering considerations which had previously been predicated upon the use of a metal tub. The distinctions are primarily those associated with material strength

the unusually high temperature environment to which the tub is subjected and considerations relating to plastic molding procedures. Thus, while the structural integrity of a metallic box beam shape defined by the conventional front loading tub is more than sufficient to resist excessive wall deformation as a function of normal loading forces as during installation, adjustment or use and temperature variations from room ambient to approximately 225° F; such normally applied loading forces would, in the absence of appropriate compensating structure, produce unacceptable wall deformation in a like configured plastic tub. Similarly, impact strength is normally of little moment in the design and installation of metallic tubs but is a matter of major concern in plastic tub design. Furthermore, various structural features appearing in a formed plastic tub as an incident of the forming operation create problems not previously associated with metal tub fabrication. Exemplary of the latter distinction are the presence, on the finished product, of mold lines and/or mold retention ribs creating localized areas of decreased impact resistance as well as the usual wall draft to permit removal of the product, or tub, from the forming mold. One primary disadvantage arising from this necessary wall draft concerns the mounting of the dishwasher rack supporting tracks in parallel.

In addition to the foregoing considerations which relate primarily to mounting and/or assembly procedures for larger capacity front loading machines, the desirability of precluding tub discoloration and the desirability for firewall separation of the tub and those electrical components constituting a fire hazard are common to all automatic dishwashing machines. As regards plastic tub discoloration, it is preferred to avoid the use of certain conventional strand type reinforcing fillers, such as chopped strand fiber glass, for the reason that their intersection with the interior plastic surfaces may provide a "bleed" path for food stains to permeate the tub structure.

The prior art suggestions relating to the use of small capacity plastic tubs of the top loading type, as in U. S. Pat. No. 2,691,986 and the use of separate plastic tub components, as in U. S. Pat. Nos. 2,877,778; 3,385,306 and 3,460,878, offer little in the way of guidelines as regards a practical reduction to practice of a large capacity front loading tub for the reason that most of the problems requiring solution are not present in smaller and/or top loading units and particularly those which employ an enveloping metal housing.

The present invention relates to the mounting and support of a front loading plastic tub and more particularly to the torsional reinforcement of a skeletal tub support frame which reinforcement permits the support frame to be of smaller, lighter gauge construction while other of the aforementioned matters are more fully described and claimed in the following, commonly owned, copending applications:

- Ser. No. 319,556, filed Dec. 29, 1972, for Double, Reversed Mounting Boss for Plastic Tubs;
- Ser. No. 319,201, filed Dec. 29, 1972, for Fill Funnel Construction for Plastic Tubs;
- Ser. No . 319,555, filed Dec. 29, 1972, for Thermal Growth Compensation and Mounting for Plastic Dishwasher Tubs;
- Ser. No. 319,203, filed Dec. 29, 1972, for Front Loading Dishwasher Employing Plastic Tub Construction;

backing plate **24** is primarily a "flat plate" structure and consequently has low torsional rigidity; the torsional load is transmitted to mounting collar **20** as a couple through fasteners **34** resulting in a tendency to rotate the mounting collar **20** about an axis Y—Y which would cause closure gasket sealing surface warpage and latch misalignment.

Similarly, conventional translational loading forces indicated by vectors A and B, as are normally involved in a typical undercabinet installation, induce mounting collar rotation about the axis Y—Y.

The torsional rigidity of the skeletal frame is substantially increased by the provision of a "torsion bar" across the bight of the U-shaped mounting collar which is effected by welding of the reinforcing member **36,** having a channel shaped portion **38,** in overlying relation to the channel shaped section **40** comprising a part of the mounting collar to define a closed box beam **42** (FIG. **3**). The reinforcing member **36** may include flat end portions **44,** extending beyond the channel shaped portion **38,** which extend down along the outer surfaces of the mounting collar legs **46** and are welded or otherwise secured thereto to provide increased bending strength.

Adequate resistance to torsional loading induced by the reaction forces R_1–R_4 may be achieved by effectively sitffening the backing plate **24** as by the cross securement of one or two closed box sections **48** to side panels **26** as in FIG. **4.** In the use of reinforcing members shown in FIG. **4,** either the lower tub wall or the base assembly may be appropriately modified to accommodate their positionment above the backing plate or the reinforcing member may be positioned below the backing plate, as shown.

While the background discussion of this specification is related primarily to front-loading dishwashers of the typy normally adapted for a permanent undercounter installation as opposed to the type of dishwasher having a hinged top closure for top-loading, it should be emphasized that many such machines are commercially produced and purchased for indefinite use as a free-standing model adaptable at a later time by the owner to a built-in unit beneath a kitchen countertop to blend with the matching cabinet structure of the kitchen. Generally, the differentce between the unit designed as a "convertible" and the unit to be immediately permanently installed is the inclusion of side, rear and top cabinet appearance panels to the basic unit structure as designed for permanent installation. Therefore, it should be understood that the present invention is specifically directed to the front-loading type of dishwasher structure whether of the generally lower-cost unit having no appearance cabinet enclosure or the more elaborate, temporarily portable unit designed for later modification for use in a fixed location.

We claim:

1. In a front loading dishwasher including a plastic tub having a generally rectangular cross-section and an open front; a metal tub support frame including a generally rectangular tub engaging portion in backing engagement with the external periphery of said plastic tub adjacent the open front thereof; said metal tub support frame including a base assembly underlying a major fraction of the lower tub wall and an upstanding mounting collar including a channel section and embracing and engaging a minor fraction of the top and side walls of said tub; a reinforcing member rigidly secured to the top portion of said collar and extending across the width of said top tub wall for increasing the torsional resistance of said tub engaging frame portion; said reinforcing member comprising a channel shaped portion overlying said mounting collar channel section and defining a closed box shape therewith in overlying relation to the tub top wall, said reinforcing member including flat end portions extending beyond said channel shaped panel portion and downwardly along the sides of said mounting collar and rigidly secured to said mounting collar.

* * * * *

United States Patent [19]

Levin

[11] **3,811,747**

[45] **May 21, 1974**

[54] **TRANSIT/COMBINATION CASE PROVIDING UNIQUE LATCH ACCESSIBILITY AND NOVEL STACKING AND LATCHING FEATURES**

[75] Inventor: **Herbert L. Levin,** Wyckoff, N.J.

[73] Assignee: **International Telephone and Telegraph Corporation,** Nutley, N.J.

[22] Filed: **Mar. 10, 1972**

[21] Appl. No.: **233,473**

[52] **U.S. Cl.** ..... **312/308,** 220/55 T, 220/46 R, 220/1.5

[51] **Int. Cl.** **B65d 21/00**

[58] **Field of Search** .. 220/97 R, 97 C, 97 D, 23–83, 220/59, 60, 55 T, 55 BD, 1.5, 46 R; 292/DIG. 49, DIG. 42, 256.69; 24/270, 68 T; 206/190.37; 229/DIG. 1

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Primary Examiner—William I. Price
Assistant Examiner—Steven M. Pollard
Attorney, Agent, or Firm—John T. O'Halloran; Menotti J. Lombardi, Jr.; Richard A. Menelly

[57] **ABSTRACT**

This disclosure describes improvements in transit/-combination case design. The transit/combination case cover latches are mounted in angled recesses on each of the four sides of the case cover to permit easy removal thereof from the front when stacked with other cases. Novel arrangements of cover latching mechanisms which are multi-functional to provide a hinging capability are disclosed which are operable in the angled recesses of the cover. Multi-functional case body reinforcement and stacking facilities are included in the form of complementary elongated raised portions and depressions in the top and underside of the case body respectively, which serve the double utility on the inner surface of the case bottom of being slides, or of providing bases therefore, to facilitate easy removal of the case contents. Provision is also made for pivotable cover latch mechanisms which provide the additional function of intercase latching when in the stacked mode. In a preferred embodiment of latch mechanism having hinging capability and "round-the-corner" operation required from the mounting thereof in the angled recesses of the case cover, the latch hook is utilized as the tension member of the pivot arrangement, while the compression member of the pivot arrangement forms an integral part of the latch itself.

16 Claims, 22 Drawing Figures

