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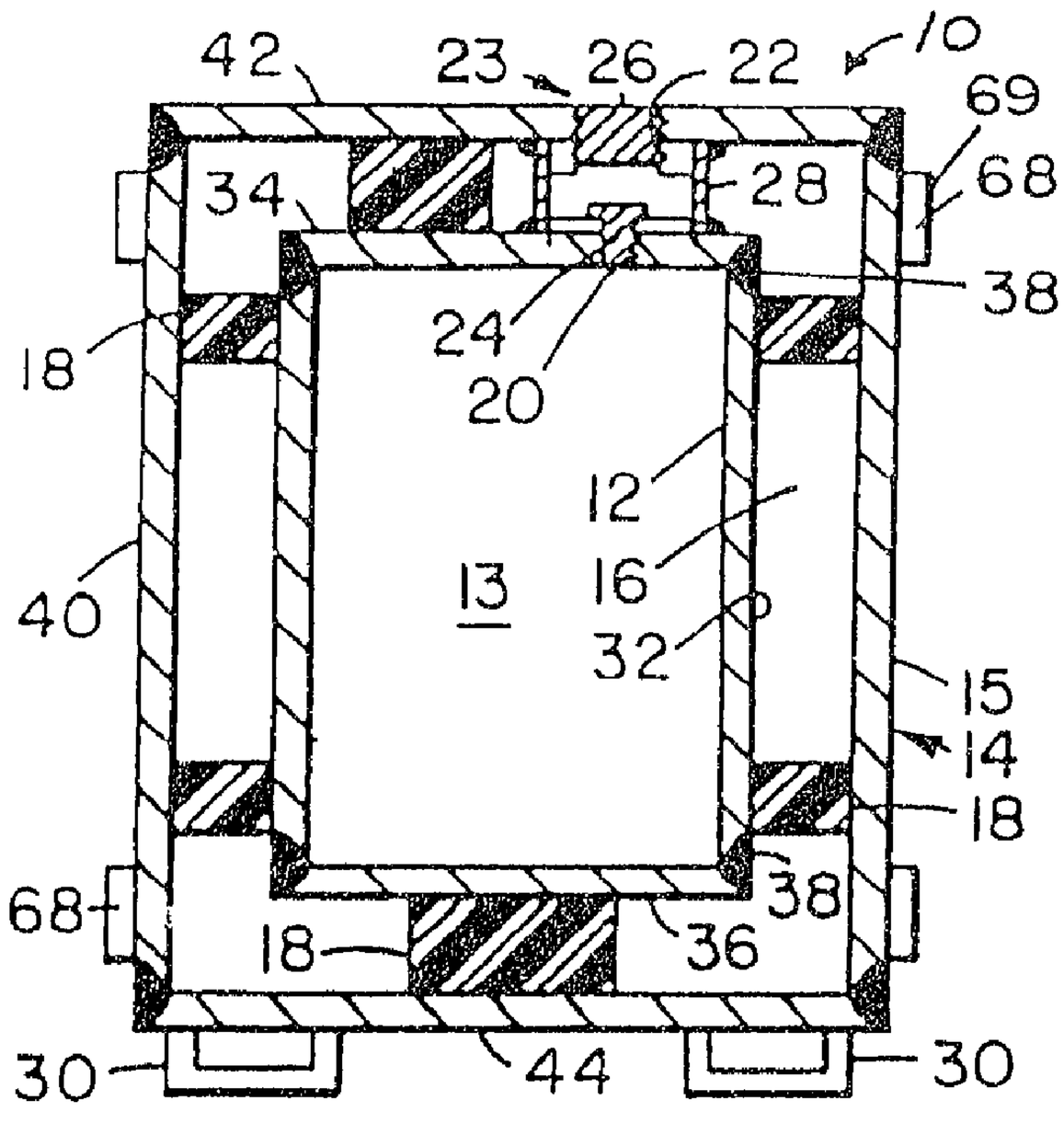

(57) Abrégé/Abstract:
A container unit for flowable materials, having puncture resistance and leak containment characteristics, comprises a metallic, closed and continuous first wall (12) providing a containment vessel (13) for flowable material, a metallic, closed and continuous second wall (14) providing a protective shell (15) surrounding the vessel (13) and spaced therefrom over at least a major portion of the outer surface thereof to provide protective spacing therebetween, spacer elements (18) positioned between the vessel (13) and shell (15) at least one aperture (20) in adjacent portions of each of the vessel (13) and shell to provide one or more access ports for the vessel, individual closure means (24) for each aperture, a tubular wall (28) extending between and connecting the apertures forming each access port to provide a conduit for the flow of materials into and out of the vessel (13), and at least one base affixed to the shell for stabilizing the container unit.

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ABSTRACT OF THE DISCLOSURE

A container unit for flowable materials, having puncture resistance and leak containment characteristics, comprises a metallic, closed and continuous first wall (12) providing a containment vessel (13) for flowable material, a metallic, closed and continuous second wall (14) providing a protective shell (15) surrounding the vessel (13) and spaced therefrom over at least a major portion of the outer surface thereof to provide protective spacing therebetween, spacer elements (18) positioned between the vessel (13) and shell (15) at least one aperture (20) in adjacent portions of each of the vessel (13) and shell to provide one or more access ports for the vessel, individual closure means (24) for each aperture, a tubular wall (28) extending between and connecting the apertures forming each access port to provide a conduit for the flow of materials into and out of the vessel (13), and at least one base affixed to the shell for stabilizing the container unit.

REUSABLE CONTAINER UNIT

This invention concerns containers having markedly simplified construction and special utility for the bulk shipment of fluid materials which may be of a toxic or otherwise hazardous nature. The invention especially concerns novel construction and features which allow repeated reuse of the container even though it is subjected to rough treatment which normally would puncture or otherwise seriously damage such containers as are presently in use for bulk fluids transport.

Of great concern to the transporter, user, Federal Regulators and environmentalist is the relative ease with which such conventional containers can be damaged, often resulting in leaks and spills of toxic or otherwise dangerous chemicals. Such incidents are particularly common for liquid containers of capacities of up to about 500 or 1000 gallons, which containers are typically moved about and stacked by fork-lift trucks or the like. During such operations, the puncture or other severe damage to the container often occurs. As a result of these experiences, Federal Regulations now substantially restrict the reuse of chemical containers and costly disposal thereof is the necessary consequence.

Heretofore, the concept of structuring fluid transport containers of the type which are readily handleable by lifting apparatus such as fork lift trucks, hand dollies, hand rollable lifts, truck tailgate lifts or the like has been largely limited to such well known containers as the conventional 55 gallon drum. Such drums are typically one-way useable and transportable in accordance with Federal Regulations and consequently they must either be disposed of or reconditioned, both in strict accordance with these regulations.

Heretofore, containers of readily handleable size have not been designed with the specific object of being reusable for toxic or otherwise dangerous fluid materials, particularly not so as to be able to easily withstand the testing rigors of the Federal Regulations covering the structure and performance of such containers while keeping the weight and cost thereof within practical limits.

Typical of attempts to solve some of the problems associated with the conventional 55 gallon drum is the disposable container shown in U.S. Patent 4,930,661 wherein a double walled structure of corrugated paper board and plastic is shown. Also, U.S. Patent 4,989,741 discloses an elaborately configured container but one which lacks certain desirable features of penetration resistance and spill containment, and which must be of extremely heavy construction in order to withstand the destructive test forces of the aforesaid Federal Regulations concerning reusable chemical containers.

Objects of the present invention therefore, are: to provide a reusable transport container for fluids wherein the container is so constructed that its mechanical strength, puncture resistance, resistance to leakage through its access ports, capacity for leakage containment in the event of puncture, and resistance to significant distortional damage is very high relative to its overall weight; and to provide such a container that is relatively simple in design and economical in construction.

These and other objects hereinafter appearing have been attained in accordance with the present invention which is defined in its broad sense as a reusable container unit for flowable materials having enhanced puncture resistance and leak containment capability, comprising metallic, substantially closed and continuous first wall means providing containment means for said material, metallic,

substantially closed and continuous second wall means providing protective shell means surrounding said containment means and spaced therefrom over at least a major portion of the outer surface thereof to provide protective spacing therebetween, spacer means positioned between said containment means and shell means for substantially maintaining said spacing therebetween, aperture means in each of said containment means and shell means adapted to provide access port means for said containment means, individual closure means for each said aperture means, tubular wall means extending between and connecting said aperture means to provide conduit means for the flow of said materials into and out of said containment means, and base means affixed to said shell means for stabilizing said container unit in at least one operative position.

In certain preferred embodiments:

(a) a major portion of said spacing is filled with one or more impact protective or absorptive materials selected from elastomer, foamed plastic, glass wool, steel wool, fiber wool, particulate absorbent clays, structural plastic, wood, fiber board or other cellulosic material;

(b) said containment means and shell means are of steel, and the ratio of said spacing thickness to each said wall means thickness is from about 4 to about 100, most preferably from about 30 to 80;

(c) each said wall means substantially defines a drum having substantially cylindrical side means and substantially flat or domed end means, and wherein said aperture means are located in adjacent end means;;

(d) said spacer means is distortionable under impact force applied to said protective shell means to thereby provide enhanced energy absorbability and destruction resistance thereto; and

(e) said tubular wall means is readily distortionable within its non-destructive limits under impact force applied against said protective means.

The invention will be further understood from the following description and drawings wherein certain dimensions are exaggerated for purposes of clarity:

Fig. 1 is a longitudinal or vertical sectional view of a cylindrical embodiment of the present container unit;

Fig. 2 is a cross-sectional view of the unit of Fig. 1;

Fig. 3 is an enlarged cross-sectional view of the access port means of the unit taken along line 3-3 of Fig. 2 in the direction of the arrows;

Fig. 4 is a top elevational view, with exaggerated angle iron thickness and width, of portions of an outer angle iron framed embodiment of the present container unit;

Fig. 5 is a side elevational view, with portions broken away for clarity, of the unit of Fig. 4;

Fig. 6 is a transverse cross-sectional view of a variation of the container unit showing a substantially square protective shell means;

Fig. 7 is a side view, partly in section, of an embodiment of stacked container units provided with spill containment structure;

Fig. 8 is a longitudinal sectional view of a variation of the spacer means in place in the spacing;

Fig. 9 is a cross-sectional view of an alternative embodiment of the container porting structure and closure means; and

Fig. 10 is a cross-sectional view of another embodiment of the container porting structure and closure means.

Referring to the drawings wherein, in several figures the identical or equivalent structures are numbered the same, and with particular reference to the claims hereof, the present container unit 10 comprises metallic, substantially closed and continuous first wall means 12 providing containment means 13 for said material, metallic,

substantially closed and continuous second wall means 14 providing protective shell means 15 surrounding said containment means and spaced therefrom over at least a major portion of the outer surface thereof to provide protective spacing 16 therebetween, spacer means 18 positioned between said containment means and shell means for substantially maintaining said spacing therebetween, aperture means 20, 22 in said containment means and shell means respectively and adapted to provide access port means generally designated 23 for said containment means, individual closure means 24, 26 for said aperture means 20, 22 respectively, tubular wall means 28 extending between and connecting said aperture means to provide conduit means for the flow of said materials into and out of said containment means, and base means 30 affixed to said shell means for stabilizing said container in at least one operative position.

With particular reference to Figs. 1-3 which depict certain preferred embodiments, the first wall means 12 comprises a substantially cylindrical sidewall 32, an upper end cap 34, and a bottom cap 36. These caps are preferably butt-welded as indicated in Fig. 1, rather than fillet-welded, to the sidewall such that the weld, e.g., 38, can be more readily inspected by x-ray in compliance with Federal Regulations. Likewise, second wall means 14 comprises a substantially cylindrical sidewall 40, an upper end cap 42, and a bottom cap 44. These caps are buttwelded to wall 40 as described above. The sidewalls and end caps may be steel, aluminum, brass or metal alloy, but preferably are of carbon or stainless steel.Depending on the impact damage resistance and penetration resistance required, the thickness of the various sidewalls and end caps can be varied, however, unexpected and markedly enhanced overall container strength, and damage and penetration resistance relative to container weight is achieved in accordance with the present invention employing the construction parameters given below.

For containers Experiencing Less Than About 10 psig Internal Pressure:

Thickness of protective shell sidewall - 1/16 to 3/16 in.

Thickness of inner vessel sidewall - 3/16 to 1/2 in.

Thickness of domed flat end caps - 3/16 to 1/2 in.

Average radius of curved (domed) end cap - 5 to 25 ft.

Container unit loaded weight - 300 - 6,000 lbs.

The above parameters generally hold for a wide range of container capacities, e.g., 30, 90, 250, and 500 gallons, wherein the metal thicknesses and the average radii approximating hermispherical radii) of the curved or domed end caps generally increase as the capacity of the container increases.

The present container of course, in its preferred embodiments, is constructed to comply with Department of Transportation specifications as detailed in SUB PART H, sections: 178.245 Specification 51; 178.251 Specifications 56 and 57; 178.252 Specification 56; and 178.255 Specification 60, as applicable.

The spacers means 18 is shown as a plurality of blocks which may be of metal, wood, plastic or hard but preferably somewhat compressible or distortionable rubber or other elastomeric material, preferably cemented at least to the sidewall and end caps of the first wall means such that the containment means 13 with the spacers affixed thereto can be slid down into the protective shell means 15 before its cap 42 is welded thereon. Any shape, configuration or number of spacers may be provided including the distortionable or crushable, shock absorbing, resilient metal, V-shaped spacer 46 of, e.g., 3 inches in width, shown in Fig. 8 as welded at its end 48 to sidewall 32.The spacers may also be comprised of one or more substantially continuous, in-situ, foamed or cured plastic material such as polyurethane, polyvinyl, or thermosetting resins such as

epoxies, methacrylate or the like which completely or partially fills the spacing. Also, wood material such as fiber board or plywood may be used, especially for spacing the end caps. In certain embodiments it is preferred that substantial portions of the spacing be filled with absorbent material such as glass wool or other wool-like material, or absorbent clays such as vermiculite, to absorb liquid from penetrations or other damage to the first wall means.It is noted that the type of material or combination of materials used to fill the spacing can be selected to provide the particular desired combination of puncture resistance, liquid absorbability, thermal insulation or the like according to the use to be made of the container unit. It is preferred that some material in addition to the spacers be placed in the spacing, however, for certain container uses, the spacing itself affords adequate puncture resistance, leakcontainment, or thermal insulating characteristics, all of which features are referred to herein as being part of the definition of the terms "protective spacing.

A particularly effective material for filling the spacing of container units which must withstand severe impact or puncture forces are the natural and synthetic rubber materials such as described in the literature, e.g., on pages 1028-1037 of Kirk-Othmer, Concise Encyclopedia Of Chemical Technology, Copyright c 1985 by John Wiley & Sons, Inc.

The inner surface of containment means 13 may be lined or coated with any type of chemical protective coating such as sprayed epoxy or vinyl resins, or slush molded latex elastomer or the like in known manner, preferably after the vessel is completely welded together. Also, removable liners such as rigid or collapsible plastic, metal, metal foil, thermoset polymeric material, ceramic, glass or the like may be employed.

The aperture means 20 and 22 are shown as being threaded for receiving the threaded bung plugs 24 and 26 respectively, having wrench sockets 27. Aperture 22 is, of course, sufficiently large for plug 24 to pass therethrough. An operable structure for the apertures, plugs and the tubular, e.g., cylindrical or square wall means 28 is shown in Fig. 3 as comprising the corrugated sleeve 50 hermetically, peripherally welded to cap 34 at 52, to nut 54 at 56, to cap 42 at 58, and to nut 60 at 62. Plug 24, in operation, seats on shoulder 64, and plug 26, in operation, seats on shoulder 66, both of which shoulders may be provided with sealing washers or gaskets, fibrous or metallic, e.g., copper, to provide a double, liquid-tight seal, the inner seal at 24/64 being well protected from any impact to which the container is likely to be subjected. It is particularly noted that the corrugations of sleeve 50 readily permit impact compression of cap 42 toward 34 without destroying the sleeve 28 and leakproof port means 23 which it provides. Such a flexible or crushable sleeve also allows the use of resilient, rubber-like spacers such as 18 of Figs. 1 and 2, whereby substantial impact and to and distortion of the container can be absorbed thereby without destroying the sealed port means. In the manufacture of the port means of Fig. 3, a useful welding sequence would be to first weld at 55, followed in order by welding at 56, 62, 52, and then at 58 after cap 42 has been placed over the outer end of tube wall 28.Alternatively to corrugated sleeve 50, the tube may be substantially straight but of thinner metal than other portions of the container such that it can readily crush under impact rather than ram against cap 34 and possibly puncturing it. Bung devices other than the screw-in plug type may be employed, such as for example, expandable elastomeric plugs, while still utilizing the indestructible characteristics of the present port means.

The base means 30 of Figs. 1 and 2 are shown as being formed, e.g., in the shape of fork-lift tine

receptacles, although other shapes may be used, including short legs between which the tines can fit. The base means, in a general sense, also includes the saddle members 68 where such are desired, having outer foot or contact means 69 and affixed preferably by welding to the sidewall 40. These members can be provided in any number and in any geometric array around the periphery of wall 40, four being shown, but hexagonal, octagonal arrays, or the like also being useful. It is preferable that these members be hollow as shown at 70 such that the walls 72 thereof can crush under impact and absorb substantial impact energy which otherwise might apply directly against the container. Welding along the sides 74 and ends 76 of these members to the sidewall 40 greatly increases the crush or deformation strength of this wall.

Referring to Figs. 4 and 5, the container is provided with a perimeter mounted angle iron frame generally designated 78, the end sections 79 thereof welded as at 80 to end the end cap means 42 and 44, to provide both crush protection and base means for stabilizing the container in a number of different positions, i.e., on any side or end thereof. End sections 79 are joined to upright frame members 81 by welding as at 83 thereto.

Referring to Fig. 6, wall means 14 is of substantially square cross section which automatically provides the base means by way of its sides 82, 84, 86, 88 and ends 90 and 92. In this or any of the other embodiments hereof, the spacing may be completely filled on the sides, top and bottom, preferably with tough, in-situ foamed or cured polymeric material such a polyurethane or epoxy which provides greatly enhanced puncture resistance, thermal insulation and, in the event of a puncture of both wall means 12 and 14, a degree of liquid absorbability when foamed polymer is employed.

Referring to Fig. 7, fluid spill protection is

provided in the form of pan means generally designated 94 and comprising cap 42 and extended peripheral or annular portion 96 of sidewall 40. In this embodiment it is preferred that the base means be comprised of short legs 98 of angle iron or the like, and of sufficient length to contact the underlying cap 42 when the containers are stacked, to allow sufficient space between the upper surfaces of wall portions 96 and bottom cap 44 to allow the insertion of fork-lift tines underneath cap 44. Any number of such containers can be stacked in this manner, limited only by the strengths of the containers and the weights of their contents.

Referring to Fig. 9, the inner surface of second wall means 14 provides the tubular wall means 28, and annular ring spacer 100 hermetically welded completely around walls 32 and 14 complete the fluid-tight access port means 23. Plugs 24 and 26, in this embodiment are sealingly but removably secured in place by any means such as Allen bolts 102 and gaskets 104.

In Fig. 10, plug 26 also provides plug portion 24 at its bottom surface. A sliding O-ring seal 104 for providing the seal of plug 26 is preferred in this embodiment in order to more readily accommodate variations from container to container in the distance between the upper surface of cap 42 and the upper sealing surface of cap 34.

The invention has been described in detail with particular reference to preferred embodiments thereof, but it will be understood that variations and modifications will be effected within the spirit and scope of the invention.

We Claim:

1. A reusable container unit for flowable materials having enhanced puncture resistance and leak containment characteristics, and being readily handleable by conventional fork lift or the like equipment, comprising metallic, closed and continuous first wall means providing containment means for said material, metallic, closed and continuous second wall means providing protective shell means surrounding said containment means and spaced therefrom over at least a major portion of the outer surface thereof to provide protective spacing therebetween, spacer means positioned between said containment means and shell means for maintaining said spacing therebetween, aperture means in each of said containment means and shell means adapted to provide access port means for said containment means, individual closure means for each said aperture means, tubular wall means extending sealingly between said containment means and said shell means and connecting said aperture means to provide conduit means for the flow of said materials into and out of said containment means, said tubular means being distortionable under impact force applied to said protective shell means, and base means affixed to said shell means for stabilizing said container unit in at least one operative position.

2. The container unit of claim 1 wherein a major portion of said spacing is filled with one or more protective materials selected from elastomer, foamed plastic, glass wool, steel wool, fiber wool, particulate absorbent clays, structural plastic, wool, fiber board and other cellulosic material.

3. The container unit of claim 1 wherein said containment means and shell means are of steel, and the ratio of said spacing thickness to each said wall means thickness is from

about 4 to about 100.

4. The container unit of claim 1 wherein each said wall means defines a drum having cylindrical side means and flat end means, and wherein said aperture means are located in adjacent end means.

5. The container unit of claim 1 wherein said spacer means is distortionable under impact force applied to said protective shell means to thereby provide enhanced energy absorbability thereto.

6. The container unit of claim 1 wherein said tubular wall means of said conduit means is distortionable under impact force applied to said protective shell means in the vicinity of said aperture means therein to thereby prevent ramming of said tubular wall means against said first wall means in the vicinity of said aperture means therein as a result of said impact force.

7. The container unit of claim 4 wherein a portion of said base means comprises a plurality of elongated saddle means, each being affixed to said cylindrical side means and extending transversely thereof and having a planar outer foot means, said saddle means being positioned on said side means to provide positional stability to said container means in a side-down position.

8. The container unit of claim 1 wherein each said aperture means is threaded and one each of said closure means is matingly threaded for securement therein.

9. The container unit of claim 5 wherein said spacer means comprises elastomeric material.

10. The container unit of claim 7 wherein each said saddle means is formed with an arcuate mounting surface which lies contiguous said cylindrical side means along from 1/8 to 1/4 of the periphery thereof.

11. The container unit of claim 6 wherein said tubular wall means is laterally corrugated to accommodate substantial axial compressibility upon impact.

12. The container unit of claim 1 wherein said second wall means provides containment pan means at the top of said protective shell means adapted to accommodate the base means of another container unit stacked thereon and to contain fluid which may spill downwardly therefrom.

13. The container unit of claim 1 wherein said first wall means defines a drum having cylindrical sidewall means butt-welded at each end to domed end cap means.

14. The container unit of claim 6 wherein said tubular wall means has a thickness less than the thickness of the adjacent portions of said second wall means such that said impact force will tend to distort said tubular wall means and be absorbed thereby.

15. The container unit of claim 13 wherein said tubular wall means has a thickness less than the thickness of the adjacent portions of said second wall means such that said impact force will tend to distort said tubular wall means and be absorbed thereby.

16. The container unit of claim 15 wherein the protective spacing between said sidewall means is filled with in-situ foamed polymeric material which affords protection comprising one or more of the features of impact and penetration resistance, liquid absorbability, and thermal insulation.

17. The container unit of claim 16 wherein said second wall means provides containment pan means at the top of said protective shell means adapted to accommodate the base means of another container unit stacked thereon and to contain fluid which may spill downwardly therefrom.

18. The container unit of claim 1 having greatly enhanced puncture resistance, wherein said protective spacing is filled with elastomeric material selected from natural rubber, isoprene, neoprene, butadiene styrene, butadiene acrylonitrile, butadienestyrene-acrylonitrile, and these polymers or copolymers copolymerized with vinylpyridine and methacrylic acid.

19. The container of claim 1 wherein said containment means is provided internally with removable liner means.

20. The container of claim 1 wherein said containment means is internally coated with chemical protective material.

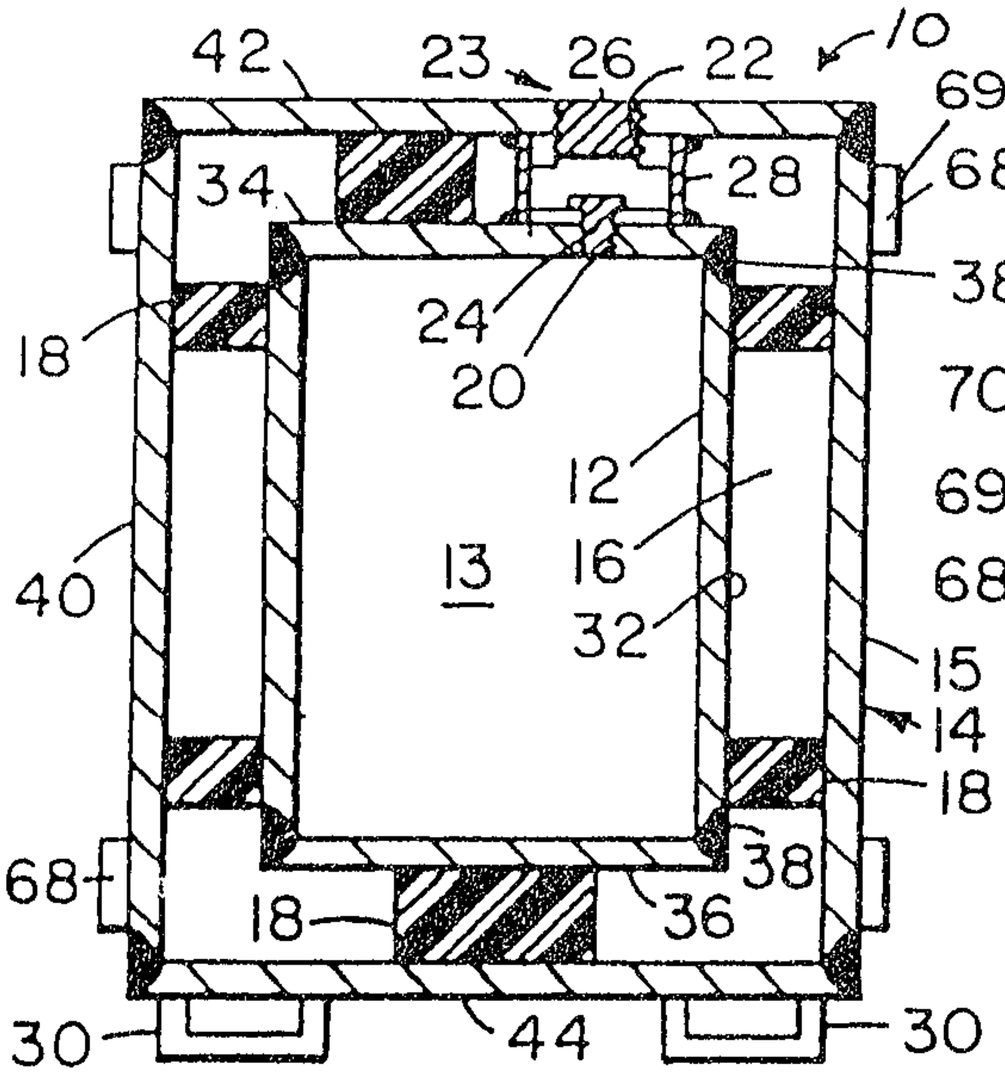


Fig. 1

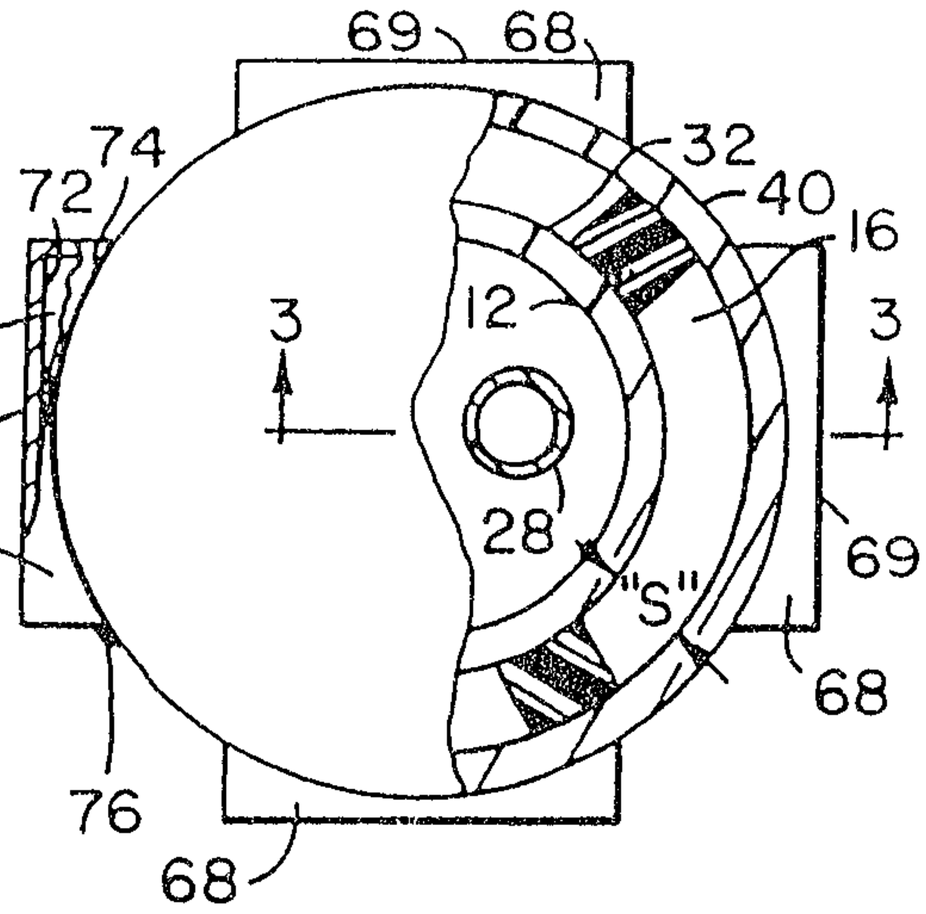


Fig. 2

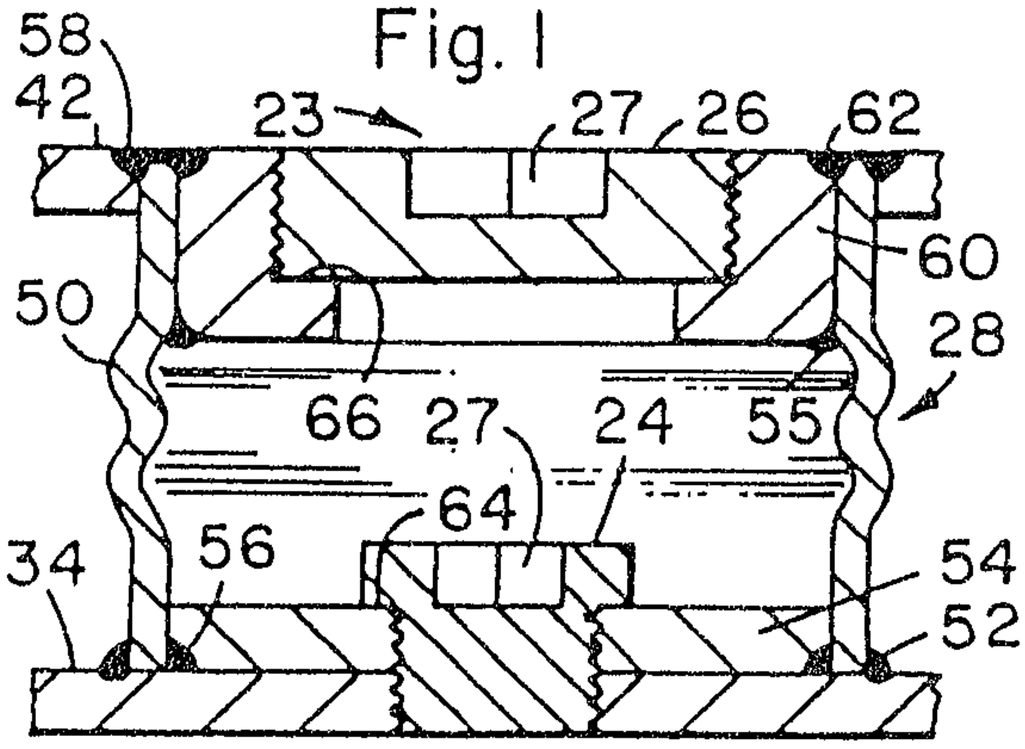


Fig. 3

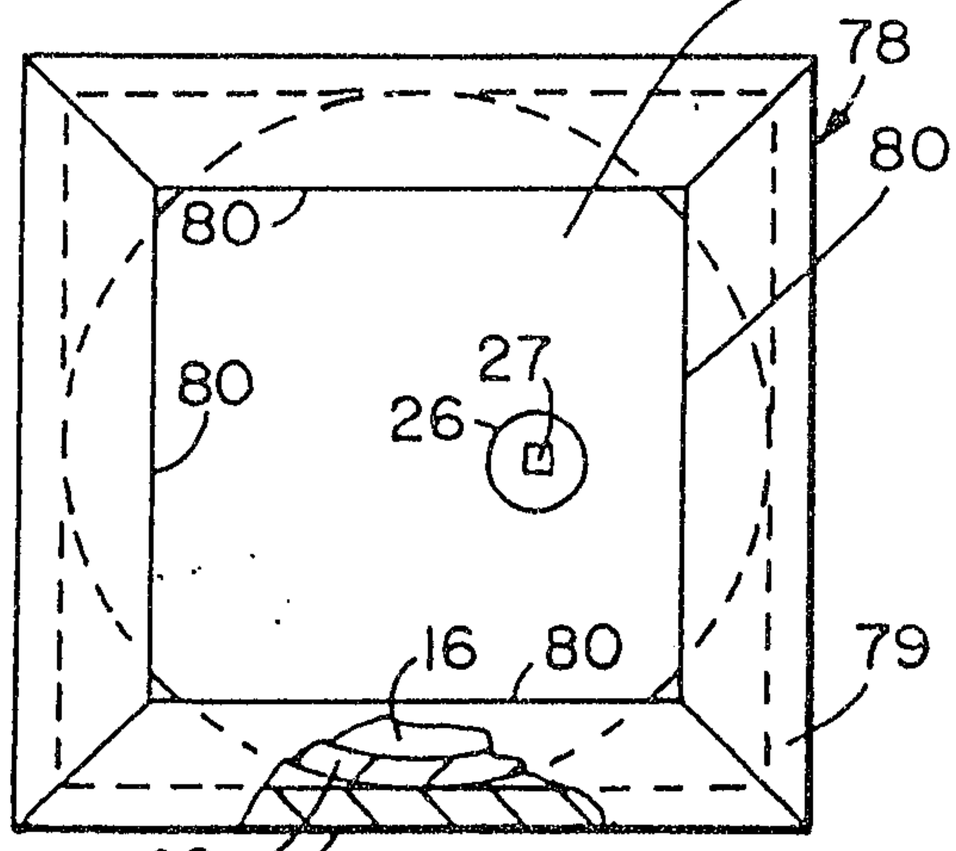


Fig. 4

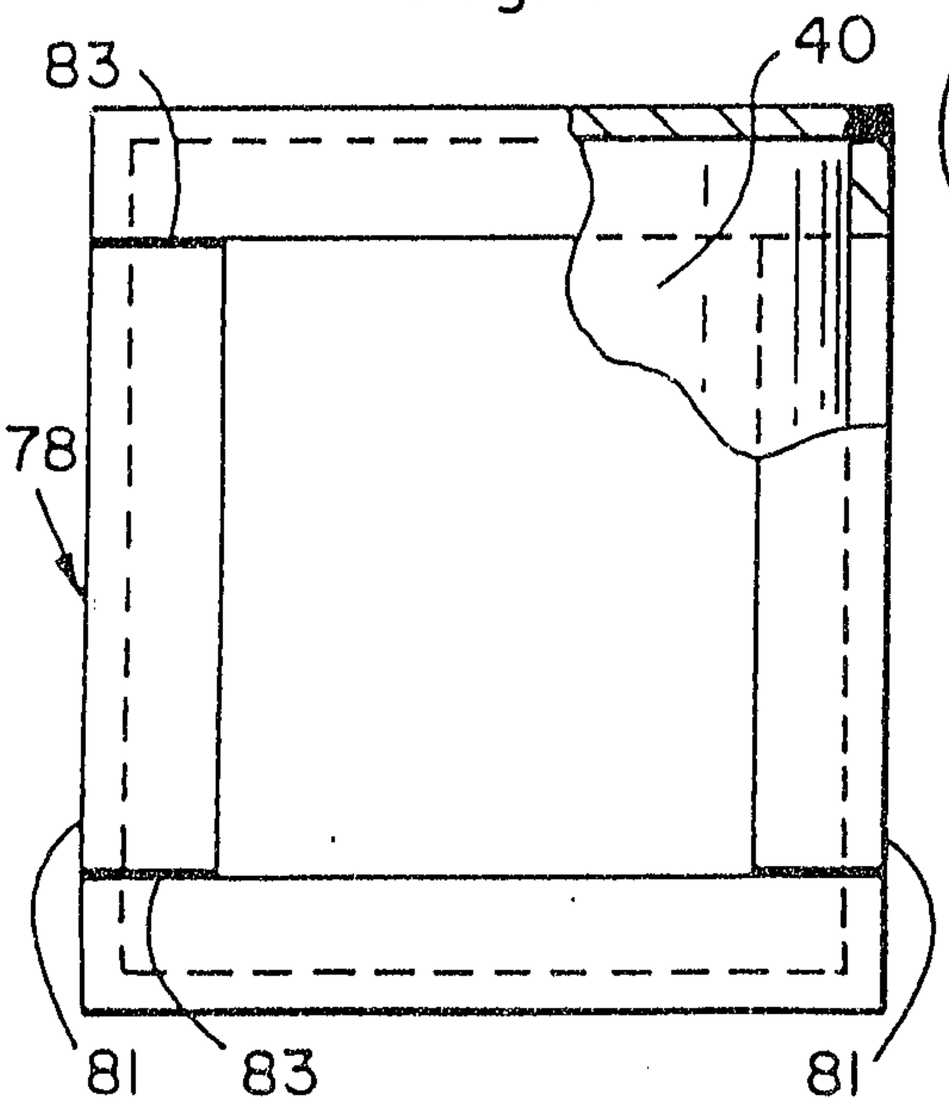


Fig. 5

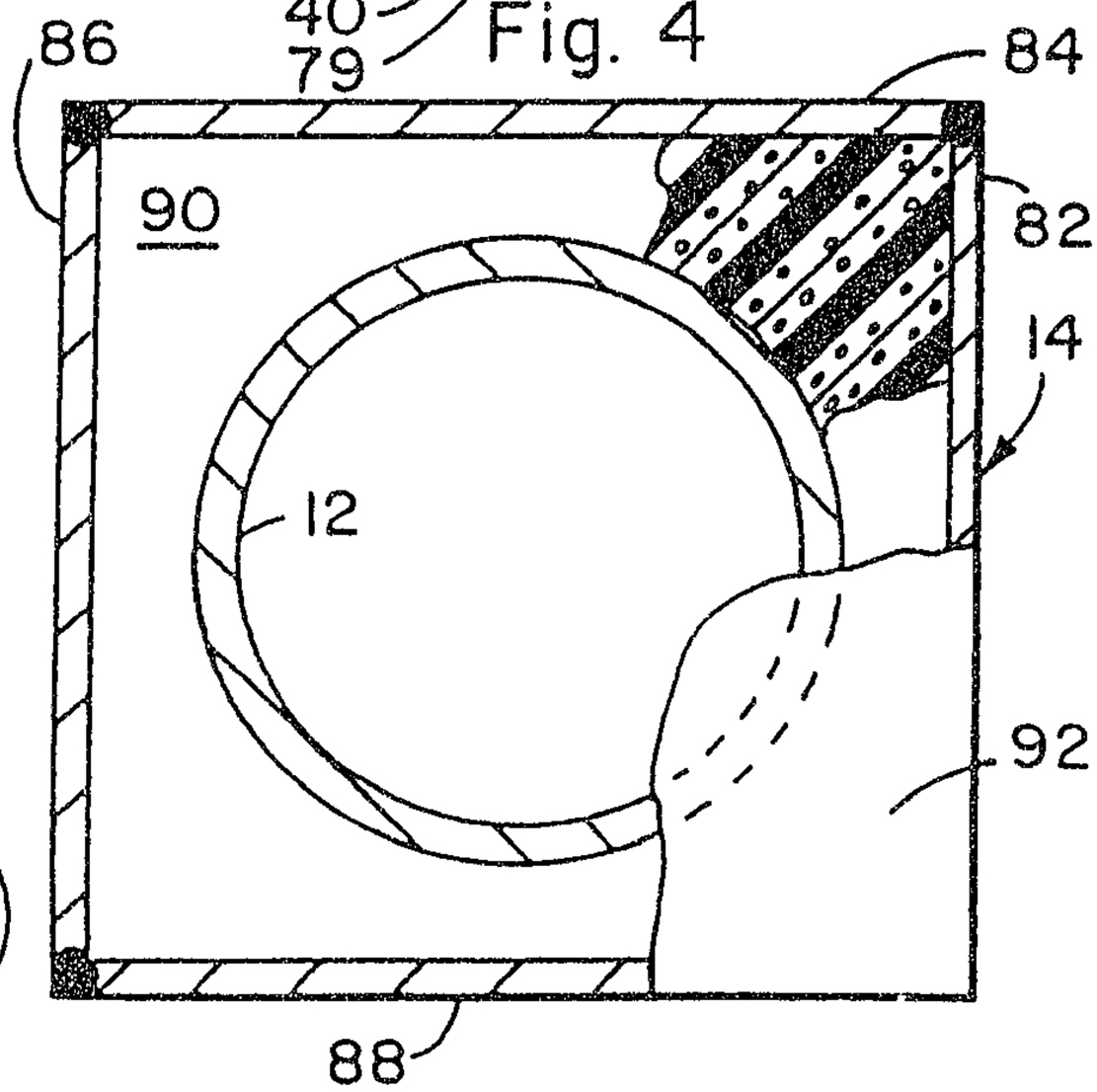


Fig. 6

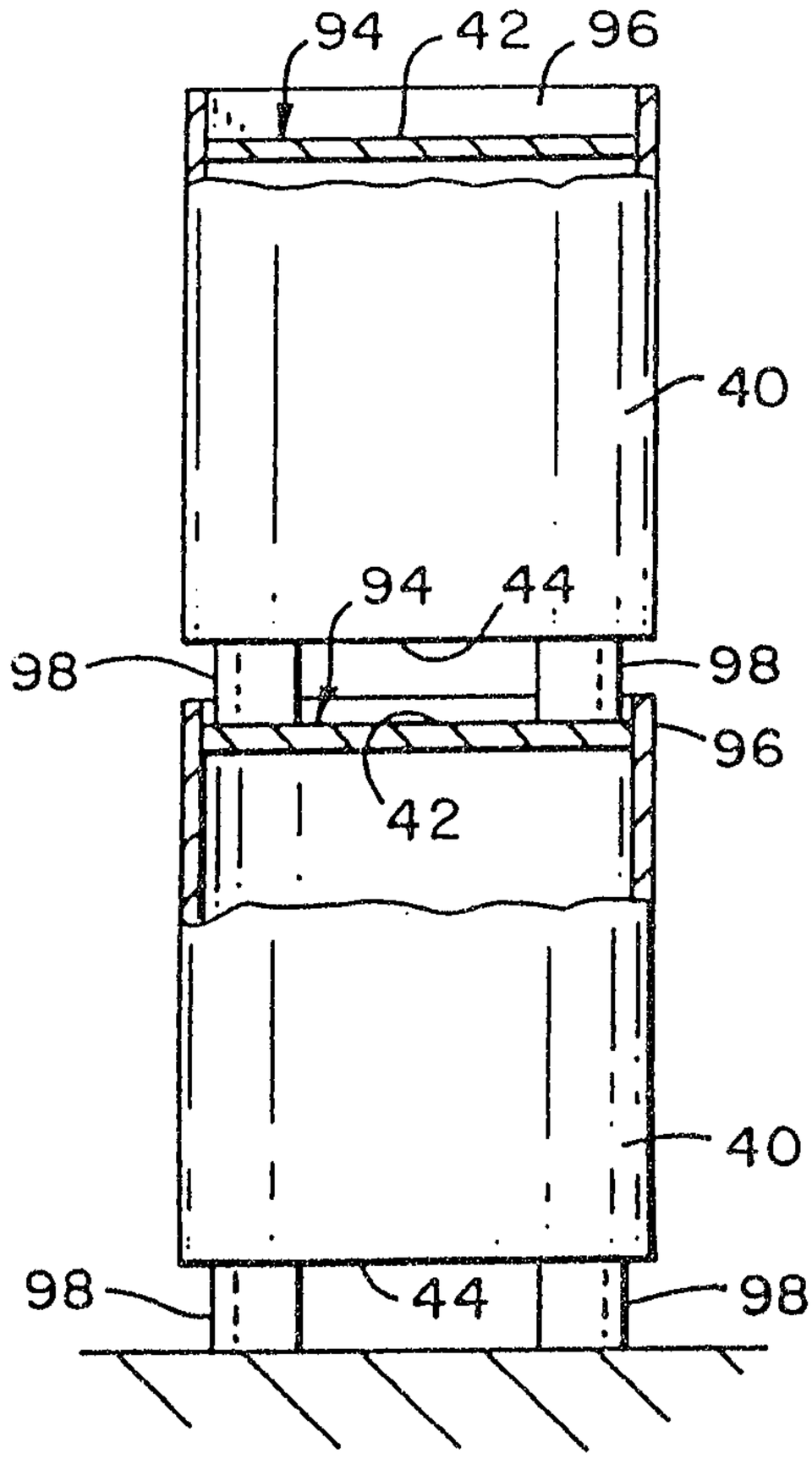


Fig. 7

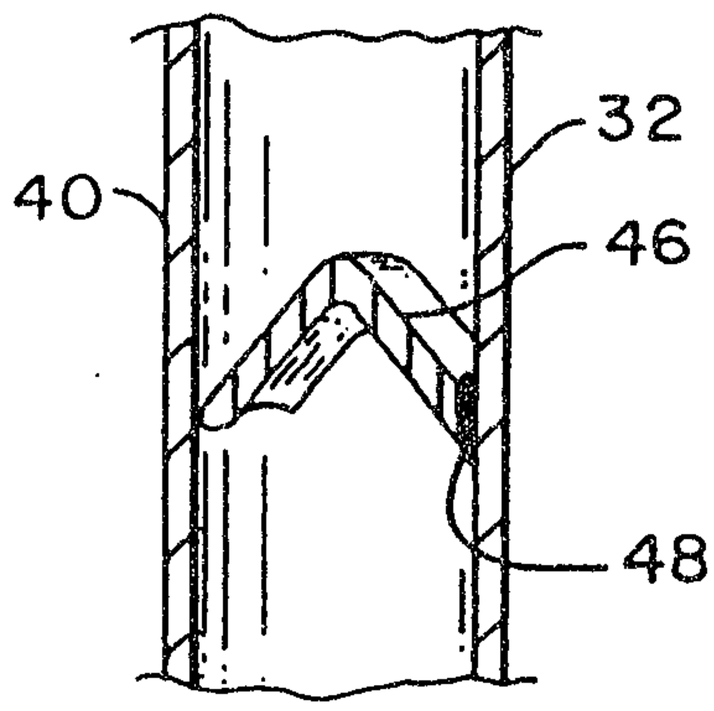


Fig. 8

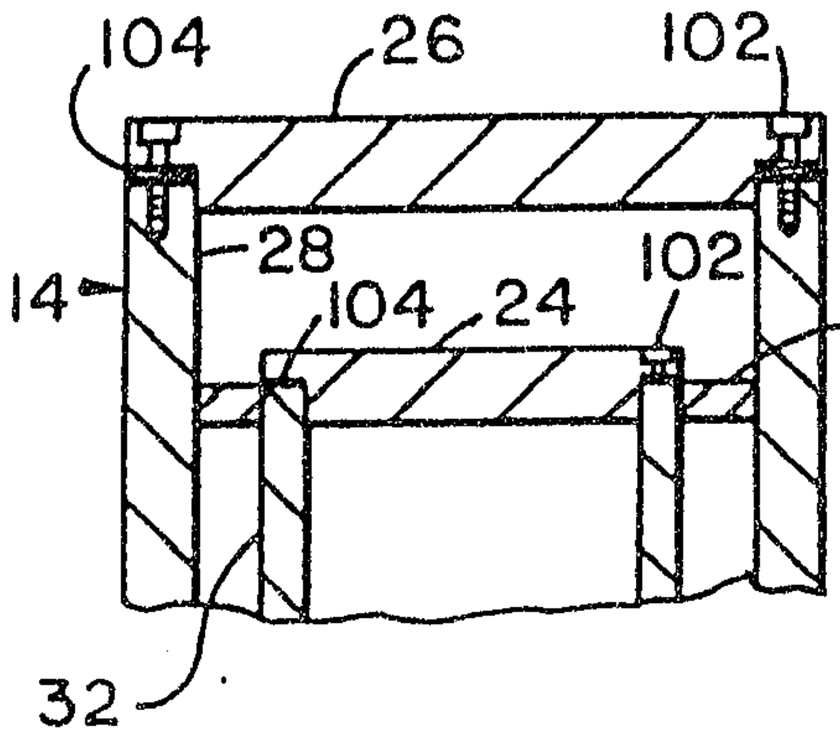


Fig. 9

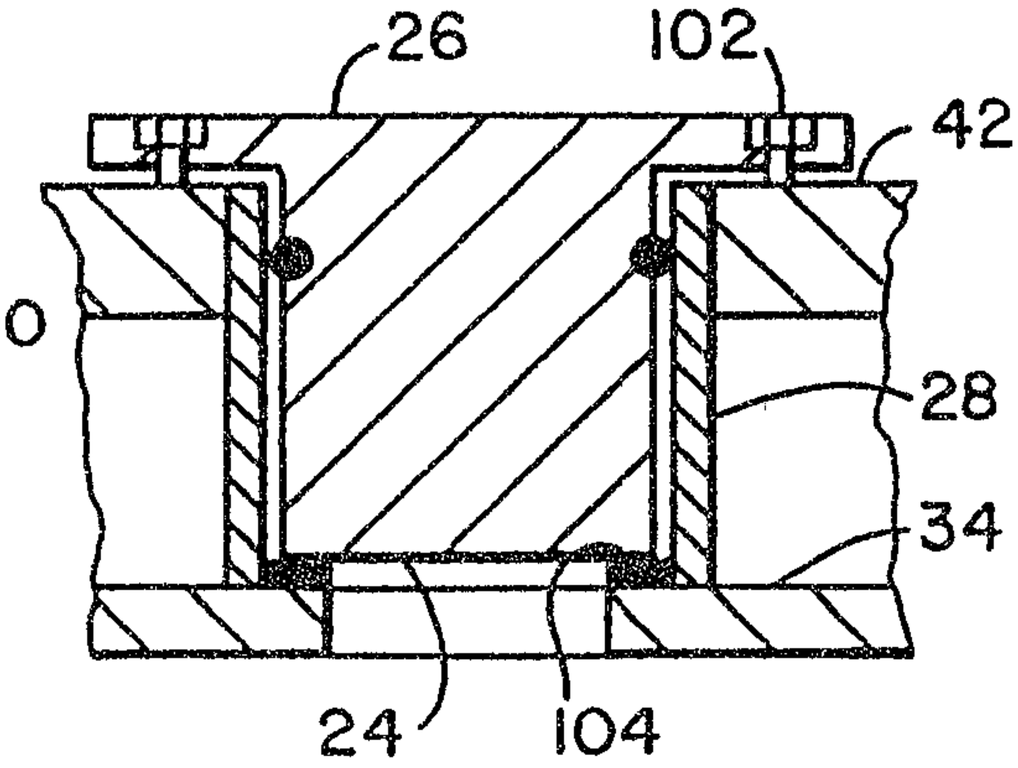
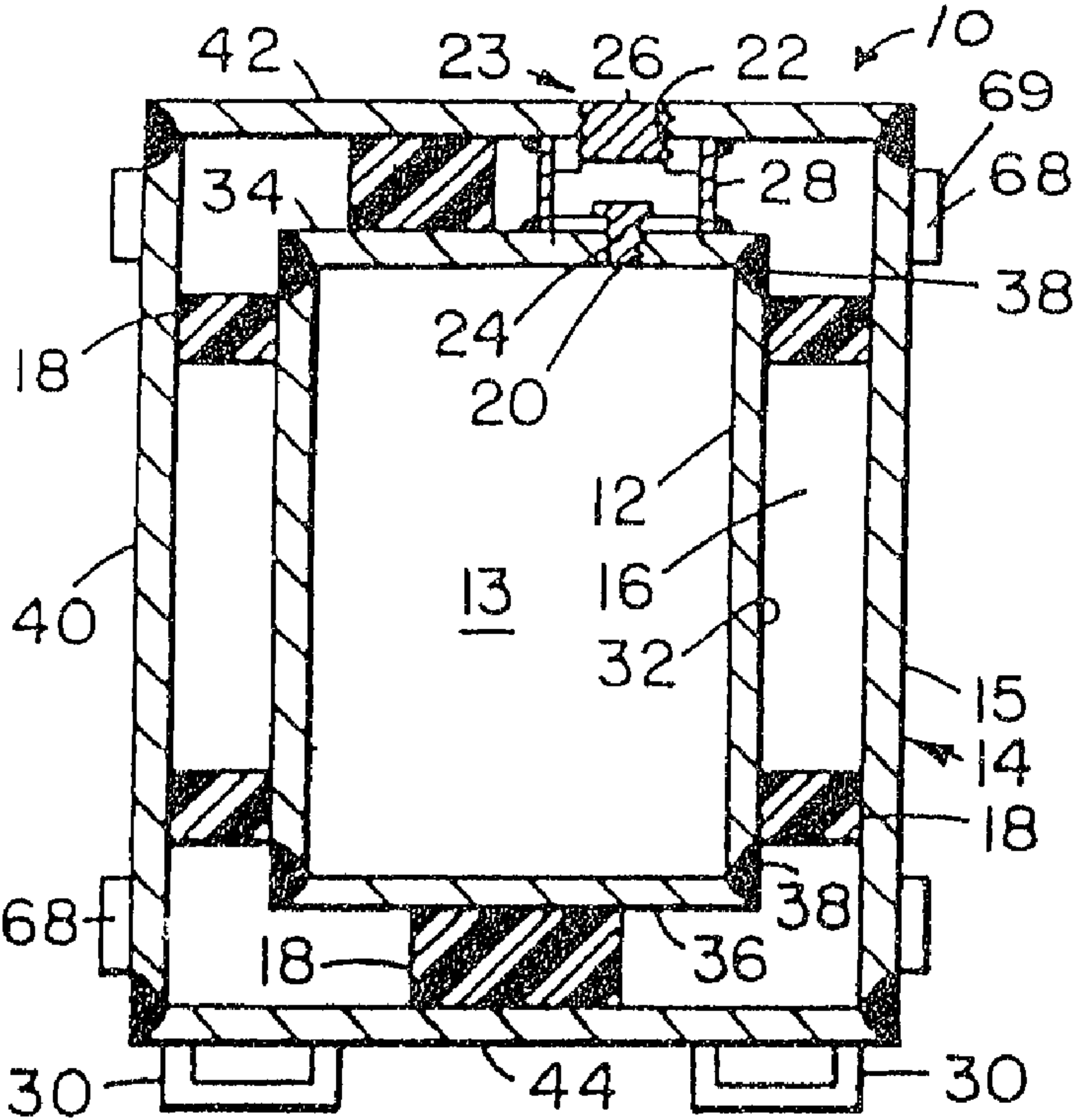


Fig. 10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