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(54) **FLEXIBLE LINER WITH FITTING ON GUSSETED SIDE**

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(57) **ABSTRACT**

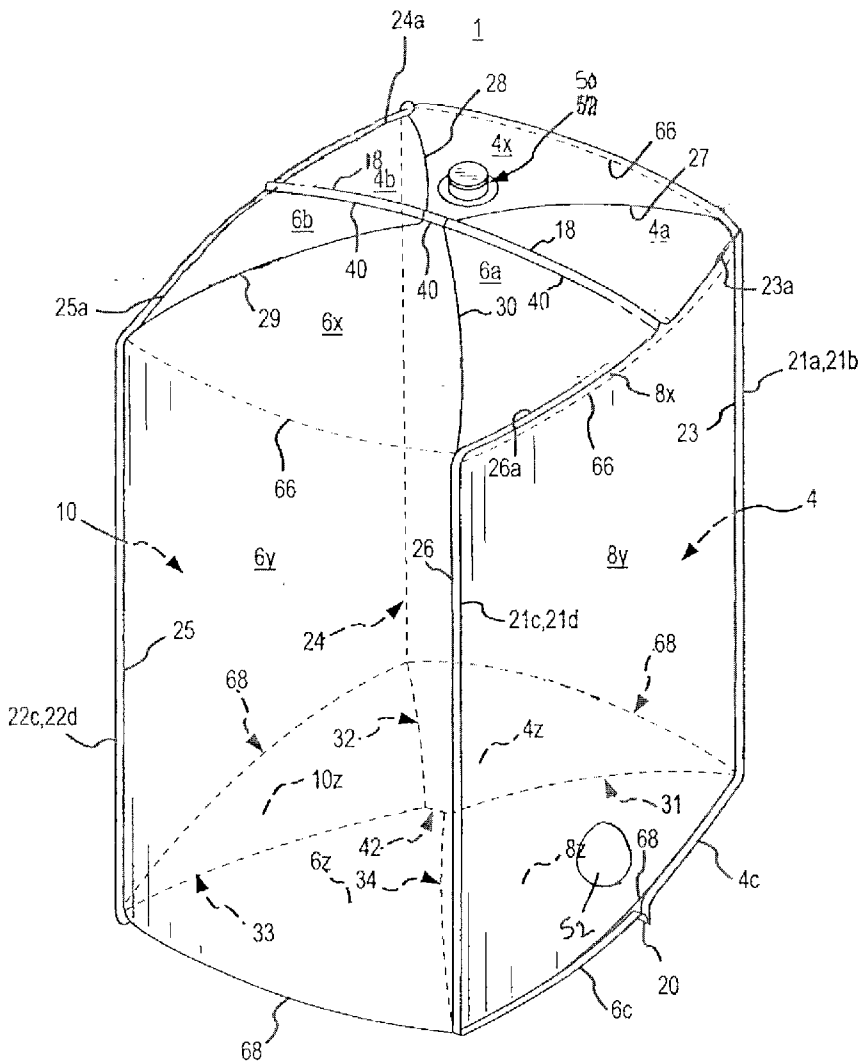
The present invention is a collapsible liner for use in a bulk container. The liner comprises a front portion, a rear portion, and first and second side portions. The front portion, rear portion, and side portions are sealed together to form a four side panels, and top and bottom panels. A removable piece is provided in at least one of the portions. The removable piece may be removed to provide an opening for receiving a fitment. After the portions are sealed together, the removable piece is removed and a fitment is fit and sealed within the opening thereby provided.

(21) Appl. No.: **11/535,326**

(22) Filed: **Sep. 26, 2006**

Related U.S. Application Data

(60) Provisional application No. 60/720,855, filed on Sep. 26, 2005.



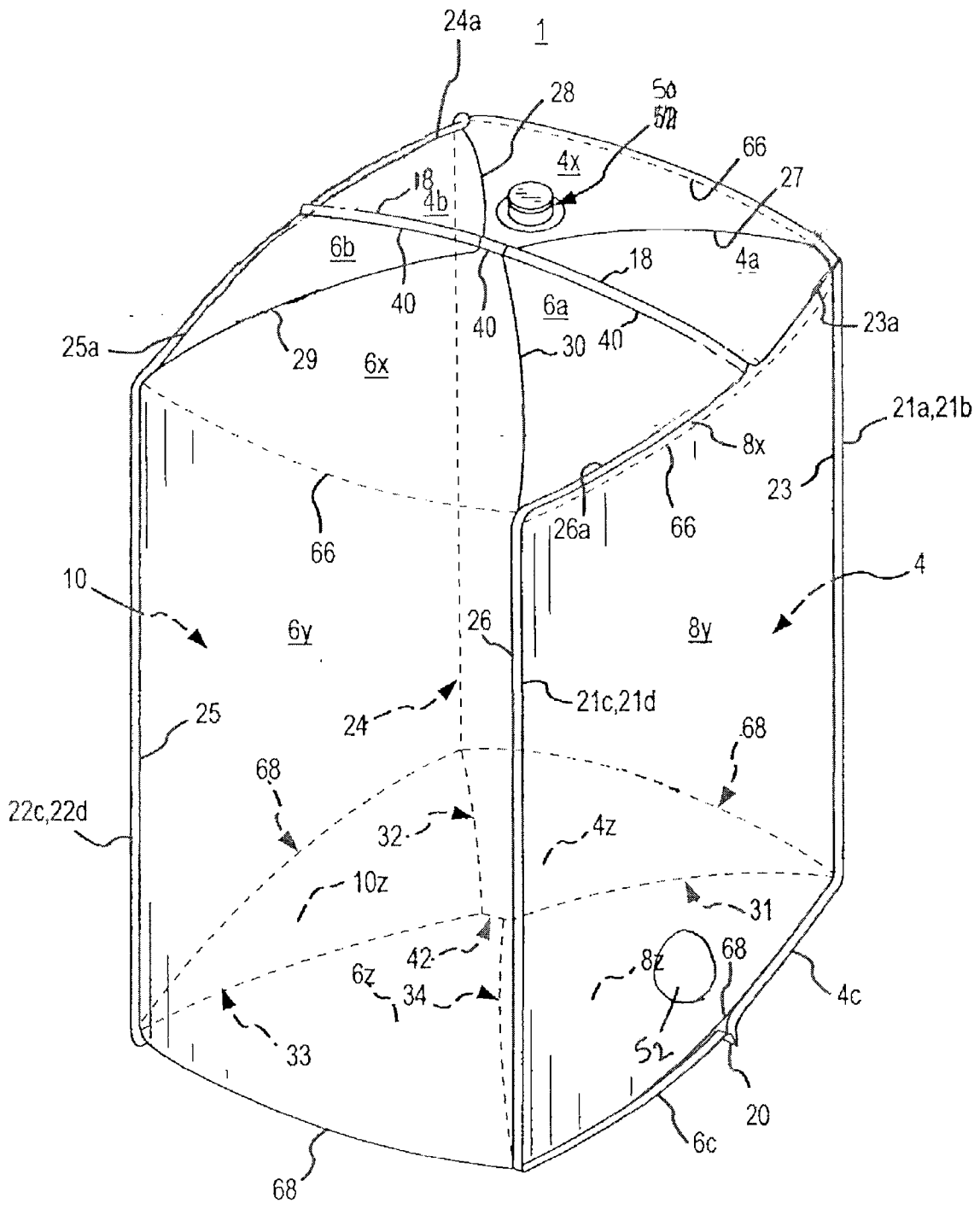


FIG.1

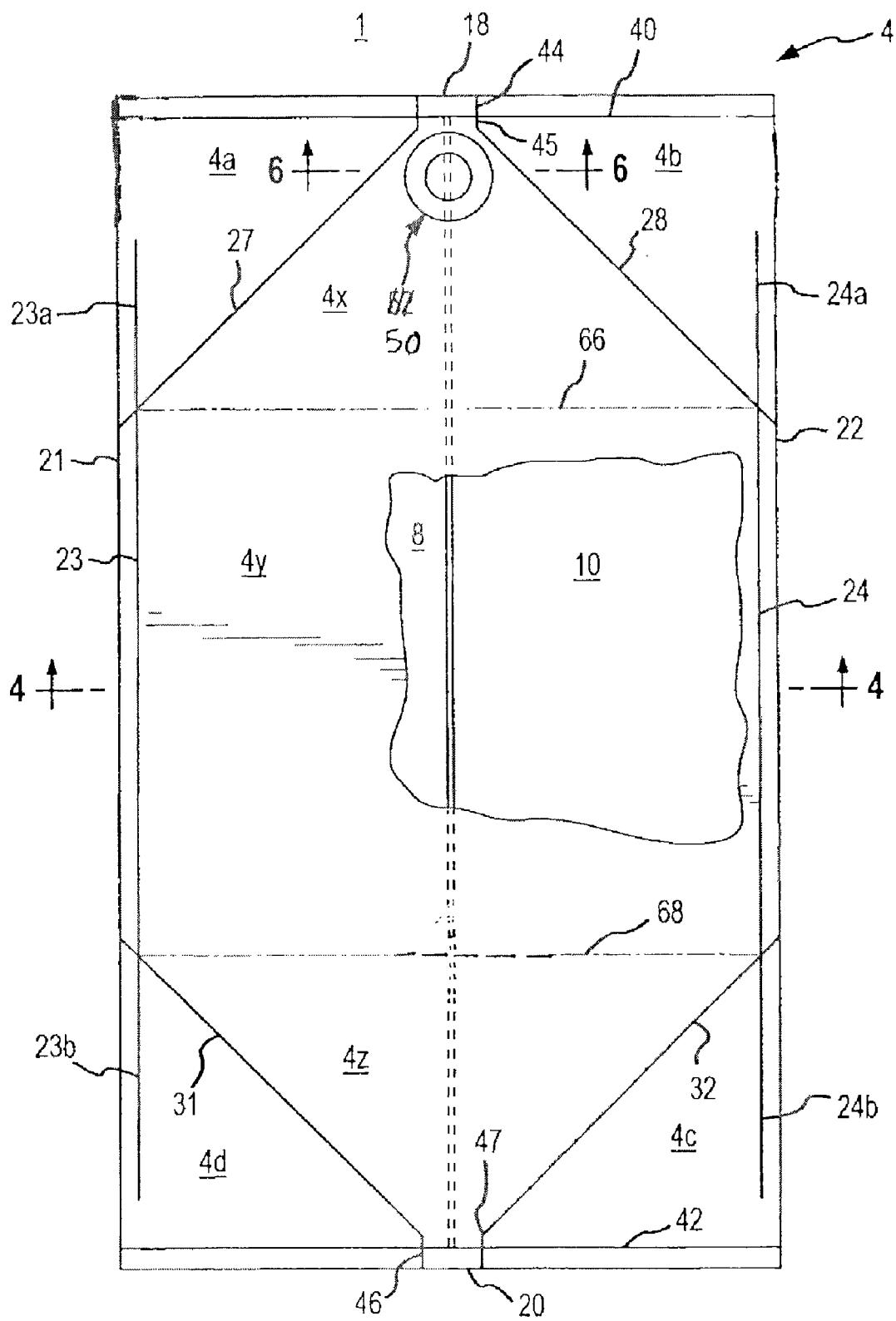


FIG. 2

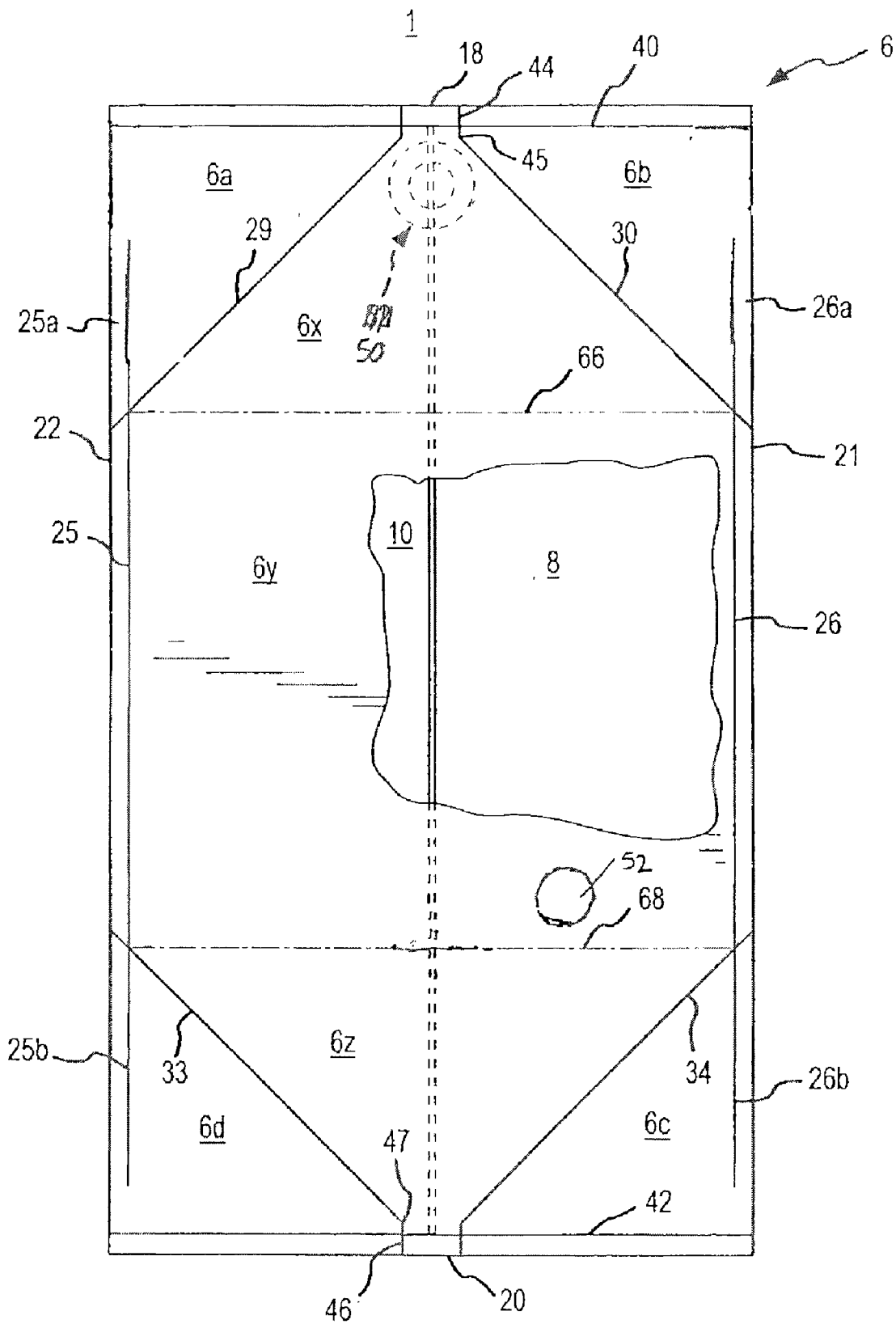
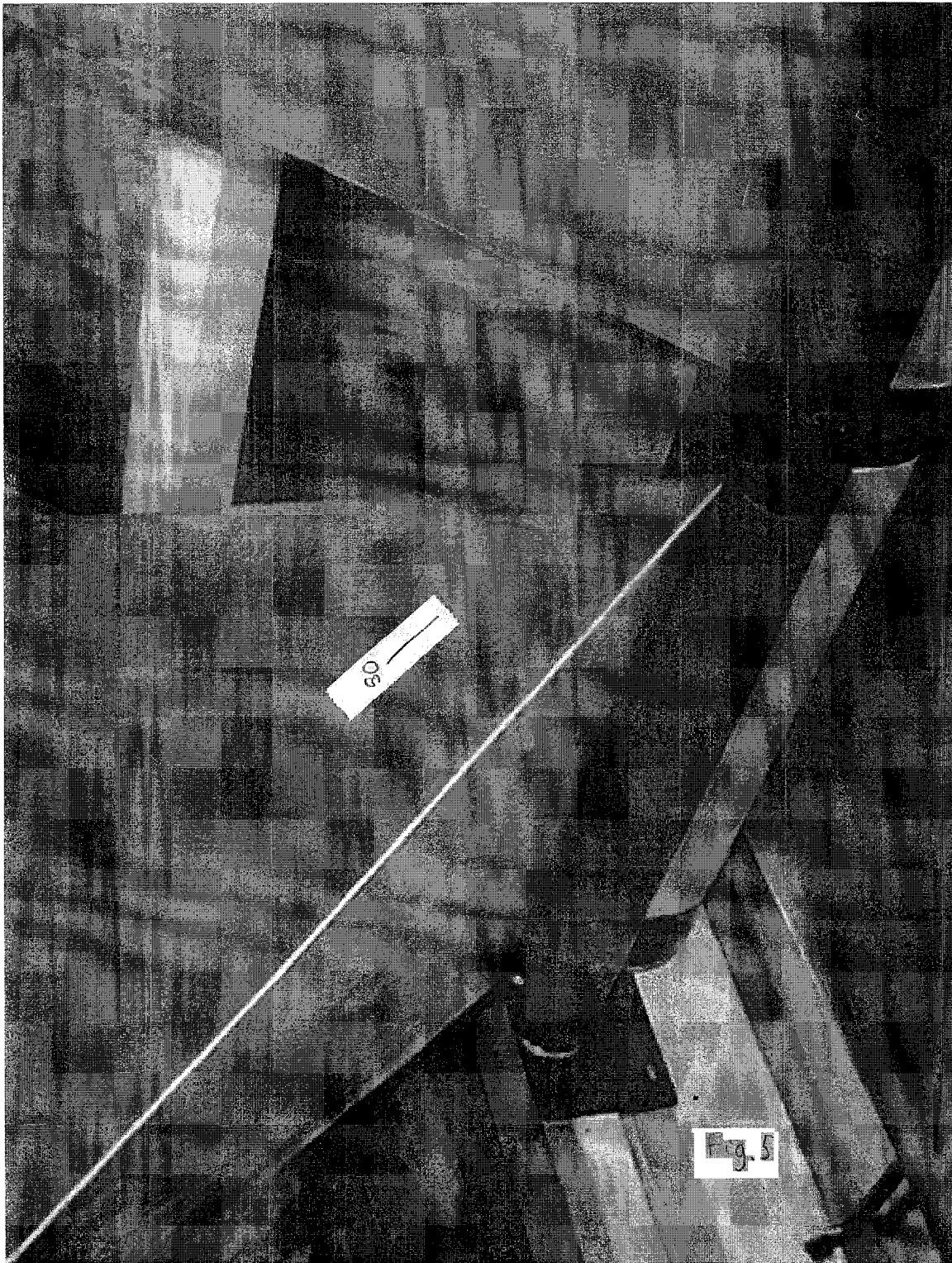
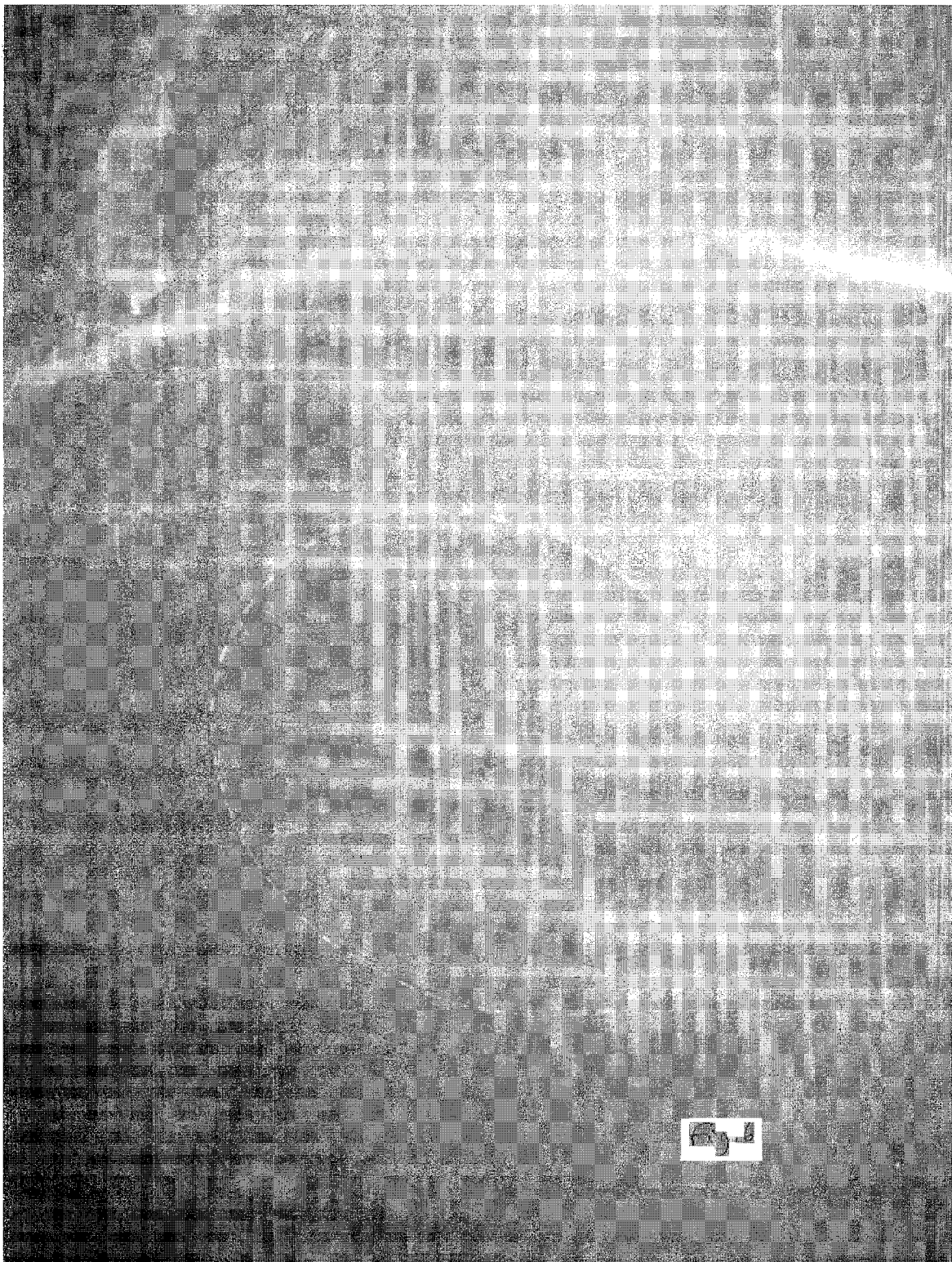
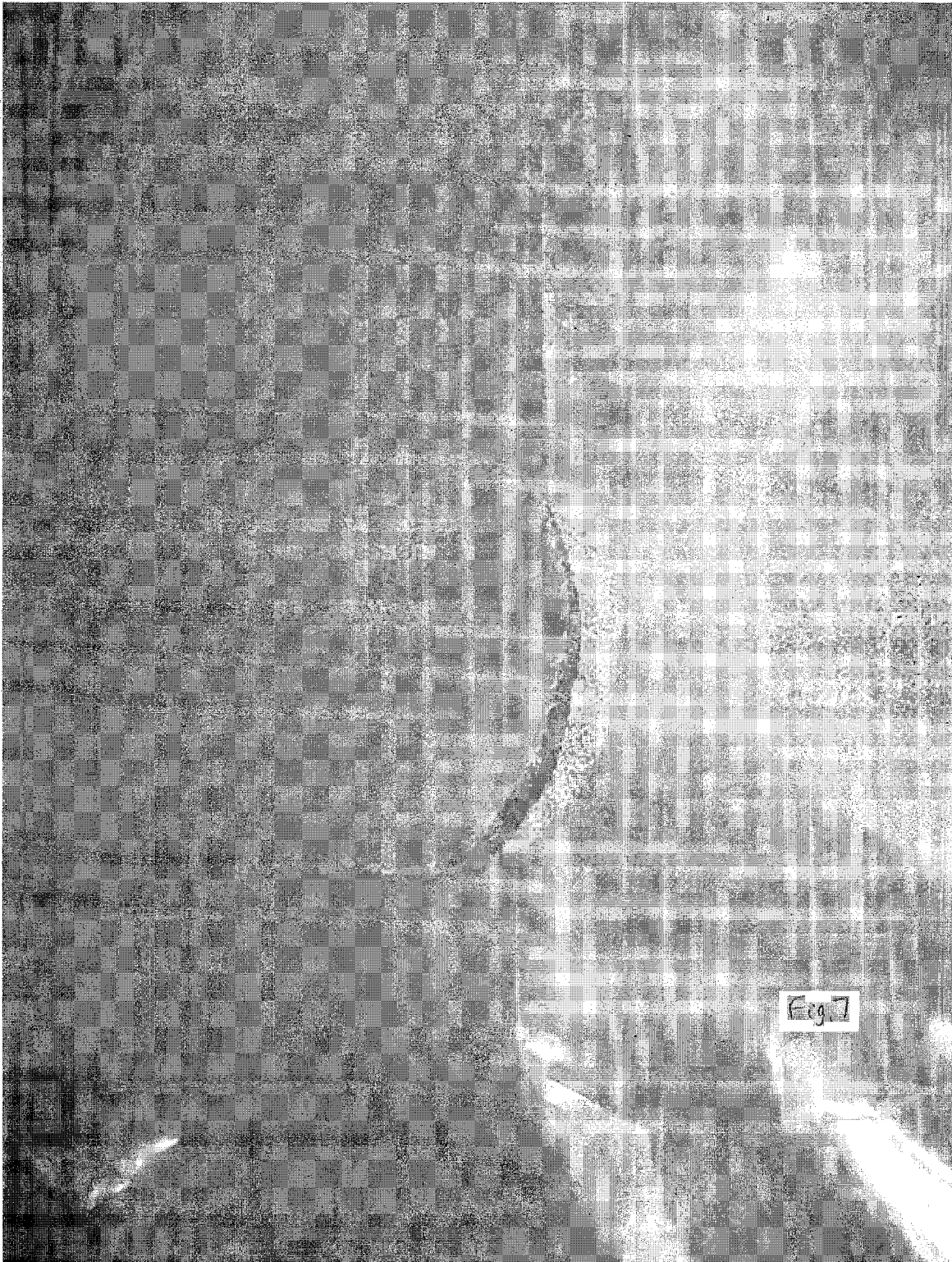
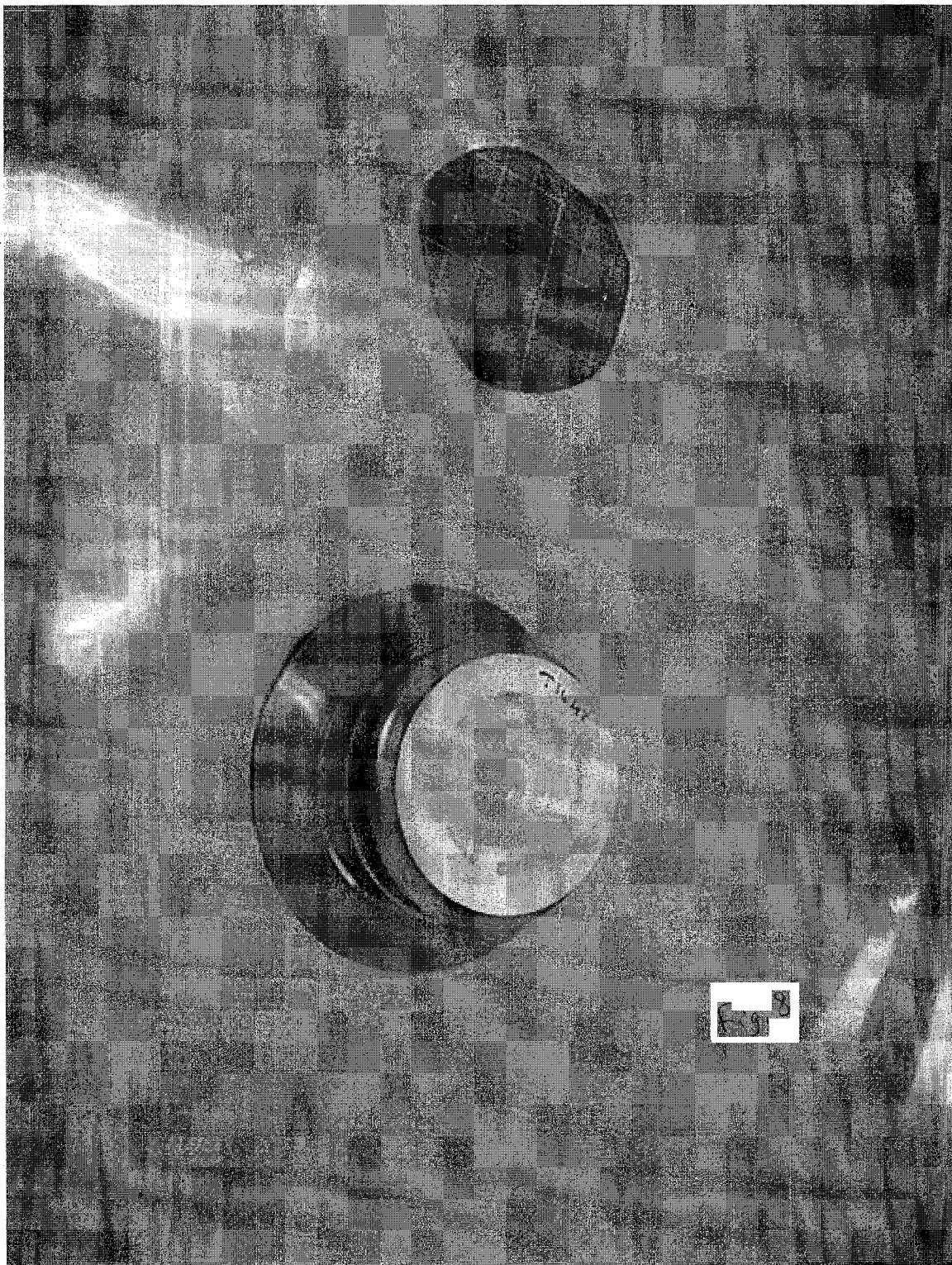


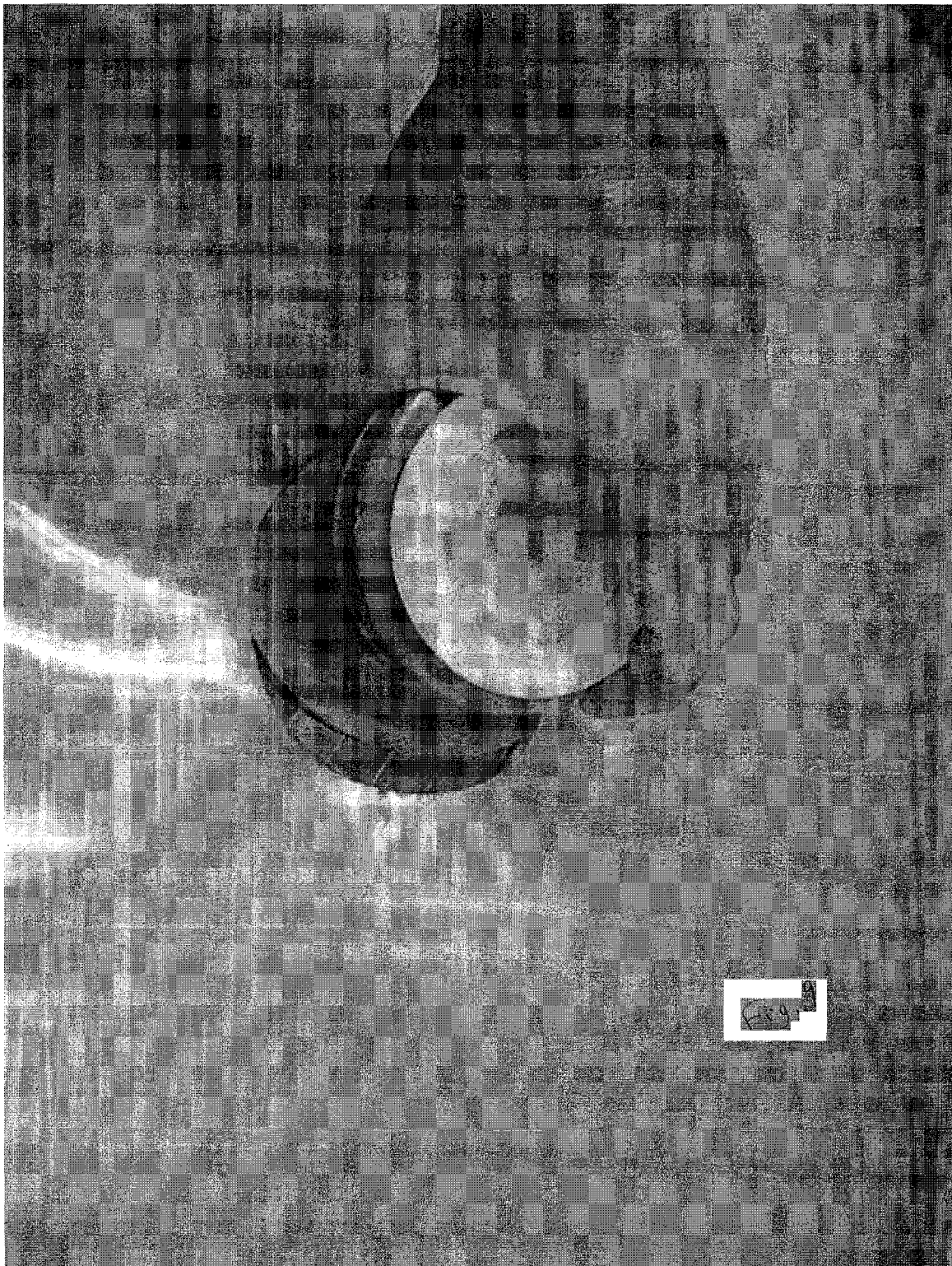
FIG. 3

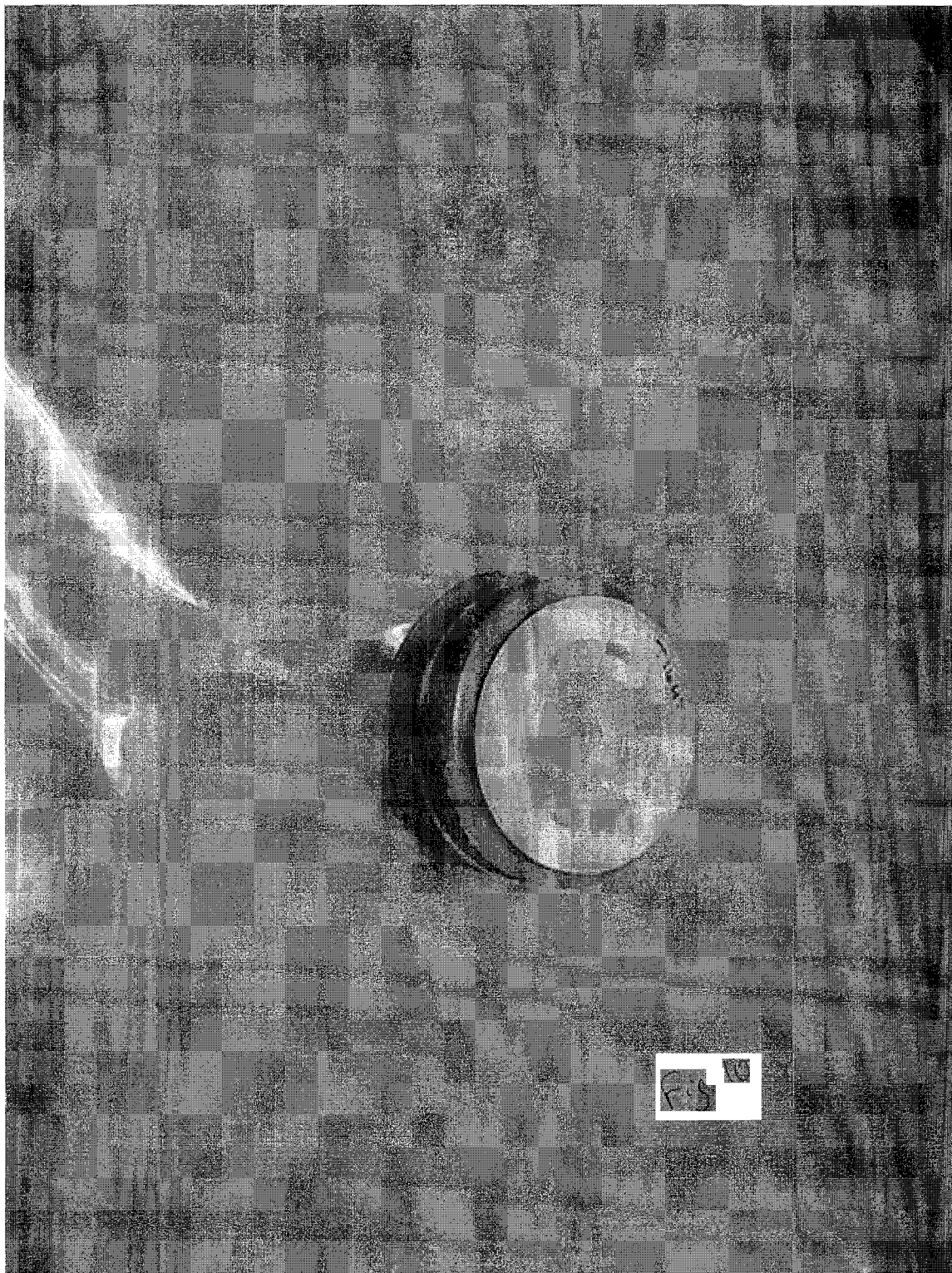


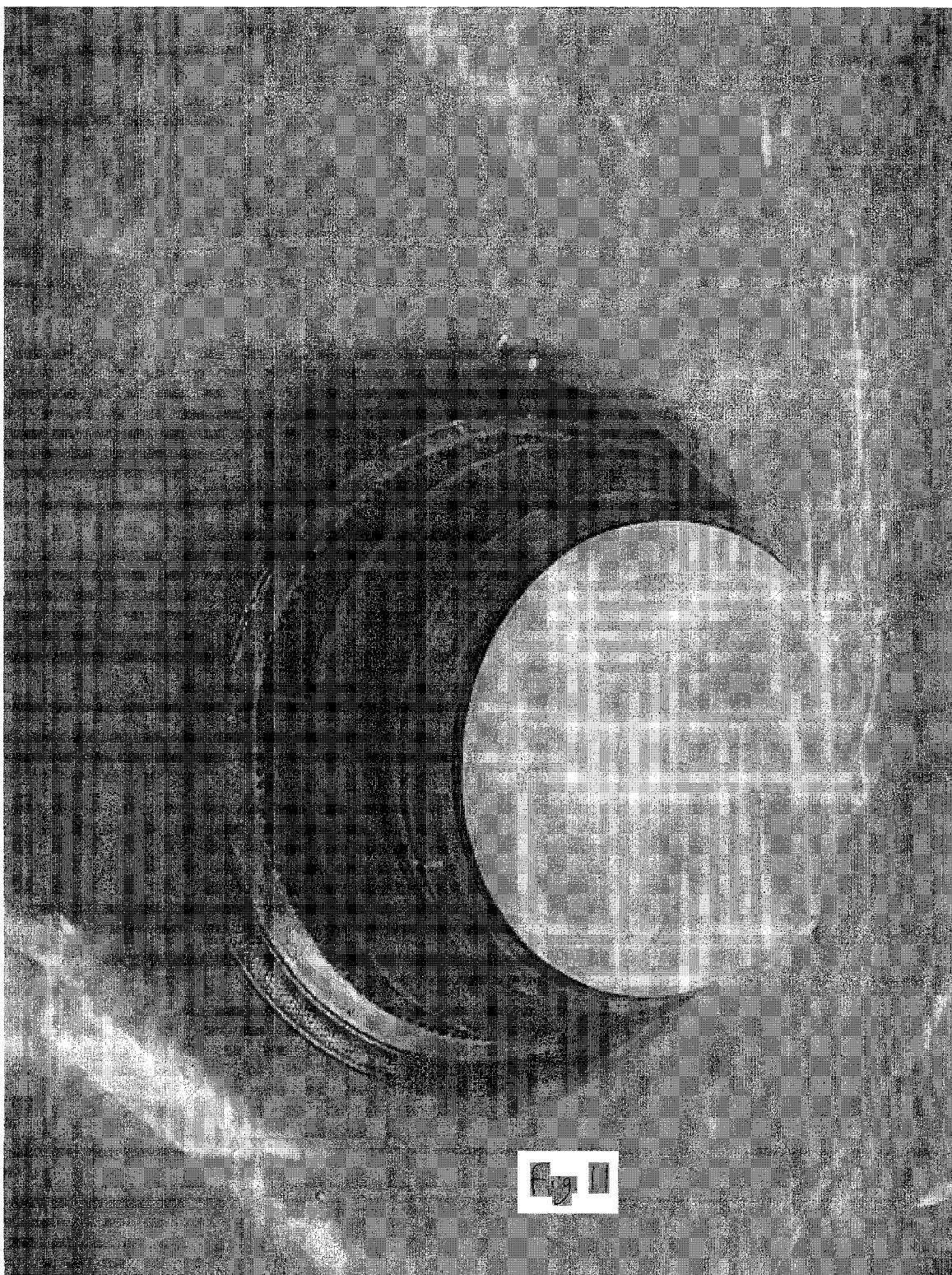


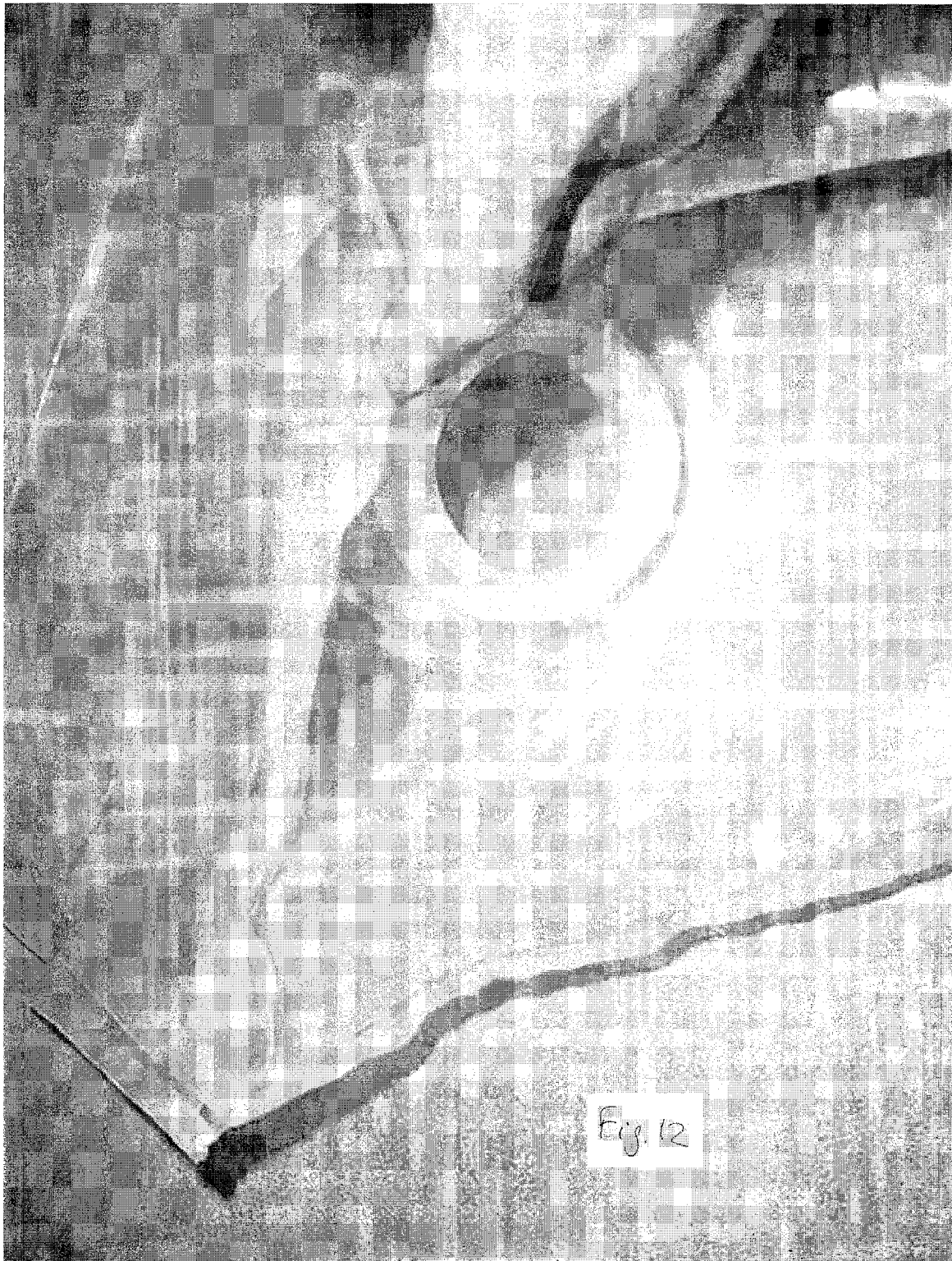












Specification Sheet



- = Fill
- = Dispense
- = Label

Specification/Product Code No: 7-5017
 Customer Part No: 421-1
 Product Description: 260G Form-Fit 3 ply (PPP) 2" BSP fill, 2" Buttruss w/ membrane dispense.
 (260G mmm 2F/TS NPT/BUT 44x36x42 CT)

Inside Seal Dimensions: 44" x 36" x 42"

Film Construction:
 ▶ Inner Ply: 4 mil mLLDPE
 ▶ Middle Ply: 4 mil mLLDPE
 ▶ Outer Ply: 4 mil mLLDPE (Nylon on Firment Panel)

Packaging
 ▶ Liners per Box: 64
 ▶ Box Weight: TBD lbs
 ▶ Boxes per Pallet: 1
 ▶ Fold Type: M09-47 (Fan Fold)

| Fitments | Gland | Plug |
|----------|-------------------------|--------------------|
| Fill | 2" BSP | 2" BSP, Reike |
| Dispense | 2" Buttruss w/ membrane | 2" Buttruss, Reike |
| Vent | None | None |

Oxygen Transmission Rate:
 Film: N/A
 Filment: N/A
 Maximum Filling Temperature: 165°F

FIGURE 13
 All tolerances are (+/- 1/2"), dimensions are inside seal to seal, shown fill & dispense up.

All statements, technical information and recommendations contained herein are based on tests we believe to be reliable, but the accuracy or completeness thereof is not guaranteed, and the following warranty is made in lieu of all other warranties, expressed or implied. CDF warrants the liners will be free from defects in material and workmanship for a period of six months from the date of delivery. Seller's and manufacturer's sole obligation and liability shall be to replace the liners which are so defective provided the defective liners are returned to CDF. The foregoing limited warranty is exclusive and expressly in lieu of all other warranties or implied warranties that may be made in connection with the sale of the liners. CDF shall not be liable for any injury, loss, or damage of any kind or for any liability to use the liners. Prior to use, the user shall independently determine the suitability of the liners for the user's intended use and user assumes all risk and liability whatsoever in connection therewith.

FLEXIBLE LINER WITH FITTING ON GUSSETED SIDE

CROSS REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims the benefit of U.S. Provisional Application No. 60/720,855, filed Sep. 26, 2005, the entire contents of which is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to flexible liners for use in bulk containers such as those used in flexible intermediate bulk container ("FIBC") systems or bag-in-box container systems. More particularly, the present invention relates to placement of a fitting on the gusseted side of a flexible liner for use in a FIBC or bag-in-box container system.

BACKGROUND OF THE INVENTION

[0003] In recent years a number of industries have adopted the FIBC or bag-in-box concept for storing and transporting fluid and particulate commodities in relatively large quantities. For example, the FIBC or bag-in-box concept has been employed for transporting in bulk such diverse products as vegetable oils, salad dressings, syrups, soy sauce, peanut butter, pharmaceuticals, talc, motor oil, industrial chemicals, detergents in liquid or powder form, and toiletry products or ingredients.

[0004] The FIBC concept is a bulk container system comprising a flexible liner in a flexible or semi-flexible bag. In one embodiment, a FIBC bag is made of a woven material (e.g., woven polymer, TYVEX®, canvas, wire mesh or net). The flexible liner is typically chemically resistant and impermeable to water and air and serves as the container for a selected commodity. The FIBC bag serves as a protective container for the liner and its contents. A FIBC bag is disclosed in U.S. Pat. No. 4,596,040 to LaFleur et al., which issued Jun. 17, 1986, and is hereby incorporated by reference in its entirety.

[0005] The bag-in-box concept comprises a flexible liner and a rigid or semi-rigid box. The flexible liner is typically chemically resistant and impermeable to water and air and serves as the container for a selected commodity. The box may be made of plywood or other wood materials, cardboard, fiberboard, metal, or plastic. The box serves as a protective container for the liner and its contents. A box for a bag-in-box system is disclosed in U.S. Pat. No. 6,533,122 to Plunkett, which issued Mar. 18, 2003, and is hereby incorporated by reference in its entirety. A bag for use in a bag-in-box system is disclosed in U.S. patent application Ser. No. 10/818,882, which was filed Apr. 6, 2004, is entitled "Bag With Flap For Bag-In-Box Container System" and is hereby incorporated by reference in its entirety. By way of example, a liner used for shipping commodities in bulk, via a FIBC or bag-in-box system, typically may have a volume in the order of 60 cubic feet. Reference is made to U.S. patent application Ser. No. 10/900,068, which is hereby incorporated by reference in its entirety.

[0006] The liner may be of any suitable configuration. For example, the liner may be generally shaped like a cube. It also can be configured so that a cross-section that is gener-

ally parallel to the top and bottom of the liner is square, rectangular, circular, or any other suitable geometry.

[0007] One consideration of the FIBC or bag-in-box mode of shipment of materials in bulk is that the outer container can be a non-returnable or one-way container. For example, where the outer container is a box for a bag-in-box system and is generally made of a corrugated fiberboard or the like, the box can be discarded after use. Alternatively, the box may consist of interlocking panels of metal, wood, or a stiff or rigid plastic material, in which case the box may be disassembled and returned to the shipper after the associated liner has been emptied of its contents.

[0008] Where the outer container is a bag for a FIBC system and is made of a low cost woven material, the bag can be discarded after use. Alternatively, where the material of the bag is more expensive, the bag may be collapsed and returned to the shipper after the associated liner has been emptied of its contents.

[0009] With respect to the FIBC and bag-in-box concepts as applied to bulk shipment of commodities, the plastic flexible liners have taken various forms. One common form is the so-called "pillow" type, which consists of at least two sheets of plastic film sealed together at their edges. Another common form is the six-sided flexible liners (e.g., liners that take the shape of a cube or rectangular parallelepiped when filled) made from a plurality of sheets of plastic film.

[0010] Liners for use with a FIBC or bag-in-box system typically include at least one drain fitting near the bottom of the liner whereby the liner's contents may be removed, at least one filler fitting near the top of the liner whereby the liner may be filled with its contents, or both. In embodiments of the liner with at least a drain fitting, the outer container (i.e., the bag of a FIBC system or the box of a bag-in-box system) is provided with a discharge opening near or at the bottom end of the outer container through which the liquid or particulate contents can be discharged from the liner via its drain fitting. The discharge opening of the outer container may be fitted with a drain fitting that mates with or accommodates the drain fitting of the liner. This mating arrangement between drain fittings of the liner and outer container assures that material discharged from the liner will be directed to the intended receiving facility and prevents the material from accumulating in the bottom of the outer container. In embodiments of the liner with at least a filler fitting, the outer container usually comprises a cover or top panel that is removable to permit access to the liner and the filler fitting.

[0011] Six-sided flexible liners comprise a front panel, a rear panel, two gusseted side panels, a top panel, and a bottom panel. During manufacture of the liners, as will be discussed more fully in the detailed description, four portions of material are sealed together to form the six panels. Several of the seals are done with a sealing press. In a parallelepiped liner, at least one of the fittings is typically provided on a gusseted side. In order to provide the fitting, a portion of the gusseted side is left unsealed such that a fitting may be manually placed therein. The fitting is manually installed on the gusseted side. This requires manual labor to unfold the gusseted side and manually cut a hole (or seal) for receiving a fitting. After the hole is manually cut, the sealing adjacent the fitting is done manually. Such provision of the hole for the fitting is time-consuming,

requires manual work, can lead to the introduction of contaminants into the liner, and is imprecise. Seals made in this manner, after the fitting has been manually added, are done manually, and are less precise and of lower quality than those done on an automated line during the manufacturing of the liner.

[0012] There is a need in the art for a method of making a liner with a fitting, such as a drain fitting, on the gusseted side of the liner with minimal manual steps. There also is a need in the art for a liner with a fitting on the gusseted side of the liner, where the liner's end seals are made as part of an automated process, prior to the attachment of the fitting.

BRIEF SUMMARY OF THE INVENTION

[0013] The present invention includes a method for providing a fitting, such as a drain fitting, on the gusseted side of the liner with minimal manual steps. In particular, liners that have rectangular cross-sections commonly have fittings on the short side, which is the gusseted side. The fittings are provided on the short side to accommodate the container in which the liner is used. The present invention also provides a liner with a fitting, such as a drain fitting, where the liner's end seals are made as part of an automated process, prior to the attachment of the fitting. As used herein, the terms fitting and fitment are used interchangeably. Seals made on an automated assembly line are generally more precise and of higher quality than those added manually after the liner is partially assembled.

[0014] The liner of the present invention comprises a front portion, a rear portion, and first and second side portions. The front portion, rear portion, and side portions are sealed together to form a front panel, a rear panel, two gusseted side panels, a top panel and a bottom panel. A removable piece is provided in at least one of the portions for receiving a fitment. Thus, after the portions are sealed together, the removable piece is removed to provide an opening and a fitment is fit and sealed within the opening.

[0015] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. 1 is a top isometric view of a liner in its inflated or filled state.

[0017] FIG. 2 is a plan view of the liner in a flattened as-made condition, with a part of the liner broken away.

[0018] FIG. 3 is a bottom view of the same liner in its flattened as-made condition, with a part of the liner broken away.

[0019] FIG. 4 is a cross sectional view taken along line 4-4 of FIG. 2.

[0020] FIG. 5 is a perspective view of a side panel being folded by the folding board, with a perforated hole visible.

[0021] FIG. 6 is a perspective view of a side panel with a perforated hole.

[0022] FIG. 7 is a perspective view of the perforated hole of FIG. 6 in a partially open state.

[0023] FIG. 8 is a perspective view of the perforated hole of FIG. 6 in a fully open state, with a fitting sitting next to the hole.

[0024] FIG. 9 is a perspective view of a fitting being inserted into the hole of FIG. 8.

[0025] FIG. 10 is a perspective view of a fitting that has been inserted into the hole of FIG. 8, but not sealed to the panel.

[0026] FIG. 11 is a perspective view of a fitting that has been inserted into the hole of FIG. 8, and sealed to the panel.

[0027] FIG. 12 is a perspective view of the sealed fitting of FIG. 11, positioned in the fold of a gusset.

[0028] FIG. 13 is a perspective of a liner in its inflated or filled state.

DETAILED DESCRIPTION

[0029] The present invention is directed to a flexible liner 1 for use in bulk containers such as those used in flexible intermediate bulk container ("FIBC") systems or bag-in-box container systems. While certain liner embodiments are discussed herein, the particular liner configuration is generally not important to the present invention, and instead, any suitable liner configuration may be used. As will be discussed more fully below, the liner comprises a front portion, a rear portion, and first and second side portions. The front portion, rear portion, and side portions are sealed together to form a front panel, a rear panel, two gusseted side panels, a top panel, and a bottom panel. More specifically, longitudinal edges of the front portion and the rear portion are sealed to respective edges of the side portions. The first and second side portions are folded to form gussets. Top ends of the front portion and the rear portion are sealed to top folds of the first and second side portions, and bottom ends of the front portion and the rear portion are sealed to bottom folds of the first and second side portions. A removable piece is provided in at least one of the portions for providing an opening to receive a fitment. The terms fitment and fitting are used interchangeably herein. After the portions are sealed together, the removable piece is removed to provide an opening and a fitment is fit and sealed within the opening. In one embodiment, the borders of the removable piece are perforated.

[0030] FIG. 1 is a top isometric view of a liner 1 in its inflated or filled state. As indicated in FIG. 1, in one embodiment, the liner 1 is a four side-seal type liner 1 (i.e., a liner having four longitudinal side-seals 23, 24, 25, 26) composed of four discrete portions (i.e., a front portion 4, a rear portion 6 and two side portions 8, 10) of flexible, heat-sealable packaging material in sheet form. The front portion 4, rear portion 6, and side portions 8, 10 may also be referred to as a front panel 4, rear panel 6, and side panels 8, 10. The side panels 8, 10 may be referred to as gusseted sides. By way of example but not limitation, the packaging sheet material may consist of polyethylene or polypropylene or some other thermoplastic material or be a laminate of two or more packaging materials bonded to one another. Each of

the portions 4-10 may comprise a single sheet of packaging material ("single ply") or two or more sheets of packaging material ("multi-ply"). In the case of multi-ply portions, the individual sheets ("plies") may be of like or different material and are secured to one another only in selected areas (e.g., at seals 23, 24, 25, 26 and other such seals as discussed in this detailed description). One embodiment comprises a two-ply liner.

[0031] For convenience and simplicity of illustration, the two-ply construction is evidenced only in FIG. 4, with the two plies of the front portion 4, for example, being identified as 4A and 4B. However, in the following description, it is to be assumed and understood that each of the four discrete portions 4-10 of the liner 1 may be comprised of two plies of flexible packaging material. Alternatively, of course, each of the four discrete portions 4-10 of the liner 1 may comprise a single ply or more than two plies.

[0032] For a discussion of the liner 1 in its flat as-formed condition, reference is now made to FIGS. 2-4. FIG. 2 is a plan view of the liner 1 in its flattened as-made condition, with part of the front portion 4 broken away to reveal the side portions 8, 10 below. FIG. 3 is a bottom view of the liner 1 in its flattened as-made condition, with part of the rear portion 6 broken away to reveal the side portions 8, 10 above. FIG. 4 is a cross sectional view of the liner 1 taken along line 4-4 of FIG. 2. As shown in FIGS. 2-4, the front portion 4 and the rear portion 6 are opposed to one another, and the side portions 8, 10 are interposed between the front portion 4 and the rear portion 6. As best illustrated in FIG. 4, the side portions 8, 10 are folded inwardly on themselves to form gussets consisting of folds 13, 14 and 15, 16, respectively.

[0033] As indicated in FIGS. 2 and 3, when the liner 1 is in the flattened as-made condition, the front portion 4 and the rear portion 6 have a generally rectangular configuration defined by a top edge 18, a bottom edge 20, and two side edges 21, 22. During manufacture, the four portions 4-10 are cut from parallel elongate supply webs of packaging material. The side portions 8, 10 are folded and inserted between the front portion 4 and the rear portion 6 before the four portions 4-10 are cut from the supply webs. As used herein and where the context so admits, the term "web" is to be understood as a single continuous sheet or two or more sheets that are brought together to form a multi-ply portion of a liner. Alternatively, as used herein, the term "web" is to be understood as a tubular film that is equivalent to two sheets that are brought together to form a multiply portion of a liner.

[0034] The side portions 8, 10 are not wider than the front portion 4 and the rear portion 6. Thus, the side portions 8, 10 may be thought of as the "short sides" of the liner 1. While any suitable configuration may be used, one common variation of the liner, shown in FIG. 13, has a height of about 42 inches, a width for the front portion 4 and the rear portion 6 of about 44 inches, and a width for the side portions 8, 10 of about 36 inches.

[0035] As shown in FIGS. 2 and 4, the front portion 4 is sealed via longitudinal seal lines 23, 24 along its two longitudinally extending side edges 21a, 22a to the adjacent side edges 21b, 22b of the folds 13, 15 of the respective side portions 8, 10. As indicated in FIGS. 3 and 4, the rear portion 6 is sealed via longitudinal seal lines 25, 26 along its two

longitudinally extending side edges 21c, 22c to the adjacent side edges 21d, 22d of the folds 14, 16 of the respective side portions 8, 10.

[0036] As illustrated in FIGS. 2 and 3, adjacent the top end of the liner 1, two oblique seals 27, 28 secure the front portion 4 to the folds 13, 15, and another two oblique seals 29, 30 secure the rear portion 6 to the folds 14, 16. Adjacent the bottom end of the liner 1, two oblique seals 31, 32 secure the front portion 4 to the folds 13, 15, and another two oblique seals 33, 34 secure the rear portion 6 to the folds 14, 16.

[0037] As shown in FIGS. 2 and 3, in one embodiment, the oblique seals 27, 28, 31, 32 extend through the longitudinal seals 23, 24, while the other oblique seals 29, 30, 33, 34 extend through the other longitudinal seals 25, 26. In other embodiments, the oblique seals 27-34 stop at their respective intersections with the longitudinal seals 23-26. The precise configuration of the seals is not central to the present invention.

[0038] Each of the oblique seals 27-34 may be provided using an automated sealer, for example, an automated press sealer. Each of the oblique seals 27-34 may be provided prior to provision of a fitting in the top portion (formed by top triangular sections 4x and 6x, rear top flaps 6a and 6b, and front top flaps 4a and 4b, discussed more fully below) or the bottom portion (formed by bottom triangular sections 4z and 6z, rear bottom flaps 6c and 6d, and front bottom flaps 4c and 4d, discussed more fully below).

[0039] In one embodiment, at the top end of the liner 1, a cross seal 40 extends laterally across the front and rear portions 4, 6 adjacent and parallel to the top edge 18. The top cross seal 40 seals the front and rear portions 4, 6 together along the length of the top cross seal 40. The top oblique seals 27-30 extend from their intersections with their respective longitudinal seals 23-26 towards the top cross seal 40. Just prior to intersecting the top cross seal 40, each top oblique seal 27-30 curves from an oblique orientation to an orientation that is generally parallel to the longitudinal seals 23-26, thereby forming a short segment 44 with a curve 45 for each oblique seal 27-30 that extends through the top cross seal 40.

[0040] As shown in FIGS. 2 and 3, at the bottom end of the liner 1, a cross seal 42 extends laterally across the front and rear portions 4, 6 adjacent and parallel to the bottom edge 20. The bottom cross seal 42 seals the front and rear portions 4, 6 together along the length of the bottom cross seal 42. The bottom oblique seals 31-34 extend from their intersections with their respective longitudinal seals 23-26 towards the bottom cross seal 42. Just prior to intersecting the bottom cross seal 42, each bottom oblique seal 31-34 curves from an oblique orientation to an orientation that is generally parallel to the longitudinal seals 23-26, thereby forming a short segment 46 with a curve 47 for each oblique seal 31-34 that extends through the bottom cross seal 42.

[0041] In manufacturing the liner 1, the cross seals 40, 42 may require a greater temperature/pressure as compared to those used to make the longitudinal side seals 23-26 and the oblique seals 27-34. This is because, in one embodiment, the cross seals 40, 42 utilize twice as many layers as the side and oblique seals 23-34. For example, referring to the upper right hand corner of FIG. 2, oblique seal 28 and longitudinal

side seal **24** are each formed by sealing front portion **4** and side portion **10** together. In contrast, cross seal **40** is formed by sealing together front portion **4**, rear portion **6**, and portion **10** folded over on itself (i.e., two layers of portion **10** are sealed together with the front and rear portions **4**, **6**).

[0042] As illustrated in FIGS. 2 and 3, the front and rear portions **4**, **6** each have a generally hexagonal configuration (as defined by their respective longitudinal side seals **23-26** and oblique seals **27-34**), except for being truncated at the upper most point by the top cross seal **40** and at the bottom most point by the bottom cross seal **42**. As can be understood from FIG. 1, the side portions **8**, **10** also each have a generally hexagonal configuration (as defined by their respective longitudinal side seals **23-26** and oblique seals **27-34**) when fully spread out flat. However, as can be understood from FIG. 1, unlike the front and rear portions **4**, **6**, the upper and lower most points of the side portions **8**, **10** are not truncated.

[0043] As can be understood from FIG. 1, the curves **45**, **47** and the truncated top and bottom end points of the hexagonal front and rear portions **4**, **6** form intersections between the panels **4-10** that are advantageous over standard non-truncated intersections found in the prior art. This is because the truncated end points and the curves **45**, **47** reduce stress concentrations in the intersection areas as compared to the non-truncated intersections found in the prior art.

[0044] As can be understood from FIGS. 1-3, the hexagonal configuration of each portion **4-10** can be divided into three parts, which are a top triangular section **4x**, **6x**, **8x**, **10x**, a rectangular section **4y**, **6y**, **8y**, **10y**, and a bottom triangular section **4z**, **6z**, **8z**, **10z**. The top triangular sections **4x**, **6x**, **8x**, **10x** are defined by the top oblique seals **27-30** and top fold lines **66** that run parallel to the top cross seal **40** and intersect the intersections between the top oblique seals **27-30** and the longitudinal side seals **23-26**. Similarly, the bottom triangular sections **4z**, **6z**, **8z**, **10z** are defined by the bottom oblique seals **31-34** and bottom fold lines **68** that run parallel to the bottom cross seal **42** and intersect the intersections between the bottom oblique seals **31-34** and the longitudinal side seals **23-26**. The rectangular sections **4y**, **6y**, **8y**, **10y** are defined by the longitudinal side seals **23-26** and the top and bottom fold lines **66**, **68**.

[0045] As can be understood from FIG. 1, when the liner **1** is inflated or filled, the top triangular sections **4x**, **6x**, **8x**, **10x** fold toward each other about their respective top fold lines **66** to form the roof of the cubical liner **1**, the bottom triangular sections **4z**, **6z**, **8z**, **10z** fold toward each other about their respective bottom fold lines **68** to form the floor of the cubical liner **1**, and the rectangular sections **4y**, **6y**, **8y**, **10y** fold about their respective longitudinal side seals **23-26** to form the sidewalls of the cubical liner **1**.

[0046] As indicated in FIG. 2, the top oblique seals **27**, **28**, the top cross seal **40**, and the side seals **23**, **24** generally define front top flaps **4a**, **4b** out of the front portion **4**. In one embodiment, each front top flap **4a**, **4b** will further include corresponding areas of the side portions **8**, **10** that are defined by the top oblique seals **27**, **28**, the top cross seal **40**, and the side seals **23**, **24**.

[0047] As shown in FIG. 3, the top oblique seals **29**, **30**, the top cross seal **40**, and the side seals **25**, **26** generally

define rear top flaps **6a**, **6b** out of the rear portion **6**. In one embodiment, each rear top flap **6a**, **6b** will further include corresponding areas of the side portions **8**, **10** that are defined by the top oblique seals **29**, **30**, the top cross seal **40**, and the side seals **25**, **26**.

[0048] As illustrated in FIG. 1, because the front top flaps **4a**, **4b** are sealed to the rear top flaps **6a**, **6b** by the top cross seal **40**, when the liner **1** is inflated or filled and takes its form, the top flaps **4a**, **6a** extend across the top triangular section **8x** and the top flaps **4b**, **6b** extend across the top triangular section **10x**.

[0049] For a continued discussion of the general configuration of one embodiment of the liner **1**, reference is again made to FIGS. 1-3. As indicated in FIG. 2, the bottom oblique seals **31**, **32**, the bottom cross seal **42**, and the side seals **23**, **24** generally define front bottom flaps **4c**, **4d** out of the front portion **4**. In one embodiment, each front bottom flap **4c**, **4d** will further include corresponding areas of the side portions **8**, **10** that are defined by the bottom oblique seals **31**, **32**, the bottom cross seal **42**, and the side seals **23**, **24**.

[0050] As shown in FIG. 3, the bottom oblique seals **33**, **34**, the bottom cross seal **42**, and the side seals **25**, **26** generally define rear bottom flaps **6c**, **6d** out of the rear portion **6**. In one embodiment, each rear bottom flap **6c**, **6d** will further include corresponding areas of the side portions **8**, **10** that are defined by the bottom oblique seals **33**, **34**, the bottom cross seal **42**, and the side seals **25**, **26**.

[0051] As can be understood from FIG. 1, because the front bottom flaps **4c**, **4d** are sealed to the rear bottom flaps **6c**, **6d** by the bottom cross seal **42**, when the liner **1** is inflated or filled and takes its cubical form, the bottom flaps **4c**, **6c** extend across the bottom triangular section **8z** and the bottom flaps **4d**, **6d** extend across the bottom triangular section **10z**.

[0052] As indicated in FIGS. 2 and 3, each longitudinal side seal **23-26** has a segment that extends across the respective bottom oblique seal **31-34** into the respective bottom flap **4c**, **4d**, **6c**, **6d**. In one embodiment, as shown in FIGS. 2 and 3, these bottom segments **23b**, **24b**, **25b**, **26b** run from the intersection of the respective oblique seal **31-34** and side seal **23-26** to a point nearly intersecting the bottom cross seal **42**. In other embodiments, the bottom segments **23b**, **24b**, **25b**, **26b** will have a greater or lesser length. In one embodiment, each longitudinal side seal **23-26** stops at its intersection with the respective bottom oblique seal **31-34** such that there are no bottom segments **23b**, **24b**, **25b**, **26b**.

[0053] For a discussion of the location of the fill and drain fittings of the liner **1**, reference is now made to FIG. 13. Reference is made to "openings" **50** and **52**. It is to be understood that the openings **50**, **52** may comprise removable pieces, may comprise thru holes where the removable pieces have been removed, or may comprise an opening having a fitting fit therein. FIG. 1 illustrates a fitment provided in opening **50**. FIGS. 2 and 3 illustrate perforated opening **52** prior to removal of a removable piece, as will be described more fully below. As shown in FIG. 13, the side portion **8**, and more specifically the rectangular section **8y** of the side portion **8**, is formed with an opening **52**. This opening is configured for receiving a fitting. The opening **52** may receive the drain fitting or the fill fitting. Generally, a

fitting located towards an upper end of the liner is a fill fitting and a fitting located towards a lower end of the liner is a drain fitting. Thus, as shown in FIG. 13, the opening 52 is a drain fitting. A drain fitting is intended to function as a drain. As may be seen in FIGS. 2 and 3, in the folded or flat configuration of the panel 1, the opening 52, is folded.

[0054] The top portion, and more specifically the top triangular section 6x of the top portion, is formed with an opening 50. The opening is configured for receiving a fitting. The opening 50 may receive the drain fitting or the fill fitting. Generally, a fitting located towards an upper end of the liner is a fill fitting and a fitting located towards a lower end of the liner is a drain fitting. Thus, as shown in FIG. 13, the opening 50 is a fill fitting. A fill fitting is for filling purposes. In one embodiment, the liner 1 may have only a drain fitting. In another embodiment, the liner 1 may have only a fill fitting.

[0055] In accordance with the present invention, the openings 50 and 52 are provided in the liner 1 by removing removable pieces of material. These removable pieces are provided at the location for receiving the fitting and correspond in size and shape to the openings 50, 52 for receiving the fitting. Any suitable manner of providing removability of the pieces may be used. For example, the borders of the removable pieces may be perforated. As shown, the removable pieces are perforated into the material of the liner at the top triangular section 6x and the rectangular section. Thus, the liner 1 may be formed and sealed, as described previously. After the front portion 4, the rear portion 6 and the two side portions 8, 10 are sealed together to form the liner 1, the openings 50 and 52 may be achieved by removing the removable pieces from the top triangular section 6x and the rectangular section 8y. While specific reference is made to the top triangular section 6x and the rectangular section 8y, it is to be noted, that removable pieces may be provided at any suitable location on the liner. Further, one of the removable pieces may be perforated while removability of the other may be achieved by other means. Further, a single or more than two removable pieces may be provided. After the openings 50, 52 are achieved, for example by removing perforated removable pieces, the fill fitting (or fill fitment) and the drain fitting (or drain fitment) may be fit therein.

[0056] A fill fitment for positioning in the opening 50 generally comprises two parts, a fixed tubular part and a cap. The fixed tubular part has a flange that underlies and is sealed to the front portion 4 by a circular seal. The cap is releasably attached to and closes off the tubular part. The cap may be attached to the tubular part by a screw, bayonet, snap-fit or other suitable form of connection known in the art.

[0057] For a better understanding of how the four portions 4-10 join together and how the liner 1 appears when inflated or filled, reference is again made to FIG. 1. As illustrated in FIG. 1, the liner 1 assumes the general shape of a cube or a rectangular parallelepiped when is inflated or filled, with the side portions 8, 10 unfolding to eliminate the gussets. The front portion 4 forms a front wall, the rear portion 6 forms a rear wall, and the side portions 8, 10 form opposite sidewalls. Thus the panels formed by the side portions 8, 10 may also be referred to as gusseted sides.

[0058] As shown in FIG. 1, because of the arrangement of the oblique seals 27-34 in relation to the longitudinal seals

23-26 and cross seals 40, 42, the four portions 4-10 come together to form the top and bottom walls of the liner 1. As illustrated in FIG. 1, the filler fitment 50 is located at the top of the liner 1 and the drain fitment 52 is located at the bottom, front side of the liner 1.

[0059] As can be understood from FIG. 1, when inflated or filled, the liner 1 is self-supporting in the sense that it tends to remain erect and not fall over when its bottom end is resting on a flat floor or platform. When an un-inflated liner 1 is inserted in an outside container, the flexibility of the un-inflated liner 1 allows the drain fitment 52 to be properly positioned in any commodity discharge opening provided in the bottom of the outside container. Once so positioned, the cap of the drain fitment 52 may be removed to initiate the liner-emptying process for an inflated or filled liner 1.

[0060] As previously explained, the flexibility of the material comprising the four portions 4-10 may cause a liner 1 to tend to collapse at its upper portion when the liner 1 is being emptied of its contents via the drain 52. Such a collapsing of the liner 1 makes it difficult to completely empty the liner 1 of viscous contents such as peanut butter, industrial oil or the like. Thus, it may be desirable to support the upper portion of the liner 1 off of an upper portion of the outside container. In one embodiment, tabs may provide an inexpensive means of supporting the liner 1 off of the outside container.

[0061] As indicated hereinabove, the four portions 4-10 that make up the liner may consist of a single ply or two or more plies. In the case of two or more plies, it is to be understood that the plies are separate from one another except in the areas of the seals described above, and that each ply may consist of a single plastic film or be a laminate of two or more materials.

[0062] Of course the invention is susceptible of other modifications and may be applied to liners 1 of different constructions.

[0063] In one embodiment, the fitments 50, 52 may have different structures or shapes. In one embodiment, the filler fitment 50 may be omitted, in which case the drain fitment 52 may also serve as a filler means for the liner by attaching a pump discharge line to pump the contents into the liner 1. Conversely, the drain fitment 52 may be omitted, in which case the filler fitment 50 may also serve as a drain means for the liner by running a pump suction line down into the liner to remove the contents of the liner 1.

[0064] The liner may have a rectangular parallelepiped shape when inflated (e.g., the side portions 8, 10 may have smaller widths than the front and rear portions 4, 6) or may have a substantially cubic shape when inflated (in which case the side portions 8, 10 have substantially the same width when unfolded as the front and rear portions 4, 6).

[0065] Although the seals whereby the four portions 4-10 are connected together are illustrated by single lines, it is to be understood that the cross-seals and the longitudinal and oblique seals that connect the front and rear portions 4, 6 to the side portions 8, 10 may vary in width and, for example, may extend out to the edges of the four portions 4-10.

[0066] FIG. 5 illustrates a side panel being folded by a folding board (also known as a v-board), as is common in the construction of a liner 1, with a perforated hole visible. The removable piece, as shown, comprises a piece of material

having a perforated borders. As shown in FIG. 5, intact material is provided within the perforations. Generally, a folding board is used to fold the four portions 4-10 to form gusseted side panels in the flat configuration of the panel shown in FIGS. 2-4. Thus, the folding board may be used to fold rear portion 6 with the removable piece 50 of the top triangular section 6x being positioned on the folding board. The removable piece 50 can travel over the folding board without disrupting the sheeting material or the folding board, and without opening.

[0067] FIG. 6 is a close up view of a portion having a removable piece 50,52. The portion may be any of portions 4-10 and the removable piece 50, 52 may be suited for providing an opening for receiving either a drain fitting or for a fill fitting. As shown in FIG. 7, to provide an opening for receiving a fitting, the liner of the removable piece is removed. Thus, in the embodiment shown, the perforations are torn. FIG. 7 illustrates the opening with a portion of the perforations torn.

[0068] After the perforations have been torn and the liner or the removable piece is removed, an opening is provided for receiving a fitting. As shown, the opening may be for receiving a drain fitting or a fill fitting. FIG. 8 illustrates such opening 50, 52 and a fitment for positioning in the opening. FIG. 9 then illustrates the fitment being inserted into the opening 50, 52 of FIG. 8 and FIG. 10 illustrates the fitment fully inserted into the opening 50, 52. After the fitment is positioned within the opening 50, 52, the fitting is sealed to the panel of the liner. FIG. 11 illustrates the sealed fitting in place in the opening 50, 52 of the panel.

[0069] As shown in FIG. 12, the sealed fitting may be positioned in the fold of a gusset, for example, in the rectangular section 8y of the side portion 8 of the liner.

[0070] Thus, as is described above, the liner may be formed of four discrete portions (i.e., a front portion 4, a rear portion 6 and two side portions 8, 10). One or more of the portions may be provided with a perforated opening 50 or 52 for receipt of a fitting. The perforated opening may be provided at any location on the portion. For example, the perforated opening may be provided on a rectangular section 8x of a side portion 52 or on a top triangular section 6x of a rear portion 6. The portions 4-10 may be sealed together, as described above. After sealing, the perforations may be torn and openings provided. Fittings may be positioned and sealed within the openings. Accordingly, manual cutting of openings and manual sealing between portions is substantially avoided.

[0071] Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

We claim:

- 1. A liner for use in a bulk container, the liner comprising:
 - a front portion, a rear portion, and first and second side portions, wherein the front, rear, and first and second side portions are sealed together to form four side panels and two gusseted panels;
 - at least one perforated opening being provided on one of the front portion, the rear portion, the first side portion, or the second side portion for receiving a fitting.
- 2. The liner of claim 1 wherein one perforated opening is provided on one of the front portion and rear portion and one perforated opening is provided on one of the first and second side portion.
- 3. The liner of claim 2 wherein the one perforated opening provided on one of the front portion and rear portion is adapted to receive a fill fitment.
- 4. The liner of claim 2 wherein the one perforated opening provided on one of the first and second side portion is adapted to receive a drain fitment.
- 5. A method for forming a liner for use in a bulk container, comprising:
 - providing a front portion, a rear portion, and first and second side portions, at least one perforated opening being provided on one of the front portion, the rear portion, the first side portion, or the second side portion;
 - sealing the front portion and the rear portion to respective edges of the side portions,
 - folding the first and second side portions to form gussets;
 - sealing a top end of the front portion and a top end of the rear portion to top folds of the first and second side portions;
 - sealing a bottom end of the front portion and a bottom end of the rear portion to bottom folds of the first and second side portions;
 - removing material from the at least one perforated opening;
 - fitting a fitment in the at least one perforated opening;
 - sealing the fitment in the at least one perforated opening.
- 6. The method of claim 5 wherein one perforated opening is provided on one of the front portion and rear portion and one perforated opening is provided on one of the first and second side portion.
- 7. The method of claim 6 wherein the one perforated opening provided on one of the front portion and rear portion is adapted to receive a fill fitment.
- 8. The method of claim 6 wherein the one perforated opening provided on one of the first and second side portion is adapted to receive a drain fitment.

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