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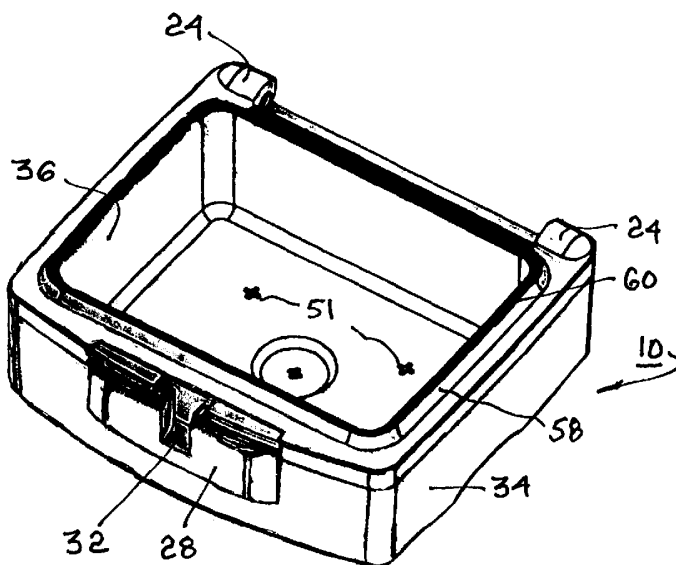
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(54) Title: FIRE AND WATER-RESISTANT CONTAINER



(57) Abstract: A fire-resistant container (14) having a full gasket (62) at the interface between hinged top (12) and bottom mating elements. The elements (12,10) are insulated and are formed with matable labyrinthine edges. One of the edges is provided with a smooth, soft gasket (62) disposed in a groove (54) in the labyrinth which forms a seal against a corresponding rib (60) in the opposing edge. The elements (12,10) are joined along common sides by a hinge (18), the rotational axis (16) of which is positioned in space relative to the gasket (62) and rib (60) such that, in closing of the container (14), the gasket (62) engages the rib (60) at all points substantially simultaneously. The hinged elements (12,10) are secured by over-center latch (28,30) such that when the container (14) is fully closed the rib (60) exerts a small and substantially uniform force against the gasket (62) to form a seal against fire and water.



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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

FIRE AND WATER-RESISTANT CONTAINER

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TECHNICAL FIELD

The present invention relates to fire-resistant containers; more particularly, to fire-resistant safes; and most particularly, to a safe container which is both fire-resistant and water-resistant.

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BACKGROUND OF THE INVENTION

Containers for temporarily protecting their contents from damage from external heat sources such as fire are well known. Such containers are said in the art to be "fire-resistant" and typically are rated for integrity over a specific exposure temperature and/or time.

15 Lockable fire-resistant containers are known as fire-resistant "safes" and are widely used for storage of documents or other valuables which may be damaged or destroyed by exposure to high temperatures. For example, various models of such fire-resistant safes are available from Sentry Group, Rochester, New York 14625 USA.

A typical top-opening fire-resistant safe has top and bottom elements which are
20 hinged and detachably latched together to form a storage cavity between the elements. Each element is initially hollow, having inner and outer shells which may be conveniently formed as by blow-molding or other known forming means. The interior of each element between the shells is filled with a non-combustible, fire-proof thermally-insulating material such as Portland cement, which typically is heavily hydrated. The shells are formed of polymeric
25 resin having a melting point higher than the boiling point of water such that the hydration prevents the shells, and especially the outer shells, from melting or igniting for an extended period of time. See, for example, fire-resistant safes as disclosed in US Patent No. 5,295,447 issued March 22, 1994 to Robbins et al., the relevant disclosure of which is hereby incorporated by reference, as are the various other US Patents incorporated by reference
30 therein.

A common problem encountered in use of prior art fire-resistant safes is that they may be inundated with water from fire hoses during the fighting of a fire. Water may leak into the interior of a safe through the hinges and jamb and may ruin contents which have been otherwise preserved from damage by the fire. Such safes have no specific barrier to water entry, such as a resilient sealing gasket at the interface between the top and bottom elements. See, for example, the relevant disclosure of US Patent No. 4,541,545 issued September 17, 1985 to Beattie et al`.

One approach to making a fire-resistant safe also water-resistant is found in the construction of known "diving boxes" intended for underwater use wherein a jamb and corresponding gasket are provided around the entire periphery of the mating portions of the top and bottom elements. An external hinge connects the top and bottom elements, and the cover is locked by one or more over-center latches such that the gasket is highly compressed.

A problem arises in adapting this construction to fire- and water-resistant containers wherein the outer shell is progressively destroyed by fire. Because the gasket is so compressed, when either the hinge or the latches are first burned away, the resilience of the gasket can cause the safe to spring open enough to destroy the water seal. Further, if the axis of the hinge lies in or near the plane containing the sealing surfaces, the region including the surfaces nearest the hinge will become engaged the earliest during closing of the safe and the gasket may ultimately be more compressed in that region than in the region of the latch. Thus, when the hinges are burned away the safe may spring open even though the latch is still intact, exposing the contents to fire and/or water.

What is needed is a fire- and water-resistant container having a gasket at the interface between a top and a bottom element, the elements being hinged and latched together, wherein the gasket is lightly and evenly loaded over its entire length such that a fire- and water-resistant seal between the elements is maintained when the hinges and/or latch are destroyed.

It is the primary object of the invention to provide an improved fire-resistant and water-resistant safe for storage of documents or other valuables.

SUMMARY OF THE INVENTION

The invention is directed to a fire-resistant container which has a full gasket at the interface between highly-insulated top and bottom elements thereof which are rotated closed to a storage space therein. The elements are each formed with a labyrinthine edge surrounding the open side, the elements meeting matably along the edges. One of the edges, preferably the edge of the top element, is provided with a smooth, soft gasket disposed in a groove in the labyrinth which forms a seal against a corresponding rib in the opposing edge. The elements are joined along a first common side, preferably the back side, by at least one hinge, the rotational axis of which is positioned in space relative to the gasket and rib such that, in closing of the container, the gasket engages the rib at all points substantially simultaneously. The elements are secured along a second common side, preferably the front side, by over-center latching means such that when the container is fully closed the rib exerts a small and substantially uniform force against the gasket. Upon being exposed to fire, the hinges and/or the latch may be destroyed without causing the seal between the gasket and the rib to be broken, thus maintaining the fire- and water- resistance of the container. In a top-opening embodiment, the weight of the top element, when freed from gravitational restraint of the hinges and latch, further compresses the gasket onto the rib, enhancing the seal. In a further preferred embodiment, the gasket material is selected to be able to melt in place while the outer shells are being thermally destroyed, thus forming a viscous seal to enhance the integrity of the container. Preferably, the gasket material emits relatively small amounts of soot upon melting, and the seal prevents any soot generated from the exposed outer surfaces of the gasket from entering the container and damaging the contents.

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BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, features, and advantages of the invention, as well as presently preferred embodiments thereof, will become more apparent from a reading of the following description in connection with the accompanying drawings, in which:

FIGS. 1 and 2 are isometric views from above of a bottom element and a top element, respectively, of a fire- and water-resistant container in accordance with the invention;

FIG. 3 is an elevational cross-sectional view of the top and bottom elements shown in FIGS. 1 and 2, hinged to form a fire- and water-resistant container, the container being shown in a partially-open position;

FIG. 4 is an elevational cross-sectional view like that shown in FIG. 3, showing the container in the closed position; and

FIGS. 5 and 6 are detailed cross-sectional views taken from circles 5 and 6, respectively, in FIG. 3.

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DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 through 4, a bottom element 10 and a top element 12 of a fire- and water-resistant container 14 in accordance with the invention are pivoted along a pivot axis 16 which is the axis of a hinge 18 extending along back outer surfaces 20,22 of elements 10,12, respectively. Hinge 18 includes female end members 24 formed in element 10 and a male center member 26 formed in element 12 for insertion into recesses in members 24 to complete the hinge. Elements 10,12 are further provided with first and second latch elements 28,30, respectively, for latching together to close container 14 as shown in FIG. 4. Each of latch elements 28,30 is provided with a slot 32 for receiving a conventional lockable closure (not shown). Preferably, the latch elements comprise a conventional overcenter mechanism such as is well known in the art and need not be further described.

Bottom element 10 includes an outer shell 34 and an inner shell 36 separated by a space which is filled with a fire-proof insulating material 38, preferably hydrated Portland cement. Shells 34,36 may be formed of metal but preferably are formed of a thermoplastic resin having a melting temperature higher than the boiling point of water. The formation of resin shells 34,36, preferably by conventional blow molding, and the filling of the space with insulation are fully described in the incorporated references. Shells 34,36 are joined as by

plastic welding along a knit line 40 surrounding a well 42 in shell 36. Well 42 is the repository cavity for materials being stored in container 14.

Like bottom element 10, top element 12 includes an outer shell 44 and an inner shell 46 separated by a space which is filled with a fire-proof insulating material 38. Shells 44,46
5 may be formed of metal but preferably are formed of a thermoplastic resin having a melting temperature higher than the boiling point of water. Resin shells 44,46, are formed and filled in the same way as shells 34,36. Shells 44,46 are joined as by plastic welding along a line 48 surrounding a shallow well 50 in shell 46.

Both inner shells 36,46 are provided with conical recesses 51 extending to the inner
10 surfaces of outer shells 34,44. Recesses 51 provide structural reinforcements for maintaining a predetermined spacing between the inner and outer shells of the top and bottom elements, respectively. Such reinforcement prevents bowing between the shells, enables the elements to be filled with predetermined amounts of liquid insulating material, and assists in anchoring the hardened insulating material within the elements.

15 A labyrinthine gasket seal is provided between elements 10,12 as follows. As shown in FIGS. 2-5, top inner shell 46 is formed having an inner ridge 52 surrounded by an intermediate groove 54 surrounded by an outer ridge 56, all of these features surrounding well 50 and defining a labyrinthine edge thereto. As shown in FIGS. 1, 3-4, and 6, bottom outer shell 34 is formed having a ridge 58 surmounted by a rounded rib 60, both features
20 surrounding well 42 and defining an edge thereto. An endless gasket 62 is press-fit into groove 54 for mating against rib 60 to form a fire- and water-resistant seal when container 14 is closed, as shown in FIG. 4.

Gasket 62 is formed of a very low durometer and compliant elastomer, for example, ethylene propylene diene monomer (EPDM) or neoprene. It is a feature of the invention that
25 the gasket be sufficiently resilient to form a seal against rib 60 but insufficiently resilient to be capable of displacing or launching top element 12 from rib 60 when the hinges or latch are destroyed by fire. Gasket 62 is preferably formed having a smooth outer surface and a cellular interior. The gasket may have any desired cross-sectional shape, and preferably is

rectilinear, and shown in FIGS. 4-6, or round like an O-ring. The gasket may be uniform in structure throughout or may have a hollow center, as shown in FIG. 6.

A shortcoming of similar prior art seals is that the region of the sealing rib nearest the hinge engages the gasket at an angle significantly non-orthogonal. This can cause the rib to roll the gasket whereby the gasket may be deformed and/or displaced. Further, such non-uniform engagement of the rib and the gasket can result in the gasket's being more highly compressed in the region nearest the hinge. It is known that such non-uniform compression can cause a top element to be sprung away from the bottom element when the hinges are destroyed by fire, thus exposing the contents of the container to fire and/or water. Therefore, it is a feature of a container in accordance with the invention that the position of axis 16 with respect to the upper surface of rib 60 and the configuration of top element 12 are jointly selected such that, as the container is closed, gasket 62 makes contact with rib 60 substantially simultaneously at all positions along rib 62. In other words, planes including rib 60 and the surface of gasket 62 are substantially parallel at the moment of contact.

It will be obvious, of course, to those skilled in the art that the labyrinthine seal shown in FIGS. 1-6 may be formed to equal effect and within the scope of the invention by forming the gasket-bearing features in the bottom element and the mating rib in the top element.

In operation, when closed, container 14 sustains substantially uniform pressure of rib 60 against gasket 62 to form a seal against incursion of fire or water into wells 42 and 50. The highly hydrated Portland cement insulation provides a large thermal reservoir when the container is exposed to fire and forestalls significant fire damage to the outer shells while the water is being boiled off. At temperatures below the ignition temperature of the resin of the shells, the gasket begins to soften. When the hinge and/or latches are destroyed by fire, the top element settles gravitationally further onto rib 60 and the softened gasket seals even more tightly around the rib. When the outer portion of the gasket eventually begins to degrade and then burn, carbonaceous products of that degradation are prevented by the enhanced seal from entering container 14.

The foregoing description of the preferred embodiment of the invention has been presented for the purpose of illustration and description. It is not intended to be exhaustive

nor is it intended to limit the invention to the precise form disclosed. It will be apparent to those skilled in the art that the disclosed embodiments may be modified in light of the above teachings. The embodiments described are chosen to provide an illustration of principles of the invention and its practical application to enable thereby one of ordinary skill in the art to
5 utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. Therefore, the foregoing description is to be considered exemplary, rather than limiting, and the true scope of the invention is that described in the following claims.

CLAIMS:

What is claimed is:

- 5 1. A container resistive of ingress by fire and water, comprising:
- a) a bottom element having inner and outer shells spaced apart by an insulating material, having a well in said inner shell for receiving materials to be sheltered from damage by fire and water, and having a first sealing feature surrounding said well;
- b) a top element having inner and outer shells spaced apart by an insulating material
- 10 and including a second sealing feature opposable to said first sealing feature,
- said top and bottom elements being joined by a hinge, one of said first a second sealing features including a resilient gasket having a surface included in a first plane and the other of said first and second sealing features having a rib for mating with said gasket included in a second plane, said hinge being positioned with respect to said planes such that
- 15 said planes are substantially parallel when said rib mates with said gasket during closing of said container.
2. A container in accordance with Claim 1 wherein said gasket is formed of a low-durometer elastomer.
- 20 3. A container in accordance with Claim 2 wherein said elastomer is selected from the group consisting of ethylene propylene diene monomer and neoprene.
4. A container in accordance with Claim 2 wherein said gasket is formed
- 25 having a smooth surface and a cellular interior.
5. A container in accordance with Claim 4 wherein said gasket is hollow.

6. A container in accordance with Claim 1 wherein said top and bottom outer shells are formed of a thermoplastic resin having an ignition temperature, and wherein the resilient material comprising said gasket has a softening temperature below said ignition temperature.

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7. A container in accordance with Claim 1 wherein said first sealing feature includes said rib and said second sealing feature includes said gasket.

8. A container in accordance with Claim 1 wherein said first sealing feature includes said gasket and said second sealing feature includes said rib.

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9. A container in accordance with Claim 1 further comprising latch means disposed on said top and bottom elements for securing said container in a closed position.

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10. A container in accordance with Claim 9 further comprising locking means such that said container is suitable for use as a fire- and water-resistant safe.

11. 1. A container resistive of ingress by fire and water, comprising:

a) a bottom element having inner and outer shells spaced apart by an insulating material, having a well in said inner shell for receiving materials to be sheltered from damage by fire and water, and having a first sealing member surrounding said well;

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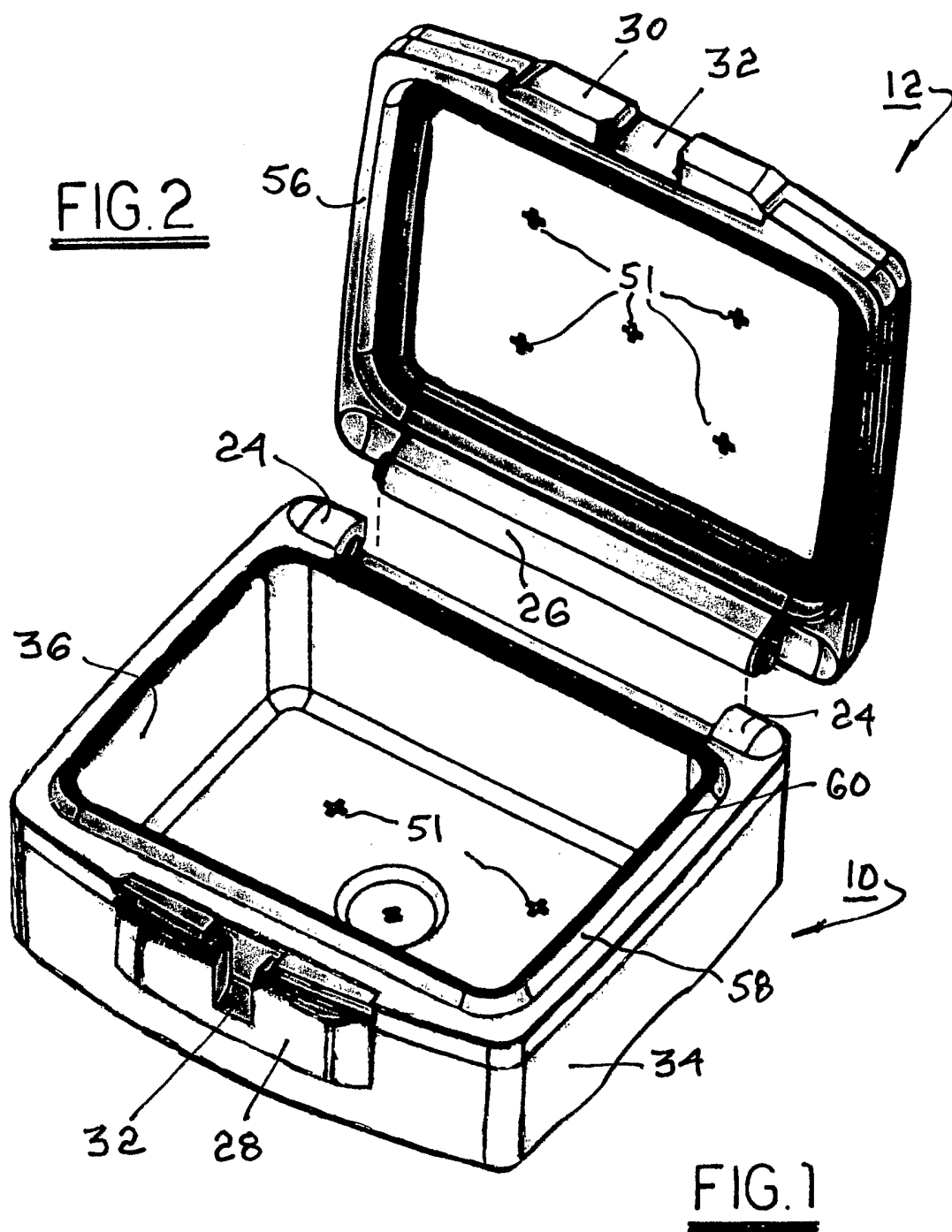
b) a top element having inner and outer shells spaced apart by an insulating material and including a second sealing member opposable to said first sealing member,

25

d) the first sealing member comprising a resilient gasket and the second sealing member comprising a rib, the resilient gasket having a surface included in a first plane and the rib included in a second plane:

c) a hinge coupled to the top and bottom elements and having an axis of rotation positioned off center and proximate the gasket or the rib such that said planes are substantially parallel when said rib mates with said gasket during closing of said container.

12. A container in accordance with claim 11 wherein the resilient gasket is lightly and evenly loaded over its entire length and the axis of the hinge lies in or near the plane containing the resilient gasket.



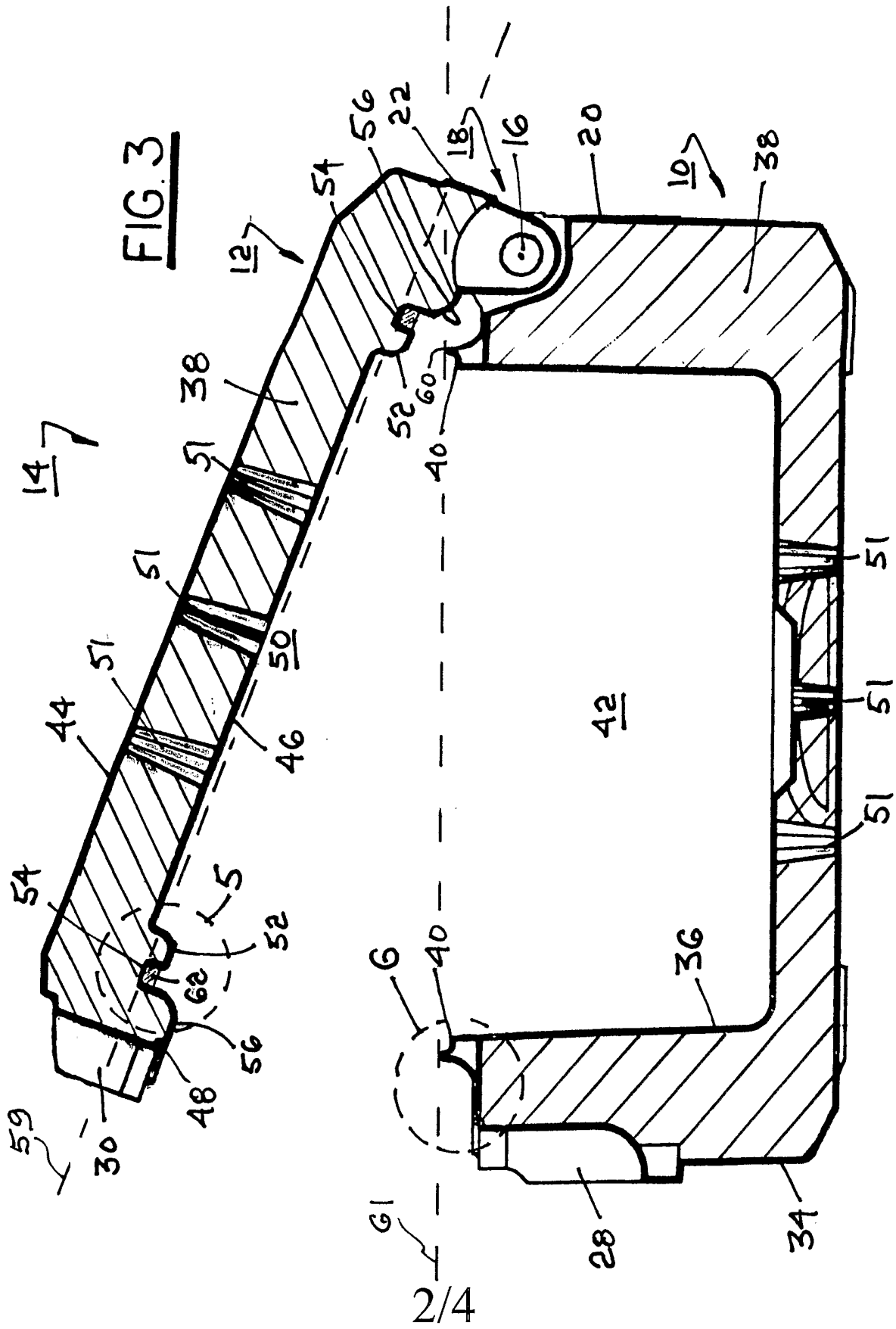


FIG. 5

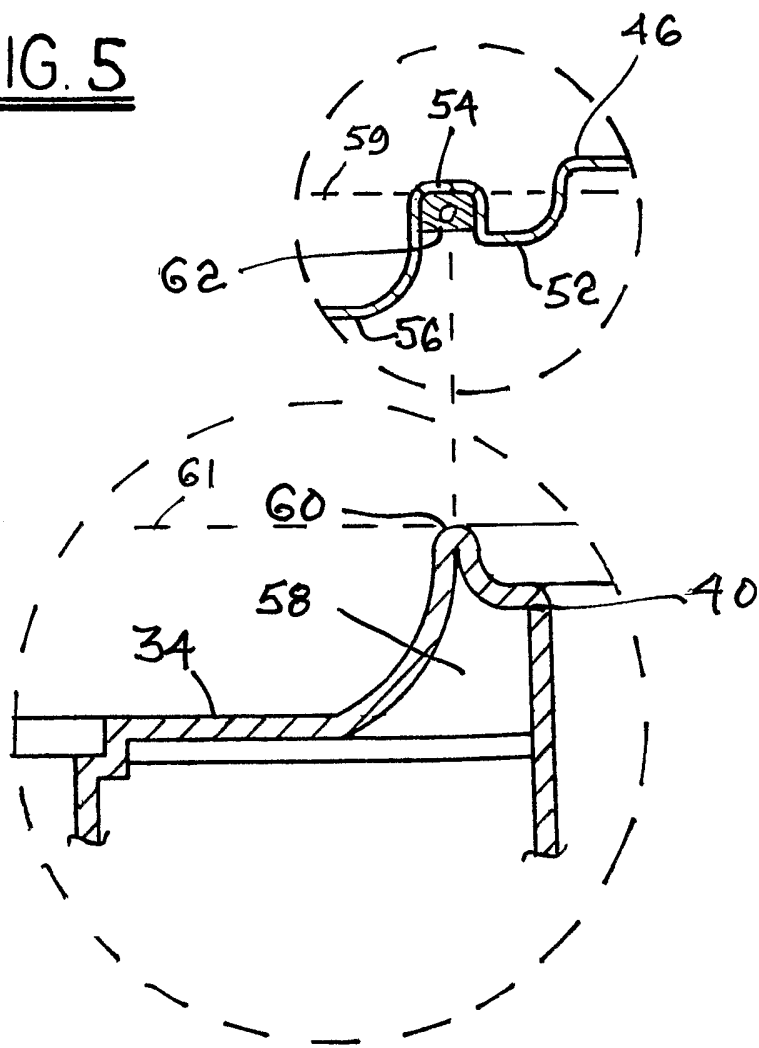


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/21960

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : E06B 7/16
US CL : 109/75

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 109/75

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X ----- Y	US 5,971,515 A (BAKER ET AL) 26 October 1999 (26/10/99), see fig. 5.	1,8-12 ----- 2-6
Y	US 4,748,790 A (FRANGOLACCI) 07 June 1988 (07/06/88), see fig. 3A.	2-6
Y	US 2,803,368 A (KOCH) 20 August 1957 (20/08/57), see fig. 2.	1-12
Y	US 4,048,926 A (BRUSH, JR. ET AL) 20 September 1977 (20/09/77), see page 5, lines 6-7.	6

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Z" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/21960

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	5,370,254 A (HARDIGG ET AL) 06 December 1994 (06/12/94), see fig. 3.	1-12
Y	US 828,423 A (RANSOM) 14 August 1906 (14/08/06), see fig. 1.	10